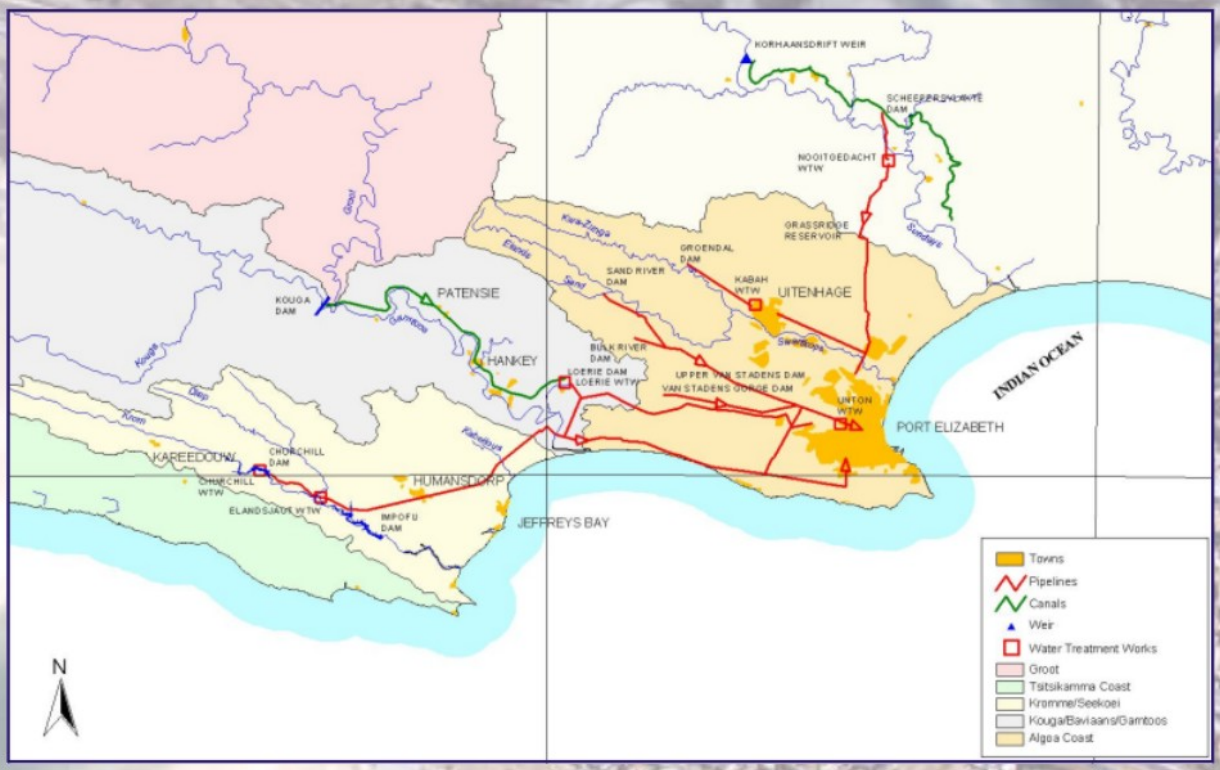
Report No. PWMA 15/000/00/0304

DEPARTMENT OF WATER AFFAIRS
AND FORESTRY

FISH - TSITSIKAMMA WATER MANAGEMENT AREA

TSITSIKAMMA TO COEGA INTERNAL STRATEGIC PERSPECTIVE



VERSION 1: February 2004

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P WMA 15/000/00/0304

Department of Water Affairs and Forestry
Directorate National Water Resources Planning

INTERNAL STRATEGIC PERSPECTIVE

for the

TSITSIKAMMA TO COEGA

portion of the

FISH TO TSITSIKAMMA WATER MANAGEMENT AREA (WMA)
(WMA 15)

Version 1: February 2004

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Department of Water Affairs and Forestry
Directorate National Water Resources Planning

DEVELOPMENT OF INTERNAL STRATEGIC PERSPECTIVE
for the
FISH TO TSITSIKAMMA WMA (WMA No 15)

Tsitsikamma to Coega Internal Strategic Perspective

APPROVAL

Title	:	**Fish to Tsitsikamma Water Management Area: Tsitsikamma to Coega Internal Strategic Perspective**
DWAF Report no.	:	P WMA 15/000/00/0304
Consultants	:	Ninham Shand in association with Umvoto Africa, Jakoet & Associates, and Tlou & Matji
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INVITATION TO COMMENT

This report will be updated on a regular basis, until the Catchment Management Strategy eventually supersedes it. Water users and other stakeholders in the Fish to Tsitsikamma WMA and other areas are encouraged to study this report and to submit any comments they may have to the Version Controller (see box overleaf).

ELECTRONIC VERSION

This report is also available in electronic format as follows:

- DWAF website:
  - Intranet: http://dwaf-www.gov.za/documents/
  - Internet: http://www.dwaf.gov.za/documents/
- On CD which can be obtained from the DWAF Map Office at:
  157 Schoeman Street, Pretoria (Emanzini Building)
  ☎ (012) 336 7813
  E-mail: apm@dwaf.gov.za

  or from the Version Controller (see box overleaf)

The CD contains the following reports (all available on the DWAF website):

- Tsitsikamma to Coega Internal Strategic Perspective (This Report)
  (Report No: P WMA 15/000/00/0304)
- National Water Resource Strategy, First Edition, 2004
- The Fish to Tsitsikamma WMA - Overview of Water Resources Availability and Utilisation
  (Report No: P WMA 15/000/00/0203)
- The Fish to Tsitsikamma WMA – Water Resources Situation Assessment
  (Report No: P WMA 15/000/00/0101)

LATEST VERSION

This report is a living document and will be updated on a regular basis. If the version of this report is older than 12 months, please check whether a later version is not available.

This can be done on the DWAF website: http://www.dwaf.gov.za/documents/

or by contacting the Version Controller (see box overleaf)

VERSION CONTROL

FISH TO TSITSIKAMMA WMA
TSITSIKAMMA TO COEGA INTERNAL STRATEGIC PERSPECTIVE

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(The most significant amendments included in the latest version will be indicated here).

EXECUTIVE SUMMARY

Introduction

The Tsitsikamma to Coega ISP-area forms the western part of the Fish to Tsitsikamma Water Management Area (WMA 15) and lies predominantly within the Eastern Cape Province but also extends into the Western Cape Province. It derives its name from the *Tsitsikamma River*, located near the western coastal boundary of this area and the *Coega River*, the most easterly coastal river of this area. The remainder of the WMA will be separately addressed in the Fish to Sundays ISP Report.

This document presents the Department of Water Affairs and Forestry's (DWAF's) internal strategic perspective (ISP) or view on how it currently manages and intends managing the water resources within the ISP-area, during the period leading up to the establishment of a fully operational Fish to Tsitsikamma Catchment Management Agency (CMA), and the development of a Catchment Management Strategy (CMS). One of the major goals of the ISP is to obtain a common understanding within DWAF about management objectives and strategies.

After internal approval, the Department will invite comment on the ISP from local authorities, water user associations, other water related organisations and the public. Formal updates of the document will periodically be done until the CMA is technically functional and financially sustainable, and assumes its functions.

The knowledge of DWAF's regional and head office water management staff about this ISP-area is documented in the ISP. The knowledge and strategies in this document will *inter alia* be used as reference material and as a training manual for new entrants involved in regional water management. The ISP presents a common and consistent approach that can be adopted when addressing water management related issues, problems and queries, and when evaluating water license applications.

The ISP has been compiled by referring to policy documentation, legislation, regional planning, departmental guidelines, and relevant water related studies and documents, and from interviews and communications with DWAF regional managers and head office staff.

The key driver of the ISP-area

The Nelson Mandela Metropolitan Municipality (NMMM) is the major economic driver in the ISP-area and in the Eastern Cape as a whole, making by far the greatest contribution towards the Province's gross geographic product. The establishment of the Coega deepwater harbour and associated heavy industrial development zone north of Port Elizabeth will add a huge stimulus to the growth of the area. The NMMM is mainly supplied with water by the Algoa Water Supply System (AWSS) which is described later in this summary. Ensuring a continuous sustainable water supply for economic activity and

community well being is essential for the socio-economic prosperity of the area. In the rest of the ISP area, irrigation is the dominant water use.

Of overriding importance in the ISP-area is the current and increasing future need to transfer water into the Algoa Coast sub-area, both from within the ISP-area and from outside it. A substantial effort is therefore required to limit the demand by implementing water demand management and to keep infrastructure development to the essential. However, just as important is timeous planning for other interventions to reconcile the future requirements with the available resources.

Water law and water management

The **National Water Act** [32] (NWA), is the principal legal instrument governing water resource management in South Africa, and is being incrementally implemented. The NWA is supported by other legislation such as the National Environmental Management Act [33] and other Acts. The NWA does away with some far-reaching concepts but introduces others, which have both economic and social features.

The NWRS is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising powers or performing duties under the NWA must give effect to the NWRS. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources.

The country has been divided into nineteen Water Management Areas. The delegation of water resource management from central government to catchment level will be achieved by establishing CMAs at Water Management Area level. Each Catchment Management Agency (CMA) will progressively develop a Catchment Management Strategy (CMS). Until such time as the CMAs are established and are fully operational, the Regional Offices of DWAF will continue managing the water resources in their areas of jurisdiction.

As part of the implementation of Integrated Water Resource Management (IWRM), in line with the requirements of the NWA, DWAF is following a process that includes:

- Determination of existing lawful use;
- Determination of water availability at acceptable confidence levels;
- Determination of ecological water requirements at high confidence levels and
- Development of the regional management strategies, the ISPs.

An iterative and interactive process will then follow where public participation (preferably through the CMAs) will play a role in determining water resource and water use reconciliation options.

Locality and physical features

The ISP-area was divided into three sub-areas in the NWRS, but was further sub-divided into five sub-areas in this ISP, which will lead to improved regional management. These sub-areas are the Groot, Kouga-Gamtoos, Kromme-Seekoei, Tsitsikamma Coast and Algoa Coast. The map following this

Executive Summary shows the demarcation of the ISP-area. These NWRS sub-areas relate to the five sub-areas used in the Tsitsikamma to Coega ISP as follows:

NWRS sub-area	Tsitsikamma to Coega ISP sub-area
Gamtoos	Groot and Kouga-Gamtoos combined
Algoa	Algoa Coast
Tsitsikamma	Tsitsikamma Coast and Kromme-Seekoei combined

The topography is characterised by several mountain ranges parallel to the coast in the southern parts and localised massifs to the inland, while the rest of the area mainly consists of the plains and hills of the Great Karoo.

The climate over the ISP area is strongly influenced by its position relative to the coast and the topography. Most of the inland has typical dry Karoo climate. Rainfall generally occurs throughout the year in the coastal region and very late in summer in the inland areas. The peak rainfall months are December and January. Rainfall is in the range of 150 mm to 600 mm/a. Small localised coastal areas receive rainfall higher than 1 100 mm/a. Evaporation is considerably greater than rainfall, ranging from 1300 mm/a in the south to as high as 2 300 mm/a in the north-west of the dry Groot River catchment.

The Baviaanskloof Wilderness Area and the Tsitsikamma National Parks are important conservation areas. Several other national parks, game parks and conservation areas are located in the ISP-area.

Demography

About 90% of the population of just over 1 million people in the ISP-area is concentrated in the Algoa Coast sub-area. The rural population is sparse, particularly in the northern parts. Relatively high population growth is projected for the Nelson Mandela Metropolitan Municipality (or NMMM in short, comprising the Port Elizabeth, Despatch and Uitenhage/KwaNobuhle urban areas) while a small decline in population is projected for the inland areas.

International links and links with other WMAs

The ISP-area does not border on any neighbouring country and is not directly linked to any other country through the transfer of water. Large quantities of water are transferred into the Fish to Tsitsikamma WMA from the Orange River Basin, which is an international river shared by four countries. Some Orange River water is transferred to the Tsitsikamma to Coega ISP-area for urban use. Additional transfers could be made in future, but the recent update of the Orange River Replanning Study found that this would require further infrastructure development in the Orange River catchment. Water resources management decisions by the Orange River basin countries could also impact on transfers into the ISP-area. An increasing volume over time, of up to 41.3 million m^3/a (by 2025) has been identified for transfers from the Orange River to NMMM for urban use. This amount has been reserved in the Upper Orange WMA.

Economic development

The major economic activities in the area are industrial activities and manufacturing, mainly in the Port Elizabeth and Uitenhage areas, and dry land and irrigated agriculture in the rural areas. The ISP-area is not rich in minerals and mining operations consist mainly of quarrying for building materials. There are no large-scale power generation or pumped storage schemes. Tourism is well established and is expected to increase, especially along the scenic coastal strip. Unemployment in the area is higher than the national average.

This ISP-area includes the fifth largest metropolitan area in the country, namely the Nelson Mandela Metropolitan Municipality, which has major motor vehicle manufacturing plants. Port Elizabeth is a major centre for trade, and has an import and export harbour and an international airport.

The Coega deepwater harbour and associated heavy industrial development zone is being established north of Port Elizabeth. Portnet expects to invest a total of R4.65 billion in the deepwater port over the coming years, the timing of which will be driven by investor demand. Negotiation regarding the establishment of an aluminium smelter is underway. The initial impact of the Coega development on water use will be limited, but it is likely to have a significant impact in the longer term. The proposed Coega Industrial Development Zone (IDZ) and Harbour Development are expected to require 15 million m^3/a within 10 years.

Land use

Most cultivated land in the interior is irrigated because the rainfall is too low and erratic to be relied upon. Important irrigation areas are the Langkloof where deciduous fruit is grown, the Gamtoos Government Water Scheme, which receives its water from Kouga Dam and the Groot River Government Water Scheme, which receives its water from Beervlei Dam. Farming with sheep, goats and cattle is common in the ISP-area, and there are significant numbers of game.

The Tsitsikamma Coast sub-area is heavily afforested. There are large areas of lush indigenous forest with most of the forests either being situated within the Tsitsikamma Forest Reserve, or the Coastal National Park. There are tracts of commercial forests in the Gamtoos catchment above Loerie Dam, in the upper Swartkops River catchment and in the Van Staden's River catchment.

Waterworks

Several major dams have been constructed for urban supply and irrigation. The largest dams are the Churchill and Impofu Dams on the Kromme River, Beervlei Dam on the Groot River, Kouga Dam on the Kouga River and the Groendal Dam on the Swartkops River. The only transfer scheme into the ISP-area is that from the Sundays River (water transferred from the Orange River via the Fish River), while there are many internal water transfers between catchments in the ISP-area, mainly to supply the Nelson Mandela Metropolitan Municipality. The various water storage and transfer systems that supply the Metropole are called the Algoa Water Supply System.

A limited number of good dam sites are available for further water resource development. The proposed Guernakop Dam was identified as the next major scheme to meet the future requirements of the Nelson

Mandela Metropolitan Municipality, once water demand management and other measures have been implemented. However, the Kouga River is however already stressed and environmental constraints to the construction of the proposed Guernakop Dam could be significant, as it will be located in a conservation area.

Groundwater is widely used to supply towns and for rural water supply, with localised over-exploitation occurring. Some towns receive part or all of their water from the regional Algoa Water Supply System. The urban and rural domestic water supplies are generally adequate, with some localised shortfalls occurring, mainly because of inadequate management of supply systems or high demand peaks caused by holidaymakers in coastal towns.

Water resources availability

The water resources are not evenly distributed across the catchment, with the natural runoff much greater towards the coastal regions, where higher rainfalls occur. The natural mean annual runoff (MAR) of 1 183 million m^3/a has been reduced by abstractions and other consumptive usages to the present-day MAR of less than 80% of this amount. The available yield in the ISP-area is a combination of surface water, groundwater, usable return flows and transfers into the ISP-area. There are few gauging stations and monitoring sites in the area. The quantities available and uncertainties around that are discussed further in the report.

The bulk of available surface water is from large dams. Limited potential for development of new dams and other water resource developments remain. The Table Mountain (TMG) Group aquifer may have significant storage potential in the Tsitsikamma Coast and Groot sub-areas.

The total requirement of the Reserve is estimated to be 21.6 million m^3/a. Only the ecological requirements of the Swartkops River and estuary have been determined at a reasonable level of confidence. There is therefore uncertainty about the estimates of the Reserve and how this may change in future.

The quality of surface water in the ISP-area varies markedly from one catchment to another. The Tsitsikamma Coast sub-area generally has excellent water quality. In the upper Kromme, Kouga and Swartkops Rivers the quality is good, but becomes poorer downstream. Quality in the Groot River is naturally poor on account of high salt concentrations and the water is unacceptable for most uses. Water quality problems are experienced in the Seekoei River due to salinity and in the middle and lower reaches of the Swartkops River on account of nutrient rich effluent return flows.

The quality of groundwater varies from one aquifer to another within and between the sub-areas. In general, the TMG aquifers which dominate the Tsitsikamma Coast sub-area and the southern section of the Groot sub-area, have good quality water. The Uitenhage Control area in the Algoa Coast sub-area is a confined artesian basin, which comprises a number of discreet aquifers. The water quality varies from brackish in the overlying sediments to very good quality water in the confined TMG below. The primary dune aquifers, present in places along the coast in the Tsitsikamma Coast, Kromme-Seekoei and Algoa Coast sub-areas, hold good quality water.

Use of return flows is low.

Calculations of the available water per river sections, rivers and the ISP-area were carefully studied, revisited and refined for this ISP, following the publication of the NWRS. These later calculations and updates of yields showed that there is considerable uncertainty regarding the water availability, particularly in the Gamtoos and Tsitsikamma sub-areas. There is enough confidence in these revisited values that they have been shown in tables in this report. **It is, however, essential that the apparent discrepancies be addressed as a matter of priority through the Reconciliation Strategy as discussed in Strategy 13.1.**

The following table shows the yields per ISP sub-area as revisited during the ISP process.

Available ISP sub-areas yield in the year 2000 (million m³/a) at 1:50 year assurance

ISP Sub-area	Natural resource		Usable return flow	Total local yield (1)	Transfers in (2)	Grand Total
	Surface water	Ground-water				
Groot	15	3	1	**19**	0	**19**
Kouga-Gamtoos	94	2	2	**98**	0	**98**
Sub total	**109**	**5**	**3**	**117**	**0**	**117**
Algoa Coast	10	6	4	**20**	62	**82**
Sub total	**10**	**6**	**4**	**20**	**62**	**82**
Kromme-Seekoei	44	2	2	**48**	0	**48**
Tsitsikamma Coast	12	0	1	**13**	0	**13**
Sub total	56	2	3	**61**	0	**61**
Total for ISP-area	**175**	**13**	**10**	**198**	**11**	**209**

1) After allowance for the impacts on yield of: ecological component of the Reserve, river losses, alien plants, dry land agriculture and urban runoff.
2) Transfers into the sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfer into the WMA.

The following table shows the yields per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report [(3)].

Available NWRS yield in the year 2000 (million m³/a) at 1:50 year assurance

NWRS sub-area	Natural resource		Usable return flow	Total local yield (1)	Transfers in (2)	Grand Total
	Surface water	Ground-water				
Gamtoos	137	5	3	**145**	0	**145**
Algoa	10	6	7	**23**	64	**87**
Tsitsikamma	41	6	2	**49**	0	**49**
Total	**188**	**17**	**12**	**217**	**31**	**248**

1) After allowance for the impacts on yield of: ecological component of the Reserve, river losses, alien plants, dry land agriculture and urban runoff.
2) Transfers into and out of sub-area may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) The revisited ISP sub-area yields, summed to NWRS key areas, are shown in brackets, following the NWRS yield values.

The *major* differences between the available yields as determined in the ISP and the NWRS yields are the following:

- Available yield in the ISP-area was determined as 209 million m^3/a compared to 248 million m^3/a in the NWRS;
- Sub-area available yields (according to the NWRS sub-areas) were determined as:
  - 117 million m^3/a in the Gamtoos sub-area compared to 145 million m^3/a of the NWRS;
  - 82 million m^3/a in the Algoa sub-area compared to 87 million m^3/a of the NWRS; and
  - 61 million m^3/a in the Tsitsikamma sub-area compared to 49 million m^3/a of the NWRS;
- The transfer into the ISP-area from the Fish to Sundays ISP-area was determined as 11 million m^3/a, compared to 31 million m^3/a of the NWRS, to reflect the actual average transfer.

Water requirements and use

Water requirements are as shown in the following table. Irrigation is by far the largest use of water in the ISP-area, being about 55% of total requirements, and is mainly used to grow vegetables, pastures, deciduous fruit and citrus. There is scope for more efficient use. Urban and industrial use is about 39% of total requirements and is increasing. Most of the major urban and industrial requirements are in the Algoa Coast sub-area, which is remote from the major local sources on the Kromme and Kouga Rivers. Other uses are limited in comparison. There is, however, scope for improving estimates of water requirements.

Calculations of the water requirements per river sections, rivers and the ISP-area were carefully studied, revisited and refined for this ISP, following the publication of the NWRS. These later calculations and updates of requirements show that there is uncertainty regarding the water requirements. There is enough confidence in these revisited values that they have been shown in tables in this report. **It is, however, essential that the apparent discrepancies be addressed as a matter of priority through the Reconciliation Strategy as discussed in Strategy 13.1.**

The following table shows the water requirements per ISP sub-area as revisited during the ISP process.

ISP sub-areas water requirements for the year 2000 (million m³/a) at 1:50 year assurance

ISP Sub-area	Irrigation	Urban (1)	Rural (1)	Mining and bulk industrial (2)	Power generation (3)	Affore-station (4)	Total local require-ments	Transfers out	Grand Total
Groot	16	1	3	0	0	0	**20**	0	**20**
Kouga-Gamtoos	79	2	1	0	0	1	**83**	16	**99**
Sub total	**95**	**3**	**4**	**0**	**0**	**1**	**103**	**16**	**119**
Algoa Coast	7	73	1	0	0	0	**81**	0	**81**
Sub total	**7**	**73**	**1**	**0**	**0**	**0**	**81**	**0**	**81**
Kromme-Seekoei	7	4	1	0	0	0	**12**	35 (5)	**47**
Tsitsikamma Coast	4	1	1	0	0	5	**11**	0	**11**
Sub total	**11**	**5**	**2**	**0**	**0**	**5**	**23**	**35**	**58**
Total for ISP-area	**113**	**81**	**7**	**0**	**0**	**6**	**207**	**0**	**207**

1) Includes the component of the Reserve for basic human needs at 25 l/c/d.
2) Mining and bulk industrial water uses, which are not part of urban systems.
3) Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well).
4) Quantities given refer to impact on yield only.
5) This is the current maximum possible transfer due to the bottleneck in the pipeline from the Impofu/Churchill system.
6) Transfers out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfer out of the WMA.

The following table shows the water requirements per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report (3).

NWRS water requirements for the year 2000 (million m³/a) at 1:50 year assurance

NWRS Sub-area	Irrigation	Urban (1)	Rural (1)	Mining and bulk industrial (2)	Power generation (3)	Affore-station (4)	Total local require-ments	Transfers out	Grand Total
Gamtoos	104	3	3	0	0	1	**111**	12	123
Algoa	12	78	1	0	0	0	**91**	0	91
Tsitsikamma	11	5	1	0	0	5	**22**	22	44
Total	**127**	**86**	**5**	**0**	**0**	**6**	**224**	**0**	**224**

1) Includes the component of the Reserve for basic human needs at 25 l/c/d.
2) Mining and bulk industrial water uses, which are not part of urban systems.
3) Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well).
4) Quantities given refer to impact on yield only.
5) Transfers out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfer out of the WMA.

The *major* differences between the water requirements as determined in the ISP from the NWRS water requirements are the following:

- Water requirements in the ISP-area were determined as 207 million m^3/a compared to 224 million m^3/a of the NWRS;
- Sub-area water requirements (according to the NWRS sub-areas) were determined as follows:

- 119 million m^3/a in the Gamtoos sub-area compared to 123 million m^3/a of the NWRS;
- 81 million m^3/a in the Algoa sub-area compared to 91 million m^3/a of the NWRS; and
- 58 million m^3/a in the Tsitsikamma sub-area compared to 44 million m^3/a of the NWRS;

- The transfers from the NWRS Gamtoos sub-area to the Algoa sub-area was determined as 16 million m^3/a, compared to 12 million m^3/a of the NWRS, to reflect the actual average transfer;
- The transfer from the NWRS Tsitsikamma sub-area to the Algoa sub-area was determined as 35 million m^3/a, compared to 22 million m^3/a of the NWRS, to reflect the actual average transfer;

Groundwater is mainly used to supply small towns and for rural water supply. Identified requirements to alleviate poverty have so far been relatively small in this sub-area. The Kruisfontein resource-poor farmers intend expanding their irrigation in the Seekoei River catchment. Other equity requirements have had a low profile, compared to elsewhere in the Eastern Cape Province.

The future focus on water use will be to ensure a sustained, reliable supply for the growing urban water requirements of the NMMM; consolidation of the existing irrigation water use and improving efficiency of use, promoting re-use of water and ensuring that water is made available to alleviate poverty.

Current yield balance

The following table shows the yield balance per ISP sub-area as revisited during the ISP process.

ISP sub-areas reconciliation of water requirements and availability for the year 2000 at 1:50 year assurance (million m^3/a)

ISP Sub-area	Available water			Water requirements			Balance (1)
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	
Groot	19	0	19	20	0	20	**-1**
Kouga-Gamtoos	98	0	98	83	16 (3)	99	**-1**
Sub total	**117**	**0**	**117**	**103**	**16**	**119**	**-2**
Algoa Coast	20	62	82	81	0	81	**1**
Sub total	**20**	**62**	**82**	**81**	**0**	**81**	**1**
Kromme-Seekoei	48	0	48	12	35 (5)	47	**1**
Tsitsikamma Coast	13	0	13	11	0	11	**2**
Sub total	**61**	**0**	**61**	**23**	**35**	**58**	**3**
Total for ISP-area	**198**	**11** (4)	**209**	**207**	**0**	**207**	**2**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) The current allocation to NMMM is 23 million m^3/a.
4) 11 million m^3/a is transferred from the Orange River via the Fish/Sundays systems. The Sundays River Scheme can supply 25.6 million m^3/a if operated at full capacity throughout the year and if some additional treatment capacity is added (currently 20 million m^3/a). The scheme's Bethelsdorp pump station has however been vandalised, which temporarily further limits the scheme's capacity.
5) This is the current maximum transfer due to the bottleneck in the pipeline from the Impofu/Churchill system.

The following table shows the yield balances per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report [3].

Reconciliation of NWRS water requirements and availability for the year 2000 at 1:50 year assurance (million m³/a)

NWRS Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	(1)
Gamtoos	145	0	145	111	12 [3]	123	**22**
Algoa	23	64	87	91	0	91	**-4**
Tsitsikamma	49	0	49	22	22 [5]	44	**5**
Total	**217**	**31** [4]	**248**	**224**	**0**	**224**	**24**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) The current allocation to NMMM is 23 million m^3/a.
4) According to the NWRS, 31 million m^3/a is transferred from the Orange River via the Fish/Sundays systems.

The reconciliation of available water and requirements for the year 2000, including transfers of Orange River water, indicates that there is a current surplus in the Tsitsikamma to Coega ISP-area of 2 million m^3/a. The ISP-area was therefore approximately in balance in the year 2000. The recently completed Algoa Pre-Feasibility study concluded that, with a growing urban demand, the Algoa Water Supply System was in balance in 2003.

The NWRS shows a balance of 24 million m³/a, which is substantially more than the balance determined in the ISP. The major difference is in the NWRS Gamtoos sub-area, where the NWRS has a balance of 22 million m³/a, compared to the ISP shortage of 2 million m³/a. This severely impacts on the ability of NMMM (or alternatively the Gamtoos irrigators) to make full use of their water use authorisation, as well as of the Gamtoos NWRS sub-area to help meet future urban growth with increased future transfers.

The difference between the ISP balance of 1 million m³/a and the NWRS shortage of 4 million m³/a in the Algoa sub-area does not change the management approach to be followed, as both balances show that the sub-area is close to a balanced situation.

The difference between the ISP balance of 3 million m³/a and the NWRS balance of 5 million m³/a in the Tsitsikamma NWRS sub-area does not change the management approach to be followed, as both balances show that the sub-area has a small surplus.

It is evident that a shortage of supply in this ISP-area could be imminent.

Future perspective and management approach

Further concentration of economic development, accompanied by continued growth in water requirements is projected in the NMMM as well as in the southern coastal strip, mainly due to tourism. Such growth will result in further stress on the water resources of the ISP-area and WMA and indicates the importance of planning to reconcile the resources with the requirements.

The implementation of water conservation and demand management measures (especially in the NMMM and in the larger irrigation schemes), more effective use of existing infrastructure, increased re-use of sewage effluent, further groundwater development and water trading will be actively persued, inter-alia through co-operative governance, with the aim to postpone the implementation of new schemes for a few years. An increasing volume of Orange River water over time, from 18.2 in 2000, to 41.3 million m^3/a by 2025 has been reserved for urban use of NMMM from the Upper Orange WMA through additional transfers. There is deteriorating water quality in the Fish/Sundays Rivers due to irrigation return flows, also in a downstream direction. Transferred water flows into the lower Sundays River from where it is pumped to NMMM. Water quality in the middle/lower Sundays River is still within acceptable limits, but is not good and is deteriorating. Partial desalination of this water may be a longer-term option for the NMMM.

More detailed determinations of some of the ecological Reserve requirements are needed in order to improve the confidence of the yield balances of rivers that are already water-stressed.

New irrigation development would be too expensive in most cases. Water for expansion of irrigation, where land is still available, should preferably be acquired through increased water use efficiency and water trading. The large conveyance losses experienced at some schemes must be tackled through demand management studies and the implementation of identified conservation measures.

Water for the use of resource-poor farmers will be given a very high priority. The feasibility of two prospective schemes at Kruisfontein (Seekoei River) and Doriskraal (Tsitsikamma River) needs to be determined. There are pockets or areas of poverty where water can make a real difference to people's lives. These include additional irrigation development for resource-poor farmers, water for farm workers and, where relevant, support of land reform initiatives.

Opportunities exist for additional use of reclaimed effluent. Of the current 48 million m^3/a of wastewater that is discharged to sea from NMMM's wastewater works, only 2.3 million m^3/a is re-used, from an installed infrastructure capacity to reclaim 8.7 million m^3/a. These opportunities require further analyses and clarification. Impact studies should be conducted to assess the viability of such identified uses.

Control of invasive alien plants will be strongly supported and existing programmes should continue.

The deep Table Mountain Group aquifer needs to be investigated as a possible future regional source. The surface and groundwater interactions need to be quantified as part of the TMG resource evaluation and management approach.

The Algoa Water Supply System (AWSS) constitutes the most important combination of sources and bulk supplies in the ISP-area. It supplies NMMM which is the economic hub of the area, and indeed of

the whole Eastern Cape Province. It is therefore extremely important that continued adequate availability of water be ensured through a *Reconciliation Strategy* for the AWSS. It is recommended that such a strategy be drawn up as soon as possible. The strategy should sort out any uncertainty about the present adequacy of water availability and establish a programme for implementation of reconciliation interventions to cover future increase in demand, and detail actions to be taken (monitoring, studies, reviews) to complete the necessary knowledge base. The Strategy should be kept up to date through annual revision.

As new schemes may take up to six to ten years to implement it is important that initiatives to implement future sources of supply commence in the near future. The construction of Guernakop Dam is a future option to supply water through the existing infrastructure of the Algoa Water Supply System.

Perspective on the sub-areas

Algoa Coast

The Swartkops River has a very ecologically important estuary, whilst the Coega River lies to the north and forms the eastern boundary of the ISP-area. Smaller rivers are the Van Stadens and Maitland Rivers. The NMMM is the major economic driver in the Eastern Cape. The Coega harbour and duty-free heavy industrial zone is under development. The water transferred into the sub-area for urban and industrial use from the Kouga/Loerie Dams, Churchill/Impofu Dams and the Sundays River (61.5 million m^3) far exceed local scheme yields. Contamination by industrial activity in the Swartkops catchment is leading to water quality problems and eutrophication. A Water Quality Management Plan will be compiled for the river. A major programme of alien removal is underway in the upper catchments of the Swartkops River. A study will be done to investigate the removal of waterweeds. There is continued urbanisation and population growth in the NMMM. Reconciliation is immediately and urgently required. A shortage in supply will develop, unless there is immediate intervention to reduce the water demand through water demand management and other conservation measures. It is possible to postpone the implementation of new schemes for many years, through various measures. However, as new schemes may take six to ten years to implement it is important that planning of future sources of supply should commence timeously. Future longer-term transfer options are from the Orange River, or from the proposed Guernakop Dam on the Kouga River.

Groot

The Groot River is a major tributary of the Gamtoos River and lies entirely in the dry Karoo. Beervlei Dam is the only major dam and is mainly used for flood control. Water from the dam is also released for downstream irrigators but river losses are high. The management strategy for the dam will be revisited and a new operational strategy determined. A disaster management plan must be prepared and implemented for the Groot and Gamtoos Rivers to safeguard the public in the Gamtoos River catchment against floods, which are features of that system. A small decline in population is projected for the area, attributable to the predicted lack of further economic growth and the impact of HIV/Aids. Water requirements in the sub-area are expected to remain constant.

Kromme-Seekoei

The Kromme River drains a narrow valley between the Suuranys Mountains and the Tsitsikamma Mountains. The Churchill and Impofu Dams in the Kromme River supply water via a transfer scheme to the NMMM and some towns. To the east, the Seekoei River flows to the sea across a fertile coastal plain.

The Kabeljous River estuary is at Jeffreys Bay. The Kromme, Seekoei and Swart Rivers require compulsory licensing due to the stressed conditions and water quality problems. Comprehensive Reserve studies are under way in the Kromme, Seekoei and Swart Rivers to support compulsory licensing. The requirement by the Kruisfontein resource-poor farmers for an allocation for additional irrigation in the Seekoei River catchment needs to be evaluated and a planning study done to determine the feasibility of the scheme. There is concern about over-abstraction of well fields by coastal towns in summer and the impact of the many illegal dams in the Seekoei River. Programmes are under way to control invasive alien plants in the Kromme, Kabeljous and Seekoei Rivers' catchments. Major wetland rehabilitation projects are underway in the Kromme and Seekoei Rivers. Population growth and resultant growth in water requirements is projected for the sub-area, partly associated with growth in the tourism industry.

Kouga-Gamtoos

The Kouga River, which rises in the Langkloof has the isolated Baviaanskloof River as its major tributary. Below Kouga Dam the Groot River joins the Kouga River to form the Gamtoos River, which flows to the sea, flanked by irrigated lands. The sub-area is approximately in balance and the apparent over-allocation of water from Kouga Dam needs to be addressed. This may impact on the Gamtoos GWS irrigators. Compulsory licensing should be undertaken for the entire sub-area if other means to balance yields with requirements are not successful. The construction of Guernakop Dam on the Kouga River remains a future option to supply water. No new licenses will be granted in the medium term and water trading is recommended to meet requirements. Large operational water losses need to be contained, and agricultural water demand management measures must be implemented to conserve water. Working for Water eradication programmes will continue in the Langkloof. The risk of flooding along the lower Gamtoos River needs to be properly managed. A small decline in future population is projected for the area, attributable to the predicted lack of further economic growth and the impact of HIV/Aids. Water requirements in the sub-area will likely remain constant.

Tsitsikamma Coast

A number of steep, deeply incised rivers flow to the sea from the Tsitsikamma Mountains. The sub-area is very scenic and most rivers have a very high conservation status. There is some surplus yield, mainly in the wetter western parts. Applications for surface water use authorisations will be handled on merit. There is some scope for development, but it will be very dependent on the environmental water requirements, still to be refined. The feasibility of a scheme in the Tsitsikamma River for resource-poor farmers must be established. Refinement of yield balances should be undertaken in prioritised rivers to be able to address the license applications. The area is heavily infested with alien invasive vegetation and alien plant control is needed especially in the lower reaches of rivers. This would yield 3 million m^3/a if all aliens in the sub-area could be removed. The growth in urban water requirement as foreseen in the NMMM may eventually impact on this sub-area's yield balance if further surface water options are developed. Water requirements in this sub-area will likely grow mainly because of an increase in tourism.

Introduction to the ISP strategies

The many issues and concerns identified in the ISP-area will be addressed through the implementation of appropriate regional water management strategies (of which many are existing). DWAF staff has identified the essential management strategies to manage the Tsitsikamma to Coega ISP-area. Additional required strategies may be developed in future.

Ten broad strategy groups, called Main strategies - that cover all necessary current and required future water management activities - were identified from current DWAF Regional Office activities, and the requirements of the NWA and the NWRS. These Main strategies are:

- ⇨ Yield balance and reconciliation;
- ⇨ Water resources protection;
- ⇨ Water use management;
- ⇨ Water conservation and demand management;
- ⇨ Institutional development and support;
- ⇨ Social and environmental considerations;
- ⇨ Integration and co-operative governance;
- ⇨ Waterworks development and management;
- ⇨ Monitoring and information management and
- ⇨ Implementation.

Under each of these Main strategy groups, specific strategies particular to the Tsitsikamma to Coega ISP-area were developed.

For each strategy, the following aspects are addressed:

- ***Management objectives*** in terms of the envisaged solutions for the strategy;
- ***Situation assessment;*** providing a synopsis of the current situation with a focus on the issues;
- ***Strategic approach;*** stating the approach or plan that DWAF will follow to reach its objectives for the strategy;
- ***Management actions;*** states the required actions to implement the strategy;;
- ***Responsibility;*** the responsible offices or Directorates are named;
- ***Priority*** in terms of the ISP rating system (1 – 5, where 1 indicates the highest priority);

Responsibilities for Main strategies and for individual strategies were assigned to responsible DWAF Directorates or Sections within the Eastern Cape Regional Office. DWAF head office champions were identified where appropriate.

Locality Map of the Tsitsikamma to Coega ISP-area
LOWER ORANGE WMA
GOURITZ WMA
FISH TO TSITSIKAMMA WMA
Restvale
Murraysburg
Rietbron
Beervlei Dam
Willowmore
Aberdeen
New Bethesda
Vanryneveldspas Dam
Graaff-Reinett
De Hoop Dam
Pearston
Somerset East
Cradock
Lake Arthur
Kommandodrift Dam
Grassridge Dam
Hofmeyr
Bedford
Cookhouse
Uitkeer
Jansenville
Klipplaat
Darlington Dam
Riebeeck-Oos
Alicedale
Kirkwood
Paterson
Steytlerville
Kleinpoort
Joubertina
Kouga Dam
Patensie
Hankey
Loerie Dam
Kareedouw
Churchill Dam
Humansdorp
Mpofu Dam
Jeffreys Bay
Paradise Beach
Cape St Francis
Oyster Bay
Sanddrif
Uitenhage
Groendal Dam
Despatch
Cannonvale
St George's Strand
New Brighton
Port Elizabeth
Kini Bay
Skoenmakerskop
Baviaanskloof
Heuningklip
Kariga
Sundays
Groot
Kouga
Gamtoos
Kabeljous
Seekoei
Tsitsikamma
Kwazunga
Elands
Swartkops
Coega
Koonap
Great Fish
Gats
LOCALITY MAP:
LEGEND:
GIS COV:
WMA Boundaries
Towns
Rivers
Dams
Quaternary Catchment
E24D Quaternary Number
Secondary Catchment
Waterman
Intp (Amended)
Wri500
Ndams
Drgnquat
Drgnquat
Drgsnd
Management Areas
L11,L12,L21-L23,L30-L70 Groot
K80A - K80F Tsitsikamma Coast
K90 - K90G Kromme/Seekoei
L81A - L82J, L90 Kouga/Gamtoos
M10A - M30B Algoa Coast
PREPARED BY:
NINHAM SHAND CONSULTING SERVICES
CLIENT:
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE NATIONAL WATER RESOURCES PLANNING
PROJECTION:
ALBERS EQUAL AREA
SCALE : 1:1 200 000
20 0 20 Kilometers
N
TITLE:
FISH TO TSITSIKAMMA WMA
TSITSIKAMMA TO COEGA ISP
Prepared by: A Lawrence
Date: 07/2002
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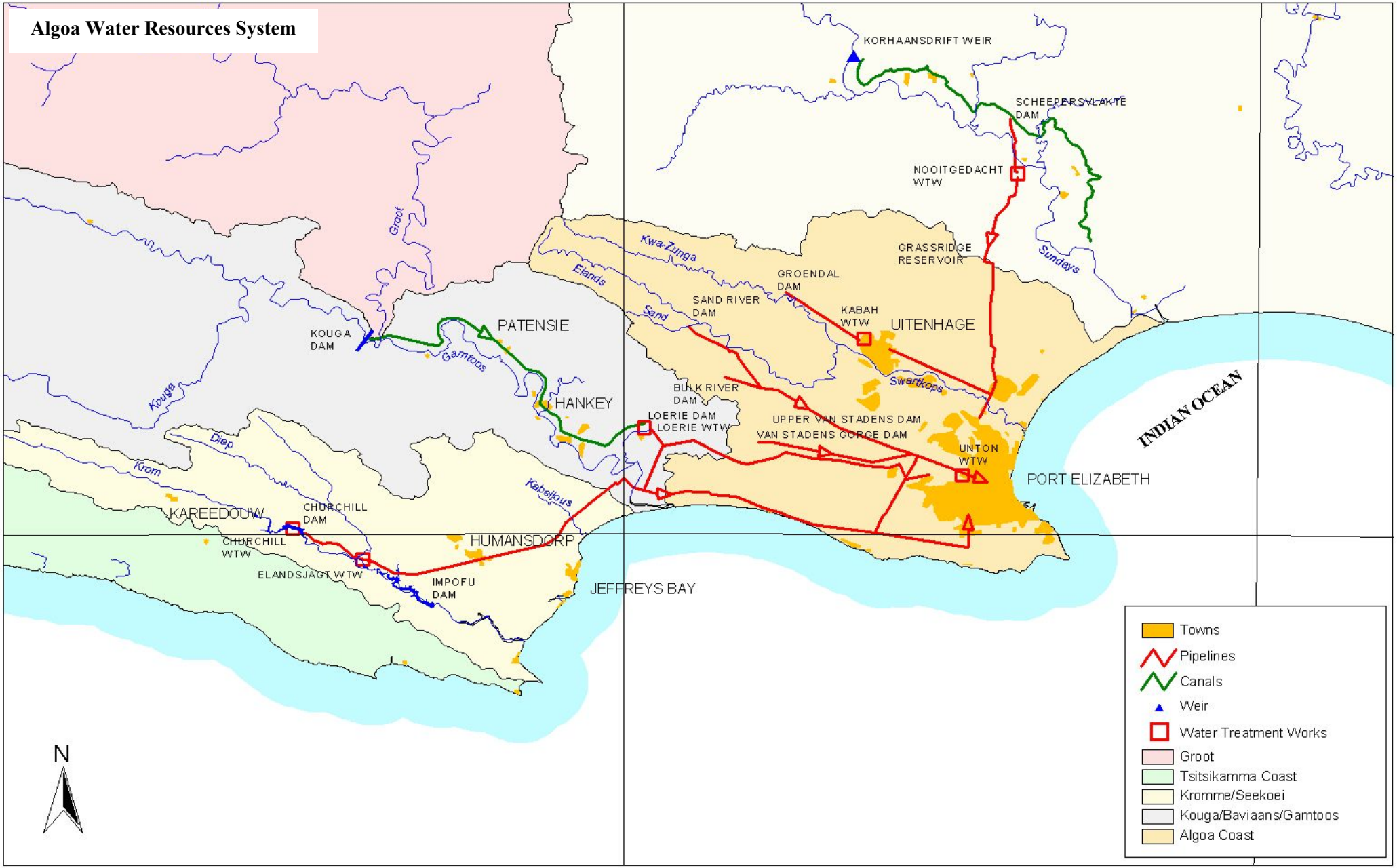

THE ALGOA WATER RESOURCES SYSTEM

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
Directorate National Water Resources Planning

TSITSIKAMMA TO COEGA INTERNAL STRATEGIC PERSPECTIVE
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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immunity deficiency syndrome
AWSS	Algoa Water Supply System
CEIMP	Consolidated Environmental Implementation and Management Plan
CMA	Catchment management agency
CMS	Catchment management strategy
DALA	Department of Land Affairs
DEAET	Eastern Cape Department of Economic Affairs, Environment and Tourism
DEAT	National Department of Environmental Affairs and Tourism
DWAF	National Department of Water Affairs and Forestry
ECA	Environmental Conservation Act
EIA	Environmental impact assessment
EMF	Environmental management framework
EPP	Emergency preparedness plans
GA	General authorisation
GIS	Geographical information system
GWS	Government water scheme
IAC	Irrigation Action Committee
IDP	Integrated development plan
IDZ	Industrial development zone
ISP	Internal strategic perspective
IWRM	Integrated water resources management
NEMA	National Environmental Management Act
NMMM	Nelson Mandela Metropolitan Municipality
NWA	National Water Act
NWRS	National Water Resource Strategy
RAMSAR	Conservation areas classified in terms in of this convention on "wetlands"
RO	Regional office (DWAF)
RDM	Resource directed measures
RQO	Resource quality objectives
SFRALAAC	Licence assessment advisory committee for stream flow reduction activities
SUP	Sustainable utilisation plan
TINWA	Team for implementation of the National Water Act
TDS	Total dissolved solids
WARMS	Water use authorisation and registration management system
WfW	Working for Water
WfWetlands	Working for Wetlands
WMA	Water management area
WQM	Water quality management
WRSA	Water resources situation assessment
WSDP	Water service development plan
WTW	Water Treatment Works
WUA	Water user association
WWTW	Wastewater treatment works

GLOSSARY OF TERMS

AQUICLUDE	An impermeable geological unit that cannot transmit water at all. (Very few natural geological materials are considered aquicludes).
AQUIFER	A saturated permeable geological unit that can transmit significant (economically useful) quantities of water under ordinary hydraulic gradients. Specific geologic materials are not innately defined as aquifers and aquitards, but within the context of the stratigraphic sequence in the subsurface area of interest.
AQUITARD	A saturated geological unit of relatively lower permeability within a stratigraphic sequence relative to the aquifer of interest. Its permeability is not sufficient to justify production wells being placed in it. (This terminology is used much more frequently in practice than aquiclude, in recognition of the rarity of natural aquicludes).
ASSURANCE OF SUPPLY	The reliability at which a specified quantity of water can be provided, usually expressed either as a percentage or as a risk. For example "98% reliability" means that, over a long period of time, the specified quantity of water can be supplied for 98% of the time, and less for the remaining 2%. Alternatively, this situation may be described as a "1 in 50 year risk of failure" meaning that, on average, the specified quantity of water will fail to be provided in 1 year in 50 years, or 2% of the time.
BASIN	The area of land that is drained by a large river, or river system.
CONDENSED AREA	The equivalent area of alien plants with a maximum concentration/density that represents the more sparsely distributed alien plants that occur over a large area.
CATCHMENT	The area of land drained by a river. The term can be applied to a stream, a tributary of a larger river or a whole river system.
COMMERCIAL FARMING	Large scale farming, the products of which are normally sold for profit.
COMMERCIAL FORESTS	Forests that are cultivated for the commercial production of wood or paper products.
CONFINED AQUIFER	An aquifer that is physically located between two aquicludes, where the piezometric water level is above the upper boundary of the aquifer. The water level in a well tapping a confined aquifer usually rises above the level of the aquifer. If the water rises above ground level, the aquifer is called artesian.
DAM	The wall across a valley that retains water, but also used in the colloquial sense to denote the lake behind the wall.
DEFICIT	Describes the situation where the availability of water at a particular assurance of supply is less than the unrestricted water requirement.
DISCHARGE AREA	The area or zone where ground water emerges from the aquifer naturally or artificially. Natural outflow may be into a stream, lake, spring, wetland, etc. Artificial outflow may occur via pump wells.
ECOSYSTEM	A unit made up of all the living and non-living components of a particular area that interact and exchange materials with each other.

ENVIRONMENTALLY SENSITIVE AREA	A fragile ecosystem, which will be maintained only by conscious attempts to protect it.
GROUNDWATER	Water in the subsurface, which is beneath the water table, and thus present within the saturated zone. In contrast, to water present in the unsaturated or vadose zone which is referred to as soil moisture.
IRRIGATION QUOTA	The quantity of water, usually expressed as m^3/ha/a, or mm/a, allocated to land scheduled under the scheme. This is the quantity to which the owner of the land is entitled at the point at which he or she takes delivery of the water and does not include conveyance losses to that point.
MEAN ANNUAL RUNOFF	Frequently abbreviated to MAR, this is the long-term mean annual flow calculated for a specified period of time, at a particular point along a river and for a particular catchment and catchment development condition.
OPPORTUNISTIC IRRIGATION	Irrigation from run-of-river flow, farm dams, or compensation flows released from major dams. As storage is not provided to compensate for reduced water availability in dry years, the areas irrigated generally have to be reduced in dry years.
POROSITY	The degree to which the total volume of soil or rock is permeated with spaces or cavities through which water or air can move.
PRIMARY AQUIFER	Aquifers in which the water moves through the spaces that were formed at the same time as when the geological formation was formed, for instance intergranular porosity in sand (for example alluvial deposits).
RECHARGE AREAS	Areas of land that allow groundwater to be replenished through infiltration or seepage from precipitation or surface runoff.
RELIABILITY OF SUPPLY	Synonymous with assurance of supply.
RESERVE	The quantity and quality of water required (a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997) for people, who are now or who will, in the reasonably near future, be (i) relying upon; (ii) taking water from; or (iii) being supplied from, the relevant water resource; and (b) to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource as indicated in the National Water Act (Act No. 36 of 1998).
RESOURCE DIRECTED MEASURES	Measures that focus on the quality and overall health of water resources.
RESERVOIR	The lake formed behind a dam wall. In this report the colloquial term dam is generally used for reservoir.
RESOURCE QUALITY	The quality of all the aspects of a water resource including: (a) the quantity, pattern, timing, water level and assurance of instream flow; (b) the water quality, including the physical, chemical and biological characteristics of the water; (c) the character and condition of the instream and riparian habitat; and (d) the characteristics, condition and distribution of the aquatic biota.
RESOURCE QUALITY OBJECTIVE	Quantitative and verifiable statements about water quantity, water quality, habitat integrity and biotic integrity that specify the requirements (goals) needed to ensure a particular level of resource protection.

RIVER SYSTEM	A network of rivers ranging from streams to major rivers and, in some cases, including rivers draining naturally separate basins that have been inter-connected by man-made transfer schemes.
SALINITY	The concentration of dissolved salts in water. The most desirable drinking water contains 500 parts per million or less of dissolved minerals.
SATURATED ZONE	The subsurface zone below the water table where pores within the geologic matrix are filled with water and fluid pressure is greater than atmospheric. Aquifers are located in this zone.
SECONDARY AQUIFER	Aquifers in which the water moves through spaces that were formed after the geological formation was formed, such as fractures in hard rock.
SOURCE DIRECTED CONTROL	Measures primarily designed to control water use activities at the source of impact, through tools such as standards, and conditions in water use authorisations.
SUB-CATCHMENT	A sub-division of a catchment.
UNCONFINED AQUIFER	An aquifer, which is not restricted by any confining layer above it. Its upper boundary is the water table, which is free to rise and fall. The water level in a well tapping an unconfined aquifer is at atmospheric pressure and does not rise above the level of the water table within the aquifer. An unconfined aquifer is often near to the earth's surface and not protected by low permeable layers, causing it to be easily recharged as well as contaminated.
UNSATURATED ZONE	An area, usually between the land surface and the water table, where the openings or pores in the soil contain both air and water.
WATER TABLE	The top of an unconfined aquifer where water pressure is equal to atmospheric pressure. The water table depth fluctuates with climate conditions on the land surface above and is usually gently curved and follows a subdued version of the land surface topography.
WATER TRANSFERS	Water transferred from one drainage basin or secondary sub-catchment to another.
WELL	An opening in the surface of the earth for the purpose of removing fresh water.
YIELD	The maximum quantity of water obtainable on a sustainable basis from a dam or river in any hydrological year, in a sequence of years, and under specified conditions of catchment development and dam operation.

FISH TO TSITSIKAMMA WATER MANAGEMENT AREA
Tsitsikamma to Coega Internal Strategic Perspective

CHAPTER 1 - BACKGROUND TO THE TSITSIKAMMA TO COEGA INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE FISH TO TSITSIKAMMA WMA

Figure 1.1 shows the position of the Fish to Tsitsikamma WMA. The Tsitsikamma to Coega ISP-area (western part of WMA 15) falls mainly in the Eastern Cape Province but also in the Western Cape Province.

The Tsitsikamma to Coega ISP-area forms the western part of the Fish to Tsitsikamma WMA. It borders the Indian Ocean to the south, the Gouritz/Lower-Orange WMAs to the west, and the Upper-Orange WMA to the north and the Sundays River catchment to the east. The remainder of the WMA will be separately addressed in the Fish to Sundays ISP Report.

Figure 1.1: Location of the Fish to Tsitsikamma WMA

To put the importance of the Fish to Tsitsikamma Water Management Area (WMA) in perspective, the following observations are made in comparison to the eighteen other WMAs:

- The WMA is one of the largest in terms of size, has the seventh largest population and the seventh highest gross regional product (GRP) of the WMAs;
- It has the eighth highest mean annual runoff but the fifth highest water requirements;
- It has been accorded the highest priority together with some other WMAs for Reserve determinations, third highest together with some other WMAs for compulsory licensing, a low priority for CMA establishment and a low priority for transfer of government-owned infrastructure to Water Management Institutions.

The Tsitsikamma to Coega ISP-area has the lion's share of the GRP, population and water requirements when compared to the remainder of the WMA.

1.2 WATER LEGISLATION AND MANAGEMENT

Water is one of the most fundamental and indispensable of all natural resources. It is fundamental to life and the quality of life, to the environment, food production, hygiene, industry, and power generation. The availability of affordable water can be a limiting factor for economic growth and social development, especially in South Africa where water is a relatively scarce resource that is distributed unevenly, both geographically and through time, as well as socio-politically.

Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role. South Africa needs to manage its water resources optimally in order to further the aims and aspirations of its people. Current government objectives for managing water resources in South Africa are set out in the National Water Resources Strategy (NWRS) as follows:

- **To achieve equitable access to water.** That is, equity of access to water services, to the use of water resources, and to the benefits from the use of water resources.
- **To achieve sustainable use of water**, by making progressive adjustments to water use to achieve a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources and the natural environment.
- **To achieve efficient and effective water use** for optimum social and economic benefit.

The NWRS also lists important proposals to facilitate achievement of these policy objectives, such as:

- Water will be regarded as an indivisible national asset. The Government will act as the custodian of the nation's water resources, and its powers in this regard will be exercised, as a public trust.

- Water required to meet basic human needs and to maintain environmental sustainability will be guaranteed as a right, whilst water use for all other purposes will be subject to a system of administrative authorisations.
- The responsibility and authority for water resource management will be progressively decentralised by the establishment of suitable regional and local institutions, with appropriate community, racial and gender representation, to enable all interested persons to participate.

1.2.1 The National Water Act (NWA)

The NWA of 1998 is the principal legal instrument relating to water resource management in South Africa. The Act is now being implemented incrementally. Other recent legislation, which supports the NWA, includes the Water Services Act (Act 108 of 1997) and the National Environmental Management Act (Act 107 of 1998).

1.2.2 The National Water Resource Strategy (NWRS)

The NWRS is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising powers or performing duties under the NWA must give effect to the NWRS. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources. The purpose of the NWRS is to provide the following:

- The National framework for managing water resources;
- The framework for preparation of catchment management strategies in a nationally consistent way;
- Information, in line with current legislation, regarding transparent and accountable public administration; and
- The identification of development opportunities and constraints with respect to water availability (quantity and quality).

1.2.3 Catchment Management Strategies (CMS)

The country has been divided into 19 Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level will be achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA will progressively develop a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA.

The Department's eventual aim is to hand over certain water resource management functions to CMAs. Until such time as the CMAs are established and are fully operational, the Regional Offices (ROs) of DWAF will have to continue managing the water resources in their areas of jurisdiction.

1.3 INTERNAL STRATEGIC PERSPECTIVES (ISPs)

1.3.1 The Objectives of the ISP Process

The objective of the ISP will be to provide a framework for DWAF's management of the water resources in each Water Management Area, until such time as the Regional Offices can hand over the management functions to the established CMAs. This will ensure consistency when answering requests for new water licences, and informing existing water users (including authorities) on how the Department will manage the water resource within the area of concern. Stakeholders must be made aware of the bigger picture as well as the management detail associated with each specific water resource management unit.

1.3.2 Approach Adopted in Developing the ISP

The ISP for the Tsitsikamma to Coega ISP was developed in five *stages*, as follows:

i) *Determining the current status* of water resource management and relevant water resource management issues and concerns in the ISP-area. The current status, as well as issues and concerns relating to water resource management in the Tsitsikamma to Coega ISP-area, were identified through individual interviews held with the relevant personnel of the Eastern Cape Regional Office in Port Elizabeth, Cradock and King Williams Town and by collating information from the Water Situation Assessment and other catchment study reports. Issues and concerns relating to the individuals' areas of expertise were identified. A starter document of the identified issues and concerns was produced as a discussion document for the first workshop.

ii) *The first workshop* was held in August 2002. The workshop attendees included the staff from the Eastern Cape Regional Offices, and the National Water Resources Planning directorate of the Department as well as the consulting team. The workshop focussed on the lists of issues in the overall ISP-area and the five selected ISP sub-areas. The issues were clarified and refined in the workshop. Following the first Workshop, the issues and concerns were updated.

iii) The third stage involved the *preparation of a basic ISP document for discussion at the second* workshop. This document (starter document for Workshop 2) presented the developed strategies and how the identified issues and concerns related to them.

iv) The fourth stage was the *second workshop* that was held in October 2002. During the workshop, the overall management of the water resources in the catchment was discussed together with the ISP management strategies and the relevant issues and concerns. The priorities and responsibilities of carrying out the strategies were assigned during the workshop.

v) The fifth stage was the finalisation of the ISP document.

As can be deduced from the above this Tsitsikamma to Coega ISP was prepared internally within the Department, and captures the Department's perspectives. Once approved by DWAF Management, it is intended that the Regional Office will make the ISP available to Water User Associations (WUAs), Water Service Providers (WSPs), Water Service Authorities (WSAs) and other forums for discussion and comment. These comments will be considered and worked into later versions of the ISP. By adopting this procedure this ISP becomes a working document, which will be progressively updated and revised by DWAF. Public participation forms part of the CMS process, for which the ISP serves as a foundation (see Paragraph 1.5).

The ISP does not formulate all the details pertaining to every strategy but provides a suggested framework for each strategy around which the details will be developed by the responsible authority. Where relevant and readily available, certain details have been included in the strategies. The responsible authority for the further development of each strategy is indicated. This is predominantly the Regional Office, which remains responsible for involving the relevant DWAF directorates.

1.3.3 Updating of the ISP Report

The ISP strategies should not lag behind national developments, become outdated or differ from related ISPs regarding trans-boundary management. There is therefore a need to have a standard process for updating strategies, and to prevent strategies becoming outdated by ensuring adequate feedback from national developments. Furthermore, the proposal and introduction of new strategies needs to be accommodated. It is suggested that each strategy has a version-control system. The following is necessary:

- Keep abreast of changes in national legislation and policy changes or refinements by keeping a list of all relevant legislation and supporting documents relevant to the ISP;
- Ensure consistency between the ISP strategies and national strategies through a regular review-and-update procedure;
- Annually review and ensure consistency and agreement regarding trans-boundary ISP management issues by liasing with the responsible managers of other areas and updating relevant ISP strategies if necessary;
- Annually review the priorities of required management actions and align budgets accordingly;
- Monitor the implementation of the ISP (review actions, progress, implementation and stumbling blocks);
- Incorporate feedback from stakeholders;
- Rigorously apply ISP version control.

Updating and Version Control

The actual frequency of ISP revision will be determined by the number and extent of revisions to management approaches as reflected in Strategy amendments. All updates to this report, particularly with respect to amendment to the Strategies, need to be passed on to and vetted by the future Catchment Manager for the Fish to Tsitsikamma WMA. There is no current incumbent but Mr T Geldenhuys has been delegated the task of managing version control in the interim.

1.3.4 The Authority of Information Contained in the ISP

The NWRS is a statutory document, subject to a high level of public scrutiny and input, and signed off by the Minister. The information contained in the NWRS is the best information and knowledge available at the time. The information in Chapter 2 and Appendix D of the NWRS Strategy on water requirements, availability and reconciliation was updated with comments received from the public participation process in the second half of 2002. To enable the finalisation of the NWRS, these figures were "closed" in February 2003.

Underlying the figures in Chapter 2 and Appendix D is a set of 19 reports called *Overview of Water Resources Availability and Utilisation*, one for each WMA. These reports contain more detailed information on each WMA than was summarised for the NWRS and are referred to, in short, as *WMA Reports*. The WMA reports were also finalised with the February 2003 information.

Still deeper in the background lies another set of reports (one per WMA), the so-called Water Resource Situation Assessment Reports. These reports contain a wealth of information on each WMA, but the figures on requirements, availability and reconciliation have been superseded by the WMA report and the NWRS.

The ISPs for all WMAs used the information contained in the NWRS and WMA reports as the point of departure. However, an inevitable result of the ISP process has been that better information has emerged in some cases. The reason is that the level of study is more detailed and intense for the ISP. This included very close scrutiny of the numbers used in the NWRS, and in some cases a reworking of base data and some re-modelling. Where the ISPs contain yield balance data which differs from the NWRS, these discrepancies are carefully explained. Where other differences from the NWRS are necessary these are also detailed in the ISP, with accompanying explanations.

It is required that the Department work with the best possible data so that the best possible decisions can be taken. Where the ISPs have improved upon the NWRS then this is the data that should be used. The new data, contained in the ISP will also be open to public scrutiny as the ISP reports will be published on the Internet and will be presented and discussed at WMA forums. Comments received will be considered and worked into subsequent versions of the ISP on a

regular (annual) basis. The NWRS will be updated to reflect the latest understanding in each new edition.

1.4 INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

It is imperative that the natural, social, economic, political and other environments and their various components are adequately considered when conducting water resources planning and management. Water as a strategic component also interacts with other components in all environments. For example, human activities such as the use of land, the disposal of waste, and air pollution can have major impacts on the quantity and quality of water which is available for human use and for proper life support to natural biota.

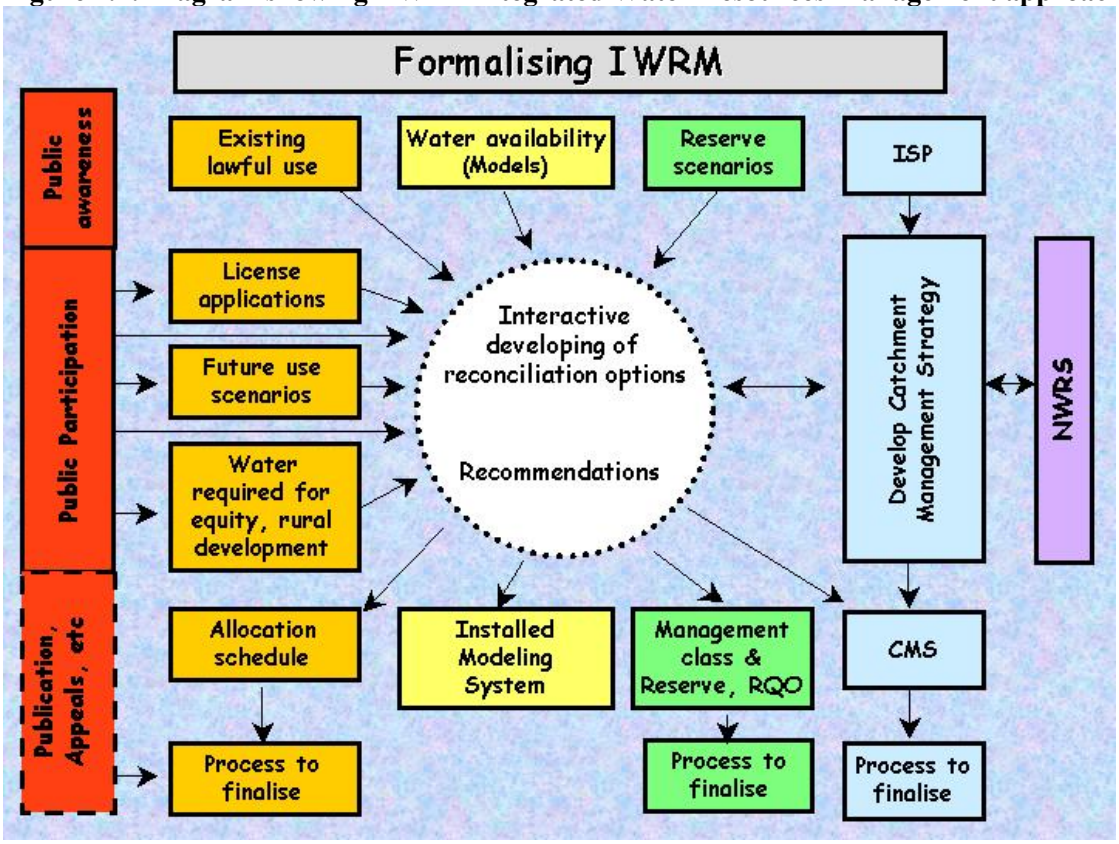
Taking an even broader view, water must also be managed in full understanding of its importance for social and economic development. It is important to ensure that there is conformity between the water-related plans and programmes of the CMAs, and the plans and programmes of all other role players in their management areas. The CMAs must therefore establish co-operative relationships with a wide range of stakeholders, including other water management institutions, water services institutions, provincial and local government authorities, communities, water users ranging from large industries to individual irrigators, and other interested persons.

This integrated planning and management approach is intended, through co-operative governance and public participation, to enable water managers to meet the needs of all people for water, employment, and economic growth in a manner that also allows protection and, where necessary, rehabilitation of aquatic ecosystems. Above all, Integrated Water Resource Management (IWRM) will enable water managers to use our precious water resources to assist us in poverty eradication and removal of inequity.

One of the big opportunities to formally integrate a large number of actions in water resource management presents itself during the compulsory licensing process.

Compulsory licensing is identified in the NWRS as a very important action for implementing the NWA. However, it is not a simple action of issuing licences but a complex process of closely related and interdependent activities that will in itself formalise IWRM to a great extent. The process of IWRM is diagrammatically depicted in **Figure 1.2**.

Figure 1.2: Diagram showing DWAF Integrated Water Resources Management approach



Before an allocation schedule can be determined and the legal steps followed to finalise compulsory licensing (through the issuing of licences to all users), many other aspects must be addressed:

- Existing use and the lawfulness of that use must be verified, all users (existing and new) must apply for licences, a good understanding of future use scenarios must be developed and water required for equity purposes and rural development must be clearly understood.

- Water availability must be understood as thoroughly as possible with "best available" existing information used to model all possible reconciliation options.

- Reserve scenarios must be developed for all significant resources in the catchment, for instance, the river flow requirements for all possible classes that may be considered.

- The development of strategies for implementing the licensing (abstraction controls, for example), the Reserve and Resource Quality Objectives (i.e. incrementally over time) must go hand in hand with the rest of the processes to ensure that practical, workable solutions are found.

The processes will then enter a very intensive, interactive phase of developing realistic reconciliation options. This would entail, for example, the selection of a specific management

class to be scrutinised for its impact on the number of licences that could be issued for use, with its concomitant impacts on the social and economic structure of the catchment.

The active participation of stakeholders in this process will then hopefully crystallise clear recommendations on an allocation schedule, management classes for the various reaches of the rivers and the resultant ecological Reserve and Resource Quality Objectives, as well as strategies for the implementation.

Although the Department will play a very strong role in guiding this process, it is extremely important to have the CMA actively involved. Preferably, at least the Board of the CMA must be in place to drive the public participation for the process.

1.5 CARING FOR THE ENVIRONMENT

DWAF is responsible for water resource development and management in terms of the NWA, and within the broader framework of other environmental legislation. The Department also strongly reflects the will to make sound decisions which ensure the development of society and the economy whilst maintaining, and where possible enhancing, ecological integrity. The concept of management of the environment has evolved from the exclusivity of protection of plants and animals to balancing the complex interaction of society, the economy, and ecology. "Environmental management is the integration of social, economic and ecological factors into planning, implementation and decision-making so as to ensure that development serves present and future generations" (NEMA).

The key legislative Acts to which DWAF is required to refer are the National Environmental Management Act (NEMA, Act 107 of 1998) and the Environment Conservation Act (ECA, Act 73 of 1989). DWAF has prepared a Consolidated Environmental Implementation and Management Plan (CEIMP) as a requirement of NEMA. This describes the Department's functions, policies, plans and programmes, and states how these comply with environmental legislation. Through the CEIMP the Department has committed itself to developing and implementing an integrated Environmental Management Framework (EMF) to ensure that its approach is aligned with the principles prescribed in NEMA and the ECA. The EMF will inform the Department at a strategic decision-making level, bring about environmental legal compliance, and help in achieving environmental sustainability through the promotion of sound environmental management practices. Integrated Environmental Management is a co-operative governance effort with DWAF as a full partner in the process.

This ISP has the responsibility of raising and maintaining the environmental consciousness of the Department's water resource planners and managers. The control over water has a very broad range of influence and impact for which strategies and planning need to account. Impacts come from many different angles.

Some of these angles of impact which are considered through this ISP are noted below:

- The direct impact of physical structures (environmental constraints to construction e.g. of weirs or dams);
- The implications of allocating and licensing water for use. Forestry and irrigation are examples of users where development based on water can mean the transformation of extensive areas of otherwise 'natural' environments;
- The allocation of water for equity. Here we can include approaches towards the application of Schedule 1 Use, General Authorisations, the revitalisation of irrigation schemes, etc.;
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty;
- Sanitation systems and the impacts on groundwater quality;
- The implementation of the Reserve;
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.

All decisions regarding water are critical to the environment. Decisions must be made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye out for the unintended consequence. It is the intention of the ISP to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries);
- Water quality - surface and groundwater;
- The approach towards the clearing of Invasive Alien Plants;
- The management of wetlands;
- Land degradation. Erosion and sedimentation (land care);
- Land use and especially how this is impacted by land reform and the re-allocation of water.

The roles of Co-operative Governance and the need for awareness raising and capacity building are key strategic elements of many strategies.

In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP endeavours to capture all of these concerns in discussion and through a strategic approach which emphasises the will of the Department to manage the environment to the best benefit of the country and its people.

The approach set out above applies to all Water Management Areas and associated ISPs, and is not repeated within the Strategy Tables (Part 2 of this ISP). It reflects the way the Department views Integrated Water Resource Management and the importance of the biophysical aspects of decision-making. There may nevertheless be specific ecological and biophysical aspects of management which require specific attention and which may not be captured in the above-mentioned or other Strategies. The ISP therefore still includes an Environmental Strategy which serves to make pertinent those issues of the environment which might not otherwise be covered.

1.6 THE SOCIAL ENVIRONMENT

The utilisation of water resources is aimed at the benefit of society, and at society through the economy. As noted in Section 1.5 this should not be at undue cost to ecological integrity.

Impacts on society are a core element of this ISP, and decisions are often complicated by the risk of unintended consequence. As a typical example the over-zealous implementation of the ecological Reserve may benefit the river, to the intended benefit of society, but the cost of lack of use of that water to jobs and to livelihoods may lead to other strains on natural resources that undo the benefits.

The implementation of the NWA requires that society be kept at the forefront of all decision-making. This principle is now deep-seated within the Department and is integral to all strategies. Water resource allocation and use has critical social impact, as does water quality management. But pivotal to the social component is the question of equity. What can be done and what is being done to redress past inequities? Within this, strategies have been developed to consider the provision of water to Resource Poor Farmers, the use of water under Schedule 1, Licensing and General Authorisations, etc. Whilst water supply and sanitation are not part of the brief of the ISP, the provision of water to meet these needs most certainly is. The urban poor, and the poor in rural villages, are as important in the consideration of the distribution and use of water resources as are the rural subsistence poor, and this should not be forgotten in the urgencies of land reform and the enthusiasm to establish a substantial class of farmers from amongst the previously disadvantaged.

This ISP aims to see water benefitting society. This can be through access to water in livelihood strategies, through small-farmer development programmes, through water supply and sanitation and especially the provision of good quality drinking water, and through the maintenance and growth of income-producing, job creating, and tax paying agricultural, commercial and industrial strategies.

Consultation and public participation is another cornerstone of the social component of any strategic document. These requirements are repeatedly stressed throughout the National Water

Act. This ISP has been prepared as DWAF's position statement with respect to the management of water resources and, although strategies and plans have been captured without consultation with the stakeholders, it remains an open and transparent document where the understanding of the Department, its visions and its principles are made clear for all to see and to interact with. This is amplified in the Implementation Strategy (Strategy No 15.1 in Chapter 15) of this ISP.

1.7 WATER QUALITY MANAGEMENT

Much of the emphasis in water resource management has revolved around ensuring that users have sufficient quantities of water. However, as more water gets used and re-used, as quantities get scarce and feedback loops get even tighter, it is quality that begins to take on a dominant role.

Water availability is only as good as the quality of that water. Both quantity and quality need to be considered at the correct level of detail, and this can mean that at times they should be considered with similar emphasis and with similar expenditure of resources. Too often we have failed to integrate the issues of quantity and quality – both with regard to surface water and groundwater. The concept of Available Assimilative Capacity, the ability of the water resource to absorb a level of pollution and remain 'serviceable', is as important in water resource management as is the concept of Systems Yield.

Quantity and quality can no longer be managed in isolation of each other. Not that this isolation has ever been total. The importance of releasing better quality water from Brandvlei Dam for freshening the saline water in the lower reaches of the Breede River, and of the addition of freshening releases from Vaal Barrage to bring water back to an acceptable quality has, *inter alia*, long been standard practice. The consequences of irrigation, the leaching of fertilisers, and more importantly the leaching of salts from deeper soil horizons can render both the lands themselves and the receiving rivers unsuitable for use. Diffuse agricultural 'effluent' may be less visible than direct discharges of sewage or industrial effluent, but are no less pernicious.

Direct discharges to rivers are licensed and managed on the basis of assimilative capacities of those rivers, and on Receiving Water Quality. Where these limits are exceeded, often through the cumulative impact of diffuse discharges, water becomes unavailable to some, or even all, users downstream. DWAF will licence users to take water, and again to discharge it in recognition that there is generally a cost to the resource in terms of a reduction in quality and a reduction in its further assimilative capacity. It is for this reason, and in order to bring about additional management and a strong incentive, that the Waste Discharge Charge System is being developed. Discharge users will be obliged to pay, depending on the quantity and quality of their discharge.

Surface water quality is affected by many things including sediment and erosion, the diffuse discharges from irrigated farmland (both fertilisers and salinity through leaching), domestic and urban runoff, industrial waste, and sewage discharges. Of these, industrial waste and sewage

discharges are the easiest to licence and control, but this does not mean that this is problem-free. The Department has found that the situation with regard to sewage discharges often far exceeds the standards and conditions demanded by licences. There is a problem of compliance with regard to Local Authorities and private operators responsible for waste management systems. Diffuse discharges only compound the problem by reducing the assimilative capacity until the water becomes unfit for use, very expensive to purify, and a danger to human health.

Groundwater quality requires equal attention, and more so as we recognise the importance of groundwater in supplementing our meagre resources, and providing water to remote communities. Although our groundwater resources are for the most part to be found at a relatively deep level (50-100m is quite typical) this water can easily be polluted by surface activity. The leaching of fertilisers is one such problem but of greater concern is the influx of nitrates, primarily a consequence of human habitation and sanitation. Pit latrines are on the one hand so necessary, and have the huge advantage of not requiring volumes of water, but disposal is 'on-site', and often responsible for the longer-term pollution of the underlying aquifers which feed and water the communities above.

Industrial wastewater discharge, diffuse agricultural discharges, wastewater treatment works, the location and management of solid waste disposal sites, the siting of new developments, informal settlements and the impacts of sanitation systems, are all elements considered with great concern in this and other ISPs. Despite this attention it may be that Water Quality has still not taken its rightful place in the integrated management of the water resource. But the Department is moving towards IWRM and the integration of quantity and quality issues. Managers have now been given crosscutting responsibilities that will ensure a far more integrated approach in future.

Actions recommended within the Department include:

- The need to actively workshop the integration process. Resource Management, Planning and Allocations of Groundwater and Surface Water Quantity and Quality.
- The review and incorporation of knowledge from recent Water Research Commission Studies on both radioactivity and nitrates (groundwater quality issues).
- A review of all water quality literature reflecting situational knowledge and understanding within this WMA (and each and every WMA).
- Ensure that Water Quality monitoring is fully integrated into WMA water resources monitoring.

Refer particularly to strategies 7.3 in Chapter 7 and 8.3 in Chapter 8 of this ISP.

1.8 GROUNDWATER

The ISP process in all of the Water Management Areas of South Africa has highlighted the role and importance of groundwater as part of the total water resource. Although groundwater has

always been important in some areas this overall vision is a significant advance on our previous understanding of the potential for groundwater use. With the surface water resources in many WMAs now fully utilised, almost the only opportunity left for further development lies in the exploitation of groundwater. More particularly it is recognised that many of the more remote towns and villages, far from surface supplies, can in fact supply or supplement existing sources through groundwater, and that this must become a priority option. So, too, many small communities and subsistence farmers can avail themselves of groundwater when it would otherwise be impossible or impractical to lay on piped supplies. This can also reduce the pressure on existing users and perhaps even circumvent the need for Compulsory Licensing. The Department will be developing its capacity to explore and encourage the use of groundwater.

Of obvious concern is the likelihood of an interaction between groundwater and surface water. If the interaction is strong then additional use of groundwater may simply be reducing the surface water resource already allocated to someone else. In some instances (such as in the case of dolomitic aquifers) this interaction can indeed be very strong, whilst across much of the country it is so weak as to be negligible. In these circumstances groundwater comprises a huge pool of available water which is only of benefit if it is utilised. Care must always be taken with the issuing of licenses to ensure that both the Groundwater Reserve and other downstream users do not end up being the losers.

The realisation in this and other ISPs is that groundwater offers a huge resource of water which can be tapped, and that this can be a very significant supplement to the national water resource. The Table Mountain Group Aquifer which underlies much of the ISP-area could be a source for future utilisation, following quantification of the resource.

See also the Groundwater Strategy No 6.2 in Chapter 6 of this ISP.

1.9 PUBLIC RECREATION - THE USE OF DAMS AND RIVERS

The use of water for recreational purposes is one of the eleven water uses regulated in terms of the NWA (Section 21 j). The Department has a national policy towards 'Recreation on Dams and Rivers' and this should, in the first instance, be adhered to. Recreational use can take many forms and only occasionally has any direct impact on the water resource. Most obvious are activities such as power-boating, sailing and swimming which can have quality/pollution impacts. Far more significant in terms of both quantity and quality is the release of water to allow for canoeing and other water sports downstream (The Berg, Dusi and Fish River canoe marathons being prime examples). These activities can bring very significant economic benefits to the WMAs concerned, and where water releases can be accommodated, particularly through alignment with the needs of the ecological Reserve or other downstream users, then so much the better.

It is noted in this ISP that water resources offer a very significant recreational outlet and that recreation is an important public and social asset necessary for national health and productivity. A central philosophy is that recreational opportunity should not be unreasonably and unnecessarily denied to users, and that the implementation of policy should ensure that disadvantaged and poor people should also be able to avail themselves of opportunities.

The Department has already transferred responsibility for the management of many public waters to Local Authorities and will continue with this process. Responsibility will therefore devolve upon these Authorities, but within the broad principles as laid down by the Department.

In this ISP refer to Strategy 13.3 in Chapter 13.

1.10 CO-OPERATIVE GOVERNANCE – THE PLACE OF THE ISP

The ISP is DWAF's approach to the management of water resources within the WMA. This will, in the longer term, be replaced by a fully consultative Catchment Management Agency. What is most important, in the medium term is that the ISP has a good fit with the Provincial Growth and Development Plan, with regional and other Environmental Management Plans, with plans and expectations of the Departments of Agriculture, Land Affairs, the Environment and others. It must also be aligned with the Integrated Development Plans and Water Services Development Plans now required for each District Municipality. Water is very often a constraining feature in development and co-operative governance planning and implementation is essential in matching what is wanted with what is possible.

In this ISP refer to Strategy 12.2 in Chapter 12.

CHAPTER 2 - OVERVIEW OF THE ISP-AREA

The *Tsitsikamma to Coega ISP-area* derives its name from the *Tsitsikamma River*, located near the western boundary of this area along the coast and the *Coega River*, its most easterly coastal river.

2.1 LOCALITY AND PHYSICAL FEATURES

2.1.1 Locality

Figure 2.1 shows the whole WMA and the sub-areas as used in the NWRS. This ISP area (Tsitsikamma to Coega) comprises the Algoa, Tsitsikamma and Gamtoos areas. The Sundays, Fish and Bushmans is included in the Fish to Sundays ISP which will follow.

2.1.2 Sub-areas

Figure 2.2 shows how the Tsitsikamma to Coega ISP-area was demarcated. Delineation of the sub-areas was judgementally based on practical considerations such as the size and location of sub-catchments, homogeneity of natural characteristics, location of pertinent water infrastructure (such as dams) and economic development. The **Groot** River sub-area was identified because of its different characteristics as an inland Karoo River. The **Kouga-Gamtoos** sub-area was identified because of its reasonably uniform character in terms of land use and linked nature of the Gamtoos GWS infrastructure. The **Kromme-Seekoei** sub-area was separately addressed because of practical considerations of closely located coastal catchments with quite similar characteristics. The **Tsitsikamma Coast** sub-area was separately identified on account of its different characteristics, being mainly a high rainfall, coastal area consisting of small rivers. The **Algoa Coast** sub-area has a distinctly identifiable urban character.

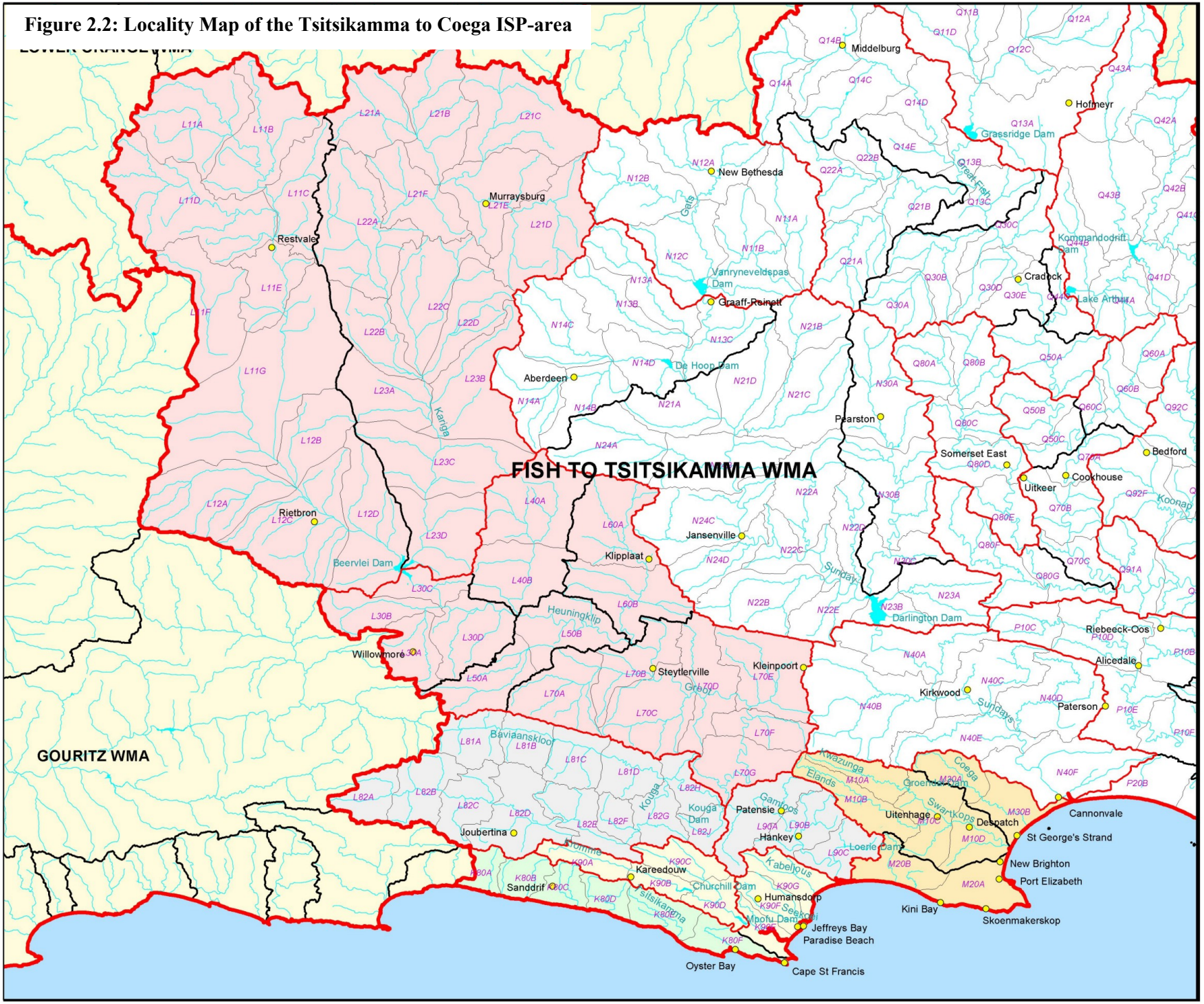
The Tsitsikamma to Coega ISP-area was divided into only three sub-areas in the NWRS. These relate to the five sub-areas used in the Tsitsikamma to Coega ISP as follows:

Table 2.1: Comparison of sub-areas between the ISP and the NWRS

ISP sub-area	NWRS sub-area
Groot Kouga-Gamtoos	Gamtoos
Algoa Coast	Algoa
Kromme-Seekoei Tsitsikamma Coast	Tsitsikamma

Figure 2.1: Map of the Fish to Tsitsikamma Water Management Area (Ref. Figure 1 of the Fish to Tsitsikamma WMA Report, September 2003)

Figure 2.2: Locality Map of the Tsitsikamma to Coega ISP-area



LOCALITY MAP:

LEGEND:

- WMA Boundaries
- Towns
- Rivers
- Dams
- Quaternary Catchment
- E24D Quaternary Number
- Secondary Catchment

Management Areas

- L11,L12,L21-L23,L30-L70 Groot
- K80A - K80F Tsitsikamma Coast
- K90 - K90G Kromme/Seekoei
- L81A - L82J, L90 Kouga/Gamtoos
- M10A - M30B Algoa Coast

GIS COV:

Waterman
Intp (Amended)
Wri500
Ndams
Drgnquat
Drgnquat
Drgsnd

PREPARED BY:

NINHAM SHAND CONSULTING SERVICES

CLIENT:

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE NATIONAL WATER RESOURCES PLANNING

PROJECTION:

ALBERS EQUAL AREA

SCALE : 1:1 200 000

20 0 20 Kilometers

N

TITLE:

FISH TO TSITSIKAMMA WMA

TSITSIKAMMA TO COEGA ISP

Prepared by:	A Lawrence
Date:	07/2002
Data Type:	Fish_TsitWMA.apr

The Tsitsikamma to Coega ISP-area, which comprises 79 quaternary catchments, has for this ISP been divided into five sub-areas to aid improved management. These are as follows:

- The *Groot* sub-area consists of 42 quaternary catchments (L11, L12, L21-L23, L30-L70);
- The *Kouga-Gamtoos* sub-area consists of 16 quaternary catchments (L81, L82, L90);
- The *Kromme-Seekoei* sub-area consists of 7 quaternary catchments (K90A-K90G);
- The *Tsitsikamma Coast* sub-area consists of 6 quaternary catchments (K80A to K80F);
- The *Algoa Coast* sub-area consists of 8 quaternary catchments (M10, M20, M30).

2.1.3 Topography

The topography is characterised by several mountain ranges parallel to the coast in the southern parts and localised massifs to the inland, while the rest of the area mainly consists of the plains and hills of the Great Karoo.

Figure 2.3: The Tsitsikamma Mountains

The Kromme River drains a narrow valley between the Suuranys Mountains to the interior and the Tsitsikamma Mountains towards the coast. To the east of the Kromme River estuary the Seekoei River flows to the sea across a fertile coastal plain. The Kabeljous River estuary is at Jeffreys Bay.

The Gamtoos River has two major tributaries, namely the Groot River and the Kouga River. The catchment of the Groot River lies entirely in the Karoo. The Groot River passes through narrow gorges in the Groot Winterhoek, Baviaanskloof, and Elandsberg mountain ranges before its confluence with the Kouga River, which rises in the Langkloof. The Kouga River rises in the Langkloof on the northern slopes of the Tsitsikamma mountain range. The main tributary of the Kouga River is the Baviaanskloof River, which rises in the rugged mountains flanking the narrow Baviaanskloof Valley. The Groot and Kouga Rivers join to form the Gamtoos River, which drains the western slopes of the Elandsberg mountain range along its 90 km journey to the sea.

On the coastal side of the Tsitsikamma Mountains a number of steep, deeply incised rivers flow to the sea in the Tsitsikamma Coast sub-area.

On the other side of the Elandsberg range, lies the Elands River, one of the two main tributaries of the Swartkops River, which flow to the sea through the ecologically important Swartkops Estuary. The other main tributary of the Swartkops River is the KwaZunga, which also rises in a mountainous area. The Coega River lies to the north of the Swartkops River. The Baakens, Maitland and Van Stadens are smaller rivers.

A significant part of the area included in this ISP is also declared Mountain Catchment Area (e.g. much of the Kouga and Baviaanskloof catchment areas). This offers a reasonable protection of the catchment against development - although today the Mountain Catchment Areas Act is rarely used.

Refer to **Figure 2.1.2 of the WRSA Report** [26] for the topographical map.

2.1.4 Geology and soils

a. Geology

The coastal strip consists of the pre-Cape Gamtoos Formation in basement inliers within the Gamtoos (L90), Maitland and Van Stadens River valleys (M10), and around Classen Point near Port Elizabeth (M20), overlain by sandstones and shales of the Cape Supergroup (Table Mountain, Bokkeveld and Witteberg Groups) in the coast-parallel mountain ranges. The interior consists entirely of sedimentary rocks of the younger Karoo Supergroup with numerous dolerite intrusions.

The mountain ranges to the west of Port Elizabeth, in which the Langkloof and Baviaanskloof are situated, consist mostly of heavily folded sandstones of the Table Mountain Group (TMG) with narrow downfolds of the shale-bearing Bokkeveld Group. One of these folds controls the upper course of the Kromme River (K90A-B) in TMG strata, widening and deepening towards Bokkeveld outcrops in the coastal quaternary catchments (K90D-G). The mountains of the catchment of the Swartkops River immediately to the north of Port Elizabeth are formed by TMG sandstones, locally cut by the important Coega Fault Zone, which influences the occurrence of springs and thermal artesian waters in the Uitenhage-Swartkops area.

To both the north-west and north-east of Port Elizabeth, between the interior mountain ranges of Witteberg Group strata and the coastal TMG ranges, there are areas of approximately 180 million year-old (Ma) conglomerate and volcanics of the Zuurberg Group (L70D-E), overlain by mudstones, sandstones, shales and conglomerates in the Uitenhage Group. These are overlain in parts by younger (<65 Ma) sand or limestone deposits of the Alexandria Formation (Bredasdorp Group). The fault-bounded basins in which these rocks occur are inland extensions of the offshore Algoa Basin on the continental shelf. The onland mapping of the hydrogeologically important fractures and faults between Port Elizabeth and Steytlerville, is fragmentary and incomplete.

The strata of the Karoo Supergroup consist of a strip of gently folded shales and sandstones of the Ecca Group in the Groot River catchment along the northern edge of the coastal mountainous belt, followed further inland by flat-lying mudstones and sandstones of the Beaufort Group.

The rocks of the Karoo Supergroup in the upper Groot River catchment are of marine origin and, consequently, might cause groundwater generally to be of high salinity. However, upstream of the Groot tributary called the "Salt", a substantial portion of the headwater catchment (L11A-G) has an entirely enclosed drainage ending in pans, which might have the same effect. The strata of the Uitenhage Group in the coastal belt also yield generally brackish groundwaters, but groundwater extracted from the rocks of the Cape Supergroup is generally of low salinity. The quality of water in the rivers during periods of low flow is similar to that of the groundwater in their catchments.

Refer to **Figure 2.3.1 of the WRSA Report** [26] for a geological map.

b. Soils

Moderately deep to deep clayey loams are found in the undulating terrain along the south-western edge of the ISP-area in the Tsitsikamma Coast sub-area and on the floor of the Langkloof Valley in the upper Kouga catchment. Shallow sandy loams are found on the steep slopes of the mountains. The balance of the area inland of the coastal mountain belt and the coastal area in and adjacent to Port Elizabeth comprises moderately deep to deep sandy soil.

Refer to **Figure 2.4.1 of the WRSA Report** for a map of soils.

2.1.5 Climate and rainfall

The climate of the ISP-area is strongly influenced by its location relative to the coast and the topography. Most of the inland has a typical dry Karoo climate. Maximum temperatures are experienced in January and minimum temperatures usually in July. Frost is prevalent in the inland areas in winter. Along the coastal areas the climate is more moderate.

The humidity is higher in summer than in winter, and is generally highest in February and lowest in July. Potential evaporation is well in excess of the rainfall and varies from 1300 mm/a in the South to as high as 2 300 mm/a in the north-west of the dry Groot River catchment. The highest evaporation is in January and the lowest evaporation is in June.

Rainfall generally occurs throughout the year in the coastal region and very late in summer in the inland areas. The peak rainfall months are December and January. Rainfall is in the range of 150 mm to 600 mm/a. Small localised coastal areas experience rainfall of more than 1 100 mm/a.

Refer to **Figure 2.2.1 of the WRSA Report** [26] for the rainfall map.

2.1.6 Vegetation

A simplified description of the vegetation types and a natural vegetation map has been included as **Figure 2.5.2.of the WRSA Report**. In brief, five types of vegetation have been recorded, according to the Acocks classification system, as follows:

- Limited areas of *Coastal Tropical Forest Types*, which include lush rain forests, mainly in the Tsitsikamma Coast sub-area; this veld type is typically confined to the coastal area or immediate vicinity, and includes areas of forest, thornveld and bushveld.

- *Karoo and Karroid Types* is dominant across the largest part of the ISP-area, both inland and in the Algoa Coast sub-area; the flora are characteristically low, typically less than 1 m high, and include scrub, bushes, dwarf trees and a few grasses.

- ⇨ *False Grassland Types* close to the coastal areas and the nearby inland areas occur on either sandy or stoney soils. Farming activities have impacted on much of this veld type.

- ⇨ *False Karoo Types* and *Pure Grassveld Types* occur in the upper eastern part of the Groot River catchment. *False Karoo* vegetation is typically low vegetation, but contains numerous grassy elements. *Pure Grassveld* represents the true grassveld, and occurs on the upper plateau and the mountaintops, in regions, which are too dry and/or experience frost too regularly for the development of any kind of forest. Farming activities have impacted on much of this veld type.

Invasive alien plants is found extensively especially in the Algoa Coast sub-area, Gamtoos River catchment and in the Tsitsikamma Coast sub-area. There is active intervention by the Working for Water programme and various local organisations are implementing alien control programmes in the Swartkops and Gamtoos River catchments. The Baviaanskloof is now relatively free of alien plants.

Aquatic weeds occur in the lower Swartkops River due to eutrophication of the river.

2.1.7 Environmental protection and sensitive areas

A vital component of ensuring sustainable conservation practices is the identification of conservation worthy habitats or sensitive ecosystems. South Africa's schedule of protected areas identifies Scientific and Wilderness Areas, National Parks and Equivalent Reserves, Natural Monuments and Areas of Cultural Significance, Habitat and Wildlife Management Areas and Protected Land/Seascapes, based on their location and the functions they fulfil.

No general listing of the sites of palaeontological, archaeological and historical significance is available.

The Baviaanskloof Wilderness Area, the Tsitsikamma Coastal National Park and the *Tsitsikamma Forest National Park* are important protected areas. The WWF and DAEAT are aiming to have the Baviaanskloof proclaimed as a World Heritage Site.

Figure 2.4: Tsitsikamma National Park

Several other national parks and conservation areas lie in the ISP-area. The Gamtoos estuary has a very high conservation importance, rated among the top fifteen estuaries in the country [3]. The area upstream of Groendal Dam is a proclaimed wilderness area.

Table **2.6.4.1 in the WRSA Report** [26] contains a list of the protected areas within the Fish-Tsitsikamma WMA.

2.2 DEMOGRAPHY, LAND USE AND DEVELOPMENT

2.2.1 Population

The population for 1995 was as shown in **Table 2.2**, according to urban and rural areas [26].

About 90% of the population of just over 1 million in the ISP-area is concentrated in the Algoa Coast sub-area. The rural areas are sparsely populated, particularly the northern parts. Relatively high population growth is projected for the Algoa sub-area. Some population growth is also projected in the Tsitsikamma Coast sub-area, partly associated with growth in the tourism industry. A small decline in population is projected for the inland areas, attributable to the lack of economic stimulus and the impact of HIV/AIDS [3].

Table 2.2: Population in 1995

Rivers	Tertiary catchment	Population in 1995		
		Urban	Rural	Total
Upper Groot (Beervlei Dam)	L1, L2	0 0 4 600	5 146 390 300	5 146 390 4 900
Lower Groot	L3 to L7	13 600	4 041	17 641
Baviaanskloof Kouga	L8	1 950 5 650	2 450 9 312	4 400 14 962
Gamtoos	L9	14 550	9 229	23 779
Total in Groot / Kouga-Gamtoos		**40 350**	**30 868**	**71218**
Upper Kromme (Impofu Dam)	K9 (Part)	2 250	1 100	3 350
Lower Kromme and Tsitsikamma Coast	K8, K9 (Part)	34 700	12 362	47 062
Total in Kromme-Seekoei / Tsitsikamma Coast		**36 950**	**13 462**	**50 412** [2]
Swartkops Port Elizabeth Coega	M1 M2 M3	1 015 900	21 784	1 037 684
Total in Algoa Coast		**1 015 900**	**21 784**	**1 037 684**
TOTAL IN ISP-AREA		**1 093 200**	**66 114**	**1 159 314**

1) Information was drawn from the Fish to Tsitsikamma WRSAS Report [26], to be able to show a more detailed breakdown of population.

2) The NWRS population (Fig 6 in the WMA Report) corresponds, except for the NWRS Tsitsikamma sub-area, which shows a population of 38 800 compared to 50 412 of the WRSAS Report.

2.2.2 Land use

Land use is predominantly grazing for livestock with intensive cultivation of irrigated land along the main rivers and timber plantations in the high rainfall areas. Crops are mainly vegetables, pastures, deciduous fruit, citrus and lucerne. Protected land in nature reserves is a noteworthy land use. **Figure 2.5** on the following page shows land use in the Fish to Tsitsikamma WMA. Over-utilisation of natural resources and pollution of rivers and groundwater have been reported in parts of the ISP-area. Strategies are being put in place by DWAF to deal with poor sanitation and solid waste disposal problems in order to limit their impact on land use, surface water and groundwater.

Figure 2.5: Land use map (Figure 3 from the NWRS Fish to Tsitsikamma WMA Report September 2003)

2.2.3 International links and links with other WMAs

The ISP-area does not border on any neighbouring country and is not directly linked to any other country through the transfer of water. Large quantities of water are transferred into the Fish to Tsitsikamma WMA from the Orange River WMA. The Orange River is an international river shared by four countries (South Africa, Lesotho, Botswana and Namibia). Some Orange River water is transferred to the Tsitsikamma to Coega ISP-area for urban use. Water resource management by the Orange River Basin countries, is facilitated through the Orange-Senqu River Basin Commission, and may impact on the ISP-area.

Orange River water is transferred to the Tsitsikamma to Coega ISP-area via the Fish and Sundays Rivers, which is situated in the Fish to Sundays ISP-area. This Fish to Sundays ISP-area is also managed by the DWAF Eastern Cape Regional Office, being situated in the Fish to Tsitsikamma WMA.

Other WMAs have very limited links with this ISP-area. Any such links will mainly be where towns in other WMAs identify resources in this ISP-area as possible future sources of supply, for example Uniondale in the Gouritz WMA [(6)].

2.2.4 Economic development

Port Elizabeth's harbour and airport are of major economic importance for the area. The harbour, together with the presence of the automotive and related industries in the Port-Elizabeth-Uitenhage area, benefit the economy of the ISP-area in the manufacturing, trade and transport sectors compared to the remainder of South Africa. The importance of Port Elizabeth as a trade centre is also supported by the tourism attractions of the surrounding areas and agricultural production in the region.

The finance and transport sectors are also closely interdependent with trade and manufacturing. Unemployment in the area is high. Of the work force of 680 000 in the WMA in 1994, 39% were unemployed, which is well above the national average of 29% [(3)].

The main opportunities for potential economic growth will arise from increasing industrialisation and the expansion of trade. Great impetus in this respect is expected to result from the new Coega harbour development and free trade zone. Little stimulation for economic development exists elsewhere in the ISP-area, and it is expected that growth will continue to be centred in the Port Elizabeth-Uitenhage area.

a. Strategic water use

There is no large-scale power generation in the ISP-area or pumped storage schemes. A small hydropower station at Kouga Dam has been decommissioned because of deterioration of the mechanical plant and severe leakage from the balancing dam that was a component of the scheme [(26)].

b. Mining

The area is not rich in minerals. There are no significant mining activities and mining operations consist mainly of quarrying for building materials. Mines are small, consisting of a limestone quarry near Hankey and a gypsum mine near Steytlerville.

Sand mining takes place in the Swartkops River above Uitenhage up to Redhouse, which causes water quality problems and impacts on the river. Commercial salt pans are situated adjacent to the Swartkops and Coega Rivers [(6)]. The Coega salt pans will disappear with the development of the harbour.

The fines produced by wash-water operations of stone mining in the Kromme River cause a slimes problem [(6)].

c. Industry

This ISP-area includes the fifth largest metropolitan area in the country, namely the Nelson Mandela Metropolitan Municipality (NMMM) (comprising Port Elizabeth-Uitenhage-Despatch-KwaNobuhle), which is the hub of motor vehicle manufacturing in the country. The Delta Motor Corporation is established in Port Elizabeth and Volkswagen is situated in Uitenhage. Several component manufacturers are clustered around these industries, e.g. tyre, automotive glass and lighting manufacturers. Automotive exports are on the increase.

Port Elizabeth is a large centre for trade and this is bolstered further by the fact that it has an import and export harbour and an international airport. The airport currently handles over 800 000 passengers per year.

The **Coega** deepwater harbour and associated heavy industrial development zone (IDZ) is being established north of Port Elizabeth, as part of the Coega Industrial Zone development. The harbour will serve as a trans-shipment hub as well as serving a number of proposed industrial clusters, including an envisaged metallurgical cluster. The container terminal is still being developed conceptually. The anchor tenant will be an aluminium smelter plant. Currently there are reported to be 1 900 new jobs in the construction phase of the harbour/IDZ, due to grow to 15 000. Portnet expects to invest a total of R4.65 billion in the deepwater port over the coming years, the timing of which will be driven by investor demand [(37)]. The Coega development is likely to become an important feature of the ISP-area. The development will have a limited short-term impact on NMMM's water requirement but the impact is expected to increase to 15 million m^3/a in ten years' time.

d. Agriculture and irrigation

Most cultivated land in the hinterland is irrigated because the rainfall is too low to rely on rain.

When there is enough water, land is irrigated along the rivers upstream of Beervlei Dam in the **Groot River catchment**, where the crops grown are mainly lucerne and other fodder types. All the arable land downstream of Beervlei Dam is irrigated in most years.

In the Langkloof, the fertile soil in the valleys of the upper tributaries of the **Kouga River catchment** is intensively cultivated. Large areas of deciduous fruit orchards and a small area of pasture are grown under irrigation, using water stored in a large number of farm dams. Small amounts of irrigation are found in the **Baviaanskloof River catchment**, mainly pastures.

Large areas of land in the river valley downstream of Kouga Dam in the **Gamtoos River catchment** are irrigated from canals, which carry water from Kouga Dam and Loerie Dam. Vegetables, citrus, lucerne and tobacco are grown.

The Churchill Dam and the Impofu Dam regulate the **Kromme River**. The valley upstream of Churchill Dam is an extension of the Langkloof and is intensively cultivated. Areas of deciduous fruit orchards, pasture, and vegetables are irrigated from farm dams and from water abstracted directly from the river. Downstream of Churchill Dam, in the catchment of the Impofu Dam, pasture is irrigated, partially from farm dams and partially from run-of-river flow.

In the **Tsitsikamma sub-area** the land is used mainly for mixed farming and the irrigation of pastures for dairy farming.

In the **Algoa Coast sub-area,** limited mixed farming is practised on the fringes of the urban areas, using treated sewage effluent direct from the treatment works, or water from the Swartkops River. Irrigation upstream of Uitenhage uses groundwater and compensation water released from Groendal Dam. Some irrigation from farm dams and run of river flow occurs along the Elands River tributary of the Swartkops River. Crops grown are mainly various types of vegetables and lucerne. In the remaining catchments mainly vegetables are irrigated using groundwater. The area of land irrigated in the Algoa Coastal Catchments remains fairly constant from year to year.

Dryland farming is a significant commercial activity in this ISP-area, concentrated in the southern coastal areas.

Farming with sheep, goats and cattle takes place in the area, and there are also significant numbers of game.

e. Forestry

The Tsitsikamma Coast sub-area is heavily afforested with major timber production. There are also large areas of indigenous forest and much of this land falls either within the Tsitsikamma Forest Reserve, or the Tsitsikamma Coastal National Park. There are tracts of commercial forests above Loerie Dam, in the Gamtoos catchment, in the upper Swartkops River catchment and in the Van Staden's River catchment. The impact of afforestation on

water availability is generally low because very little of the afforestation is in catchments regulated by major dams.

The commercial forests in the ISP-area were mainly planted before 1972, when licenses were not yet required. Almost all commercial forests in the ISP-area belong to what was previously SAFCOL. No licenses have been issued since the implementation of the NWA. Some licenses were issued between 1994 and 1998, mainly for the replanting of pastures/veld, amongst others in the catchment of the Elands River.

f. Tourism

On the coastal strip, tourism is well established, as the area between Natures Valley and Cape St Francis offers some of the country's most scenic coastline and rain forests. Some of the world's best surfing is available in the Jeffrey's Bay/Cape St Francis area. Port Elizabeth is known as the "friendly city" and attracts tourists, conference organisers/delegates and water sport events. The numerous wilderness areas, parks and game farms add to the attraction. A casino has been developed in Port Elizabeth.

Figure 2.6: Port Elizabeth beachfront scene

Figure 2.7: Hobie Beach pier

2.3 WATERWORKS

2.3.1 Algoa Water Supply System

The water supply system serving the Port Elizabeth area is known as the **Algoa Water Supply System** (AWSS). It has developed from several separate schemes that have become interlinked. The AWSS consists of a few minor local sources (Sand, Bulk, Van Stadens, Groendal and Uitenhage groundwater), supply from the East (Orange water) and the western system which bring water from the Kouga (and Loerie) and Kromme River dams. The north-eastern system can be regarded as starting at Scheepervlakte Dam, but in order to abstract water there it must come all the way from Gariep Dam with competition for infrastructure capacity from irrigation en route, including the ± 4 000 ha allocated to emerging farmers. Signs are that the Eastern Cape Government wants to implement the latter as soon as possible. Demands on the Algoa System are for both urban/industrial use and irrigation. Joint management and operation with forums such as those in place for the Western Cape Water Supply System are called for.

The AWSS supplies potable water to over a million people and a large number of industries, the largest user being the NMMM with a water requirement of 73 million m^3/a. The 1:50 year yield of the system in 2000 was approximately 112 million m^3/a from local sources and potentially 25,6 million m^3/a from the Orange River (restricted to potentially 15 million m^3/a due to infrastructural constraints). In addition, approximately 1,2 million m^3/a of sewage effluent is recycled for industrial use to system water users and 1,1 million m^3/a to agricultural users. The total assured system supply was approximately 130 million m^3/a in 2000 and the system demand 130 million m^3/a. In the year 2000 the AWSS was thus already in balance. **Appendix C2** provides a detailed AWSS yield balance.

The AWSS is operated in an integrated, shared manner, in which the major components of infrastructure are predominantly owned and operated by DWAF and the NMMM. The water treatment works associated with the system and other system infrastructural details are shown in **Appendix B9**. **Appendix B6** lists the existing irrigation boards and associated information. The existing major dams are listed in **Appendix B8**. Details of possible future bulk water supply schemes within the ISP-area are provided in **Appendix B10**.

The various components of the system are as follows:

- Gamtoos Government Water Scheme;
- Churchill Water Supply Scheme;
- Groendal Dam on the Swartkops River;
- Other NMMM municipal dams;
- The Lower Sundays Government Water Scheme;
- Uitenhage aquifer.

The larger dams in the area are (See **Appendix B8** for more detail):
Kromme-Seekoei sub-area: Churchill and Impofu Dams on the Kromme River;
Tsitsikamma Coast sub-area: Klippedrift and Lorentz/Dreyer Dams on the Loopspruit;
Groot River sub-area: Beervlei Dam on the Groot River and Klipfontein Dam on the Heuningsklip River;
Kouga-Gamtoos sub-area: Haarlem Dam on the Haarlem River, Kouga Dam on the Kouga River and Loerie Dam on the Loerie River;
Algoa Coast sub-area: Groendal Dam on the Swartkops River, Sand River Dam on the Sand River, Bulk River Dam on the Bulk River and the two Van Stadens River Dams on the Van Stadens River.

Appendix B also contains detailed information relating to other water infrastructure. **Figure 2.10** shows the interconnected nature of the AWSS.

The only transfer scheme into the ISP-area is that from the Sundays River – providing on average 11 million m^3/a (water transferred from the Orange River via the Fish River), while there are many internal water transfers between catchments in the ISP-area, mainly to supply the NMMM.

No bulk water users with their own supply schemes, or supplied individually by DWAF or one of the district councils, were identified.

(a) Kouga/Loerie sub-system

The Gamtoos Government Water Scheme comprises the Kouga Dam and the Loerie Dam. DWAF owns Kouga Dam, its main canal and tributary canals and ancillary infrastructure and also Loerie Dam. The Gamtoos Irrigation Board operates Kouga Dam and its main canal on behalf of DWAF. NMMM owns and operates Loerie Dam treatment works.

The yield of the scheme is allocated to Port Elizabeth Municipality, to Hankey and Patensie for urban use, and the balance to irrigation. Water is conveyed from Kouga Dam to Loerie Dam by means of a canal from which irrigation requirements are abstracted. On average about 66 million m³/a is released from Kouga Dam and 14 million m^3/a is delivered to Loerie Dam. With the exception of that supplied to Hankey and Patensie, all water for urban use is discharged from Loerie Dam to the Loerie Water Treatment Works. The treated water is conveyed by pipeline from there to the Port Elizabeth area.

Hankey and Patensie draw raw water from the scheme and treat it at their own works. NMMM supplies the town of Loerie with treated water. The 1:50 year yield of the scheme is 71.1 million m^3/a of which 23,0 million m^3/a is allocated to NMMM, but on average only 16 million m^3/a is currently supplied. Approximately 0,8 million m^3/a is supplied to Hankey and Patensie for urban use and most of the balance to irrigation.

The scheduled irrigation area from Kouga Dam in 1995 was 7 353 ha, but 9 880 ha were irrigated. Crops grown are vegetables (60%), citrus (22%), lucerne and tobacco. The present allocation of water from Kouga and Loerie Dams to the Gamtoos Irrigation Board is 59.5 million m^3/a. Canal losses are a function of the flow and are estimated at about 13.5 million m^3/a. The irrigators require on average 40 million m^3/a, (but at a low assurance of supply). Port Elizabeth currently uses less than its full allocation on average.

Irrigation in the Langkloof. The Langkloof in the upper reaches of the catchment of the Kouga River (sub-catchments L82A, B, C and D) is an area of intensive irrigation from farm dams. Irrigation in the Langkloof was intense but quite restrained until Eskom embarked on its rural electrification programme in about 1980. Since then, there has been a massive expansion of areas under irrigation with extensive pumping. Irrigation is mostly from tributaries of the Kouga River rising in the Tsitsikamma Mountains and flowing into the Langkloof – such as the Ongelegen River, the Misgund River, Louterwater, etc. The Kouga itself has no valley floor after crossing the Langkloof at Haarlem. It was estimated that, in 1992, irrigated land in the area consisted of 5 635 ha of deciduous fruit orchards and 145 ha of pasture. Irrigation is from a large number of farm dams, the combined capacity of which in 1992 was estimated to be about 26 million m³. (The Haarlem Dam has a significant 4.7 million m^3 capacity). Average annual irrigation water use was estimated to be 32 million m³/a in 2000.

Future growth in irrigation in this area is likely to be determined by availability of water and market forces. The area has been excluded from General Authorisations for surface water abstraction. The general authorisation impoundment limit restricts storage to 10 000 m^3, upstream of Kouga Dam, which will also have an effect on development. These limits may only be

exceeded with a license issued by the Minister of Water Affairs and Forestry. Owing to the high degree of development in the area, together with its effect on the yield of Kouga Dam (and the possibility of the Guernakop Dam which may eventually be constructed downstream for supply to NMMM), licenses for large waterworks in the Langkloof will only be given in exceptional circumstances.

A small hydro power station at Kouga Dam has been decommissioned because of deterioration of the mechanical plant and severe leakage from the balancing dam that was a component of the scheme.

(b) Kromme sub-system

The Churchill Water Supply Scheme utilises the water of the Kromme River (for supplies mainly to the NMMM area. NMMM currently uses about 34 million m³/a from the Kromme River system (Impofu and Churchill Dams). Supplies to Humansdorp and smaller towns in the vicinity are also supplemented from this scheme. This generally occurs during the summer to meet the increase in demand caused by holidaymakers.

The scheme comprises Churchill Dam, Impofu Dam, and Churchill and Elandsjacht Water Treatment Works and pipelines and pumps that convey the water to the NMMM area. Humansdorp, Jeffrey's Bay and St Francis Bay are also partially supplied from this scheme as well as minor amounts to Thornhill and Paradise Beach. These towns rely as far as possible on their own groundwater schemes, which have a combined yield of 4,3 million m^3/a.

(c) The Lower Sundays Government Water Scheme Extension

Prior to 1983, it was believed that the yield from the Port Elizabeth supply sources would be adequate up to 1997. However, the 1983 to 1989 drought highlighted the need for a greater long-term assured supply of water to the region. The Lower Sundays Government Water Scheme was subsequently implemented to supplement supply to Port Elizabeth. The primary function of the scheme was therefore to increase the assurance of supply to the Port Elizabeth metropolitan area.

Recent re-evaluation of the Orange River System resulted in substantial reductions in the available yields. It was planned to develop the infrastructure to supply the original envisaged requirement by NMMM in stages, but the Metropole now has a low requirement for this water.

The Orange/Sundays River Supply System conveys water from Gariep Dam on the Orange River to the Nooitgedacht Water Treatment Works from where it is distributed to the northern areas of NMMM. The treatment works, pump station, rising main, Grassridge Balancing Dam and the gravity main to Port Elizabeth is owned and operated by NMMM. The rest of the system, which is an extension of the Lower Sundays River Government Water Scheme, is owned and operated by the Department of Water Affairs and Forestry. The current 25,6 million m^3/a capacity of this scheme is limited by treatment capacity and could, if necessary, be substantially increased in the future by extending the treatment works and increasing the capacity of the delivery pipelines and some sections of the raw water conveyance system. At present, water treatment capacity of approximately 20 million m^3/a has been constructed, the intention being to increase both the

treatment and conveyance capacity as dictated by future water requirements. Approximately 11 million m^3/a is supplied to NMMM.

Issues and concerns regarding the Lower Sundays Government Water Scheme Sub-system that were identified are:

- The acceptability of the water quality to domestic and industrial users.
- The availability of water for future expansion of the system.

(d) Uitenhage Aquifer

The geology and hydrogeology of the area are well documented. The primary aquifer is of marine origin and is saline and the secondary aquifer is artesian. The proclamation area consists of over 200 registered farms and the Port Elizabeth, Uitenhage and Despatch municipal areas, as well as the Elands River Forest Reserve.

The Uitenhage Subterranean Government Water Control Area was proclaimed in 1957 to halt indiscriminate borehole drilling and subsequent pumping that caused a noticeable reduction in borehole yield in the area. Two areas are a cause for concern, namely the large Amanzi Estates irrigation project (citrus farming in M30A), which abstracts from the Coega Ridge Aquifer, and the Kruisrivier farms. Individual farmers also abstract from the aquifer. The Amanzi Estates are using more than their allocation while the Kruisrivier farms are not using their allocation, which may also be higher than they could currently use.

Further abstraction from groundwater in this proclaimed area would only be allowed after issue of a license from DWAF. Limited further licenses will be issued. In the stressed areas there is little hope of getting a license but there is a possibility in the remaining areas. Three licenses are currently pending. Two further boreholes may well be allowed for the Port Elizabeth industrial area. The quarry operation at Coega also needs a license to remove the groundwater from the quarry floor.

Water flows from springs and from the secondary aquifer to the NMMM's Kabah Water Treatment Works from where treated water is supplied to Uitenhage. The springs have a firm yield of 1,6 million m^3/a.

(e) Other system infrastructure

Groendal Dam on the Swartkops River supplies water by pipeline to the Kabah Water Treatment Works from where treated water is supplied to Uitenhage. The dam, treatment works and pipeline are all owned and operated by NMMM. The 1:100 year yield of the dam is 5,1 million m^3/a, of which 3,6 million m^3/a is allocated to urban water supplies and the balance of 2,4 million m^3/a to irrigation of riparian land downstream of the dam. The treatment works is also supplied from springs, which have a firm yield of 1.6 million m^3/a.

Sand River Dam and Bulk River Dam and the Upper and Lower Van Stadens Dams supply the Linton Water Treatment Works, all of which were owned and operated by NMMM. The combined 1:50 year yield of the dams is 3,3 million m^3/a

(f) Future sources

Several major dams have been constructed in the water management area for urban supply and irrigation. Limited numbers of good dam sites are available for further water resource development.

The proposed Guernakop Dam was identified as the next viable major infrastructure scheme to supply the NMMM once other intervention measures have been implemented. Concerns have been expressed about the negative impact that further impoundment of the Kouga River would have on the protected environmental area in which it would be located. The Tsitsikamma River and other coastal rivers have also been identified as possible future sources to augment the supplies from the Kromme River.

Figure 2.8: Loerie Dam

Figure 2.9: Scheepersvlakte balancing dam

2.3.2 Local water supply schemes

Virtually all municipalities outside the NMMM are located within the Cacadu District Municipality, whose IDP [41] has been submitted. Certain of the other WSDPs have been submitted, however, the detail and information provided varies and is in some cases incomplete. Groundwater is extensively used by towns and for rural water supply, with localised over-exploitation occurring. Some towns receive part or all of their water from the regional Algoa Water Supply System. The urban and rural domestic water supplies are generally adequate, with some localised shortfalls occurring, mainly due to inadequate management of supply systems or high demand peaks due to holidaymakers in coastal towns.

Figure 2.10: Algoa Water Supply System

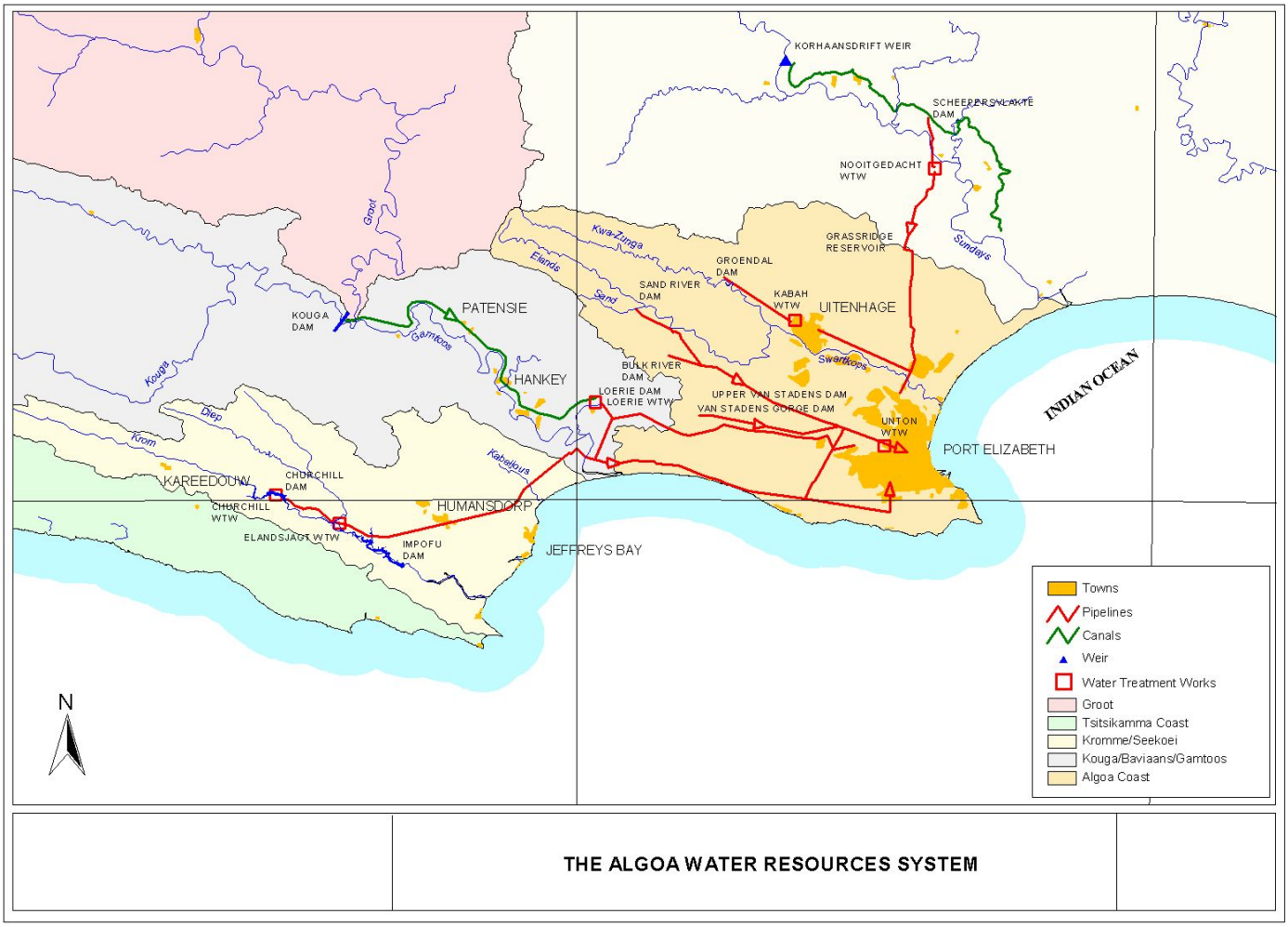
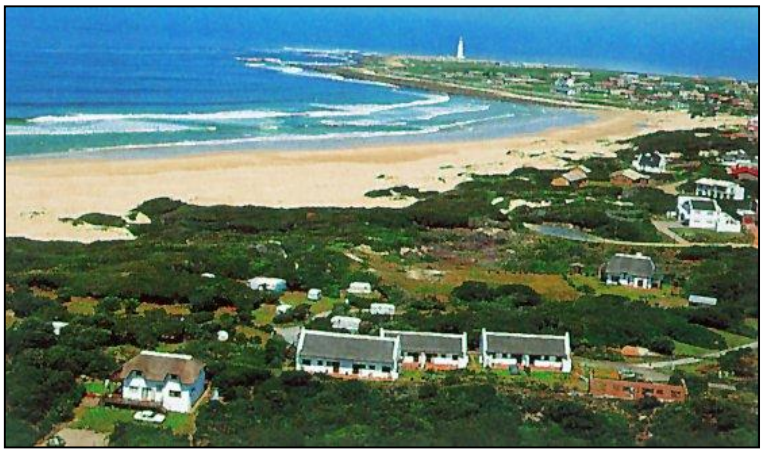


Figure 2.11: Cape St Francis – an urban water user



Current estimates are that at least 65% of the *rural* populations in the Eastern Cape do not have adequate water supply and about 95% do not have adequate sanitation. The relative situation in this ISP-area is much better, with most of the problems in the Eastern Cape being confined to the Mzimvubu to Keiskamma WMA.

CHAPTER 3 – WATER RESOURCES PERSPECTIVE OF THE ISP-AREA

This chapter presents a perspective of the water availability in the catchment, an overview of the water requirements attributed to the various water use sectors and an overview of the yield balance and reconciliation options. More detailed descriptions and discussions are contained in the yield balance database included in **Appendix C.** In general, supplies and demands in the catchment are currently roughly in balance with a few catchments experiencing water stress.

As will become clear in this Chapter, there is a possibility that limited additional amounts of Orange River water could in future be transferred to this ISP-area via the Fish and Sundays Rivers to meet the growing urban demand in the Port Elizabeth/Uitenhage/Despatch urban areas, now unified under the Nelson Mandela Metropolitan Municipality (NMMM) and for the Coega IDZ, which is currently under development. This urban requirement may also necessitate the building of new infrastructure within the ISP-area for further transfers within the ISP-area.

Tables 3.1 to **3.12** contain hydrological information on the ISP-area, which is contained in more detail in **Appendix C**. Calculations of the yields and water requirements per river sections, rivers and the ISP-area were carefully studied, revisited and refined for this ISP, following the publication of the NWRS. Demands were checked by liasing with DWAF officials, municipalities and the Gamtoos Irrigation Board. These later calculations and updates of yields showed that there is considerable uncertainty regarding the water availability and use. There is enough confidence in these revisited values that they have been shown in tables in this report. **It is however essential that the apparent discrepancies be addressed as a matter of priority through the Reconciliation Strategy as discussed in Strategy 13.1.**

3.1 WATER RESOURCES AVAILABILITY

3.1.1 Water availability

The NWRS sub-areas relate to the five sub-areas used in the Tsitsikamma to Coega ISP as follows:

Table 3.1: NWRS and ISP sub-areas

NWRS sub-area	Tsitsikamma to Coega ISP sub-area
Gamtoos	Groot and Kouga-Gamtoos combined
Algoa	Algoa Coast
Tsitsikamma	Tsitsikamma Coast and Kromme-Seekoei combined

A summary of the natural runoff, together with the estimated average annual flow requirements for the ecological component of the Reserve, are given in **Table 3.2**. This information is drawn from the NWRS. More detail on the estimation of the Reserve is discussed in **Addendum 3 of the NWRS First Edition, 2004** [(2)]. Only estimates of the Reserve for the instream flow requirements of the rivers were available. Estimates of the requirements of the estuaries still need to be made and incorporated into the figures. If the estuarine requirements are significantly higher than the riverine requirements, it may have a serious impact on strategies.

Table 3.2: Natural mean annual runoff and ecological Reserve (million m³/a)

Sub-area	Natural MAR [(1)]	Ecological Reserve [(1, 2)]
Groot	209.0	18.2
Kromme-Seekoei	134.9	15.5
Kouga-Gamtoos	282.0	20.8
Tsitsikamma Coast	410.0	91.5
Algoa Coast	147.1	14.9
Total for ISP-area	**1183.0**	**160.9**

1) Quantities given are incremental, and refer to the sub-area under consideration only.
2) This is the total volume, based on preliminary estimates. Impact on yield will be a portion of this.

The water resources are not evenly distributed across the catchment, with the natural runoff much greater towards the coastal regions, where higher rainfalls occur. The natural mean annual runoff (MAR) of 1 183 million m^3/a has been reduced by abstractions and other consumptive usages to the present-day MAR of less than 80% of this amount.

The total impact of the Reserve on the yield is estimated to be 21.6 million m^3/a. Only the ecological requirements of the Swartkops River and estuary have been determined at a reasonable level of confidence. There is therefore uncertainty about the estimates of the Reserve and how this may change in future.

The ***available yield*** is *the amount of water that can be expected to be "available" for commercial use (at an assurance of 98%), either from dams, directly from rivers, or from groundwater - during any one year*.

The available yield in the ISP-area is a combination of surface water, groundwater, usable return flows and transfers into the ISP-area. Gauging stations and monitoring sites in the area should generally be increased. The quantities available and uncertainties around that are discussed further in the report.

Calculations of the available yield per river sections, rivers and the ISP-area were carefully studied, revisited and refined for this ISP, following the publication of the NWRS. These later calculations and updates of yields showed that there is considerable uncertainty regarding the water availability, particularly in the Gamtoos and Tsitsikamma sub-areas. There is enough confidence in these revisited values that they have been shown in tables in this report.

It is, however, essential that the apparent discrepancies be addressed as a matter of priority through the Reconciliation Strategy as discussed in Strategy 13.1.

Table 3.3 shows the yields per ISP sub-area as revisited during the ISP process.

Table 3.3: Available ISP sub-areas yield in the year 2000 (million m³/a) at 1:50 year assurance

ISP Sub-area	Natural resource		Usable return flow	Total local yield (1)	Transfers in (2)	Grand Total
	Surface water	Ground-water				
Groot	15	3	1	**19**	0	**19**
Kouga-Gamtoos	94	2	2	**98**	0	**98**
Sub total	**109**	**5**	**3**	**117**	**0**	**117**
Algoa Coast	10	6	4	**20**	62	**82**
Sub total	**10**	**6**	**4**	**20**	**62**	**82**
Kromme-Seekoei	44	2	2	**48**	0	**48**
Tsitsikamma Coast	12	0	1	**13**	0	**13**
Sub total	**56**	**2**	**3**	**61**	**0**	**61**
Total for ISP-area	**175**	**13**	**10**	**198**	**11**	**209**

1) After allowance for the impacts on yield of: the ecological component of the Reserve, river losses, alien plants, dry land agriculture and urban runoff.
2) Transfers into the sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfer into the WMA.

Table 3.4 shows the yields per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report (3).

Table 3.4: Available NWRS yield in the year 2000 (million m³/a) at 1:50 year assurance

NWRS sub-area	Natural resource		Usable return flow	Total local yield (1)	Transfers in (2)	Grand Total
	Surface water	Ground-water				
Gamtoos	137	5	3	**145**	0	**145**
Algoa	10	6	7	**23**	64	**87**
Tsitsikamma	41	6	2	**49**	0	**49**
Total	**188**	**17**	12	**217**	**30**	**247**

1) After allowance for the impacts on yield of: ecological component of Reserve, river losses, alien plants, dry land agriculture and urban runoff.
2) Transfers into and out of sub-area may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfers into and out of the WMA.

The *major* differences between the available yields as determined in the ISP from the NWRS yields are the following:

- Available yield in the ISP-area was determined as 209 million m^3/a compared to 248 million m^3/a in the NWRS;
- Sub-area available yields (according to the NWRS sub-areas) were determined as:
  - 117 million m^3/a in the Gamtoos sub-area compared to 145 million m^3/a of the NWRS;
  - 82 million m^3/a in the Algoa sub-area compared to 87 million m^3/a of the NWRS; and
  - 61 million m^3/a in the Tsitsikamma sub-area compared to 49 million m^3/a of the NWRS;
- The transfer into the ISP-area from the Fish to Sundays ISP-area was determined as 11 million m^3/a, compared to 31 million m^3/a, to reflect the actual average transfer;
- The surface water yield of the NWRS Gamtoos sub-area was determined as 109 million m^3/a compared to 137 million m^3/a of the NWRS. Updated hydrology from the Algoa Pre-Feasibility study for the Kouga catchment was used for the revised yield of Kouga Dam. The yield of Loerie Dam was reduced from 7.7 million m^3/a to 2.4 million m^3/a to portray the actual current yield due to the way the dam is now operated to reduce manganese levels in the dam's water. The run-of-river yields of the Groot, Baviaanskloof and Kouga rivers were reduced to the best estimates obtained from system analyses;
- The usable return flow in the Algoa sub-area was determined as 4 million m^3/a compared to 7 million m^3/a of the NWRS, to account for current use of wastewater;
- The surface water yield of the NWRS Tsitsikamma sub-area was determined as 56 million m^3/a compared to 41 million m^3/a of the NWRS, mainly because of greater allowance for environmental flows.

The total year 2000 *available yield* from the ISP-area at a 1:50 year assurance is 209 million m^3/a. The bulk of available surface water is from large dams. Limited potential for development of new dams and other water resource developments remain. Groundwater holds significant possibilities for development, such as the deep Table Mountain (TMG) Group aquifer which may have significant storage potential in the Tsitsikamma Coast and Groot sub-areas.

3.1.2 Surface water

The natural water resources of the ISP-area as a whole are dominated by the surface resources, with a natural surface Mean Annual Runoff (MAR) of approximately 1 183 million m^3/a. These resources are not evenly distributed with the natural runoff being much greater towards the coastal regions, mainly due to rainfall distribution. A high percentage of the surface runoff in the area originates from the higher rainfall coastal areas. Major dams provide the bulk of the surface water yield.

3.1.3 Groundwater

Groundwater use is shown in **Table 3.4**. Groundwater is often the only source of water for rural domestic use and stock watering, whilst several towns also obtain a large proportion or all of their water from underground sources. Groundwater is also used for urban supply by coastal towns,

but supplies to these towns are significantly supplemented from the AWSS, as groundwater cannot support their growing demands and seasonal peaks.

There are various schools of thought regarding the levels of exploitation of groundwater and the overall availability of this important resource in the catchment (refer to Paragraph 6.2 in the WRSA Report for more background to the groundwater resources of the catchment and their harvest potential [(7)]). The surface-groundwater relationships have not been clearly documented and need to be confirmed (see *Reliability of the yield estimates strategy*). There is strong interdependence between groundwater and surface water in the higher rainfall coastal area. Increased abstraction of groundwater in these areas is likely to have a direct impact on the base flow in surface streams and may induce the intrusion of seawater where wells or boreholes are located near the coast.

The TMG has significant storage potential in the Tsitsikamma Coast and in the Groot sub-areas. In these areas the groundwater yield should be evaluated over a number of rainfall seasons for potential future use.

There are uncertainties, assumptions and critical gaps in the hydrogeological database for all aquifers other than for the Swartkops aquifer in this ISP-area. Accuracy of the available yield and potential of the different aquifers based on current usage, recharge, storage, climate patterns and predicted climate change is dependent on the reliability of the available input data. The present spread of rain gauge data (reliability and record length) and flow gauge data is inadequate to evaluate regional patterns or aquifer specific patterns of recharge and discharge. The density and representivity of data is inadequate to interpret regional patterns of seasonal fluctuations, surface groundwater interactions, spring discharge, environmental dependency and response to climate variations.

Data has not been drawn into a readily accessible database for the Regional Office. This impacts on the accuracy of the yield evaluations, licensing decisions and on the potential to implement conjunctive development and management of groundwater and surface water resources. It is necessary to prepare a GIS data and knowledge base at a scale of data collection and presentation suitable for catchment management. The various published map references and associated literature are a guideline, but not detailed enough for the regulatory decisions now required. It must be a high priority to integrate the knowledge and information base that currently resides outside of and within DWAF and to ensure that knowledge management and dissemination is implemented.

Municipal use is variably monitored and populated in the DWAF database. Private use is significant and unmonitored. It is not possible to make sustainable or defensible licensing decisions based on incomplete or inadequate records, point source data, and irregular time series data without aquifer modelling. It is necessary to define and to quantify the groundwater resource within hydrogeological provinces at a relevant scale and based on quantitative scientific principles.

Classification of the different aquifers into classes comparable to the national classification of rivers, estuaries and wetlands, will form an integral part of the compulsory licensing process and impact on the approach to and relevance of groundwater reserve determination.

Development and coordination of the interaction between Hydrogeology within and outside of DWAF and development and prioritisation of strategic tasks given the limited human resources is urgently required.

There are 5 500 known boreholes in this ISP area. The position of less than one quarter of the boreholes is known to within 100 m. The registration of boreholes is very much incomplete and cannot be successfully managed until the regional database is upgraded. Control of groundwater usage would not be practical due to staff and database limitations.

Only 25 boreholes are monitored in the urban supply schemes and in the Uitenhage Control Area for water level and for groundwater quality. Only the Uitenhage Control area has automatic data loggers.

The groundwater usage has been assessed on a 1:250 000 scale. Current estimates are that groundwater contributes about 13 million m^3/a (or 6%) to the local yields in the ISP-area. It is necessary to revise and verify the current estimates of groundwater usage in the ISP area and sub areas. Groundwater usage in the small town supplies is variably well monitored but there are issues of consistency, reliability, frequency of measurement and routine interpretation of the data and resultant change as required to optimise groundwater abstraction and evaluate long term sustainable utilisable potential (SUP).

The St Francis Bay well field is well run and managed on a well field scale. The establishment of a basin hydrogeology approach, the installation of the necessary monitoring infrastructure and protocols for ensuring that groundwater optimisation and the upgrading of regional system understanding occurs is required. It must be a high priority to integrate the knowledge and information base that currently resides outside of and within DWAF, and to ensure that knowledge management and dissemination is implemented.

The sustainable utilisable potential (SUP) of groundwater in this ISP-area to contribute to agrivillages and poverty alleviation is significant, provided that a holistic approach is adopted. This means that over and above sound scientific and quantitative regional resource evaluation and management strategies, the approach should also include selection of appropriate technology, community training, ongoing optimisation of the groundwater usage and a sound Operations and Maintenance protocol and practise.

It is important to ensure that, after a groundwater scheme is established, the necessary short to long-term support for groundwater management is in place as required. It is seen as a priority that groundwater management, and operations and maintenance are combined.

3.1.4 Surface water quality

The quality of surface water in the ISP-area varies markedly from one catchment to another.

Quality in the Groot River is naturally poor and the water is unacceptable for most uses. The natural high salt load in the groundwater and the resulting high salinity in the base flow of the Groot River cause this. High fluoride concentrations also occur in the groundwater.

Water quality in the upper Kromme River is excellent, but the quality decreases slightly in a downstream direction, mainly due to changes in the underlying geology. Water quality problems are experienced in the Seekoei River.

Water quality is excellent in the upper Kouga River but deteriorates downstream. Below the confluence of the Kouga River and the Groot River, the river becomes the Gamtoos. The influence of the Groot River is such that the Gamtoos has a quality unacceptable to irrigators (as discussed above).

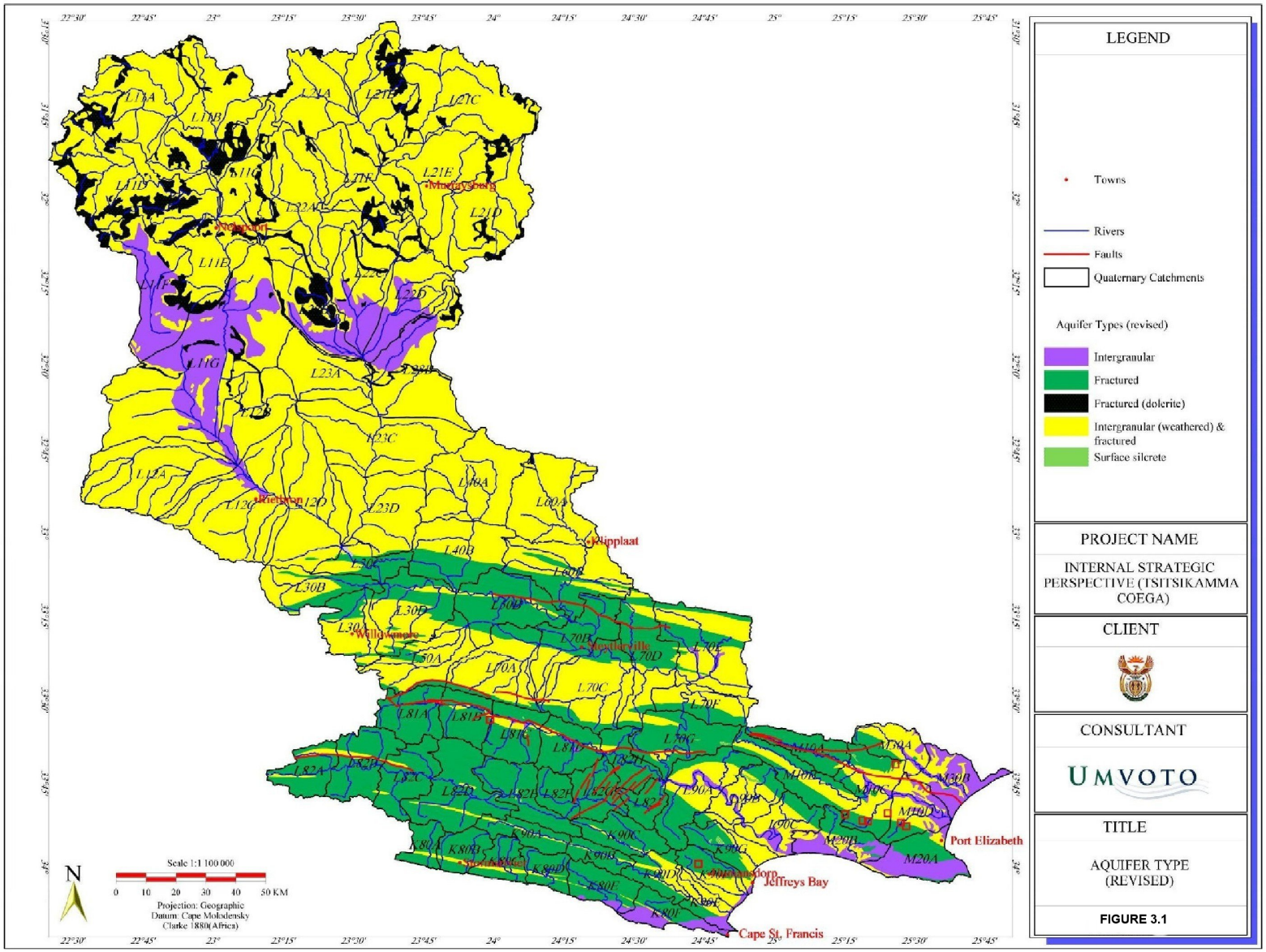
The Tsitsikamma Coast sub-area generally has excellent surface water quality.

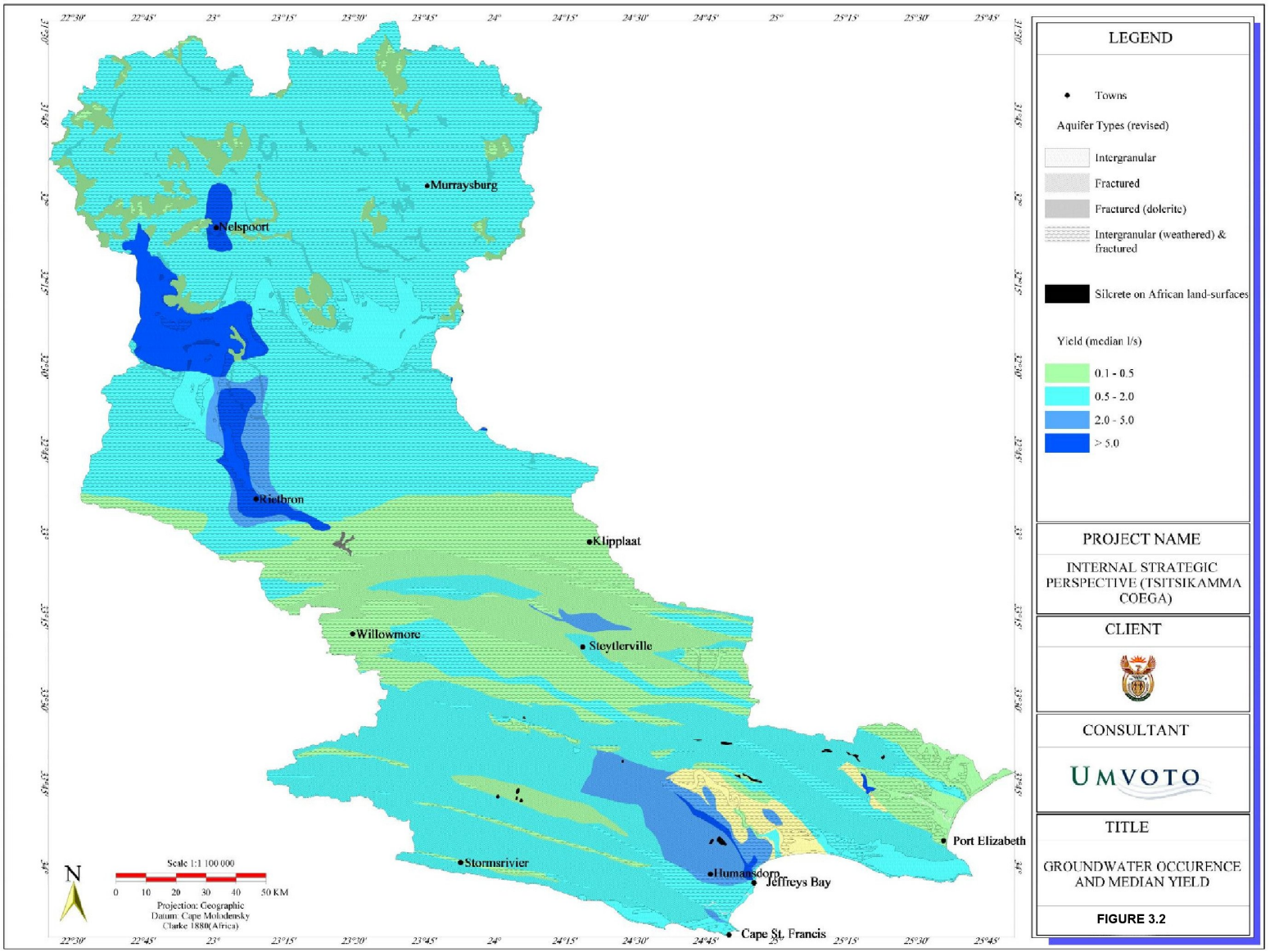
Water quality in the upper Swartkops River is good. However, water quality in the middle and lower reaches of the Swartkops River is poor. The urban and industrial centre of Port Elizabeth and Uitenhage is located in the Swartkops catchment. Treated sewage effluent return flows, contaminated storm water runoff and the natural geology account for the deterioration in water quality in the middle and lower reaches. There are extensive informal settlements on the floodplain of the Swartkops River and its tributaries, which also negatively impacting on downstream water quality.

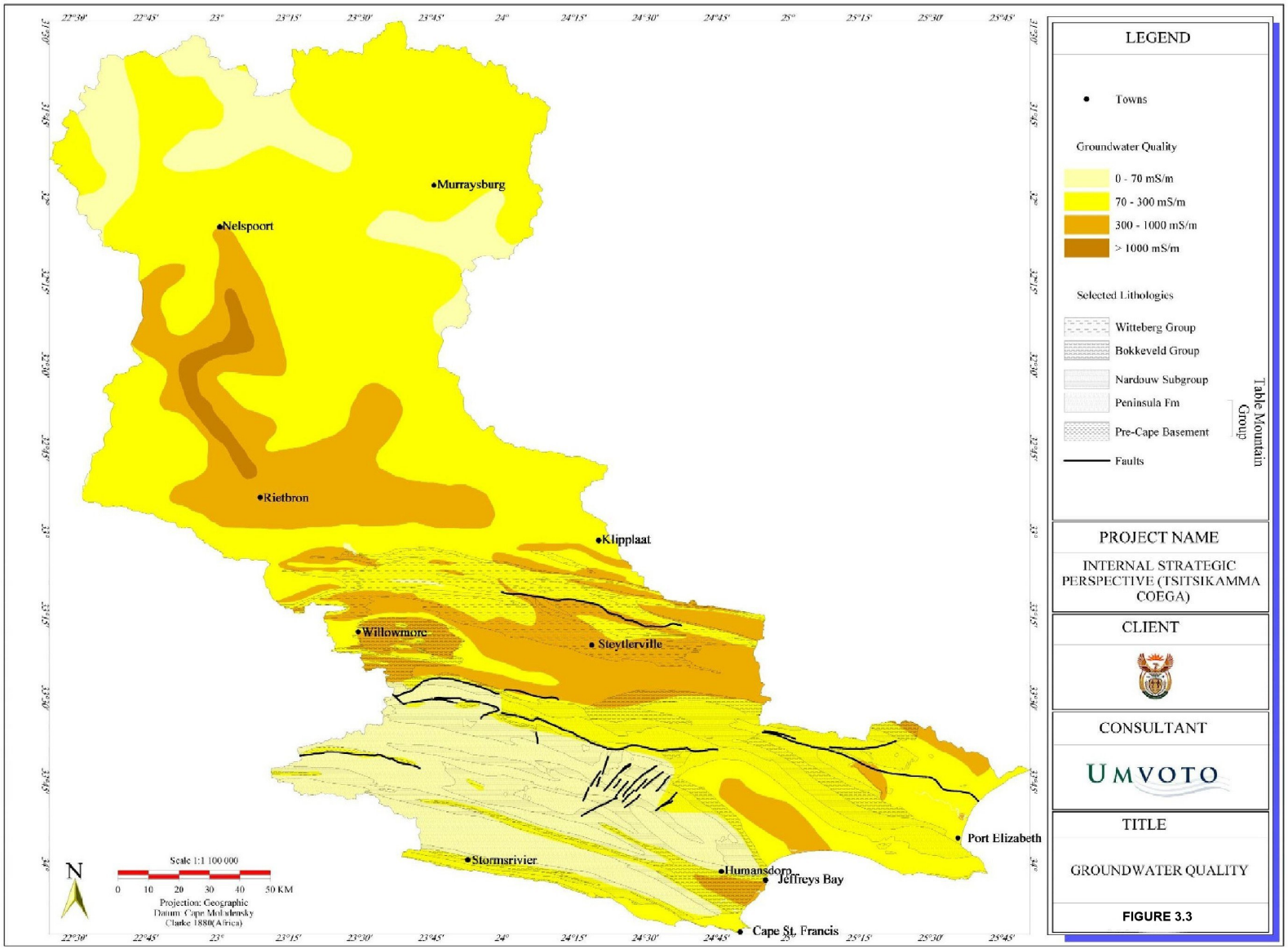
3.1.5 Groundwater quality

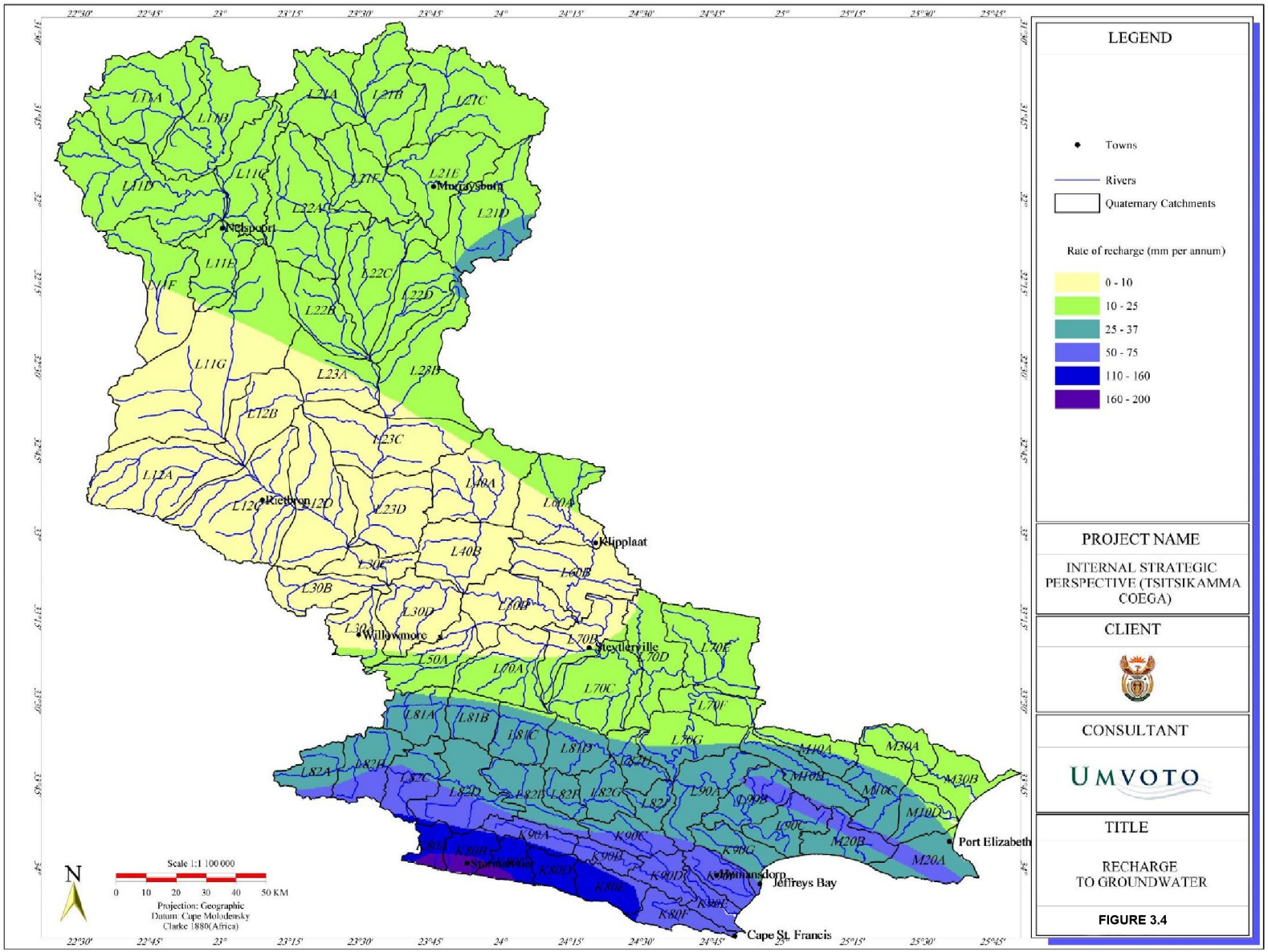
The quality of groundwater varies from one aquifer to another within and between the sub-areas. In general, the TMG aquifers which dominate the Tsitsikamma Coast sub-area and the southern section of the Groot sub-area, have good quality water. Water quality in the upper Groot is generally poor. The Uitenhage Groundwater Control area in the Algoa Coast sub-area is a confined artesian basin, which comprises a number of discreet aquifers. The water quality varies from brackish in the overlying sediments to very good quality water in the confined TMG below. Primary dune aquifers are present in places along the coast in the Tsitsikamma Coast, Kromme-Seekoei and the Algoa Coast sub-areas and hold good quality water.

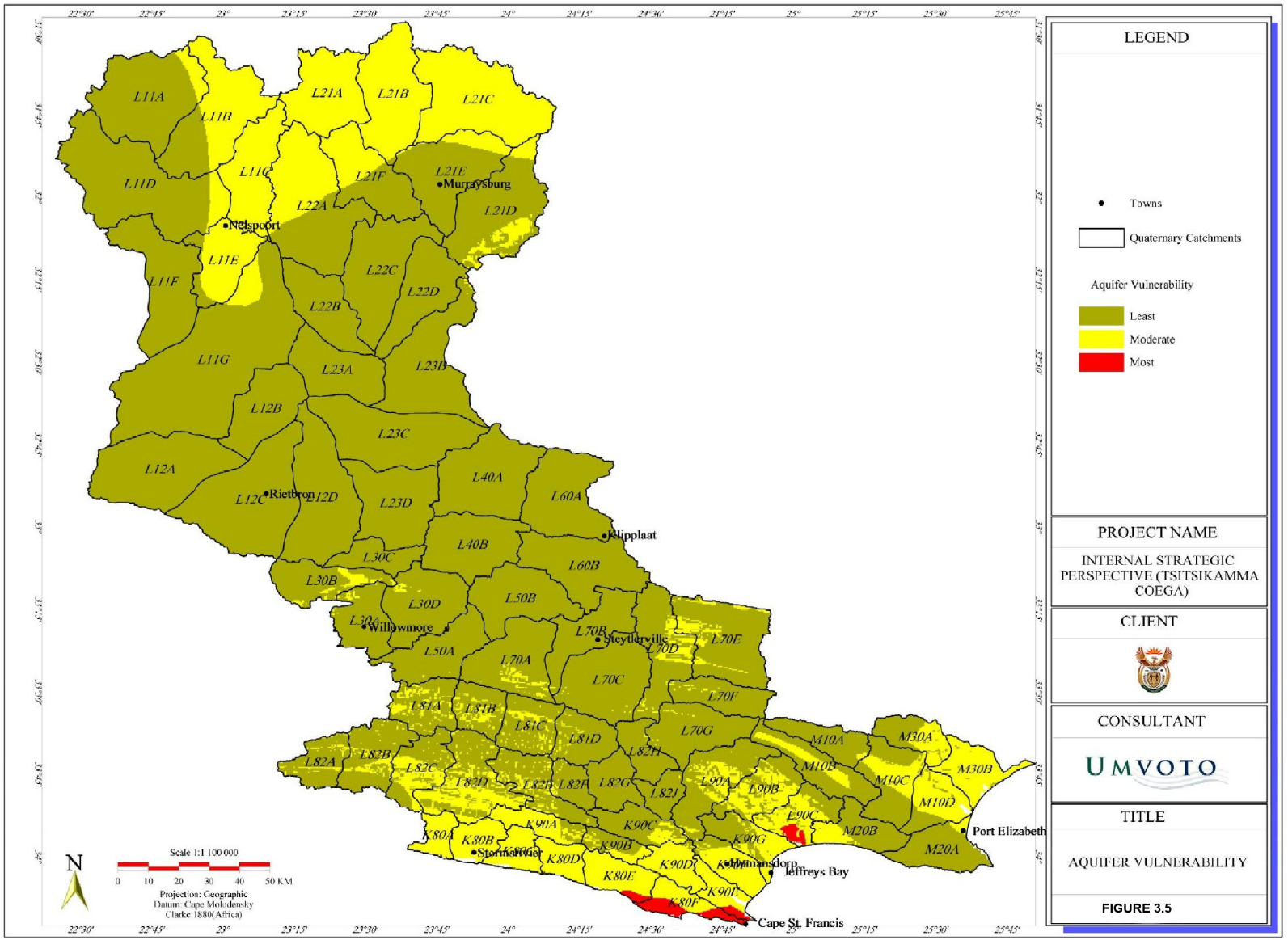
The contamination of the Swartkops aquifer is known. It is required that co-ordinated action between Water Quality and Geohydrology is achieved to address the matter with a view to remediation of the aquifer and the establishment of appropriate overall water resource management objectives in this sub-area. Meaningful water resource management and resource protection measures in this aquifer and regionally are required in order to fulfil the DWAF regulatory mandate.


LEGEND
Towns
Rivers
Faults
Quaternary Catchments
Aquifer Types (revised)
Intergranular
Fractured
Fractured (dolerite)
Intergranular (weathered) & fractured
Surface silcrete
PROJECT NAME
INTERNAL STRATEGIC PERSPECTIVE (TSITSIKAMMA COEGA)
CLIENT
CONSULTANT
UMVOTO
TITLE
AQUIFER TYPE (REVISED)
FIGURE 3.1
Port Elizabeth
Jeffreys Bay
Cape St. Francis
Scale 1:1 100 000
0 10 20 30 40 50 KM
Projection: Geographic
Datum: Cape Moloden sky
Clarke 1880(Africa)
N


LEGEND
Towns
Aquifer Types (revised)
Intergranular
Fractured
Fractured (dolerite)
Intergranular (weathered) & fractured
Silcrete on African land-surfaces
Yield (median l/s)
0.1 - 0.5
0.5 - 2.0
2.0 - 5.0
> 5.0
PROJECT NAME
INTERNAL STRATEGIC PERSPECTIVE (TSITSIKAMMA COEGA)
CLIENT
CONSULTANT
UMVOTO
TITLE
GROUNDWATER OCCURENCE AND MEDIAN YIELD
FIGURE 3.2
Murraysburg
Nelspoort
Rietbron
Klipplaat
Willowmore
Steytlerville
Port Elizabeth
Stormsrivier
Humansdorp
Jeffreys Bay
Cape St. Francis
Scale 1:1 100 000
0 10 20 30 40 50 KM
Projection: Geographic
Datum: Cape Molodensky
Clarke 1880(Africa)
N


LEGEND
Towns
Groundwater Quality
0 - 70 mS/m
70 - 300 mS/m
300 - 1000 mS/m
> 1000 mS/m
Selected Lithologies
Witteberg Group
Bokkeveld Group
Nardouw Subgroup
Peninsula Fm
Pre-Cape Basement
Table Mountain Group
Faults
PROJECT NAME
INTERNAL STRATEGIC PERSPECTIVE (TSITSIKAMMA COEGA)
CLIENT
CONSULTANT
UMVOTO
TITLE
GROUNDWATER QUALITY
FIGURE 3.3
Murraysburg
Nelspoort
Rietbron
Klipplaat
Willowmore
Steytlerville
Stormsrivier
Humansdorp
Jeffreys Bay
Port Elizabeth
Cape St. Francis
N
Scale 1:1 100 000
0 10 20 30 40 50 KM
Projection: Geographic
Datum: Cape Moludensky
Clarke 1880(Africa)


LEGEND
Towns
Rivers
Quaternary Catchments
Rate of recharge (mm per annum)
0 - 10
10 - 25
25 - 37
50 - 75
110 - 160
160 - 200
PROJECT NAME
INTERNAL STRATEGIC PERSPECTIVE (TSITSIKAMMA COEGA)
CLIENT
CONSULTANT
UMVOTO
TITLE
RECHARGE TO GROUNDWATER
FIGURE 3.4
Scale 1:1 100 000
0 10 20 30 40 50 KM
Projection: Geographic
Datum: Cape Molodensky
Clarke 1880(Africa)
N
Nelspoort
Murraysburg
Rietbron
Willowmore
Klipplaat
Steytlerville
Jeffreys Bay
Port Elizabeth
Cape St. Francis


LEGEND
Towns
Quaternary Catchments
Aquifer Vulnerability
Least
Moderate
Most
PROJECT NAME
INTERNAL STRATEGIC PERSPECTIVE (TSITSIKAMMA COEGA)
CLIENT
CONSULTANT
UMVOTO
TITLE
AQUIFER VULNERABILITY
FIGURE 3.5
Murraysburg
Nelspoort
Rietbron
Klipplaat
Willowmore
Steytlerville
Port Elizabeth
Jeffreys Bay
Cape St. Francis
Scale 1:1 100 000
0 10 20 30 40 50 KM
Projection: Geographic
Datum: Cape Molodensky
Clarke 1880(Africa)
N

3.2 WATER REQUIREMENTS AND USE

There is a large variation in levels of assurance (or alternatively the risk of failure to supply the full required amount) at which various users need their water supplied. It is therefore necessary to convert actual (average) water use to an equivalent, assured water use to determine a meaningful yield balance. The assurance level chosen for comparison purposes is the 1:50 year (or 98%) level of assurance of supply. Values shown in **Tables 3.5 and 3.6** have been expressed at the standardised 98% assurance of supply. More detail is provided in the yield balance database included in **Appendix C**.

Calculations of the water requirements per river sections, rivers and the ISP-area were carefully studied, revisited and refined for this ISP, following the publication of the NWRS. These later calculations and updates of requirements show that there is uncertainty regarding the water requirements. There is enough confidence in these revisited values that they have been shown in tables in this report. **It is, however, essential that the apparent discrepancies be addressed as a matter of priority through the Reconciliation Strategy as discussed in Strategy 13.1.** It is also recommended that, if possible, more accurate values be generated from the water use registration and verification process (WARMS) that is taking place as part of the implementation of the NWA.

Table 3.5 shows the yields per ISP sub-area as revisited during the ISP process.

Table 3.5: ISP sub-areas water requirements for the year 2000 (million m³/a) at 1:50 year assurance

ISP Sub-area	Irrigation	Urban (1)	Rural (1)	Mining and bulk industrial (2)	Power generation (3)	Afforestation (4)	Total local requirements	Transfers out	Grand Total
Groot	16	1	3	0	0	0	**20**	0	**20**
Kouga-Gamtoos	79	2	1	0	0	1	**83**	16	**99**
Sub total	**95**	**3**	**4**	**0**	**0**	**1**	**103**	**16**	**119**
Algoa Coast	7	73	1	0	0	0	**81**	0	**81**
Sub total	**7**	**73**	**1**	**0**	**0**	**0**	**81**	**0**	**81**
Kromme-Seekoei	7	4	1	0	0	0	**12**	35 (5)	**47**
Tsitsikamma Coast	4	1	1	0	0	5	**11**	0	**11**
Sub total	**11**	**5**	**2**	**0**	**0**	**5**	**23**	**35**	**58**
Total for ISP-area	**113**	**81**	**7**	**0**	**0**	**6**	**207**	**0**	**207**

1) Includes the component of the Reserve for basic human needs at 25 l/c/d.
2) Mining and bulk industrial water uses, which are not part of urban systems.
3) Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well).
4) Quantities given refer to impact on yield only.
5) This is the current maximum possible transfer due to the bottleneck in the pipeline from the Impofu/Churchill system.
6) Transfers out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers therefore does not necessarily correspond to the total transfer out of the WMA.

Table 3.6 shows the water requirements per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report [(3)].

Table 3.6: NWRS water requirements for the year 2000 (million m³/a) at 1:50 year assurance

NWRS Sub-area	Irrigation	Urban (1)	Rural (1)	Mining and bulk industrial (2)	Power generation (3)	Affore-station (4)	Total local require-ments	Transfers out	Grand Total
Gamtoos	104	3	3	0	0	1	**111**	12	123
Algoa	12	78	1	0	0	0	**91**	0	91
Tsitsikamma	11	5	1	0	0	5	**22**	22	44
Total	**127**	**86**	**5**	**0**	**0**	**6**	**224**	**0**	**224**

1) Includes the component of the Reserve for basic human needs at 25 l/c/d.
2) Mining and bulk industrial water uses, which are not part of urban systems.
3) Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well).
4) Quantities given refer to impact on yield only.

The *major* differences between the water requirements as determined in the ISP from the NWRS water requirements are the following:

- Water requirements in the ISP-area were determined as 207 million m^3/a compared to 224 million m^3/a of the NWRS;
- Sub-area water requirements (according to the NWRS sub-areas) were determined as follows:
  - 119 million m^3/a in the Gamtoos sub-area compared to 123 million m^3/a of the NWRS;
  - 81 million m^3/a in the Algoa sub-area compared to 91 million m^3/a of the NWRS; and
  - 58 million m^3/a in the Tsitsikamma sub-area compared to 44 million m^3/a of the NWRS;
- Irrigation in the NWRS Gamtoos sub-area was reduced from 123 to 119 million m^3/a. Irrigation above Beervlei Dam in the Groot Catchment was reduced to 2.5 million m^3/a because of the low run of river yield estimated at the 1 in 50 year reliability level. Irrigation use in the Kouga River catchment was re-estimated as 28.5 million m^3/a using the modelled use during system analysis of the Algoa Pre-Feasibility study;
- Irrigation in the Gamtoos: In the ISP the canal loss was added to the use by irrigation. The irrigation use is the sum of the following:
  36.5 average demand factored by approximately 90%
  13.5 canal losses and groundwater irrigation use
  50.10^6 m^3/a
- Urban use in the Algoa sub-area was determined as 73 million m^3/a, compared to 78 million m^3/a of the NWRS, to reflect actual use;
- The transfer from the NWRS Gamtoos sub-area to the Algoa sub-area was determined as 16 million m^3/a, compared to 12 million m^3/a of the NWRS, to reflect the actual average transfer;
- The transfer from the NWRS Tsitsikamma sub-area to the Algoa sub-area was determined as 35 million m^3/a, compared to 22 million m^3/a of the NWRS, to reflect the actual average transfer;

Irrigation constitutes by far the largest user of water in the region (55%) and is mainly used to grow vegetables, pastures, deciduous fruit, citrus and lucerne. There is scope for more efficient

use. Urban use is about 39% of total requirements and is on the increase. Other uses are limited in comparison. Most of the urban and industrial requirements are in the Algoa Coast sub-area, remote from the main source of supply on the Kromme and Kouga Rivers.

Groundwater is mainly used to supply small towns and for rural water supply. Identified requirements to alleviate poverty have so far been relatively small in this sub-area. The Kruisfontein resource-poor farmers intend expanding their irrigation in the Seekoei River catchment. Other equity requirements have had a low profile, compared to elsewhere in the Eastern Cape Province.

Equity requirements are not a major component in this ISP-area, compared to elsewhere in the Eastern Cape Province. The Kruisfontein resource-poor farmers intend expanding their irrigation in the Seekoei River catchment [(6)] and the Tsitsikamma Development Trust intends building a dam in the Tsitsikamma River for irrigation by resource-poor farmers. The feasibility of both schemes still has to be established.

Use of return flow is currently low. Most of the effluent from urban areas along the coast is discharged to the ocean, typically after treatment, and discharge into a river. A small quantity of effluent is re-used, mainly in Port Elizabeth for industrial purposes. Effluent re-use will be substantially increased to also supply the Coega development [(4)]. Currently 46 million m^3/a is discharged to the sea [(4)].

Figure 3.6: Overhead-sprinkler irrigation

Water losses through urban distribution systems and inefficiencies in irrigated agriculture are significant. An estimation of total achievable water savings in NMMM shows that 10 million m^3 (14%) per annum could be saved over a period of 5 to 7 years. Sufficient information about irrigation water losses is not generally available.

The future focus on water use will be to ensure a sustained, reliable supply for the growing urban water requirements of the NMMM; consolidation of the existing irrigation water use and improving efficiency of use, promoting re-use of water and ensuring that water is made available to alleviate poverty.

3.3 YIELD BALANCE

3.3.1 Current situation

The ***yield balance*** is: *(the sum of the available resources and the transfers into the area) minus (the sum of the various water requirements and losses and the transfers out of the area).*

Table 3.7 shows the yield balance per ISP sub-area as revisited during the ISP process.

Table 3.7: ISP sub-areas reconciliation of water requirements and availability for the year 2000 at 1:50 year assurance (million m³/a)

ISP Sub-area	Available water			Water requirements			Balance (1)
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	
Groot	19	0	19	20	0	20	**-1**
Kouga-Gamtoos	98	0	98	83	16 (3)	99	**-1**
Sub total	**117**	**0**	**117**	**103**	**16**	**119**	**-2**
Algoa Coast	20	62	82	81	0	81	**1**
Sub total	**20**	**62**	**82**	**81**	**0**	**81**	**1**
Kromme-Seekoei	48	0	48	12	35 (5)	47	**1**
Tsitsikamma Coast	13	0	13	11	0	11	**2**
Sub total	**61**	**0**	**61**	**23**	**35**	**58**	**3**
Total for ISP-area	**198**	**11 (4)**	**209**	**207**	**0**	**207**	**2**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) The current allocation to NMMM is 23 million m^3/a.
4) 11 million m^3/a is transferred from the Orange River via the Fish/Sundays systems. The Sundays River GWS can supply 25.6 million m^3/a if operated at full capacity throughout the year and if some additional treatment capacity is added (currently 20 million m^3/a). The scheme's Bethelsdorp pump station has however been vandalised, which temporarily further limits the scheme's capacity.
5) This is the current maximum transfer due to the bottleneck in the pipeline from the Impofu/Churchill system.

Table 3.8 shows the yield balances per NWRS sub-area from the NWRS Fish to Tsitsikamma WMA Report (3).

Table 3.8: Reconciliation of NWRS water requirements and availability for the year 2000 at 1:50 year assurance (million m³/a)

NWRS Sub-area	Available water			Water requirements			Balance (1)
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	
Gamtoos	145	0	145	111	12 (3)	123	**22**
Algoa	23	64	87	91	0	91	**-4**
Tsitsikamma	49	0	49	22	22 (5)	44	**5**
Total	**217**	**31 (4)**	**248**	**224**	**0**	**224**	**24**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) The current allocation to NMMM is 23 million m^3/a.
4) According to the NWRS, 31 million m^3/a is transferred from the Orange River via the Fish/Sundays systems.

The reconciliation of available water and requirements for the year 2000, including transfers of Orange River water, indicates that there is a current surplus in the Tsitsikamma to Coega ISP-area of 2 million m^3/a. The ISP-area was therefore close to balance in the year 2000. The recently completed Algoa Pre-Feasibility study concluded that, with a growing urban demand, the Algoa Water Supply System reached balance by 2003.

The NWRS shows a balance of 24 million m^3/a, which is substantially more than the balance determined in the ISP. The major difference is in the NWRS Gamtoos sub-area, where the NWRS has a balance of 22 million m^3/a, compared to the ISP shortage of 2 million m^3/a. This severely impacts on the ability of NMMM (or alternatively the Gamtoos irrigators) to make full use of their water use authorisation, as well as of the Gamtoos NWRS sub-area to help meet future urban growth with increased future transfers.

The difference between the ISP balance of 1 million m^3/a and the NWRS shortage of 4 million m^3/a in the Algoa sub-area does not change the management approach to be followed, as both balances show that the sub-area is close to a balanced situation.

The yield balances for the sub-areas show that most of them are in balance, except the Tsitsikamma Coast area, which shows a small surplus. It is evident that a shortage of supply in this ISP-area could be imminent.

The **uncertainties** in the yield balance and their possible impact are significant. The uncertainties are:

a) The confidence in **hydrological calculations of water availability** varies from good in some dammed rivers to poor for most undammed rivers. Information regarding the Algoa system is reasonable, although there is uncertainty about the transfer volumes. There is too few flow gauging stations, especially in the undammed rivers in the Tsitsikamma Coast. For the Tsitsikamma River, the record from the new gauging station is still too short for reliable simulation of flow. The national problem of too few rain gauges for accurate modelling is also an issue in this ISP-area. This is addressed in Strategy 6.1.

b) The confidence in most values of the **Reserve** is low. No estuarine requirements have been determined. The Swartkops River Reserve was determined with reasonable confidence at an intermediate level, and most of the other estimates at only a desktop level of confidence. Any increases in environmental releases from existing dams would have a severe impact on the yield balance.

c) There is uncertainty about the confidence in the **1:50 year irrigation water use** values. Actual, average use values were converted to 1:50 year (or 98%) level of assurance of supply to determine a meaningful yield balance.

d) **Water losses** in the Gamtoos canal, losses in the transfer of Orange River water to NMMM and losses from river releases to irrigators below dams, amongst others, should be more reliably established.

e) There is still uncertainty about the amount of water consumed by **invasive alien plants**.

More detailed yield balance calculations are shown in **Appendix C**. The yield balance database will allow water resource planners the opportunity to estimate impacts of proposed developments on the availability of resources.

3.3.2 Future perspective

Table 3.9 represents a perspective of the possible future requirements for the base (probable) scenario. The actual increase in water requirements is according to the NWRS.

The year 2025 base scenario water requirements (compared to 2000) were derived by assessing the probable growth in water requirements. Little change in the water requirements are projected for most of the ISP-area. The only expected change is growth in urban water requirements. The water requirements of the NMMM in the Algoa Coast sub-area is expected to increase from 73 to 100 million m³/a. Growth in the urban requirements of coastal towns in the Kromme-Seekoei sub-area (from 4 to 5 million m³/a) and the Tsitsikamma Coast sub-area (from 1 to 2 million m³/a) are foreseen. The other requirements are expected to remain constant for the base scenario.

Table 3.9: Year 2025 base scenario water requirements (million m³/a)

Sub-area	Irrigation	Urban	Rural	Mining and bulk industrial	Power generation	Affore-station	Total local require-ments	Transfers out	Grand Total
Groot	16	1	3	0	0	0	**20**	0	**20**
Kouga-Gamtoos	79	2	1	0	0	1	**83**	16	**99**
Sub-total	**95**	**3**	**4**	**0**	**0**	**1**	**103**	**16**	**119**
Algoa Coast	7	100	1	0	0	0	**108**	0	**108**
Sub-total	**7**	**100**	**1**	**0**	**0**	**0**	**108**	**0**	**108**
Kromme-Seekoei	7	5	1	0	0	0	**13**	35	**48**
Tsitsikamma Coast	4	2	1	0	0	5	**12**	0	**12**
Sub-total	**11**	**7**	**2**	**0**	**0**	**5**	**25**	**35**	**60**
Total	**113**	**110**	**7**	**0**	**0**	**6**	**236**	**0**	**236**

1) Actual increase in requirements is according to the NWRS WMA Report, Table 6.

Table 3.10 represents the yield balance for the base scenario in 2025.

Table 3.10: Reconciliation of water requirements and availability for the year 2025 base scenario (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	(1)
Groot	19	0	19	20	0	20	**-1**
Kouga-Gamtoos	98	0	98	83	16	99	**-1**
Sub-total	**117**	**0**	**117**	**103**	**16**	**119**	**-2**
Algoa Coast	20	62	82	108	0	108	**-26**
Sub-total	**20**	**62**	**82**	**108**	**0**	**108**	**-26**
Kromme-Seekoei	48	0	48	13	35	48	**0**
Tsitsikamma Coast	13	0	13	12	0	12	**1**
Sub-total	61	0	61	25	35	60	**1**
Total	**224**	**11**	**235**	**236**	**0**	**236**	**-1**

1) Actual increase in requirements from year 2000 is according to the NWRS WMA Report Table 6.
2) Surpluses are shown in the most upstream sub-area where they first become available.
3) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.

The Algoa Coast sub-area is expected to develop a shortfall of 26 million m^3/a, while the other sub-areas will all be close to a balanced situation. The shortfall in the Algoa Coast sub-area will be met by increasing the local yield by 26 million m^3/a, through increased urban water demand management measures and use of effluent return flows, especially for Coega.

A high growth scenario, which provides the probable upper limit of development, was also formulated. The actual growth in water requirements for this scenario is according to the NWRS, except for an additional increase of 4 million m^3/a growth in irrigation requirements in the Tsitsikamma Coast sub-area which has been added. Significant growth in urban requirements, from 73 to 151 million m^3/a is expected to take place in the Algoa Coast sub-area. Urban growth in the coastal towns in the Kromme-Seekoei sub-area (from 4 to 7 million m^3/a) and Tsitsikamma Coast sub-area (from 1 to 3 million m^3/a) and towns in the Kouga-Gamtoos (from 2 to 4 million m^3/a) sub-area are also foreseen. The other requirements are expected to remain constant for the high growth scenario. **Table 3.11** represents a perspective for the possible future requirements for the high growth scenario.

Table 3.11: Year 2025 high growth scenario water requirements (million m³/a)

Sub-area	Irrigation	Urban	Rural	Mining and bulk industrial	Power generation	Affore-station	Total local require-ments	Transfers out	Grand Total
Groot	16	1	3	0	0	0	**20**	0	**20**
Kouga-Gamtoos	79	4	1	0	0	1	**85**	16	**101**
Sub-total	**95**	**5**	**4**	**0**	**0**	**1**	**105**	**16**	**121**
Algoa Coast	7	151	1	0	0	0	**159**	0	**159**
Sub-total	**7**	**151**	**1**	**0**	**0**	**0**	**159**	**0**	**159**
Kromme-Seekoei	7	7	1	0	0	0	**15**	35	**50**
Tsitsikamma Coast	8	3	1	0	0	5	**17**	0	**17**
Sub-total	**15**	**10**	**2**	**0**	**0**	**5**	**32**	**35**	**57**
Total	**117**	**166**	**7**	**0**	**0**	**6**	**296**	**0**	**296**

1) Actual increase in requirements is according to the NWRS WMA Report Table 6, except for an additional increase of 4 x $10^6 m^3/a$ growth in irrigation requirements in the Tsitsikamma Coast sub-area.

Table 3.12 represents the yield balance for the high growth scenario in 2025.

Table 3.12: Reconciliation of water requirements and availability for the year 2025 high growth scenario (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
Groot	19	0	19	20	0	20	**-1**
Kouga-Gamtoos	98	0	98	85	16	101	**-3**
Sub-total	**117**	**0**	**117**	**105**	**16**	**121**	**-4**
Algoa Coast	20	62	82	159	0	159	**-77**
Sub-total	**20**	**62**	**82**	**159**	**0**	**159**	**-77**
Kromme-Seekoei	48	0	48	15	35	50	**-2**
Tsitsikamma Coast	13	0	13	17	0	17	**-4**
Sub-total	**61**	**0**	**61**	**32**	**35**	**80**	**-6**
Total	**198**	**11**	**209**	**296**	**0**	**296**	**-87**

1) Actual increase in requirements is according to the NWRS WMA Report Table 6, except for an additional increase of 4 x $10^6 m^3/a$ growth in irrigation requirements in the Tsitsikamma Coast sub-area.

A significant shortfall of 87 million m^3/a is expected to develop in the ISP-area by 2025 under the high growth scenario. A large shortfall of 77 million m^3/a is expected to develop in the Algoa Coast sub-area, while small deficits will develop in the other sub-areas.

Urban growth in the Kouga-Gamtoos, Kromme-Seekoei and Tsitsikamma sub-areas can be met by local development. No intervention is proposed for the Groot sub-area.

The expected large shortfall in the Algoa Coast sub-area should be met through a variety of intervention measures as follows:

i) Increase the sub-area yield by 32 million m^3/a through increased urban water demand management measures (reducing the yield by 12 million m^3/a) and use of effluent return flows, especially for Coega (20 million m^3/a).
ii) Increased transfers of 45 million m^3/a to the Algoa Coast sub-area as follows:
   - Increased transfer of 11 million m^3/a from the Kromme River System, by upgrading the bulk supply pipeline from the Churchill/Impofu Dams (*assuming the yield balance uncertainty can be solved*);
   - Additional transfers from the Kromme-Seekoei and Kouga-Gamtoos sub-areas respectively, transferring water released by the removal of invasive alien plants in catchments above the AWSS dams (3 million m^3/a from Kouga Dam and 2 million m^3/a from the Kromme River dams) yielding 5 million m^3/a;
   - Trading of water use authorisations between the irrigators and NMMM. Savings from reduced canal losses in the Kouga canal and the phasing-out of irrigation in the Baviaanskloof will release 7 million m^3/a that could be transferred;
   - Transfer of 22 million m^3/a from the Orange River (likely requiring further infrastructure development in the Orange River) or alternatively from the Kouga River, from the building of Guernakop Dam.

Proper monitoring is required to enable decision-makers to confidently know which development scenario is actually unfolding.

3.4 MANAGEMENT APPROACH

Considerable uncertainty about the yield balance was identified. The NWRS shows a yield balance of 24 million m^3/a, whilst the ISP shows a yield balance of 2 million m^3/a.

The extremely important role of the NMMM as the major economic driver in the ISP-area and the Eastern Cape economy is evident. The recently completed Algoa Pre-Feasibility study showed that a deficit in the water supply to NMMM would develop, unless there is immediate intervention. The already developing deficit is expected to develop to a shortfall of 26 million m^3/a by 2025 under the base scenario and to a shortfall of 77 million m^3/a by 2025 under the high development scenario. The Algoa Pre-Feasibility found that the actual expected growth in NMMM's water demands, partly due to the development of Coega, is likely to be very close to the high development scenario.

A detailed strategy, in cooperation with NMMM and other parties, is required to:

- More accurately assess the current yield balance situation; and to
- Determine the order and timing of reconciliation options.

The approach should be to determine the first order assessment from existing knowledge and expert opinion to give guidance to longer-term reconciliation interventions. The need for further detailed studies or implementation actions should be assessed. This should include a review of the resources, the Reserve, water requirements as well as the identification and prioritisation of reconciliation interventions relevant to this ISP-area. A long-term (15-20 years) water resource planning strategy must be developed so that more regular planning will be undertaken, particularly relating to distribution infrastructure. That strategy should also deal with how authorities responsible for water services and DWAF should plan together.

A distinction is made in the process to be followed between catchments that have allocable water, catchments in balance and stressed catchments. Where water is available to be allocated, equity and efficiency of use will be considered, but water cannot be reserved indefinitely. In stressed catchments a process will be followed to achieve a balance between requirements and yields.

Any new schemes that may be considered (groundwater or surface water) will be for basic human needs and urban water supply rather than for expansion of irrigation, unless such expansion is for the redressing of inequities. Poverty alleviation prospects or schemes will receive a high priority. Off-channel storage must be considered as an alternative to in-channel storage, particularly where river flow dynamics are important in sustaining the health of ecologically sensitive rivers and estuaries.

Requirement scenarios should be regularly updated by:

- Confirming existing use;
- Comparing possible scenarios of future use and upgrading such future scenarios as required;
- Adding scenarios of water conservation and demand management, and
- Preferably handling expansion of irrigation through increased efficiency and water trading.

Water resource options to meet requirements will be evaluated, which include the following:

- Water conservation and demand management;
- Removal of alien plants;
- Increasing the efficiency of current supply systems or utilising spare capacity;
- Water trading opportunities;
- Use of wastewater;
- Groundwater development;
- New development or increased transfers of surface water resources;
- Desalination.

CHAPTER 4: SUB-AREA PERSPECTIVES

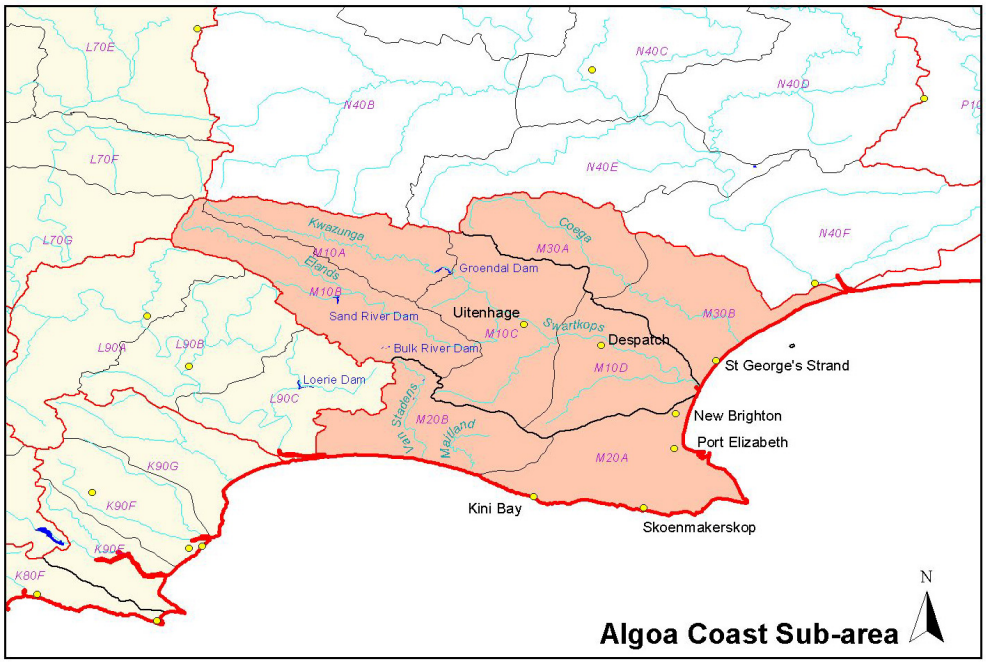
4.1 ALGOA SUB-AREA

The NMMM falls within the Algoa Coast sub-area, which is the major economic driver. This section briefly describe the water availability, requirements and yield balance in the Algoa Coast sub-area and the main perspectives that drive the strategies relating to this sub-area and smaller sub-management areas (e.g. rivers) within it.

4.1.1 Location and rivers in the sub-area

Along the Elandsberg range, lies the Elands River (M10B), one of the two main tributaries of the **Swartkops River** (M10C and D) which has a catchment area of 2 630 km^2 and flows to the sea through the ecologically important Swartkops Estuary (M10D). The other main tributary of the Swartkops River is the KwaZunga, which also rises in a mountainous area (M10A). The **Coega River** (M30A and B) lies to the north and forms the eastern boundary of the ISP-area. The **Van Stadens River and Maitland River** (M20B) are small rivers and the Baakens River can be ignored because it is so small.

Figure 4.1: Map of the Algoa Coast sub-area



MAIN FEATURES:

Main Rivers:
- Swartkops River (M10);
- Van Stadens and Maitland Rivers (M20);
- Coega River (M30).

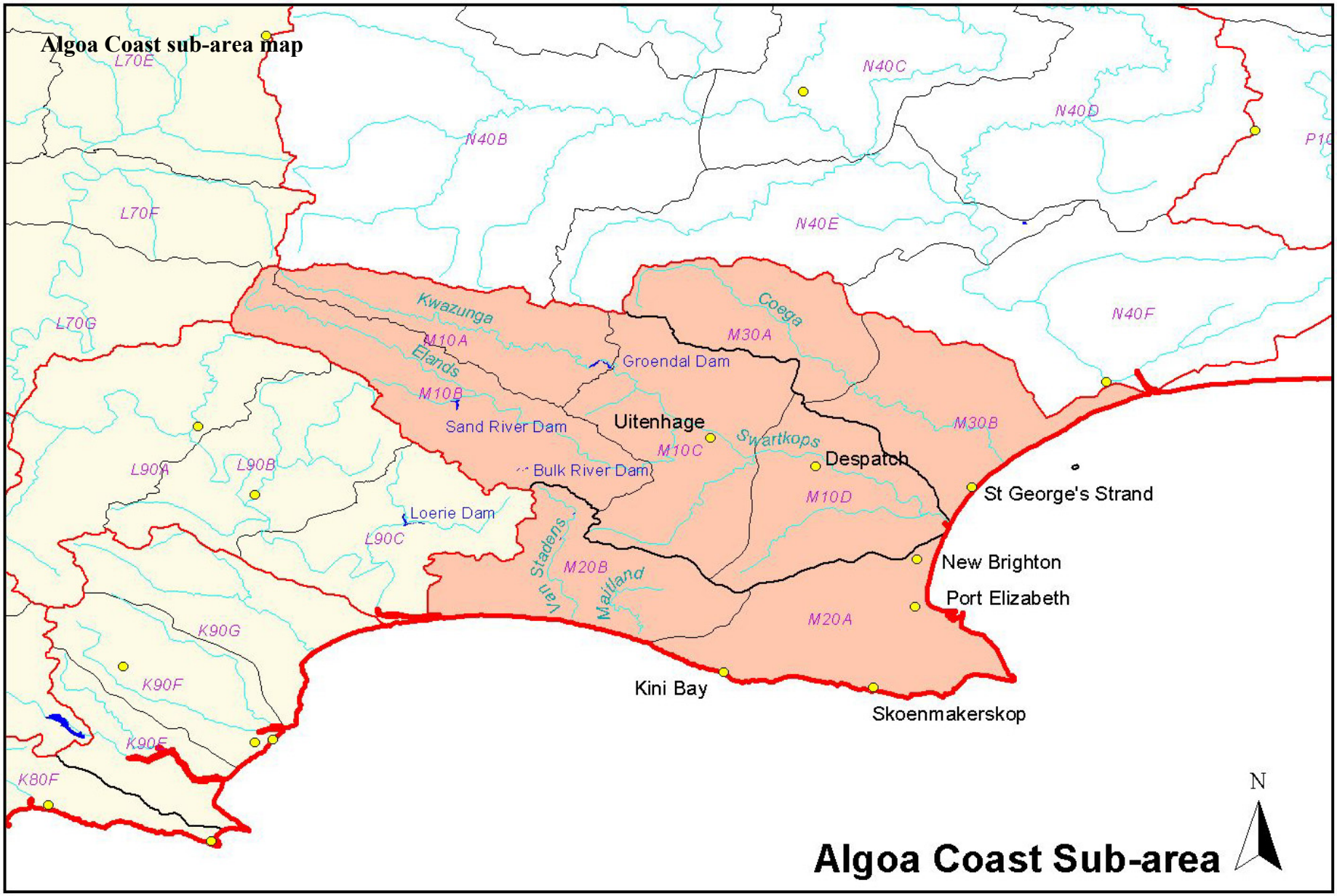
Towns: Port Elizabeth, Despatch, Uitenhage.

Main dams:
- ⇨ Groendal Dam (12.3 Mm³) in M10A;
- ⇨ Bulk River Dam (0.65 Mm³) in M10B;
- ⇨ Sand Dam (2.7 Mm³) in M10B.

Future identified schemes:
None.

Transfer schemes:
Imports (62 Mm³/a) from:
- ⇨ Kouga/Loerie Dams;
- ⇨ Churchill/Impofu Dams;
- ⇨ Sundays River Scheme (Orange River).

Major conservation areas:
- Groendal conservation area;
- Swartkops estuary.


Algoa Coast sub-area map
L70E
N40C
N40D
N40B
L70F
N40E
N40F
L70G
Kwazunga
Coega
M30A
M10A
Elands
Groendal Dam
M10B
Sand River Dam
Uitenhage
M30B
Swartkops
M10C
Despatch
L90A
L90B
Bulk River Dam
St George's Strand
M10D
Loerie Dam
L90C
Van Stadens
M20B
Maitland
New Brighton
Port Elizabeth
M20A
K90G
K90F
Kini Bay
Skoenmakerskop
K90E
K80F
N
Algoa Coast Sub-area

4.1.2 Water resources availability

The current estimation of the average annual volume of flows required for each river to satisfy the ecological riverine requirements of the Reserve are as shown in **Table 4.1**. Note that this differs from the impact that the ecological water requirement has on the available yield of the catchment.

Table 4.1: Algoa Coast sub-area average long-term Reserve flow requirement

River	Tertiary catchment or quat	MAR (10^6 m³/a)	Average IFR requirement (10^6 m³/a)
Swartkops River	M1 (part)	71.0	8.2
	M1 (part)	5.6	0.4
Van Stadens / Maitland	M2 (part)	20.4	2.0
	M2 (part)	39.7	3.4
Coega River	M3 (part)	5.1	0.6
	M3 (part)	5.3	0.3
Total		**147.1**	**14.9**

Components of the Reserve for the Swartkops River were determined at an intermediate level of determination. The confidence of the Reserves for the other rivers in the ISP-area is low. The local yields from the sub-area are as described in **Table 4.2**. The major portion of the local yield is from the dams owned by NMMM. The transfers into the sub-area for urban use however far outweigh the local yield.

Table 4.2: Algoa Coast sub-area yield at 1:50 year assurance for the year 2000 in million m³/a

Tertiary catchment or quat	River	Natural resource		Usable return flows	Total local yield	Transfers in	Grand Total
		Surface water	Ground-water				
M1 (part)	Zwartkops	8.6	4.8	0.5	13.9	0.0	13.9
M1 (part)		-0.2	0.3	1.4	1.5	69.7	71.2
M2 (part)	Van Stadens / Maitland	0.0	0.2	1.3	1.5	0.0	1.5
M2 (part)		1.3	0.4	0.1	1.8	0.0	1.8
M3 (part)	Coega	0.0	0.2	0.1	0.3	0.0	0.3
M3 (part)		0.0	0.1	0.1	0.2	0.0	0.2
Total yield		**9.7**	**6.0**	**3.5**	**19.2**	**61.5**	**80.7**

4.1.3 Current water requirements and use

The water use for the year 2000 is shown in **Table 5.3**.

Table 4.3: Algoa Coast sub-area water use for the year 2000 at 1:50 year assurance (million m³/a)

Tertiary catchment or quat	River	Irrigation	Urban	Rural	Mining and bulk industrial	Power gene-ration	Affore-station	Total local require-ments	Transfers out	Grand Total
M1 (part)	Zwartkops	3.1	0.0	0.4	0.0	0.0	0.1	3.6	7.9	11.5
M1 (part)		0.8	72.5	0.1	0.0	0.0	0.0	73.4	0.0	73.4
M2 (part)	Van Stadens / Maitland	1.0	0.0	0.2	0.0	0.0	0.0	1.2	0.3	1.5
M2 (part)		0.8	0.0	0.2	0.0	0.0	0.1	1.1	0.0	1.1
M3 (part)	Coega	0.5	0.0	0.1	0.0	0.0	0.0	0.6	0.0	0.6
M3 (part)		0.6	0.0	0.2	0.0	0.0	0.0	0.8	0.0	0.8
Total		**6.8**	**72.5**	**1.2**	**0.0**	**0.0**	**0.2**	**80.7**	**0.0**	**80.7**

The annual water requirements of NMMM is 72.5 million m^3/a, which is supplied from the following sources:

Transfer from Kouga/Loerie Dams (13.6 + 2.4):	16.0
Transfer from Churchill/Impofu Dams:	34.5
Transfer from Lower Sundays River Scheme (Orange River water):	11.0
Municipal dams (Groendal, Bulk, Sand, Lower/Upper Van Stadens):	8.2
Uitenhage springs:	1.6
Re-use of sewage effluent:	1.2
Total:	**72.5 million m^3/a**

4.1.4 Sub-area yield balance

The yield balances in the sub-area are shown in **Table 4.4**.

Table 4.4: Algoa Coast sub-area yield balance for the year 2000 at 1:50 assurance

Tertiary catchment or quat	River	Available water			Water requirements			Balance
		Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
M1 (part)	Zwartkops	13.9	0.0	13.9	3.6	7.9	11.5	2.4
M1 (part)		1.5	69.7 (4)	71.2	73.4	0.0	73.4	-2.2
M2 (part)	Van Stadens / Maitland	1.5	0.0	1.5	1.2	0.3	1.5	0.0
M2 (part)		1.8	0.0	1.8	1.1	0.0	1.1	0.7
M3 (part)	Coega	0.3	0.0	0.3	0.6	0.0	0.6	-0.3
M3 (part)		0.2	0.0	0.2	0.8	0.0	0.8	-0.6
Total		**19.2**	**61.5**	**80.7**	**80.7**	**0.0**	**80.7**	**0.0**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) All internal transfers shown within the sub-area area are transfers from local dams for use within the NMMM;
4) The transfer in for use by NMMM (which requirements falls in this part of tertiary catchment M1) is 50,5 10^6 m^3/a cumulatively from the Kromme/Seekoei and Kouga/Gamtoos sub-areas, 11 10^6 m^3/a Orange River water transfer, and 8.2 10^6 m^3/a inter ISP-area transfer from municipal dams. Springs and sewage re-use meet the further NMMM urban requirement.

The total yield from the sub-area was calculated as 80.7 million m^3/a and the total requirements as 80.7 million m^3/a. The sub-area is in balance with no surplus yield.

4.1.5 Future water requirements

Opportunities and aims for future water use are as follows:

Irrigation: Irrigation is likely to decrease because of urbanisation.

Urban use: There is continued urbanisation and population growth in the NMMM. In the NWRS, two water use growth scenarios were formulated. In terms of these scenarios, the projected growth in demands for NMMM is:

- The base scenario foresees demand of 100 million m^3/a in 2025;
- The high scenario foresees demand of 151 million m^3/a in 2025.

Results from the recently completed Algoa Pre-Feasibility study (4) indicate that demand is projected to increase from 72.5 million m^3/a in 2000 to 150 million m^3/a in 2025 if no intervention measures are introduced to control the demand. Actual growth is therefore projected to be very close to the NWRS projected high growth scenario. NMMM should already be

implementing water demand management measures as an intervention measure, to balance the growing urban requirements with the available AWSS yield.

It is expected that the initial impact of the Coega deepwater harbour and associated heavy industrial development zone on NMMM's water demand will be limited. The number of wet industries that are established will influence the impact. It is planned that the Coega IDZ, deep harbour and heavy industrial development will initially receive water from purified effluent from the Fishwater Flats wastewater reclamation works as its primary source (once its demand reaches 1.8 million m^3/a). The sources may later need to be extended to use Orange River water. The proposed Coega IDZ and Harbour Development are expected to require 15 million m^3/a within ten years.

Figure 4.2: Site of the Coega IDZ

Figure 4.3: Coega harbour layout

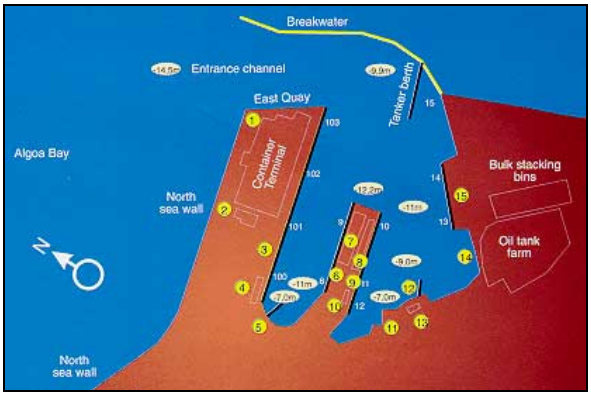


Figure 4.4: The Swartkops estuary

Of overriding importance in the ISP-area is the immediate effort required to limit the water demand and, following that, the increasing future need to transfer water into the Algoa Coast sub-area, mainly from within the ISP-area but possibly also from the Upper Orange WMA via the Sundays-Fish Transfer Scheme. Infrastructure development should be kept to the essential, but just as important is timeous planning for required infrastructure development.

Commercial forestry: There are tracts of commercial forests above Loerie Dam, in the upper Swartkops River and in the Van Stadens River catchment, managed by SAFCOL. The Swartkops Study recommended that the forestry industry be studied in more detail and concluded that forestry in the area is not very viable and is poorly managed. It could be recommended that forests not be re-planted or

even not harvested.

Alien plant control: Invasive alien trees are mainly situated in the catchment areas of NMMM-owned dams. Eradication would provide the benefits of increasing the base flows of the rivers.

Groundwater: Limited opportunity still exists for use of water from the Uitenhage Aquifer. The possibility of a deep aquifer, the Table Mountain Group aquifer, which stretches along the coast up to the NMMM, needs to be investigated as a possible future regional source. The surface and groundwater interactions need to be quantified as part of the TMG resource evaluation and management approach. The accessible storage volumes in the different TMG aquifers will need to be quantified in the context of longer-term rainfall patterns in order to develop an appropriate groundwater management strategy. The relevant information must therefore be sourced.

4.1.6 Management perspective

Yield balance and reconciliation

Issue 1: With the high importance of Port Elizabeth-Uitenhage as the hub of economic activity in the Eastern Cape Province and one of the largest and most important urban and industrial centres in the country, high priority should be given to ensuring the availability of sufficient water to meet this area's steadily growing requirements. The supply of water for the Coega harbour and duty-free heavy industrial zone will further significantly impact on the future requirements. The Algoa Pre-Feasibility study found that the AWSS requirement already exceeded the system yield if water conservation and demand management was not applied. Water conservation and demand management measures should therefore already be implemented by NMMM.
Sub-area perspective 1: A detailed strategy in cooperation with NMMM and other parties is required, as described in Section 3.4, to:

- More accurately assess the current yield balance situation and
- Determine the order and timing of reconciliation options.

This should be implemented by:

- Prioritising the short-listed intervention options with current information;
- Identifying urgent further studies to improve the priorities of the strategies and
- Reprioritising when further information becomes available.

The following interventions should all be considered:

- ➔ Water conservation and demand management (implement in phases - Phase 1 should be currently implemented and should be fully implemented by 2007);
- ➔ Re-use of sewage effluent (meet all Coega needs as required);
- ➔ Increased transfers from the Kromme River System by upgrading the bulk supply pipeline from Churchill/Impofu Dams (this option will require that the yield balance uncertainty be urgently solved);
- ➔ Removal of invasive alien plants (continue existing programmes of clearing above existing dams supplying NMMM);
- ➔ Trading of water use authorisations with the irrigation sector: savings from reduced canal losses in the Kouga canal and the phasing-out of Baviaanskloof irrigation should be

traded for urban water use. It is accepted that 5 million m^3/a of the current 13.5 million m^3/a losses in the Kouga canal can be saved and phasing out of irrigation in the Baviaanskloof will make 2 million m^3/a available;

- ➔ Groundwater development, especially TMG aquifers;
- ➔ Further transfers of Orange River water (possibly with further infrastructure development in the Orange River) - water treatment capacity of approximately 20 million m^3/a has been constructed and upgrading of Nooitgedacht water treatment works and pipeline system will initially be required to first use the spare capacity. This option has the disadvantage of supplying poorer quality water that need to undergo additional treatment, which is costly. There are also further infrastructural implications for increased abstraction from the scheme as well as resistance by users.
- ➔ Further transfers from the Kouga River, with the development of Guernakop Dam, which was previously identified as the next most feasible large dam in the ISP-area. The Kouga River is already stressed and the environmental constraints on the construction of Guernakop may be significant, being sited in a conservation area. The expected additional yield is 30 million m^3/a. This scheme would make use of the existing water transfer infrastructure of the Algoa System;

Issue 2: The highly rated and sensitive Swartkops estuary needs to be protected. The estuary has been studied in some detail and environmental and estuarine flow requirements were determined. Recommended environmental flood releases from catchment dams cannot be released because catchment dams do not have the required outlet capacities.
Sub-area perspective 2: Eradicate alien invasives to ensure adequate low flows in the Elands River tributary of the Swartkops River. Additional base flows due to clearing should be released from dams to improve the ecology. A comprehensive Reserve will have to be determined according to the latest methods before tackling problems such as inadequate outlet capacities of catchment dams to make flood releases.

Issue 3: Chemical contamination of surface and groundwater by industrial activity effluent return flows, spillages and urban storm water runoff in the Swartkops catchment is leading to eutrophication of the Swartkops River.
Sub-area perspective 3: Use recommendations of the recent Swartkops River Study as the basis to compile a Water Quality Management Plan for the Swartkops River and add additional actions that may be required. Implementation of the dense settlements programme to curb pollution caused by informal settlements in the Swartkops River catchment and other areas has been recommended.

Water use

Issue 4: Water quality impacts are putting the Swartkops River under stress especially in the middle to lower reaches.
Sub-area perspective 4: No further water use licenses will be considered.

Issue 5: Licenses need to be issued in the Coega catchment for water use requirements of the Coega IDZ.

Sub-area perspective 5: A Reserve for the Coega River was recently determined and approved, in order to be able to issue licenses. Meet the initial water requirements of the Coega IDZ through effluent re-use from the Fishwater Flats WWTW.

Issue 6: Heavy infestation by invasive aliens, especially wattles, occurs in the Swartkops catchment. The Swartkops River is also infested with water hyacinth.
Sub-area perspective 6: WfW is currently implementing a major programme of alien removal in the upper catchments of the Swartkops River. A study will be done to investigate the removal of waterweeds.

Water conservation and demand management

Issue 7: There is a need for more efficient and beneficial use of water in the NMMM to curb the growth in water requirements and postpone the impact that new water supply infrastructure will place on the environment.
Sub-area perspective 7: Liaise closely with Metropolitan officials and industry to ensure that their urban and industrial water conservation and demand management implementation plans are already being implemented as accepted in the Algoa Pre-Feasibility Study. Set benchmarks and stay informed of progress with demand management initiatives.

Waterworks development and management

Issue 8: The Algoa Water Supply System bulk infrastructure and components supplies water to just over 1 million people and are critical to the regional economy. Effective operation and maintenance of the system therefore has a high priority. Transfer of ownership of components of the system to water use institutions needs to take place.
Sub-area perspective 8: The new *Operation and Maintenance contract* and *Bulk Supply Agreement* between DWAF, NMMM, Sundays River Irrigation Board and Gamtoos Irrigation Board will be used to manage the system. Transfer of infrastructure to NMMM will continue. Potential to improve the operation and maintenance of the system and reduce losses will be identified, further investigated and where feasible, implemented.

Public health and safety

Issue 9: Prevention and mitigation measures for drought conditions should be developed to mitigate the possible severe impact these could have on the regional economy.
Sub-area perspective 9: The Department will co-operate with the National Department of Agriculture, which leads the drought-working group established by the National Disaster Management Centre, in developing prevention and mitigation measures for drought conditions.

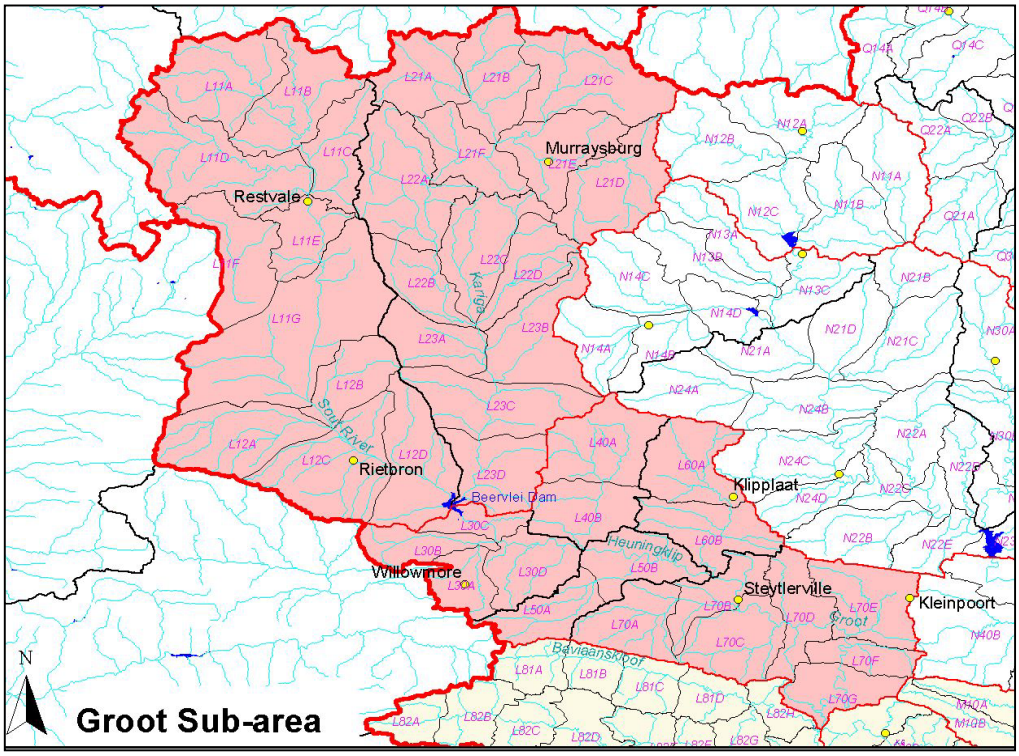
Monitoring and information management

Issue 10: Updated, regular information is required to be able to plan remedial measures to improve the state of the Swartkops River.
Sub-area perspective 10: Biological monitoring of the Swartkops River is planned as part of the River Health Programme.

4.2 GROOT SUB-AREA

The Groot River tributary was identified as a separate sub-area because of its different characteristics as an inland Karoo River. This Chapter provides an overview of the water availability, requirements and yield balance in the Groot sub-area and the main perspectives that drive the strategies relating to this sub-area and smaller sub-management areas (e.g. rivers) within it.

Figure 4.5: Map of the Groot sub-area



MAIN FEATURES:

Main Rivers:
- ⇨ Kariega River (L2);
- ⇨ Sout River (L1);
- ⇨ Heuningsklip River (L60).

Towns:
Murraysburg, Restvale, Rietbron, Klipplaat, Willowmore, Steytlerville, Kleinpoort, Three Sisters.

Main dams:
- ⇨ Beervlei Dam (90 Mm³) in L30C.

Future identified schemes:
None.

Transfer schemes:
- ⇨ Water is released from Beervlei Dam for irrigation use along the lower Groot River

4.2.1 Location and rivers

The Groot River is a major tributary of the Gamtoos River. The catchment of the Groot River (L11, L12, L21, L22, L23, L30, L40, L50) lies entirely in the Karoo, where it covers an area of 29 560 km^2 (**Figure 4.5**). The Groot River passes through narrow gorges in the Groot Winterhoek, Baviaanskloof, and Elandsberg mountain ranges (L70G) before its confluence with the Kouga River.

4.2.2 Water resources availability

This is an area with very low rainfall, typically ranging from about 100 to 400 mm per annum, with a MAR of 209 million m^3 per annum.

The current estimation of the average annual volumes of flows required for each river to satisfy the ecological riverine requirements of the Reserve are as shown in **Table 4.5**. Note that these flows differ from the impact that the ecological water requirements have on the available yield of the catchment.

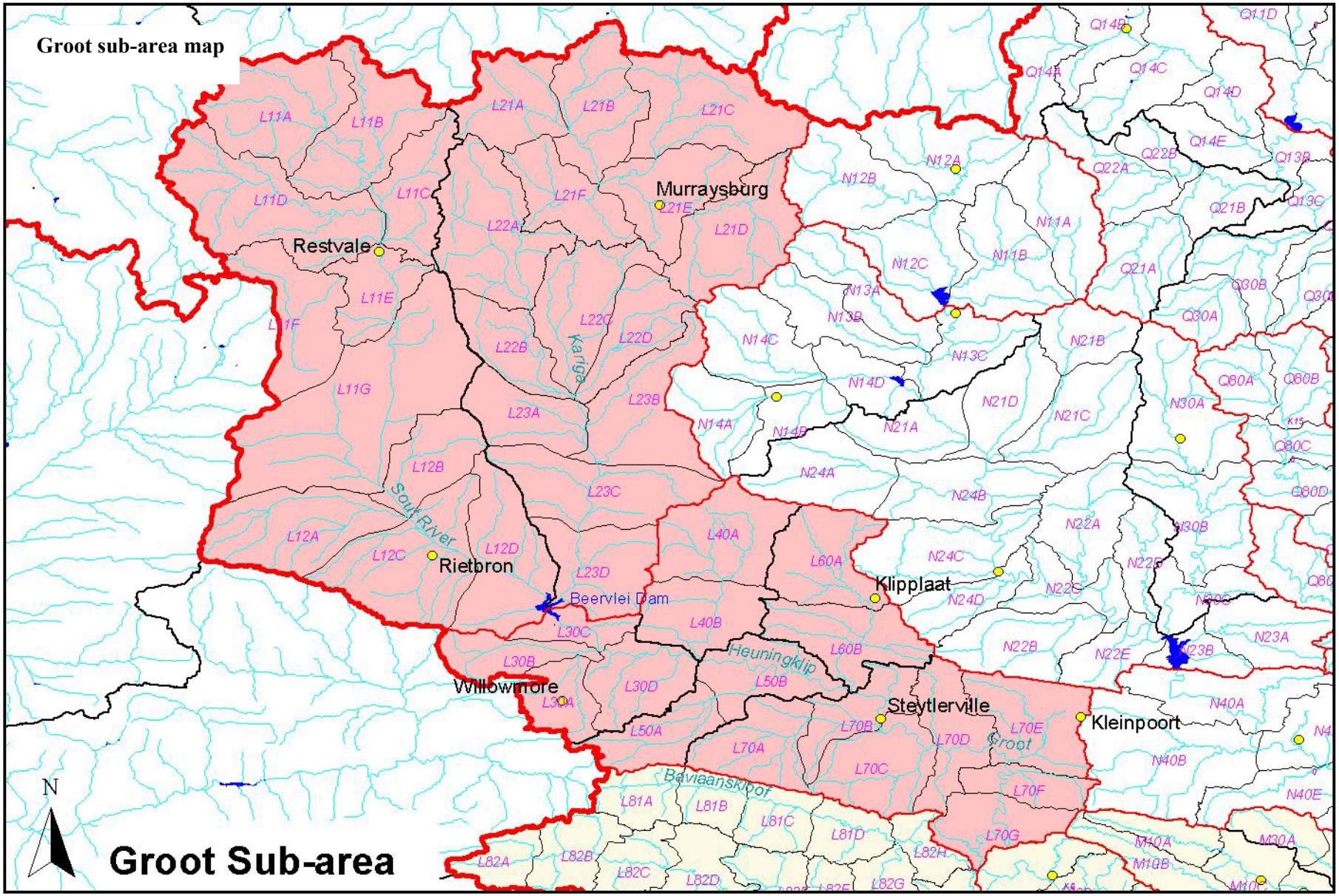

Groot sub-area map
Murraysburg
Restvale
Rietbron
Willowmore
Beervlei Dam
Klipplaat
Steytlerville
Kleinpoort
Kariga
Sout River
Heuningklip
Groot
Baviaanskloof
N
Groot Sub-area

Table 4.5: Groot sub-area average long-term Reserve flow requirement

River	Tertiary catchment or quat	MAR (10^6 m³/a	Average IFR requirement (10^6 m³/a
Above Beervlei Dam	L1, L2	142.0	13.0
Below Beervlei Dam	L3 to L7	52.5	4.1
	L70G	14.5	1.1
Total		**209.0**	**18.2**

These Reserve requirements were desktop estimations, as adopted in the NWRS. The ecological sensitivity of aquatic systems other than rivers, such as lakes, wetlands and groundwater systems has not yet been assessed. The local yields from the sub-area are as described in **Table 4.6**. The major portion of the yield is from the Beervlei Dam on the main stem of the Groot River.

Table 4.6: Groot sub-area yield at 1:50 year assurance for the year 2000 in million m³/a

Tertiary catchment or quat	River	Natural resource		Usable return flows	Total local yield	Transfers in	Grand Total
		Surface water	Ground-water				
L1, L2	Above Beervlei Dam	12.2	2.6	0.2	15.0	0.0	15.0
L3 to L7	Below Beervlei Dam	0.8	0.7	1.0	2.5	12.0	14.5
L70G		2.3	0.0	0.1	2.4	0.0	2.4
Total yield		**15.3**	**3.3**	**1.3**	**19.9**	**0.0**	**19.9**

4.2.3 Current water requirements and use

The water use for 2000 is shown in **Table 4.7**.

Table 4.7: Groot sub-area water use for the year 2000 at 1:50 year assurance (million m³/a)

Tertiary catchment or quat	River	Irrigation	Urban	Rural	Mining and bulk industrial	Power gene-ration	Affore-station	Total local require-ments	Transfers out	Grand Total
L1, L2	Above Beervlei Dam	2.5	0.4	1.5	0.0	0.0	0.0	4.4	12.0	16.4
L3 to L7	Below Beervlei Dam	11.4	0.7	0.9	0.0	0.0	0.0	13.0	0.0	13.0
L70G		2.4	0.0	0.1	0.0	0.0	0.0	2.5	0.0	2.5
Total		**16.3**	**1.1**	**2.5**	**0.0**	**0.0**	**0.0**	**19.9**	**0.0**	**19.9**

4.2.4 Sub-area yield balance

The yield balances in the sub-area are as described in **Table 4.8**.

Table 4.8: Groot sub-area yield balance for the year 2000 at 1:50 assurance

Tertiary catchment or quat	River	Available water			Water requirements			Balance
		Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
L1, L2	Above Beervlei Dam	15.0	0.0	15.0	4.4	12.0 (3)	16.4	-1.4
L3 to L7	Below Beervlei Dam	2.5	12.0	14.5	13.0	0.0	13.0	1.5
L70G		2.4	0.0	2.4	2.5	0.0	2.5	-0.1
Total		**19.9**	**0.0**	**19.9**	**19.9**	**0.0**	**19.9**	**0.0**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
5) 12 10^6 m³/a is release from Beervlei Dam for downstream irrigation use by the Groot River GWS.

The total yield from the sub-area was calculated as 19.9 million m³/a and the total requirements as 19.9 million m³/a. The sub-area is accordingly in balance, with no surplus yield.

4.2.5 Future water requirements

A small decline in future population is projected for the area, attributable to the predicted lack of further economic growth and the impact of HIV/Aids. Water requirements in the sub-area is likely to remain constant, as forecast during the National Demographic study undertaken by DWAF, due to increased per capita water use countering the effects of the decline in population.

No opportunities for further water use have been identified. The need to revisit the purpose and management of Beervlei Dam is likely to have the biggest impact on possible future irrigation use. No opportunities for poverty alleviation have been identified.

From **Table 4.8** it is apparent that the various river sections are all approximately in balance. There are therefore no apparent allocatable quantities in this sub-area according to the yield balance calculations. There are no pending license applications. Applications for surface water use authorisations will therefore be handled *ad hoc* and on merit, but it is very unlikely that further licenses will be granted in the medium term.

4.2.6 Management perspective

The following describes the major issues, drivers and sub-area management perspectives as follows:

Yield balance and reconciliation

Issue 1: The yield of Beervlei Dam has not recently been determined, but should be re-evaluated utilising the longer rainfall records and survey data on increased siltation. An updated yield will be required when the management of the Groot River GWS is reviewed.
Sub-area perspective 1: Determine an updated yield for Beervlei Dam at various levels of assurance, to be available when the management review of the Groot River GWS is done.

Water use

Issue 2: There are concerns about the extent and impact of large impoundment structures and flood diversion works on the Groot River above Beervlei Dam, used mainly for the opportunistic irrigation of veld.

Sub-area perspective 2: Verify the extent and likely impact of such works from information obtained from the registration process of existing water uses.

Issue 3: The Groot River catchment is in balance and general authorisations (**Appendix B5**) are in place for surface water abstraction. Water for irrigation is generally used at a very low assurance.
Sub-area perspective 3: Though there do not seem to be opportunities for further development, preferably evaluate trading applications instead of issuing new water authorisations if opportunities do arise.

Waterworks development and management

Issue 4: A decision on the future management and operational strategy for the dual-purpose Beervlei Dam is required. Water from the dam can be used either for existing irrigation or to protect the Gamtoos River Valley from flooding. There is also a large reduction in the utilisable yield of Beervlei Dam due to large river transportation losses associated with releases for irrigation use. Irrigators currently do not pay for such losses.
Sub-area perspective 4: Revisit the management strategy and operating rule co-operatively with the Department of Agriculture. The large river losses will be addressed. Water could possibly be released to fewer farmers over a longer period. The various options and possible impacts will be assessed, and a future operational strategy for Beervlei Dam will be determined.

Issue 5: No Sustainable Utilisation Plan has been drafted for Beervlei Dam, to determine the recreational and other uses and required management of the water surface and surrounding areas.
Sub-area perspective 5: Draft a Sustainable Utilisation Plan for Beervlei Dam and implement this and manage the dam.

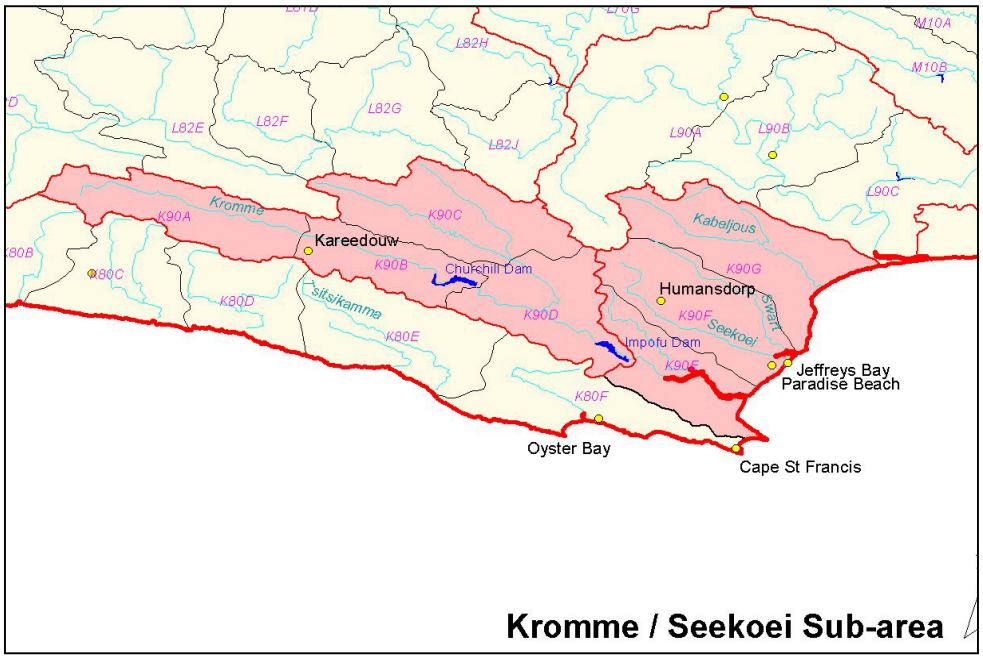
Issue 6: A disaster management strategy is required to adequately communicate and manage the risk of flooding in the Gamtoos Valley to ensure public safety.

Sub-area perspective 6: Prepare and implement a disaster management plan for the Groot and Gamtoos Rivers to safeguard the public in the Gamtoos River catchment against disastrous floods.

4.3 KROMME-SEEKOEI SUB-AREA

The Kromme-Seekoei sub-area was grouped as a unit because of the similar problems of stress being experienced especially in the Kromme/Seekoei/Swart Rivers and because of practical considerations of closely located catchments with quite similar characteristics. This Chapter provides an overview of the water availability, requirements and yield balance in the Kromme-Seekoei sub-area and the main perspectives that drive the strategies relating to this sub-area and smaller sub-management areas (e.g. rivers) within it.

Figure 4.6: Map of the Kromme-Seekoei sub-area



MAIN FEATURES:

Main Rivers:
- ⇨ Kromme River (L90A to E);
- ⇨ Seekoei River (L90F);
- ⇨ Kabeljous River (L90 G).

Towns:
Kareedouw, Humansdorp, Jeffreys Bay, St Francis Bay, Sea Vista, Paradise Beach.

Main dams:
- ⇨ Churchill Dam (32 Mm³) in K90B;
- ⇨ Impofu Dam (87 Mm³) in K90DD.

Future identified schemes:
Identified possible future transfers from a Tsitsikamma River scheme via Churchill/Impofu Dams to NMMM.

Transfer schemes:
- ⇨ Churchill WTW (Churchill Dam) to NMMM – pipeline (1.8 m³/s);
- ⇨ Elandsjagt WTW (Impofu Dam) to NMMM – pipeline.

Major conservation areas:
Kromme River wetlands

4.3.1 Location and rivers in the sub-area

The **Kromme River** drains a narrow valley (K90A, B, C, D and E) between the Suuranys Mountains to the interior and the Tsitsikamma Mountains towards the coast. To the east of the Kromme River estuary (K90E), the **Seekoei River** flows to the sea across a fertile coastal plain (K90G). The **Kabeljous River** (K90G) estuary is at Jeffreys Bay.

4.3.2 Water resources availability

The current estimation of the average annual volumes of flows required for each river to satisfy the ecological riverine requirements of the Reserve is as shown in **Table 4.9**. Note that this differs from the impact that the ecological water requirement has on the available yield of the catchment.

Kromme-Seekoei sub-area map

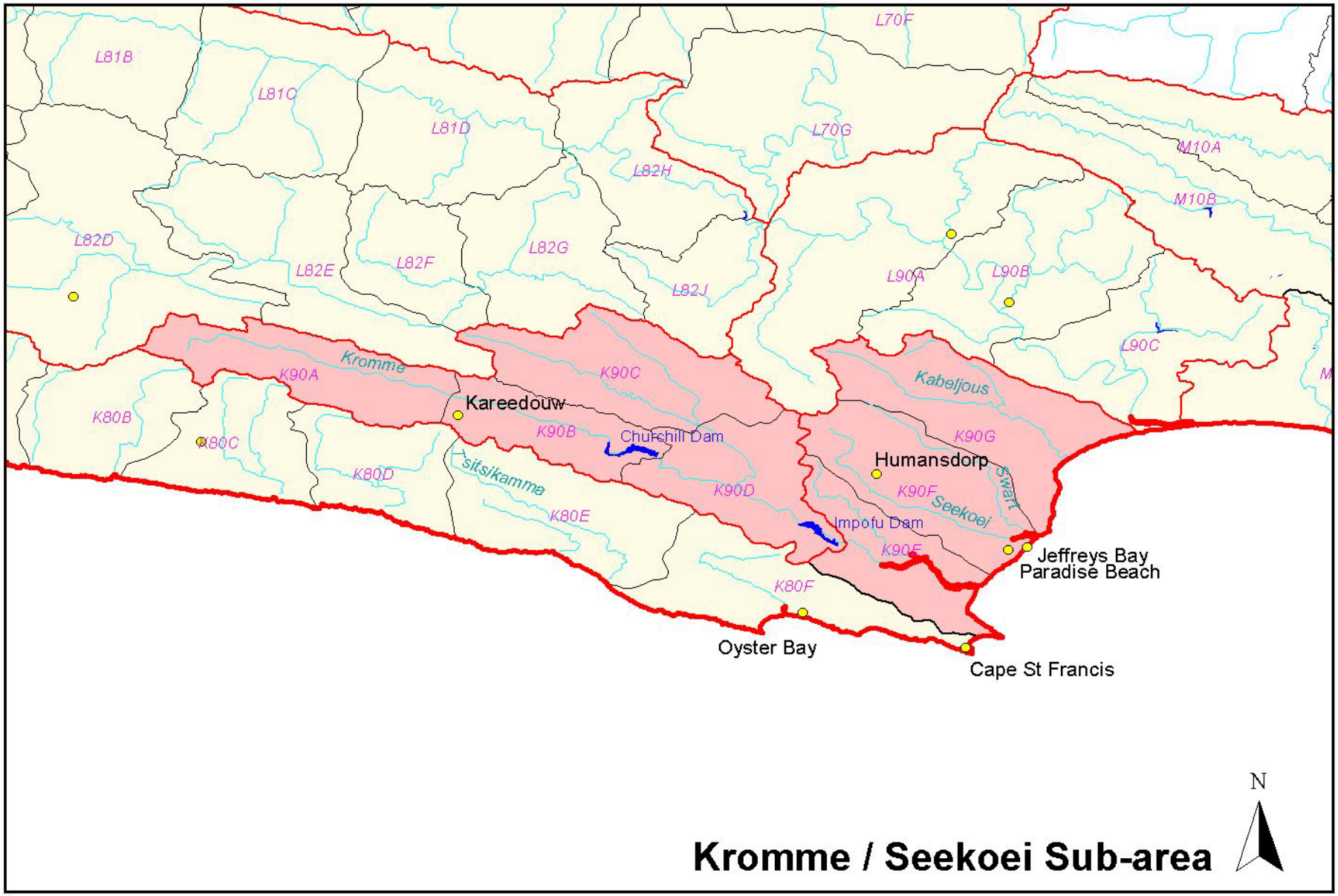


Table 4.9: Kromme-Seekoei sub-area average long-term Reserve flow requirement

River	Tertiary catchment or quat	MAR (10^6 m³/a)	Average IFR requirement (10^6 m³/a)
Kromme above Impofu Dam	K9 - above Churchill Dam	56.2	6.9
	K9 - below Churchill Dam	30.8	2.3
Kromme below Impofu Dam	K9 (Part)	12.0	1.2
Total in Kromme		**99.0**	**10.4**
Seekoei - Swart Rivers	K9 (Part)	18.8	1.8
Kabeljous River	K9 (Part)	17.1	3.3
Total		**134.9**	**15.5**

These Reserve requirements were desktop estimations, as adapted in the NWRS. The ecological sensitivity of aquatic systems other than rivers, such as lakes, wetlands and groundwater systems has not yet been assessed. Estuarine systems have also not been well studied and the estuarine flow requirements have not been determined, but may exceed the riverine requirements.

The local yields from the sub-area are as described in **Table 4.10**. In this sub-area, the major portion of the yield is from the Churchill and Impofu Dams in the Kromme River.

Table 4.10: Kromme-Seekoei sub-area yield at 1:50 year assurance for the year 2000 in million m³/a

Tertiary catchment or quat	River	Natural resource		Usable return flows	Total local yield	Transfers in	Grand Total
		Surface water	Ground-water				
K9 – above Churchill Dam	Kromme above Impofu Dam	29.2	0.1	0.3	29.6	0.0	29.6
K9 – below Churchill Dam		12.6	0.0	0.2	12.8	0.0	12.8
K9 (Part)	Kromme below Impofu Dam	0.4	0.5	0.1	1.0	0.3	1.3
Total in Kromme		**42.2**	**0.6**	**0.6**	**43.4**	**0.3**	**43.7**
K9 (Part)	Seekoei - Swart	0.7	0.8	0.1	1.6	0.5	2.1
K9 (Part)	Kabeljous	0.7	0.6	1.1	2.4	1.2	3.6
Total yield		**43.6**	**2.0**	**1.8**	**47.4**	**0.0**	**47.4**

4.3.3 Current water requirements and use

Current water use for the year 2000 is shown in **Table 4.11**.

Table 4.11: Kromme-Seekoei sub-area water use for the year 2000 at 1:50 year assurance (million m³/a)

Tertiary catchment or quat	River	Irrigation	Urban	Rural	Mining and bulk industrial	Power gene-ration	Affore-station	Total local require-ments	Transfers out	Grand Total
K9 – above Churchill Dam	Kromme above Impofu Dam	2.0	0.2	0.1	0.0	0.0	0.0	2.3	23.7	26.0
K9 – below Churchill Dam		2.0	0.0	0.2	0.0	0.0	0.0	2.2	12.8	15.0
K9 (Part)	Kromme below Impofu Dam	0.7	0.7	0.1	0.0	0.0	0.0	1.5	0.0	1.5
Total in Kromme		**4.7**	**0.9**	**0.4**	**0.0**	**0.0**	**0.0**	**6.0**	**36.5**	**42.5**
K9 (Part)	Seekoei - Swart	1.0	1.0	0.1	0.0	0.0	0.0	2.1	0.0	2.1
K9 (Part)	Kabeljous	1.1	2.4	0.1	0.0	0.0	0.0	3.6	0.0	3.6
Total		**6.8**	**4.3**	**0.6**	**0.0**	**0.0**	**0.0**	**11.7**	**34.5**	**46.2**

4.3.4 Sub-area yield balance

The yield balances in the sub-area are as described in **Table 4.12**.

Figure 4.7: Churchill Dam wall

Figure 4.8: Impofu Dam

Table 4.12: Kromme-Seekoei sub-area yield balance for the year 2000 at 1:50 assurance

Tertiary catchment or quat	River	Available water			Water requirements			Balance
		Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
K9 – above Churchill Dam	Kromme above Impofu Dam	29.6	0.0	29.6	2.3	23.7	26.0	3.6
K9 – below Churchill Dam		12.8	0.0	12.8	2.2	12.8	15.0	-2.2
K9 (Part)	Kromme below Impofu Dam	1.0	0.3	1.3	1.5	0.0	1.5	-0.2
Kromme		**43.4**	**0.0**	**43.4**	**6.0**	**36.2**	**42.2**	**1.2**
K9 (Part)	Seekoei - Swart	1.6	0.5	2.1	2.1	0.0	2.1	0.0
K9 (Part)	Kabeljous	2.4	1.2	3.6	3.6	0.0	3.6	0.0
Total		**47.4**	**0.0**	**47.4**	**11.7**	**34.5**	**46.2**	**1.2**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.

The total yield from the sub-area was calculated as 47.4 million m³/a, after transfers and return flows and the total requirements as 46.2 million m³/a. The sub-area is approximately in balance, with a surplus yield 1.2 million m³/a, mainly due to a surplus in the upper Kromme River, which indicates some small additional capacity in the transfer scheme to NMMM.

4.3.5 Future water requirements

Some population growth is projected for the area, partly associated with growth in the tourism industry. Water requirements in the sub-area are likely to increase.

Opportunities and aims for future *water use are as follows:*

- **Poverty alleviation:** Water is required for further irrigation development by the Kruisfontein resource-poor farmers in the Seekoei River catchment;
- **Urban use:** Further export of water will likely be required in future for urban supply to the NMMM. The local towns are expected to grow as well due to the growing tourist industry and growing coastal towns.
- **Infrastructure management:** Limit the water requirement imposed by operational losses, by promoting or implementing efficient water management of the bulk water supply transfer infrastructure and purification works to NMMM.
- **Infrastructure development:** Further water infrastructural development would entail the upgrade of the main transfer pipeline from Churchill/Impofu Dams to NMMM to make full

use of available water from this sub-system to supply the NMMM, as well as towns within the sub-area.

From **Table 4.12** it is apparent that the sub-area and the various rivers are almost all approximately in balance, but there is a small surplus in the upper Kromme River above Churchill Dam. It is very unlikely that surface water use authorisations will be granted in the short term, since Reserve determinations are currently being undertaken in the Kromme and Seekoei Rivers. The needs of the Kruisfontein resource-poor farmers in the Seekoei River catchment must also receive attention.

4.3.6 Management perspective

The following describes the major issues, drivers and sub-area management perspectives as follows:

Yield balance and reconciliation

Issue 1: Most of the sub-area is already water stressed. New water allocations in the Kromme River have been put on hold.
Sub-area perspective 1: The Kromme, Seekoei and Swart Rivers require compulsory licensing due to stressed conditions and hypersalinity occurring in the estuaries. Poverty alleviation requirements and preservation of wetlands further drive the need for compulsory licensing in the Seekoei River, as do wetlands for the Kromme River.

Issue 2: Additional water transfers of 10.6 million m^3/a from the Churchill/Impofu system to NMMM has been earmarked for implementation by 2008 in the Algoa Pre-Feasibility study.
Sub-area perspective 2: The uncertainty regarding the yield balance in the Kromme River must be urgently addressed, especially regarding the actual current transfer volumes to NMMM. Revisit the hydrology, system yields and water requirements and clarify whether further transfers from the Kromme River System is possible.

Issue 3: Over-abstraction by coastal towns from well fields during high peak use in holiday season leads to the salination of such well fields through seawater intrusion and could render them permanently damaged and unfit for urban use if this practise is not curtailed.
Sub-area perspective 3: The need to compile management plan/s for aquifers supplying coastal towns must be urgently investigated to protect them for sustainable use. DWAF will provide assistance to initiate such studies where funds are forthcoming.

Water resources protection

Issue 4: It is important that sufficient water remains in the Kromme and Seekoei/Swart Rivers at all times to meet the requirements of the ecological component of the Reserve. The determination of a comprehensive Reserve for these rivers and estuaries is regarded as essential, because the catchments are stressed. There are also demands for releases from the Impofu Dam for estuarine health as the Kromme River upper estuary is becoming hyper-saline. Decisions are required to deal with license applications in the Swart and Seekoei Rivers, particularly for the

Kruisfontein resource-poor farmers. The combined Seekoei/Swart Rivers estuary is in a very poor state, with water quality problems and hyper-salinity under certain conditions.
Sub-area perspective 4: During 2003/04 the D: RDM, supported by the EC Regional Office staff, will undertake comprehensive Reserve determinations as part of compulsory licensing for the Kromme and Seekoei Rivers and estuaries.

Issue 5: Wetlands in the Kromme and Seekoei catchments are highly rated and should be protected. An Eastern Cape Wetlands Forum was established and it was decided to map wetlands and to undertake preliminary assessments of their condition. Major wetland rehabilitation projects are underway in the Kromme and Seekoei Rivers, undertaken by Working for Water with funding by Working for Wetlands and Mondi Wetlands.
Sub-area perspective 5: The current rehabilitation projects in the Kromme and Seekoei Rivers will be completed in the near future. New projects or initiatives will be initiated in accordance with the priorities identified by the Eastern Cape wetland inventory study.

Issue 6: The requirement for a regional solid waste site, which has been in planning for many years, is an urgent requirement.
Sub-area perspective 6: DWAF needs to apply pressure on the Kouga Municipality to attach an even higher priority to establish a regional solid waste site.

Water use

Issue 7: The Kromme River below the Churchill and Impofu Dams is stressed and the estuary is heavily impacted. The Seekoei/Swart Rivers are also stressed and the combined estuary is heavily impacted.
Sub-area perspective 7: Until compulsory licensing is done, no further licenses should be issued in the Kromme River below Churchill and Impofu Dams, and in the Seekoei and Swart Rivers. Re-allocation could, if necessary, follow compulsory licensing to provide water to the Kruisfontein resource-poor farmers in the Seekoei River catchment.

Issue 8: Many illegal dams, built before and after the implementation of the NWA, and illegal centre pivots in the Seekoei River aggravate stressed conditions and result in increased conflict amongst users.
Sub-area perspective 8: Illegal use will be actively addressed to protect the rights of legal users and the environment.

Issue 9: There is a major alien infestation problem in the sub-area.
Sub-area perspective 9: Programmes to eradicate aliens are being implemented in the Kromme, Seekoei and Kabeljous River's catchments. Plan further eradication initiatives that will have the most benefits, following these existing eradication programmes.

Integration and co-operative governance

Issue 10: The Kruisfontein resource-poor farmers have applied for an allocation for new irrigation, to expand their existing irrigation. The IAC has identified this scheme for further investigation in terms of the DWAF subsidy scheme for resource-poor farmers. This application

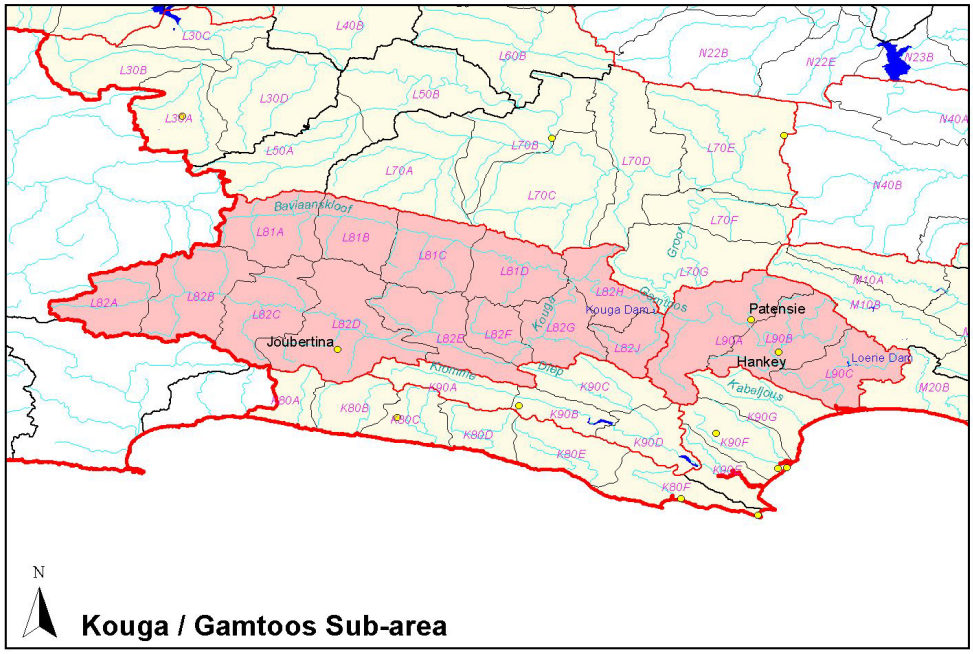
needs to be evaluated and a planning study done to determine the feasibility of the scheme. Constraints are a lack of staff and funds to do the planning study.

Sub-area perspective 10: Arrange finance to undertake an evaluation and planning study for the Kruisfontein resource-poor farmers and prioritise the formation of the WUA that includes them.

4.4 KOUGA-GAMTOOS SUB-AREA

The Kouga-Gamtoos sub-area was identified because of its reasonably uniform character in terms of land use and the linked nature of the Gamtoos GWS. The Groot River tributary was not included as part of this sub-area because of its different characteristics as an inland Karoo system. This Chapter provides an overview of the water availability, requirements and yield balance in the Kouga-Gamtoos sub-area and the main perspectives that drive the strategies relating to this sub-area and smaller sub-management areas (e.g. rivers) within it.

Figure 4.9: Map of the Kouga-Gamtoos sub-area



MAIN FEATURES:

Main Rivers:
- ⇨ Kouga River (L82);
- ⇨ Baviaanskloof River (L81);
- ⇨ Lower Gamtoos River (L90).

Towns: Joubertina, Patensie and Hankey, Krakeel, Misgund, Louterwater and Loerie.

Main dams:
- ⇨ Haarlem Dam (4.7 10^6 m³) in L82A;
- ⇨ Joubertina Dam (0.2 10^6 m³) in L82D;
- ⇨ Kouga Dam (128 10^6 m³) in L82 H/J;
- ⇨ Loerie Dam (3.2 10^6 m³) in L90C.

Future identified schemes:
Future Guernakop Dam in L82G.

Transfer schemes:
- ⇨ Kouga Dam to Loerie Dam – canal;
- ⇨ **Loerie** Dam **(L90C) to NMMM** – pipeline

Major conservation areas:
Baviaanskloof wilderness area (L81).

4.4.1 Location and rivers in the sub-area

The *Kouga-Gamtoos* sub-area consists of tertiary catchments L81, L82 and L90 and their 16 quaternary catchments (Figure 5.5). The Kouga River, with a catchment area of 4 053 km^2, rises in the Langkloof (L82A, B, C and D). The main tributary of the **Kouga River** is the isolated **Baviaanskloof River**, which rises in the rugged mountains flanking the narrow Baviaanskloof Valley (L81A, B, C, D) running parallel to the Langkloof. Below Kouga Dam the Groot River emerges from the inland Karoo from a narrow valley through the Baviaanskloof Mountains and joins the Kouga Rivers to form the **Gamtoos River** (L90A), which drains the western slopes of the Elandsberg mountain range along its 90 km journey to the sea (L90C), flanked by irrigated lands.

Kouga-Gamtoos sub-area map

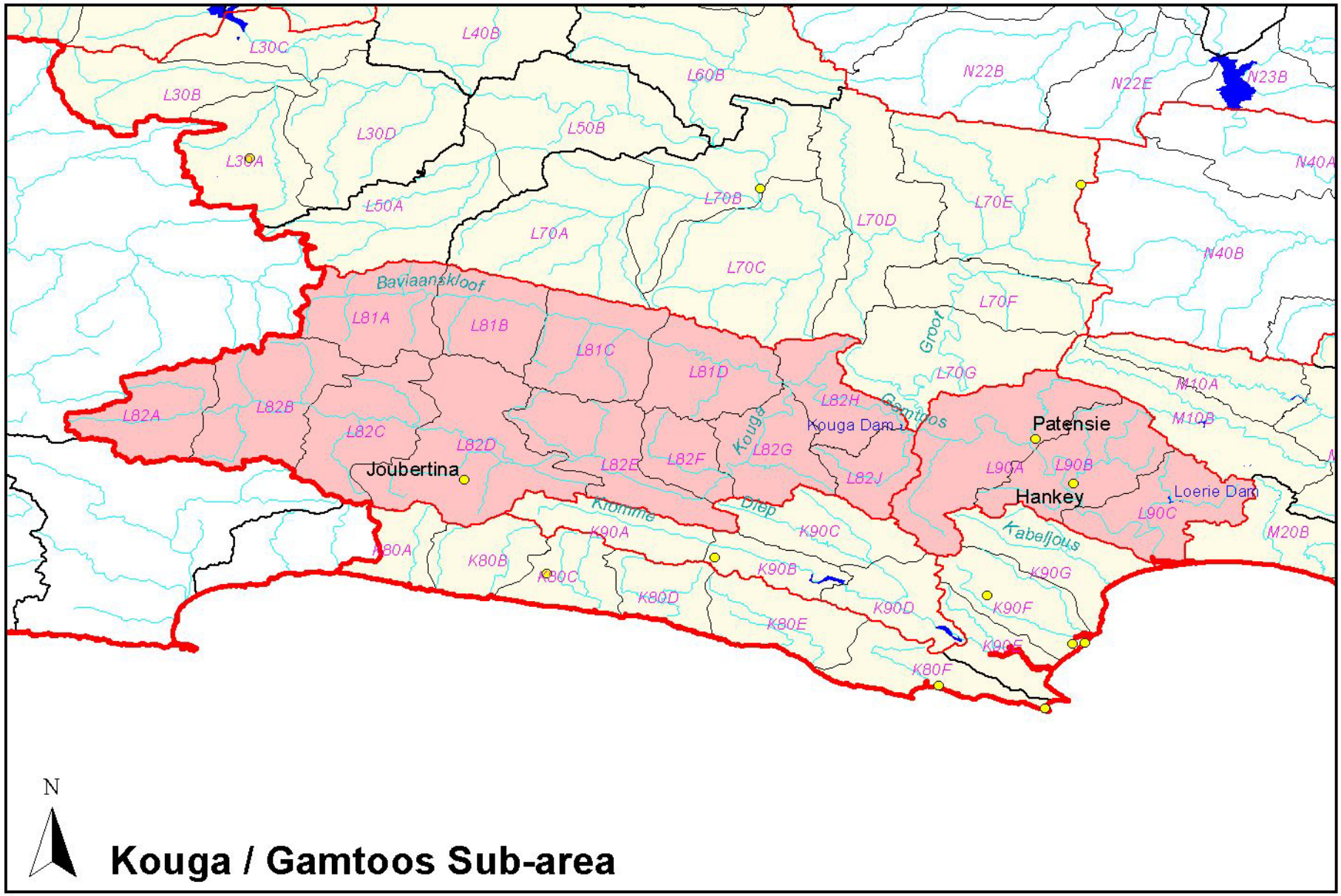


Figure 4.10: Baviaanskloof River at Rooipoort

Figure 4.11: Kouga Dam on the Kouga River

4.4.2 Water resources availability

The current estimation of the average annual volume of flows required for each river to satisfy the ecological riverine requirements of the Reserve are as shown in **Table 4.13**. Note that this differs from the impact that the ecological water requirement has on the available yield of the catchment.

Table 4.13: Kouga-Gamtoos sub-area average long-term Reserve flow requirement

River	Tertiary catchment	MAR (10^6 m³/a)	Average IFR requirement (10^6 m³/a)
Baviaanskloof	L81	45.8	7.0
Kouga	L82	148.2	13.0
Gamtoos	L9	88.0	0.8
Total		**282.0**	**20.8**

These Reserve requirements were desktop estimations, as adapted in the NWRS. The ecological sensitivity of aquatic systems other than rivers, such as lakes, wetlands and groundwater systems has not yet been assessed. Estuarine systems have also not been well studied. Determination of the estuarine requirements for the important Gamtoos estuary may also impact on the ecological requirements and hence the yield balance.

It is estimated that large quantities of water are lost through the impacts of invasive alien plants in the catchment, and the feasibility of eradication thereof should remain a high priority.

The local yields from the sub-area are as described in **Table 4.14**. The major portion of the yield is from Kouga Dam on the Kouga River. Groundwater is considered to be under-utilised in the Kouga and Gamtoos areas, but there is uncertainty about the reliability of this assessment.

Table 4.14: Kouga-Gamtoos sub-area yield at 1:50 year assurance for the year 2000 in million m³/a

Tertiary catchment or quat	River	Natural resource		Usable return flows	Total local yield	Transfers in	Grand Total
		Surface water	Ground-water				
L8 (Part)	Baviaanskloof	2.0	0.1	0.0	2.1	0.0	2.1
L8 (Part)	Kouga	88.6	0.0	2.1	90.7	0.0	90.7
L9	Gamtoos	3.1	1.6	0.3	5.0	63.6 (1)	68.6
Total yield		**93.7**	**1.7**	**2.4**	**97.8**	**0.0**	**97.8**

1) Transfer in from Kouga Dam consists of 50 10^6 m^3 (36.5 + 13.5) for Gamtoos GWS irrigation and 13.6 10^6 m^3 that will be transferred on to NMMM via Loerie Dam for abstraction.
2) Average use by the Gamtoos Irrigation Board is 40 10^6 m^3/a at a low assurance of supply. Their 1:50 year water requirement is estimated as 36.5 10^6 m^3/a. The canal losses of 13.5 10^6 m^3/a is also viewed as an irrigation requirement.

4.4.3 Current water requirements and use

Current water use is shown in **Table 4.15**.

Table 4.15: Kouga-Gamtoos sub-area water use for the year 2000 at 1:50 year assurance (million m/a)

Tertiary catchment or quat	River	Irrigation	Urban	Rural	Mining and bulk industrial	Power gene-ration	Affore-station	Total local require-ments	Transfers out	Grand Total
L8 (Part)	Baviaanskloof	2.0	0.0	0.1	0.0	0.0	0.0	2.1	0.0	2.1
L8 (Part)	Kouga	26.5	0.8	0.6	0.0	0.0	0.0	27.9	63.6 (1)	91.5
L9	Gamtoos	50.0	1.0	0.7	0.0	0.0	0.5	52.2	16.0 (2)	68.2
Total		**78.5**	**1.8**	**1.4**	**0.0**	**0.0**	**0.5**	**82.2**	**16.0**	**98.2**

1) Transfer from Kouga Dam consists of 50 10^6 m^3 for Gamtoos GWS irrigation and 13.6 10^6 m^3 that will be transferred on to NMMM via abstraction from Loerie Dam.
2) Transfer from the Gamtoos catchment for urban use in NMMM consists of 13.6 10^6 m^3 from Kouga Dam that is transferred via the canal and Loerie Dam and 2.4 10^6 m^3 that is abstracted from Loerie Dam.

4.4.4 Sub-area yield balance

The yield balances in the sub-area are as described in **Table 4.16**.

Table 4.16: Kouga-Gamtoos sub-area yield balance for the year 2000 at 1:50 assurance

Tertiary catchment or quat	River	Available water			Water requirements			Balance
		Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
L8 (Part)	Baviaanskloof	2.1	0.0	2.1	2.1	0.0	2.1	0.0
L8 (Part)	Kouga	90.7	0.0	90.7	27.9	63.6	91.5	-0.8
L9	Gamtoos	5.0	63.6	68.6	52.2	16.0	68.2	0.4
Total		**97.8**	**0.0**	**97.8**	**82.2**	**16.0**	**98.2**	**-0.4**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
4) Allocation from Kouga Dam (via Loerie Dam) to NMMM is 23 million m^3/a, which is sometimes utilised and leads to a much larger deficit in such years.

The total yield from the sub-area was calculated as 97.8 million m^3/a and the total requirements as 98.2 million m^3/a. From **Table 4.16** it is apparent that the sub-area is approximately in balance, with a deficit of 0.4 million m^3/a and that the Baviaanskloof, Kouga and Gamtoos Rivers are all approximately in balance. In years that NMMM uses their full allocation of 23 million m^3/a from Kouga Dam, the Kouga River could come under severe stress if the irrigation farmers below Kouga Dam take up their full quota. There are therefore no allocatable quantities in this sub-area according to the yield balance calculations. No new licenses will therefore be granted in the medium term.

4.4.5 Future water requirements

A small decline in future population is projected for this sub-area, attributable to the predicted lack of further economic growth and the impact of HIV/Aids. Water requirements in the sub-area will likely remain constant, as forecast during the National Demographic study undertaken by DWAF. The growth in urban water requirement as foreseen in the NMMM will influence the future water transfers of this sub-area.

Opportunities and aims for future water use are as follows:

- **Poverty alleviation:** Make water available for alleviation of poverty, such as to agrivillages and farm workers;
- **Infrastructure management:** Limit the water requirement imposed by operational losses, by promoting or implementing efficient water management of the bulk water supply transfer infrastructure and the operation of the transfer canal and Loerie Dam.
- **Urban use:** Further export of water in future for urban supply to the NMMM is planned. This could involve water saved through reducing the losses in the Kouga canal as well as

savings from decommissioning of irrigation in the Baviaanskloof catchment. The building of a further dam on the Kouga River is a further option to augment the urban requirement.

- **Irrigation:** Limited opportunities for further expansion of agriculture exist in the Langkloof. The prospect of water trading between Langkloof irrigators and irrigators from the Gamtoos River GWS would have to be very carefully considered. There is, however, a need to decrease irrigation use in the Gamtoos GWS through higher efficiency to improve the yield balance. Promote beneficial and economically viable irrigation water use.

4.4.6 Management perspective

The following describes the major issues, drivers and sub-area management perspectives as follows:

Yield balance and reconciliation

Issue 1: Most of the area is already water stressed and local resources are already insufficient to meet needs in drought conditions. Future needs for the NMMM could not be met under these conditions. The Kouga/Loerie system is under stress, Kouga Dam is over-allocated and the sub-system will be under severe stress if the Reserve is taken into account. In years that NMMM uses their full allocation of 23 million m^3/a from Kouga Dam, the Kouga River is already under severe stress. New water allocations in the Kouga, Baviaanskloof and Gamtoos Rivers have been put on hold.
Sub-area perspective 1: It is evident that compulsory licensing should be undertaken for the entire sub-area if other measures to balance the requirements with the yields are not successful, because of the stressed situation, uncertainty regarding the Reserve requirements, requirements for irrigation expansion in the Langkloof and future urban requirements of NMMM. Re-allocation could, if necessary, follow compulsory licensing for supply to help resource-poor farmers or to promote beneficial use. Until then, no further licenses should be issued in the entire sub-area, unless circumstances are exceptional.

Issue 2: Future augmentation of supply is planned for the urban water requirement of NMMM. The Guernakop Dam in the Kouga River was identified as a likely potential future source to NMMM in the longer term. It could provide an estimated yield of 30 million m^3/a to the NMMM.
Sub-area perspective 2: The Guernakop Dam option will be studied further according to the recommended overall programme of augmentation to NMMM. According to the Algoa Pre-Feasibility Study, this option will not be required before at least 2020.

Issue 3: An additional 2 million m^3/a for urban supply to NMMM will become available if irrigation in the Baviaanskloof ceases, according to the Algoa Pre-Feasibility Study. This would also be in line with the conservation efforts in the Baviaanskloof.
Sub-area perspective 3: Persue the decommissioning of irrigation in the Baviaanskloof

Issue 4: An additional 5 million m^3/a for urban supply to NMMM is planned to become available from reduced losses in the Kouga transfer canal before 2016, according to the Algoa Pre-Feasibility Study.

Sub-area perspective 4: Implement measures to reduce losses from the Kouga transfer canal.

Water resources protection

Issue 5: The possible impact of the determination and implementation of the Reserves and RQOs for the Baviaanskloof, Kouga and Gamtoos Rivers must be established. The possible estuarine requirements of the highly rated Gamtoos River must be kept in mind before further water authorisations in the Gamtoos catchment are considered.
Sub-area perspective 5: A detailed determination and careful assessment of the requirements for the ecological component of the Reserve as part of the compulsory licensing process are required to confirm the perception that these catchments are already water-stressed. Given its environmental importance, the ecological water requirements of the Gamtoos estuary should first be determined at an improved level of confidence before further water authorisations in the Gamtoos catchment are considered.

Issue 6: Wetlands have a high priority in this sub-area and should be conserved.
Sub-area perspective 6: DWAF will continue with the compilation of the inventory of the identification and prioritisation of the ecological importance and sensitivity of wetlands. Improved confidence studies according to regional priorities will follow the completion of the inventory.

Water use management

Issue 7: Review of the efficiency of use and acceptable risks of supply, linked to tariffing, may free up some water for urban use from the Gamtoos GWS. There is very limited scope for irrigation expansion in the Gamtoos GWS. The current allocation of 59.5 million m^3/a to the Gamtoos GWS and the assurance at which the water is supplied needs to be revisited.
Sub-area perspective 7: Review the Gamtoos GWS allocation as part of the compulsory licensing process.

Issue 8: There is a need to better understand the possible implications of large-scale water trading involving farmers from the Gamtoos GWS.
Sub-area perspective 8: The implications of buying out farmers from the Gamtoos GWS on a large-scale needs to be investigated, to understand the impact of a partial water use shift from agricultural use to urban use by NMMM, or to a lesser degree to Langkloof irrigators in the upper tributaries of the Kouga River, who wish to expand.

Water conservation and demand management

Issue 9: An estimated 13.5 million m^3 of water per annum is lost in the canal between Kouga and Loerie Dams due to seepage. Spillages also occur at Loerie Dam. Improved agricultural water use and loss control in the Gamtoos GWS is necessary.
Sub-area perspective 9: Once completed, DWAF will implement the findings of their current investigation into the implementation of agricultural water conservation and demand management measures in the Gamtoos GWS. Improved operation of Lourie Dam could reduce spillage.

Issue 10: The extent and impact of alien plants in the sub-area is unacceptable.
Sub-area perspective 10: The Baviaanskloof River catchment has been cleared and is now relatively free of aliens. Working for Water eradication programmes will continue in the Langkloof. Further mapping will continue to be able to determine future priorities for control and clearing.

Integration and co-operative governance

Issue 11: Water is required to alleviate poverty.
Sub-area perspective 11: No specific need has been short-listed for further study in this sub-area. The needs of resource-poor farmers will be determined on a larger regional scale to be able to address the most deserving needs first through co-operative governance. Consider the need to make water available to meet the requirements of farm workers and agrivillages in the sub-area.

Waterworks development and management

Issue 12: Effective management of the Gamtoos GWS infrastructure, which forms part of the Algoa Water Supply System, is required.
Sub-area perspective 12: Outstanding identified Gamtoos GWS infrastructure will be transferred to the Gamtoos Irrigation Board. The scheme is well managed but some operational improvements (including the management of the water level in Lourie Dam) need to be implemented to improve system efficiency and to make saved water available to NMMM.

Issue 13: The risk of periodic devastating flooding along the lower Gamtoos River needs to be properly managed.
Sub-area perspective 13: A disaster management plan needs to be prepared and implemented for the Groot and Gamtoos Rivers to safeguard the public in the Gamtoos River catchment against such disastrous floods as have occurred in the past.

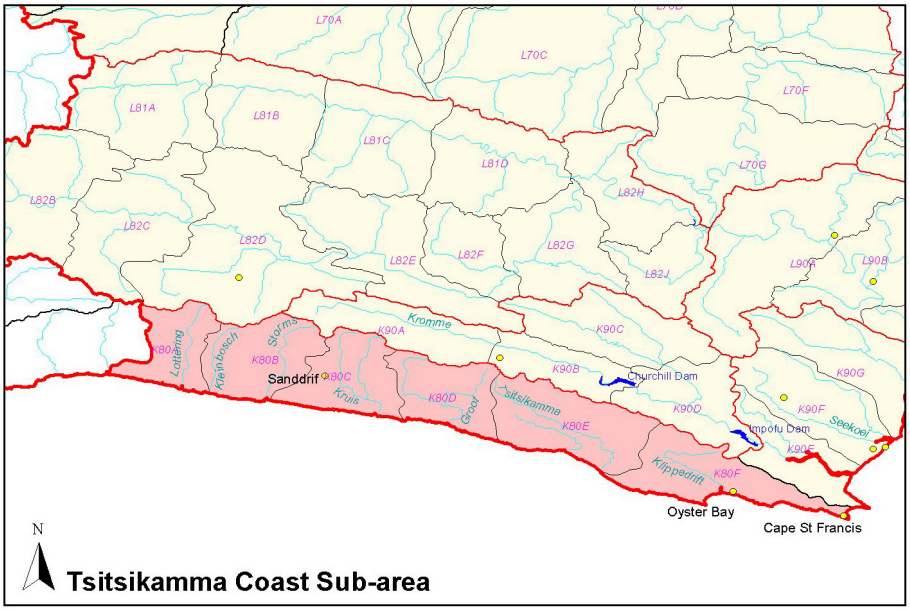
4.5 TSITSIKAMMA COAST SUB-AREA

The Tsitsikamma Coast sub-area is separated from the rest of the ISP-area by the Tsitsikamma Mountains and generally enjoys higher rainfall. Its scenic character and resultant tourist trade also sets it apart. This Chapter provides an overview of the water availability, requirements and yield balance in the Tsitsikamma Coast sub-area and the main perspectives that drive the strategies relating to this sub-area and smaller sub-management areas (e.g. rivers) within it.

4.5.1 Location and rivers in the sub-area

In front of the Tsitsikamma Mountains a number of steep, deeply incised rivers (K80A to F) flow to the sea (**Figure 4.12**). These are the Lottering and Elandsbos Rivers (K80A), Storms and Kleinbosch Rivers (K80B), Kruis, Elands and Sanddrift Rivers (K80C), Groot River (K80D), **Tsitsikamma River** (K80E) and the Loopspruit, Slang River and Klippedrift Rivers (K80F).

Figure 4.12: Map of the Tsitsikamma Coast sub-area



MAIN FEATURES:

Main Rivers:
- ⇨ Lottering River (K80A);
- ⇨ Kleinbosch River (K80B));
- ⇨ Storms River (K80B);
- ⇨ Kruis River (K80C);
- ⇨ Groot River (K80D);
- ⇨ Tsitsikamma River (K80E);
- ⇨ Klippedrift River (K80F).

Towns: Storms River, Sanddrif, Oyster Bay, Cape St Francis.

Main dams:
- ⇨ Klippedrift Dam (3.1 Mm³) in K80F.

Future identified schemes:
- Diversion dam on the Tsitsikamma River connecting to the Churchill/Impofu pipeline;
- Various small schemes connecting to the Tsitsikamma scheme.

Major conservation areas:
Tsitsikamma National Park

4.5.2 Water resources availability

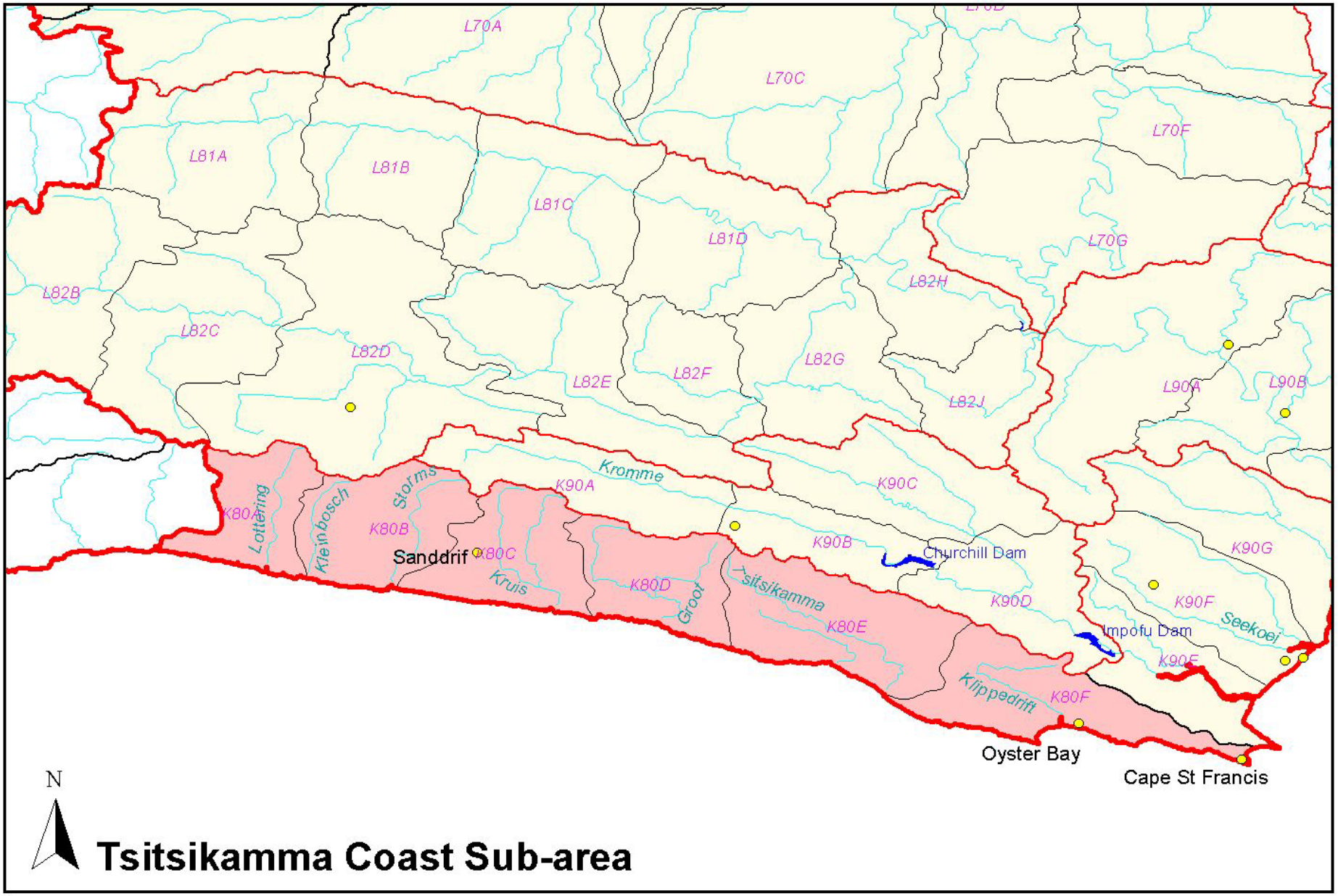
The current estimation of the average annual volumes of flows required for each river to satisfy the ecological riverine requirements of the Reserve are as shown in **Table 5.17**. Note that this differs from the impact that the ecological water requirement has on the available yield of the catchment.

Table 4.17: Tsitsikamma Coast sub-area average long-term Reserve flow requirement

Sub-area	Tertiary catchment or quat	MAR (10^6 m³/a)	Average IFR requirement (10^6 m³/a)
Tsitsikamma Coast	K8 – quats A, B, C, D	322.2	76.0
	K8 – quats E, F	87.8	15.5
Total		**410.0**	**91.5**

These Reserve requirements were desktop estimations, as adapted in the NWRS. The ecological sensitivity of aquatic systems other than rivers, such as lakes, wetlands and groundwater systems has not yet been assessed. Estuarine systems, which are important in this sub-area have also not been well studied.

Tsitsikamma Coast sub-area map



The local yields from the sub-area are described in **Table 4.18**. The major portion of the yield is from farm dams and direct pumping from the various rivers within the sub-area.

Table 4.18: Tsitsikamma Coast sub-area yield at 1:50 year assurance for the year 2000 in million m³/a

Tertiary catchment or quat	Sub-area	Natural resource		Usable return flows	Total local yield	Transfers in	Grand Total
		Surface water	Ground-water				
K8 – quats A, B, C, D	Tsitsikamma Coast	9.9	0.1	1.1	11.1	0.0	11.1
K8 – quats E, F		2.1	0.2	0.3	2.6	0.0	2.6
Total yield		**12.0**	**0.3**	**1.4**	**13.7**	**0.0**	**13.7**

4.5.3 Current water requirements and use

The water use for 2000 is shown in **Table 4.19**.

Table 4.19: Tsitsikamma Coast sub-area water use for the year 2000 at 1:50 year assurance (million m³/a)

Tertiary catchment or quat	Sub-area	Irrigation	Urban	Rural	Mining and bulk industrial	Power gene-ration	Affore-station	Total local require-ments	Transfers out	Grand Total
K8 – quats A, B, C, D	Tsitsikamma Coast	3.0	1.2	0.3	0.0	0.0	4.1	8.6	0.0	8.6
K8 – quats E, F		0.9	0.2	0.2	0.0	0.0	0.5	1.8	0.0	1.8
Total		**3.9**	**1.4**	**0.5**	**0.0**	**0.0**	**4.6**	**10.4**	**0.0**	**10.4**

4.5.4 Sub-area yield balance

The yield balances in the sub-area are as described in **Table 4.20**.

Table 4.20: Tsitsikamma Coast sub-area yield balance for the year 2000 at 1:50 assurance

Tertiary catchment or quat	Sub-area	Available water			Water requirements			Balance
		Local yield	Transfers in	Total	Local require-ments	Transfers out	Total	
K8 – quats A, B, C, D	Tsitsikamma Coast	11.1	0.0	11.1	8.6	0.0	8.6	2.5
K8 – quats E, F		2.6	0.0	2.6	1.8	0.0	1.8	0.8
Total		**13.7**	**0.0**	**13.7**	**10.4**	**0.0**	**10.4**	**3.3**

1) Surpluses are shown in the most upstream sub-area where they first become available.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA..

The total yield from the sub-area was calculated as 13.7 million m³/a and the total requirements as 10.4 million m³/a. The sub-area is approximately in balance, with a surplus yield of 3.3 million m³/a. More surplus water is available in the wetter western parts of the Sub-catchment.

4.5.5 Future water requirements

Figure 4.13: Southern part of the Tsitsikamma Coast sub-area

Water requirements in this sub-area will likely grow mainly because of an increase in tourism, but also because there is pressure from farmers for additional irrigation, particularly for pastures. The growth in urban water requirements as foreseen in the NMMM may eventually impact on

this sub-area's yield balance if further surface water options are developed. Available yields in the Tsitsikamma Coast sub-area will increase along with infrastructure development.

Opportunities and aims for future water use are as follows:

Irrigation: There is a pending application to construct a new 8-million m³ dam on the Tsitsikamma River and for a 0.45-million m³ dam at Doriskraal for resource-poor farmers. There may be potential for further irrigation development.

Urban and rural use: There is some local growth, driven by tourism.

From **Table 4.20** it is apparent that the sub-area has a small positive yield balance, with potential for further development. Applications for surface water use authorisations will be handled ad hoc and on merit. The need for development will be handled separately for every small river in the sub-area.

4.5.6 Management perspective

The following describes the major issues, drivers and sub-area management perspectives as follows:

Yield balance and reconciliation

Issue 1: The expected growth in the sub-area requires that adequate data is available to improve the reliability of the water availability calculations. Only four of the many coastal rivers currently have flow gauges on them.
Sub-area perspective 1: Prioritise the installation and maintenance of stream flow gauging stations as well as other monitoring requirements and allocate funds to support implementation of new gauging stations and the like where required.

Issue 2: There is uncertainty about how much water is actually available for allocation in these coastal rivers, especially since the water availability was determined at low levels of confidence and no estuarine environmental water requirements have been determined. There are some pending water use license applications. Continued growth in water use requires that the availability of water use be refined to determine refined yield balances.
Sub-area perspective 2: Updated yield balances will be determined for the various rivers as further information becomes available and to be able to address the license applications, taking full account of the regional needs of the Algoa System.

Water conservation

Issue 3: Due to the high conservation status of most rivers in this sub-area, it is important that sufficient water remains in the rivers at all times to meet the requirements with respect to the ecological component of the Reserve.

Sub-area perspective 3: Give priority to the determination of the Reserve, especially for the Tsitsikamma River and estuary, Groot River and estuary, Sanddrift River and Klippedrift River and estuary to ensure that licensing for afforestation and abstractions from these rivers remains within acceptable limits.

Issue 4: Wetlands have a high priority in this sub-area and should be conserved.
Sub-area perspective 4: DWAF will continue with the compilation of the inventory of the identification and prioritisation of the ecological importance and sensitivity of wetlands. Improved confidence studies according to regional priorities will follow the completion of the inventory.

Issue 5: Due to the scenic splendour and eco-tourism value of rivers in this sub-area, there is a need to protect the relatively pristine rivers and estuaries.
Sub-area perspective 5: Entrench a management approach that limits the possibility of accidental pollution accidents or hazardous spills.

Water use

Issue 6: There is conflict relating to the DWAF-approved construction of the 8 million m^3 Anderson Dam on a tributary of the Tsitsikamma River and the Water Tribunal has very recently ruled on the new water authorisation issued by DWAF to the Valley Trust.
Sub-area perspective 6: Implement compulsory licensing in the Palmiet tributary in terms of the Water Tribunal ruling and reach a decision on the water authorisation following the outcome. If water is not available the water authorisation will only be valid for a one-year period and lapse.

Issue 7: Water for development is available from the various small rivers and license applications are pending, notably for the 0.45-million m^3 dam at Doriskraal for resource-poor farmers on the Tsitsikamma River.
Sub-area perspective 7: Evaluate the allocatable amounts from each river individually and pro-actively ensure that a feasibility study of the prospective Doriskraal resource-poor farmers scheme receives priority.

Issue 8: This area is heavily infested with alien invasive plants. Alien plant control is needed, especially in the lower reaches of rivers in the sub-area.
Sub-area perspective 8: Consider the feasibility of removing the invasive alien plants.

Issue 9: Control over the management of riparian zones should be improved for commercial forests, since they are currently not complying with prescribed no-vegetation riparian zones and so add to the problem of alien plants.
Sub-area perspective 9: DWAF and the Forestry industry must check on compliance of commercial forestry in the Tsitsikamma Coast area with regard to riparian zones. DWAF will facilitate a discussion of the issue with SAFCOL to enforce control through existing legislation.

Public health and safety

Issue 10: Disaster planning is needed to limit the possible disastrous consequences of emergency spills on the N2 highway.
Sub-area perspective 10: Ensure that disaster management plans to contain emergency spills on the N2 highway are implemented through co-operation with all the other involved role-players.

Monitoring and information management

Issue 11: The monitoring of estuarine eco-systems needs to be established for many of these coastal rivers to obtain adequate information when determining the ecological estuarine requirements.
Sub-area perspective 11: Install water level recorders and other required monitoring devices and ensure good management of such monitoring systems.

CHAPTER 5 – INTRODUCTION TO THE ISP STRATEGIES

The many issues and concerns identified in the ISP-area will be addressed through the implementation of appropriate regional water management strategies (of which many are existing). DWAF staff has identified the essential management strategies to manage the Tsitsikamma to Coega ISP-area. Additional required strategies may be developed in future.

Ten broad strategy groups, called Main strategies, that cover all necessary current and required future water management activities were identified from current DWAF Regional Office activities, and the requirements of the NWA and the NWRS. These Main strategies are:

- ⇨ Yield balance and reconciliation;
- ⇨ Water resources protection;
- ⇨ Water use management;
- ⇨ Water conservation and demand management;
- ⇨ Institutional development and support;
- ⇨ Social and environmental considerations;
- ⇨ Integration and co-operative governance;
- ⇨ Waterworks development and management;
- ⇨ Monitoring and information management and
- ⇨ Implementation.

Under each of these Main strategy groups, specific strategies particular to the Tsitsikamma to Coega ISP-area were developed.

For each strategy, the following aspects are addressed:

- ***Management objectives*** in terms of the envisaged solutions for the strategy;
- ***Situation assessment;*** providing a synopsis of the current situation with a focus on the issues;
- ***Strategic approach;*** stating the approach or plan that DWAF will follow to reach its objectives for the strategy;
- ***Management actions;*** states the required actions to implement the strategy;;
- ***Responsibility;*** the responsible offices or Directorates are named;
- ***Priority*** in terms of the ISP rating system (1 – 5, where 1 indicates the highest priority);

Responsibilities for Main strategies and for individual strategies were assigned to responsible DWAF Directorates or Sections within the Eastern Cape Regional Office. DWAF head office champions were identified where appropriate.

Thirty one strategies were developed for implementation under the ten Main strategy groups, in the five sub-areas.

All possible strategies that may be required in future were not developed. Other required strategies may become apparent and should be developed as they become necessary. Some strategies combine aspects that may need to be expanded into separate strategies. The effectiveness, issues or problems encountered with water supply and sanitation programs in rural areas were not addressed in this ISP.

The various actions required to implement the ISP strategies have been identified and listed under each strategy. The general lack of adequate human and financial resources will influence the scope of work that can actually be addressed under the various strategies. Each strategy has been prioritised, and in many cases specific actions under strategies have been prioritised as well. What is further required, following this study, is that the actions listed under each strategy should be revisited and prioritised to be in line with the available resources and funding to implement each strategy. The redirecting or retraining of DWAF's regional staff resources, to be in line with the identified relative strategy priorities, or of obtaining additional resources, must be seriously considered. Where various implementation options exist, the evaluation of each option should be documented, as well as the approach and decisions on implementation actions that were selected for immediate or later implementation. Specific targets or benchmarks to measure the progress of strategy implementation should also be developed and documented.

CHAPTER 6 – YIELD BALANCE AND RECONCILIATION STRATEGIES

NEED FOR YIELD BALANCE AND RECONCILIATION STRATEGIES

The various sectors within the ISP-area have different overall water requirements and these requirements are generally at different levels of assurance of supply. Consequently, the sub-areas vary from more stressed to less stressed than the overall ISP-area. Anticipated economic growth coupled with the need for urban expansion will place further stress on the regional water resources. The yield balance situation and the current and future management perspectives and reconciliation options were discussed in *Chapter 4: Water resources perspective of the ISP-area*.

Yield balance and reconciliation strategies address the need to:

- ⇨ Clarify uncertainties and information gaps regarding the availability of surface water and groundwater;
- ⇨ Undertake detailed water requirement investigations;
- ⇨ Determine and implement water reconciliation strategies for specific systems, geographical areas or water sectors;
- ⇨ Undertake requirements of compulsory licensing.

The strategies further address the key elements of:

- The possible impact of the implementation of Reserves,
- Future water supply to NMMM and municipalities;
- The dominance of irrigation as the largest water use sector and
- The need to allocate water for poverty alleviation.

Adequate amounts of water at acceptable assurances of supply are required especially for the NMMM, but also for towns. This will require good and timeous planning.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

6.1 Reliability of the yield;
6.2 Groundwater;
6.3 Compulsory licensing;
6.4 NMMM future augmentation;
6.5 Use of treated effluent and
6.6 Supply to local authorities.

It was considered unnecessary to develop strategies for specific water use sectors. There is no specific "water requirement" strategy, as this is adequately covered in the other strategies.

6 YIELD BALANCE AND RECONCILIATION

6.1 RELIABILITY OF THE YIELD ESTIMATES

Management objective:

To address the uncertainties, assumptions and gaps as identified in the hydrology and methods used to determine the water availability in the various catchments, river reaches, dams and systems of this ISP-area.

Situation assessment:

Significant growth has taken place in the Tsitsikamma Coast area but adequate data is not always available to enable reliable water availability calculations. Only four of the many coastal rivers have flow gauges on them. Since this area is likely to develop rapidly, improving gauging capacity in the Tsitsikamma Coast area must be a priority.

The yield of the Kouga Dam was updated and extended as part of the Algoa Water Supply Pre-Feasibility Study in 2001 [(4)] and covered the hydrological period 1930 to 1998. There is no flow gauge on the Baviaanskloof River. The remaining hydrology that forms part of the total Algoa Water Supply System is as used in the 1996 Algoa Water Resources Stochastic Analysis study [(24)] and covers the hydrological period 1930 to 1989.

The Kromme River is well gauged at the dams, but there are no gauges in the problematic Seekoei/Swart Rivers or on the Kabeljous River.

Additional flow gauging is required in the Lower Swartkops River, but no suitable flow gauging sites have been found and the water level recordings will have to suffice. No flow gauge has been installed in the Coega River.

The flow gauging stations and their available records are listed in **Appendix B11**.

Current estimates are that groundwater contributes about 13 million m³/a (or 6%) to the local yield in the ISP-area and surface water contributes 206 million m³/a (or 94%). In addition, 11 million m³/a is transferred into the ISP-area and 10 million m³/a is re-used, providing a total ISP-area yield of 230 million m³/a at 1: 50 year assurance.

The following issues and concerns were identified:

- Until the required releases for the Reserve are more accurately determined, the utilisable yields of dams and the Algoa system will only significantly change if there are significant hydrological events, noticeable land use changes or improvements in input data;
- The yields of stressed river reaches and catchments need to be determined at high-confidence levels as part of the compulsory licensing process;
- Uncertainty regarding irrigation water use;
- Available data on the following aspects is inadequate (Ref. Fish to Tsitsikamma Situation Assessment Report [(26)]):
  - Appropriate yields from farm dams and run-of-river yields for all ISP-areas;
  - The distribution, types and areas of crops irrigated from "private" sources and their water requirements.
  - Ecological flow requirements of both rivers and estuaries and their impacts on the utilised yields of water resources;
  - The estimated impacts of alien plants and afforestation on the yields of the water resources seem high;
  - The reasons for the limited utilisation of the groundwater resource in relation to its apparent total potential.
- Information needs to be improved on the capacities of the raw water supplies of some of the towns;
- There is a need to update the estimate of the appropriate yield of Beervlei Dam at a variety of assurances, as it has not been determined in recent years;
- The Algoa Pre-Feasibility study derived severely reduced hydrology (volume of available water) for the Tsitsikamma River compared to what was understood to be available. The new hydrology is based on a three-year record from the new gauging station. There is concern about the low confidence in the revised hydrology. Various reports recently produced also use conflicting hydrology for yield from this river. This needs to be resolved.

Strategic approach:	Improve the knowledge of surface water availability by promoting the installation of more rain gauges and gauging stations throughout the ISP-area. Vigorously pursue the installation of rain gauges as well as water level recorders in identified estuaries. Address the paucity of groundwater information by initiating studies and installing systems that improve knowledge about groundwater availability. Only update the hydrology of a specific system or river when there is a specific need, such as a significant license application or when there is good reason to believe that the hydrology will change after an update. Update the appropriate yields of stressed river reaches and catchments as part of the compulsory licensing process.
Management actions:	1. Undertake more detailed assessments of the availability of groundwater data; 2. Verify groundwater use data, once registered, to amend groundwater yields if necessary. This will be in terms of priorities identified in the *Groundwater strategy*; 3. Determine run-of-river and farm dam yields by applying the WRSM system yield model for the necessary catchments as developed in the Orange River Replanning study; 4. Improve knowledge on private irrigators from the registration process where possible; 5. Improve knowledge on municipal infrastructure from WSDPs; 6. Hydrological monitoring should continue in the Tsitsikamma River to improve the base data; 7. Undertake further research on the water use of alien plants in this ISP-area; 8. The D: RDM is undertaking a comprehensive Reserve determination in the Kromme River and a rapid determination of the Seekoei River. Refer to the *Reserve and RQO strategy*; 9. Update the Beervlei Dam yield for various levels of assurance according to the priorities in the Groot River GWS strategy.
Responsibility:	Directorate National Water Resources Planning.
Priority:	2 – High, due to the importance and cost implications of decisions to be made, at least in feeder catchments of NMMM.

6	YIELD BALANCE AND RECONCILIATION

6.2	GROUNDWATER
Management objective:	The objective of this strategy is to ensure that the RO is appropriately equipped with a human resource and a knowledge base to explore, develop, license and manage the regional groundwater resource within the Integrated Water Resources Management framework.
Situation assessment:	Groundwater is an important resource and could be more so in future, as surface water resources becomes increasingly under pressure from water users. The groundwater situation in the ISP-area is discussed in sections 3.1.3 and 3.1.5 of this report. *The following groundwater resource availability issues and concerns were identified:* • Appropriate knowledge and risk management is needed; • The groundwater component of the Ecological Reserve and the SUP of the different aquifers as well as that of the hydrological system as a whole can only be determined at desktop level of confidence until there are significant improvements in input data; • The SUP of aquifers, the TMG in particular, requires an evaluation of the storage capacity of the aquifer in order to establish the potential yield as well as the potential to increase assurance of supply in an IWRM context; • Stressed aquifers or aquifer zones and the evaluation of the cause (over abstraction or medium to long term climate variations or land use changes) need to be determined at high-confidence levels as part of the compulsory licensing process; • Private irrigation usage needs to be quantified and monitored with respect to the distribution, types and areas of crops irrigated; • Aquifer protection measures and aquifer vulnerability must be routinely considered in land use planning and development; • Available data on the following aspects is inadequate: - Appropriate yields from different aquifer systems on a regional scale for all ISP-areas other than in the Uitenhage Control area; - Identification of Groundwater Dependent Ecosystems and the nature and significance of this dependency, in particular of the wetlands and coastal estuaries; - Expected, modelled or measured impact of groundwater abstraction on these ecosystems and thus the impact of the groundwater Reserve on utilisable yields of the water resources and/or management options; - Impacts of alien plants and afforestation on the yields of the groundwater resources are high, in particular in zones of groundwater discharge and areas with a high water table. This impacts on the rate of groundwater recharge to the regional systems over time. *The following specific monitoring related issues and concerns were identified:* • There is an urgent need to expand the current monitoring network; • There is a need to verify existing lawful use; • There is a need to quantify the extent and cause of pollution in the lower Swartkops River area and to take remedial action; • There is a need to establish and implement a Knowledge Management Strategy; • There is a need to develop a regional database; • There is a need to define a short to medium approach to Hydrogeology in IWRM context in the Region.
Strategic approach:	Develop the medium to long term Mission, Vision, Strategies and Goals for the Hydrogeology Division in the Region to realise the following: Integrate hydrogeology knowledge and information into RO planning and water resource development and management. Equip the RO to provide reliable quantitative input and information on groundwater resources and licensing decisions within DWAF and to other local and central government, NGO and private sector parties as needed. Vigorously promote the installation of necessary monitoring infrastructure and resources in order to address the paucity of groundwater information and improve ability to effectively manage the abstraction of groundwater by all sectors. Initiate the necessary studies and research that upgrade the groundwater resource evaluation information and develop conjunctive management options.

	Significant effort and investment is required to address the concerns of different stakeholders and to present groundwater information, implementation and management practise in a manner and on a physical and time scale that is relevant to water service providers and decision makers.
Management actions:	*Prepare detailed business, staffing and action plans to give effect to the above strategy proposals for the Regional Geohydrology Division*. The key actions must include: 1. Do desktop assessments of Sustainable Utilisable Potential (SUP) of different aquifers and prioritise aquifers for more detailed work; 2. Detailed assessments of the groundwater SUP for different aquifers at an appropriate scale and level of risk with respect to water demand, licensing and compulsory Reserve Determination needs; 3. Necessary research to map and quantify the relationship of the different aquifers to significant ecosystems, surface water low flow and perennial streams with particular focus on the TMG domain; 4. A comprehensive regional hydro-census and the necessary follow on database design and management tasks to facilitate interpretation, use and dissemination of the information; 5. Plan and Use of the Hydrocensus actions and results to verify groundwater use and design and to expand groundwater monitoring throughout the ISP area whilst including selected private boreholes; 6. Developing a strategy for interaction with local and provincial government departments, donor organisations and within DWAF RO to promote and maintain cooperation as regards monitoring protocol and data sharing; 7. Promote communication between relevant divisions within the regional offices in the exchange of data, information and planning on different projects that would benefit from the involvement of the Geohydrology division and vice versa 8. Integrate the results of research projects funded by DWAF and or the WRC into the regional knowledge base. 9. Updating the regional hydrogeological database with municipal information, information from donor organisations and other government and DWAF departments; 10. Developing a Regional Strategy for knowledge management and integration. 11. Develop and implement a regional strategic approach to groundwater protection in cooperation with the regional Water Quality Section and local government. It is necessary to: - Evaluate the risk to and/or quantify the known contamination of different aquifers from both licensed and unlicensed waste sites, septic tanks and VIPs, waste water treatment plants, planned and existing agricultural and industrial development; - Establish groundwater resource protection measures as a matter of urgency; 12. Establish Recharge Zone Management and Protection protocols; 13. Commission a study to address the existing and ongoing contamination of the Swartkops Aquifer.
Responsibility:	RO Geohydrology, assisted by D: Information Programmes.
Priority:	1 – Very high and ongoing.

6	YIELD BALANCE AND RECONCILIATION

6.3	COMPULSORY LICENSING
Management objective:	To initiate and manage the compulsory licensing process for the identified stressed areas.
Situation assessment:	Most catchments in the ISP-area are approaching or are already in a stressed situation. Even if irrigation development is contained at the current levels of development, potential requirements from the domestic and industrial sectors are estimated to increase significantly by 2025. Hence the whole of the ISP-area can be considered to be a stressed area. The Groot sub-area is approximately in balance and no large increase in water requirements are foreseen. Compulsory licensing is not regarded as a high priority. In the Kouga-Gamtoos sub-area the Baviaanskloof River is approximately in balance. The Kouga River is currently in balance, but potentially very stressed if NMMM uses their full allocation. Langkloof irrigation farmers have expressed a need for irrigation expansion. The lower Gamtoos River is in balance, but the estuarine requirements have not been adequately determined and may put significant additional stress on the system. All of this indicates a high priority for compulsory licensing. The Kromme, Seekoei (high priority) and Swart Rivers require compulsory licensing due to stressed conditions, hypersalinity occurring in the estuaries, plus strong environmental lobbying and pressure from DEAET. Poverty alleviation requirements and preservation of wetlands further drive the need for compulsory licensing in the Seekoei River, as do wetlands for the Kromme River. Compulsory licensing is not regarded as necessary for the Kabeljous River. There appears to be no current allocable water from the Seekoei River for the needs of the Kruisfontein project for resource-poor farmers. It is expected that, until compulsory licensing is introduced, further water could likely not be allocated to them (See the *Poverty alleviation and land reform strategy*). Many rivers in the Tsitsikamma Coast Area require refined yield balances to be determined due to the large number of license applications, the continued growth in water use and the uncertainty about how much water is actually available for allocation, especially since no estuarine requirements have been determined. Compulsory licensing has a medium priority in the more intensively used rivers in the sub-area. The Water Tribunal has ruled that compulsory licensing be implemented in the Palmiet tributary to reach a decision on the Valley Trust water use authorisation. The Algoa Coast sub-area catchments are in balance with growing requirements. Compulsory licensing is not regarded as a high priority, since additional water would have to come from outside the sub-area. The Uitenhage aquifer is already a GWCA. Most compartments have no allocatable water.
Strategic approach:	Compulsory licensing should be undertaken for the identified high priority rivers (Kouga and Kromme-Seekoei), because of the stressed situation, possible irrigation expansion and future urban requirements of NMMM. Re-allocation could if necessary be done along with compulsory licensing to provide water for poverty alleviation such as e.g. resource-poor farmers, as well as for the Reserve and to balance requirements with yields.
Management actions:	Implement the compulsory licensing process in the identified catchments in a phased, integrated manner as a step-wise process in the Kouga, Gamtoos, Kromme, Seekoei and Swart Rivers as a high priority, but according to national priorities, as follows: • Implemented in the Palmiet tributary of the Tsitsikamma River to reach a decision on the Valley Trust water use authorisation. • Do verification of existing use and the lawfulness of such use; • Update the hydrology and set up water resources models as required by compulsory licensing to update the yields of these catchments; • Revisit and refine the water requirements; • As a first step undertake comprehensive Reserve determinations in the Kromme-Seekoei sub-area, followed by Reserves for the other identified rivers; • Assess the social dynamics of the identified catchments and the potential economic impacts of

	allocation decisions; • Revisit the current yield balance and potential yield balance scenarios in the identified catchments once the Reserve and detailed modelling studies are complete, and the social and economic issues are understood; • Undertake scenario and operational assessments and the development of a set of water allocation rules, following the required participative stakeholder processes, ensuring that water for poverty alleviation receives adequate priority; • Publish water allocation schedules for the Kouga, Kromme, Seekoei and Swart Rivers and identified Tsitsikamma Coast Rivers, following the quantification of multi-criteria decision-making recommendations and the required public, legal and administrative processes.
Responsibility:	The RO in consultation with D: WA, TINWA, D: RDM and D: NWRM.
Priority:	1 – Very high, especially for current and possible feeder catchments for NMMM.

6	YIELD BALANCE AND RECONCILIATION

6.4	NELSON MANDELA METROPOLE FUTURE AUGMENTATION
Management objective:	The strategy will address the need to identify and study (at the appropriate level) the best intervention options that must be investigated and implemented to ensure the timeous availability of water to meet the increasing requirements of the Nelson Mandela Metropolitan Municipality (NMMM) at an acceptable assurance of supply and cost, whilst ensuring minimal environmental and social impacts.
Situation assessment:	Urbanisation is continuing in the NMMM and the population is growing accordingly. The Coega harbour and duty-free heavy industrial zone will further increase future water requirements. The recently completed Algoa Pre-Feasibility Study aimed to determine priorities in the development of water resources for the NMMM region with appropriate phasing to suit the growing demand in the area. The study particularly focussed on the feasibility of extending the date by which the next augmentation scheme should be implemented, by reducing the water demand through water demand management measures, re-use of treated effluent, and some other measures. The augmentation schemes would be increased Orange River water transfers and the building of Guernakop Dam on the Kouga River. The 2000 water requirement for NMMM was 72.5 million m³/a. For the growth option that includes the Coega IDZ development (15 million m^3/a required within 10 years) without any intervention measures the projected requirement according to the NWRS in 2025 is 100 and 151 million m³/a for base and high scenario, respectively. Results from the Algoa Pre-Feasibility Study show that augmentation is required for the Algoa water supply system by 2007, whilst a base assumption is that water demand measures are already increasingly implemented by NMMM. The available yield is determined by the storage facilities that are currently in place. The yield of the Algoa Water Supply System is shown in **Appendix C2**. Once implemented the Reserve will further impact on the available yield of the Algoa system and on the coastal catchments in particular. It was always the intention that water from the Orange River would be available to supply the urban and industrial water requirements of Port Elizabeth and its surrounding areas for many years into the future. Additional transfers could be made in future, but the recent update of the Orange River Yield Balance Study (April 2003), which included the acceptable requirements of other Orange River basin countries, found that this would require further infrastructure development in the Orange River catchment. An increasing volume over time, of up to 41.3 million m^3 by 2025 has been identified for transfers from the Orange River to the NMMM for urban use. This amount has been reserved in the Upper Orange WMA, and has been taken up in the ISP of that WMA. It is planned that the Coega development will initially receive purified effluent from the Fishwater Flats wastewater reclamation works as its primary source. NMMM registered a use of 97 million m^3/a during the recent registration process. Only 2.4 million m^3/a use from Loerie Dam was registered. The possible yield from that dam is however estimated to be between 7 and 10 million m^3/a if operated at the minimum operating level for most of the time. Manganese problems and the inoperational bottom outlet are blamed for the inefficient operation of Loerie Dam. The option of acquiring water use authorisations through trading could offer the Metropolitan area the opportunity to augment its supply. Significant areas infested by invasive alien plants are found within the feeder catchments upstream of dams. This impacts on the availability of water. The development of groundwater from deep aquifers (TMG for example) holds potential but requires further study to determine the yields available.
Strategic approach:	Develop a reconciliation strategy for the Algoa System (see Strategy 13.1). This should include a review of the resources, the Reserve, water requirements as well as the identification and prioritisation of reconciliation interventions relevant to this WMA. A 15-20 years water resource planning strategy must be developed, setting a framework within which more regular feasibility level planning will be

	undertaken, particularly relating to distribution infrastructure. That strategy should also deal with how authorities responsible for water services and DWAF should plan together. For future supply to meet the growing urban requirements of the NMMM, the following reconciliation interventions appear to be favourable and are listed in order of current understanding of priority: ▪ **Water demand management.** (Refer to the *urban water conservation and demand management strategy*). Water demand management was identified as the most viable way of making water available to the NMMM. The NMMM initiated an implementation programme in 1998. It is believed that the metropolitan urban demand can for several years be kept reasonably constant with demand management measures. The savings as a result of demand management are expected to be obtained by the reduction of site leaks, reservoir overflows, unmetered connections and behavioural change of consumers; ▪ **Industrial use of treated effluent.** (Refer to the *Use of treated effluent strategy*). Limited use of treated effluent by industry currently takes place. Infrastructure to deliver treated effluent to the Coega IDZ should be installed in tandem with the development taking place. ▪ **Make full use of existing infrastructure.** By upgrading the bulk supply pipeline, the Churchill/Impofu system could be fully utilised, if uncertainties regarding the hydrology can be cleared; ▪ **Removal of invasive alien plants** holds potential throughout the coastal catchments, both for augmenting yield by clearing upstream of existing storage facilities or to make provision for the Reserve. Working for Water projects should continue. ▪ **Water trading / buying out of irrigation rights.** The trading of existing licences makes better use of available water without further impacting on the yield. By decommissioning irrigation in the Baviaanskloof catchment and reducing losses in the Kouga canal water could become available for urban use. Through registration and verification of existing lawful use, the extent of unused allocations will be determined. Illegal users will also be identified and such use put to an end, bringing water back into the system. (See the *Licensing strategy*); ▪ **Table Mountain Group aquifer.** (Refer to the *Groundwater strategy*). The possibility of a deep TMG aquifer, which stretches up to NMMM, has often been mentioned as a possible future source; ▪ **Further diversion of Orange River water from the Sundays River.** The Orange / Sundays Rivers transfer scheme, along with the upgrading of the Nooitgedacht water treatment works and pipeline is a future supply option for augmentation to the NMMM, but would require infrastructure development in the Orange River basin. The current supply system has spare capacity. The disadvantage is that water of poorer quality needs to undergo additional treatment, which is costly. There is also some resistance by users; ▪ **New surface water schemes**. Guernakop Dam on the Kouga River was identified as the most promising next dam development option; The Department will not give favourable consideration to licence applications for new schemes unless all other reconciliation options, such as water demand management and water re-use have been properly explored, and the proposed scheme compares favourably both with regard cost and environmental impact. Off-channel storage must be considered as an alternative to in-channel storage, particularly where river flow dynamics are important in sustaining the health of ecologically sensitive rivers and estuaries. Consider all social, environmental and economic impacts and costs in the comparison and selection of future augmentation options.
Management actions:	Undertake the Algoa System Reconciliation Strategy Study to be completed before the end of 2005. This study will *inter alia* review and build on the outcome of the Algoa Pre-feasibility Study and will recommend actions for further detailed studies. In the mean time selectively implement the Algoa Pre-feasibility Study recommendations. The following actions are required: 1. Immediately implement Phase 1 of Demand Management as a priority, to achieve an 8 million m^3/a reduction in water use by 2007. Monitor the success of NMMM's WDM re-use programmes and improve knowledge about the programme by liasing with NMMM on a regular basis; 2. Infrastructure to deliver treated effluent to the Coega IDZ should be installed in tandem with the

	development taking place; 3. Urgently revisit the hydrology of the Kromme River to establish if the upgrade of bulk supply infrastructure, in order to enable the full utilisation of the yield of the Churchill/Impofu system by 2008, is feasible; 4. Areas need to be identified by the RO and prioritised for clearing invasive alien plants, so as to make best use of available budgets, to optimise results. Attach alien plant clearing conditions to licences, so as to optimise clearing of private land. Determine comparative costs of clearing invasive alien plants against new surface water schemes in areas where infestation is high. 5. Plan to use operating savings from the Kouga canal and phased-out Baviaanskloof irrigation by 2016; 6. Develop a broad understanding of the Table Mountain Group aquifer system. Couple it to the TMG work being done in other areas of the country and investigate when a detailed study in this ISP-area is necessary; 7. Commission a study to investigate the implications of trading water use authorisations; 8. The proposed changes to the treatment process at the Nooitgedacht WTW should be investigated and optimised through laboratory and pilot plant tests, before further transfers of Orange River water are considered; 9. Discuss the current operation of Churchill, Loerie and Impofu Dams and the Loerie Dam allocation with NMMM and recommend the implementation of operational recommendations from the Algoa Pre-Feasibility Study. Review the allocation from Loerie Dam to NMMM; 10. Reassess the Guernakop Dam option; 11. The impact of climate change on both surface and groundwater needs to be studied.
Responsibility:	D: NWRP is responsible for general planning such as the Reconciliation Strategy. D: Options Analysis is responsible for feasibility analyses of identified options. NMMM is responsible for water demand management, effluent re-use and bulk distribution.
Priority:	1 – Very high.

6	YIELD BALANCE AND RECONCILIATION

6.5	USE OF TREATED EFFLUENT
Management objective:	To address the need for increased use of treated effluent for irrigation, industrial use and possibly domestic use and to reduce the volume of returned waste.
Situation assessment:	Water that could potentially be re-used is being discharged to sea in the NMMM. Treated wastewater has been used in the Port Elizabeth area for a long time, albeit in relatively small quantities. The major wastewater treatment works (WWTWs) in the Tsitsikamma to Coega ISP-area are owned and operated by the Nelson Mandela Metropolitan Municipality. They are the Fishwater Flats, Cape Recife and Driftsands WWTWs in Port Elizabeth, Despatch WWTW and the Kelvin Jones and KwaNobuhle WWTWs in Uitenhage. Approximately 48 million m^3 of treated effluent is discharged annually from the WWTWs in the NMMM area. The WWTWs currently operating in the Tsitsikamma to Coega ISP-area are listed in **Appendix B4**. There is still uncertainty about the implementation date of a new WWTW at Coega. Initially effluent will go to the Fishwater Flats WWTW, via the existing Markman outfall sewer, which has spare capacity. It is however estimated that the Coega Development Zone and Motherwell stages 3 and 4 extensions will ultimately generate 22 million m^3/a of effluent, which will require treatment at the envisaged Coega WWTW. Currently only small quantities of water are reclaimed at most of these WWTWs. A total of 2.3 million m^3 is reclaimed annually according to the Algoa Pre-Feasibility Study from an installed infrastructure capacity to reclaim effluent of 8.7 million m^3/a. Reclaimed effluent is currently used for industrial and irrigation purposes. The current recycled effluent is substantially cheaper than treated water supplied to NMMM. About 60 % of the current reclaimed effluent capacity is at the Fishwater Flats WWTW, with about half of the current reclaimed effluent use from it. The "*Re-use of treated effluent Report*" of the Algoa Pre-Feasibility Study (2001) [(4)] concluded that the quantity of effluent at the Fishwater Flats WWTW makes it possible to treat the effluent to a reasonable standard or blend this with raw water at Nooitgedacht WTW, to be used for domestic use. It may however be expensive and is likely to be (at least initially) resisted by industries and residents, according to a survey that was undertaken as part of the Pre-Feasibility Study. Further information is however required and more detailed studies need to be conducted before any definite recommendations will be forthcoming. NMMM is investigating methods to reduce the salt load in the raw water. The influence of turbidity and the high concentration of faecal coliforms on re-use are also issues to be further investigated in further studies to be initiated. Future use of reclaimed water is likely to be mainly industrial use, although there is already resistance from industries and unwillingness to increase their use of such water. There is not much irrigation within the NMMM boundaries, and this is unlikely to increase. Groundwater recharge with reclaimed water has not been investigated. Water re-use could potentially also be implemented by more local authorities, such as Humansdorp and Jeffreys Bay.
Strategic approach:	This strategy will have a high profile, as its successful implementation could delay the construction of major new water infrastructure for NMMM by several years. A large amount of water is discharged to sea, which could potentially be re-used. This will be a joint strategy with NMMM, and will have to be managed and implemented co-operatively. The role of DWAF is to guide and give direction, mainly to NMMM, but also to empower smaller municipalities to implement this strategy. This will be done through the *Capacity building, public participation and communication Strategy.* Liaise closely with the relevant NMMM officials to identify and initiate targeted additional measuring of water quality variables at several WWTWS. Co-operatively identify and initiate further studies to implement this water augmentation option, since there are still so many uncertainties after the Algoa Pre-Feasibility Study. The development of the Coega IDZ provides an ideal opportunity for much increased re-use.

Management actions:	Facilitate the implementation of the recommendations of the "*Re-use of treated effluent Report*" of the Algoa Pre-Feasibility Study (2001), through co-operative governance. Further to this initiative, the following actions are required: 1. Promote increased water re-use by including it as a license condition for any new licences to be issued for water abstraction or effluent return; 2. Ensure that the WSDPs of relevant smaller local authorities adequately address the need for water re-use, as any further allocations from surface or ground water will be hard to come by. Convey the need for re-use in provincial liaison meetings; 3. Initiate any necessary re-use initiatives and studies for Coega as a priority; 4. Investigate the viability and feasibility of treating effluent to certain standards for industrial use, potable use, groundwater-recharge or irrigation, particularly in the NMMM area; 5. Establish interest groups for the various water uses, and engage them to inform the proposed studies and address the resistance to re-use; 6. Investigate the option to reticulate into the existing distribution network, areas of high growth potential and stressed areas in NMMM; 7. Engage the larger authorities that are discharging effluent to rivers and the sea such as Humansdorp (Seekoei River) and Jeffreys Bay (sea) and induce them to consider effluent re-use as a future augmentation option; 8. Determine the environmental impacts of possible capping of flows (limiting the volume of return flow) in the Seekoei River relating to environmental impacts; 9. Determine the environmental impacts of possible capping of flows in the Swartkops River relating to water quality.
Responsibility:	NMMM and specific local municipalities are responsible.
Priority:	Priority 1 – Very high for NMMM. Priority 3 – Medium for other local authorities. Implement over the medium term.

6 YIELD BALANCE AND RECONCILIATION

6.6 SUPPLY TO LOCAL AUTHORITIES

Management objective:

Through this strategy local authorities will know and understand the limitations to their water supply. IDPs, WSDPs and Water Sector Plans should reflect these opportunities and constraints. Local authorities will work together with the Department to access potential resources and to optimise the use of that water which is already available.

Situation assessment:

Virtually all municipalities outside the NMMM reside under the Cacadu District Municipality, whose IDP [(42)] has been submitted. Certain of the WSDPs have been submitted. However, the detail and information provided varies and is in some cases incomplete.

Future sources of supply are indicated in **Table 6.6 – 1** at the end of this strategy and **Appendix B10**. Supplies to some municipalities are augmented from the existing Kromme River system and to others from the Kouga/Loerie system.

The water situation in the larger towns is as follows:
(Information is also presented in a table following the strategy)

Karoo towns:

Murraysburg obtains water from river boreholes at an acceptable reliability (unknown assurance but no shortages occur). A future water use and availability study is planned.

Steytlerville uses groundwater as its source of supply. Steytlerville developed a new borehole field about 10 years ago in addition to their existing boreholes. It is an expensive scheme where water has to be pumped for about 15 km. They also receive water from their own dams. They experience summer shortages and implement water restrictions. Steytlerville requires additional boreholes and pipelines to avoid summer shortages.

Klipplaat is located just within the ISP-area boundary and receives water from boreholes and the Klipfontein Dam. The yield of the dam is far in excess of the town's urban water use requirements and is generally full. The local authority purchased the dam from SA Railways. Boreholes are used for municipal supply as well but water quality is poor. Water and other basic municipal services are costed as one fixed monthly amount per household at a very low tariff, which includes unlimited water consumption [(5)].

Willowmore uses groundwater (including fountains) as its main supply source. The water transfer pipeline and network of Willowmore is in a very poor state and water cost is high. The town is water stressed in summer and water restrictions are implemented in response. It is an old scheme but the supply problems encountered are due to poor water operational management and maintenance. No metering is done, billing is incorrect and unaccounted-for water use is high.

Towns in the Langkloof

Small towns in the Langkloof such as Misgund (use from dam), Louterwater (Formosa Dam) and Haarlem (Haarlem Dam) have adequate assurances of supply, but often have supply problems, mainly due to poor water management. These towns do not have the technical knowledge to manage their water requirements and systems. Various towns in the Langkloof may require water augmentation, but no formal applications have been received yet. The Joubertina Dam currently supplies water to Louterwater, in addition to irrigation.

The **Krakeel** WUA, which will be created shortly, intends submitting a license application for a new dam in the upper reaches of the Krakeel River for water supply to the town. The dam will also serve to increase the surety of supply to irrigation farmers in and around Krakeel. An application has not yet been submitted because the WUA is still to be created and some information is also required from the District Municipality. The Joubertina Dam also supplies water to Krakeel.

Joubertina gets water from the Joubertina Dam in the Wabooms River at an unknown assurance. It is a small dam, shared with irrigators. Water demand management has not yet been implemented.

	Joubertina has a poorly managed scheme with inadequate storage in its system and future water planning has not been done. There is a need for long-term water planning and implementation of WDM in Joubertina. The possible buying out of irrigation rights by the town is an obvious way to increase availability, as there are a number of willing sellers who are unable to exercise their rights due to erosion and damaged distribution systems. **Uniondale** in the Gouritz WMA recently undertook a study into future water augmentation. They are investigating the buying out of water rights from the Haarlem Dam on the Groot River (tributary of the Kouga River) as a source for augmentation of urban water supply. They also investigated the raising of the Haarlem Dam by 300mm to increase the yield, thereby reducing the buying out of irrigation rights, if needed at all. This will be a 15 km long transfer scheme, draining into the Kamanassie River, which flows past Uniondale on its way to the Kamanassie Dam near Oudtshoorn. Refer to the Gouritz ISP for Uniondale's local planning. **Kareedouw** uses springs and groundwater as its source of supply. Recently water had to be tanked in. They have maintenance problems and have not done long term planning of their water requirements. **Gamtoos valley towns:** **Hankey and Patensie** are supplied from Kouga Dam with good reliability. They only draw from local rivers or storage in a canal section during the annual maintenance on the canal. Further supply is planned to be from Kouga Dam. **Coastal towns:** Coastal areas are growing in terms of holidaymakers and coastal population. **Humansdorp, Jeffreys Bay, St Francis Bay and Cape St Francis** all use groundwater as their primary source of supply. There are regular claims by the coastal towns that they run short of water in the holiday season although they also receive water from the Churchill / Impofu Dams pipeline during these times. The shortages are likely due to high summer peaks or possibly to poor management because they try to minimise use from the Kromme system pipeline due to the higher comparative cost. As a result, they tend to over-abstract from the well fields. This leads to the salination of the well fields through seawater intrusion. A site for a new dam was identified in the Kabeljous River in 1988 as a possible new source of supply for Jeffreys Bay, as well as for irrigation. The buying out of land in the basin makes this option rather expensive. **Oyster Bay** abstracts groundwater for urban use and also obtains water from springs. Boreholes are inadequate to meet seasonal peaks. A preferred option should be to investigate buying out some water rights from the Klippedrift Dam farmers. Alternatively they could obtain a supply from the Kromme River supply system. *The following issues and concerns have been identified:* • There is continued urbanisation in this ISP-area. Water requirements are growing in almost every town, even though populations have become stagnant or are even slightly declining in some areas. Services are being upgraded in many Karoo and coastal towns; • Many towns in this area occasionally run short of water and the DWAF perception is that these situations very often result from poor water management, with Willowmore being a prime example; • An adequate process of co-operative governance is not currently in place; • Switching water use between sectors. Some towns use irrigation allocations for urban use. Due to the lower assurance of supply this affects the yield balance.
Strategic approach:	The approach will be to work with and inform local authorities. Promote up-front liaison and agreement between DWAF and municipalities regarding proposed developments as mentioned in the WSDPs. Also promote awareness at Municipalities of the need to inform government of their plans and to consult with DWAF staff before making recommendations. The WSDPs should preferably more closely conform to the NWRS, ISP and Catchment Plans. They should highlight the current sources of supply and future anticipated sources of supply of the local authorities. WSDPs should also refer to each other where applicable. Future planning should consider applicable social,

	environmental and economic impacts and costs, also at local authority planning level in the IDPs, WSDPs and Water sector Plans. Plan and implement a programme to build capacity at District and Local Municipalities. Clearly communicate to Municipalities the need for Water Services Development Plans to: • More closely conform to the NWRS, ISP and catchment plans; • Highlight the current sources of supply and future anticipated sources of supply of the local authorities; • Refer to each other where applicable and • Address water demand management in sufficient detail. The RO will identify outstanding WSDPs and provide pressure to ensure that they are submitted. Review IDPs, WSDPs and Water sector plans where necessary and propose feedback to the relevant municipalities to ensure that requirements are realistic. IDPs and WSDPs must become the documents that reflect the total municipal water strategies. The WSDPs should include water conservation and demand management measures and effluent re-use measures where appropriate. Encourage municipalities at any available forum, committee or other venues jointly attended by DWAF and local authorities to first pursue alternative augmentations options, such as water demand management, effluent re-use, water trading, eradication of alien plants or groundwater use, in water stressed areas before applying for additional surface water use. Further encourage municipalities to develop local schemes or identify potential local schemes as the next step. Where potential future supply cannot be identified in the WSDPs, further investigations must be identified and implemented by the local authorities. Where capacity building or help by DWAF is required, address this according to the *Capacity building, public participation and communication Strategy (Strategy No 11.3).* An approach and strategy must be developed for each town. The over-abstraction of coastal aquifers must be stopped – address this in the strategy for each coastal town. Address the poor management through liaison and capacity building efforts. Uniondale will attempt to get water from Haarlem Dam through trading of water use authorisations, for a possible future inter-WMA transfer scheme.
Management actions:	1. Update the list of all municipal water sources, requirements, issues and future augmentation plans as contained in this Strategy, **Table 6.6 – 1** at the end of this strategy and **Appendix B10**, once the WSDPs are complete. Advise municipalities what can and can't be done and inform them of options; 2. Improve local water management by informing municipal employees: Market the ISP to them to inform their IDP and WSDP needs. Capacitating of officials in District Municipalities is planned by the EC RO; 3. Ask D: WUE at DWAF head office and the regional WC division to assist municipalities with the development and implementation of WDM strategies as a national priority to overcome the technological barriers many of the local municipalities in the area face; 4. Address the recommendation of the incorporation of informal settlements at Humansdorp and Kareedouw in the Dense Settlements Pilot Project Implementation Programme, to solve the pollution problem according to priority, through the *Water quality management Strategy (Strategy 7.5)*. The local municipality will have to implement the programme and DWAF can lend support to them; 5. An aquifer management plan/s is essential for aquifers supplying the coastal towns to avoid over-abstraction and saline intrusion. Through co-operative governance, aim to improve monitoring, have water management plans compiled and introduce stepped tariffs. Directorate Information Programmes and RO Hydrological information Sub-Directorate must investigate this and compile a strategy to deal with the situation; 6. Ensure that Uniondale *in the Gouritz WMA* considers all augmentation options before reaching their final decision. The RO must reach a decision on the acceptability of the Haarlem Dam yield, and whether the yield must be recalculated, before a decision on any new allocation from the dam will even be considered. Arrange an urgent meeting with Eden District Municipality to discuss the issue. Review Uniondale's WSDP. Arrange a meeting between the DM, Haarlem Irrigation Board, HCC, Uniondale local municipality and DWAF towards resolving the issue; 7. Revisit the allocations to Humansdorp, Jeffreys Bay, St Francis Bay and Cape St Francis from Impofu Dam upon completion of the Kromme River Reserve study.

Responsibility:	The RO must review the WSDPs and follow up with local authorities in cases where submissions are incomplete or have not been submitted. The RO must guide the local authorities with regard to development of local schemes, implementation of water demand management and implementing investigations where future sources of supply are uncertain.
Priority:	1 – Very high.

Table 6.6 - 1: Local authorities water supply situation assessment

Town/s	Water consumption	Assurance of water supply/ reliability of the water source	Current supply source	Problems with current supply	Need to augment existing supply	Comment on WDM initiatives and success	Planned water schemes / studies
Cape St Francis/ St Francis Bay		St Francis Bay assurance as per Algoa System with poor quality water. Cape St Francis has good assurance with good quality water.	Boreholes, springs (Mosterds Hoek and Sterkfontein) and Algoa System (Churchill Dam) for St Francis Bay	Demand peaks are seasonal with the boreholes being unable to supply fully in peak periods. Over-abstraction of groundwater to minimise use of Algoa System water results in seawater intrusion into the well field.	Yes	December water restrictions coinciding with peak holiday period.	Increase supply from Algoa System.
Oyster Bay	0,24 x 10^6 m^3/a	Inadequate reliability of boreholes to meet seasonal demand.	Boreholes, springs.	Demand peaks are seasonal with the boreholes being unable to supply fully in peak periods	Yes	December water restrictions coinciding with peak holiday period.	Supply water from Algoa System.
Haarlem	0,15 x 10^6 m^3/a	Good	Haarlem Dam	Supply problems due to poor water management. Lack of technical expertise.	No	No	
Hankey	0,65 x 10^6 m^3/a Hankey and Patensie have a combined allocation of 0,5 x 10^6 m^3/a from the Gamtoos Government Scheme.	Good	Kouga Dam (primary source), Klein River, Algoa Water System. Water is stored in a canal section during the canal maintenance period.	Yes. Water shortage can occur when the Gamtoos Irrigation Board cleans the canal. Siphon from canal system has operational problems. There is also a degeneration of the material of the pipe of the siphon system.	No	General water restrictions during maintenance of Gamtoos irrigation canal.	No
Humansdorp/ Kruis River	0,18 x 10^6 m^3/a	Good	Boreholes. Three springs connected to an earth storage dam and the Algoa Water System (Churchill Dam). A nearby farm dam, also fed by a spring, supplies the town.	Demand peaks are seasonal. All-year intermittent draw off of water from Algoa System when local system unable to cope. Over-abstractions of groundwater to minimise use of Algoa System water results in sea water intrusion into the well field.	No	Year round water demand management in place to minimise dependency on Algoa Water System. No initiatives for installation of low water consumption fixtures in new developments.	K80/K90 Catchment Management Plan Study (to be initiated in 2003) by DWAF.
Jeffreys Bay	Water consumption for the combined areas of Jeffreys Bay and Ashton Bay was 0,83 x 10^6 m^3/a.	Reasonable to good quality water.	9 boreholes and Algoa System (Churchill Dam).	Demand peaks are seasonal. Over-abstraction of groundwater to minimise use of Algoa System water results in seawater intrusion into the well field.	Possibly during holiday season.	December water restrictions - coinciding with peak holiday period.	No
Joubertina	0,56 x 10^6 m^3/a	Unknown reliability or assurance of supply.	Joubertina Dam, boreholes (monitored by DWAF).	No.	Yes	No	A need for long term municipal water planning exists.
Kareedouw	0,25 x 10^6 m^3/a	Unknown reliability. Recent tanking in of water, possibly due to poor maintenance management.	Boreholes and springs (Tsitsikamma Mountains)	Yes: water quality.	Possible low assurance, unknown if there is a need to augment.		Additional boreholes when required. A need for long term municipal water planning exists.
Klipplaat	0,24 x 10^6 m^3/a	Adequate to well beyond 2010.	Klipfontein Dam (1,82 million m^3 off channel storage); five boreholes (primary source).	Yes. Water has high TDS. Supply system does not have disaster management (e.g. fire capabilities). A shortage of borehole pumps also exists.	No.	No. Cost of water included in fixed monthly basic municipal services charge (R45 in 1999) with unlimited household water use.	Water sector plan to be prepared by DWAF.
Murraysburg		Good	River boreholes	None at present. Future residential development water requirements are unknown.	No	System of water meters at reservoirs and at end users installed to monitor water losses.	Future water use and availability study planned.

Town/s	Water consumption	Assurance of water supply/ reliability of the water source	Current supply source	Problems with current supply	Need to augment existing supply	Comment on WDM initiatives and success	Planned water schemes / studies
Patensie	0,29 x 10^6 m^3/a. Hankey and Patensie have a combined allocation of 0,5 x 10^6 m^3/a from the Gamtoos Government Scheme.	Good	Kouga Dam (primary source). Algoa Water system. Water is stored in a canal section during the canal maintenance period.	Water shortage could occur when the Gamtoos Irrigation Board cleans the canal.	No	No restrictions were in place during 2002. Restrictions were, however, in place during the 1988 drought.	No
Port Elizabeth	72.5 x 10^6 m^3/a of which 12 Mm^3/a is from the Orange River Scheme. Port Elizabeth has a 23 x 10^6 m^3/a allocation from the Gamtoos Government Water Scheme	Algoa System has a total assured supply of 105 Mm^3/a, 76 Mm^3/a from local sources, 25,6 Mm^3/a from Orange-Sundays River Transfer, 1.2 Mm^3/a from recycled sewage effluent. (1:50 year), Algoa water requirement of 69 Mm^3/a (1998). The annual water demand from the Algoa System is expected to be about 150 Mm^3/a in 2025, with the Coega industrial development zone accounting for 15 Mm^3/a. 2025 allocation of water from the Orange/Sundays River Supply System is 41 Mm^3/a.	Churchill Dam, Impofu Dam, Bulk River Dam, Sand River Dam, Van Stadens Dams, Algoa Water System. Approximately 1.2 Mm^3/a of sewage was recycled for industrial use. The Coega Industrial Development Zone will initially be supplied with water from effluent re-use from the Fishwater Flats Treatment Works as its primary source and later extended to use of water from the Sundays River.	Water treatment capacity is at present limited to 25,6 Mm^3/a. The NMMM requires augmentation of supply in about 2007, which depends on a number of variables.	Yes (1) Water demand management (2) Further effluent re-use (3) Full use of water from the Churchill/Impofu Dams (4) Further use from Kouga Dam – savings of canal losses and Baviaanskloof irrigation (5) From Orange/ Sundays River Scheme together with the upgrading of the Nooitgedacht Treatment Works. Disadvantage of a high dissolved solid content, which will negatively impact on water quality unless desalinated.	Due to the effects of the droughts of the 1980s, severe water restrictions were implemented. This resulted in a relatively low level of "luxury" water use in the urban sector. Little impact with respect to reduced water use was evident in both the agricultural and industrial sectors. This can be attributed to the relatively low level of non-essential water being consumed by these two sectors.	• Water demand management; • Industrial re-use of effluent; • Full use of Kromme River water • Improved supply system operational aspects – Kouga Dam; • Water trading / buying out irrigation rights; • Further diversion of Orange River water from the Sundays River; • Table Mountain Group aquifer; • Guemakop Dam on the Kouga River.
Steytlerville	0,13 x 10^6 m^3/a	Low reliability.	Boreholes - two north of town and three south of town and local dams.	Yes. Summer shortage.	Yes	Water restrictions (e.g. watering of gardens restricted). High cost of water restricts wastage and use.	Additional boreholes, pipelines.
Storms River	0,02 x 10^6 m^3/a	Good	Boreholes; local river.	No	No	No	No
Uitenhage/ Despatch	Uitenhage Groendal Dam 6 x 10^6 m^3/a; Springs 2 x 10^6 m^3/a; Algoa System 2,3 x 10^6 m^3/a; Despatch 1,4 x 10^6 m^3/a.	Good	Springs, Groendal Dam (9% ownership share). Algoa Water System: Western areas dams supply KwaNobuhle, Orange River Scheme supplies Uitenhage.	No	Yes, in future	Restrictions of 1989 showed up to 25% reduction in monthly consumption. No restrictions in place since Orange River Water Scheme connection.	Refer Algoa Pre-feasibility Study. Current study of integration of Uitenhage and KwaNobuhle water supplies.
Van Stadens River Mouth		Good	Algoa Water System				
Willowmore	0,25 x 10^6 m^3/a 80 erven with shared standpipes, 400 erven with single tap. No waterborne sewerage.	Good	Boreholes and fountains	Yes. Summer shortage. High UAW water use. Regular breaks in pipeline from aquifer to purification works (5 km length of pipeline).	No	Water restrictions (e.g. watering of gardens restricted). Cost of water at R1,28 m^3/a (1999).	Additional boreholes when required.

NOTE: The Algoa System supplies potable water to almost 1 million people and a large number of industries. The system components are:
(i) Gamtoos Government Water Scheme;
(ii) Churchill Water Supply Scheme;
(iii) Groendal Dam;
(iv) Sand River Dam; and Bulk River Dam;
(v) The Orange / Sundays River Supply System.

CHAPTER 7 –WATER RESOURCES PROTECTION STRATEGIES

NEED FOR WATER RESOURCES PROTECTION STRATEGIES

The *Water resources protection Main Strategy* addresses the need to achieve the protection of water resources to ensure their continuing availability for human use by leaving enough water of appropriate quality in rivers and streams to maintain their ecological functioning, which will be achieved by:

- Classification of freshwater bodies and determination of their human and environmental Reserves;
- Setting resource quality objectives for freshwater bodies;
- Addressing water quality management, pollution control and sanitation and
- Addressing solid waste management.

Water required for socio-economic growth must therefore be balanced with the availability of water that is fit for use by all users, including the protection of the aquatic ecosystem. The NWRS defines two complementary approaches for the protection of water resources. **Resource Directed Measures** focus on the character and condition of the in-stream and riparian habitat, whilst **Source Directed Controls** focus on the control of water use at the point of potential impact, through conditions attached to water use authorisations.

These strategies will therefore aim to achieve adequate protection for surface and groundwater resources, in terms of the desired states of these resources or components thereof to reach a balance between protection and sustainable use.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

7.1 Reserve and resource quality objectives;
7.2 Wetlands and
7.3 Water quality management.

Figure 7.1: Kromme wetlands rehabilitation

7 WATER RESOURCES PROTECTION

7.1 RESERVE AND RESOURCE QUALITY OBJECTIVES

Management objective:

Develop the regional strategy to determine and implement management classes, Reserve requirements and resource quality objectives for surface freshwater bodies and groundwater, within the requirements of the national framework. This will be done according to the prescribed methods by using applicable levels of determination.

Situation assessment:

The RDM Directorate is currently undertaking a comprehensive Reserve determination to support compulsory licensing for the Kromme River and estuary and a Rapid determination for the Seekoei/Swart Rivers and estuary. The RO will lend support to the study.

No ecological releases according to Reserve requirements have so far been determined for any dam in this ISP-area. The dams also generally do not have adequately sized outlet structures to release required flood releases for the ecology.

There are pending license applications in many of the ISP catchments, which require Reserves to be in place before they can be evaluated. Reserve determinations are required on significantly modified rivers to issue licenses. There is a lack of groundwater monitoring data to support groundwater Reserve determinations in this ISP-area. Licences for groundwater abstraction cannot be processed without a groundwater Reserve determination.

The status of Reserve determinations in the various sub-areas is as follows:

a. Groot sub-area

No Reserve, better than a desktop estimation, has been determined for the Groot River tributary of the Gamtoos River. The Reserve determination has a low priority.

b. Kouga-Gamtoos sub-area

No Reserves better than desktop estimations have been determined in this catchment yet and no releases for the environment are made from the Kouga Dam or its main canal. The integrity of the radial gates at the dam is uncertain and the other outlets are small. This will affect the ability to make flood releases. According to the Desktop evaluation, the entire river reaches of both the Kouga and Baviaanskloof Rivers exhibit a Desired Ecological Management Class of either Class A or Class B, which indicate high ecological sensitivity and importance. Much of this area falls within conservation areas, and any future human manipulation of these reaches would require very strong motivation.

The Gamtoos Estuary is highly rated as a system of ecological and economic importance [(2)]. The maintenance of this estuary in adequate health requires the Gamtoos River to carry water of sufficient quantity and adequate quality. These needs have not been adequately determined.

c. Kromme-Seekoei sub-area

Estuaries in this sub-area are highly rated in terms of ecological protection. Reserve determination for individual rivers in this sub-area is as follows:

i. Kromme River

The determination of a comprehensive Reserve for the Kromme River and estuary, which is underway, is regarded as essential, because the catchment is stressed and decisions are required to deal with license applications.

Releases from Impofu Dam

2 Million m³ is annually released for environmental needs from Impofu Dam. Certain irrigators below the Impofu Dam are constantly in need of water and there is demand for releases from the Impofu Dam for estuarine health. Two farmers downstream of Impofu Dam could use all the environmental releases released from the Dam whenever such releases take place, which could have a detrimental affect on the estuary. The farmers have registered an established use during the recent water use process. The environmental releases from Impofu Dam are not

effective because the volumes of the releases are too small due to too small outlet structures and release mechanisms for effecting larger releases, and because of the interception of releases by farmers. The current system cannot effectively serve the environmental water requirements release pattern. Releases are currently required to balance the salinity levels in the lower Kromme River.

Kromme estuary
The Kromme River upper estuary is becoming hyper-saline and is not functioning as an estuary any more. It is speculated that the bridge over the Kromme estuary has affected the functioning of the estuary. A Reserve determination of the Kromme estuary, which is underway, is required because:

- The river is already stressed and the estuary is in a poor state;
- The Reserve determination need is partly driven by estuarine and wetlands needs;
- It needs to be determined if current allocations should be cut (no new license applications have been received).

ii. Seekoei / Swart Rivers

Seekoei River
The determination of a comprehensive Reserve for the Seekoei River, which is underway, is essential, because the catchment is stressed and decisions are required to deal with license applications. Releases of normal flow, as defined in the previous Water Act, 1956 [(39)] through farm dams, are not taking place as required. This also has an effect on the ecology of the river while provision for the ecological Reserve is not in place.

Swart River
An application to abstract water for irrigation from the Swart River in terms of Section 33 of the NWA has been submitted. Another application has been submitted for the construction of a new dam on a tributary of the Swart River. The construction of a new dam on the Swart River will not be allowed before the current Reserve determination is complete. Releases of normal flow, as defined in the previous Water Act, 1956, through farm dams, are not taking place as required. This also has an effect on the ecology of the river while provision for the ecological Reserve is not in place.

A Reserve determination of the Swart River, which is underway, is essential because:

- The river is already stressed;
- The Reserve determination need is driven by estuarine needs and new applications that must be considered;
- There is pressure from DEAET to determine a Reserve.

Seekoei / Swart Estuary
The Seekoei and Swart Rivers have a combined estuary. The estuary is in a very poor state. Since the Seekoei River has many farm dams, many illegal, water quality problems are encountered during the dry-season low flows. The estuary is permanently closed but seawater moves into the estuary when overtopping occurs during spring tide with resultant hyper-saline conditions. A causeway was built over the Seekoei estuary and as a result the sea outlet is now much smaller. The Seekoei estuary falls in a DEAET nature reserve. DEAET has complained about the riverine and estuarine water quality as well as inadequate releases made for the estuary.

A Reserve determination of the Seekoei / Swart estuary is underway because:

- The river is already stressed;
- The Reserve determination need is driven by estuarine needs and new applications that must be considered;
- The application for use by the Kruisfontein resource-poor farmers;
- There is pressure from DEAET to determine a Reserve.

iii. Kabeljous River:
Reserve determination is not a high priority for the Kabeljous River. There are no new applications for licenses and there is no pressure from DEAET to determine a Reserve. The

	large estuary is naturally closed for approximately 90 % of the time. **d. Tsitsikamma Coast sub-area** Reserves have to date been determined for the Bobbejaans, Witteklip, Sanddrift, Kruis, Groot and Tsitsikamma Rivers at varying levels of confidence/determinations, for licensing purposes. An application to undertake an Intermediate Reserve determination on the Tsitsikamma River and estuary and Rapid Reserve determinations on the Groot River and its estuary, Sanddrift River and Klippedrift River and its estuary was recently submitted to the RDM office. These determinations have been requested in reaction to the number of applications received for processing by them. The Tsitsikamma Coast National Park falls within the area. **e. Algoa Coast sub-area** **i. Swartkops River** • **Intermediate Reserve.** An Intermediate Reserve had been completed for the Swartkops River in 2001, and resource quality objectives have been set [(27)]. The reports have not yet been signed off and the D: RDM Office has not yet approved the Reserve determination; • **Classification.** The Reserve determination found that the KwaZunga River is generally in a good condition, especially in the higher reaches, but river conditions deteriorate downstream. Siltation of the "hippo-holes" due to afforestation and alien plants in the Elands River is a problem. Some areas such as the Chatty River are in a poor state. The estuary received a preliminary C classification. Methods for classification changed *after* the Reserve determination was done; • **Environmental releases from dams.** The determined Reserve recommends environmental releases from the Groendal, Bulk River and Sand River Dams. Firstly, the catchment dams do not have the required outlet capacities (e.g. outlet valve sizes constraints) to reach the peak flow rates of up to 16 m^3/s required for the intermediate flows. Major structural alterations to the dams would be required to provide sufficient capacity. Secondly, the very extensive alien invasive problem in the river section must be removed before any such releases can be implemented and can be effective for ecological protection, else the alien plants would use such water to enhance their growth; • **Estuary.** The Swartkops estuary has enough fresh water inflow, but water quality is unacceptably poor and microbial pollution is a concern. There have been large modifications to the Swartkops River estuary such as causeways and bridges. The specifications and methods used to determine the estuarine component of the Reserve were not up to the current standard, because the guidelines were not available then. It is not regarded as necessary to update the EFR because the funds could generate more value at alternate determinations. **ii. Sand River** A vegetation survey was done in the Sand River after the installation of gauging stations. **iii. Coega River** A preliminary Reserve determination in the Coega River was done at rapid level and approved by DWAF, to be able to process licence applications for the Coega IDZ. Licenses for impeding and diverting and also for altering the bed, banks, course or characteristics of the watercourse will need to be issued. Environmental impact assessments have also been done. **iv. Uitenhage aquifer** A Reserve was determined in two areas of the Uitenhage aquifer and signed off by the DG [(5)].
Strategic approach:	Reserve determinations for rivers and estuaries will continue to be done on an ad hoc basis as the need arises, depending on the availability of resources and information. Determinations must be done according to the latest, existing RDM methodologies. Follow the development of Reserve methodologies for wetlands and groundwater, and ensure the timeous identification and initiation of such Reserve studies. Operational releases at dams must be matched with releases for ecological requirements. Investigate the implementation of this procedure at dams affected by the Swartkops River Reserve, and ensure their practical implementation. Develop appropriate dam operating rules to achieve the aims of such

	Reserves. The issue of outlet structures at dams that cannot cope with required flood releases is a serious issue. The sizes of floods to be released must however first be determined at accepted high confidence before huge costs can be allocated to alter such outlet structures. Dams in the Swartkops basin, Kouga Dam and Impofu Dam are potentially affected dams.
Management actions:	• Request the allocation of additional resources and funding for Reserve determinations in the Eastern Cape RO; • Develop the river classification at regional level, when a classification framework becomes available; • Review releases from Churchill Dam in terms of the Comprehensive Reserve requirements to serve downstream licensed users, once the Reserve has been determined. • Review the licensing conflict between environmental needs and farmers below Impofu Dam in terms of Comprehensive Reserve requirements once available; • Eradicate alien invasives to ensure adequate low flows in the Elands River, towards the operationalising of the Swartkops Reserve. Revisit the Swartkops Reserve recommendations at a later stage.
Responsibility:	The RO, in consultation with the D: RDM, is responsible for implementing this strategy.
Priority:	Priority 1: Very high - Kromme, Seekoei/Swart and Tsitsikamma Rivers and Groot River (Tsitsikamma Coast) and estuaries, and Klippedrift River; Priority 2: High - Sanddrift, Kouga and Gamtoos Rivers; Priority 3: Medium – Coega and Van Stadens Rivers; Priority 4: Low - Swartkops, Groot (tributary of Gamtoos), Baviaanskloof, Kabeljous, Bobbejaans, Witteklip, Kruis, Lotterings, Storms, Kleinbosch and Maitland Rivers. This is a continuous programme that requires immediate and ongoing attention.

7	WATER RESOURCES PROTECTION

7.2	WETLANDS
Management objective:	To formulate and implement a long term management plan for wetlands conservation.
Situation assessment:	Not enough is known about the extent as well as the current state of affairs of wetlands in the Eastern Cape. Wetlands in the Kromme/Seekoei and Tsitsikamma Coast sub-areas are highly rated and should be protected. An Eastern Cape Wetlands Forum was established and it was decided to map wetlands and undertake preliminary assessments of their condition. The Forum acts as a think tank and co-ordinating body for the development of wetland management research and education in the Eastern Cape. A study is underway, that will *inter alia* firstly map the wetlands in the upper catchments of NMMM's water resource feeding areas. DWAF is spending close to R700 000 on the project to identify, map and assess the condition of the wetlands in the catchment areas of NMMM (and the Buffalo City) Metropole. A GIS-based inventory of wetlands is being compiled for the Eastern Cape from 1: 50 000 maps according to priority. Identification of wetlands, data capture as well as some ground-truthing and very superficial assessment of requirements is currently being done. This will be followed by preliminary assessment of the wetlands and later more intensive studies and rehabilitation. It is also intended to educate local communities and farmers, under guidance of the Wetlands Forum, to create jobs through labour intensive wetlands rehabilitation. The Eastern Cape wetland inventory study is one of the most important steps towards wetlands conservation. Major wetland rehabilitation projects are underway in the Kromme and Seekoei Rivers. Monitoring of wetlands will also be done under the guidance of the EC Wetlands forum elsewhere in the Eastern Cape. R3 million is being spent on projects as part of the *Mondi Wetlands* programme and *Working for Wetlands* programme. A major wetlands rehabilitation project, the *Kromme wetland rehabilitation project* is underway in the Kromme River, situated in the Churchill Dam catchment. Various studies have previously been done on the wetland. The current project is aimed at conservation of the Kromme River wetland by mitigatory construction measures for head-cuts and the eradication of alien plants, mainly wattles. *Working for Water* is undertaking the project with funding from *Working for Wetlands*. Gabions were initially used to protect head-cuts but concrete structures are now erected through labour intensive methods. Rehabilitation will continue for several years. A wetlands rehabilitation project is underway in the Seekoei River. Two structures are currently being constructed. Working for Water is funding a project to identify, map and assess the condition of the wetlands in the Baviaanskloof River system. The above-mentioned projects provide important information and guidance to *Working for Wetlands* who concentrate on the rehabilitation of the wetlands
Strategic approach:	The Eastern Cape Wetlands inventory should be completed to be able to identify further studies or projects. Contribute towards the completion of the inventory and the current rehabilitation projects. Continue to build on the excellent co-operation that has been initiated and established between DWAF and a diverse range of organisations, towards the common goal of protecting wetlands. Stay in touch with all the ongoing initiatives.
Management actions:	1. Complete the Eastern Cape GIS-based inventory of wetlands; 2. Identification and undertaking of further phases of the Eastern Cape Wetlands Inventory study; 3. Do improved-confidence studies of the ecological importance and sensitivity of wetlands in the Eastern Cape following completion of the Eastern Cape Wetlands Inventory and identify wetlands within the ISP-area that require Reserve determinations; 4. Co-operate with the Mondi Wetlands Project to develop education and public relations programmes and with Natal University regarding educational modules; 5. Involvement in co-operative governance issues:

	• Assist with the capacitation and training of young scientists from previously disadvantaged backgrounds in wetland work and public relations research; • Liaise with Working for Wetlands, DEAT nationally and provincially and the International Ramsar Convention on Wetlands regarding rehabilitation strategies; • Liaise with Rhodes University's Geography Department, NMMM and the Gamtoos Irrigation Board regarding implementation of the wetlands projects; • Assist with the development and maintenance of the Eastern Cape Wetlands Forum; • Liaise with the wetlands mapping project being done around Queenstown on a WRC groundwater project.
Responsibility:	RO, in consultation with the RDM Directorate and the Eastern Cape Wetlands Forum.
Priority:	Priority 1 – Very high.

7	WATER RESOURCES PROTECTION

7.3	WATER QUALITY MANAGEMENT
Management objective:	To improve management and control of point source pollution, diffuse pollution and spills, including solid and toxic waste sites and prevention of contamination.
Situation assessment:	*Issues and concerns in the ISP-area are*: Pollution of surface water, groundwater, estuaries and wetlands in the ISP-area is a concern; • The desktop level quality classification system for Eastern Cape rivers is under development, broadly focussed on the Water Quality Guideline Document; • It is unknown which WWTW have adequate contingency plans to deal with power outages and spills; • There is no known groundwater contamination in the area. Diffuse pollution from settlements on groundwater in various catchments is however of some concern; • Diffuse pollution from settlements in close proximity to rivers (contamination of the Chatty River is such an example) is of concern; • There is no serious problem with on-site sanitation in the area; • WWTWs generally comply with standards. Specific issues and concerns were: **a. Kouga-Gamtoos sub-area** • Negative impacts on the river quality due to agricultural activities. **b. Kromme-Seekoei sub-area** • The Humansdorp solid waste site impacts on groundwater due to poor management; • Contamination due to spillages from industries in Kareedouw; • Unacceptable water quality impacts in the Kromme River caused by stone mining operations; • Urgent need for a regional solid waste site; • Uncertainty if the handling of sludge and backwash water at Churchill Dam is still a problem; • High organic loads due to inadequate pre-treatment at the dairy farm and abattoir in Humansdorp. **c. Tsitsikamma Coast sub-area** • Need to protect the relatively pristine rivers and estuaries; • Insufficient effluent treatment and disposal minor spillages, and resultant microbial point-source pollution; • Occurrence of accidental petroleum pollution incidents; • Need for Pollution Incident Management Plans in sensitive environmental areas. **d. Algoa Coast sub-area** **Van Stadens River** • Management of effluent is required to the special effluent standard. **Swartkops River** • There is some concern about the pollution to the Swartkops alluvial aquifer from upstream industrial oxidation ponds. However there is uncertainty about the interaction between surface water and groundwater in the middle and lower reaches of the Swartkops River. This will be addressed in the **Groundwater strategy**; • Water quality objectives have been set according to the Water Quality Framework Policy; • Chemical contamination of surface and groundwater by industrial activity effluent return, spillages and urban storm water runoff; • Eutrophication and sensitivity of the Swartkops River to contamination; • Diffuse-source pollution of surface and groundwater by informal settlements; • Minor impact of sea effluent-outlets on bathing areas; • Water quality impacts of mining activities in the river;

	• Uncertainty about the inclusion of tidal marches in conservation planning; • Accidental spillages at waste sites; • Need for a consolidated Water Quality Management Plan for the Swartkops River. **Coega River** • Diffuse groundwater contamination from piggeries and bricks manufacturing; • Adequate effluent disposal planning for the Coega IDZ.
Strategic approach:	Implement water quality management actions in accordance with best management practice as follow: 1. Complete and distribute the desktop level water quality assessment documentation; 2. Manage compliance to pollution-related General Authorisations and review such authorisations and terms of actual management measures required; 3. Encourage WfW, along with municipalities, to put together a business plan to address eradication of waterweeds in the EC Province under the Invasive alien plant control strategy; 4. Keep minor point-source pollution under control with regular visits; 5. More attentively monitor storm water discharges and spillages from problem industries in co-operation with municipalities; 6. Solve unacceptable impacts caused by mining operations in rivers in co-operation with the Department of Mines; 7. Hold discussions with polluters in sensitive catchments to convey the importance of curtailing pollution; 8. Implement discharge charges (polluter pays), as recommended in the draft National Water Quality Framework policy, once it has been approved; 9. Through co-operative governance with local authorities, build capacity to ensure that operators of WWTWs develop responsibilities and procedures for emergency control of spillages, power failure and mechanical breakdown; 10. Identify and address diffuse pollution from informal settlements through WUAs and the Dense Settlements strategy; 11. Ensure that Pollution Incident Management Plans in environmentally sensitive areas are operational and that all parties know what their responsibilities are; 12. Monitor the effectivity of oxidation ponds at the various municipalities at regular intervals; 13. Control diffuse pollution from intensive agricultural business ventures with the Department of Agriculture through co-operative governance; 14. Get buy-in from local authorities (who are responsible for waste management) on solid waste site strategies and implement the strategy and monitoring along with them; 15. Control site-specific measures for solid waste by setting appropriate pollution-control conditions in new licenses issued; 16. Through co-operative governance with local authorities, implement the Department's Sanitation Policy and monitor it; 17. Encourage district and local authorities to further develop and enforce bylaws, draft regulations et cetera to systematically deal with water quality problems with the long-term view of improving the water quality and riverine environments.
Management actions:	The required actions to address specific water quality management issues and concerns are as follows: **a. Kouga-Gamtoos sub-area** • Address water quality impacts of irrigations through dialogue with the Gamtoos Irrigation Board. **b. Kromme-Seekoei sub-area** • DWAF must put pressure on the Kouga local municipality to establish a regional solid waste site; • Recommend pre-treatment at polluting Humansdorp industries and co-operatively solve with the local municipality. **c. Algoa Coast sub-area** **i. Swartkops River** • DWAF Head office D: WDD appointed consultants to study the water hyacinth problem in the Swartkops River; • Study the recommendations of the Swartkops River study. Use it as basis for a

	Swartkops River Water Quality Management Plan and add additional actions required; • Investigate the adequacy of pollution control mechanisms of industries situated in the Swartkops catchment; • Drastic steps should be taken against serious polluters in the Swartkops River as required; • Implementation of the Dense Settlements Programme for these informal settlements in the Swartkops River catchment has been recommended along with other areas. **ii. Coega River** • The Coega Development Corporation (IDZ implementers) is developing a groundwater-monitoring programme; • Study the recommendations of the Coega due-diligence report regarding sea effluent outlets, once published, and issue licenses with revised conditions if necessary.
Responsibility:	The RO is responsible for developing this regional strategy, assisted by D: WD&D.
Priority:	1 – Very high. This is an ongoing strategy.

CHAPTER 8 –WATER USE MANAGEMENT STRATEGIES

NEED FOR WATER USE MANAGEMENT STRATEGIES

Chapter 4 of the NWA describes the provisions by which water use may be progressively adjusted to achieve the Act's principle objectives of equity of access to water, and sustainable and efficient use of water. Many of the Act's sustainability and efficiency related measures would be applied through conditions of use imposed when authorisations to use water are granted. Formal water use authorisations will also facilitate administrative control of water use by water management institutions, and will form the basis upon which charges for water use may be made, and provide for the collection of water-related data and information.

Until compulsory licensing is introduced, the existing water use control measures need to be strategically implemented to provide a means of reducing the number of authorisations that require processing under the existing arrangement. The protection of water resource must not be compromised through the modification of existing controls.

The *Water use management Main Strategy* is required to address:

- ⇨ Management of Schedule 1 (basic) water use;
- ⇨ Management of water use in river basins shared with other countries;
- ⇨ Usage of general authorisations to manage water use;
- ⇨ Verification of the legality of existing water use;
- ⇨ Processing and issuing of new water use authorisations;
- ⇨ Control of invasive alien plants and weeds and
- ⇨ Implementation of pricing for water use.

A strategy for Schedule 1 use was not developed, as related management issues were regarded as having a low priority in this ISP-area.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

8.1 General authorisations;
8.2 Verification of existing lawful use;
8.3 Licensing;
8.4 Invasive alien plant control;
8.5 Pricing.

8 WATER USE MANAGEMENT

8.1 GENERAL AUTHORISATIONS

Management objective:	To ensure that general authorisations are correctly introduced and updated in the required geographical areas, to allow lower-impact water use and discharge to continue whilst using the scarce resources in DWAF more effectively as a result of the reduction in administration.
Situation assessment:	Current General Authorisations (GAs) are listed in **Appendix B5**. General authorisations as published in terms of Section 39 of the NWA have stipulated the following: • The entire ISP-area, except for the Groot sub-area, has been excluded from GAs for surface water abstraction; • No areas have been excluded from GAs for the storage of water storage of water; • The Algoa sub-area (M primary drainage region) includes a Subterranean Government Water Control Area for groundwater abstraction, in terms of the previous Water Act, 1956. It is also classified for irrigation with waste and for the disposal of waste; • Groundwater abstraction zones have been declared for many quaternaries throughout the ISP-area in all the sub-areas, varying from no abstraction to 750 m^3 of allowable abstraction per hectare/a respectively. • GAs apply for discharges to water resources for the whole ISP-area; • The Van Stadens River is the only water resource to which a special limit effluent standard applies; • There are no RAMSAR listed wetlands in the ISP-area. Control and management of river channel modification is time-consuming as no such general authorisations are available. Existing GAs are currently under review and GAs for other uses are being compiled.
Strategic approach:	General authorisations are generally in place but the need for some changes or refinements have been identified. The more urgent identified changes to the GAs must be evaluated and motivated to enable changes to the GAs to be made.
Management actions:	1. Introduce area specific GAs, where water use limits are determined by availability of water and degree of river modification; 2. Implement GAs for river channel modification; 3. DWAF staff must motivate any identified requirements for changes to the general authorisations; 4. Review the GAs every two years.
Responsibility:	The RO is responsible for developing this strategy in consultation with the relevant head office Directorate.
Priority:	4 – Low.

8	WATER USE MANAGEMENT

8.2	VERIFICATION OF EXISTING LAWFUL USE
Management objective:	This strategy is necessary as an essential preliminary step towards compulsory licensing to improve the knowledge about water use and enable water pricing to be implemented.
Situation assessment:	**a. Groot sub-area** There are concerns regarding the actual impact of impoundments and flood diversions, including the irrigation of veld, from the Groot River above Beervlei Dam. Uncertainty exists regarding the extent of groundwater use due to poor record keeping. **b. Kromme-Seekoei sub-area** NMMM is concerned about irrigation water abstracted directly out of Impofu Dam. Uncertainty exists about the extent of irrigation use from the Kromme River. Illegal use in the Seekoei River needs to be dealt with immediately. **c. Tsitsikamma Coast sub-area** There is conflict amongst farmers relating to the construction of the Anderson dam on a Tsitsikamma River tributary. The High Court and Water Tribunal cases regarding Anderson's illegal dam is pending. There is also a need to determine the Reserve of the Klippedrift River to reach a decision on the existing large illegal dam on the river.
Strategic approach:	This important activity forms an integral part of the compulsory licensing process. It is however very time consuming and requires excellent knowledge of the previous Water Act, and the legal and administrative procedures relating to licensing, as well as many years of relevant experience. Verification is also dependent upon the availability of information relating to a specific water use. This activity will have to be conducted as a priority within the constraints posed by the availability of resources – in this case mainly being skilled people and information. The initial focus should be on building resources, i.e. ensuring that information is available and people are recruited and capacitated to undertake the verification and subsequent actions. The serious situation of illegal use in the Seekoei River must be dealt with as a matter of urgency, as it causes serious stress in the catchment, conflict amongst users and very negatively impacts on river and estuarine health. An approach to the situation is recommended in the *Licensing strategy (No. 8.3)*.
Management actions:	Implement the regional verification of registered water use, verification of the status of illegal dams (regarding impoundment), abstraction and afforestation, determination of existing lawful use and procedure for dealing with unauthorised water use according to the policy being developed by D: WU as follows: • Immediately verify and deal with illegal use in the Seekoei River catchment, according to management actions as recommended in the *Licensing strategy*; • Arrange training for appropriate Regional Office officials upon completion of the procedures being developed; • Encourage further registration of use and complete the population of the WARMS database with water user registration information; • Improve knowledge of impoundments, farms dams, diversion works, groundwater use and irrigation, SFRAs and domestic and industrial use through the registration process, after such uses have been registered; • Audit the WARMS data and use appropriate remote sensing data, maps, aerial photography or any other relevant information in the audit and do random or targeted field check verifications according to available resources; • Improve knowledge of the assurance of supply of registered water use; • Use the Departmental pro forma letters to deal with under, over or no registration, based on the administrative process in Section 35; • Determine the verification of existing lawful use of all water uses based on the requirements, methodology etc in the Water Act, 1956; • Use the Departmental pro forma letters to deal with the different scenarios related to under, over or no registration based on the administrative process required by Section 35 of the NWA and the Administrative Justice Act; • Verify the extent and likely impact of large impoundment and flood diversion works in the Groot

	River above Beervlei Dam from information obtained from the registration process of existing water uses;
Responsibility:	The RO is responsible for this strategy, assisted by the Directorate Water Abstraction and Instream Use where necessary.
Priority:	1 – Very high.

8	WATER USE MANAGEMENT

8.3	LICENSING
Management objective:	Implementation of a streamlined interim strategy to reach decisions on license applications and water use authorisations and to issue authorisations when required with the appropriate attached conditions, within the NWRS and ISP water management framework, taking local conditions into account.
Situation assessment:	The yield balance calculations indicate that most catchments in the ISP-area are approaching or are probably already in a stressed situation. The situation in the sub-areas are as follows: **a. Kouga-Gamtoos sub-area** Krakeel Town requires a new dam in the Langkloof for supply to the town. Farmers in the Langkloof (Kouga catchment) would like to expand operations. They have expressed interest to trade water from lower Gamtoos River farmers. Regular temporary trading currently takes place within the Gamtoos irrigation scheme. Future trading between the Gamtoos Irrigation Board and NMMM is a possibility. **b. Kromme-Seekoei sub-area** Future trading in the Kromme-Seekoei sub-area is a possibility. A license application has been received from the Kruisfontein resource-poor farmers. Current use, compiled by the many (approximately 12) illegal dams in the Seekoei River and two illegal centre pivot irrigation systems places the River under stress. The status of the illegal dams must be dealt with and the current Kromme/Seekoei Rivers Reserve must be complete before the license application can be dealt with. **c. Tsitsikamma Coast** There are many pending applications for water use in the Tsitsikamma River and other coastal rivers, including an application for an 8 million m³ dam on the Tsitsikamma River from commercial farmers. The Tsitsikamma Development Trust applied for a 0.45 million m³ dam upstream of the site of the commercial farmers, for use by resource-poor farmers. A Reserve has to be determined before these licenses can be processed. A classification system for rivers/estuaries is not yet available for the ISP-area, which hampers processing of new license applications, especially in the Tsitsikamma Coast sub-area. **d. Algoa Coast** The license for effluent from the Fishwater Flats treatment works should be amended due to increased volume. Future planning by NMMM is of concern, as the comprehensive Reserve requirements to be allowed for in that planning, are not available and are unlikely to be soon. Licenses for groundwater abstraction from the Uitenhage aquifer GWCA can still be issued for some compartments. The commercial forests in the upper Swartkops River and in the Van Stadens River catchment are poorly managed by SAFCOL and are seemingly not very viable. There is a backlog of new authorisation applications due to the fact that Reserve determinations take time to be done, and the intensive hydrological calculations to be performed. The Regional Office has insufficient resources to undertake the Reserve determinations required for processing new authorisation applications and for the hydrological calculations. Trading of some existing authorisations for irrigation could take place.
Strategic approach:	The licensing approach will be to evaluate and process water use and storage licenses only in those catchments or aquifers that clearly have allocatable volumes of water. The processing will be subject to the constraints posed by the availability of resources and information. The establishment of Water Use Licensing Advisory Committees to assist in the development of indicators for the assessment of applications will be promoted. Establish a central register of license applications to ensure that the various offices, which issue licenses, are aware of each other's activities so that a holistic licensing approach is followed. Decisions with regard to *water quality management* will be valuated against the DWAF Water Quality Guidelines. Conditions to be imposed will be made in terms of a hierarchy of principles as follows:

a. *Prevention of pollution*, since prevention is better than cure. This is usually the most expensive option but may be required in certain cases. Specific areas in the Tsitsikamma to Coega ISP-area catchments where the environment cannot absorb controlled discharges of waste will need to be identified.
b. *Minimisation of pollution at source*: The next level of condition would be for a water user to minimise unavoidable waste production on site. This could include recycling/re-use of waste or water containing waste; detoxifying waste; neutralisation of waste; treatment of waste streams; introduction of cleaner technologies and best management practices.
c. *Disposal of waste and/or discharge of water containing waste* according to the *precautionary principal*: If there are no alternatives to dispose of waste and/or the discharge of water containing waste, then the precautionary principle could be sanctioned. In the case of the disposal of waste, the minimum standards listed in the guidelines will be adopted. In the instance of the discharge of water containing waste, the Waste Discharge Standards (currently the General and Special Standards for Phosphate), apply as the minimum requirement. Such disposal will only be allowed if the receiving environment has the capacity to assimilate the additional waste load.
d. *Disposal of waste and/or discharge of water containing waste* according to the *differentiated approach:* If it is believed that the minimum requirements will not ensure fitness for use of the receiving environment, stricter standards will be enforced in accordance with the differentiated approach. This approach takes account of catchment-specific conditions and includes the determination of RQOs and setting standards that must ensure compliance with RQOs. The levels at which the objectives will be set will be determined through the application of the management classification system for the resource that was mentioned above. Again, clearly defined and spatially pegged RQOs and other requirements for specific reaches of river would be the ideal that water resource managers need to strive for in fulfilling their responsibilities.

The following are required to address the current licensing situation:

1. Implement available streamlining procedures to reduce the backlog of authorisation applications;
2. Motivate for additional resources and budget for processing authorisations if necessary;
3. Develop a local classification system in the ISP-area;
4. Prioritise required Reserve determinations and motivate to the D: RDM;
5. Use GAs in conjunction with a classification system, to reduce the number of authorisations to be processed until the comprehensive Reserve determinations and other more reliable information are available;
6. Further evaluate the possibility of a central office that at least keeps a register of all water licenses issued in the RO, to eliminate the potential for license conflict due to licenses being issued from various offices.
7. WUAs, once established, or irrigation boards in the interim, must ensure compliance among members with regard to the Reserve requirements of their authorisations;
8. Simple operating rules must be provided with each authorisation to facilitate compliance;
9. Finalise the review of the current water trading policy. All possible consequences of water trading, especially between catchments, should be carefully examined before the go-ahead to trade is given;
10. Implement licensing regional control and auditing procedures;
11. Address the additional flow generated by the eradication of alien plants through licensing and control (Refer to the Invasive a*lien plant control Strategy*);
12. Educate municipal policy makers and officials about the licensing process and the ISP to improve their planning for license applications and to improve the quality of their WSDPs.

Current use by the many (approximately 12) illegal dams in the Seekoei River and two illegal centre pivot irrigation systems places the river under stress. The status of the illegal dams must therefore be dealt with and the Kromme/Seekoei Rivers Reserve currently being determined must be complete before the license application can be dealt with.

Immediately attend to the situation in the Seekoei River catchment as follows:

- Take immediate steps against the users who have illegally developed since the NWA came into force. Until such time as compulsory licensing is done, owners of illegal dams must keep the outlets of such dams open and release all stored water. DWAF will exercise control to ensure that this is abided by. The owners of such dams can then apply for the closing of their dam outlets during compulsory licensing. If granted they would not have to rebuild their dams. If not, they could be held accountable for all costs in terms of required remediation

	measures; • The installation of centre pivots after the implementation of the NWA is illegal and such use must be stopped immediately. Such prospective users can apply for water use licenses during compulsory licensing, • Follow up with action against illegal users under the 1956 Water Act. Tackle clear cases first, followed by the rest. A compromise solution will be to limit storage in dams to the legal 250 000 m^3 limit (under the old Act). The owners of such illegal dams would be required to release water, at full capacity, whenever the rising storages in the dams reach the allowable limit. This should continue until the water levels in the dams have dropped to the legal limit. Owners of dams who do not agree with the capacities as determined by DWAF could appoint acceptable persons to re-survey the dams at their own cost. Very strong action must be initiated against farmers who do not adhere to this requirement; • The cost implications of the control measures that DWAF would have to undertake should be for the account of the illegal users; • Address abstraction from "hippo-holes" through simple operating rules. The catchment users can solve this among themselves. In the longer term, a WUA is required to deal with such problems. Deal with the application for a dam in the Tsitsikamma River for resource-poor farmers through the *Poverty alleviation and land reform Strategy (No.12.3)*. A feasibility study must be done to determine whether the proposed irrigation scheme is feasible – to be administered under the IAC.
Management actions:	Evaluate and reject or authorise any application use that exceeds Schedule 1 or the limits of any General Authorisations with a license according to the guidelines provided in the "Assessment of water use authorisations and license applications" document. As a transitional measure in terms of the NWA allow "existing lawful use" to continue until such time as it is licensed through compulsory licensing. The SFRA Licence Assessment Advisory Committee (LAAC) will continue to evaluate decisions with regard to forestry. Specific actions are: 1. Immediate address illegal use in the Seekoei River; 2. Comprehensive Reserve studies will be undertaken by the D: RDM for the Kromme and Seekoei Rivers, partly to be able to address the backlog in license applications; 3. Undertake a Comprehensive Reserve determination of the Uitenhage aquifer; 4. Separate the small coastal rivers for licensing to deal with each individually; 5. Issue a license for the Fishwater Flats treatment works; 6. Address the Krakeel Town water requirement by recommending an investigation into the buying out of irrigators. 7. The implications of possible water trading between Langkloof irrigators and irrigators from the Gamtoos River GWS must be very carefully assessed – especially for the IFR of the Kouga River; 8. Facilitate a detailed study of the existing forestry industry in the Algoa Coast sub-area, to establish its viability and what conditions should be attached when licenses for existing lawful use are issued. *No new licenses will be issued for the following catchments:* • Kromme River below Churchill Dam: The river is stressed and the estuary is heavily impacted; • Seekoei/Swart Rivers: The rivers are stressed and the combined estuary is heavily impacted; • Groot River: The catchment is in balance and water quality is very poor – rather evaluate trading applications; • Kouga River: The catchment is in stress and Kouga Dam is over-allocated; • Gamtoos River: The catchment is in balance and the estuarine Reserve should be determined first; • Swartkops River: The river is in stress – especially the middle to lower reaches - and is heavily impacted; • Maitland and Van Stadens River: These catchments are in balance; *License applications for use from the following rivers could be authorised* after very careful consideration (no river has any significant allocatable surface water quantity): • The Kromme River above Churchill Dam shows some surplus; • The Kabeljous River is less impacted; • The Baviaanskloof River is not impacted;

	• Rivers in the Tsitsikamma Coast – evaluate each river individually. • Rivers in the Tsitsikamma Coast – This is the only sub-area where new afforestation licenses should be considered; • Coega River: This river is likely in balance –some groundwater potential is still available; • Some components of the Uitenhage / Coega Ridge aquifers.
Responsibility:	The RO in consultation with the Directorates WU, RDM, NWRM and Information Programmes (where applicable) and the SFRALAAC is responsible for implementing this strategy.
Priority:	Priority 1 – Very high.

8	WATER USE MANAGEMENT

8.4	INVASIVE ALIEN PLANT CONTROL
Management objective:	Effective implementation of the regional Working-for-Water programme.
Situation assessment:	The condensed area (equivalent area that the alien plants would occupy if it were condensed to provide a completely closed canopy cover) of alien plants in the Tsitsikamma to Coega ISP-area is 588 km², as estimated in 1999. The average reduction in system yield is 10 million m³/a at a 1:50 year yield for this ISP-area. The Kouga and Kromme Rivers and the Tsitsikamma Coast area are the most heavily infested in the ISP-area. Working for Water (WfW) in the Eastern Cape is currently focusing on mainly state-owned and some private land through funding provided by the DWAF trading account. Clearing activities have been focussed on a strip either side of river channels, and on high mountain areas where priority is on light infestations to reduce the spreading of seeds. The status of conservation through clearing of aliens in relevant sub-areas is as follows: **a. Kouga-Gamtoos** The upper Kouga River system has been very heavily invaded by black wattle. In a 1:50 year flood these trees are uprooted, sediment is exposed and is rushed into the Kouga Dam. The Baviaanskloof is now relatively free of aliens. Some eradication programmes are under way in the Langkloof. Many of the upper catchments and tributaries are becoming invaded (e.g. in the Bo-Kouga). Urgent action is required to get this under control before the densely infested lower systems are tackled. **b. Kromme-Seekoei** There is major alien infestation in the area. Programmes to eradicate aliens are being implemented in the Kabeljous and Seekoei Rivers catchments. **c. Tsitsikamma Coast** Working for Water is responsible to deal with the requirement for weeds eradication. Eradication plans are required for lower reaches of rivers in the area. There are large tracts of commercial (Blue Gum and Pine) forests managed by SAFCOL in this area. Existing licenses do not address riparian conditions. The forestry industry now has certification as a self-controlling measure. SAFCOL's management regarding riparian zones should be improved since they are currently not complying. **d. Algoa Coast** WfW is currently implementing a major programme of alien removal in the upper catchments of the Swartkops River. The upper Swartkops catchments have been cleared, as well as those above the dams in the Elands River and above Groendal Dam. Wattle is the major invasive tree. Removal of aliens in the Elands River tributary could supply the required low-flows for the Reserve. The Gamtoos Irrigation Board is the implementing agent. The Swartkops River is also infested with water hyacinth. Many heavily infested areas such as the Lower Van Stadens River have not been included in programmes to be addressed. It is unclear whose responsibility this is.
Strategic approach:	From a water management perspective, target areas that are lightly infested for the clearing of invasive plants. Clean such areas and keep them clean, starting with the cleanest. Following that, areas that have already been infested should be targeted for clearing. Do not focus on trying to clear odd densely invaded riverbeds until the surrounds and feeder catchments have been addressed. Identify specific opportunities for clearing areas where this will relieve stressed situations by increasing baseflow conditions. The Upper-Kouga, Kromme and Seekoei Rivers are examples of such rivers. The clearing of alien plants should also be used as a tool to augment water supply in over-allocated catchments or catchments where water must be allocated for poverty alleviation. This is preferable to reducing water allocations and possibly having to deal with compensation claims.
Management actions:	The following are required to manage the control of invasive alien plants: 1. Complete current alien mapping initiatives and reconcile mapping with clearing data collected on an ongoing basis; 2. Continuously develop clearing plans to optimise clearing and job creation within available

	budgets; 3. WfW will identify beneficiaries of clearing and do representative proportioning of clearing costs among those users; 4. Address additional flow generated by eradication of aliens in a catchment through licensing and control; 5. Implement the national WfW Exit Strategy for handover to Maintenance when it becomes available; 6. Implement the control of waterweeds when business plans and programmes have been finalised; 7. Design a regional strategy of co-operation with the Department of Agriculture and Provincial Department of Environmental Affairs to educate farmers on the importance of alien eradication; 8. Identify opportunities for job-creation through use of the biomass; 9. Funding for WfW programmes should be constant. Five-year plans should be drawn up and monitored to avoid social problems following retrenchment. 10. Review the WfW prioritisation and budget in the Kouga-Gamtoos and Kromme-Seekoei sub-areas to alleviate water-scarcity. 11. DWAF and the Forestry industry must check on compliance of commercial forestry in the Tsitsikamma Coast area and Elands River with regard to riparian zones. Ask Mike Edwards of SA Forestry to take the issue up with SAFCOL on behalf of DWAF and use the Conservation of Agriculture Resources Act to enforce control. 12. Determine the responsibility for clearing alien invasives in the Lower Van Stadens River.
Responsibility:	The RO is responsible.
Priority:	Priority 1: Very high. Programmes are ongoing.

8	WATER USE MANAGEMENT

8.5	PRICING
Management objective:	Effective regional implementation of the raw water pricing strategy.
Situation assessment:	The new tariff structure has been implemented for use from all major DWAF dams in the ISP-area. DWAF has implemented a *Return on Assets* tariff charge for urban use from Loerie Dam. NMMM has complained that irrigation farmers also utilise water from the canal and it was their opinion that irrigators should also contribute towards this tariff. The Pricing strategy for raw water charges does not make provision for irrigators to pay such a charge. Irrigators also see no reason why they should make a contribution, since they do not benefit from Loerie Dam. The operational benefit of security of supply gained by the farmers from Kouga Dam is reflected in the depreciation charge payable by the irrigators.
Strategic approach:	Phase in the various charges of the Pricing Strategy in a practical manner. Complete the introduction of water resource management charges. Introduce the phasing in of full financial cost recovery for water sold from government schemes more rapidly. It is expected that the introduction of additional economic incentives will not feature soon.
Management actions:	Implement the *Pricing Strategy for water use charges* and implement the *Pricing Strategy for wastewater use* (once finalised) as follows: 1. Register the water uses for which a pricing strategy have been formally established; 2. Support the annual setting of charges for funding water resource management, development and use of waterworks and for achieving the equitable and efficient allocation of water; 3. Immediately implement tariffs for water supplied from GWSs; 4. Complete implementation of water resource management charges; 5. Implement effective mechanisms and structures for income generation, proportioning and accounting of funds collected from tariffing; 6. Inform water users how tariffs budgets were determined in terms of the implementation of this strategy – through the *Information management* and *Capacity building, public participation and communication* strategies; 7. Revisit the operational benefit of security of supply gained by farmers abstracting from the canal to Loerie Dam in the Bulk water supply agreement being drafted.
Responsibility:	The RO, assisted by D: WA&IU and the WARMS office.
Priority:	Priority 1 – Very high. Immediate implementation of some components and phasing in of other components over the medium and long term is necessary.

CHAPTER 9 - WATER CONSERVATION AND WATER DEMAND MANAGEMENT STRATEGIES

NEED FOR WATER CONSERVATION AND WATER DEMAND MANAGEMENT STRATEGIES

The options for further augmentation of water supply by developing physical infrastructure are limited. Attention needs to be devoted to managing the demand for water, encouraging the efficient and effective use thereof and minimisation of loss or waste of water. The foundation of effective water conservation and demand management is the creation of a water conservation and demand management culture within all water management and water services institutions and among water users.

The National Water Conservation and Demand Management Strategy is currently being developed. This strategy is based on the reasonable premise that many water users can maintain their quality of life and achieve the desired outcomes from their water use, whilst using less water. Furthermore significant reductions in water use can be achieved by changes in behaviour and the adoption of water-saving technologies. DWAF will continue to encourage all water users to voluntary comply with the water conservation and demand management principles and strategies.

The *Water conservation and demand management Main Strategy* is required to address urban, agricultural and industrial conservation measures and water demand management.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

9.1 Urban water conservation and demand management;
9.2 Agricultural water conservation and demand management;
9.3 Industrial water conservation and demand management;

9 WATER CONSERVATION AND DEMAND MANAGEMENT

9.1 URBAN WATER CONSERVATION AND DEMAND MANAGEMENT

Management objective:	Utilisation of the opportunities created through the NWA to identify the need for regional urban water demand management measures and to promote the implementation thereof through co-operative governance, assistance, buy-in and capacity building.
Situation assessment:	There are water stressed situations in many catchments and systems of the ISP area. There is a possibility that the availability of water may be further reduced once the comprehensive Reserve determination requirements have been established. Urban demand of the ISP-area is forecast to increase. An evaluation of water conservation and demand management in the urban water use sector estimates that up to 50% of the total quantity of water that is supplied is not accounted for in many of the urban areas. Most of the Municipalities in the ISP-area do not have the capacity, experience, knowledge and funds to implement water demand management strategies. Promotion of water conservation/water demand management throughout the ISP-area should be done, but a demand management programme can probably only be effectively implemented by the larger municipalities where capacity, knowledge and funds are available. It is therefore advisable that the DWAF head office and regional office, and/or the CMA's in future should assist the municipalities by appointing consultants to do situation assessments and to develop water demand management strategies, guide them with the implementation thereof and do monitoring and evaluation. Otherwise it is unlikely that such measures will be implemented in many municipalities. Funds for such studies could be generated through water tariffs. Stepped tariffs are generally not in place in the smaller towns, except to accommodate the 6 kl per month free basic use. Demand management is currently ad hoc and is not addressed according to correctly identified priorities. Information is required to prioritise the required WC/WDM initiatives for each municipality, as there is a lack of relevant information. Establishment of a WDM plan for each town according to identified priorities in terms of the WC/WDM principles is required. The Port Elizabeth and Uitenhage Municipalities initiated demand management measures several years ago and were making good progress. There is a perception that many of these initiatives seem to have a lower priority under the NMMM. The "*Water demand management programme for the Port Elizabeth Region*" report [(4)] was produced in November 2001 as part of the Algoa pre-feasibility study, and addressed urban water demand management in the NMMM area and two meetings were held to discuss the content of the report with NMMM officials. There is a clear need for closer co-operation between DWAF and NMMM regarding the implementation of their demand management programme. The unaccounted for water (UAW) of Willowmore is high and there is a need for demand management measures to be implemented. There is also a need for demand management in small Langkloof towns, Joubertina and for the introduction of stepped water tariffs in Humansdorp.
Strategic approach:	The situation is fast approaching when the NMMM water supply needs to be augmented. According to system analyses calculations, it is likely to be required by about 2008, if water demand management measures are successful. If they are not successful, augmentation could be required sooner. It is essential that very close and regular liaison take place about the success, or failure of NMMM with their water demand management programme, which will have a huge impact on the required timing of the following augmentation scheme. The implementation of further augmentation options that require infrastructural development will not be approved if serious and adequate steps have not been taken by NMMM to ensure that water is not being wasted and UAW is at an acceptable level. Implementation of water demand management at smaller municipalities will be promoted, within the constraints posed by resources at both DWAF and such municipalities. Although District Municipalities are responsible for ensuring that local authorities implement WDM, DWAF should in the interim, continue to assist until the District Municipalities are capacitated financially and technically.

Management actions:	Ensure the implementation of a regional urban water conservation and demand management strategy by facilitating the implementation of the recommendations of the "*Water demand management programme for the Port Elizabeth Region*" report, November 2001at an increased rate. Set up regular liaison meetings with NMMM officials to stay informed about their WDM initiatives and progress. Develop a revised implementation planning programme for the situation where WDM is not as successful as planned for. Following this approach, implement an urban water conservation and demand management strategy as follows: 1. Facilitate the establishment of a water demand management plan for each local authority, according to priority, through co-operative governance and assist municipalities to draw up detailed local urban conservation and demand management strategies where required, cooperatively with the responsible District Municipality; 2. Ensure that the WSDPs of local authorities implement local water conservation and demand management strategies prior to the development of new schemes and also include plans for the use of water saved by effective demand management measures; 3. Review WSDPs submitted to ensure that water conservation and demand management objectives have been adequately addressed; 4. WC/WDM plans should include benchmarking. Set benchmark targets for water savings with local authorities through co-operative governance; 5. Build capacity in local authorities by providing appropriate support services where these are needed in local planning, development of new supply schemes or rehabilitation of existing schemes; 6. Use the water allocation process to promote water conservation and demand management principles; 7. Promote the principles of water conservation and demand management through forums and the media. Encourage the use of printed and electronic media to disseminate information to all stakeholders and contribute regular articles to relevant publications to promote the concepts of water conservation and demand management; 8. Ask the Directorate Water Use Efficiency and the regional Water Use Efficiency division to assist district and local municipalities with the implementation of WDM, as a national priority, to overcome the technical barriers many municipalities face; 9. Assist the municipalities financially by appointing consultants to do Situation Assessments, to develop Water Demand Management strategies and assist with the implementation thereof. The funds can be generated through Water Resource Management tariffs. 10. Regularly liaise with responsible officials and if necessary politicians at Humansdorp, Willowmore, Joubertina, Langkloof towns and other municipalities where water demand management interventions are required and aggressively promote the implementation of demand management measures.
Responsibility:	Water Service Providers and large individual water users are responsible for implementing urban water use demand management programmes that have developed with the assistance of DWAF. The RO has a regulatory and advisory role but will continue its monitoring and mentoring role to build capacity and to promote the concept. D: WUE is responsible for a national framework and the development of standardised demand management methods and procedures. District Municipalities are responsible for ensuring that local WC/WDM Plans are compiled and implemented by the local municipalities.
Priority:	Priority 1: Very high.

9	WATER CONSERVATION AND DEMAND MANAGEMENT

9.2	AGRICULTURAL WATER CONSERVATION AND DEMAND MANAGEMENT
Management objective:	To ensure that in this stressed area water is beneficially used in agriculture, and that amongst other initiatives water conservation and demand management principles are applied by the agricultural sector to release water for use within the sector, to open up irrigation opportunities for emerging farmers, to release more water to cater for the needs of competing water users and to protect the environment.
Situation assessment:	An evaluation of agricultural water conservation and demand management shows that irrigation accounts for an estimated 55% of total consumptive water requirements (i.e. excluding the ecological Reserve) in the Tsitsikamma to Coega ISP-area. Outside of Government Water Schemes, not enough is known about the efficiency of use. In the Gamtoos Irrigation Board area a pilot study is underway by the WUE Directorate to test the National WC/DM strategy, by assisting the Board to develop a Water Management Plan. This study looks into the efficiency of irrigation water use of the Board and possible improvements to operational aspects. Irrigation in the Gamtoos River is generally well managed, but there is some scope for water conservation. The completed Water Management Plan will be implemented and annually reviewed.
Strategic approach:	The approach will be to promote water conservation and demand management through cooperative governance where the need is greatest. Once the recommendations from the Gamtoos WC/DM study are made, further initiatives will be formulated.
Management actions:	Study the results arising from the WUE Directorate study into agricultural water demand management options in the Gamtoos GWS and facilitate the implementation of the recommendations. Based on the results and experiences of the WC/WDM study on the Gamtoos irrigation scheme, undertake or facilitate the undertaking of water development plans for other irrigation schemes. Implement a regional agricultural water conservation and demand management strategy as follows: 1. Synchronise the implementation of water conservation and demand management with the introduction of compulsory licensing and re-allocations. Recognition of efficiency could be taken into account in the determination of re-allocations during compulsory licensing; 2. Set targets with WUAs (co-operative governance) for re-allocation of water saved; 3. Promote the use of more water efficient irrigation equipment in order to conserve water. Discourage the use of flood irrigation where laser levelling is not continually done to increase the efficiency; 4. Use the water allocation process to promote water conservation and demand management principles; 5. Provide appropriate support services where these are needed in planning, development of new irrigation schemes and rehabilitation of existing schemes; 6. Encourage the use of the printed and electronic media to disseminate information to all stakeholders and contribute regular articles to local agricultural publications to promote the concepts of WC/DM; 7. Initiate awareness campaigns through workshops, discussion forums, and newsletters.
Responsibility:	WUAs, Irrigation Boards and individual farmers are responsible for implementing agricultural water demand management programmes and the development of Water Management Plans, with the assistance of DWAF where necessary. The RO has a monitoring and mentoring responsibility to build capacity and to promote the principle. D: WUE is responsible for a national framework and the development of standardised agricultural demand management policy, methodology and procedures.
Priority:	1 – Very high.

9	WATER CONSERVATION AND DEMAND MANAGEMENT

9.3	INDUSTRIAL WATER CONSERVATION AND DEMAND MANAGEMENT
Management objective:	Utilisation of the opportunities created through the legislation to identify the need for regional industrial water demand management measures and to promote the implementation thereof through co-operative governance, buy-in and capacity building.
Situation assessment:	The increasing competition for available water in large parts of the ISP-area highlights the stressed nature of many catchments or systems in this ISP-area. The availability of water may be further reduced once the comprehensive Reserve determination requirements have been established, since estimates of the Reserves are currently low. Industry is expected to be the biggest contributor to future economic growth. The industrial sector, which includes large industries, mines and power generation activities mainly in the Port Elizabeth and Uitenhage areas, is projected to have the greatest growth in water requirements. Much of this growth will occur in NMMM, specifically manufacturing and other industrial activities, which only have limited water resources nearby. It is imperative to have assured water supplies at a reasonable cost to support the industrial development and for the industrial sector to improve its efficiency of water use and to minimise waste. The ISP-area is not rich in minerals and mining operations consist mainly of quarrying for building materials. There are no mining activities of particular significance and no large-scale power generation. Limited industrial demand management initiatives have so far been undertaken.
Strategic approach:	The implementation of a regional industrial water conservation and demand management strategy is dependent on co-operative governance, since all significant industries fall within municipal boundaries. Co-operative partnerships are therefore required with especially NMMM, but also with smaller municipalities, to implement demand management in partnership.
Management actions:	Develop and implement a regional industrial water conservation and demand management strategy as follows: 1. Identification of the largest water consuming industries; 2. Classification of those businesses that have the greatest impacts on the water resources in terms of water utilised, wastewater discharged and the efficiency and effectiveness thereof; 3. Develop regional and local levels of databases for the purposes of monitoring the water-related performance of businesses. There are too many businesses for all of them to be included in the databases, and only those businesses that have the greatest impacts on the water resources will be considered (i.e. the high priority categories); 4. Undertake performance auditing on identified industries. Determine whether the water is lost through leaks or bad maintenance or through the normal production process or business operation. Use best practise or good practise guidelines and manuals to provide guidance; 5. Ensure or facilitate the implementation of measures in industries where wastage is noted, such as fixing leaks to reduce further wastage; 6. Analyse the efficiency of production processes to understand how water is being utilised; 7. Design and implement communication, public awareness and education programmes as required; 8. Set up water conservation forums; 9. Identify and undertake pilot projects; 10. Manage non-conforming industries.
Responsibility:	Water management institutions and large individual water users are responsible for implementing urban water use demand management programmes. The RO has a monitoring and mentoring responsibility to build capacity and to promote the concept. D: WUE is responsible for a national framework and the development of standardised demand management methods and procedures.
Priority:	2 - High

CHAPTER 10 - INSTITUTIONAL DEVELOPMENT AND SUPPORT STRATEGIES

NEED FOR INSTITUTIONAL DEVELOPMENT AND SUPPORT STRATEGIES

The NWA provides for a fundamental transformation of water resources management and governance, to appropriate and representative regional and local institutions. Such institutions include any organisation or person who fulfils the functions of a water management institution. Water User Associations and Catchment Management Agencies are such organisations.

The *Institutional development and support Main Strategy* is required to address:

- ⇨ International rivers joint management structures and related issues;
- ⇨ Formation of Catchment Management Agencies;
- ⇨ Catchment Forums and Advisory Committees related issues;
- ⇨ Formation of Water User Associations.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

10.1 Catchment management agency;
10.2 Water user associations.

No international rivers flow within or border this sub-area; therefore no internationally related strategy is required.

10	INSTITUTIONAL DEVELOPMENT AND SUPPORT

10.1	CATCHMENT MANAGEMENT AGENCY
Management objective:	Establishment of a catchment management agency in the Fish to Tsitsikamma WMA, according to the national programme of implementation, to provide a platform for taking decisions regarding the development, conservation, management and control of water resources.
Situation assessment:	The establishment of the Fish to Tsitsikamma CMA (CMA 15) has taken longer than initially anticipated, due to it being a more complex process, requiring extensive participation by a wide range of stakeholders. In the interim, before the CMA is in place, a Proto-CMA will be formed, where DWAF will act as the CMA until the CMA is in place. The Proto-CMA will be established during 2004. An Eastern Cape Wetlands Forum and an Eastern Cape Disaster Management Forum are functioning. The existing Swartkops Trust is a watchdog body for the lower section of the Swartkops catchment.
Strategic approach:	The ISP Report will provide the initial baseline data that can be used by the catchment management agency (or Proto-CMA) to develop its catchment management strategy, objectives, plans, guidelines and procedures for the protection, use, development, conservation, management and control of the water resources in its area of responsibility. The constraints and opportunities of establishing a CMA for WMA 15 need to be determination and agreement must be reached on the best process to follow to establishment.
Management actions:	Develop and implement a CMA implementation plan (between the RO and D: CM) by assessing the constraints and opportunities of establishing a Catchment Management Agency for WMA 15 and the best process to follow to establishment. Then design the implementation process and implement it according to the TINWA programme. Ensure that the Catchment Management Agency prepares business plans and annual reports for institutional performance review. Encourage the establishment of disaster management forums in all District Municipalities.
Responsibility:	The responsibility for developing the details of the WUA strategy lies with the RO. The D: WMI Governance will be part of the CMA implementation team.
Priority:	Priority 2 – High.

10	INSTITUTIONAL DEVELOPMENT AND SUPPORT

10.2	WATER USER ASSOCIATIONS
Management objective:	To transform existing irrigation boards to WUAs or form new WUAs as required.
Situation assessment:	**a. Kouga-Gamtoos sub-area** • The Heights Irrigation Board and other small Irrigation Boards lack the capacity to transform to WUAs; • There is resistance by some Langkloof irrigators to an umbrella Langkloof WUA; • The Gamtoos Irrigation Board has temporarily halted their process of transformation to a WUA. **b. Kromme-Seekoei sub-area** • Water management institutions that operate in the area are DWAF, NMMM and local and district municipalities. There are no irrigation boards in this sub-area; • No WUAs have been established yet in this sub-area; • Heights Irrigation Board (part): See Kromme-Seekoei sub-area. **c. Tsitsikamma Coast sub-area** • The process to transform the Klippedrift Irrigation Board to a WUA started recently; • The Fingo community land restitution case is in progress. **d. Algoa Coast sub-area** • A WUA is the preferred institutional body to manage the Swartkops catchment.
Strategic approach:	The WUAs to be established in the ISP-area will be prioritised. WUAs will then be systematically established according to demands and priorities, within the constraints posed by existing resources. Existing irrigation boards will be transformed into WUAs together with all other users in the area, as soon as there is greater clarity on the process. DWAF will continue encouraging the formation of WUAs to solve conflicts between water users, especially irrigators. The practice of using advisory committees to advise on operational aspects of GWSs will be continued as long as is necessary, until WUAs have been established. The approach regarding WUAs will be as follows: 1. DWAF should standardise its process for transformation from an irrigation board to a WUA; 2. Prioritise the WUAs to be established and systematically establish WUAs or Catchment Forums according to demands and priorities; 3. Ensure that the regional transformation process is clear to all; 4. Existing irrigation boards should be transformed into WUAs, together with all other users in the area as soon as possible; 5. Where irrigation boards are not present, new WUAs should be established according to demand and priorities; 6. DWAF must encourage the solving of conflicts due to over-abstraction by irrigators, leading to very low flows, through the establishment of WUAs; 7. Ensure that the terms of reference for the WUAs are appropriate and that all users are included in a WUA; 8. WUAs must prepare business plans and annual reports for institutional performance review; 9. The WUA must ensure that all members are monitored, both in terms of quantity of abstraction and discharge of waste; 10. Continue the use of advisory committees to advise on operational aspects of GWSs until WUAs are established as a representative body to communicate with; 11. Transfer GWSs to farmers according to the WUA process.
Management actions:	1. Complete the *Beervlei Dam future management and operational strategy* study before proceeding with the establishment of a WUA. 2. DWAF will aid the Fingo community to form a WUA following their land restitution case in the Tsitsikamma Coast sub-area; 3. Provide assistance for the establishment of the Kruisfontein WUA as a priority, should a water

	licence be granted to expand their scheme under the DWAF subsidy policy; 4. Investigate the institutional aspects to adequately manage the Swartkops catchment; 5. Disestablish the Swartkops Irrigation Board.
Responsibility:	The responsibility for developing the details of the WUA strategy lies with the RO. D: WMI Governance will be part of the CMA implementation team.
Priority:	The priorities for establishment of the various WUAs vary from Priority 3 - medium to Priority 4 - low. Establishment of new WUAs in ex-homeland areas have the highest priority, but there are none in this area.

CHAPTER 11 – SOCIAL AND ENVIRONMENTAL CONSIDERATIONS STRATEGIES

NEED FOR SOCIAL AND ENVIRONMENTAL CONSIDERATIONS STRATEGIES

The *Social and environmental considerations Main Strategy* is required to address:

- ⇨ Public consultation and participation
- ⇨ Education and capacity building in the water sector
- ⇨ Community awareness;
- ⇨ Communications relating to water;
- ⇨ Compliance with environmental legislation;
- ⇨ Mitigation of environmental and social impacts;
- ⇨ The environmental development approval process;
- ⇨ Strategic Environmental Assessment.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

11.1 Capacity building, public participation and communication;
11.2 Environmental.

11 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

11.1 CAPACITY BUILDING, PUBLIC PARTICIPATION AND COMMUNICATION

Management objective:	Promotion of the DWAF management perspective for the Tsitsikamma to Coega ISP-Area, achieving buy-in from users and service providers to ensure that wise water management is implemented for overall community beneficiation.
Situation assessment:	A Communication Section has been established within the RD: Planning, Development and Institutions. A wide range of RO staff are responsible for the various public participation requirements, mainly in line with their staffing line functions. Capacity building, public participation and communications already form an integral part of the functions of many staff. This should be formalised and should form part of a Plan for the ISP-area.
Strategic approach:	A very wide range of public consultation, education and capacity building need to take place, within the many identified ISP strategies. Where appropriate, the Departmental guidelines should be followed. In many cases, best or good practice and experience of what is appropriate for specific communities and circumstances will have to be followed. A regional public participation approach will be developed and implemented, incorporating the range of required activities. The RO must draw up a Plan to indicate its level of skill in public participation in the Region and the ISP-area. The RO must also list or at least indicate the skills that the Department may have to call upon locally, to achieve its public participation agenda and goals. The Region should take stock of all the public participation demands being made on it and reflect on whether it has the capacity and capability to meet these needs, now and into the future. Further to this the Region should evaluate, or allow for an evaluation of both its skills and successes (and failures) in processes requiring public participation. Particular attention should be given to efforts to reach out to the less powerful groups and the poor, who are not accustomed to being drawn into the public debate. The following strategies in the ISP require public participation or capacity building efforts: • *Groundwater* – informing municipal officials on groundwater management issues; • *Compulsory licensing* – public consultation and participation is an integral part of the process; • *Use of treated wastewater* - educating municipal officials on how to implement re-use to augment their water supplies; • *Supply to local authorities* - the need to inform policy makers, officials and users in terms of water conservation and demand management, proper water resources planning and operational management; • *Reserve and RQOs* – the public process to determine the class of a freshwater body; • *Wetlands* – informing farmers on the value and use of wetlands; • *Water quality management* - the need to inform users in each WUA of the importance of sustainable development and protection of local water resources. The implementation of the DANIDA Dense Settlement Strategy is to be encouraged; • *Licensing* – educating municipal employees on water authorisation policies and planning, and how licensing affects their WSDPs; • *Invasive alien plant control* - education of farmers regarding the importance of alien plant control; • *Pricing* - informing water users how tariffs budgets are determined; • *Urban water conservation and demand management* – promotion of the principles of water conservation and demand management through forums and the media. Public participation mainly rests with the local authorities; • *Catchment Management Agency* - Forums and Advisory Committees, which precede the CMA, involve participation by all stakeholders, including the general public. The principal behind establishing CMAs is the delegation of water resource management to a regional level and the involvement of local communities in the process; • *Water user associations* - all users served in an identified area for a WUA must be included in the establishment and management of the WUA; • *Poverty alleviation and land reform* – ensuring that communications, awareness creation and education programmes are appropriate for mainly rural communities; • *Environmental* – EIA processes entail public participation. Approval of new infrastructure also calls for a public comment period, for DWAF ministerial approval and for appeals to DEAT or DEAET for environmental ministerial approval;

	• *Public health and safety* - education, training and awareness creation programmes regarding flood warning systems for all flood-prone areas; • *Recreation on state-owned dams* - Planning of a community awareness campaign regarding recreational use of polluted rivers under the Public Participation strategy, co-operatively with NMMM and the Department of Health.
Management actions:	**a. Capacity building** Implement the guidelines of the Employment Equity Act where required. Inform policy makers, officials, users and the public as required by the various ISP strategies. **b. Community education and awareness** 1. Refine the public consultation and participation strategies requirements; 2. Between the RO and Directorate WMI Governance develop a regional public participation approach based on the guidelines provided by Directorate WMI Governance. This should identify what the needs are in addressing public participation; 3. Ensure that the necessary resources are available; 4. Implement the required identified actions and programmes; 5. Educate water use authorities regarding the implementation of the ISP; 6. Support public awareness campaigns on the value of urban rivers as social amenities, and assist with cleaning campaigns. **c. The water education programme** Implement the water education programme. **d. Communications** 1. Contribute to national communication programmes; 2. Contribute to the Strategic Plan and Annual Report.
Responsibility:	The RO assisted by Directorates WMI Governance and WA&IU (SES) and WfW.
Priority:	Priority 1 – Very high.

11	SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

11.2	ENVIRONMENTAL
Management objective:	The objective of this strategy is to successfully undertake water resource development and management within the broader framework of environmental legislation.
Situation assessment:	Environmental compliance is currently mostly centralised in Head Office Directorates, mainly in the Directorate Social and Ecological Studies. Other environmental compliance activities form part of infrastructure development.
Strategic approach:	Ensure compliance with the requirements of National Environmental Management Act (NEMA), Environmental Conservation Act (ECA) and other related environmental legislation. Manage the siting and management of waste disposal onto land.
Management actions:	1. Ensure compliance with environmental legislation (NEMA and ECA) through regional implementation of the Department's Consolidated Environmental Implementation and Management Plan, within the context of the DWAF Environmental Management Framework; 2. DWAF will prepare regular *State of Water Resources* Reports, which will build on the State of Rivers reports by the River Health Programme. The reports will describe progress in achieving the environmental objectives of the NWA, and indicate areas where new interventions or intensified efforts are required; 3. DWAF will make inputs to national environmental reporting by DEAT; 4. Oversee the management of waste disposal onto land; 5. Use Strategic Environmental Assessment (SEA) as a tool to *inter alia* determine forestry potential as and when required.
Responsibility:	The implementation of the Environmental strategy is the responsibility of all DWAF Directorates and the RO. The D: WA&IS (SES) responsibility is to oversee the development of environmental and social policies and procedures within the department.
Priority:	Priority 2 – High. To be implemented on a continuous basis.

CHAPTER 12 - INTEGRATION AND CO-OPERATIVE GOVERNANCE STRATEGIES

NEED FOR INTEGRATION AND CO-OPERATIVE GOVERNANCE STRATEGIES

These strategies address cooperative data collection, information sharing, sharing of visions and plans, and cooperative making of joint decisions which are satisfactory or at least acceptable to all parties. The ISP strategies interface with those of other South African government Departments, local authorities and water service providers. Consequently, there is an inherent need for establishing co-operative relationships with such organisations. This is required to ensure that management and control of the water resources in the ISP-area are integrated with the relevant strategies of other organisations, whilst meeting the requirements of particular legislation with which it must comply.

Water for development or equity is a major focus that will be pursued under this Main Strategy. In addressing inequities of the past, the provision of an equitable share of available water to previously disadvantaged communities is being addressed to improve the livelihoods of the poor. The establishment of resource poor farmers and the provision of water to areas in which land restitution is in progress must be prioritised as one of the ways to reduce poverty. The water reconciliation for the ISP-area has shown that little water is available for allocation to resource poor farmers. Procedures must therefore be introduced to make water available for them.

The *Integration and co-operative governance Main Strategy* is required to address:

- ⇨ Poverty alleviation issues pertaining to resource–poor farmers and other measures;
- ⇨ Water-related land reform issues;
- ⇨ Regional, local and sector-specific co-operative governance;
- ⇨ Capacity building and support, including job creation, financial support and educational issues;
- ⇨ Water services issues.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

12.1 Poverty alleviation and land reform strategy;
12.2 Co-operative governance strategy;

Water services issues have not been addressed in this version of the ISP.

12 INTEGRATION AND CO-OPERATIVE GOVERNANCE

12.1 POVERTY ALLEVIATION AND LAND REFORM

Management objective:	To provide assistance to prospective and current resource-poor farmers through the Irrigation Action Committee (IAC) and the WUAs or to other poverty alleviation and land reform initiatives and so contribute towards social upliftment and equity in water use.
Situation assessment:	*The Kruisfontein resource-poor farmers:* Kruisfontein resource-poor farmers have applied for an allocation for new irrigation. They intend expanding their existing irrigated area of 18 ha by a further 20 ha. The IAC has identified this scheme for further investigation for purposes of the DWAF subsidy scheme for resource-poor farmers. The present scheme is supplied from fountains. The extension may involve building of a dam in the upper reaches of the stressed Seekoei River catchment. In terms of DWAF policy, the water licences of established farmers may have to be bought out to supply the envisaged scheme, preferably as a last measure. There are illegal dams in the catchment, which illegally use water that could possibly supply water for poverty alleviation. This application needs to be evaluated and a planning study done to determine the feasibility of the scheme. Constraints are a lack of staff and funds to do the planning study. The Irrigation Action Committee wishes to appoint consultants to investigate the proposed scheme. They may also assist with the funding and construction of the scheme, as devised by D: WU. A Reserve determination will be necessary to allocate a water license. A WUA needs to be created once the scheme has been proven to be economical. A subsidy should then be paid to the WUA. Subsidy funds may not be forthcoming and there is an attempt to source funds within DWAF. The Tsitsikamma Development Trust applied for a license to construct a 450 000 m^3 dam at Doriskraal in the Tsitsikamma River for irrigation development for resource-poor farmers. The project is being facilitated by the Provincial Department of Agriculture (PDA), and had been considered by the IAC. It was regarded as a project that could be feasible and the PDA was to appoint a consultant to undertake a feasibility study towards a final decision by the IAC. They have not yet appointed such a consultant. The D: RDM will no longer undertake a Reserve at comprehensive level for the Tsitsikamma River in 2003 due to budgetary constraints, which could influence this license application. Continuous liaison between PDA and DWAF is necessary regarding progress with the feasibility study. DWAF must pro-actively lend support where possible. Land restitution may go ahead for the Fingo community in the Tsitsikamma Coast sub-area. The Haarlem Dam was built for small farmers as well as for established farmers, but the needs of local resource-poor farmers cannot be easily addressed due to their non-payment of water rates they believe should be free. It is one of the few dams where water is made available for equity. The farmers at Haarlem have excellent systems laid on for their plots. Piping and irrigation sprinklers are free and water costs are extremely low. There is the phenomenon of agrivillages in this part of the world. Haarlem is a communal village, but has been swelled by RDP houses and by others taking up the state subsidy. Uniondale has seen massive growth. Many of the Langkloof towns now have extensive housing complexes. Farm workers have been moving into some of the villages. Some of these are well suited to offering the opportunity to provide water to villagers for productive use – for the growing of subsistence and supplementary crops. Kruisfontein is a community village. There is no communal land in the ISP-area. The application for a dam for Krakeel Town could also include use of the planned dam by resource poor farmers.
Strategic approach:	Pro-actively support poverty alleviation and land reform principles, by initiating or supporting initiatives through co-operatives governance, via the various implementation vehicles provided by legislation. Investigate how more water could beneficially be made available to the villages for agriculture and home gardens. Review the position of farm workers and allocations for them. Investigate if there are any opportunities for small grower forestry in the Tsitsikamma Coast sub-area. Before the introduction of compulsory licensing, address the needs of prioritised resource poor farmers through the IAC, through co-operative governance between DWAF, the Department of Land Affairs, the Department of Agriculture, appropriate District Municipalities and DEAET.

	To seriously implement this strategy, the staffing requirements for this strategy must be clarified and adequate staff must be allocated to implement it.
Management actions:	• Through co-operative governance, ensure that the needs of resource-poor farmers in the Haarlem and Krakeel communities receive adequate attention. • Follow up on possibilities to source funding for the feasibility study of the prospective Kruisfontein resource-poor farmers extension. • Arrange a meeting/liaise with PDA regarding the prospective Tsitsikamma resource-poor farmers, to find out why the feasibility study is not proceeding. • Ask the District Municipalities to provide information on potentially beneficial allocations to villages for agriculture and home gardens. Ask PDA to review the position of farm workers and their existing need for water supplies. • At the next IAC meeting, follow up on the letter addressed by D: NWRP to the PDA regarding the need for a structured transfer of information, particularly from DWAF and PDA, but also from District Municipalities, regarding potential resource-poor farmer (and commercial) irrigation development information and required water resources information. Together with the PDA, develop a protocol to put this structured transfer of information in place. Other management actions to be implemented are: • Identification of areas where it may be possible to develop and sustain resource poor farmers in the ISP-area; • Identification and short-listing of schemes by the IAC for further evaluation. DWAF will provide the water resource availability picture to aid the identification process; • Evaluation of the short-listed and prioritised schemes through planning studies to determine the feasibility of the schemes. Evaluate the use of groundwater as a source of supply to identified and prioritised resource-poor farmer schemes. DWAF will provide input regarding water requirements and availability of every project being considered or implemented in a structured fashion; • Ways in which appropriate relevant information regarding water requirements and water availability can be effectively assessed in a structured way and transferred to the IAC must be revisited; • Ways in which the irrigation development needs of the PDA in line with the provincial economic development strategy and various priority lists can be effectively communicated to the IAC in a structured way must be revisited; • Ensuring the availability of staff and funds to do the planning studies to undertake such studies by lobbying for a higher priority for such activities within the Department and other Departments at a political level; • Motivate for Reserve determinations where required to be able to allocate water licenses where water is still available; • Where water is not available, first follow alternative appropriate steps to make water available such as water demand management and alien plants eradication. Then investigate re-allocation through the buying of existing irrigation rights or reducing the existing allocations of other irrigators by agreement; • Sharing of available water resources to supply resource poor farmers in certain cases will be required through re-allocation during compulsory licensing if other measures to make water available are not adequate; • Attach a high priority to the forming of WUAs where the needs of resource poor farmers have been prioritised, once the scheme has been proven economical; • Arrange payment of a subsidy to the WUA and assist with the sourcing of such funds if necessary according to the procedure for funding and construction of such schemes, as devised by D: WU.
Responsibility:	The development of this strategy is the responsibility of the RO.
Priority:	1 – Very high.

12	INTEGRATION AND CO-OPERATIVE GOVERNANCE

12.2	CO-OPERATIVE GOVERNANCE
Management objective:	To improve co-operation between the RO and other authorities regarding shared decision-making and so achieve improved overall governance to better manage the water resources in the Tsitsikamma to Coega ISP-area.
Situation assessment:	*In the spirit of good co-operative governance, the RO have been involved with:* • The establishment of Committees to oversee the management of the Swartkops River basin; • Liaison with DEAET, the Department of Agriculture and local authorities through the Steam flow reduction activities Licensing Advisory Action Committee (SFRALAAC) was established; • The existing Wetlands and Riparian zone Delineation Policy Committee between DWAF and DEAET; • The existing Provincial Liaison Committee and its sub-committees, such as the Irrigation Action Committee involving DWAF, the Department of Agriculture, DEAET and the Department of Land Affairs; • The existing Integrated Water Services Management Forum. *The following specific related issues and concerns were identified relating to co-operative governance:* • The integrated nature of the Algoa system and related future planning, which requires significant co-operation between various organisations; • The important role of NMMM in the Swartkops catchment. The catchment stakeholders are dominated by NMMM and they should play a major role in the co-operative governance initiatives; • Spills into storm water systems (affecting water quality) in especially the Swartkops River catchment, which need to be addressed; • Need for co-operative governance relating to pollution potential in the Groot River regarding inadequate sanitation in Steytlerville; • Need for improved co-operative governance in the Kromme River because of the varied activities in the catchment; • Need for co-operative governance in the Swartkops and Coega catchments due to the effect of the N2 highway; • The need for improved co-operation between DWAF, DALA and DEAET for the management of wetlands, estuaries and alien plant control programmes; • The need for an Eastern Cape provincial strategy that aligns with the ISP perspective; • Need for groundwater representation on the IAC because of uncoordinated drilling for service delivery, often unknown to DWAF.
Strategic approach:	Promote the effective management of water resources in the ISP-area through co-operation between DWAF, other government departments and local authorities. Continue involvement in the various co-operative management bodies already established, and ensure active involvement in new bodies that are being or will be established, if they contribute towards improved water management. *The approach will be as follows:* 1. Identify information needs from and information sharing needs with other departments, local authorities and institutions; 2. Align the DWAF information needs and information that needs to be shared and implement effective co-operative governance with other departments, local authorities and institutions through various formal and informal committees or other forms of co-operative decision making and information sharing; 3. Identify and keep a list of other acts that impact on DWAF's activities and set up liaison for additional problem areas that need to be addressed; 4. Define all the lines of communication and relationships; 5. Document all levels of co-operative governance e.g.: How will decisions be made?, the responsibilities of each party and signed Memorandums Of Understanding; 6. Review the effectiveness of committees and other liaison structures and propose changes as needed.

Management actions:	*The following specific co-operative government actions are required to address issues and concerns in the ISP-area:* 1. Obtain the Provincial Situation Assessment recently done by the Eastern Cape Provincial administration, study it and provide feedback. Liaise with the EC Provincial Government, get involved with the compilation of the Provincial strategy and share information; 2. Arrange a meeting between DWAF and DEAET for improved co-operation regarding the management of wetlands, estuaries and alien plant control programmes; 3. Develop and implement a pro-active policy to inform planned infrastructure processes about possible impacts and DWAF requirements with the relevant co-operative government partners; 4. Develop and implement a pro-active policy regarding IDPs and WSDPs; 5. Establish a water conservation and demand management co-operative initiative with local authorities and the Department of Housing; 6. Ensure groundwater representation on the IAC; 7. Assist Steytlerville through consultation to develop an appropriate sanitation system; 8. Set up a meeting with the Departments of Environmental Affairs, Mineral and Energy Affairs, NMMM and District Municipalities to facilitate improved co-operative governance in the Kromme River; 9. Set up meetings with NMMM and the Departments of Environmental Affairs and Mineral and Energy Affairs to facilitate improved co-operative governance in the Swartkops and Coega catchments about the effect of the N2 highway; 10. Invite NMMM to all planned actions and meetings about the Swartkops catchment.
Responsibility:	Although the issues identified are at ISP level, the need for improved co-operative governance is a National requirement, with action from the RO on area specific matters.
Priority:	1 – Very high.

CHAPTER 13 – WATERWORKS DEVELOPMENT AND MANAGEMENT STRATEGIES

NEED FOR WATERWORKS DEVELOPMENT AND MANAGEMENT STRATEGIES

Alternative options for the future management and ownership of major water resource infrastructure currently owned and operated by DWAF, is being investigated at national level. In the interim, there is an ongoing need to economically and safely manage the existing water resource infrastructure at both national and regional level.

The Waterworks development and management *Main Strategy* is required to address:

- ⇨ Strategies for new proposed schemes;
- ⇨ Strategies for major infrastructure operational components;
- ⇨ Strategies for specific geographical areas or rivers;
- ⇨ Recreation relating to water resources;
- ⇨ Disaster management planning.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

13.1 Algoa Water Supply System;
13.2 Groot River GWS management;
13.3 Using water resources for recreation;
13.4 Public health and safety.

No major scheme has been identified for implementation. A specific *Coega IDZ strategy* has not been developed in this version of the ISP, but may be required in future.

13 WATERWORKS DEVELOPMENT AND MANAGEMENT

13.1 ALGOA WATER SUPPLY SYSTEM

Management objective:

Ensuring effective operation and maintenance of the Algoa water supply system bulk infrastructure and components and transfer of ownership as required.

Situation assessment:

This strategy addresses issues and concerns relating to the integrated system and sub-systems, and to system operation during drought.

The water supply system serving the Port Elizabeth area is known as the Algoa Water Supply System (AWSS). It has developed from several separate schemes that have become interlinked. The AWSS consists of a few minor local sources, supply from the East (Orange water) and the western system which bring water from the Kouga (and Loerie) and Kromme River dams. Demands on the Algoa System are for both urban/industrial use and irrigation. Joint management and operation with forums are called for. The system and sub-systems of the AWSS are addressed under the following headings:

- Algoa water supply system
- Kouga/Loerie sub-system;
- Kromme sub-system;
- Sundays River Scheme extension sub-system;
- Uitenhage Aquifer and
- Other system infrastructure.

a. The Algoa water supply system

Assurance of supply relating to DWAF dams operated by other institutions will be dealt with in the licensing process.

The following issues and concerns regarding the Algoa System were identified:

- The need for a refined encompassing operational policy for the Algoa water supply system;
- The need for a uniform systems approach towards management and tariffing for users in the Algoa Water Supply System;
- The requirement for management plans for the scouring of dams;
- Proper maintenance of non-DWAF owned dams operated by other institutions, to link scouring to overtopping events and prevent problems such as the Van Stadens Dam scouring incident;
- The impact that the limitations of the supply network within NMMM from the various sources has on the selection of augmentation options.

b. Kouga/Loerie sub-system

Issues and concerns regarding ongoing operation and routine maintenance in the Kouga/Loerie Sub-system that were identified are:

- The need to transfer ownership of the tributary canals and other infrastructure from DWAF to the Gamtoos Irrigation Board;
- The need for the Departmental Control Committee to decide on the selling of hydropower infrastructure at Kouga Dam;
- Likely recommendations from the current *Gamtoos irrigation scheme WDM and operations* study by D: WDM that investigates demand management options and possible improvement of operational aspects;
- Need for improvement of irrigation use efficiency in the Gamtoos River GWS;
- Need for improved operational efficiency of the sub-system regarding aspects such as spillages and losses from the Gamtoos Irrigation canal;
- The envisaged compilation of the *Gamtoos Irrigation Board Water Management Plan*, following completion of the *Gamtoos irrigation scheme WDM and operations* study;
- Release of anoxic water from Kouga Dam due to stratification;
- Concern about the application of the operational rule of Loerie Dam and the actual versus the modelled incremental yield;

	• Operation problems of the Hankey siphon such as flood impacts and pipe material degeneration; • Leaks from the Loerie canal; • Concern regarding the integrity of the Kouga Dam scour valve. **c. Kromme sub-system** DWAF owns Impofu Dam and NMMM owns Churchill Dam. NMMM has compiled operation and maintenance manuals for Impofu Dam. Issues and concerns regarding the Kromme-Seekoei Sub-system that were identified are: • Compilation of new operating rules for Impofu Dam and the need in terms of a court order to incorporate releases to farmers therein; • The requirement for new license conditions for the users below the dam; • The need to address the current inadequate environmental releases from Impofu Dam; • Minor erosion below the Impofu Dam spillway. **d. The Lower Sundays Government Water Scheme Extension** The following issues and concerns have been identified: • The need to transfer ownership of the Sundays River transfer scheme infrastructure from DWAF to NMMM. **e. Uitenhage Aquifer** Issues and concerns regarding the Uitenhage Aquifer Sub-system that were identified are: • New licenses can be issued on merit; • The interrelationship between groundwater and surface water has not been adequately determined; • The need to split the management needs of the primary and secondary aquifers; • Uncertainty whether the specific recommendations, especially regarding abstractions, for the management of the aquifer are being adequately monitored. **f. Other infrastructure** No specific issues and concerns regarding the other system infrastructure were identified.
Strategic approach:	A medium term Algoa System Reconciliation Study is urgently required (see Strategy 13.1). A 15-20 years water resource planning strategy must be developed, setting a framework within which more regular feasibility level planning will be undertaken, particularly relating to distribution infrastructure. That strategy should also deal with how authorities responsible for water services and DWAF should plan together. Many of the operational and maintenance issues covered in this strategy would form part of such this study. A more integrated management approach is being persued, as illustrated by the agreements being drafted between the various parties for operation, maintenance and supply aspects of the system. The implementation of a system tariff would be a logical extension of this approach. Continue the transfer of the ownership of components of the system to the Gamtoos Irrigation Board and NMMM respectively. Improved system operation and the cutting of losses or spillages from the system must be a key priority, especially for the Kouga-Loerie sub-system. Problems around the operation of Loerie Dam must be discussed between DWAF and NMMM and solved. Irrigation efficiencies must also be improved. Management Plans are needed for all system dams. Illegal users must be prosecuted.
Management actions:	**Algoa Water Supply System** 1. The medium term Algoa System Reconciliation Strategy Study (ASRSS) must urgently be undertaken, to be completed before the middle of 2004. 2. The existing operation and maintenance procedures for the Algoa System should be documented, reviewed and amended; 3. Complete the current drafting of the new *Operation and Maintenance contract* between DWAF, NMMM, Sundays River Irrigation Board and Gamtoos Irrigation Board; 4. Complete the current drafting of the new *Bulk Supply Agreement* between DWAF, NMMM,

	Gamtoos Irrigation Board and the Sundays River Irrigation Board; 5. Incorporate assurance of supply as an item in the bulk supply agreement being drawn up and address assurance of supply relating to DWAF dams operated by other institutions in the licensing process – address in the ASRSS; 6. Investigate the phasing in of a systems tariff and how users will be affected; 7. Ensure that management plans are put in place for all major dams; 8. Complete the compilation of the policy to ensure improvement of maintenance on non-DWAF operated dams and agree on the relevant budget allocations. **i. Kouga-Loerie Sub-system** 1. Establish the most appropriate timing of the ownership transfer process of ancillary infrastructure from DWAF to the Gamtoos Irrigation Board and implement the transfer; 2. Review the unsolicited bid to utilise the Hydropower plant and reach a decision; 3. The WUA (Gamtoos Irrigation Board in the interim) should implement recommended follow-on work from the Gamtoos irrigation scheme WDM and operations study – address in the ASRSS; 4. Set targets for irrigation efficiency following the current WDM and operations study – address in the ASRSS. 5. Investigate reasons why NMMM is not operating Loerie Dam according to the recommended operating rule by arranging a meeting with NMMM and revise the Loerie Dam incremental yield in the yield balance if necessary – address in the ASRSS; 6. Address management problems following possible anoxic releases from Kouga Dam in the Reserve determination – address in the ASRSS; 7. Revisit the need to construct the Bodker balancing dam or other infrastructure following the current study to avoid system spillages – address in the ASRSS; 8. Seal the scour valve at Kouga Dam. **ii. Kromme Sub-system.** 1. Incorporate releases to farmers (in terms of a court order) in the operating rules being compiled. 2. Address the requirements for environmental releases from Impofu Dam and requirements for license conditions for downstream irrigators through the comprehensive Reserve and compulsory licensing processes – address in the ASRSS; 3. Address the erosion below the Impofu Dam spillway in the operation and maintenance manual. **iii. Sundays River transfer scheme** 1. Finalise ownership transfer of the Sundays River transfer scheme infrastructure from DWAF to NMMM. **iv. Uitenhage Aquifer** 1. Continue monitoring and compile and implement an Aquifer Management Strategy – address in the ASRSS; 2. Initiate action against Amanzi Estates;
Responsibility:	NWRP is responsible for general planning such as the Reconciliation Strategy study. The responsibility lies with the RO for upgrading existing infrastructure and with D: Options Analysis for new infrastructure. The RO is responsible for developing this strategy in consultation with the NMMM and the Gamtoos Irrigation Board.
Priority:	1- Very high.

13	WATERWORKS DEVELOPMENT AND MANAGEMENT

13.2	GROOT RIVER GWS MANAGEMENT
Management objective:	The development of an operational strategy in the best interest of public safety in the Gamtoos Valley and of irrigators downstream of Beervlei Dam, and effective operation and maintenance of the GWS.
Situation assessment:	***The Groot River Government Water Scheme*** relies on Beervlei Dam, completed in 1957, for water. DWAF owns, operates and maintains Beervlei Dam. An area of 2 516 ha was scheduled under the scheme in 1995 and 2 530 ha were irrigated. Annual average use is reported to be 18,5 million m^3/a. The yield of Beervlei Dam is roughly estimated to be 20 million m^3/a at 1:10 year assurance and 12 million m^3/a at 1:50 year assurance. 30 Million m^3/a is allocated for the Groot River Government Water Scheme from Beervlei Dam for irrigation. Some listed irrigators are located very far below the dam. Beervlei Dam is essentially a flood control dam. The dam fills quickly but also has a very large flood-absorption capacity. The current operating rule is that water should be released within a year when the dam fills, to prevent salt build-up in irrigated land. Water from the dam can be used for existing irrigation or to protect the Gamtoos River valley from flooding. Natural river water quality is poor. *The following issues and concerns were identified:* • Required decision on the future management and operational strategy of Beervlei Dam; • Large reduction in the yield of Beervlei Dam due to river transportation losses associated with releases for irrigation use, because some irrigators are located so far below the dam; • Non-payment by irrigators for large river transportation losses; • The interest of some scheduled farmers to de-schedule because they don't use the water; • Annual fluctuation of operation and maintenance tariffs.
Strategic approach:	Here is a situation where there is conflict between irrigation and flood control objectives. Very large transfer losses also occur in conveying the current irrigation releases, which offers big scope for water savings. A decision on the future use of the dam is required. The management strategy for Beervlei Dam will be revisited, co-operatively with the Department of Agriculture. A decision will be reached on the future intended use of the dam. The large river losses must be addressed. Water could possibly be released to fewer farmers over a longer period. The various options to determine possible impacts will be assessed and a future operational strategy for Beervlei Dam will be determined. A disaster management plan will be prepared and implemented for the Groot and Gamtoos Rivers to safeguard the public in the Gamtoos River catchment against the floods, which are a feature of that system.
Management actions:	1. Revisit the management strategy and operating rule co-operatively with the Department of Agriculture. Water could possibly be released to fewer farmers over a longer period. Assess the various options to determine possible impacts. 2. Establish a WUA as soon as possible; 3. Develop a communication disaster management strategy for flooding in the Gamtoos Valley.
Responsibility:	The RO is responsible for implementing this strategy.
Priority:	Management strategy: Priory 3 – Medium. Implement over the medium term; WUA: Priority 1 – Implement as soon as possible.

13	WATERWORKS DEVELOPMENT AND MANAGEMENT

13.3	USING WATER RESOURCES FOR RECREATION
Management objective:	Ensuring the sustainable and equitable management and regulation of the use of water resources, especially state-owned dams, for recreation. This will be achieved through public administration and service delivery based on sound policy.
Situation assessment:	Many dams, rivers and estuaries in the ISP-area are extensively used for recreational purposes, such as the Kromme Estuary, lower Gamtoos River and Klippedrift River. Recreational use linked to tourism is growing in the Tsitsikamma Coast sub-area. Recreational activities such as swimming are also commonplace in polluted rivers such as the Chatty and Swartkops Rivers. *The following specific related issues and concerns were identified:* • The danger that river pollution holds for recreational use in the Chatty and Swartkops Rivers is a concern; • No Sustainable Utilisation Plan has been prepared for Beervlei Dam; • Management of the activities decided on in the Sustainable Utilisation Plan of Impofu Dam.
Strategic approach:	To guide the use of water for recreation clear DWAF guidelines are necessary, based on policies that address the needs and expectations of the tourism industry and other recreational users, without losing focus of the Department's obligations to government and local communities. To ensure that government's objectives are attained through management of this use, the policy environment in which this takes place must be clarified, understood and implemented, considering the current constraints of Schedule 1. Several initiatives are currently being undertaken by DWAF. **Legal and Policy Framework** DWAF's *Policy for Using Water for Recreational Purposes* defines government's overall and DWAF's particular responsibility towards this water use and industry. It further establishes the basic principles, aims and policy for regulating this water use. In an effort to meet the objectives of the NWA and this Policy relating to the creation of economic opportunities for historically disadvantaged people and improving quality of life, DWAF has initiated an Implementation Programme aimed at: • Creating awareness about the importance of using water resources and state assets for recreation as well as awareness of the relevant policy and associated protocol; • Developing a single, standardised approach and establishing just administrative procedures; • Ensuring integration, development and implementation of environmental and financial management as well as industry tools, thereby promoting the objectives of co-operative governance; • Capacity building and empowering of relevant stakeholders; and • Creating an enabling environment that is conducive to unlocking the potential of water resources for recreational activities and use. **Planning Framework** To effectively manage the use of water resources for recreation, *management plans* are required *combined with representative institutional structures* to take charge of the implementation thereof in an equitable manner. The *Sustainable Utilisation Planning Procedure* (SUPP) replaces the process for *compilation of Zoning Plans*, traditionally applied only to state dams. Such Zoning Plans were spatial and environmental, and often failed to consider economic and social issues. They also lacked guidelines regarding institutionalisation, capacity building and empowerment for their implementation. The SUPP unlocks the socio-economic potential of water resources through the compilation of sustainable access, utilisation and development plans. Sustainable Utilisation Plans (SUPs) are based on environmental constraints, community and water user needs and requirements, and sound business principles.

	Implementation and Management Framework Although it is envisaged that management and control of this use will largely be based on self-regulation and compliance, the various role-players must understand their respective roles and functions regarding the regulation of this use. Such role-players are the Directorate Water Abstraction and Instream Use, previously the Directorate Social and Ecological Services (D: WA&IU, previously SES), Regional Offices, Delegated Authorities, and Water Management Institutions, i.e. CMAs and WUAs. Currently the respective roles and responsibilities are played out as follows but may change over time through restructuring and roll-out of catchment management programmes and initiatives: 1. *Delegated Authorities and Water Management Institutions* will be responsible for *inter alia* – • Participation in the compilation and implementation of Sustainable Utilization Plans (SUPs); • Ensuring local compliance to industry norms and standards and relevant legislative requirements; 2. *Regional Offices* for among other- • Communicating policy and protocol to water users (industry and recreational users), communities, and resource managers; • Prioritising and facilitating SUPPs; • Conducting needs and expectation assessments of relevant stakeholders; • Capacitating and empowering relevant stakeholders; • Reporting on compliance and performance audits; and 3. *D: WA&IU (previously SES)* for the development and updating of policy and protocol based on results of performance and compliance reports. The above roles and responsibilities will be clarified, confirmed and communicated to the various role-players. **Approach** The approach to clarify DWAF's area specific position and strategy will be: • Establishing the necessary linkages with D: WA&IU (previously SES) for policy and protocol implementation; • Compiling Resource and Asset Inventories (dealing with *inter alia* types, legal encumbrances such as ownership, other vested rights etc.; water quality conditions relevant to levels of recreational use; and hydrological conditions); • Developing Resource Utilisation Profiles (detailing manner, purpose and extent of the use); • Evaluating existing Institutionalisation / Management (Control and Supervision) Delegations; • Recording Industry / Private Sector Interest (regarding access, use and development); • Evaluating efficiency and representivity of Community Involvement and Beneficiation Mechanisms; and • Compiling an Inventory of Existing Management / Zoning Plans (detailing status and implementation). • Prioritising the compilation, institutionalisation and empowerment of SUPs for water resources taking into consideration the area specific information.
Management actions:	The implementation and management of the *Sustainable Utilisation Plan* (SUP) of Impofu Dam has been addressed in the *Operation and Maintenance manual* of the dam. NMMM will continue to manage the activities that were addressed, following the drafting of a SUP by DWAF for Impofu Dam's surface area and surrounding land. Draft a sustainable Utilisation Plan for Beervlei Dam.
Responsibility:	The RO is responsible for implementing this strategy and D: WA&IU (previously SES) for the development and updating of policy and protocol based on results of performance and compliance reports.
Priority:	3 – Medium.

13	WATERWORKS DEVELOPMENT AND MANAGEMENT

13.4	PUBLIC HEALTH AND SAFETY
Management objective:	Effective disaster management planning and implementation relating to floods management, operation during droughts, dam safety and emergency spills.
Situation assessment:	*The following specific public health and safety related issues and concerns were identified:* **a. Disaster Management planning** • An Eastern Cape Disaster Management Forum has been established; • The need for each District Municipality to have a disaster management forum; • The Cacadu District Municipality drew up a dam-break plan. • Need for a Groot / Gamtoos Rivers Disaster Management Plan to monitor and manage the lower Gamtoos and Groot Rivers; • Uncertainty about the existence of disaster plans for NMMM owned and operated dams. • Emergency Preparedness Plans have been done for Kouga and Loerie dams. • A disaster management plan has been implemented below Impofu Dam. **b. Operation during drought** • The high dead water storage level in Impofu Dam. **c. Dam safety** • All dam safety issues in the Kromme-Seekoei area have been addressed. **d. Emergency spills** • Emergency spills on the N2 in the Tsitsikamma sub-area.
Strategic approach:	Until such time as the *Public Safety Unit* has been established, an interim strategy will be implemented as follows: **a. Disaster Management planning** 1. Procedures to supply water during times of emergency need to be documented to determine repair work that may be required to specific infrastructural components; 2. Integrate any disaster management plans with the Disaster Management Act; 3. Emergency supply arrangements need to be developed for various durations of possible non-supply from the system or components for the various user groups. 4. Encourage the establishment of disaster management forums in all District Municipalities through the Water management institutional framework strategy; 5. Complete Emergency Preparedness Plans for all government dams in the ISP-area and implement; 6. Encourage owners of Category 2 private dams to prepare EPPs for their dams; 7. Through the Co-operative governance strategy liaise with NMMM, other affected municipalities and the Department of local government and housing to influence the fast tracking of the housing process to get people out of dangerously located informal settlements. **b. Operation during floods** 1. Implement the recommendations on *The Report on the Algoa system operation of May 1999* when flooding is imminent. **c. Operation during drought** 1. Implement the recommendations in The Report on the Algoa system operation of May 1999 in a drought period; 2. Draw up a drought management plan to operate government infrastructure during droughts; 3. Draw up a drought management plan to co-operatively deal with supply to local authorities during times of drought; 4. Review and document procedures adopted during previous droughts; 5. Identify shortcomings in terms of operation during previous droughts; 6. Develop procedures for the implementation of restrictions in the agricultural sector; 7. Address both surface and groundwater resources.

	d. Dam safety 1. Implement the requirement of the NWA regarding dam safety; 2. Process dam safety applications and issue authorisations as required; 3. Keep a regularly updated register of all dams with a safety risk; 4. Undertake dam safety inspections and reporting; 5. Take actions against illegal or unsafe dams. **e. Emergency spills** 1. Request the polluter to remedy its effects; 2. Contact relevant emergency services and disaster management centres.
Management actions:	**a. Beervlei Dam / Gamtoos River** *Disaster Management planning:* Prepare and implement a Disaster Management Plan for the Groot and Gamtoos Rivers. **b. Kromme River / Impofu Dam** *Operation during drought:* Investigate the possibility of utilising the dead storage in Impofu Dam in times of drought. **c. Kromme River / Impofu Dam** Address the need for plans to contain emergency spills on the N2 highway through the Co-operative governance strategy. **d. Swartkops River / Loerie Dam and other NMMM dams** *Disaster Management planning:* Liaise with NMMM officials to establish the status of disaster management plans for their dams and encourage them to implement such plans for all their dams; *Operation during drought:* Consult with the NMMM regarding the operation of their infrastructure;
Responsibility:	The RO is responsible for developing this strategy in consultation with NMMM and the Gamtoos Irrigation Board, for upgrading existing government infrastructure as required in terms of this strategy and for operation of government infrastructure during droughts.
Priority:	2 – High.

CHAPTER 14 - MONITORING AND INFORMATION MANAGEMENT STRATEGIES

NEED FOR MONITORING AND INFORMATION MANAGEMENT STRATEGIES

The Act requires the Minister to establish national monitoring systems for water resources to collect appropriate data and information. The Department is addressing the shortcomings of the current arrangements by amalgamating all existing and planned monitoring and assessment systems into a structured and coherent monitoring, assessment and information system.

Monitoring is required to introduce billing, to ensure compliance with water authorisation conditions, and to control all water use.

The *Monitoring and information management Main Strategy* is required to address:

- ⇨ Water use control from freshwater bodies and bulk water infrastructure;
- ⇨ Monitoring networks and data capturing for physical, chemical and biological aspects of surface and groundwater;
- ⇨ Issues relating to information systems and
- ⇨ Information access and requirements.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

14.1 Water use control;
14.2 Monitoring networks and data capturing;
14.3 Information management.

14	MONITORING AND INFORMATION MANAGEMENT

14.1	WATER USE CONTROL
Management objective:	Improved control and management of users to ensure compliance with authorisations for all uses.
Situation assessment:	Water use control of NMMM's water supplies is generally acceptable. No monitoring of supply to small towns is done in the Groot River basin. This is a situation also reflected widely in other smaller towns. The location and status of monitoring boreholes of municipalities is poorly documented. Actual groundwater abstraction information is not available from many towns. Officials at smaller local municipalities do not have the technical expertise or capacity to do groundwater and surface water monitoring correctly over an extended period and DWAF staff lacks the capacity to do such monitoring on their behalf. Water use is monitored for all coastal towns abstracting water from the Impofu Dam pipeline by metering the off-takes.
Strategic approach:	There is concern about the poor state of monitoring in small local authorities to control water use, especially with regard to groundwater. Local municipal staff will be informed (within DWAF staffing constraints) to enable them to monitor themselves and keep supply records. Address the major problems or targeted areas to improve the state of groundwater monitoring and availability of information in the ISP-area, to improve control over water use. Review and document the acceptability of current water use control by DWAF and other service providers as well as large private users in the ISP-area (what is currently monitored, how acceptable is it and what is required?). Monitor compliance of non-metered uses through regular visits and more attentive monitoring of problem sites or unacceptable impacts. Facilitate adequate control over non-compliance through co-operative governance between DWAF and NMMM, local municipalities and WUAs. Initiate a co-operative approach to establish water use control monitoring requirements between DWAF, NMMM, local municipalities and WUAs. Ensure that all monitoring related requirements are written into the scope of appointment of WUAs. Include monitoring as a requirement of future groundwater authorisations to improve the availability of data.
Management actions:	Compile a regional Water Use Control Plan, following the review and documentation of the acceptability of current water use control by DWAF and other service providers as well as large private users in the ISP-area. Prioritise areas where improved groundwater information is required. Target local authorities in these areas and engage them regarding groundwater information requirements. Install or facilitate the installation of automatic recorders for groundwater and surface water monitoring at such small local municipalities as a priority. Address the lack of monitoring at small towns in the Groot River basin. Investigate the situation of each town and engage the municipal structures to promote the implementation of monitoring devices through co-operative governance.
Responsibility:	The development of this strategy is the responsibility of the RO in consultation with the NMMM, D: WDD and D: Information Programmes.
Priority:	1 – Very high.

14	MONITORING AND INFORMATION MANAGEMENT

14.2	MONITORING NETWORKS AND DATA CAPTURING
Management objective:	The installation of effective regional monitoring networks and population of repository databases to ensure adequate quantification of the balance between sustainable water use and protection of surface freshwater bodies and groundwater.
Situation assessment:	Groundwater monitoring is generally inadequate and there is a need to improve estuarine monitoring. The location and status of monitoring boreholes in the ISP-area is not well documented. In addition to the absence of sufficient monitoring boreholes, resource capacity for monitoring is a problem. The regional hydrological data capture systems and databases are acceptable to regional staff (monitoring and capturing of rainfall, evaporation, surface water, ground water and water quality). The available information and monitoring systems to capture usable information are however not acceptable. There is a lack of either personnel (DWAF for some monitoring functions) or skills (municipalities) to monitor adequately and a lack of funds to increase monitoring points at an acceptable rate. Water quality samples are taken monthly by DWAF and not two-weekly, as is preferable, due to a lack of manpower. *The following specific monitoring related issues and* concerns *were identified:* **i. Groot** • Inaccurate measuring of flow above and below Beervlei Dam. **ii. Kouga-Gamtoos** • No groundwater monitoring is done by DWAF in the Kouga-Gamtoos sub-area, except that required for the National Ground Water Database. More monitoring is needed; • No water quality sampling in the Kouga River is done above Kouga Dam; • There are no gauging weirs below Kouga and Loerie Dams due to inadequate foundation conditions. This will create a problem for the monitoring of an IFR. **iii. Kromme -Seekoei** • No water quality sampling in the Kromme River is done by DWAF above Impofu Dam; • Monitoring of dairy farming activities and feedlots in the lower Kromme and Seekoei Rivers are done ad-hoc; • Water level recorders were installed in the Kromme and Seekoei Rivers' estuaries; • Monitoring of water quality from boreholes is not done; • The installation of low-flow monitoring devices were planned but not yet installed; • There is a minor need for increased biological monitoring in the Kromme River due to industrial discharge from Kareedouw. **iv. Tsitsikamma Coast** • No groundwater monitoring is done by DWAF in the Tsitsikamma Coast area, except that required for the National Ground Water Database; • Need for monitoring of the Groot estuary to obtain base information for possible future schemes; • Need for monitoring of the Klippedrift estuary. **v. Algoa Coast** • Uncertainty about the responsibility for monitoring of the Swartkops estuary; • Biological monitoring of the Swartkops River is planned as part of the River Health Programme; • Groundwater data is continually entered into the NGWDB from a dedicated link in the PE DWAF office. Three-monthly water quality sampling is done; • There is no monitoring on the Coega or lower Swartkops Rivers; • Need for estuarine monitoring in the Van Stadens River to obtain base information for

	possible future schemes; • Need for water level recording in the Swartkops Estuary; • Need to improve coastal and marine monitoring through co-operative governance.
Strategic approach:	Develop a detailed regional strategy for the monitoring and data capturing needs of the ISP-area by the following generic actions: 1. Review or identify all aspects that need to be monitored. Group all monitoring needs into logical systems with common goals according to functional areas, which are then divided further into sub-systems; 2. Develop a detailed information requirement and monitoring needs assessment for the various systems, which were grouped by functional areas; 3. Identification and motivation of required or additional monitoring points or functions required for the ISP-area; 4. Amalgamation of the identified existing and planned monitoring and assessment systems needs into a coherent and structured monitoring, assessment and information system; 5. Review resources required for adequate monitoring of surface and groundwater; 6. Motivation for the regional share of the national monitoring budget; 7. Regularly review and update the regional monitoring strategy; 8. Develop co-operative, collaborative relationships between the Department and other organisations or individuals that has relevant data or operate water-related monitoring, assessment and information systems. *Surface water monitoring:* Continue existing monitoring and data-capturing systems and identify the need to install additional rainfall, flow or estuarine recorders. Estuarine recorders are currently needed for four estuaries. Meet with NMMM and the Swartkops Trust to determine responsibility for monitoring of the Swartkops estuary and establish monitoring. *Groundwater monitoring*: Build capacity, especially at local authorities. Additional staff are also urgently required in the RO. *Water quality monitoring*: This was largely addressed in the *Water quality management Strategy*, which also dealt with water quality monitoring needs. *Coastal and marine monitoring* are required and help must be obtained from the Coastal and Marine Research Institute of PE. They monitor the tidal area and could be part of a co-operative governance effort.
Management actions:	Develop an integrated regional monitoring ISP-area Programme that includes the following: • The situation regarding monitoring in the ISP-area indicating what is being monitored, further monitoring requirements and what monitoring is duplicated or unnecessary; • Include all monitoring functions within DWAF (Hydro, Geohydrology, Water quality, Regional office and Head office and the River Health of the CMA); • Liaise and integrate with organisations with a strong water interest outside DWAF but within the ISP-area (Dept. of Agriculture, other Provincial Administration departments such as DEAET, Housing, Mineral and Energy Affairs, NMMM, local authorities, Nature conservation (Weather Bureau) and research institutions such as the CSIR, universities, NGOs and the ARC. The Programme must address: • The coordinating structure and responsibilities; • Who will be responsible to gather data, according to which methods and standards will it be gathered and at what frequency (standards should conform to the needs of all users and if international standards exist it should be the minimum standard); • Agreement on who will fund the functions and whether it is financially feasible over the longer term; • An Implementation Programme with required actions and budgets; • Address custodianship of the databases and requirements for auditing of information or databases through the *Information Management Strategy (14.3)*; Specific actions to be included in the Monitoring Programme are: • Install water level recorders in the Groot and Klippedrift estuaries (Tsitsikamma Coast sub-area), and in the Swartkops and Van Stadens estuaries (Algoa Coast sub-area);

	• Install the planned low-flow recorders in the Kromme-Seekoei sub-area; • Meet with NMMM and the Swartkops Trust to determine responsibility for monitoring of the Swartkops estuary. Plan the required monitoring, arrange funding and install monitoring devices and systems; • Meet with the Coastal and Marine Research Institute of PE University and ask them to assist with coastal and marine monitoring.
Responsibility:	The development of this strategy is the responsibility of the RO in consultation with the NMMM, the RDM office and the Directorates of Information Programmes, Waste Discharge and Disposal and the IWQS.
Priority:	Priority 2 – High. Implement over the medium term.

14	MONITORING AND INFORMATION MANAGEMENT

14.3	INFORMATION MANAGEMENT
Management objective:	Facilitate improved storage, manipulation, backup, archiving, dissemination, access to and sharing of information within the ISP-area.
Situation assessment:	Arial photography has been completed and dams have been surveyed during the current surveys of all dam volumes and pump structures in the Kouga-Gamtoos and Kromme-Seekoei sub-areas. The WARMS system managers have been informed of the requirement for water use queries per catchment area. Once completed the alien invasive mapping in the Kouga-Gamtoos sub-area will be used to determine items to be addressed in a 5-year plan, which will be used for control, conservation and water resource management. Groundwater data for populating the National Groundwater Database is submitted twice annually. *The following monitoring related issues and concerns were identified:* • There is ongoing capturing according to priority in the registration process. Data of some water users and solid waste sites have not yet been captured; • There is an ongoing mapping project that captures data on alien invasive species in the upper catchments and higher-lying areas; • There was a loss of captured waste site data in the RO due to inadequate backup facilities. Only 20 % of solid waste sites are now populated in the *Waste Manager* programme (waste license information); • There is an urgent requirement for adequate data storage, backup and archiving systems for captured Eastern Cape data since data is valuable and expensive.
Strategic approach:	*Compile an ISP-area Information Management Plan as follows:* 1. Identify what information the Departmental information managers require; 2. Determine GIS specific requirements such as hardware for storage; 3. Identify information requirements from other departments, provincial and local government and other organisations in the ISP-area with a water interest; 4. Compile an *information sharing policy* with other departments, provincial and local government and other organisations and identify the following: - What information should be shared? - Who should have access to it? - What is the integrity of the information to be shared? - With whom is sharing of information beneficial? 5. Implement the *information sharing policy* through co-operative governance with other departments, local authorities and institutions through various formal and informal committees or other forms of effective co-operation; 6. Address custodianship of the databases and requirements for auditing of information or databases for shared databases. Set time intervals between data gathering and availability on the databases and determine a policy of the costing aspects of making data available; 7. Re-capture waste related license information in *Waste Manager*; 8. Install adequate storage, backup and archiving facilities and library systems in all the Eastern Cape regional offices; 9. Formulate an approach to deal with available WARMS information. The current resources in the RO to implement this Strategy are inadequate. Skilled IT and GIS staff, funds to buy and properly manage the software and databases and technical staff to evaluate, manage and improve the systems and databases and to liaise with other information managers are required. The available staff is very stretched and address issues according to priorities. The most important approach is thus to source resources. Restructuring is under way in the RO, which is a difficult time to source resources, but is also opportune to divert resources to information management, which in the past generally seemed to be undervalued in importance.

Management actions:	Implement the ISP-area Information Management Plan. Follow up on the conflict of groundwater use figures for irrigation use in the Gamtoos River (L) catchment.
Responsibility:	A new Chief Directorate Scientific Services will be created to take overall responsibility. The development of the regional strategy is the responsibility of the RO.
Priority:	1 – Very high.

CHAPTER 15: IMPLEMENTATION STRATEGIES

NEED FOR IMPLEMENTATION STRATEGIES

The *Implementation Main Strategy* is required to address:

- ⇨ Implementation programme for the ISP;
- ⇨ Resources to implement the ISP;
- ⇨ Delegation of responsibility;
- ⇨ Budgeting priorities.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategy have been developed further:

15.1 Implementation.

15 IMPLEMENTATION

15.1 IMPLEMENTATION

Management objective:	To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Tsitsikamma to Coega ISP-area. This will require commitment, funding and capacity.
Situation assessment:	The ISP is an internal document developed by the Department of Water Affairs and Forestry. The ISP sets out the approaches which the Department is taking towards water management in this ISP-area – and lists suggested actions towards achieving good management of its water resources. The wider public has not been given opportunity to input into this ISP – yet it is recognised that the approaches adopted have a significant impact on the populace of the ISP-area. Whilst the approach to date in developing this ISP has been non-participatory, it must be remembered that this is not a Catchment Management Strategy – but DWAF setting out how it sees the situation, and the steps which it views as most appropriate in dealing with the situation. The ISP is however not a closed document and it will to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document – opening out the thinking and planning of the Department. Although DWAF makes no commitment to adopt every comment made, these will be taken seriously and the ISP will be updated and improved as newer and better perspectives are formed. Once the CMA has been established it will be required to develop a CMS, and this will require full public participation. It is to be hoped that the ISP will be taken as useful baseline information and, indeed, that the approaches adopted here are found to be acceptable to, and adaptable by, the new dispensation.
Strategic approach:	The ISP is guided by the approach set out in the NWRS – and details this approach for the Berg WMA. The ISP carries significant weight in expressing how water resource planning and management will be carried out in the WMA. It is not, however, an inflexible document. As such the ISP may be adjusted and adapted when new and better ideas are presented. Despite this the approaches and requirements of this ISP may not be ignored. The implementation of the ISP is an enormous task and will have to be tackled in a stepwise fashion. Much of what is in this document describes the day-to-day functions of the Department – but there are many new tasks, functions, and actions set out in response to DWAF's visions for the future. It is recognised that it is quite impossible to immediately launch into, and achieve, all that is required by this ISP. Funds and capacity are blocks that must be climbed over. The approach is to take the ISP and to use it as instruction, guidance, and motivation in the development of yet clearer management and action plans. These must be built into Departmental Business Plans, and budgeted for as part of Departmental operating costs. This will necessarily be in a phased manner as dictated by available resources, but it is important that the ISP be used to leverage maximum funds, maximum capacity, and to bring optimum management to the WMA. The position with regard to the 'Authority of Information Contained in the ISP' is set out in Paragraph 1.3.4 of Chapter 1 of this ISP document.
Management actions:	The following actions are required: a. Publish the ISP to be accessible for public input and comment (consider hard-copy and web-based options). Copies will be presented to key stakeholders on request. It is not the intention to have a major drive for public input, but merely to create opportunity for input. b. There are many actions in the ISP which do require public involvement – and it is important that the thinking with regard to, for example, the use of groundwater, and the importance of WC/DM, is delivered forcefully both to local authorities, other direct water users such as agriculture, and the wider public. c. Collate and consider all comment in revising and improving the ISP. d. The ISP should be open to continuous improvement, with possible updating on a bi-annual basis. e. All Regional Office water resource management staff, Working for Water, NMMM and other major stakeholders should have access to, or copies of, the ISP

	f. Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP is not ruled out. g. The practicalities of implementation demands must always be considered. h. Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets. The names of Eastern Cape Regional Office personnel that have been identified to be responsible for implementation of the strategies are shown in the following **Table 15.1**, as well as identified DWAF head office champions.
Responsibility:	The RO is responsible for implementing this strategy.
Priority:	Priority 1 – Very high. The implementation is to be ongoing until the Fish to Tsitsikamma WMA is established and the ISP is superseded by a CMS.

Table 15.1: Responsibilities/champions for Main strategies and strategies (February 2004)

Main Strategies and Strategies	Regional Office Responsibility	Head Office Champions (1)
1. Yield Balance and Reconciliation	**Theo Geldenhuys**	**NWRP / OA**
1.1 Reliability of the yield balance	Theo Geldenhuys	NWRP: F. Stoffberg/OA: A. Brown
1.2 Groundwater	Wandile Nomquphu	Information programmes
1.3 Compulsory licensing	Theo Geldenhuys	WA: Ashwin Seetal
1.4 Nelson Mandela Metropole future augmentation	Theo Geldenhuys	OA: Alan Brown
1.5 Effluent re-use	Andrew Lucas	WDD
1.6 Supply to local authorities	Flip de Wet / PDI: T. Mbassa	NWRP: F Stoffberg / OA: A Brown
2. Water Resources Protection	**Andrew Lucas**	**RDM / WDD**
2.1 Reserve and resource quality objectives	Andrew Lucas / M. Labuschagne	RDM / WDD
2.2 Wetlands	Martin Labuschagne	WfWetlands / RDM
2.2 Water quality management	Andrew Lucas	WDD
3. Water Use Management	**Theo Geldenhuys**	**WA&IU / WUE**
3.1 General authorisations	F. de Wet / A. Lucas / W. Nomquphu	WA&IU: Johan Wessels / WDD
3.2 Verification of existing lawful use	Flip de Wet	WA&IU: Flip Nötling / WDD
3.3 Licensing	Flip de Wet / Andrew Lucas	WA&IU: Johan Wessels
3.4 Invasive alien plant control	Patrick Marsh	NWfW: Christo Marais
3.5 Pricing	Dirk Crafford / Steven Mullineux	WA&IU: Piet Pretorius
4. Water Conservation and Demand Management	**Theo Geldenhuys**	**WA&IU / WUE**
4.1 Urban water conservation and demand management	Martin Labuschagne	WUE: Nigel Adams
4.2 Agricultural water conservation and demand management	Martin Labuschagne	WUE: Ephraim Mokoena
4.3 Industrial water conservation and demand management	Martin Labuschagne	WUE
5. Institutional Development and Support	**Theo Geldenhuys**	**WMIG**
5.1 Catchment management agency	Theo Geldenhuys	WMIG: Eiman Karar
5.2 Water user associations	Steven Mullineux	WMIG: Eiman Karar
6. Social and Environmental considerations	**Mfuzi Mpendu**	**WMIG / WA&IU (SES)**
6.1 Capacity building, public participation and communication	Mfuzi Mpendu	WMIG: E. Karar / WAIU (SES): Jean Msiza
6.2 Environmental		WA&IU (SES): Barbara Weston
7. Integration and Co-operative Governance	**Zolile Keke**	**None**
7.1 Poverty eradication and land reform	Steven Mullineux / Mfuzi Mpendu	WA&IU: Francois van der Merwe

Main Strategies and Strategies	Regional Office Responsibility	Head Office Champions (1)
7.2 Co-operative governance	Zolile Keke	None
8. Waterworks Development and Management	**Dewald Coetzee**	**None**
8.1 Algoa System management	Dewald Coetzee	None
8.2 Groot River GWS management	Dewald Coetzee	None
8.3 Using water resources for recreation	Theo Geldenhuys	WA&IU (SES): Lorraine Fick
8.4 Public health and safety	Piet Oosthuizen	WRPS: Chris Swiegers
9. Monitoring and Information Management	**P.Oosthuizen/A.Lucas/T.Geldenhuy**	**CD: SS**
9.1 Water use control	F. de Wet, A. Lucas, W. Nomquphu	None
9.2 Monitoring networks and data capturing	P.Oosthuizen/ A.Lucas/ W. Nomquphu	CD: SS
9.3 Information management	Theo Geldenhuys	CD: SS / WARMS: A. Muller
10. Implementation	**CD: Southern region**	**None**
10.1 Implementation	CD: Southern regions H. van Vliet	None

1. The abbreviations for the various DWAF Directorates, related organisations and designations are:

National Water Resources Planning	:	WRP
Options Analysis	:	OA
Waste Discharge and Disposal	:	WDD
Working for Wetlands	:	WfWetlands
Water abstraction and Instream Use	:	WA&IU
Water Use Efficiency	:	WUE
National Working for Water	:	NWfW
WMI Governance	:	WMIG
Social and Ecological Studies	:	WA&IU (previously SES)
Water Resource Planning Systems	:	WRPS
Water Allocation		WA
Scientific Services	:	SS
Chief Director	:	CD

TSITSIKAMMA TO COEGA INTERNAL STRATEGIC PERSPECTIVE

APPENDICES

APPENDIX A: REFERENCES AND DOCUMENTATION

Appendix A1: References
Appendix A2: Relevant ISP strategies documentation

APPENDIX B: ISP-RELATED INFORMATION

Appendix B1: Rivers and towns
Appendix B2: Previous and new municipalities
Appendix B3: Solid waste disposal sites
Appendix B4: Waste water treatment works
Appendix B5: General authorisations tables
Appendix B6: Controlled and other large irrigation schemes
Appendix B7: Resource poor farmers
Appendix B8: Major dams
Appendix B9: Major infrastructure and transfer schemes
Appendix B10: Future local schemes
Appendix B11: Flow gauging stations
Appendix B12: Algoa system bulk water supply infrastructure

APPENDIX C: YIELD BALANCES

Appendix C1: Detailed yield balances
Appendix C2: Algoa system yield balance

REFERENCES

1. Department of Water Affairs and Forestry, South Africa. April 2003. Orange River Continuous Study: Orange River Yield Balance (Report No. P D000/00/4903).

2. Department of Water Affairs and Forestry, South Africa, 2004. National Water Resource Strategy, First Edition.

3. Department of Water Affairs and Forestry, South Africa, 2004. National Water Resource Strategy Fish to Tsitsikamma WMA Report, First Edition (Report No. P WMA 15/000/00/0203).

4. Department of Water Affairs and Forestry, South Africa, 2002. Algoa Pre-Feasibility Study Project Reports (Report No PM 000/00/2401).

5. Department of Water Affairs and Forestry, South Africa. 2002. Personal communication with many DWAF staff.

6. Department of Water Affairs and Forestry, South Africa. 2002. Eastern Cape Regional Office staff personal interview.

7. Department of Water Affairs and Forestry, South Africa. 1996. Groundwater Harvest Potential of the Republic of South Africa. (Map).

8. Department of Water Affairs and Forestry, South Africa. http://www.dwaf.gov.za website. January 2003.

9. Department of Water Affairs and Forestry, South Africa. 8 October 1999. General authorisations in terms of Section 39 of the National Water Act. Government Notice No. 1191.

10. Department of Water Affairs and Forestry, South Africa. 1998. Guidelines for the assessment of water use authorisations and license applications in terms of Section 27(1) of the National Water Act.

11. Department of Water Affairs and Forestry, South Africa. 1999. *Primary water situation at Karoo towns*. Prepared by S Mullineux of the Eastern Cape Regional Office Advisory Services. (No Report number).

12. Department of Water Affairs and Forestry, South Africa. 1999. Pricing strategy for raw water use.

13. Department of Water Affairs and Forestry, South Africa. 1999. Regulations requiring that a water use be registered. Government Notice No 1352.

14. Department of Water Affairs and Forestry, South Africa. February 2003. Undertaking Reserve determinations at various levels for the various freshwater bodies. Latest available comprehensive set of documentation.

15. Department of Water Affairs and Forestry, South Africa. 2000. Water conservation/demand management strategy for the South African agricultural sector, Final Draft.

16. Department of Water Affairs and Forestry, South Africa. 2000. Water conservation / demand management strategy for the South African industry - mining and power sector, First External Draft.

17. Department of Water Affairs and Forestry, South Africa. 2001. *An Investigation into the groundwater use in South Africa*. Technical Report: Gh 3917.

18. Department of Water Affairs and Forestry, South Africa. February 2003. Vision and Mission Statement for Managing Water Resources in South Africa.

19. Department of Water Affairs and Forestry, South Africa. Final Draft. July 2000. Implementation Guidelines for Water Conservation and Water Demand Management for the Agriculture Sector Regarding the Development of Irrigation Water Development Plans for the Agriculture Sector of South Africa. DWAF website.

20. Department of Water Affairs and Forestry, South Africa. April 2001. Agreement of November 2000 with Organised Agriculture on setting of charges.

21. Department of Water Affairs and Forestry, South Africa. 1989. *Droogtetoestande in die Oos Kaap kusstreek en Langkloofgebied* (No Report No.).

22. Department of Water Affairs and Forestry, South Africa. 2002. Environmental Management Framework for Water Resources Management, Draft 1.

23. Department of Water Affairs and Forestry, South Africa. 2001. Environmental Implementation and Management Plan, First Edition.

24. Department of Water Affairs and Forestry, South Africa. 1996. Algoa Water Resources Stochastic Analysis Study Project Reports. Report no. P M000/00/0795.

25. Department of Water Affairs and Forestry, South Africa. 1994. Algoa Water Resources System Analysis Study Project Reports (Report No. P M000/00/1293).

26. Department of Water Affairs and Forestry, South Africa. 2002. Fish to Tsitsikamma Water Management Area Water Resources Situation Assessment (WRSA) Report *(Report No: P WMA 15/000/00/0101)*.

27. Department of Water Affairs and Forestry, South Africa. 2001. Zwartkops River Management Strategy Report (No DWAF Report No., Ninham Shand No. 3146/7804).

28. Employment Equity Act.

29. Environmental Conservation Act, Act 73 of 1989: Schedule 1, Regulations 1182 and 1183.

30. Maclear, L G A. 1996. Geohydrology of the Swartkops River Basin, Uitenhage Region, Eastern Cape. MSc dissertation (No Report No.).

31. Midgley, D C, Pitman, W V & Middleton, B J. 1994. *Surface Water Resources of South Africa, 1990*. Water Research Commission Report no. 298/5.1/94.

32. National Water Act, 1998, Act 36 of 1998.

33. National Environmental Management Act, Act 107 of 1998.

34. Port Elizabeth Municipality. 1999. Algoa System Operation Report (No Report No.).

35. The Constitution of South Africa, Act 108 of 1996.

36. Transnet, 30 January 2003. http://www.port-technology.com website.

37. Vegter, J.R. 1994. *Groundwater Resources of South Africa*. An explanation of a set of National Groundwater Maps. Report no. TT74/95. Prepared on behalf of the Water Research Commission.

38. Versveld, D B, Le Maitre, D C and Chapman, R A. 1998. *Alien invading plants and water resources in South Africa – a preliminary assessment*, Prepared on behalf of the Water Research Commission (WRC Report No. TT 99/98).

39. Water Act, Act 54 of 1956.

40. Water Services Act, Act 108 of 1997.

41. Western District Regional Services Council. 1999. *Western District Council Eastern Cape Water Services Development Plan* (No Report No.).

RELEVANT ISP STRATEGIES DOCUMENTATION

WATER RESOURCE RECONCILIATION STRATEGIES
Reliability of the yield balance: 1. NWRS: Chapter 2 [2]; 2. National Water Resources Strategy Fish to Tsitsikamma WMA Report Draft 1(Oct 2002) [3]; 3. Fish to Tsitsikamma Situation Assessment Report (Aug 2002) [26]; 4. Algoa Pre-Feasibility Study (being finalised) [4]; 5. Orange River Development Project Replanning Study (1997); 6. Algoa Water Resources Stochastic Analysis (1996) [31]; 7. Algoa Water Resources System Analysis (1994) [32]; 8. Appendix B11: Flow gauging stations; 9. Appendix C: ISP-area yield balance.
Groundwater: 1. NWA: Chapter 4 Part 1; 2. NWRS: Chapter 6; 3. National Water Resources Strategy Fish to Tsitsikamma WMA Report Draft 1 (Oct 2002) [3]; 4. Fish to Tsitsikamma Situation Assessment Report (Aug 2002) [26]; 5. Hydrogeological Map Sheet 3324, Port Elizabeth, 1:500 000 Meyer, 1998; 6. Geological map Sheet 3324 Port Elizabeth, 1:250 000 Toerien, 1991; 7. Groundwater Resources of South Africa, Vegter 1994; 8. An investigation into the groundwater use in South Africa, DWAF, 2001; 9. The Groundwater Harvest Potential of the Republic of South Africa (Seymour and Seward, 1996); 10. A Synthesis of the Hydrogeology of the Table Mountain Group – formation of a research Strategy, WRC 2002.
Compulsory licensing: 1. NWA: Section 43 [28]; 2. NWRS: Chapter 3 Part 2; 3. National Water Resources Strategy Fish to Tsitsikamma WMA Report (Oct 2002).
Nelson Mandela Metropole future augmentation: 1. Algoa water resources system analysis study, 1994; 2. Algoa water resources stochastic analysis study , 1995; 3. Algoa pre-feasibility study, 2002; 4. "Primary water situation at Karoo towns" Report, 1999 [11]; 5. "Droogtetoestande in die Oos Kaap kusstreek en Langkloofgebied" Report, 1989 [21]; 6. Orange River Continuous Study: Orange River Yield Balance, April 2003 [1].
Effluent re-use: 1. NWA: Chapter 4 Part 5; 2. NWRS: Chapter 2; 3. Algoa Pre-Feasibility Study "*Re-use of treated effluent*" report, 2001; 4. Appendix B4 - Wastewater treatment works.
Supply to local authorities: 1. NWRS: Chapter 2; 2. WRSA Report Chapter 4; 3. The White Paper on local government; 4. Discussion document towards a White Paper on Integrated Pollution Control and Waste Management; 5. The Water Services Act;

6. Local Government transition Act, 1993;
7. Appendix B1: Rivers and towns;
8. Appendix B2: Previous and new municipalities;
9. Appendix B3: Solid waste disposal sites;
10. Appendix B4: Wastewater treatment works;
11. Appendix B8: Major dams;
12. Appendix B9: Major infrastructure and transfer schemes;
13. Appendix B10: Possible future bulk water supply schemes;
14. IDPs and WSDPs of the various municipalities;
15. National Water Conservation/Water Demand Management strategy.

RESOURCE PROTECTION STRATEGIES

Reserve and resource quality objectives:

1. NWA: Chapter 3;
2. NWRS: Chapter 3;
3. Comprehensive set of documentation to undertake Reserve determinations at various levels for the various freshwater bodies [(14)]. Much of this documentation is still under development as methods to determine the Reserve and resource quality objectives are being refined;
4. Resource Directed Measures for protection of Water Resources;
5. The draft National Water Quality Framework Policy (June 2002);

Wetlands:

1. NWA: Chapter 3;
2. NWRS: Chapter 3;
3. Eastern Cape Wetlands Inventory study documentation (not completed yet);
4. Documentation to undertake Reserve determinations at various levels for wetlands. Much of this documentation is still under development;
5. Resource Directed Measures for protection of Water Resources (wetland ecosystem);
6. Convention on Wetlands of International Importance especially as Waterfowl Habitat or RAMSAR Convention.

Water quality management:

1. NWA: Chapter 3 Parts 4 and 5;
2. NWRS: Chapter 3;
3. The draft National Water Quality Framework Policy (June 2002);
4. "Water Quality Management Policies and Strategies in the RSA", 1991;
5. Managing the Water Quality effects of Settlements: The National Strategy Policy Document U 1.1 First Edition;
6. Development of a Waste Discharge Charge system Framework Document - Second Edition;
7. Minimum requirements for the Handling, Classification and Disposal of Hazardous Waste: Second Edition;
8. Minimum requirements for Waste Disposal by Landfill: Second Edition;
9. Minimum requirements for Water Monitoring at Waste Management Facilities: Second Edition;
10. Guideline Document for the implementation of Regulations on use of water for Mining and related activities aimed at the protection of Water Resources. Second Edition;
11. Information Booklet: Waste Management and the Minimum Requirements;
12. Policy and Strategy For Groundwater Quality Management in South Africa;
13. South African Water Quality Guidelines;
14. Water Services Act, Act 108 of 1997;
15. Draft sanitation paper for African sanitation and hygiene;
16. White paper on basic household sanitation;
17. National Sanitation Policy – White Paper. August 1996;
18. Sanitation Services: A Water Services Act interpretive guide.

WATER USE MANAGEMENT STRATEGIES
General Authorisations: 1. NWA: Chapter 4 Part 6; 2. NWRS: Chapter 3 Part 2; 3. General authorisations in terms of Section 39 of the National Water Act, Government Notice No. 1191 of 8 October 1999 [9]; 4. Invitation to submit written comments on proposed general authorisation (using water for recreational purposes) in terms of Section 39 of the national water act, Government Notice No. 540 of 15 June 2001; 5. Appendix B5: Tsitsikamma Coega ISP-area General Authorisation tables.
Verification of existing lawful use: 1. NWA: Chapter 4 Parts 3 and 10 and Chapter 16 Section 151; 2. NWRS: Chapter 3 Part 2; 3. Fish to Tsitsikamma WMA Water resources situation assessment report Chapter 9, 2002; 4. Regulations requiring that a water use be registered, Government notice No 1352 of 12 November 1999 [13]; 5. Administrative Justice Act; 6. Water Act, 1956; 7. Pro forma Departmental letters (D: WU).
Licensing: 1. NWA: Chapter 4 Parts 1 to 10 and Schedule 1; 2. The National Water Amendment Act, Act 45 of 1999; 3. NWRS: Chapter 3 Part 2; 4. Fish to Tsitsikamma Water Resources Situation Assessment Report, 2002 Chapter 3.4; 5. Guidelines for the assessment of water use authorisations and license applications in terms of Section 27(1) of the National Water Act, 1998 [10]; 6. Government Notice No. 704, 4 June 1999, National Water Act, 1998 (No. 36 of 1998): Regulations on the use of water for mining and related activities aimed at the protection of water resources; 7. Government Notice No. 1352, 12 November 1999, National Water Act, 1998 (No. 36 of 1998): Regulations requiring that a water use be registered [13]; 8. National Forests Act; 9. National Environmental Management Act, Act 107 of 1998 [29]; 10. Orange River Continuous Study: Orange River Yield Balance, April 2003. *Other regulations that are in preparation, or are contemplated in the near future will deal with:* 11. Limiting or restricting the purpose, manner or extent of water use in respect of impeding or diverting the flow of water in a watercourse; altering the bed, banks, course or characteristics of a watercourse; and using water for recreational purposes; 12. The outcomes or effects of management practices for waste treatment, to encourage reduction of wastes at source, recycling, detoxification and neutralisation; 13. Transactions in respect of authorisations to use water (trade).
Invasive alien plant control: 1. NWA: Section 36; 2. NWRS: Chapter 3.3.5; 3. Water use licensing (Final draft): The Policy and procedure for licensing stream flow reduction activities; 4. The Fish to Tsitsikamma WMA WRSA Report of June 2002 provides alien invasive information to a quatenary level; 5. Alien invading plants and water resources in South Africa: A preliminary assessment, 1998 [39]; 6. Conservation of Agriculture Resources Act (Act No. 43 of 1983); 7. National Forest Act, 1998 (Act 84 of 1998).

Pricing:

1. NWA: Chapter 5 Part 1;
2. NWRS: Chapter 3 Part 4;
3. "*Pricing strategy for raw water use*" [(12)] of November 1999;
4. Agreement of November 2000 with Organised Agriculture on setting of charges from April 2001 [(20)];
5. Guideline on the determination and use of the water resource management charge, of January 2002;
6. "*Draft Pricing strategy for wastewater*".

WATER DEMAND MANAGEMENT STRATEGIES

Urban water conservation and demand management:

1. Water Services Act, Act 108 of 1997;
2. NWRS: Chapter 3 Part 3;
3. The draft National water conservation and demand management strategy;
4. Regulations relating to compulsory national standards and measures to conserve water;
5. Sector specific strategies supporting the draft national strategy;
6. SABS Code of Practice 0306 of 1998 titled "*The Management of Potable Water in Distribution Systems*";
7. "Water demand management programme for the Port Elizabeth Region" report, November 2001 as part of the Algoa Pre-feasibility study;
8. Draft Water Conservation / Demand Management Strategy for the South African Water Services Sector;
9. Regulations relating to compulsory national standards and measures to conserve water.

Agricultural water conservation and demand management:

1. Water Services Act, Act 108 of 1997;
2. NWRS: Chapter 3 Part 3;
3. The draft National water conservation and demand management strategy;
4. Regulations relating to compulsory national standards and measures to conserve water;
5. Sector specific strategies supporting the draft national strategy;
6. Final Draft Water Conservation / Demand Management Strategy for the South African Agricultural Sector [(15)];
7. Implementation Guidelines for Water Conservation and Water Demand Management for the Agriculture sector regarding the Development of Irrigation Water Development plans for the Agriculture Sector of South Africa [(19)];
8. Regulations relating to compulsory national standards and measures to conserve water.

Industrial water conservation and demand management:

1. Water Services Act, Act 108 of 1997;
2. NWRS: Chapter 3 Part 3;
3. The draft National water conservation and demand management strategy;
4. Regulations relating to compulsory national standards and measures to conserve water;
5. Sector specific strategies supporting the draft national strategy;
6. "Water demand management programme for the Port Elizabeth Region" report, November 2001 as part of the Algoa Pre-feasibility study;
7. Draft Water Conservation / Demand Management Strategy for the South African Industry – Mining and Power Sector [(16)];
8. Regulations relating to compulsory national standards and measures to conserve water.

INSTITUTIONAL DEVELOPMENT AND SUPPORT STRATEGIES

Catchment Management Agency:

1. NWA: Chapter 7;
2. NWRS: Chapter 5 Part 5;
3. DWAF CMA/WUA Guide Series: Guide 1 entitled "*Monitoring the water management institutions*", January 2002;
4. DWAF CMA/WUA Guide Series: Guide 2 entitled "*The catchment management agency as an organisation*";

5. DWAF CMA/WUA Guide Series: Guide 4: "*Public participation*";
6. *Implementation of Catchment Management in South Africa – The National Policy;*
7. *Developing a generic framework for a catchment management strategy;*
8. *Policy and Procedure for the establishment of advisory committees (Final Draft).*

Water User Associations:

1. NWA: Chapter 8;
2. NWRS: Chapter 3 Part 5;
3. Fish to Tsitsikamma Water Resources Situation Assessment Report, 2002, Chapter 3 and 4;
4. DWAF CMA/WUA Guide Series: Guide 1 entitled "*Monitoring the water management institutions*", January 2002;
5. DWAF CMA/WUA Guide Series: Guide 4: "Public participation";
6. Transformation of irrigation boards guide;
7. Draft Water User Association Policy document;
8. Policy and Procedure for the establishment of advisory committees (Final Draft).

SOCIAL AND ENVIRONMENTAL CONSIDERATIONS STRATEGIES

Capacity building, public participation and communication:

1. NWA: Chapters 7, 8 and 9;
2. NWRS: Chapter 3 Part 5;
3. Generic Public Participation Guidelines;
4. The Employment equity Act [(24)].

Environmental:

1. NWRS: Chapter 5.3;
2. National Environmental Management Act: Chapter 5;
3. Environmental Conservation Act: Schedule 1, Regulations 1182 and 1183;
4. First edition Environmental Implementation and Management Plan;
5. Environmental Management Framework for water resources management Draft 1;
6. Guidelines for standardised Environmental Management Plans;
7. Regulations framed in terms of Paragraphs (B), (C) and (J) of Section Seventy of the Water Act, 1956;
8. Using water for recreational purposes, March 2002;
9. Summary planning procedure: Sustainable utilisation, access and development of water resources for recreation, tourism and socio-cultural purposes, approved July 2001;
10. Decision support system for Policy on the Development at State Dams, October 1999;
11. National Heritage Resources Act, Act 25 of 1999.

INTEGRATION AND CO-OPERATIVE GOVERNANCE STRATEGIES

Poverty alleviation and land reform:

1. NWA: Chapter 5 Part 2;
2. NWRS: Chapter 3 Part 4;
3. WRSA Chapter 5;
4. Restitution of Land Rights Act (Act No. 22 of 1994);
5. "*Pricing strategy for raw water use*" of November 1999 [(12)];
6. Rural development strategy of the Government of National Unity – a discussion document, Oct 1995.

Co-operative governance:

1. NWRS: Chapter 3 Part 5;
2. The Constitution of South Africa [(36)].

WATERWORKS DEVELOPMENT AND MANAGEMENT STRATEGIES
Algoa System management: 1. Algoa System Operation and Maintenance contract being drafted; 2. Algoa System Bulk Supply Agreement being drafted; 3. Appendix B6 contains information regarding existing irrigation boards; 4. Appendix B8 contains information on existing major dams; 5. Appendix B9 contains information on bulk water supply infrastructure; 6. Appendix B10 contains information on possible future bulk water supply schemes. 7. Appendix B13 contains the Algoa water resources system diagram; 8. Appendix B14 contains information on water treatment works and potable water supply schemes; 9. Appendix D contains information the Algoa water supply system balance; 10. "*The Geohydrology of the Swartkops River basin – Uitenhage Region, Eastern Cape*", MSc dissertation by Maclear, 1996 [26].
Groot River GWS management: 1. WRSA Report Chapter 4; 2. Appendix B6 contains information regarding existing irrigation boards; 3. Appendix B8contains information on existing major dams; 4. Appendix B9 contains information on bulk water supply infrastructure; 5. The "*Report on the Algoa system operation*" of May 1999.
Using water resources for recreation: 1. NWA Chapter 12; 2. NWRS: Chapter 4 Part 1; 3. Policy for Using Water for Recreational Purposes, March 2002; 4. (Summary) Planning Procedure for the Sustainable Utilisation, Access and Development of Water Resources for Recreation, Tourism and Socio-cultural Purposes, July 2001; 5. Concession Management Policy: Access, Utilisation and Development of Water Resources and State Land adjoining Government Waterworks for Recreational Purposes, July 2002; 6. Regulations framed in terms of paragraph (b), (c) and (j) of Section 70 of the Water Act, 1956 (Act No. 54 of 1956) published in Government Notice No. R654 of 1 May 1964 and as amended by Government Notices No. R1161 of 13 June 1975 and R206 of 4 February 1983; 7. Public Finance Management Act, 1999 (Act No. 1 of 1999) and relevant Treasury Regulations in respect of utilisation of state assets; 8. Delegations of Powers and Duties in terms of the National Water Act 1998, 11 June 1999; 9. Department of Water Affairs and Forestry's Contributions towards Unblocking Delivery on Tourism – a Co-ordinated Report. January 2003; 10. Support System for Policy on Development at State Dams. October 1999; 11. Guidelines for the Compilation of Zoning Plans for Government Waterworks, August 1999; and 12. Methodology for Carrying Capacity Assessment for Water Surface Areas.
Public health and safety: 1. NWA: Chapter 3 Part 5 and Chapter 12; 2. NWRS: Chapter 3 Part 7; 3. National disaster management Act, Act 57 of 2002; 4. The "*Report on the Algoa system operation*" [33] of May 1999 is relevant to drought management.
MONITORING AND INFORMATION MANAGEMENT STRATEGIES
Water use control: 1. NWA, Act 36 of 1998: Chapter 4; 2. NWRS: Chapter 3 Part 2; 3. Water Services Act, Act 108 of 1997.

Monitoring networks and data capturing: 1. NWA: Chapter 14; 2. NWRS: Part 6 pages 89 to 91; Appendix B11: Flow gauging stations.
Information management: 1. NWA: Chapter 14; 2. NWRS: Chapter 3 Part 6; 3. Promotion of Access to Information Act; 4. Regulations relating to the Promotion of Access to Information.
IMPLEMENTATION STRATEGIES
Implementation: 1. NWA; 2. NWRS; 3. ISP.

RIVERS AND TOWNS

Quaternaries	Rivers / river reaches	Towns / suburbs
Kromme - Seekoei (quats K90A-K90G)		
K90A	Kromme River	Jagersbos, Kammiebos
K90B	Kromme River: above Churchill Dam	Kareedouw
K90C	Diep River	Seekoei
K90D	Kromme River: Churchill Dam - Impofu Dam	Billson, Salielaagte
K90E	Kromme River: Impofu Dam - Krombaai	Sea Vista, St Francis Bay, Cape St Francis
K90F	Seekoei River / Swart River	Humansdorp
K90G	Kabeljous River	Jeffrey's Bay
Tsitsikamma Coast (quats K80A - K80F)		
K80A	Lotterings River, Elandsbos River	Lottering
K80B	Storm River, Kleinbosch River	Stormsriver
K80C	Kruis River, Elands River, Sanddrift River	Kruisrivier
K80D	Groot River	Woodlandsville, Witelsbos
K80E	Tsitsikamma River	Clarkson
K80F	Loopspruit, Slang River, Klippedrift River	Oyster Bay
Groot (quats L11, L12, L21, L22, L23, L30 - L70)		
L11A	Salt River: Tafelkop - Drupfontein	Soutrivier, Wagenaarskraal
L11B	Salt River, Kookfonteinspruit	Pampoenfontein, (R29 - Maanhaarspoort)
L11C	Salt River tributary	Three Sisters, Biesiepoort
L11D	Kromme River: Rooiberg - Salt River	Kromrivier
L11E	Salt River: Nelspoort - Leporteberge	Nelspoort
L11F	Platdoring River: Abrahams Poort - N1	Lemoen Renosterkop
L11G	Salt River: R61 crossing	Hannekuil
L12A	Amos River (upper Salt River)	Amos poortjie, Middelkraal
L12B	Skilpad River	Nuwejaarsfontein, Middelkraal
L12C	Salt River, Boesmans River, Grasvlei se Spruit	Rietbron
L12D	Salt River, Bosduiwe River	Broadmead, Grobbelaarskraal
L21A	Brak River: N1 - R63 crossing	------
L21B	Brak River: R63 - Buffalo River	Bloemhof
L21C	Snyderskraal River, Bakensklip River	Rietpoort, Rietfontein
L21D	Buffalo River: Source - R62	------
L21E	Buffalo River: Vierplaats - Vastrap	Murraysburg
L21F	Klein River, Buffalo River	------
L22A	Tierhoekspruit, Buffalo River	Kruidfontein
L22B	Kariega River, Juriesfontein River	------

Quaternaries	Rivers / river reaches	Towns / suburbs
L22C	Tulplaagte River	Aasvoelkrans
L22D	Kariega tributary: Kamdeboberg - R61	Kykrug
L23A	Kariega River: R61 crossing	Karreepoort, Koedoeskop
L23B	Kariega River, Oupkaas River, Gannaleegte River	Pretoriuskuil, Doornpoort
L23C	Kariega River: Bakoond - The Star	------
L23D	Kariega River: The Star - Beervlei Dam	Blouplaas
L30A	Groot River tributary	Willowmore
L30B	Witkoppies se loop, Groot River	Brakfontein (R57)
L30C	Groot River: Beervlei Dam	------
L30D	Groot River	Solitree, Knoetze
L40A	Hopspruit, Plessis River	------
L40B	Hopspruit: Plessis River - Groot River	Draaiberg, Miller
L50A	Sandpoortjie River (Tafelberg)	------
L50B	Groot River, Railway - Heuningklip River	------
L60A	Upper Heuningklip River	Klipplaat
L60B	Heuningklip River: Klipplaat - Groot River	Mount Stewart
L70A	Upper Grootvlei River	Rooiklip
L70B	Lower Grootvlei River	Steytlerville
L70C	Grass River, Groot River: Steytlerville - Soutkloof	Willowvale
L70D	Groot River, Soutkloof River	Baroe
L70E	Groot River, Haaspoortspruit	Wolwefontein
L70F	Groot River (Bloukoprante)	------
L70G	Groot River : Groot Winterhoekberge - Gamtoos River	Cambria
Kouga-Gamtoos (quats L81, L82, L90)		
L81A	Baviaanskloof River	Voorkloof, Houtkloof
L81B	Baviaanskloof River	Vleikloof, Studtis
L81C	Baviaanskloof River : Studtis - Sandvlakte	Sandvlakte
L81D	Baviaanskloof River : Sandvlakte - Smitkraal	Miskraal - Coega
L82A	Kouga River (Witberg)	Haarlem
L82B	Kouga River (Langkloof)	Misgund
L82C	Kouga River (Langkloof)	Bruinklip, Louterwater
L82D	Kouga River, Wabooms River (Ouberg)	Joubertina
L82E	Kouga River : Kougakop - Grootkaree	------
L82F	Kouga River, Jobertskraal River	------

Quaternaries	Rivers / river reaches	Towns / suburbs
L82G	Kouga River (Perdeberg)	Wolwekraal
L82H	Kouga River : Kouga/Baviaanskloof confluence - Kouga Dam	Kleinplaat
L82J	Kouga River : Groot River confluence	------
L90A	Gamtoos River	Andrieskraal, Patensie
L90B	Gamtoos River ; Patensie - Hankey	Hankey
L90C	Gamtoos River : Hankey - river mouth	Loerie
Algoa Coast (quats M10, M20, M30)		
M10A	KwaZunga River (Groot Winterhoek mountains)	------
M10B	Elands River	Triptree
M10C	Swartkops River : Elands confluence	Uitenhage
M10D	Swartkops River : Despatch - river mouth	Despatch, Port Elizabeth
M20A	Maitland River, Draaifontein River, Bakens River, Papkuils River	Port Elizabeth, Cape Recife
M20B	Van Stadens River	Van Stadensriviermond
M30A	Coega River	Centlivres
M30B	Coega River	Coega

OLD AND NEW MUNICIPALITIES

Old Transitional Local Council	New Municipality name	New District Municipality
Hankey	Kouga Municipality	Cacadu District Municipality
Humansdorp		
Jeffreys Bay		
Patensie		
St Francis Bay		
Joubertina	Koukamma Municipality	
Kareedouw		
Despatch	Nelson Mandela Metropolitan Municipality	
Port Elizabeth		
Uitenhage		
Steytlerville	Baviaans Municipality	
Willowmore		
Klipplaat (with Jansenville)	Ikwezi Municipality	
Murraysburg	N/A	Central Karoo District Municipality
Haarlem	N/A	Garden Route / Klein Karoo District Municipality

SOLID WASTE DISPOSAL SITES

Quaternary catchment	Area	Local authority	District Municipality	Type of site
Kromme-Seekoei (quats K90A-K90G)				
K90B	Kareedouw	Koukamma Municipality	Cacadu District Municipality	Communal
K90E	St Francis Bay	Kouga Municipality	Cacadu District Municipality	Small, New site being evaluated
K90F	Humansdorp	Kouga Municipality	Cacadu District Municipality	Communal
K90G	Jeffreys Bay	Kouga Municipality	Cacadu District Municipality	Medium
Tsitsikamma Coast (quats K80A - K80F)				
K80A	Lottering	Koukamma Municipality	Cacadu District Municipality	Communal, under closure
K80B	Storms River Village	Koukamma Municipality	Cacadu District Municipality	Communal, Waste burning
K80C	Kruisrivier	Koukamma Municipality	Cacadu District Municipality	
K80D	Witelsbos	Koukamma Municipality	Cacadu District Municipality	Communal
K80D	Woodlands	Koukamma Municipality	Cacadu District Municipality	Communal
K80E	Clarkson	Goukamma	Cacadu District Municipality	Communal
K80E	Tsitsikamma Nat. Park	Goukamma	Cacadu District Municipality	Communal
Groot (quats L11, L12, L21, L22, L23, L30 - L70))				
L30A	Willowmore	Baviaans Municipality	Cacadu District Municipality	Communal
L70B	Steytlerville	Baviaans Municipality	Cacadu District Municipality	Communal, upgraded
Kouga-Gamtoos (quats L81, L82, L90)				
L82C	Louterwater	Koukamma Municipality	Cacadu District Municipality	Communal, to be upgraded
L82D	Joubertina	Koukamma Municipality	Cacadu District Municipality	Communal, to be upgraded
L82H	Klipplaat	Ikwezi Municipality	Cacadu District Municipality	Communal
L90A	Patensie	Kouga Municipality	Cacadu District Municipality	Communal
L90B	Hankey	Kouga Municipality	Cacadu District Municipality	Communal
L90C	Loerie	Kouga Municipality	Cacadu District Municipality	Communal
Algoa Coast (quats M10, M20, M30)				
M10C	Uitenhage	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	Hazardous Waste
M20A	Waste-Tech (Enviroserve)	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	H:H
M20A	Arlington	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	G:L:B
M20A	Ibhayi Salt Pan	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	G:M:B
M20A	Seaview	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	Communal, Intended Transfer Station
M20A	Blue Horizon Bay	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	Communal, Closed
M20B	VanStadens	Nelson Mandela Metropolitan Municipality	Cacadu District Municipality	Communal, Intended Transfer Station

WASTEWATER TREATMENT WORKS

Quaternaries	Controlling Authority	Name	Capacity	Disposal
Kromme-Seekoei (quats K90A-K90G)				
K90	Cacadu District Council	Kruisfontein Oxidation Ponds	800m3/d	Irrigation
K90	Koukamma Municipality	Kareedouw Sewage Treatment Works	Small < 1000m3/d	Irrigation
K90	Kouga Municipality	St Francis Bay Sewage Treatment Works	Small < 1000m3/d	Irrigation
K90	Kouga Municipality	Humansdorp Sewage Treatment Works	4Ml	Seekoei River
K90	Kouga Municipality	Jeffreys Bay Sewage Treatment Works	1.5 Ml	Irrigation
K90	Nestle (Pty) Ltd	Food and nutritional products		sewer
K90		Patensie (Mechanical)		
Tsitsikamma Coast (quats K80A - K80F)				
K80	DEPARTMENT OF ENVIRONMENT AFFAIRS	Lottering s/t/works		
K80	Boskor Sawmills (Pty) Ltd	Boskor Sewage Treatment Works	Small < 1000m3/d	Kleinbos River
K80	SAFCOL	Laurelridge sew/t/wrks		
K80	SAFCOL	Kromme Forest s/t/wrks		
K80	SAFCOL	Lottering State Forest Sewage Treatment Works	Small < 1000m3/d	Blaauwkranz River
K80	SAFCOL	Blue Lillies State Forest Sewage Treatment Works	Small < 1000m3/d	Irrigation
K80	SAFCOL	Witelsbos Plantation Sewage Treatment Works	Small < 1000m3/d	Irrigation
K80	Storms River State Forest	Storms River State Forest STW	Small < 1000m3/d	To Forest
K80	Total SA (Pty) Ltd	Total Village Sewage Treatment Works	Small < 1000m3/d	Storms River
K80	Tsitsikamma National Park	Storms River Mouth Sewage Treatment Works	Small < 1000m3/d	Sea
K80		Clarkson Oxidation Ponds	400 m3/d	Irrigation
Groot (quats L11, L12, L21, L22, L23, L30 - L70))				
L30	Baviaans Municipality	Willowmore Oxidation Ponds	Small < 1000m3/d	Irrigation
L60	Ikwezi Municipality	Klipplaat Oxidation Ponds	87 m3/d	Heuningklip River
L70	Baviaans Municipality	Steytlerville Nightsoil Trench		
Kouga-Gamtoos (quats L81, L82, L90)				
L82	Cacada District Council	Louterwater Sewage Treatment Works	Small < 1000m3/d	Irrigation
L82	Goukamma Municipality	Joubertina Sewage Treatment Works	Small < 1000m3/d	Kromme River
L82	Granor Passi Langkloof	Granor Passi: Effluent Disposal	?	Evaporation/ Irrigation
L82	Lanko Ko-op	Lanko Ko-op Effluent Treatment	Small < 1000m3/d	Irrigation
L90	SAFCOL	Otterford s/t/works		
L90	Cacada District Council	Loerieheuwel Oxidation Ponds	20 m3/d	Evaporation
L90	Kouga Municipality	Hankey Oxidation Ponds	Small < 1000m3/d	Irrigation
L90	SAFCOL	Longmore s/t/works		
Algoa Coast (quats M10, M20, M30)				
M10	Algoa Chest Hospital	Algoa Chest Hospital Sewage Treatment Works	Small < 1000m3/d	Irrigation
M10	Nelson Mandela Metropolitan Municipality	KwaNobuhle Sewage Treatment Works	4Ml	Brak River
M10	Nelson Mandela Metropolitan Municipality	Fishwater Flats Water Reclamation works	112 000 m3/d	To Sea
M10	Nelson Mandela	Uitenhage Sewage Treatment Works	5-10 Ml	Swartkops river

Quaternaries	Controlling Authority	Name	Capacity	Disposal
	Metropolitan Municipality			
M10	Nelson Mandela Metropolitan Municipality	Despatch Sewage Treatment Works	4Ml	Swartkops River
M10	Plascon Paints (Pty)Ltd	Plascon Paints	Nil	sewer
M10	Riverside Tanning	Riverside tanning Effluent Disposal	Small < 1000m3/d	Evaporation Ponds
M10	St Albans Prison	St Albans Prison Sewage Treatment Works	Small < 1000m3/d	Irrigation
M20	EAST CAPE ADMIN BOARD	ALOES BREWERY PE S/W		
M20	EXOTAN - PORT ELIZABETH	EXOTAN NO2 EFFL. T.W.		
M20	Cape of Goodhope	Cape of Goodhope Woolcombers	Small < 1000m3/d	Evaporation Ponds
M20	Eveready SA	Eveready SA	nil	Municipal Sewer
M20	EXOTAN - PORT ELIZABETH	EXOTAN NO1 EFFL. T.W.		
M20	Eyethu Fishing	Eyethu Fishing	Small < 1000m3/d	P E Habour
M20	Fairview race course	Fairview Race Course Sewage Treatment Works	Small < 1000m3/d	Irrigation
M20	Lake Farm Centre	Lake Farm Sewage Treatment Works	Small < 1000m3/d	Irrigation
M20	Nelson Mandela Metropolitan Municipality	Cape Recife Sewage Treatment Works	5-10 Ml	To Sea
M20	Nelson Mandela Metropolitan Municipality	Driftsands Sewage Treatment Works	5-10 Ml	To Sea
M20	Nelson Mandela Metropolitan Municipality	Fishwater Flats S/WRKA		
M20	Oosterlig Visserye Bpk	Oosterlig Visserye STW		
M20	Pretoria Portland Cement	Pretoria Portland Cement	Marine Discharge	Papenkuils Canal
M20	SA FELLMONGERS PTY LTD	SA CAPE FELLMONGERS		
M20	SA TRANSPORT SERVICES	HUMEWOOD SEWAGE WORKS		
M20	Woodridge College	Woodridge Sewage Treatment Works	Small < 1000m3/d	Irrigation

Gazette 25367

GOVERNMENT NOTICE

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

NO. 1227 **29 August 2003**

SCHEDULE

1. THE TAKING OF WATER FROM A WATER RESOURCE AND STORAGE OF WATER

[Section 21(a) and (b)]

TABLE 1.1 Areas excluded from General Authorisation for surface water abstraction

Primary drainage region	Secondary/Tertiary/Quaternary drainage region and excluded resources	Description of main river in drainage region for information purposes
K	K80A to F K90A to G	Lottering, Storms, Sanddrif, Groot, Tsitsikamma, Klippedrift Rivers Kromme, Seekoei, Kabeljous Rivers
L	L81 L82 L90	Baviaanskloof River Kouga River Lower Gamtoos River
M	M10 M20 M30	Swartkops River Maitland River Van Stadens River

TABLE 1.2 Subterranean government water control areas excluded from General Authorisation for groundwater abstraction

Primary drainage region	Tertiary/ Quaternary drainage region	Description of subterranean government water control area	Government Notice No.	Government Gazette Date
M	M10, M20, M30	Uitenhage	260	1957-08-23

TABLE 1.3 Areas excluded from General Authorisation for storage of water

Primary drainage region	Secondary/Tertiary/Quaternary drainage region	Description of main river in drainage region for information purposes

Table 1.4 Groundwater Abstraction Zones: Tertiary and Quaternary Drainage Regions

Zone A NO WATER MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS EXCEPT AS SET OUT UNDER SCHEDULE 1.	Zone B 45 M^3 PER HECTARE PER ANNUM MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS	Zone C 75 M^3 PER HECTARE PER ANNUM MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS	Zone D 150 M^3 PER HECTARE PER ANNUM MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS (MAXIMUM OF 100 000 M^3 PER ANNUM)	Zone E 400 M^3 PER HECTARE PER ANNUM MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS (MAXIMUM OF 200 000 M^3 PER ANNUM)	Zone F 750 M^3 PER HECTARE PER ANNUM MAY BE ABSTRACTED FROM THESE DRAINAGE REGIONS (MAXIMUM OF 200 000 M^3 PER ANNUM)
L11E, G	L11A-D, F	L21D	K90E-G	K80A-F	
L12A-D	L21A-C, E, F	L70A, B, E	L50A	K90A-D	
L22B, C	L22A, D	L90B	L70C, F	L70G	
L23A-D	L30A, C	M30B	L90A, C	L81A-D	
L30B, D	L40A		M10B-D	L82A-H, J	
L40B	L50B		M20B	M10A	
	L60A, B		M30A	M20A	
	L70D				

2 ENGAGING IN A CONTROLLED ACTIVITY, IDENTIFIED AS SUCH IN SECTION 37(1): IRRIGATION OF ANY LAND WITH WASTE OR WATER CONTAINING WASTE GENERATED THROUGH ANY INDUSTRIAL ACTIVITY OR BY A WATERWORK

[Section 21(e)]

TABLE 2.1 Subterranean government water control areas excluded from General Authorisation for irrigation with waste

Primary drainage region	Tertiary/ Quaternary drainage region	Description of subterranean government water control area	Government Notice No.	Government Gazette Date
M	M10, M20, M30	Uitenhage	260	1957-08-23

3 DISCHARGE OF WASTE OR WATER CONTAINING WASTE INTO A WATER RESOURCE THROUGH A PIPE, CANAL, SEWER OR OTHER CONDUIT; AND DISPOSING IN ANY MANNER OF WATER WHICH CONTAINS WASTE FROM, OR WHICH HAS BEEN HEATED IN, ANY INDUSTRIAL OR POWER GENERATION PROCESS

[Section 21(f) and (h)]

TABLE 3.4: Listed Water Resources

	WATER RESOURCE		
13	Van Stadens River to tidal water		
	RAMSAR LISTED WETLANDS:	**PROVINCE**	**LOCATION**

4 DISPOSING OF WASTE IN A MANNER WHICH MAY DETRIMENTALLY IMPACT ON A WATER RESOURCE

[Section 21(g)]

TABLE 4.1 Subterranean government water control areas excluded from General Authorisation for disposal of waste

Primary drainage region	Tertiary/ Quaternary drainage region	Description of subterranean government water control area	Government Notice No.	Government Gazette Date
M	M10, M20, M30	Uitenhage	260	1957-08-23

CONTROLLED AND OTHER IRRIGATION SCHEMES

Quaternaries	Scheme	Scheduled area	Irrigated area (1999)	Available water	Average annual use (1999)	Water Source	Main crop
		(ha)	(ha)	(10^6 m^3/a)	(10^6 m^3/a)		
Groot (quats L30 - L70)							
L30A, L30B, L30C, L30D, L40B, L50B, L60B, L70B	Groot River Government Water Scheme	2720	2530	20	18.5	Beervlei Dam	
Kouga-Gamtoos (quats L81, L82, L90)							
L82A,B, C and D	Langkloof Irrigation area		5780 (1992)			Farm dams (Kouga River Catchment)	Deciduous fruit
L82A	Haarlem - 1(PE) Irrigation Board	889					
L82B	Misgund East Irrigation Board	240					
L82C	Apies River - 2(PE) Irrigation Board	360					
L82D	Heights Irrigation Board	97					
L82D	Wabooms River Irrigation Board	232					
L90A, L90B, L90C	Gamtoos River Government Water Scheme	7460	9880	57	57	Kouga Dam, Loerie Dam	Vegetables and Citrus
Tsitsikamma Coast (quats K80A-K80F)							
K90F	Klippedrift - 2(PE) Irrigation Board	2396					
Algoa Coast (quats M10, M20, M30)							
M10C	Zwartkops River - 1 (PE) Irrigation Board	878					

RESOURCE POOR FARMERS

Quatenary Catchment	Area	Implementing Authority
Kromme-Seekoei (quats K90A-K90G)		
K90F	Kruisfontein (existing)	IAC: DWAF / Agriculture province
Tsitsikamma Coast (quats K80A - K80F)		
None		
Groot (quats L11, L12, L21, L22, L23, L30 - L70)		
None		
Kouga-Gamtoos (quats L81, L82, L90)		
L90A	Ilima CPA 150 families 53ha	SA Bottling Co (Coca-Cola)
L90B	10ha	Hankey Democratic Farmers Association with assistance from Gamtoos Irrigation Board
Algoa Coast (quats M10, M20, M30)		
M10C		NMMM municipal food lots

MAJOR DAMS

Quaternaries	Dam name	Live storage 10^6 m^3	Yield (10^6 m^3/a)				Assurance	Owner
			Domestic	Irrigation	Other	Total		
Kromme-Seekoei (quats K90A-K90G)								
K90B	Churchill Dam	32			2(a)	44(a)	1:50	Nelson Mandela Metropolitan Municipality
K90D	Impofu Dam	87	42 (a)		2(a)	44(a)	1:50	Nelson Mandela Metropolitan Municipality
Tsitsikamma Coast (quats K80A - K80F)								
K80F	Klippedrift Dam	3.1		2.5		2.5	1:10	Klippedrift Irrigation Board
K80F	Lorentz / Dreyer Dam	1						
Groot (quats L11, L12, L21, L22, L23, L30 - L70))								
L12D, L23D, L30C	Beervlei Dam	90		12		12	1:50	DWAF
L60A	Klipfontein Dam	1.8	0.83			0.83	1:50	Ikwezi Municipality (Klipplaat)
Kouga-Gamtoos (quats L81, L82, L90)								
L82A	Haarlem Dam	4.7	0.2	3.6	0	3.8	1:50	Haarlem Irrigation Board
L82D	Joubertina Dam	0.21	unknown			unknown	unknown	Koukamma Municipality (Joubertina)
L82H, L82J	Kouga Dam	128	23.5(b)	50(b)		73.5(b)	1:50	DWAF
L90C	Loerie Dam	3.17	23.5(b)	50(b)		73.5(b)	1:50	DWAF
Algoa Coast (quats M10, M20, M30)								
M10A	Groendal Dam	12.3	4.1	2.4		6.5	1:50	Nelson Mandela Metropolitan Municipality
M10B	Bulk River Dam	0.65	3.3(c)			3.3(c)	1:50	Nelson Mandela Metropolitan Municipality
M10B	Sand River Dam	2.67	3.3(c)			3.3(c)	1:50	Nelson Mandela Metropolitan Municipality
M20B	Van Stadens River Dam	0.37	3.3(c)			3.3(c)	1:50	Nelson Mandela Metropolitan Municipality

(a) Impofu Dam and Churchill Dam Yields combined.

(b) Kouga Dam and Loerie Dam Yields combined

(c) Bulk River Dam, Sand River Dam and Van Stadens River Dam Yields combined

MAJOR INFRASTRUCTURE AND TRANSFER SCHEMES

Water Treatment Works			
Quaternaries	**Name**	**Owner**	**Capacity (Ml/d)**
Kromme-Seekoei (quats K90A-K90G)			
K90B	Churchill Dam	Nelson Mandela Metropolitan Municipality	95
K90D	Elandsjagt, Impofu Dam	Nelson Mandela Metropolitan Municipality	105
K90E	St Francis Bay	Kouga Municipality	4.3
K90F	Humansdorp	Kouga Municipality	2.2
K90G	Jeffreys Bay	Kouga Municipality	4.5
Groot (quats L30 - L70)			
L30A	Willowmore	Baviaans Municipality	
L60A	Klipplaat	Ikwezi Municipality	
Kouga-Gamtoos (quats L81, L82, L90)			
L82D	Joubertina	Koukamma Municipality	
L91A	Patensie	Kouga Municipality	0.5
L90B	Hankey	Kouga Municipality	1
L90C	Loerie	Nelson Mandela Metropolitan Municipality	105
Algoa Coast (quats M10, M20, M30)			
M10C	Kabah, Uitenhage	Nelson Mandela Metropolitan Municipality	20
M20A	Linton, Port Elizabeth	Nelson Mandela Metropolitan Municipality	16
M30B	Nooitgedacht, Despatch	Nelson Mandela Metropolitan Municipality	70

Pipelines			
Source to Supply end: Main Pipelines to Port Elizabeth	**Approximate Length (km)**	**Capacity (Ml/d)**	**Diameter (cm)**
Churchill Dam – Impofu Dam – Port Elizabeth	108	146	146
Loerie Dam – Port Elizabeth	60		
Sundays River – Nooitgedacht, Treatment Works – Port Elizabeth	50		
Sand River Dam / Bulk River Dam – Linton Treatment Works – Port Elizabeth	50		
Van Stadens Dam – Port Elizabeth	25		
Other Pipelines			
Joubertina Dam – Joubertina Treatment Works	5		
Groendal Dam – Kabah Treatment Works	15		
Despatch – Uitenhage	17		

Canals	
Quaternaries	**Source to Supply end**
Kouga-Gamtoos (quats L81, L82, L90)	
L90A, L90B, L90C	Kouga Dam - Loerie Dam Canal Length 44km: Capacity 475Ml/d at Kouga Dam (head of canal) and 285Ml/d at entry to Loerie Dam

Borehole Supply	
Quaternaries	**Town**
Kromme-Seekoei (quats K90A-K90G)	
K90G	Jeffreys Bay
K90B	Kareedouw
K90E	Cape St Francis
Tsitsikamma Coast (quats K80A - K80F)	
K80B	Storms River
K80F	Oesterbaai
Groot (quats L11,L12,L21,L22,L23,L30-L70)	
L30A	Willowmore
L70B	Steytlerville
L21E	Murraysburg
L60A	Klipplaat
Kouga-Gamtoos (quats L81, L82, L90)	
L82D	Joubertina

POSSIBLE LOCAL FUTURE BULK WATER SUPPLY SCHEMES

Quaternaries	Scheme
Kromme-Seekoei (quats K90A-K90G)	
K90B	Additional boreholes required for Kareedouw local scheme
Tsitsikamma Coast (quats K80A - K80F)	
K80F	Additional supply to Oyster Bay from Algoa System
Groot (quats L11, L12, L21, L22, L23, L30 - L70))	
L30A	Additional boreholes to supplement Willowmore local scheme
L60A	Additional boreholes to supplement Klipplaat local scheme
L70B	Additional boreholes to supplement Steytlerville local scheme
Kouga-Gamtoos (quats L81, L82, L90)	
L82B, 82C, 82D, 82E, 82F,82G, 82H,K80E	Tsitsikamma River, Kouga River and Groot River can be used as possible future raw water source to supplement Algoa System.
L82D	Possible future raw water to Joubertina Dam from local rivers
Algoa Coast (quats M10, M20, M30)	
None	

FLOW GAUGING STATIONS

Station No	Place or description	River / Pipeline	Latitude	Longitude	Catchment Area	Record Period of Primary Data	
					km^2	From	To
Tsitsikamma Coast (quats K80A – K80F)							
K8H001 - A01	Farm508 Pineview	Kruis River	33 58'50"	24 01'17"	35	Jun 1961	Present
K8H002 - A01	Kwaaibrandbos Reserve Witelsbos	Elands River	33 58'50"	24 03'02"	35	Jul 1961	Present
K8H003 - M01	Farm508 Pineview	Pump from Kruis River	30 38'12"	27 22'09"			
K8H004 - A01	Huisklip	Tsitsikamma River	34 08'06"	24 26'21"		2002	Present
K8H0045 - A01	Geelhoutboom	Tsitsikamma River	34 05'47"	24 26'21"		2002	Present
K8H006 - A01	Rooiwal	Groot River	34 01'57"	24 11'47"		2002	Present
Kromme-Seekoei (quats K90A – K90G)							
K9H001 - A01	Kromrivier Poort	Kromme River	34 00'05"	24 29'35"	357	Sep 1948	Present
K9H002 - M01	Kromrivier Poort	Pipe from dam	34 00'05"	24 29'35"	N/A	Sep 1948	Present
K9H003 - A01	Impofu Dam	Kromme River	34 05'31"	24 42'00"	851	Apr 1983	Present
K9H004 - M01	Impofu Dam	Pipe from Purification Works	34 05'31"	24 42'00"	N/A	Jun 1985	Present
K9H005 - A01	St Francis	Kromme River Tidal Pool	34 08'47"	24 50'08"	N/A	Jan 1990	Present
K9H006 - A01	Osbosch	Kromme River	34 07'29"	24 47'52"			Present
K9H007 - A01	Kruisfontein (Humansdorp)	V-Notch	33 59'37"	24 43'52"			Present
K9R001 - A01	Kromrivier Poort	Kromme River Dam	34 00'05"	24 29'25"	357	Sep 1948	Present
K9R002 - A01	Elandsjagt	Impofu Dam	34 05'31"	24 42'00"	851	Apr 1983	Present
Groot (quats L11, L12, L22, L23, L30 – L70)							
L1H001 - A01	Kamferskraal	Salt River	32 14'16"	23 03'04"	3938	Jul 1917	Oct 1945
						Mar 1961	Sep 1981
L1H002 - A01	Klipkraal	Salt River	32 04'08"	23 00'29"	3675	Feb 1973	Present
L1H003 - A01	Kamferskraal	Salt River	32 14'16"	23 03'04"	3938	Jul 1917	Apr 1941
						Feb 1973	Sep 1981
L2H001 - A01	Stellenbosch Valley	Buffalo River	32 14'36"	23 24'43"	5582	Dec 1923	Jul 1945
L2H002 - A01	Riet Valley	Buffalo River	31 58'54"	23 51'19"	851	Oct 1925	Jan 1952
L2H003 - A01	Murraysburg	Buffalo River	31 56'10"	23 47'00"	1145	Apr 1954	Present
L2H004 - A01	Stellenbosch Valley	Buffalo River	32 14'36"	25 24'43"	5584	Feb 1961	Nov 1984
L3H001 - A01	Wind Heuwel Beervlei Dam	Groot River	33 05'11"	23 29'44"	20339	Jun 1917	Sep 1957
L3H002 - A01	Wind Heuwel Beervlei Dam	Canal from dam (Right)	33 04'37"	23 29'29"	N/A	Jul 1974	Present
L3R001 - A01	Windheuwel	Beervlei Dam	33 04'37"	23 29'29"	20336	Jan 1958	Present
L6H001 - A01	Campherspoort	Heuningklip River	33 12'10"	24 14'08"	1290	Jan 1926	Aug 2000
L6H002 - A01	Klipplaat uitspanning	Heuningklip River	33 02'44"	24 20'00"	675	Apr 1963	Nov 1982
L7H001 - A01	Koene Laagte	Grootvlei River (Rooiklip)	33 21'23"	24 16'58"	730	Aug 1926	Dec 1927
L7H002 - A01	Steytlerville	Groot River	33 19'19"	24 20'50"	25730	Sep 1928	Jul 1985
L7H003 - A01	Groote Vley	Grootvlei River (Rooiklip)	33 21'00"	24 20'00"	798	Feb 1928	May 1928
L7H004 - A01	Drie Kuilen	Groot River	33 24'49"	24 39'10"	27746	Jan 1939	Jul 1948

Station No	Place or description	River / Pipeline	Latitude	Longitude	Catchment Area	Record Period of Primary Data	
					km^2	From	To
L7H005 - A01	Drie Kuilen	Groot River	33 25'21"	24 39'35"	27774	Sep 1963	Jun 1985
L7H006 - A01	Grootriviers Poort (HI Q10 -24)	Groot River	33 43'52"	24 37'06"	29232	Mar 1964	Present
L7H007 - A01	Sand Poort	Groot River	33 25'28"	24 41'25"	28451	Nov 1982	Present
Kouga - Gamtoos (quats L81, L82, L90)							
L8H001 - A01	Diepkloof	Wabooms River	33 51'57"	23 50'10"	21	Apr 1965	Present
L8H002 - A01	Welgelegen	Haarlemspruit	33 44'15"	23 18'19"	52	Jul 1970	Present
L8H003 - A01	Welgelegen	Canal from Haarlemspruit (right)	33 44'15"	23 18'19"	N/A	Jul 1970	Present
L8H004 - A01	Twee Rivieren	Canal from Kouga Dam (right)	33 44'24"	24 35'17"	3887	May 1962	Present
L8H005 - A01	Stuurmanskraal	Kouga River	33 47'26"	24 01'50"	1302	Apr 1990	Present
L8H006 - A01	Twee Rivieren Kouga Dam	Kouga River	33 44'24"	24 35'17"	3887	Oct 1961	Dec 1969
L8H007 - M01	Merwe du Preez	Irrigation pipeline from Kouga Dam	33 44'24"	24 35'17"			Present
L8R001 - A01	Twee Rivieren	Kouga Dam	33 44'24"	24 35'17"	3887	Oct 1961	Present
L9H001 - A01	Vensters Hoek	Gamtoos River	33 48'32"	24 50'00"	33821	Feb 1927	Mar 1928
L9H002 - A01	Andrieskraal	Gamtoos River	33 45'28"	24 39'33"	12862	Jun 1939	Jul 1948
L9H003 - A01	Patensie	Groot River	33 46'39"	24 48'44"	33296	Jul 1962	Sep 1971
L9H005 - A01	Inflow canal from Kouga Dam	Loerie River Loerie Dam	33 51'58"	25 02'25"	N/A	Sep 1969	Present
L9H006 - M01	Pipeline to Purification Works	Loerie Dam	33 51'58"	25 02'25"	N/A	Sep 1969	Present
L9H007 - M01	Pipeline to Purification Works - Washing water	Loerie Dam	33 52'04"	25 02'14"	N/A		Present
L9R001 - A01	Loerie Dam	Loerie River	33 51'58"	25 02'25"	147	Sep 1969	Present
Algoa Coast (quats M10, M20, M30)							
M1H001 - A01	Springfield , Springfontein	Swartkops River	33 44'08"	25 19'08"	349	Mar 1927	Jul 1930
M1H002 - A01	Groendal	Swartkops River	33 41'24"	25 16'00"	261	Mar 1928	Jan 1930
M1H003 - M01	Sandfontein Uitenhage	Uitenhage sources	33 42'00"	25 26'17"	N/A	Mar 1961	Present
M1H004 - A01	Wincanton Longhill	Elands River	33 47'50"	25 18'31"	400	April 1965	Sep 1984
						Oct 1986	Present
M1H005 - A01	Swartkops	Swartkops Spa canal	33 52'42"	25 36'46"	N/A	Jun 1968	Dec 1969
M1H006 - M01	Groendal Dam	Pipeline to Purification Works	33 41'24"	25 16'00"	N/A	Jan 1935	Present
M1H007 - A01	Groendal Dam	Compensation water from pipeline	33 41'24"	25 16'00"	N/A	Dec 1938	Present
M1H007 - M01	Groendal Dam	Compensation water from pipeline	33 41'24"	25 16'00"	N/A		Present
M1H008 - M01	Bulk River	Pipeline from Bulk River Dam	33 48'00"	25 10'37"	N/A	Jan 1968	Present
M1H009 - M01	Elandsfontein Annex	Pipeline from Sand River Dam	33 43'40"	25 05'52"	N/A	Jan 1968	Present
M1H010 - A01	Groendal Dam	Swartkops River	33 41'24"	25 16'00"	261	Mar 1980	Present
M1H012 - A01	Uitenhage	Swartkops River	33 46'21"	25 23'10"			Present
M1R001 - A01	Groendal	Groendal Dam	33 41'24"	25 16'00"	261	Dec 1938	Present
M1R002 - A01	Bulk River	Bulk River Dam	33 48'00"	25 10'37"	34	Jan 1968	Present
M1R003 - A01	Elandfontein Annex	Sandriver Dam	33 43'40"	25 05'52"	51	Jan 1968	Present

Station No	Place or description	River / Pipeline	Latitude	Longitude	Catchment Area	Record Period of Primary Data	
					km^2	From	To
M2H001 - M01	Watershed Van Stadens dam-upper	Pipeline to Purification Works	33 51'10"	25 13'25"	N/A	Jan 1968	Present
M2R001 - A01	Watershed	Van Stadens dam-upper upper	33 51'10"	25 13'25"	14	Jan 1968	Present
M2R002 - A01	Watershed	Van Stadens dam-upper Lower	33 53'00"	25 12'42"	36	Jan 1968	Present
M3H001 - A01	Amanzi Rietheuwel	Artesian borehole B/H BA 1+2	33 41'55"	25 29'46"	N/A	Oct 1971	Present
M3H002 - A01	Amanzi Rietheuwel	Artesian borehole B/H BA 3	33 41'55"	25 28'50"	N/A	Oct 1971	Present
M3H003 - A01	Alwijn Balmoral Rietheuwel	Artesian borehole B/H RH 14	33 43'45"	25 31'33"	N/A	Oct 1971	Present

Ref : List of Hydrological Stations July 1990, Hydrological Information Publication No15 Vol 1 & 2

ALGOA SYSTEM: BULK WATER SUPPLY INFRASTRUCTURE

TREATMENT WORKS			RAW WATER SOURCE					
NAME	CAPACITY (Ml/d)	OWNER/ OPERATOR	NAME	URBAN YIELD *		ADDITIONAL YIELD ALLOCATED TO OTHER USERS (10^6 m^3/a)	OWNER **	OPERATOR **
				(10^6 m^3)	(Ml/d)			
Linton	16	PE	Bulk River Dam Sand River Dam Van Stadens Dams	3,3	9,0	None	PE	PE
Kabah	20	U	Groendal Dam, springs	5,7	15,5	2,4 to irrigation	U	U
Loerie	105	PE	Kouga Dam Loerie Dam	23	63	52 to irrigation, Hankey and Patensie, and losses.	DWAF	GIB
Churchill	95	PE	Churchill Dam	42,4	116	2 for environmental purposes	PE	PE
Elandsjacht	105	PE	Impofu Dam	(on the same river)			DWAF	PE
Nooitgedacht	70	PE	Orange River Scheme	25,6 (allocation)	70	See Section 3.2	DWAF	SRIB
Humansdorp	2,2	Humansdorp	Boreholes, springs	0,8	2,2	None	H	H
St Francis Bay	4,3	SFB	Boreholes	1,6	4,3	None	SFB	SFB
Jeffrey's Bay	4,5	JB	Boreholes	1,6	4,3	None	JB	JB
Hankey	1,0	Hankey	Kouga Dam	} 0,5	} 1,4	None	DWAF	GIB
Patensie	0,05	Patensie	Kouga Dam			None	DWAF	GIB
TOTALS	**423,05**			**104,5**	**285,7**			

PE = Port Elizabeth TLC
U = Uitenhage TLC
DWAF = Department of Water Affairs and Forestry
GIB = Gamtoos Irrigation Board
SRIB = Sundays River Irrigation Board
SFB = St Francis Bay TLC
JB = Jeffreys Bay TLC
* The yields of the dams are at 1:50 year assurance
** In 1995

DETAILED YIELD BALANCES

Sub-area / River		RESERVE			SURFACE YIELDS						WATER USE					WATER BALANCE								
		Averages			1: 50 Reliability						1: 50 Reliability					Local yields			Transfers		Return flows			
Quats	River	MAR	Avg IFR as % MAR	Avg Incremental IFR	Major Dams (1)	Run-of-river and farm dams (2)	Surface water with Reserve/Aliens (3=1+2)	Alien vegetation (4a)	Reserve (4b)	SURFACE WATER (5=3-4a-4b)	Irrigation	Urban use	Rural use	Forestry	REQUIREMENTS (6)	Surface water (7=5)	Groundwater (8)	Total (9=7+8)	Transfers in (10)	Transfers out (11)	Re-used (12)	TOTAL YIELD (13=9+10-11+12)	REQUIREMENTS (14=6)	YIELD BALANCE (13-14)
K9 (Part)	Kromme above Impofu Dam	56.2	12%	6.9	28.9	3.6	32.5	1.7	1.6	29.2	2.0	0.2	0.1	0.0	2.3	29.2	0.1	29.3	0.0	23.7	0.3	5.9	2.3	3.6
		30.8	7%	2.3	15.5	1.8	17.3	1.8	2.9	12.6	2.0	0.0	0.2	0.0	2.2	12.6	0.0	12.6	0.0	12.8	0.2	0.0	2.2	-2.2
K9 (Part)	Kromme below Impofu Dam	12.0	10%	1.2	0.0	1.3	1.3	0.9	0.0	0.4	0.7	0.7	0.1	0.0	1.5	0.4	0.5	0.9	0.3	0.0	0.1	1.3	1.5	-0.2
Total: Kromme River		**99.0**	**11%**	**10.4**	**44.4**	**6.7**	**51.1**	**4.4**	**4.5**	**42.2**	**4.7**	**0.9**	**0.4**	**0.0**	**6.0**	**42.2**	**0.6**	**42.8**	**0.3**	**36.5**	**0.6**	**7.2**	**6.0**	**1.2**
K9 (Part)	Seekoei - Swart Rivers	18.8	10%	1.8	0.0	1.0	1.0	0.2	0.1	0.7	1.0	1.0	0.1	0.0	2.1	0.7	0.8	1.5	0.4	0.0	0.1	2.0	2.1	-0.1
K9 (Part)	Kabeljous River	17.1	19%	3.3	0.0	0.8	0.8	0.0	0.1	0.7	1.1	2.4	0.1	0.0	3.6	0.7	0.6	1.3	1.2	0.0	1.1	3.6	3.6	0.0
Total: Kromme-Seekoei		**134.9**	**11%**	**15.5**	**44.4**	**8.5**	**52.9**	**4.6**	**4.7**	**43.6**	**6.8**	**4.3**	**0.6**	**0.0**	**11.7**	**43.6**	**2.0**	**45.6**	**1.9**	**36.5**	**1.8**	**12.8**	**11.7**	**1.1**
K8	Tsitsikamma Coast	322.2	24%	76.0	0.0	23.0	23.0	0.9	12.2	9.9	3.0	1.2	0.3	4.1	8.6	9.9	0.1	10.0	0.0	0.0	1.1	11.1	8.6	2.5
		87.8	18%	15.5	2.5	1.5	4.0	1.0	0.9	2.1	0.9	0.2	0.2	0.5	1.8	2.1	0.2	2.3	0.0	0.0	0.3	2.6	1.8	0.8
Total: Tsitsikamma Coast		**410.0**	**22%**	**91.5**	**2.5**	**24.5**	**27.0**	**1.9**	**13.1**	**12.0**	**3.9**	**1.4**	**0.5**	**4.6**	**10.4**	**12.0**	**0.3**	**12.3**	**0.0**	**0.0**	**1.4**	**13.7**	**10.4**	**3.3**
Total: Tstskmma/Krom-Seekoei		**544.9**	**0.3**	**107.0**	**46.9**	**33.0**	**79.9**	**6.5**	**17.8**	**55.6**	**10.7**	**5.7**	**1.1**	**4.6**	**22.1**	**55.6**	**2.3**	**57.9**	**1.9**	**36.5**	**3.2**	**26.5**	**22.1**	**4.4**
L1, L2	Above Beervlei Dam	142.0	9%	13.0	12.0	0.2	12.2	0.0	0.0	12.2	2.5	0.4	1.5	0.0	4.4	12.2	2.6	14.8	0.0	12.0	0.2	3.0	4.4	-1.4
L3 to L7	Below Beervlei Dam	52.5	8%	4.1	0.8	0.0	0.8	0.0	0.0	0.8	11.4	0.7	0.9	0.0	13.0	0.8	0.7	1.5	12.0	0.0	1.0	14.5	13.0	1.5
L70G		14.5	8%	1.1	0.0	2.3	2.3	0.0	0.0	2.3	2.4	0.0	0.1	0.0	2.5	2.3	0.0	2.3	0.0	0.0	0.1	2.4	2.5	-0.1
Total: Groot		**209.0**	**9%**	**18.2**	**12.8**	**2.5**	**15.3**	**0.0**	**0.0**	**15.3**	**16.3**	**1.1**	**2.5**	**0.0**	**19.9**	**15.3**	**3.3**	**18.6**	**12.0**	**12.0**	**1.3**	**19.9**	**19.9**	**0.0**
L8 (Part)	Baviaanskloof	45.8	15%	7.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.1	0.0	2.1	2.0	0.1	2.1	0.0	0.0	0.0	2.1	2.1	0.0
L8 (Part)	Kouga	148.2	9%	13.0	71.1	23.4	94.5	3.6	2.3	88.6	26.5	0.8	0.6	0.0	27.9	88.6	0.0	88.6	0.0	63.6	2.1	27.1	27.9	-0.8
L9	Gamtoos	88.0	1%	0.8	2.4	0.7	3.1	0.0	0.0	3.1	50.0	1.0	0.7	0.5	52.2	3.1	1.6	4.7	63.6	16.0	0.3	52.6	52.2	0.4
Total: Kouga/Gamtoos		**282.0**	**7%**	**20.8**	**73.5**	**26.1**	**99.6**	**3.6**	**2.3**	**93.7**	**78.5**	**1.8**	**1.4**	**0.5**	**82.2**	**93.7**	**1.7**	**95.4**	**63.6**	**79.6**	**2.4**	**81.8**	**82.2**	**-0.4**
Total: Groot/Gamtoos		**491.0**	**8%**	**39.0**	**86.3**	**28.6**	**114.9**	**3.6**	**2.3**	**109.0**	**94.8**	**2.9**	**3.9**	**0.5**	**102.1**	**109.0**	**5.0**	**114.0**	**75.6**	**91.6**	**3.7**	**101.7**	**102.1**	**-0.4**
M1	Zwartkops River	71.0	12%	8.2	9.6	0.3	9.9	0.1	1.2	8.6	3.1	0.0	0.4	0.1	3.6	8.6	4.8	13.4	0.0	7.9	0.5	6.0	3.6	2.4
		5.6	7%	0.4	0.0	0.0	0.0	0.0	0.2	-0.2	0.8	72.5	0.1	0.0	73.4	-0.2	0.3	0.1	69.4	0.0	1.4	70.9	73.4	-2.5
M2	Van Stadens / Maitland	20.4	10%	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.2	0.0	1.2	0.0	0.2	0.2	0.0	0.3	1.3	1.2	1.2	0.0
		39.7	9%	3.4	0.2	1.3	1.5	0.1	0.1	1.3	0.8	0.0	0.2	0.1	1.1	1.3	0.4	1.7	0.0	0.0	0.1	1.8	1.1	0.7
M3	Coega River	5.1	12%	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.6	0.0	0.2	0.2	0.0	0.0	0.1	0.3	0.6	-0.3
		5.3	6%	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.2	0.0	0.8	0.0	0.1	0.1	0.0	0.0	0.1	0.2	0.8	-0.6
Total: Algoa Coast		**147.1**	**10%**	**14.9**	**9.8**	**1.6**	**11.4**	**0.2**	**1.5**	**9.7**	**6.8**	**72.5**	**1.2**	**0.2**	**80.7**	**9.7**	**6.0**	**15.7**	**69.4**	**8.2**	**3.5**	**80.4**	**80.7**	**-0.3**
Total: ISP-area		**1183.0**	**14%**	**160.9**	**143.0**	**63.2**	**206.2**	**10.3**	**21.6**	**174.3**	**112.3**	**81.1**	**6.2**	**5.3**	**204.9**	**174.3**	**13.3**	**187.6**	**146.9**	**136.3**	**10.4**	**208.6**	**204.9**	**3.7**

ALGOA WATER SUPPLY SYSTEM BALANCE at 1:50 year assurance

Sub-system	2000 Demands (10^6 m³/a)					1 : 50 Yield [8] (10^6 m³/a)
	NMMM	Other urban	Agriculture	Kouga canal losses	Total	
Kouga Dam	13.6[1]	2	36.5 [2]	13.5	65.6	65.2 [6]
Loerie Dam	2.4 [1]				2.4	2.4
Churchill/Impofu Dams	34.5 [3]	2 [4]	2		38.5	35.5
NMMM old dams	3.5				3.5	3.5
Groendal Dam and Uitenhage springs	6.3				6.3	5.7
Sundays River GWS	11 [5]				11	15 [7]
Effluent re-use	1.2		1.1		2.3	2.3
Total for ISP Area	**72.5**	**4**	**39.6**	**13.5**	**129.6**	**129.6**

NOTES:

1. Transfer from Kouga/Loerie Dam – allocation is 23 (22.5 + 0.5) 10^6 m³/a
2. Agricultural quota from Kouga Dam is 59.5 10^6 m³/a
3. Treatment and conveyance capacity restricted
4. Demand from coastal towns may increase
5. Sundays River water quality is somewhat unsatisfactory
6. Kouga Dam yield is believed to have declined due to development in the catchment
7. Pumping capacity limitation
8. Taking into account the effect of invasive alien plants and the Reserve