REPORT No. PWMA 16/000/00/0304

DEPARTMENT:WATER AFFAIRS AND FORESTRY

Directorate: Water Resources Planning

GOURITZ
WATER MANAGEMENT AREA

INTERNAL STRATEGIC PERSPECTIVE

VERSION 1
MARCH 2004

COMPILED BY:

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IN ASSOCIATION WITH:

UMVOTO

JAKOET & ASSOCIATES

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

GOURITZ WMA

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Version 1

March 2004

Department of Water Affairs and Forestry
Directorate National Water Resource Planning

DEVELOPMENT OF INTERNAL STRATEGIC PERSPECTIVE
FOR THE
GOURITZ WATER MANAGEMENT AREA (WMA No 16)

APPROVAL

Title	:	**Gouritz Water Management Area: Internal Strategic Perspective**
DWAF Report No	:	P WMA 16/000/00/0304
Consultants	:	Ninham Shand in association with Umvoto Africa and Jakoet & Associates
Report Status	:	Version 1, March 2004
Version Controller	:	Mr J Van Staden (Catchment Manager Gouritz WMA)
Date	:	March 2004

STUDY TEAM: Approved for Ninham Shand

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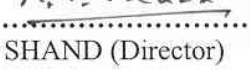

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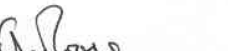

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REFERENCE

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INVITATION TO COMMENT

This report will be updated on a regular basis until it is eventually superceded by the Catchment Management Strategy. Water users and other stakeholders in the Gouritz River 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.pwv.gov.za/documents/
  - Internet: http://www.dwaf.gov.za/documents/
- On CD which can be obtained from DWAF Map Office at:
  157 Schoeman Street, Pretoria (Emanzini Building)
  +27 12 336 7813
  mailto:apm@dwaf.gov.za

  or from the Version Controller (see box overleaf)

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

- Gouritz WMA Internal Strategic Perspective (*This Report*)
  (Report No: P WMA 16/000/00/0304)
- The National Water Resource Strategy, First Edition, 2004
- The Gouritz WMA - Overview of Water Resources Availability and Utilisation
  (Report No: P WMA 16/000/00/0203)
- The Gouritz WMA – Water Resources Situation Assessment
  (Report No: P WMA 16/000/00/0101)

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/

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VERSION CONTROL

GOURITZ WMA
INTERNAL STRATEGIC PERSPECTIVE

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

GOURITZ WMA

INTERNAL STRATEGIC PERSPECTIVE

EXECUTIVE SUMMARY

1. INTRODUCTION

The Gouritz Water Management Area (WMA) is situated in the southwest region of South Africa and falls almost entirely within the Western Cape Province. It derives its name from the largest river within its boundaries, namely the Gouritz River. The WMA borders on the Olifants/Doring WMA to the northwest, on the Breede WMA to the west, on the Lower Orange WMA to the north and on the Fish to Tsitsikamma WMA in the east. The southern border is the Indian Ocean.

2. WATER LEGISLATION AND MANAGEMENT

The **National Water Act** of 1998 (NWA) is the principal legal instrument relating to water resource management in South Africa. It is now being incrementally implemented. The NWA introduces far-reaching concepts such as the **National Water Resource Strategy** (NWRS), the First Edition of which will be published in the first quarter of 2004. This NWRS is being progressively developed to set 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 delegation of water resource management from central government to catchment level, as provided for in the NWA, will be achieved by establishing a Catchment Management Agency (CMA) for each WMA and each CMA will progressively develop a Catchment Management Strategy (CMS), within the general framework set by the NWRS. Until such time as the CMA is established and is able to manage the water resources within the WMA according to its CMS, the Regional Offices (ROs) of the Department of Water Affairs and Forestry (DWAF) will continue to manage water resources according to the Internal Strategic Perspective (ISP).

3. INTERNAL STRATEGIC PERSPECTIVES

This document presents DWAF's Internal Strategic Perspective (ISP) or view on how it intends managing the water resources within the Gouritz WMA during the period leading up to the establishment of a CMA and the development of a CMS by the CMA. The ISP will inter alia provide a consistent basis for the Western Cape Regional Office to process requests for new water use licences.

After internal approval, the Department will obtain comment on the ISP from local authorities, Water User Associations (WUAs), other water related organisations and the public. This will take place through the RO's established liaison structures (forums) and through normal contact with water users in the execution of its duties. This ISP document will be updated periodically

until the CMA for the Gouritz WMA is fully functional and has prepared a CMS. All updates to the document will be authorised by the RO, and the task of managing version control will be the function of the Catchment Manager for the Gouritz WMA.

The ISP has been compiled by referring to policy documentation, legislation, regional planning, departmental guidelines and relevant water related studies, and is also based on interviews and communications with DWAF's regional managers, as well as staff in relevant Head Office directorates.

The yield balances quoted in this report are the same as those contained in the First Edition (2004) of the NWRS. More detailed figures appear in Report No P WMA 16/000/00/0203, Gouritz Water Management Area, which was compiled as part of the NWRS process.

The ISP does not assume to address all possible issues. This is a living document and further improvements will be made and strategies developed as new issues arise.

4. INTEGRATED WATER RESOURCE MANAGEMENT

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 will include:

- development of the ISPs;
- verification of existing lawful use;
- determination of water availability at acceptable confidence levels; and
- determination of Ecological Reserves at high confidence levels.

An iterative and interactive process will also follow where public participation will play a role in determining water resource and water use reconciliation options. This will be handled by DWAF until the CMA can take over.

The following aspects of water resource management will be encompassed within the broad process of IWRM:

- caring for the environment and where possible, enhancing ecological integrity;
- keeping society at the forefront of all decision making;
- affording the correct level of attention to addressing water quality issues in relation to both surface and groundwater;
- managing groundwater as an integral part of the total water resource;
- taking cognisance of the recreational and social use of dams and rivers; and
- forging ways to improve co-operative governance with other authorities towards more effective water resource management.

5. TOPOGRAPHY AND CLIMATE

The topography and climate within the Gouritz WMA is such that three distinct water resource zones can be distinguished. These are the:

- *The semi arid Great Karoo* consisting of the Gamka River catchment to the north of the Swartberg Mountains and the Touws/Buffels/Groot River catchments, to the west of the Klein Swartberg Mountains.
- *The Olifants River* which is fed by mountain streams rising in the Swartberg Mountains to the north, the central Kammanassie Mountains and the coastal Outeniqua Mountains in the south.
- *The Coastal Belt* which has been subdivided into two areas namely the Gouritz/Goukou/Duiwenhoks sub-area, extending from the western boundary of the WMA to (and including) the catchment of the lower Gouritz River. The remaining coastal belt to the eastern boundary of the WMA, referred to as the Coastal sub-area.

Figure (i) shows the five constituent sub-areas of the Gouritz WMA.

A hot and dry Karoo climate predominates in the Great Karoo and Olifants regions whilst along the coastal belt the climate is more temperate with significantly higher rainfall, occurring year round. Cold fronts approaching from the south-west bring rain to the coastal belt, whilst thunderstorms occur over the inland Karoo and Olifants River catchments between February and April. The MAP decreases from east to west, ranging from as high as 1000mm in the south-east to as low as 160 mm in the north of the WMA. Frost occurs in the Central Karoo in winter, typically from June to August.

6. DEMOGRAPHICS

The total population was estimated at 436 800 (Year 2000, Gouritz WMA Report) of whom 60% (242 800) reside in the coastal strip from Mossel Bay eastwards. Of these approximately 90% reside in urban areas. Total population figures are likely to remain fairly constant in this WMA. A general trend of migration from rural areas to towns (particularly along the coast) is to be expected as people move towards the larger urban centres in search of employment.

7. ECONOMIC ACTIVITY

Less than 1% of South Africa's Gross Domestic Product (GDP) originates from the Gouritz WMA, making it, from an economic perspective, one of the weakest WMAs in the country. The agricultural sector is provides a wide range of products including wine grapes, fruit, fodder, vegetables, grains, hops, dairy, timber, tobacco, ostriches, sheep, cattle and goats. The fish and shellfish industry also plays a role in the economy of the coastal region. In the little Karoo, particularly the Oudtshoorn area, the ostrich industry plays an important function in the region's economy.

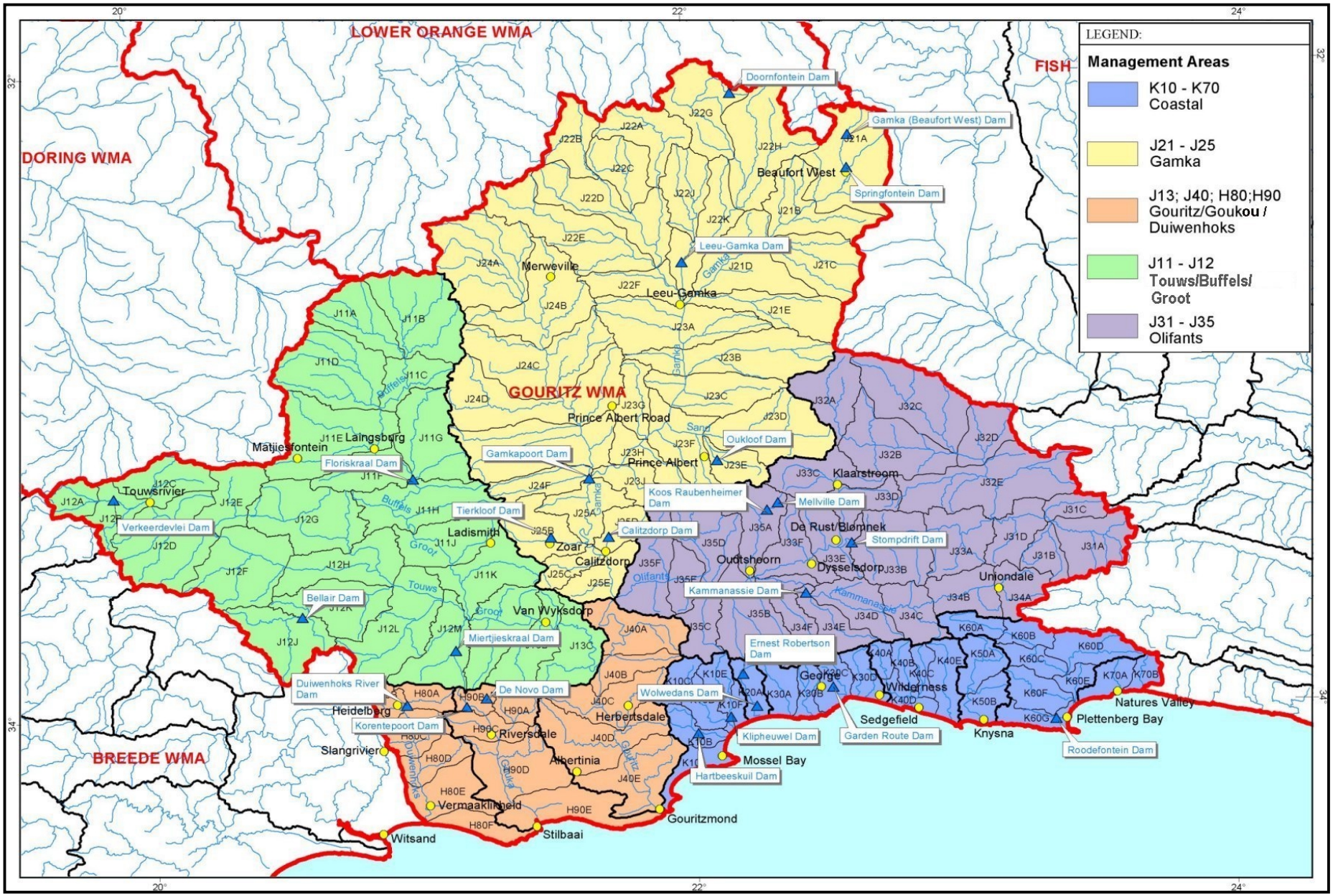

Figure (i) : The Sub-Areas of the Gouritz WMA

Commercial forestry brings a wide array of processing and manufacturing activities. The impact on the economy of the region as a result of reducing this activity in the Western Cape remains uncertain. Tourism is likely to experience ongoing growth particularly within the coastal region. At Mossel Bay the PetroSA natural gas extraction and refinery project plays a significant role in the manufacturing industry.

8. THE WATER RESOURCE AND CURRENT YIELD BALANCE

In the interior, runoff from the Great Karoo and Olifants River catchments is very erratic and dams generally only fill after major flood events. Surface water is used opportunistically and irrigators have become accustomed to operating at low assurances of supply. Urban users rely extensively on groundwater.

In the high rainfall (eastern) areas of the coastal belt extensive use is made of run-of-river yield. In the central and western regions of the coastal belt storage dams supply towns and irrigators. Groundwater is used to supplement urban supply, and for limited irrigation use, rural domestic use and stockwatering.

The assessment of water availability, water requirements and yield balance for the Gouritz WMA is based on the water resource figures published in the First Edition of the NWRS (2004) and these are considered to be the most reliable information to date. The following figures are based on a 98% (1 in 50 year) assurance of supply:

Availability (Yield):	275 million m^3/a
Requirements:	339 million m^3/a
Yield Balance:	-64 million m^3/a

At the Year 2000 level of development the Gouritz WMA experienced a shortfall of approximately 64 million m^3/a. However, as the ecological Reserve component had at that stage not been implemented, the actual deficit experienced by users is considerably smaller.

Paragraph 12 of this Executive Summary provides a more detailed reconciliation, taking the five sub-areas into account and the various sectoral water requirements in each.

9. PROJECTED FUTURE YIELD BALANCE SCENARIOS

The NWRS has developed two scenarios with respect to water requirements in the year 2025. The ***base scenario*** is built on the assumption of high population growth and more equitable distribution of wealth. A total projected water requirement for the Gouritz WMA for 2025 is estimated at 357 million m^3/a, which would result shortfall of 79 million m^3/a.

A possible ***high scenario*** is based on the assumption of high population growth and high standard of socio-economic development. A total projected water requirement for the Gouritz WMA for 2025 of 446 million m^3/a is estimated, with a resulting shortfall of 158 million m^3/a.

The potential for yield development (110 million m^3/a) lies primarily in the coastal catchments, where there is opportunity to develop storage infrastructure. However it is anticipated that this potential will reduce, once the Reserve has been determined. There is very little potential for any development of surface water yield in the in-land sub-areas.

10. SURFACE WATER QUALITY

In terms of surface water quality, elevated salinity occurs naturally within the inland catchments of the Great and Little Karoo as a result of natural geology and high evaporation. Farming practices (crop selection, for example) have been adapted to suit. In the developed urban areas, particularly the more densely populated coastal towns, man-made interventions such as the discharge of water containing waste, and diffuse pollution, impact on water quality.

11. THE GROUNDWATER SITUATION

Some minor adjustments to the current groundwater hydrological provinces have been suggested and are shown on Figure A14.1 of Appendix 14.

A number of wellfield development options have been identified whilst others are currently being studied. These include:

- The Deep Artesian Groundwater Exploration for Oudtshoorn Municipal Supply (DAGEOS) is currently in progress and is focussing on the Peninsula Aquifer of the Table Mountain Group (TMG).
- The Klein Karoo Rural Water Supply Scheme (KRWSS) offers potential for limited further development, particularly for drought relief in the Calitzdorp area.
- The impact study of groundwater abstraction on ecosystems in the Kammanassie Nature Reserve and environs is nearing completion. Initial results indicate that the impact on those sites in the study, considered vulnerable to abstraction, are in fact small.
- Studies to evaluate recharge, storage and flow regimes in the TMG will be undertaken by the University of the Western Cape (UWC) in the Kammanassie area.

In terms of regional scale monitoring, the density and representivity of data is inadequate to interpret regional groundwater patterns. However from observations at Beaufort West, Leeu-Gamka and Laingsburg (all in the Karoo) it has been possible to deduce that regional aquifer recharge is event (flood) response driven, occurring in some years and not in others.

Groundwater quality obtained directly from the TMG aquifers is generally excellent whilst that from shallow weathered-and-fractured aquifers in pre-and post TMG rocks is generally of poorer quality. In the Little Karoo poor quality brackish groundwater (generally unfit for human consumption but supportive of livestock) is associated with Bokkeveld and Cretaceous (Uitenhage Group) aquifers, whilst the quality of water in the primary alluvial aquifers is variable.

12. RECONCILIATION INTERVENTIONS

Possible reconciliation intervention options to address the shortfall (Section 8 above) in the Gouritz WMA include:

- Water conservation and demand management,
- Increased effluent re-use,
- Improved management of groundwater resources,
- Aquifer storage recovery,
- Trading of existing water use authorisations,
- Removal of invasive alien plants,
- Development of new surface and groundwater supply schemes,
- Reallocating water through compulsory licensing,

All of these will have to be studied at greater levels of detail to enable decisions to be made on which combinations should be implemented as well as the sequence and programme for their implementation.

13. WATER RESOURCE SITUATION ASSESSMENT OF THE FIVE KEY AREAS

The water resources of the Gouritz WMA are managed according to the five sub-areas shown on Figure (i), namely:

- The Gamka
- The Touws/Buffels/Groot
- The Olifants
- The Gouritz/Goukou/Duiwenhoks
- The Coastal Catchments

The following table shows the availability of water (Year 2000) in each of these areas:

SUB-AREA	WATER AVAILABILITY (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground-water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
GAMKA	26	24	0	0	0	2	0	**48**	0	**48**
TOUWS/BUFFELS/ GROOT	21	23	0	0	0	2	0	**42**	0	**42**
OLIFANTS	53	15	3	5	0	1	4	**71**	0	**71**
GOURITZ/GOUKOU/ DUIWENHOKS	66	1	2	2	0	2	10	**59**	0	**59**
COASTAL	97	1	2	4	6	33	22	**55**	0	**55**
TOTAL AVAILABLE	**263**	**64**	**7**	**11**	**6**	**40**	**36**	**275**	**0**	**275**

It must be noted that the impact on yield of the Reserve is based on the desktop estimate and does not allow for the estuarine ecological water requirements.

The water requirements for Year 2000 in the Gouritz WMA are as shown in the following table:

SUB-AREA	WATER REQUIREMENTS (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
GAMKA	49	5	1	0	0	**55**	0	**55**
TOUWS/BUFFELS/ GROOT	49	2	2	0	0	**53**	0	**53**
OLIFANTS	62	10	2	0	0	**74**	0	**74**
GOURITZ/GOUKOU/ DUIWENHOKS	51	3	3	0	1	**58**	1	**59**
COASTAL	43	32	3	6	14	**98**	0	**98**
TOTAL REQUIREMENT	**254**	**52**	**11**	**6**	**15**	**338**	**1**	**339**

The respective yield balances within each sub-area resulting in the cumulative shortfall of 64 million m^3/a for the Gouritz WMA are:

Gamka:	-7 million m^3/a
Touws/Buffels/Groot:	-11 million m^3/a
Olifants:	-3 million m^3/a
Gouritz/Goukou/Duiwenhoks:	In balance
Coastal:	-43 million m^3/a

14. THE GAMKA SUB-AREA PERSPECTIVE

The 7 million m^3/a shortfall is not considered to be serious as irrigation practises have been adapted to suit lower levels of assurance of supply. Whilst there is no opportunity for further allocation out of the surface water resource, there is potential for further development of the groundwater resource, particularly for meeting urban requirements at the larger towns of Beaufort West and Laingsburg where there may be some growth in population in the future. In other towns the urban requirements may well reduce as people migrate towards the more established urban areas, in search of employment opportunities. Consequently for the Year 2025 scenarios the shortfall is expected to remain unchanged for the *base scenario* and to increase to 12 million m^3/a under the *high scenario.*

15. THE TOUWS/BUFFELS/GROOT SUB-AREA PERSPECTIVE

As is the case in the adjacent Gamka sub-area, the 11 million m^3/a shortfall in this sub-area is not considered to be significant. There is no opportunity for further allocation out of the surface water although there is potential for further development of the groundwater resource. If any growth in the urban water requirement takes place, this is likely to be small and will be met through the further exploitation of groundwater resources. This will be offset against a reduction in the rural water requirement. The Year 2025 *base scenario* shortfall is estimated to reduce to 9 million m^3/a and that of the *high scenario* to 10 million m^3/a.

16. THE OLIFANTS SUB-AREA PERSPECTIVE

There is very little potential for further development of surface water yield. The extent of over-allocation to irrigators in this sub-area must be determined through the verification process. If farmers are willing to continue operating at a low assurance of supply (as they currently do) then re-allocation through compulsory licensing in this sub-area might not be required. The Year 2025 *base scenario* estimates a shortfall increase to 4 million m^3/a and to 12 million m^3/a for the *high scenario,* due to an increase in the urban water requirements. These are likely to be met through the exploitation of groundwater. The Deep Artesian Groundwater Exploitation for Oudtshoorn Municipal Supply (DAGEOS) study is being undertaken. The water use licence for the potential piped transfer of water from Haarlem Dam (Fish to Tsitsikamma WMA) to the town of Uniondale in the Gouritz WMA has yet to be approved.

17. THE GOURITZ/GOUKOU/DUIWENHOKS SUB-AREA PERSPECTIVE

The apparent state of balance in this sub-area should be cautiously interpreted. The probable unlawful abstraction from the Duiwenhoks and Langtou Rivers will be clarified during the verification of existing lawful use. Under the *base scenario* for Year 2025 it is estimated that there will be a small surplus of 1 million m^3/a as a result of reduced rural water requirements. The *high scenario* reflects a shortfall of 1 million m^3/a as a result of increased urban water requirements.

18. THE COASTAL SUB-AREA PERSPECTIVE

The significant shortfall in the Coastal catchments is largely attributed to the impact on yield of Reserve estimates associated with the ecologically important coastal rivers in that region. The preliminary Reserve estimates do not account for the ecological water requirements of the estuaries, which could further increase the shortfall. There are three distinct water resource management regions in the Coastal sub-area. The estimated shortfalls within each are:

Mossel Bay to George:	-14 million m^3/a
Wilderness Coast Rivers	-19 million m^3/a
Knysna to Bloukrans:	-10 million m^3/a
Total Shortfall (Coastal Sub-Area)	**-43 million m^3/a**

The Year 2025 *base scenario* estimates an increase in the urban water requirement of some 18 million m^3/a, and an overall shortfall of 60 million m^3/a. The *high scenario* estimates a shortfall of some 158 million m^3/a, due to the anticipated substantial increase in urban water requirements.

There is an urgent need to implement reconciliation interventions in the Coastal sub-area in order to alleviate the estimated shortfall and to make provision for the Reserve. Whilst there is some potential for further development of surface water yield, this should preferably not be for new irrigation development, unless off-channel storage is provided. Irrigators should turn to water trading as the option for acquiring licences for new irrigation.

The targeted removal of invasive plants could potentially "free-up" an estimated 22 million m^3/a which could contribute significantly towards meeting the Reserve requirement.

Good quality groundwater is obtainable from the primary aquifers on the coastal plain, particularly where these are underlain by TMG. Precautions to prevent saline intrusion of these aquifers are important to ensure their sustainability.

The implementation of WC/DM by local authorities is a requirement throughout the WMA. In the expanding coastal towns this is of great importance. Over and above WC/DM, the most important water resource management aspects requiring attention in each of the three regions of the Coastal sub-area are:

Mossel Bay to George:
A Reconciliation of water requirements and availability must be urgently undertaken in this region. The last overall planning analysis for Wolwedans Dam and the rest of the system supplying water to the Mossel Bay region (Mossel Bay, PetroSA, Groot Brak, Hartenbos and Klein Brak) was undertaken almost 20 years ago. The supplies to the Mossel Bay and George regions should be planned in an integrated manner.

The Wilderness Rivers:
The provision for the estuarine Reserve requirement is the dominant water resource challenge in this area. The existing resource is fully utilised. As such appropriate design choices must be made where advantage is to be taken of surplus water during high flow periods. Off-channel storage and regulated abstraction is an option for this region - through which optimum protection is afforded to the estuaries.

Knysna to Bloukrans:
As above. Roodefontein Dam on the Piesangs River is being raised by Plettenberg Bay Municipality to provide additional storage for proposed increased transfers out of the Keurbooms River.

19. THE TEN STRATEGIC WATER RESOURCE MANAGEMENT AREAS OF THIS ISP

The strategies contained in this document were developed to give effect to the NWA and the NWRS.

The ten broad strategic groups, referred to as **Main Strategies,** cover all currently identified water management activities of the DWAF RO and the requirements of the NWA and the NWRS. These are:

(i) Yield balance and reconciliation strategies address the need relating to the existing uncertainties and information gaps in the availability of surface water and groundwater, the water requirements and the possible reconciliation interventions (WC/DM, removal of invasive alien plants, water trading, for example), and the potential for the development of the groundwater resource in the Gouritz WMA. The Mossel Bay region in particular requires urgent attention in terms of improved estimates of current and future availability, and water requirements. Four strategies were developed, namely:

- ⇨ Water Resource Availability
- ⇨ Water Requirements
- ⇨ Reconciliation of Water Supply and Demand
- ⇨ Groundwater

(ii) Water resource protection strategies address 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. This will be achieved by classification of freshwater bodies and determination of their human and environmental Reserves, setting resource quality objectives for freshwater bodies, addressing solid waste management, pollution control, sanitation and salinity. The following four strategies were developed:

- ⇨ Reserve and Resource Quality Objectives
- ⇨ Estuaries
- ⇨ Managing Solid Waste
- ⇨ Water Quality Management

(iii) Water use management strategies address the objectives of equity of access to water, and sustainable and efficient use thereof. This will be achieved through conditions of water use imposed through authorisations. These will include general authorisations (GAs) to manage water use, verification of the legality of existing water use, processing and issuing of new water use authorisations, possible re-allocation of water and changing land use. Six water use management strategies have been developed, namely:

- ⇨ General Authorisations
- ⇨ Verification of Existing lawful Use
- ⇨ Allocation and Licensing
- ⇨ Compulsory Licensing
- ⇨ Afforestation
- ⇨ Removal of Invasive Alien Plants

(iv) Water conservation and demand management strategies are required as an alternative to further augmentation of water supply by developing physical infrastructure. Attention needs to be devoted to managing the demand for water, encouraging the efficient and effective use thereof, minimising loss or waste of water and creating a water conservation and demand management culture within all water management and water services institutions, and among water users. These strategies will address urban and agricultural conservation measures and water demand management. The following two strategies have been developed:

- ⇨ Water Conservation and Demand Management: Water Services
- ⇨ Agricultural Water Conservation and Demand Management

(v) Integration and co-operative governance strategies address the establishment and nurturing of co-operative relationships with other South African Government Departments, local authorities and water service providers for co-operative data collection, information sharing, sharing of visions and plans, capacity building and support and co-operative making of joint decisions. This strategy further aims to alleviate poverty by addressing the inequities of the past relating to water, *inter alia* relating to resource poor farmers and by support rendered to water related land reform initiatives. Two strategies were developed, namely:

- ⇨ Co-operative Governance
- ⇨ Redressing Inequities

(vi) Institutional development and support strategies address the 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. Local authorities and Water User Associations (WUAs) are such organisations. The following two strategies have been developed:

- ⇨ Supply to Local Authorities
- ⇨ Water User Associations

(vii) The **Social** strategy addresses the importance of DWAF highlighting the social aspects of its agenda. These are already very clear in the quest for equity, in support for resource poor farmers, in the water supply and sanitation programme, and in the poverty alleviation drive, but it is nevertheless very important that DWAF never loses sight of its social responsibilities. One specific strategy has been developed, namely:

- ⇨ Disaster Management

(viii) **Waterworks development and management** strategies address the ongoing need to economically and safely operate and manage the existing water resource infrastructure currently owned by DWAF. The potential for the construction of new works is also addressed. Two strategies were developed, namely:

- ⇨ Operation and Maintenance of DWAF owned Infrastructure
- ⇨ Construction of New Works

(ix) **Monitoring and information management** strategies address the monitoring of, collection of and data capturing of water resource related information from surface freshwater bodies and groundwater. Resulting information will enable the introduction of water billing and will ensure compliance with water authorisation conditions and the control of all water users. Issues relating to information systems and information access and requirements are also addressed. The following two strategies were developed:

- ⇨ Abstraction Control Monitoring
- ⇨ Monitoring Networks and Data Capture

(x) **Implementation strategies** address the need for a consolidated approach within DWAF to the implementation and ongoing management of the ISP process. This will formalise the implementation, so that delegated responsibilities and a programme of implementation can be drawn up according to priorities set in the ISP. The ISP is a developing process and the document will be reviewed on a regular basis and strategies will be amended, updated or added so as to achieve the management objectives for the Gouritz WMA. One strategy was developed, namely:

- ⇨ ISP Implementation

Under each of these main strategy groups, the specific strategies particular to the Gouritz WMA have been identified and developed. Frameworks for 27 strategies have been developed. As additional strategies are identified through the implementation process (including feedback from stakeholders), this document will be updated by the Department.

For each strategy, the following aspects are addressed:

- ***Management objectives*** in terms of the envisaged solutions for the Strategy;
- ***Situation Assessment*** stating the relevant issues, problems, uncertainties and gaps in information;
- ***Strategic Approach*** as to a correct management procedure or solution to a problem in terms of the DWAF's management perspective for the ISP-area;
- ***Management Actions*** required to implement the strategy and the responsible organisations or persons;
- ***Responsibility and Priority***. The responsible implementing authority and the priority for implementation in terms of the ISP rating system (1 – 5, where 1 is of highest priority).

GOURITZ WMA

INTERNAL STRATEGIC PERSPECTIVE

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LIST OF ABBREVIATIONS

ASR	Aquifer Storage Recovery
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
CNCB	Cape Nature Conservation Board
DAGEOS	Deep Artesian Groundwater Exploitation for Oudtshoorn Municipal Supply
DEADP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DECAS	Department of Environment Affairs, Culture and Sport
DWAF	Department of Water Affairs and Forestry
ECA	Environmental Conservation Act
EWR	Ecological Water Requirement (formerly referred to as IFR)
GAs	General Authorisations
GDP	Gross Domestic Project
IAC	Irrigation Action Committee
IDP	Integrated Development Plan
ISP	Internal Strategic Perspective
IWRM	Integrated Water Resource Management
KKRWSS	Klein Karoo Rural Water Supply Scheme
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mg/ℓ	milligrams per litre
mS/m	millisiemens per meter
NEMA	National Environmental Management Act
NWA	National Water Act
NWRS	National Water Resource Strategy
PetroSA	Formerly Mossgas
RO	Regional Office (DWAF, Western Cape Regional Office)
SFRA LAAC	Streamflow Reduction Activities Licence Assessment Advisory Committee
SUP	Sustainable Utilisable Potential
TINWA	Team for Implementation of the National Water Act
TMG	Table Mountain Group
WfW	Working for Water
WMA	Water Management Area
WRC	Water Research Commission
WRSA	Water Resources Situation Assessment
WSA	Water Service Authorities
WSAM	Water Situation Assessment Model
WSDP	Water Service Development Plan
WSP	Water Service provider
WTW	Water Treatment Works
WUA	Water User Association
WWTW	Wastewater Treatment Works

GLOSSARY OF TERMS

AQUIFER	A saturated permeable geologic 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.)
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 time.
BASIN	The area of land that is drained by a large river, or river system.
BIOTA	A collective term for all the organisms (plants, animals, fungi, bacteria) in an ecosystem.
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.
CONFINED AQUIFER	An aquifer that is physically located between two aquitards. The water level in a well tapping a confined aquifer usually rises above the level of the aquifer.
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. The outflow maybe into a stream, lake, spring, wetland, etc.
ECOLOGICAL IMPORTANCE	A measure of the extent to which a particular species, population or process contributes towards the healthy functioning of an ecosystem. Important aspects include habitat diversity, biodiversity, the presence of unique, rare or endangered biota or landscapes, connectivity, sensitivity and resilience. The functioning of the ecosystem refers to natural processes.
ENVIRONMENTALLY SENSITIVE AREA	A fragile ecosystem which will be maintained only by conscious attempts to protect it.
FORMAL IRRIGATION SCHEME	The term applies to a scheme where water for irrigation purposes is stored in a dam controlled by DWAF or an Irrigation Board and supplied in pre-determined quotas to irrigators registered under the scheme.

GROUNDWATER	Water in the sub-surface, 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.
INTERBASIN TRANSFER	Water transferred from one WMA to another.
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. In this report, the MARs are based on the 70-year period October 1920 to September 1990 inclusive.
NON-POINT SOURCE OF POLLUTION	Contaminates found in water from a source that cannot be specifically defined. For example contamination resulting from municipal runoff or agricultural infiltration.
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, areas irrigated generally have to be reduced in dry years.
PERMEABILITY	The portion of the proportionality constant of hydraulic conductivity, which is a function of porous medium alone. Permeability is an intrinsic property, which is a function of mean grain diameter, grain size distribution, sphericity and roundness of grains and the nature of grain packing.
POINT SOURCE OF POLLUTION	Contaminants found in water that can be readily identified from a specific source such as a leaking underground storage tank.
POTABLE WATER	Water, which is free from impurities that may cause disease or harmful physiological effects, such that the water is safe for human consumption.
QUATERNARY CATCHMENT	The basic unit of area resolution used in the WR90 series of reports published by the Water Research Commission and also in this report. The primary drainage regions are divided into secondary, tertiary and quaternary catchments. The quaternary catchments have been created to have similar mean annual runoffs : the greater the runoff volume the smaller the catchment area and vice versa. The quaternary catchments are numbered alpha-numerically in downstream order. A quaternary catchment number, for example R30D, may be interpreted as follows : the letter R denotes Primary Drainage Region R, the number 3 denotes secondary catchment 3 of Primary Drainage Region R, the number 0 shows that the secondary catchment has not, in this case, been sub-divided into tertiary catchments, and the letter D shows that the quaternary catchment is the fourth in sequence downstream from the head of secondary catchment R30.
RECHARGE AREAS	Areas of land that allow groundwater to be replenished through infiltration or seepage from precipitation or surface runoff.

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 OBJECTIVES	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 ppm or less of dissolved minerals.
SUB-CATCHMENT	A sub-division of a catchment.
SURFACE WATER	Bodies of water, snow, or ice on the surface of the earth (such as lakes, streams, ponds, wetlands, etc.).
UNCONFINED AQUIFER	(a.k.a. water table aquifer) - An aquifer in which the water table forms the upper boundary. The water level in a well tapping an unconfined aquifer will rise only to the level of the water table within the aquifer.
WATER IMPORTS	Water imported to one drainage basin or secondary sub-catchment from another.
YIELD	The maximum quantity of water obtainable on a sustainable basis from a dam in any hydrological year in a sequence of years and under specified conditions of catchment development and dam operation.

PART 1 – INTRODUCTION AND OVERVIEW

CHAPTER 1: BACKGROUND TO THE GOURITZ WMA INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE GOURITZ WMA

Figure 1.1 shows the location of the Gouritz WMA, which falls almost entirely within the Western Cape Province.

Figure 1.1: Location of the Gouritz 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 CMA. 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 Gouritz WMA 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 Gouritz WMA. This was achieved through interviews with individual members of DWAF's RO in Bellville and by collating information from the NWRS, WMA reports, Water Resource Situation Assessment (WRSA) reports and other catchment study reports. The following topics were discussed with Regional Office staff and their issues and concerns documented:

- Water Situation
- Resource Protection
- Water Use
- Water Reconciliation
- Water Infrastructure
- Monitoring and Information
- Water Management Institutions
- Co-operative Governance
- Planning Responsibilities.

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 with attendees from the Regional Office, the Integrated Water Resource Planning (IWRP) Chief Directorate of the Department as well as the consulting team. The workshop focussed on the lists of general issues in the WMA as well as area-specific issues. The issues were clarified and refined during the workshop. Strategies were discussed and developed to address the issues.

iii) The third stage involved the preparation of the second workshop document to be used for refining strategies to address the various issues and concerns, during the second workshop.

iv) The fourth stage was the second workshop. During this workshop the overall management of the water resources in the catchment was discussed along with the ISP management strategies and the relevant issues and concerns. The priorities and responsibilities for carrying out the strategies were identified. First workshop attendees were again involved, as were representatives of several DWAF Head Office directorates.

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

As can be deduced from the above this Gouritz 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 1.6).

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 Catchment Manager for the Gouritz WMA. The current incumbent is Mr J Van Staden, who has been delegated the task of managing version control.

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 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” for changes in February 2003.

Underlying the figures in Chapter 2 and Appendix D is a set of 19 reports "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 superceded 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 in hardcopy, 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 (yearly) 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.

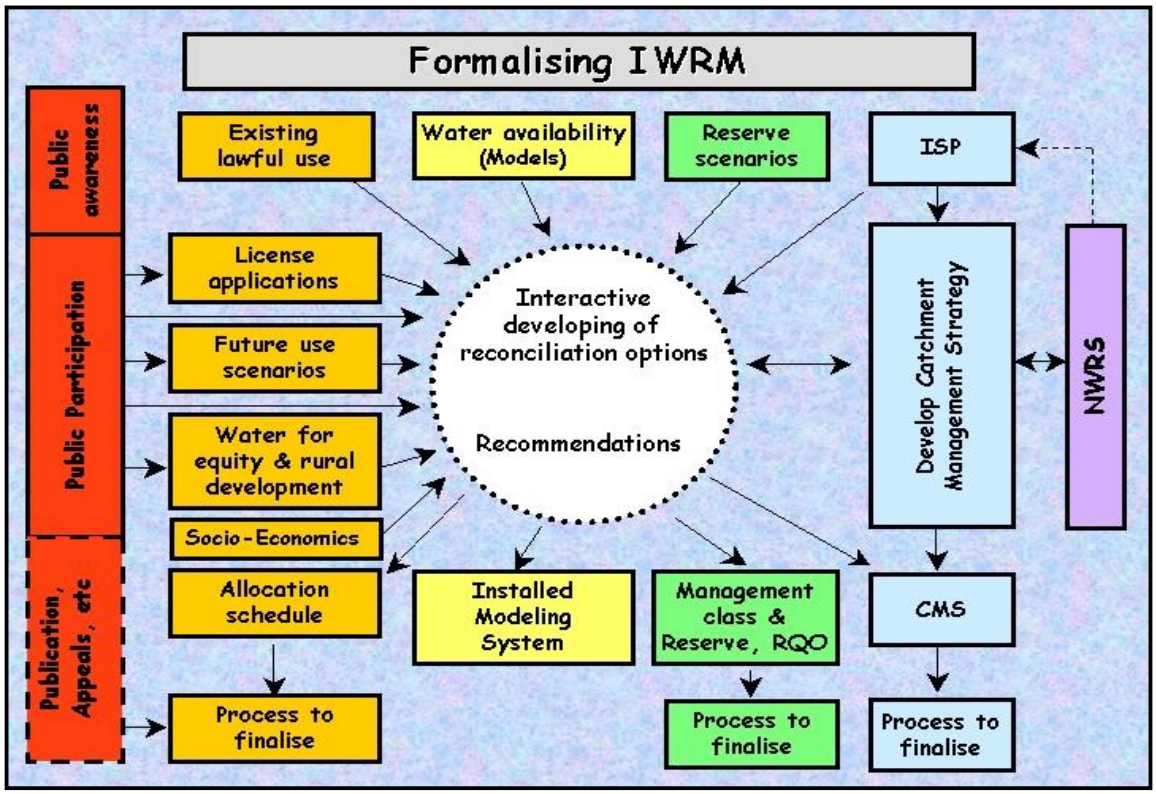

Figure 1.2: Diagram showing DWAF Integrated Water Resources Management approach

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 employment 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 benefiting 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 are cornerstones 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 (10) in Part 2 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.

Water quality is a very important aspect of strategy within this ISP – considered primarily within the Water Quality Strategy and also under Groundwater. 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 2.3 and 2.4 in Part 2 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 many areas 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 licences 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 a large portion of the Gouritz WMA is being specifically researched for its utilisation potential.

See also the Groundwater Strategy (1.4), in Part 2 of this ISP.

1.9 PUBLIC RECREATION - THE USE OF DAMS AND RIVERS

The use of water for recreational purposes is one of the 11 water uses regulated in terms of the NWA (Section 21 j). The Department is developing 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.

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 Strategies 6.1 and 8.1.

1.10 CO-OPERATIVE GOVERNANCE – the place of the ISP

The ISP is DWAF's approach to the management of water resources within the Gouritz 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.

CHAPTER 2: BROAD OVERVIEW OF THE GOURITZ WMA

2.1 LOCATION

The Gouritz WMA (WMA) is shown on Figure 3.1. The area includes the catchment area of the Gouritz River and its major tributaries, as well as the catchments of the smaller coastal rivers that lie to the east and west of the Gouritz River mouth.

The WMA is bounded by four other WMAs and lies within the boundaries of three provinces. Most of the area falls within the Western Cape Province, small portions of the upper catchment of the Olifants River fall in the Eastern Cape Province, whilst tiny portions of the upper catchments of the Gamka and Groot Rivers fall within the Northern Cape Province.

The topography of the WMA is characterised by the flat open plains of the Great and Klein (Little) Karoo, interrupted by steep mountain ranges orientated in an east-west direction. Consequently the water resources of the Gouritz WMA occur in three distinctly different zones, namely:

- *The semi arid Great Karoo* consisting of the Gamka River catchment, to the north of the Swartberg Mountains and the Groot River catchment, to the west of the Sewe-Weeks Poort (Klein Swartberg Mountains). The southern boundary of the Groot River catchment lies along the Langeberg Mountains.
- *The Olifants River* flows though an arid valley but is fed by mountain streams rising in the Swartberg Mountains to the north, the central Kammanassie Mountains and the coastal Outeniqua Mountains in the south.
- *The Coastal Belt* rivers rise in the Langeberg and Outeniqua Mountains along the coast and flow in valleys deeply incised into the coastal plain. Although the management of the water resources in the many small incremental catchments do have similarities, there are specific needs within certain of them. This region is further subdivided in Chapter 3 where specific catchments are focussed on in more detail.

The Gouritz River and its tributaries (the Gamka, Groot and Olifants Rivers) drain an area of 45 702 km^2. The main stem of the river is 267 km long from its source in the Great Karoo to Gouritzmond where it enters the Indian Ocean (J40E). The other numerous short reach coastal rivers drain an area of 7 437 km. The total area of the WMA is 53 139 km^2.

2.2 CLIMATE

In the Great Karoo and central Olifants River regions, the hot dry Karoo climate predominates. Along the southern coastal strip, the climate is more temperate with significantly higher rainfall.

2.2.1 Temperature

The mean annual temperature ranges between 16ºC along the south-east coast to 17ºC in the interior, with an average close to 17ºC for the catchment as a whole. Maximum temperatures of up to 41ºC are experienced during February, predominantly in the inland catchments where minimum temperatures as low as 0ºC usually occur in July. Table 2.2.1 summarises temperature data for the Gouritz WMA.

TABLE 2.2.1 : TEMPERATURE DATA

MONTH	TEMPERATURE (ºC)	AVERAGE	RANGE
January	Mean temperature	21	18 - 24
	Maximum temperature	36	33 - 41
	Minimum temperature	10	10 - 11
	Diurnal range	12	8 - 7
July	Mean temperature	12	11 - 14
	Maximum temperature	27	24 - 28
	Minimum temperature	2	0 - 4
	Diurnal range	13	8 - 18

(Ref: Gouritz WMA : Water Resources Situation Assessment Report)

Frost occurs along the Central Karoo in winter, typically over the period of June to August.

2.2.2 Rainfall

The Great Karoo and Olifants River catchment regions are classified as a very late summer rainfall region, with a large proportion of annual precipitation falling between March and May. The catchments of the Coastal Belt are classified as an all year round rainfall region. Along the south coast, rain is experienced throughout the year with the highest precipitation occurring during spring (August to November) and again during late summer (February and March).

Precipitation over much of the WMA is from cold fronts approaching from the south-west, with very high rainfall on the parallel lying, coastal side of the mountains. Precipitation decreases rapidly further away from the mountain ranges, to the extent that the inland regions of the Great Karoo and Olifants River catchments are semi-desert areas. The Karoo normally receives most of its rainfall from thunderstorm activity during the period from February to April. Along the south-west portion of the WMA, high rainfall occurs in the months of April to August. As a result of the influence of the mountains, a large spatial variability in the mean annual precipitation (MAP) is experienced. The MAP decreases from east to west, ranging from as high as 1000mm in the south-east along the coast to as low as 160 mm toward the north of the WMA.

2.3 GEOLOGY

The Great Karoo consists of flat plains and low hills formed by Karoo sediments and doleritic intrusions. Towards the south the terrain becomes mountainous consisting of sandstones, shales and tillites of the Cape Supergroup. In the Olifants River catchment, in the vicinity of Oudtshoorn, the geology consists of sandstones, quartzite and conglomerates of the Malmesbury Group, overlain in the valley floors by alluvial deposits. Rocks of the Malmesbury Group are also exposed along the coastal strip between Mossel Bay and Plettenberg Bay.

2.4 DEMOGRAPHICS

The current demographics of the Gouritz WMA were assessed for input to the Gouritz Water Resources Availability and Utilisation Report (also referred to as the Gouritz WMA Report), which provides input to the NWRS.

The Gouritz WMA is one of the WMAs with the lowest population in the country. The total population is estimated at 436 800. The arid inland parts are particularly sparsely populated. Close to 60% (242 800) of the total WMA population is concentrated in the narrow coastal strip from Mossel Bay eastwards. Of these approximately 90% reside in urban areas. The economic activity and employment opportunities have, and will continue to attract people to that area. Similarly in the rural Karoo area, it is estimated that almost 80% of the population residing in that area, live in towns and villages. Details of the population figures for each ISP sub-area are presented in Chapter 3.

Future population trends are likely to be influenced by economic opportunities and job creation. It is anticipated that the growth in the coastal catchments is likely to be relatively strong, particularly in the larger urban centres such as Mossel Bay and George, and to a lesser extent, Knysna and Plettenberg Bay. Due to the lack of economic stimulant in the Great Karoo region, together with the general trend towards urbanisation, a decline in population is expected in that area. Little change is expected in the Gouritz and Olifants sub-areas, although there is likely to be some migration towards Oudtshoorn, out of the rural areas, because of potential employment opportunities.

2.5 ECONOMIC ACTIVITY

Less than 1% of South Africa's Gross Domestic Product (GDP) originates from the Gouritz WMA, making it, from an economic perspective, one of the weakest WMAs in the country.

2.5.1 Regional Economy

The Gross Geographic Product (GGP) is the total value of all final goods and services produced within the economy in a geographic area for a given period. GGP is the most commonly used measure of total economic activity in an area and is also the basis for the national account. The

GGP of the Gouritz WMA was R4,9bn in 1997. The most important magisterial districts in terms of contribution to GGP in this WMA are shown below:

- George 27,1%
- Oudtshoorn 17,9%
- Knysna 10,9%
- Mossel Bay 10,3%
- Beaufort-West 10,1%
- Other 23,7%

The most important sectors in terms of contribution to GGP are shown below:

- Trade 19,3%
- Government 18,1%
- Agriculture 17,2%
- Financial Services 14,2%
- Manufacturing 11,0%
- Other 22,2%

The agricultural sector provides a wide range of products including wine grapes, fruit, fodder, vegetables, grains, hops, dairy, timber, tobacco, ostriches, sheep, cattle and goats. The Southern Cape area is the only region in South Africa suitable for the production of hops. Approximately half of the hops required by the South Africa brewing industry is cultivated in the George district. The fish and shellfish industry also plays a role in the economy of the coastal region. In the little Karoo area, particularly the Oudtshoorn area, the ostrich industry plays an important function in the region's economy. This industry is experiencing strain with the market now flooded by cheaper products from other areas in the world. This becomes aggravated when the Rand strengthens and currently the international market demand is relatively stagnant.

Forestry is one of the strongest components of agricultural production particularly in the coastal region. Forestry also brings a wide array of processing and manufacturing activities. Wooden furniture made from high quality indigenous wood is one of the most important export articles of the Southern Cape region. The commercial forestry operator SAFCOL, is in the process of reducing its activity in the Western Cape and as such the future of the commercial forestry industry in this WMA is uncertain.

The trade sector is supported by a strong transport industry, the service orientated nature of the majority of the urban settlements in the area, as well as a growing tourism market.

The financial sector is supported by the strong property market driven by retired people and tourism along the coastal areas, especially in places like Plettenberg Bay, Knysna and Sedgefield and east of Mossel Bay. The financial sector is also focused on supporting the agricultural and trade sectors in the financing of machinery and equipment.

Manufacturing occurs to the greatest extent in Mossel Bay and George, and to a lesser extent, in Oudtshoorn. At Mossel Bay the PetroSA natural gas extraction and refinery project plays a large role in the manufacturing industry. The manufacturing and transport sectors in that town are also supported by the harbour, which is important to the region as the only harbour in this WMA.

A wide variety of government, social and financial services are located in the major towns such as Mossel Bay, Knysna, Plettenberg Bay, Oudsthoorn and George.

2.5.2 Labour

Of the total labour force of 191 000 in 1994, 15% were unemployed (ref. Gouritz WMA Report), which is much lower than the national average of 29%. 66% were active in the formal economy. 29% of the formally employed labour force worked for the government. The second largest percentage, 17% were involved in agriculture, and 15% in the construction sectors.

2.6 CURRENT WATER RESOURCE PERSPECTIVE FOR THE WMA

The term "yield balance" describes the comparison of available water from existing resources in a particular area (at a specific assurance of supply), with the water requirements from those resources (at the same assurance of supply). When deducting the requirements from the availability, a resulting positive balance is referred to as a "surplus" and a negative balance as a "shortfall" or "deficit". The yield balance is used as an indicator of the level of water stress in an area of interest, and is used extensively to support water resource planning decisions.

In order to develop an understanding of the current yield balance within the Gouritz WMA, it is necessary to consider the available yield, current requirements, and the potential to develop additional yield. An important impact on this potential is that of the Reserve, particularly in the coastal rivers, where the high ecological importance of the rivers and estuaries may introduce significantly higher Reserve requirements than preliminary estimates of ecological water requirements suggest.

The assessment of water availability, water requirements and the resulting yield balance for the WMA that follows, is based on the figures used in the NWRS which are considered to be the most reliable information to date.

2.6.1 Water Resources

The total Mean Annual Runoff (MAR) of the Gouritz WMA is 1 680 million m^3/a. Approximately 20% (332 million m^3/a) of the total surface water runoff originates from the Great Karoo (Gamka and Groot River catchments), 14% (229 million m^3/a) from the Olifants River catchment and 66% (1 118 million m^3/a) from the rivers of the coastal belt. Of the MAR within the coastal belt, the catchments to the east of Mossel Bay (K10A to K70B) generate almost 70% (771 million m^3/a) of the 1 118 million m^3/a.

The runoff from the Great Karoo and Olifants River catchment is very erratic. Consequently some dams take up to 10 years to fill, only reaching full capacity after major flood events. Thereafter storage levels decrease significantly over periods of up to 3 years, and fluctuate at low levels until the next flood event of sufficient size allows the dam to fill again. This is illustrated in Figure 2.6.1, which shows the dam storage levels between 1983 and 1994 for the Stompdrift Dam on Olifants River.

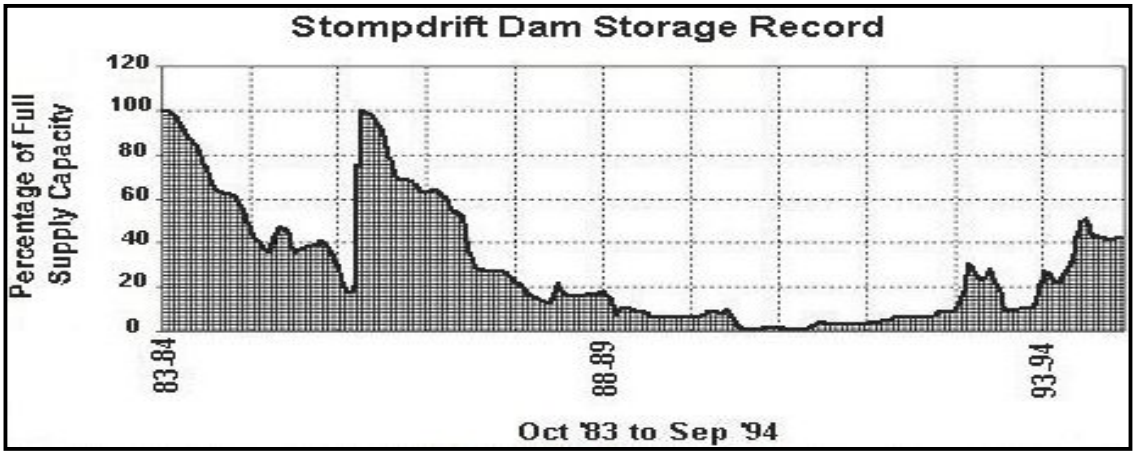

Figure 2.6.1 : Storage levels in the Stompdrift Dam (1983 – 1994)

The characteristics of the water resources of the five sub-areas are described in some detail in Chapter 3 of this report and the overall WMA situation is only briefly outlined below:

In the interior

In the interior catchments of the Karoo and Olifants River, runoff from many of the catchments in the Swartberg, the Outeniqua and Langeberg Mountains is perennial and the normal flows are diverted into farm dams or into earth canals for run-of-river irrigation on a shared basis. Flood runoff from these mountains and from the Great and Little Karoo is also used for opportunistic run-of-river irrigation, but most is stored in dams for later use by irrigators, the largest of these being the Kammanassie, Stompdrift and Gamkapoort Dams. Lucerne is the dominant crop irrigated by run-of-river, whilst the Gamkapoort and Calitzdorp Dams supply water primarily for vineyards and fruit production. Groundwater is used extensively for water supply to the urban sector, and for rural domestic use, stock watering and irrigation to a lesser extent.

Along the coast belt

Along the coast, the relatively deeply incised perennial rivers in the eastern areas (from Wilderness eastwards) are predominantly utilized on a run-of-river basis to supply urban areas. Some irrigation with very limited storage is provided. Some of this storage comes through the use of off-channel dams and some in dams on smaller rivers and tributaries. In the west storage dams supply towns and irrigators, the greatest storage being in the dams supplying the urban and industrial areas of George and Mossel Bay. Groundwater usage is mainly for stock watering and as a supplement to some urban supplies. Afforestation takes place in the higher rainfall coastal areas in the foothills of the Langeberg and Outeniqua Mountains.

The 1 in 50 year yields of all dams and run-of-river abstractions in the WMA are shown in Table 2.6.1. The table includes estimates of the impact of the Reserve on the yield of the WMA based on DWAF's desktop methodology. However this was determined for riverine Reserve requirements only as no methodology was available for estimating the estuarine Reserve requirements. Refer to the Reserve and Resource Quality Objectives Strategy (2.1). The impact of invasive alien plants is also shown and detail provided in the Removal of Invasive Alien Plants Strategy (3.6).

Groundwater plays an important current and potential role as a source of supply, particularly in the drier regions of the Karoo and Little Karoo, where surface water runoff is predominantly in the form of flash floods, and there is very limited base flow. Groundwater supplies in these areas have a higher assurance of supply than surface water even when this is stored in dams, because of the irregular nature of flood runoff and the high evaporation rates, which impact assurance of supply.

Table 2.6.1 shows the water availability estimate (Year 2000 level of development) for the Gouritz WMA.

TABLE 2.6.1 : AVAILABILITY OF WATER IN THE GOURITZ WMA (million m^3/a)

REGION	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
GOURITZ WMA	263	64	7	11	6	40	36	**275**	0	**275**

Appendix 11 presents the details of the main dams in the Gouritz WMA.

2.6.2 Sectoral Water Requirements

Table 2.6.2 below shows the sectoral water requirements for the Gouritz WMA. The largest component of water use is the irrigation sector, which utilises approximately 75% of the total requirement.

TABLE 2.6.2 : REQUIREMENTS IN THE GOURITZ WMA (million m^3/a, Year 2000)

REGION	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
GOURITZ WMA	254	52	11	6	15	**338**	1	**339**

In order to evaluate the yield balance, it is necessary to compare the water availability and water requirements at an equivalent assurance of supply. For this purpose, a 98% level of assurance (1 failure in 50 years) has been used. However, especially in the Karoo, irrigation use is variable and dependent entirely on when water is available. The actual average volumes used for irrigation are therefore likely to be more than indicated in the table, but this water would be available at lower assurances of supply. Farmers have adapted their practices (such as choice of crops) accordingly.

2.6.3 Yield Balance

Table 2.6.3 provides a reconciliation summary at WMA level for the Year 2000 level of development in the Gouritz WMA and at a 98% level of assurance of supply. This is based on the same information as that presented in the NWRS.

TABLE 2.6.3 : RECONCILIATION OF REQUIREMENTS AND AVAILABILITY IN THE GOURITZ WMA (million m^3/a, Year 2000)

REGION	Yield Balance (1:50 Year)						
	Availability			Requirements			
	Local Yield	Transfers In	Total	Local Requirements	Transfers Out	Total	Balance (1)
GOURITZ WMA	275	0	275	338	1	339	**(64)**

(1) Numbers in brackets indicate a negative balance (shortfall).

The Gouritz WMA yield balance in 2000 had a deficit of approximately 64 million m^3/a. However, as the ecological Reserve component had at that stage not been implemented, the actual deficit experienced by users is considerably smaller. The yield balances within each of five sub-areas of the WMA (see Figure 3.1) are discussed in more detail in Chapter 3. It is shown that the greatest shortfalls occurred in the Coastal sub-area (K1 to K7 quaternaries) between Mossel Bay and the Bloukrans River (43 million m^3/a). Small shortfalls were also experienced in the other sub-areas, with the exception of the Gouritz/Goukou/Duiwenhoks sub-area (see Figure 3.1), which was in balance.

2.7 PROJECTED FUTURE YIELD BALANCE SCENARIOS

The NWRS has developed two scenarios with respect to future requirements, namely:

- A Base Scenario with projected water requirements for 2025;
- A High Economic Growth Scenario with projected water requirements for 2025.

These are described hereafter. It is important to note that the Base Scenario is at this stage regarded as the most likely scenario.

2.7.1 The Year 2025 Base Scenario

Within the spectrum of population and economic growth scenarios, a ***base scenario*** was selected for estimating the most likely future water requirements. This is built on the high scenario of population growth and more equitable distribution of wealth leading in time to higher average levels of water services. The ratio of domestic to public and business (commercial, communal, industrial) water use for urban centres in the year 2000, for the respective centres, is maintained. For the base scenario the projected water requirements for the Gouritz WMA for 2025 of 357 million m^3/a would result in a deficit when reconciling with water availability of 79 million m^3/a. The yield water balance and potential development of additional yield is shown in Table 2.7.1.

2.7.2 The Year 2025 High Scenario

A possible ***high scenario*** of future water requirements, is also given, based on the assumption of high population growth and high standard of services (socio-economic development); together with a strong increase in the economic requirements for water, where the public and business use of water would increase in direct proportion to the gross domestic product. It assumes no general increase in irrigation requirements from those in 2000 and no adjustments have been made for reflecting the impacts of increased water use efficiency. For the high scenario the projected water requirements for the Gouritz WMA for 2025 of 446 million m^3/a would result in a deficit when reconciling with water availability of 158 million m^3/a. The yield water balance and potential development of additional yield is shown in Table 2.7.1.

TABLE 2.7.1 : RECONCILIATION OF WATER REQUIREMENTS AND AVAILABILITY FOR THE 2025 SCENARIOS (million m^3/a)

Component	Annual Volume (1:50 Year)		
	Base Scenario Year 2025	High Scenario Year 2025	Potential for yield development
Gross Local Yield	354	364	110
Less: Impact of Invasive Alien Plants	- 36	-36	
Less: Impact of the Desktop Estimate of the Reserve	- 40	-40	
Net Local Yield	278	288	
Transfers In	0	0	
Transfers Out	1	1	
Available Yield	277	287	
Local Requirements	356	445	
BALANCE	**(79)**	**(158)**	

The shortfalls for both scenarios essentially reflect a worsening of the 2000 situation. In this WMA, the developed water resource is fully utilised and any increase in requirement will introduce an equivalent increase in shortfall.

The potential for yield development lies primarily in the coastal catchments, where there is opportunity to develop storage infrastructure (primarily off-channel) so as to take advantage of surplus flows during the high rainfall periods. It is anticipated that this potential will reduce, once the Reserve has been determined. There is very little potential for any development of surface water yield in the in-land sub-areas.

2.8 SURFACE WATER QUALITY

Figure 2.8.1 shows the current surface water quality monitoring points in the Gouritz WMA and provides an indication of the water quality in those areas where monitoring takes place and where data is adequate for interpretation purposes (Ref: Gouritz WMA Water Resource Situation Assessment Report, June 2002). The same information is presented in tabular format in Table 2.8.1.

TABLE 2.8.1: SUMMARY OF SURFACE WATER QUALITY IN THE GOURITZ WMA

Secondary Catchment	No of Quaternaries	Number of Quaternary Catchments in Class					
		Ideal	Good	Marginal	Poor	Unacceptable	No Data Available
H80	6	0	0	0	0	0	6
H90	5	2	0	1	0	0	2
J10	25	1	2	1	7	4	10
J20	35	1	5	2	0	0	27
J30	27	1	10	2	0	3	11
J40	5	0	1	0	0	2	2
K10	6	4	0	1	0	0	1
K20	1	0	0	1	0	0	0
K30	4	2	1	1	0	0	0
K40	5	2	0	1	0	0	2
K50	2	1	0	0	0	0	1
K60	7	4	1	0	0	0	2
TOTAL	**128**	**18**	**20**	**10**	**7**	**9**	**64**

Classes Based on Total Dissolved Solids (TDS, mg/l)

Ideal:	< 260
Good:	260 – 600
Marginal:	601 – 1800
Poor:	1801 – 3400
Unacceptable:	> 3400

The extent of the data limitation is illustrated by the fact that 50% of the quaternary catchments cannot be assessed, in terms of surface water quality, due to insufficient data. The majority of these catchments lie within the Gouritz River catchment.

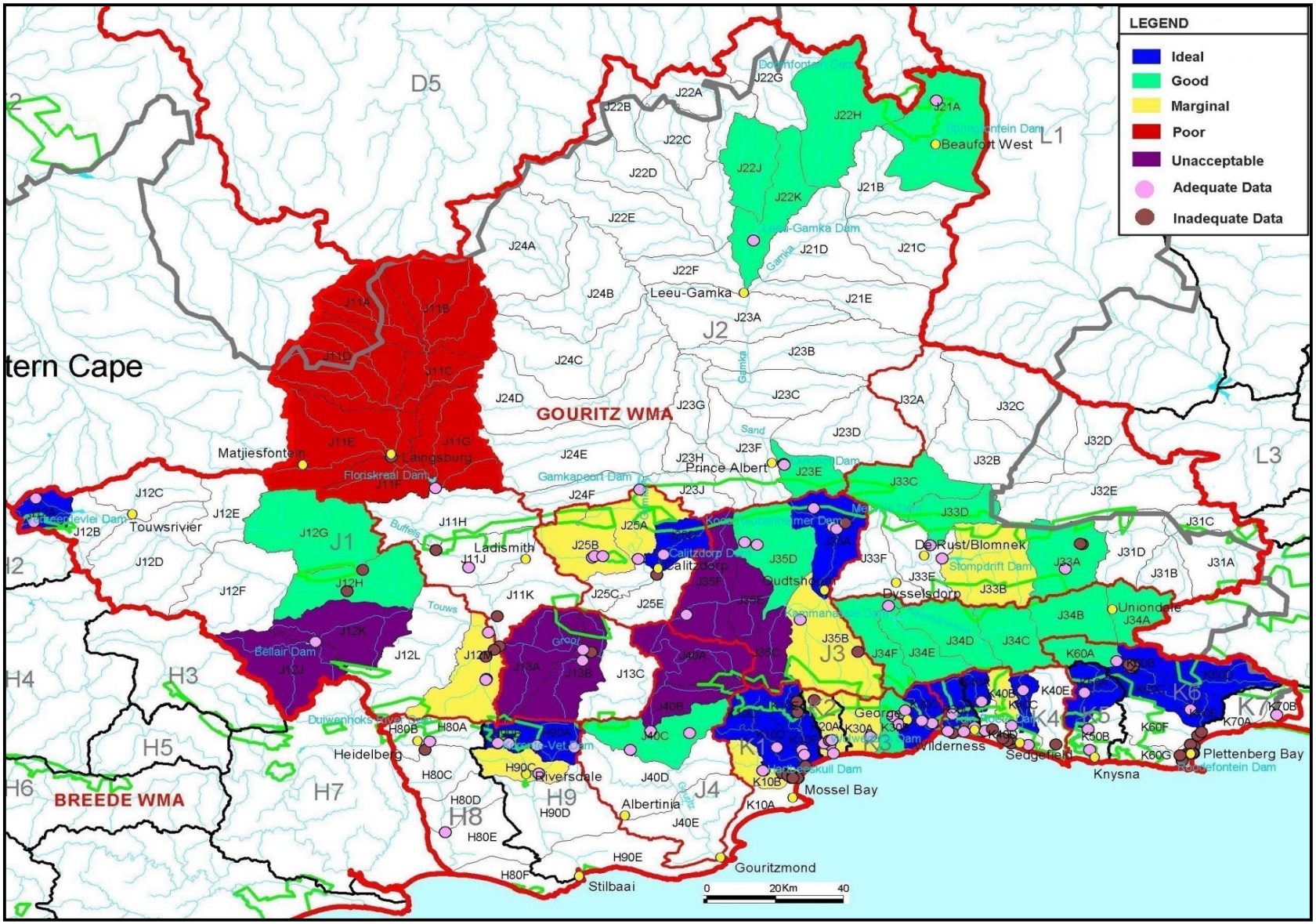

Figure 2.8.1 : Surface Water Quality and Data Sampling Points in the Gouritz WMA

Elevated salinity occurs naturally over the inland catchments of the Great and Little Karoo as a result of natural geology and high evaporation. This is a historical situation and one to which the ecology and the farmers have adapted. The selection of crop types by farmers has allowed them to continue financially viable farming operations, making best use of the available water for irrigation. Outside of government controlled irrigation schemes, irrigation is largely opportunistic in the inland catchments. Elevated salinities do not occur to the same extent in the coastal catchments. Chapter 3 provides comment on the water quality in each of the five sub-areas.

In the developed urban areas, particularly the more densely populated coastal towns, man-made interventions result in problems commonly associated with urban water use. These include discharge of water containing waste, WWTW not meeting their required water quality standards for discharge, and diffuse pollution from informal settlements.

Refer also to the Water Quality Management Strategy (2.4).

2.9 THE GROUNDWATER SITUATION

This is to be read in conjunction with the following groundwater information presented graphically in Appendix 14:

Figure A14.1: Aquifer Types and Hydrological Provinces
Figure A14.2: National Groundwater Database and DWAF Geohydrology Monitoring Points
Figure A14.3: Groundwater Quality
Figure A14.4: Groundwater Occurrence and Median Yield
Figure A14.5: Aquifer Vulnerability
Figure A14.6: Recharge to Groundwater

2.9.1 Hydrological Provinces

In terms of groundwater management, the Gouritz WMA is subdivided into five hydrological provinces. These are shown on Figure A14.1 of Appendix 14 and listed below.

- Gamka sub-area.
- Groot sub-area
- Olifants sub-area
- Gouritz sub-area
- Coastal sub-area

In the proposed revision (also shown on Figure A14.1) part of the Gamka sub-area, below the Leeu-Gamka and Dwyka confluence at the Gamka Poort Dam, is removed from a redefined Gamka Karoo Hydrogeological Province (GKHP). Furthermore, the Buffels River catchments above the Floriskraal Dam and the Traka River catchments above the poort through the eastern Swartberg range, are added to the GKHP from the Groot and Olifants sub-areas, respectively.

In this manner, the main Swartberg divide and its northwestern extension along the Witberge, forms the southern GKHP boundary.

It appears to make greater hydro(geo)logical sense to consider the (Dwyka)Gamka River in the Calitzdorp area (J25 tertiary) and the Groot River downstream from the Buffels confluence (J13 tertiary) as right-bank tributaries of the more perennial Olifants River, before the latter passes into the Gouritz River downstream of the Groot confluence. From this perspective the J40A and J40B quaternaries of the Gouritz become annexed as a tertiary of the Olifants. In this manner, the main Langeberg-Outeniqua divide forms the southern boundary of the (reduced) Groot sub-area in the west, and the revised Olifants sub-area in the east. Both of these sub-areas could be considered as compartments of a wider Klein Karoo Hydrogeological Province.

Finally, a slight revision is proposed to the boundary between the (reduced) Gouritz and Coastal sub-areas. By adding the K10A and K10B quaternaries in the Mossel Bay area to the Gouritz sub-area, a more naturally consistent hydrogeological subdivision is achieved between the generally lower, tertiary limestone-covered, coastal plain of the Riverdale-Still Bay area, and the higher (~200 m), seacliff-bounded, coastal plateau of the George-Plettenberg Bay area. On a wider regional scale, the boundary is also one between a Breede-Gouritz Hydrogeological Province (BGHP) and a Knysna-Tsitsikamma Hydrogeological Province, respectively extending into the adjacent Breede and Tsitsikamma-Fish WMAs

2.9.2 Wellfield Development and Studies

To date there have been a number of local scheme or municipal and community studies (see Supply to Local Authorities Strategy – 6.1). Most studies pertain particularly to the Klein Karoo Rural Water Supply Scheme (KKRWSS) and have been funded by DWAF and/or the WRC. One regional study, the Deep Artesian Groundwater Exploration for Oudtshoorn Municipal Supply (DAGEOS) is underway. It is funded by DBSA with a minor contribution from the WRC and contribution in kind from DWAF RO. The latter study is evaluating the Sustainable Utilisable Potential (SUP) of the TMG with a focus on the Peninsula Aquifer.

This KKRWSS currently pumps less than 1 million m^3/a from the TMG with the greater abstraction being from the Nardouw Aquifer. The water is treated at Dysselsdorp in the east and Calitzdorp in the west. The closure of the Calitzdorp side of the scheme is under debate. It is recommended that, although there may be adequate surface water supplies to Calitzdorp, the KKRWSS could be a source in times of drought either to Calitzdorp or surrounding users and the option is to expand the Calitzdorp wellfield and reticulate it to the east.

A study on the impact of groundwater abstraction on ecosystems in the Kammanassie Nature Reserve and environs is nearing completion. The joint WCNCB/DWAF study has been led by the Pretoria Technikon and funded by the WRC. The results presented in the first draft (2003) of the research report have indicated that the sites considered vulnerable to abstraction and of ecological significance are in fact little impacted upon. The results do not preclude any impact in other areas.

Recent work to evaluate a groundwater Reserve methodology was undertaken for DWAF by the CSIR in the Kammanassie using a GIS-based approach. Private use of groundwater is significant, particularly in the Western Kammanassie area and in the Olifants Catchment where there is conflict over the water resource and where groundwater is inadequately monitored. Studies to evaluate recharge, storage and flow regimes in the TMG will be funded by the WRC and undertaken by the University of the Western Cape (UWC) in the Kammanassie area.

The purpose of the Deep Artesian Groundwater Exploration for Oudtshoorn Supply (DAGEOS) is to evaluate the regional flow regime, storage capacity, recharge and discharge patterns of the Peninsula and Skurweberg (Nardouw) aquifers in a N-S corridor between the Outeniqua and Swartberg ranges, centred around the town of Oudtshoorn in the Olifants River valley. It is under consideration depending upon changing responsibilities for the KKRWSS, for the study domain to be expanded to include the greater District Local Council (DLC) area.

Albertinia has up to now been supplied by groundwater from the Nardouw Aquifer. This wellfield is not optimally exploited. The borehole distribution is poor with resultant local over-abstraction and borehole management problems arising from high iron content. Poor wellfield design and management has resulted in a poor perception of groundwater. A primary aquifer source underlain by TMG south of Albertinia is possible but would require further investigation as would the dependency of wetlands on groundwater in the Canca se Leegte area.

Good quality water is obtainable from the primary aquifers on the coastal plain where these are underlain by TMG. The TMG outcrops between George and Storms River is a potential source for the towns in the area.

2.9.3 Groundwater Monitoring

On a regional scale, the density and representivity of data is inadequate to interpret regional patterns. It is also necessary to understand the impacts of snowfall on the Swartberg, the Outeniqua, the Kammanassie and other Mountains with regard to spring discharge into the WMA. Recharge and discharge patterns in the Swartberg and Outeniqua Mountains are particularly important as regards quaternary catchment mass balance on either side of the major surface-water divides, which in some instances are not groundwater divides. At present the level of detail and available time series data is limited. It is not cohered into a readily accessible database for the RO such that it would assist in groundwater allocation.

Only the KKRWSS has automatic data loggers. Groundwater usage in supplies to small towns is variably monitored. There are issues of consistency, reliability, frequency of measurement and routine interpretation of the data needed to optimise groundwater abstraction.

The Beaufort West wellfield is managed on a wellfield scale and water levels are declining. There have been reports of declining water tables in Leeu-Gamka and Merweville. Follow on studies in Leeu-Gamka have shown the water table to be at the same level as in the late eighties.

This result indicates that in the long term the supply is sustainable but regional aquifer recharge is event (flood) response driven, occurring in some years and not in others. Similar patterns have been reported at Laingsburg. Currently rural communities are supplied in the Ladismith area with groundwater. There is resistance to development of groundwater from conservancy groups in the Rooiberg area.

2.9.4 Groundwater Quality

Figure 2.8.2 shows the range of groundwater quality within the Gouritz WMA. The groundwater quality is evaluated based on the electrical conductivity (EC), measured in millisiemens per meter (mS/m). This is an indication of the salt content. The following range is used to classify the water quality:

Excellent Quality:	< 70 mS/m
Good Quality:	70 – 300 mS/m
Poor Quality:	> 300 mS/m

The quality of groundwater obtained directly from the TMG is generally excellent, except that its upper portion (Nardouw) is subject to a local problem related to dissolved ferrous iron, with consequent bacterial clogging of groundwater abstraction systems (wells, pumps and pipes).

Groundwater from shallow weathered-and-fractured aquifers in pre- and post TMG rocks is generally of poorer quality. In the Karoo aquifers north of the Swartberg range, the quality is good. Poorer quality is usually associated with the Dwyka and lower Ecca outcrops.

In the Little Karoo and contiguous intermontane regions, poor quality, brackish groundwater (generally unfit for human consumption but supportive of livestock) is associated with Bokkeveld and Cretaceous (Uitenhage Group) aquifers. Similar considerations apply to Bokkeveld and pre-TMG basement units south of the Langeberg-Outeniqua ranges.

The highest quality water (EC<70 mS/m) from the primary aquifers on the coastal plain is obtainable where these are underlain by (TMG) strata. The TMG outcrop between George and Storms River is a potential source for the towns in the area.

The contamination of private boreholes in Beaufort West itself and the Leeu Gamka boreholes (used for agriculture purposes) by hydrocarbons from seepage out of sub-surface fuel tanks at petrol stations is known and clean up is underway in Beaufort West.

The use of groundwater by a number of coastal towns is not adequately monitored nor managed with regard to saline intrusion and/or contamination by septic tanks.

2.10 RECONCILIATION INTERVENTIONS

There are a number of possible reconciliation intervention options that can be considered to address current deficits and to cover the expected future increase in requirements within the Gouritz WMA. These reconciliation intervention options are addressed in the Reconciliation of Water Supply and Demand Strategy (1.3) and are as listed hereafter:

- **Managing Assurance of Supply** to farmers in this WMA is important in order to understand the actual water volumes supplied, the level of assurance of that supply, and the appropriate catchment management charge for water used at lower assurances of supply by that sector.
- **Water Conservation and Demand Management,** primarily in the Water Services (urban) sector and to a lesser extent in the irrigation sector. This is further addressed in the Water Conservation and Demand Management Strategies (4.1 and 4.2, in Part 2 of this document).
- **Increased Effluent Re-use** offers some potential, particularly in the larger urban centres of the coastal catchments, where increased use of treated effluent could be used for irrigation of recreational developments. At Plettenberg Bay for example, 3Ml/d of treated effluent is available (peaking to 4 Ml/d in the summer) with which golf courses and equestrian centres could be irrigated. Keen interest is being expressed by developers for potential development of new golf courses along the Garden Route. This is further addressed under the Reconciliation of Water Supply and Demand Strategy (1.3).
- **Improving Management of Groundwater Resources,** by establishing a better understanding of aquifer systems, particularly the interaction between surface base flow, groundwater abstraction and recharge. This is discussed in detail in the Groundwater Strategy (1.4) and the Monitoring Networks and Data Capture Strategy (9.2), in Part 2. In light of the limited surface water resource availability in the inland catchments, reliance should increasingly be placed on exploitation of groundwater resources.
- **Aquifer Storage Recovery (ASR),** allows for available storage within aquifers to be used for storing surplus water, injected into the aquifer through various techniques. This technique could be well suited to the drier regions (high evaporation) of this WMA, where aquifer storage levels are drawn down in the dry season. ASR could be used to boost recharge during infrequent periods of surplus flow, taking advantage of aquifer storage. This is further addressed under the Groundwater Strategy (1.4).
- **Trading of Existing Water Use Licences** provides an opportunity for licences to be acquired for more beneficial use of water without placing further stress on the existing resource. In the urban sector the purchase of lei-water authorisations by local authorities offers an opportunity to augment municipal supplies. The Allocation and Licensing Strategy (3.3) addresses this.
- **Removal of Invasive Alien Plants** allows for a potential increase in water availability. The Removal of Invasive Alien Plants Strategy (3.6) discusses this in more detail.

- **Development of New Surface and Groundwater Supply Schemes** will be subject to the provision for the Reserve and considered only once all potential water conservation and demand management steps have been taken and other intervention options considered. The Supply to Local Authorities Strategy (6.1) identifies potential schemes for meeting urban water requirements.
- Ultimately, it may be necessary to **re-allocate water through compulsory licensing**, so as to provide for the Reserve, address inequity or over-allocation, whilst striving to achieve the most beneficial use of water in the national interest. The Compulsory Licensing Strategy (3.4) discusses this in detail.

All of these will have to be studied at greater levels of detail to enable decisions to be made on which, or which combinations should be implemented. It will further be necessary to determine the most economical options and the sequence and programme for their implementation.

CHAPTER 3: SITUATION ASSESSMENT FOR THE FIVE KEY SUB-AREAS

The central issue in this WMA is that there is insufficient yield available to meet the current requirements. Whilst shortfalls may be accommodated in the irrigation sector by users adapting to low assurances of supply, certain other sectors, primarily the Reserve, can not. Another issue or concern is that the ecological importance of catchments along the coastal belt necessitates that the Reserve be determined and implemented to ensure protection of these valuable ecosystems.

In order to adequately address all the issues and concerns within the Gouritz WMA, it proved necessary to sub-divide the WMA into smaller units. Catchments were grouped on the basis of similar physical, climatic and topographical characteristics. For the purposes of the ISP, it was decided to use the same five sub-divisions as used in the NWRS. The five sub-areas, their characteristic and yield balances are discussed in detail in this chapter.

These five sub-areas are:

- The Gamka
- The Touws/Buffels/Groot
- The Olifants
- The Gouritz / Goukou / Duiwenhoks
- The Coastal Catchments

A brief overview of each of the five sub-areas is provided, together with the water resource situation assessment, the projected increase in requirements, as well as comment on the future for each sub-area. Figure 3.1 shows the five sub-areas.

Figure 3.2 shows the municipal boundaries within the Gouritz WMA (the solid waste sites are also shown and are referred to in this Chapter).

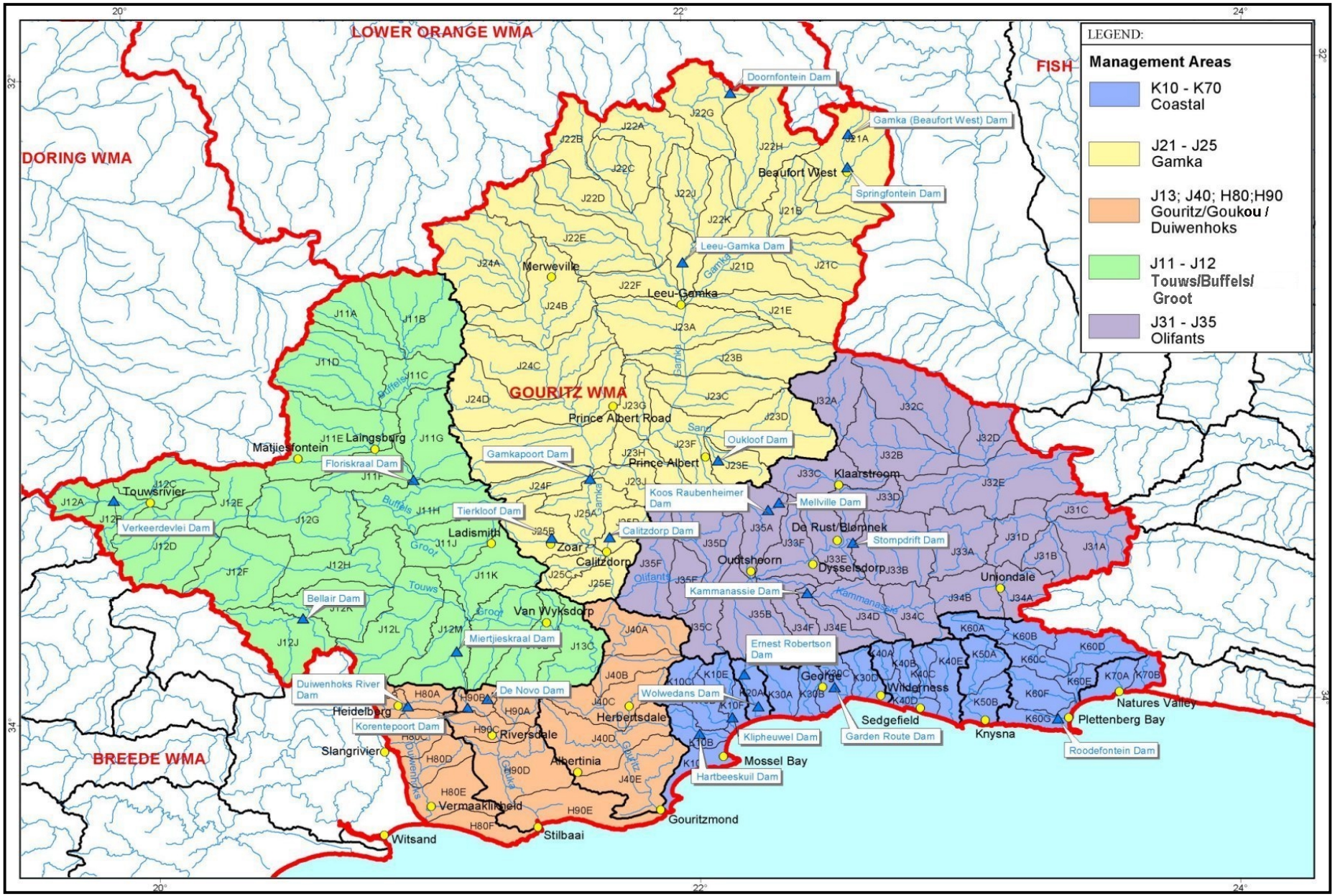

Figure 3.1 : The Sub-Areas of the Gouritz WMA

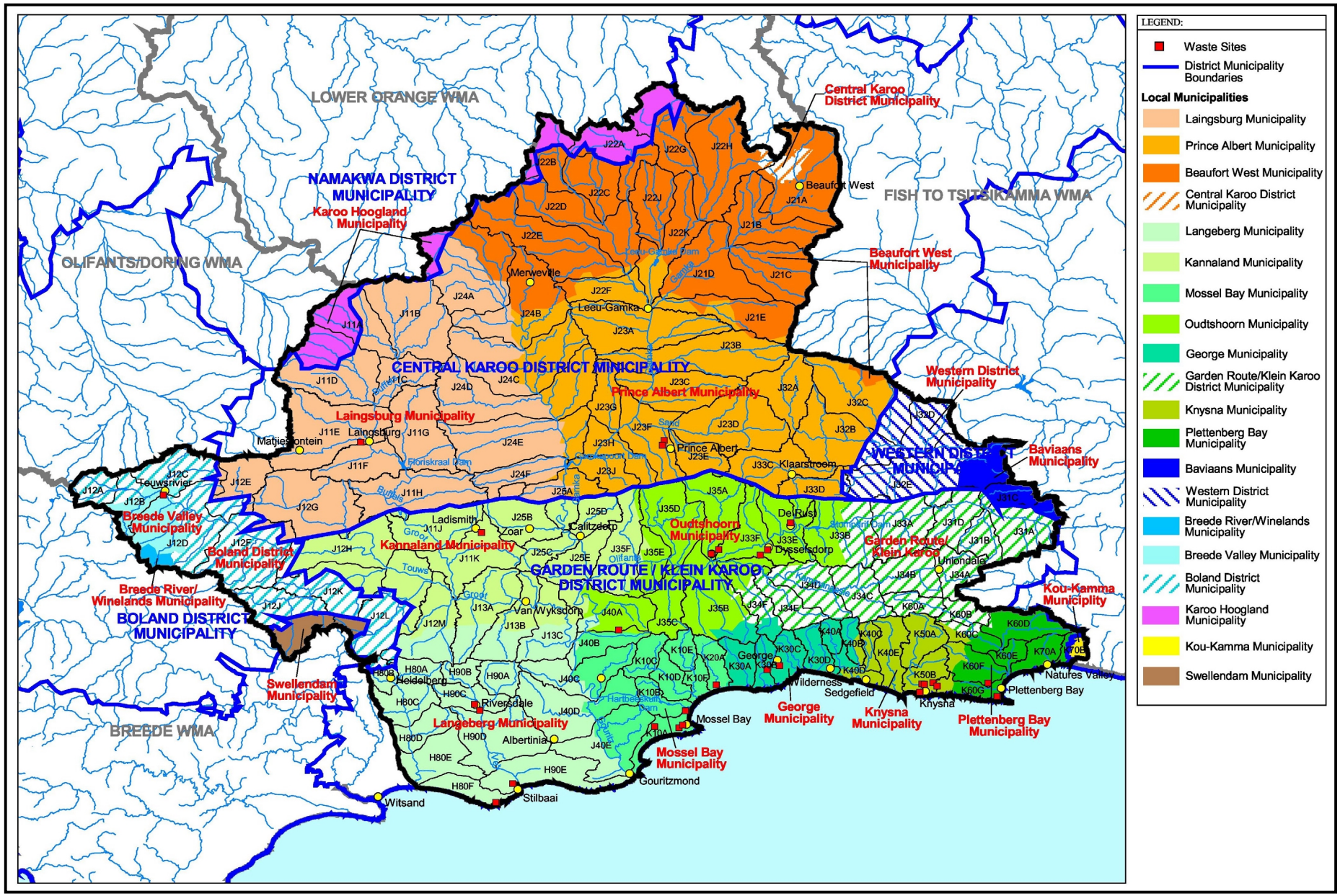

Figure 3.2: Municipal Boundaries in the Gouritz WMA

3.1 THE GAMKA SUB-AREA

The Gamka sub-area consists of secondary drainage area J2 that includes 5 tertiary drainage areas (J21 – J25), in which a total of 35 quaternary sub-catchments are situated. The main rivers in the sub-area are the Gamka River (J21A - E), the Koekemoers River (J22A - E), the Leeuw River (J22G - K) and the Dwyka River (J24A - F). Figure 3.1.1 shows the Gamka sub-area. It covers a total area of 19 051 km^2.

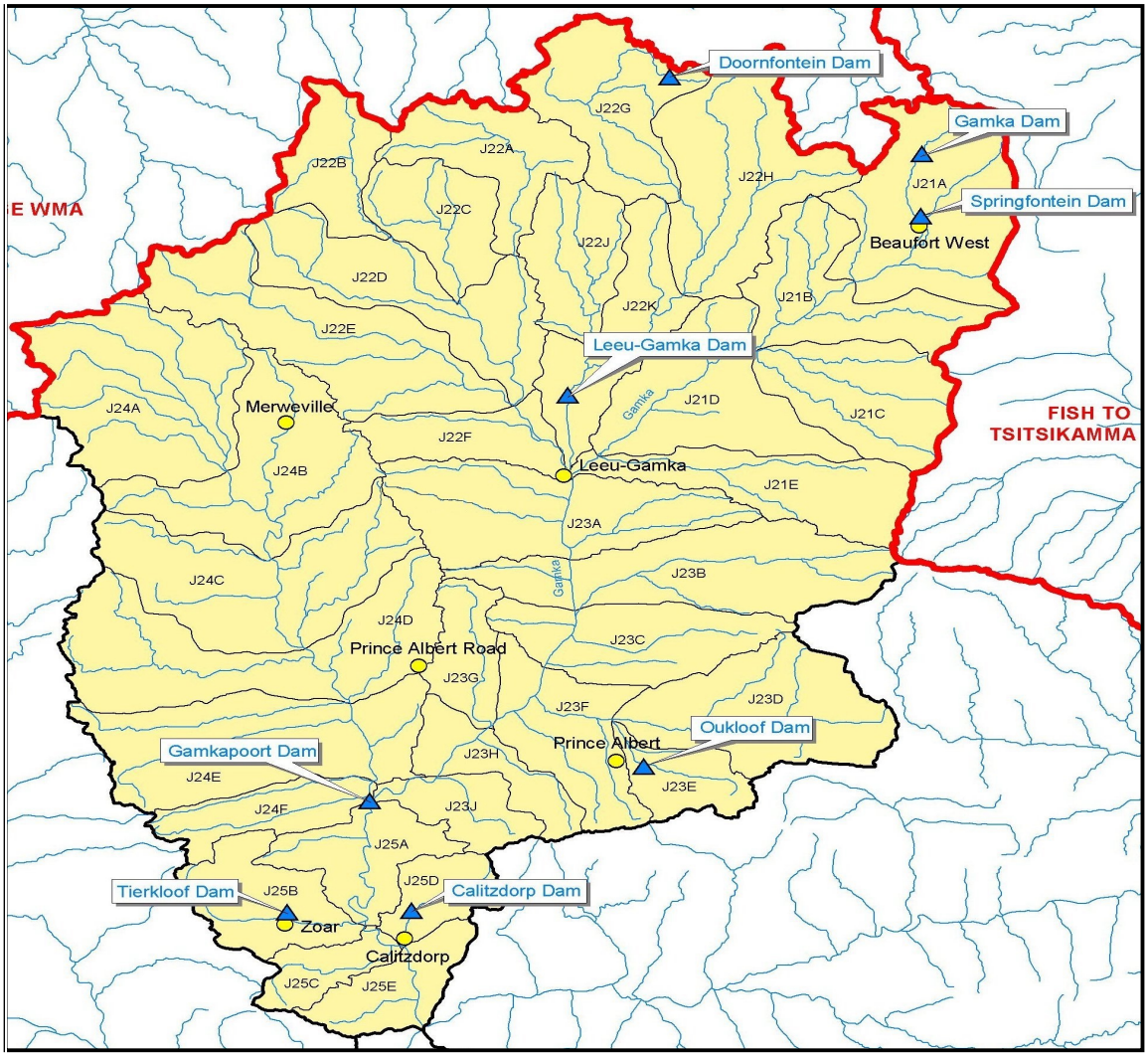

Figure 3.1.1 : The Gamka Sub-Area

3.1.1 Topography and Rainfall

The Gamka River (J21A to E) rises in the mountains of the Great Karoo to the north of Beaufort West and is joined by the Leeu & Koekemoers Rivers (J22A to F) at Leeu Gamka, flowing southwards as the Gamka River (J23A - J) into Gamkapoort Dam (J23J and J24F). The Dwyka River (J24A-E) rises in the Karoo mountain escarpment north of Merweville and flows southwards, also into Gamkapoort Dam. The sub-area also includes the catchments downstream of Gamkapoort Dam up to the confluence with the Olifants River (J25A - E). The greater portion of the sub-area lies in the Great Karoo, which extends northwards from Gamkapoort Dam. Downstream of Gamkapoort Dam the Gamka River flows through the Klein Swartberg to its

confluence with the Olifants River in the Little Karoo south of Calitzdorp (J25A-E). The mean annual precipitation (MAP) at tertiary catchment level ranges between 160 (J24) and 207 (J22) mm per annum, typical of the Great Karoo. In the Little Karoo (J25), the MAP increases to 301 mm per annum.

3.1.2 Main Water Resource Infrastructure

The eight main dams in this sub-area are :

- Doornfontein Dam (J22G), has a capacity of 4,4 million m^3. It is privately owned and used for irrigation purposes.
- Gamka Dam (J21A), north of Beaufort West, is owned by DWAF and operated by the Beaufort West municipality. The dam has a capacity of 1,8 million m^3 and is solely used for municipal supply.
- Springfontein Dam (J21A) lies immediately outside the town of Beaufort West. It is owned by the municipality and used to supply lei-water to the town. The capacity was not known at the time of preparing this report.
- Leeu-Gamka Dam (J22K) is owned by DWAF and operated by the Leeu-Gamka River Irrigation Board. The dam has a capacity of 14,3 million m^3 and is used for irrigation purposes only.
- Gamkapoort Dam (J25A) is the largest dam in this sub-area. It has a capacity of 44,2 million m^3 and supplies the Gamka River and the Buffelsvlei Irrigation Boards.
- Oukloof Dam (J23E) is owned by DWAF and operated by the Cordiers River Irrigation Board, which draws water from it for irrigation purposes. The dam has a capacity of 4,2 million m^3.
- Calitzdorp Dam (J25D) has a capacity of 4,8 million m^3. It is owned and operated by the Calitzdorp Irrigation Board. The town also has an allocation from the dam for municipal supply.
- The small Tierkloof Dam at Zoar (J25B) is owned by DWAF and operated by the Kannaland Municipality. The dam is used for domestic supply to the Zoar community. According to the RO, the dam has a capacity of 0,045 million m^3.

Many of the dams used for irrigation purposes are operated at a low level of assurance of supply being filled by flood runoff which is utilized in the following months so as to minimise evaporation losses. Opportunistic run-of-river irrigation during floods also takes place. Groundwater is extensively used for stock watering and rural supplies. It is also the main source of supply for a number of towns, or supplements their surface water supplies. Groundwater is also utilized for irrigation.

3.1.3 Population

Population estimates have been assessed for the Gouritz WMA (ref: Gouritz WMA Report) as input to the NWRS. The population estimate for the Gamka sub-area and the other four sub-areas of the Gouritz WMA are based on this estimate.

The estimate showed that approximately 48 400 people resided in this sub-area of which 20% were estimated as the rural population. The total population constituted approximately 11% of the overall population in the Gouritz WMA. It is anticipated that the future trend will be a decrease in population as people continue to migrate towards the urban centres outside this sub-area, in search of employment.

3.1.4 Land-use

Only 63 km^2 (6300 ha) of irrigated land is found within the total 19 051 km^2 of this sub-area. Of this, more than 50% lies downstream of Gamkapoort Dam. Lucerne and pasture is the dominant crop type upstream of Gamkapoort Dam whilst stone fruit and vineyards are the main crops downstream of the dam, reflecting differences in assurance of supply.

3.1.5 Water Quality

The surface water quality in the Gamka, Leeu and Dwyka Rivers ranges from good in the upper reaches to marginal (where elevated salinities occur). The source of the salinity is from seepage through the natural geology. Whilst this has some impact on crop selection, farmers have adapted their practises to suit. They rely on floods, during which the salinities would be diluted. The Water Quality Management Strategy (2.4) addresses this in more detail.

The solid waste disposal site at Calitzdorp is not yet permitted (a requirement of Section 21 of the Environmental Conservation Act) and is poorly sited in close proximity to the Nels River. This poses a potential threat to water quality from diffuse runoff and this is addressed in the Managing Solid Waste Strategy (2.3).

3.1.6 Yield Balance

It is generally understood that there is no surplus water available for further allocation and that water is used at relatively low levels of assurance. Based on an equivalent 98% level of assurance of supply, the available yield at the Year 2000 level of development in this sub-area is as shown in Table 3.1.1. The requirements are shown in Table 3.1.2.

TABLE 3.1.1 : AVAILABILITY IN THE GAMKA SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
GAMKA	26	24	0	0	0	2	0	**48**	0	**48**

A strong reliance is placed on groundwater due to the limited surface water availability in this sub-area.

TABLE 3.1.2 : REQUIREMENTS IN THE GAMKA SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
GAMKA	49	5	1	0	0	**55**	0	**55**

As shown in the above tables, requirements exceed availability, placing this sub-area in a **shortfall** of 7 million m^3/a.

3.1.7 Future for this Sub-Area

The 7 million m^3/a shortfall is not seen as too big a problem as irrigation practises have been adapted to suit lower levels of assurance of supply. There is no opportunity for further allocation out of the surface water resource (refer to the Allocation and Licensing Strategy- 3.3), although there is potential for further development of the groundwater resource. It is however not anticipated that the urban requirements will increase, except perhaps in Beaufort West and Laingsburg where additional supplies are likely to be available from groundwater. In other towns the urban requirements may well reduce as people migrate towards the more established urban areas, in search of employment opportunity. Consequently, for the Year 2025 scenarios (refer to Chapter 2), the shortfall is expected to remain unchanged for the *base scenario* and to increase to 12 million m^3/a under the *high scenario* in this sub-area.

3.2 THE TOUWS/BUFFELS/GROOT SUB-AREA

The Touws/Buffels/Groot sub-area consists of secondary drainage area J1 that includes 3 tertiary drainage areas (J11 – J13), in which a total of 27 quaternary sub-catchments are situated. The main rivers in the sub-area are the Buffels River (J11A - K), the Touws River (J12A - M), and the Groot River (J13A - C). This sub-area covers a total of 13 313 km^2. Figure 3.2.1 shows the Touws/Buffels/Groot sub-area.

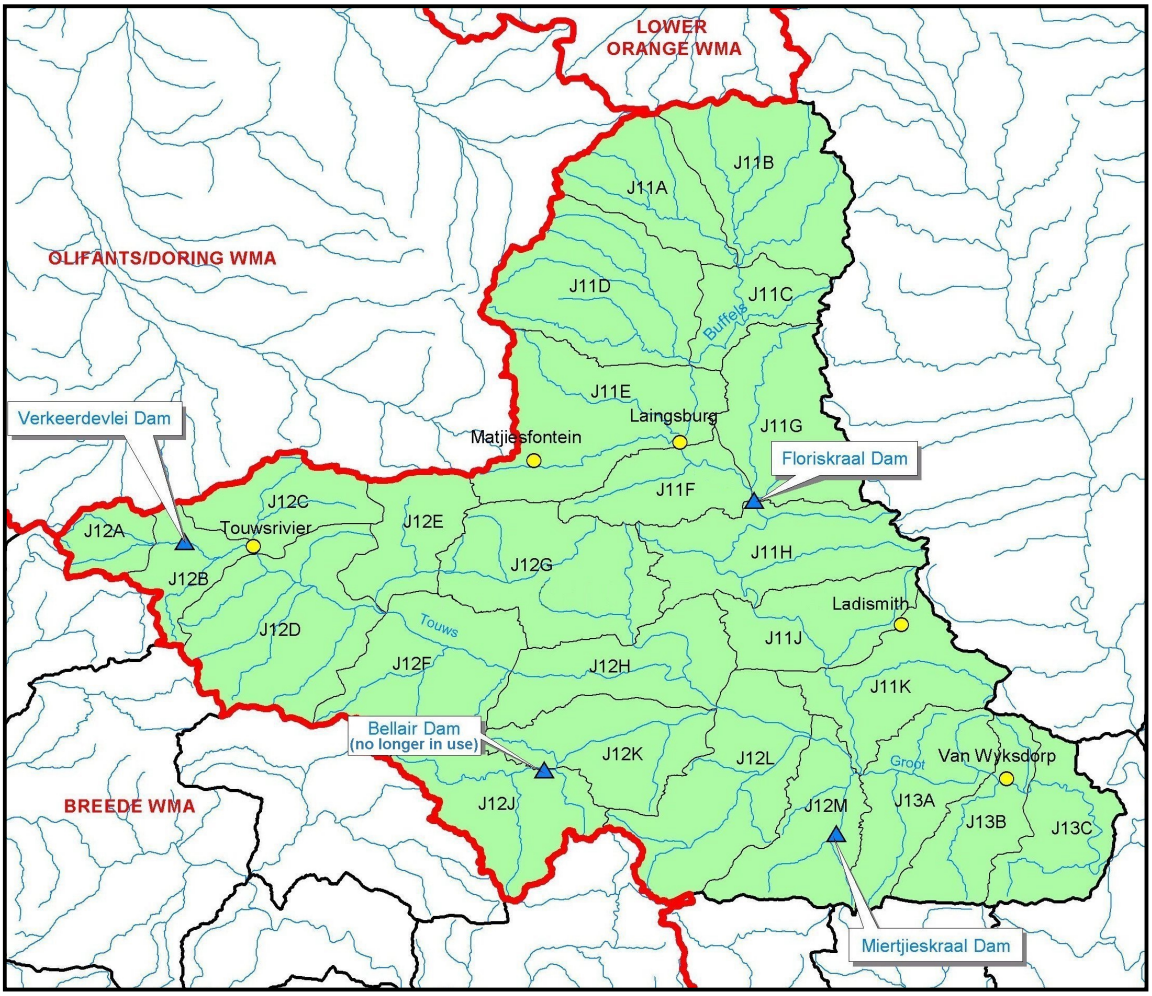

Figure 3.2.1 : The Touws/Buffels/Groot Sub-Area

3.2.1 Topography and Rainfall

The Touws/Buffels/Groot sub-area includes the Touws River (one of the two main tributaries of the Groot River), rising at the western limit of the Great Karoo and draining in an east-south-easterly direction to the confluence with the Groot River (J12A - M). The Buffels River (the other main tributary of the Groot River) rises in the Great Karoo, flows southwards into Floriskraal Dam (J11A - G). Below the dam, the Groot River flows through the Klein Swartberg Mountains and associated ranges into the Little Karoo to its confluence with the Touws River (J11H and K) and thereafter to its confluence with the Gouritz River (J13A - C). The mean annual precipitation (MAP) at tertiary catchment level is 230mm per annum for J11, 276mm per annum for J12 and 316mm per annum for J13.

3.2.2 Main Water Resource Infrastructure

The four main dams in this sub-area are :

- Floriskraal Dam (J11F, D and H) is the largest dam in this sub-area with a capacity of 50,3 million m^3. It is owned by DWAF, and operated by the Buffels River Irrigation Board. The 10 radial spillway gates are operated and maintained by DWAF. The dam is solely used for the supply of irrigation water.
- Verkeerdevlei Dam (J12B) on the Donkies River is operated by the Verkeerdevlei Irrigation Board. It has a capacity of 5,5 million m^3 and is used for irrigation purposes only. The ownership of the dam is uncertain. It was built by SA Railways to supply water to Touws River for their steam locomotives and is situated on land that is presently managed by the South African National Defence Force. The RO has confirmed that the town of Touwsriver does not receive any water from this dam. At some stage 'ownership' was passed on to Provincial Government after SA Railways (or its successor) abandoned the use of steam locomotives. Verkeerdevlei Irrigation Board, operates the dam and uses water from it.
- Bellair Dam (J12J) was used for irrigation purposes. The dam rarely filled. It had a capacity of 10,1 million m^3 and during the regional floods of 2002, the wall failed. It is no longer in use and according to the RO, DWAF do not intend rebuilding it.
- Miertjieskraal Dam on the Brand River is owned and maintained by DWAF and operated by the Brand River Irrigation Board, which also operates and maintains the distribution canals (also owned by DWAF). The capacity of the dam is to be determined.

These irrigation dams are all operated at a low level of assurance of supply.

Groundwater is extensively used for stock watering, rural supplies and for the supply of the towns. The groundwater supply to Laingsburg mainly originates from the Buffels River alluvium, from which water is also abstracted for irrigation.

3.2.3 Population

The population estimate (ref: Gouritz WMA Report) indicated that approximately 21 500 people resided in this sub-area. 39% of those were estimated as the rural population. The total population constituted approximately 5% of the overall population in the Gouritz WMA. It is envisaged that there will be a reduction in population in this sub-area as people continue to migrate to other centres in search of employment.

3.2.4 Land-use

An estimated 98 km^2 (9800 ha) of irrigated land is found within the total 13 313 km^2 of this sub-area. Of this, it is estimated that an average of only 38 km^2 (3800 ha) is harvested annually. Crops such as lucerne can lie dormant in certain years when water is not available. The assurance

of supply to irrigators in this sub-area is low and as such, much of the irrigation is opportunistic, taking place as and when water is available.

3.2.5 Water Quality

The surface water quality in this sub-area is of high salinity and considered to be poor. In the upper reaches of the Touws River (J12A), water quality is good but deteriorates in a downstream direction showing increasing concentration of dissolved solids. This is attributed to the dry nature of the catchment and the saline geology. Water quality in the Groot River (J13 tertiary catchment), is classified as poor with high saline concentration, also attributed to the natural geology. The river biota has adapted to these natural circumstances and as such, the impact is considered to be more of a concern in terms of water use. Consequently crop selection and farming practices have had to adapt to these conditions and make best use of what is available. Refer also to the Water Quality Management Strategy (2.4). WWTW in this sub-area do not impact on water quality and their treated effluent is utilised for irrigation.

3.2.6 Yield Balance

There is no surplus water available for further allocation and water is used at low levels of assurance of supply. Based on an equivalent 98% level of assurance of supply, the available yield at the Year 2000 level of development in this sub-area is as shown in Table 3.2.1 and the requirements in Table 3.2.2.

TABLE 3.2.1 : AVAILABILITY IN THE TOUWS/BUFFELS/GROOT SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
TOUWS/ BUFFELS/ GROOT	21	23	0	0	0	2	0	**42**	0	**42**

A strong reliance is placed on groundwater in this sub-area.

TABLE 3.2.2 : REQUIREMENTS IN THE TOUWS/BUFFELS/GROOT SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
TOUWS/ BUFFELS/ GROOT	49	2	2	0	0	**53**	0	**53**

As shown in the above tables, requirements exceed availability, placing this sub-area in a **shortfall** of 11 million m^3/a.

3.2.7 Future for this Sub-Area

The future for this sub-area is much the same as that of the adjacent Gamka sub-area. The 11 million m^3/a shortfall is not considered to be significant as irrigation practises have been adapted to suit lower levels of assurance of supply. There is no opportunity for further allocation out of the surface water resource (refer to the Allocation and Licensing Strategy – 3.3), although there is potential for further development of the groundwater resource. If any growth in urban water requirements takes place, this is likely to be small and will be met through the further exploitation of groundwater resources. This will be offset against a reduction in the rural requirement.

Under the *base* and *high scenarios* for Year 2025, the shortfall in this sub-area is expected to reduce marginally from that in Year 2000. This is primarily due to the shift in population from the rural to the urban areas, both within and outside of this sub-area. The *base scenario* estimates a reduction in shortfall to 9 million m^3/a whilst a shortfall of 10 million m^3/a is estimated for the *high scenario*.

3.3 THE OLIFANTS SUB-AREA

The Olifants sub-area consists of secondary drainage area J3 that includes 5 tertiary drainage areas (J31 – J35), in which a total of 27 quaternary sub-catchments are situated. The main rivers in the sub-area are the Olifants River and its main tributary the Kammanassie River (J34). This sub-area covers a total of 11 017 km^2 and is shown in Figure 3.4.1.

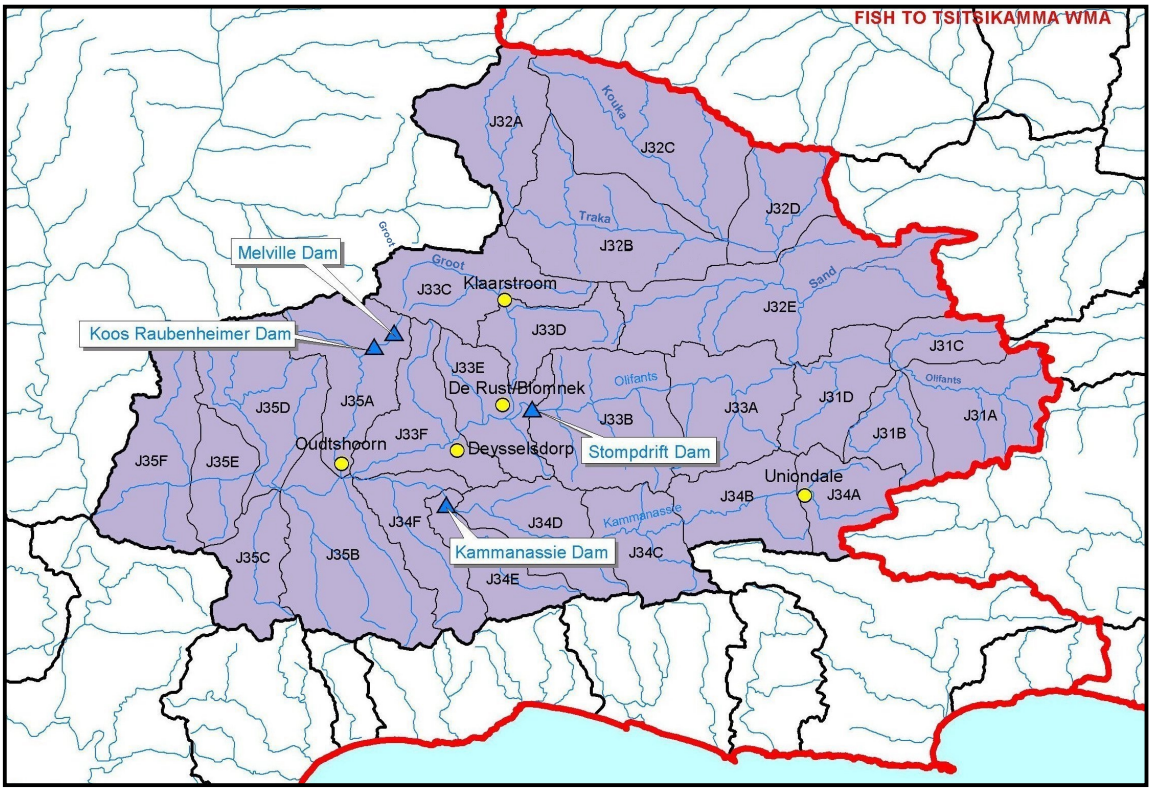

Figure 3.3.1 : The Olifants Sub-Area

3.3.1 Topography and Rainfall

The Olifants sub-area includes the Olifants and Kammanassie Rivers and their respective tributaries. The northern tributaries of the Olifants River rise in the Great Karoo, north of the Swartberg Mountains (J32). The Olifants River rises to the east (J31A - D) and flows westward to the confluence with its northern tributaries (J31D and J32E), from where it flows into Stompdrift Dam (J33A and B). The Kango, Grobbelaars, Wynands, Kansa and Vlei rivers drain the southern slopes of the Swartberg (J33E and F, J35A, D, E and F). The Kammanassie River rises in the Outeniqua and Kammanassie Mountains (J34A).

The mean annual precipitation (MAP) at tertiary catchment level is 377mm per annum for J31, 177mm per annum for J32, 384mm per annum for J33, 509mm per annum for J34 and 382mm per annum for J35. The higher MAP in the J34 catchments is due to the fact that they include the north facing slopes of the Outeniqua Mountains and are more exposed to the frontal systems (bringing rain to the coastal mountains) than the rest of this sub-area.

3.3.2 Main Water Resource Infrastructure

The four dams in this sub-area are :

- Stompdrift Dam (J33B) on the Olifants River and Kammanassie Dam (J34E) on the Kammanassie River supply water to the Olifants River Government Water Scheme for irrigation purposes. The dams have capacities of 55,3 million m^3 and 35,8 million m^3 respectively. They are jointly operated by DWAF and by the Stompdrift – Kammanassie Irrigation Board which is yet to be officially transformed into a WUA. Dam maintenance is undertaken by DWAF. The extensive distribution canal system that forms part of the scheme is also owned by DWAF but is operated and maintained by the Irrigation Board. The scheme serves downstream irrigators throughout the Olifants River Valley (J33E&F, J34F and J35B to F) from the dams to the confluence with the Gamka River. Conveyance losses along extensive lengths of unlined canals result in a decrease in assurance of supply as one moves further downstream. The consequence thereof being smaller allocations per hectare than upstream. This is further addressed under the Agricultural WC/DM Strategy (4.2).
- Koos Raubenheimer Dam (J35A) has a capacity of 9,2 million m^3 and is the main source of supply to the town of Oudtshoorn. The dam is owned by the Municipality, but irrigators receive low flows, which are routed around the dam in a canal, as well as annual releases from the dam, if the storage is greater than a prescribed capacity.
- Melville Dam (J35A) has a capacity of 0,4 million m^3 and together with Koos Raubenheimer Dam, also supplies the town of Oudtshoorn. The dam is owned by the municipality.

Surface water is also extensively utilized for run-of-river irrigation through the diversion of normal and flood flows on a share basis for direct usage and into farm dams. Flood flows in the Olifants River are also diverted for irrigation.

The Klein Karoo Rural Water Supply Scheme (KKRWSS) is owned by DWAF and operated by the Overberg Water Board. Although not entirely confined to the boundaries of this sub-area, the scheme does lie predominantly therein. It supplies potable water for domestic and stock watering purposes to the following areas:

- The town of Dysselsdorp
- Rural communities and farms in the Olifants River valley downstream of the Stompdrift and Kammanassie Dams
- Rural communities and farms in the Gamka River valley downstream of the Calitzdorp and Gamkapoort Dams, up to the confluence of the Olifants and Gamka Rivers.

Raw water for the scheme is obtained from groundwater sources and the scheme currently supplies 1,1 million m^3/a. The raw water is treated in two water treatment works. The Western Works is located near Calitzdorp, has a design capacity of 0,9 million m^3/a, but was operated at less than 0,1 million m^3/a in 1995. The Eastern Works is situated close to Dysselsdorp, has a design

capacity of 3,5 million m^3/a and is currently being loaded at 1,0 million m^3/a. The scheme supplies domestic and stockwatering water requirements and is currently not operated at its full potential on account of the problems associated with borehole supplies. This is largely attributed to inefficient borehole construction and iron contamination of the borehole casings and of the reticulation pipe work. Hence the scheme has some spare capacity.

The water from the KKRWSS is used for the following purposes (1997/98 figures):

Dysselsdorp	44,5%
Rural domestic	28,5%
Stock watering	12%
Losses	13%
Waterworks	2%

Outside of the KKRWWS, groundwater is also abstracted by some towns and for irrigation purposes, the latter mainly from the alluvium of the Olifants River Valley.

3.3.3 Population

It was estimated (ref: Gouritz WMA Report) that approximately 88 500 people resided in this sub-area. 23% of those were estimated as the rural population and the remainder urban with the majority living in Oudtshoorn. The total population constituted approximately 21% of the overall population in the Gouritz WMA. It is not anticipated that there will any significant growth in the population in this sub-area. However it is probable that there will be some shift from the rural areas into Oudtshoorn, and as such the domestic water requirements of the town are likely to increase.

3.3.4 Land-use

An estimated 218 km^2 (21 800 ha) of irrigated land is found within the total 11 017 km^2 of this sub-area. Of this, it is estimated that an average of only 48 km^2 is harvested annually. This suggests that the assurance of supply to irrigators in this sub-area is extremely low, aggravated by the losses experienced in the conveyance of water in unlined canals within the Olifants River Government Water Scheme and most tributaries. These issues are addressed under the Verification of Existing Lawful Use Strategy (3.2) and the Agricultural WC/DM Strategy (4.2).

The combined allocation from the Stompdrift and Kammanassie Dams is 87,7 million m^3/a which is 266% of their combined 1:50 year yield of 33 million m^3/a. The allocated quantities of water are supplied to irrigators occasionally and only after dams fill or partially fill after flood events, but may not be supplied to irrigators during dry years. Although this represents an apparent over-allocation, the dominant crop type is lucerne which is well suited to these opportunistic irrigation practices at low assurances of supply.

An effective area of infestation by invasive alien plants is estimated at approximately 225 km^2, with a reduction in surface water runoff of 8 million m^3/a. This has an estimated impact on the yield of this sub-area of 4 million m^3/a. The infestation is most prevalent in the Kammanassie River catchment, where the reduction in yield contributes to 3 million m^3/a of the 4 million m^3/a reduction in the Olifants sub-area as a whole. The Removal of Invasive Alien Plants Strategy (3.6) addresses this in more detail.

Only 1,2 km^2 of afforestation is found in this sub-area, and has a negligible annual reduction on surface water runoff and yield.

3.3.5 Water Quality

Water quality in this sub-area ranges from ideal in the upper reaches of the mountain sub-catchment tributaries (Table Mountain Group sandstone), to poor in the lower reaches of these tributaries and the Olifants River, with very poor water quality in the J35F quaternary catchment. This elevated salinity is in part due to natural causes (evaporation and geological processes) as well as agricultural return flows.

In the larger urban centres (Oudtshoorn for example), vandalism of the sewage reticulation and pumpstation infrastructure occasionally leads to sewage spills from the system. The industrial expansion taking place in the Oudtshoorn area will introduce additional load on the WWTW and upgrading of the works will be necessary to avoid spills. Refer to the Water Quality Management Strategy (2.4).

3.3.6 Yield Balance

Based on an equivalent 98% level of assurance of supply, the available yield at the Year 2000 level of development in this sub-area is as shown in Table 3.3.1 and the requirements in Table 3.3.2.

TABLE 3.3.1 : AVAILABILITY IN THE OLIFANTS SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
OLIFANTS	53	15	3	5	0	1	4	**71**	0	**71**

TABLE 3.3.2 : REQUIREMENTS IN THE OLIFANTS SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
OLIFANTS	62	10	2	0	0	**74**	0	**74**

As shown in the tables, requirements are slightly less than the available water and as such there is a **shortfall** of 3 million m^3/a. The assurance of supply to irrigators in this sub-area is low and as such, much of the irrigation is based on utilising water opportunistically. This in turn introduces limitations in terms of cultivating permanent crop types.

3.3.7 Future for this Sub-Area

There is very little potential for further development of the surface water yield, particularly for the purposes of irrigation. In this regard it is recommended that the actual extent of over-allocation to irrigation be determined during the registration and its verification process (Verification of Existing Lawful Use Strategy – 3.2). Thereafter the situation needs to be reassessed for the lower levels of assurance of supply, more in line with current practices, to which farmers have adapted their water use. If the assurances of supply are acceptable to them, re-allocation through compulsory licensing in that area might not be required. Once this has been established, and the needs of the farmers determined, only then should a decision be taken regarding the implementation of compulsory licensing to address the over-allocation. Refer also to the Compulsory Licensing Strategy (3.4).

The Year 2000 shortfall of 3 million m^3/a is estimated to increase marginally (to 4 million m^3/a) due to an increase in the urban water requirement for the Year 2025 *base scenario*. For the corresponding *high scenario*, the urban water requirement is anticipated to further increase, resulting in a shortfall of 12 million m^3/a.

Increased urban water requirements are likely to be met through the exploitation of groundwater. The Deep Artesian Groundwater Exploitation for Oudtshoorn Municipal Supply (DAGEOS) study is being undertaken. There is some potential for a new dam (Kombuis Dam) on the Grobbelaars River. Although irrigators along the river currently abstract the available base flow, a dam would allow the flood peaks to be captured and the additional yield made available to Oudtshoorn. The Supply to Local Authorities Strategy (6.1) identifies the current sources of supply to towns in the WMA. Suggestions are also made with respect to future possible sources of supply, subject to all other possible interventions (WC/DM, effluent re-use, invasive alien plant removal, etc) being implemented first.

The Eden / Klein Karoo District Municipality is in the process of purchasing a 50 ha allocation from the Haarlem Irrigation Board (Fish to Tsitsikamma WMA) for augmenting the supply to the

town of Uniondale (Gouritz WMA). The pipeline installation has been partially completed, however the water use licence yet to approved by the Department.

3.4 THE GOURITZ/GOUKOU/DUIWENHOKS SUB-AREA

The Gouritz/Goukou/Duiwenhoks sub-area consists of secondary drainage areas H8, H9 and J4 in which a total of 16 quaternary sub-catchments are situated. The main rivers in the sub-area are the lower Gouritz River (J40A - E), the Goukou River (H90A - E) and the Duiwenhoks River (H80A - F). This sub-area covers a total of 5 299 km^2 and is shown in Figure 3.4.1.

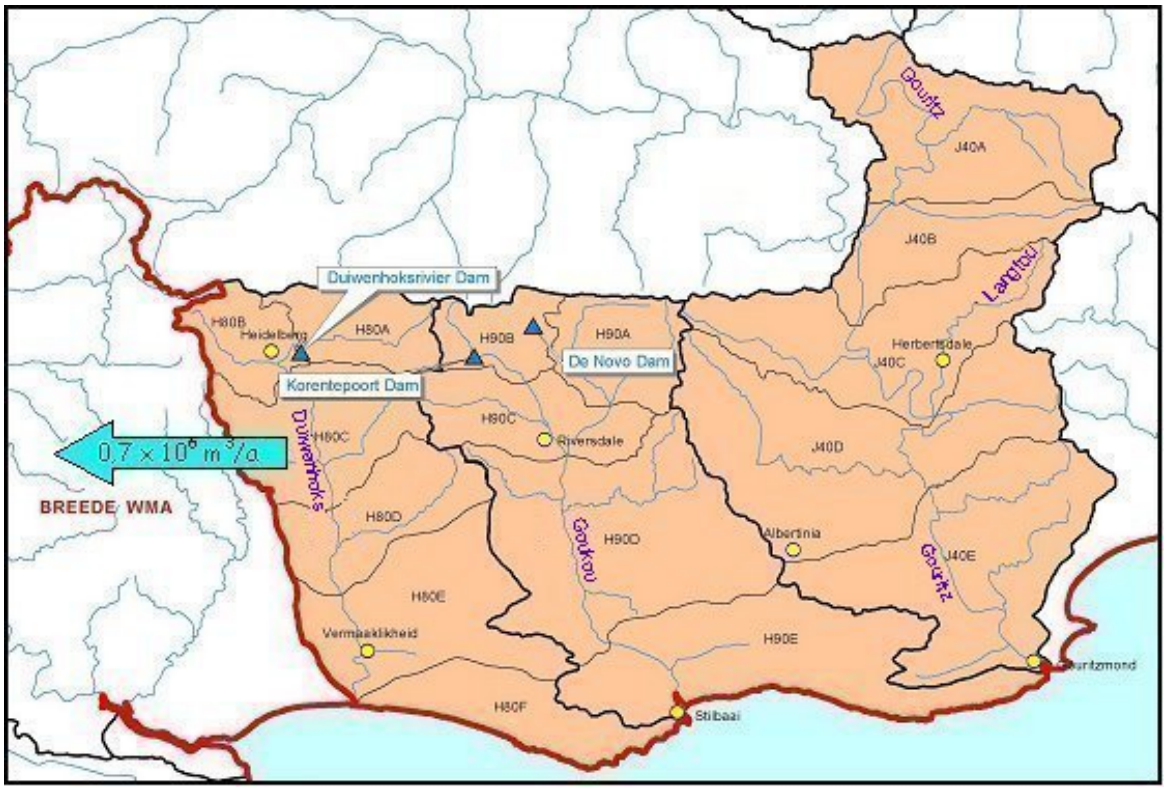

Figure 3.4.1 : The Gouritz/Goukou/Duiwenhoks Sub-Area

3.4.1 Topography and Rainfall

This sub-area constitutes the coastal catchments of the lower Gouritz River (J40A – J40E), the Goukou River catchment (H90A – H90E) and the Duiwenhoks River catchment (H80A - H80F). The mean annual precipitation (MAP) at tertiary catchment level (H80, H90 and J40) is 504mm per annum for H80, 493mm per annum for H90 and 452mm per annum for J40. The Duiwenhoks River rises in the Langeberg Mountains and flows via the town of Heidelberg to the sea. The Goukou River flows through the town of Riversdale. The Lower Gouritz River flows through the Langeberg Mountains and drains towards Gouritzmond. In quaternary catchment J40E, to the east of the Gouritz River, rolling hills and sand dunes are prevalent, with endoeric areas (areas from which there is no flow of surface water to downstream catchments or the sea).

3.4.2 Main Water Resource Infrastructure

The three main dams in this sub-area are :

- Duiwenhoks River Dam (H80A) has a capacity of 6,4 million m^3 and an estimated 1 in 50 year yield of 9,8 million m^3/a. It is owned by DWAF, and operated by the Duiwenhoks River Irrigation Board, which utilises approximately 3,7 million m^3/a (1 in 50 year level of assurance of supply) for irrigation purposes. A further 1,1 million m^3/a is used to supply the Duiwenhoks Rural Water Supply Scheme, of which 0,7 million m^3/a is transferred into the Breede WMA to supply farmers. The town of Heidelberg is currently also supplied from the dam and has an estimated annual requirement of approximately 1 million m^3/a. The potential to supply the town of Witsand out of yield from the dam has been identified as an option to augment the supply to that town.
- Korentepoort Dam (H90B; also referred to as the Korente-Vette Dam), on the Korente-Vette River is owned by DWAF and operated by the Korente-Vette Irrigation Board and is the main source of supply to the Korente-Vette Irrigation Scheme. The dam has a capacity of 8,3 million m^3 and a yield of 5,8 million m^3/a. It is used primarily for irrigation purposes, whilst also providing municipal supply to the town of Riversdale.
- De Novo Dam (H90B) on the Vette River is a small dam owned by DWAF, operated by the Korente-Vette Irrigation Board and used to supplement the supply to the Korente-Vette Irrigation Scheme by feeding into the irrigation system canals. The capacity of the dam is approximately 0,1 million m^3 and it has an estimated yield of 0,15 million m^3/a.

  There is limited groundwater usage, mainly for stock watering and supplies to coastal resorts.

3.4.3 Population

It was estimated (ref: Gouritz WMA Report) that approximately 35 700 people resided in this sub-area of which 33% were estimated as the rural population. The total population constituted approximately 8% of the overall population in the Gouritz WMA. The estimates do not account for the seasonal influx of visitors to the coastal resort towns of Stilbaai and Gouritzmond. The local authority (Langeberg Municipality) has provided the following estimates of population increase during the summer holiday season:

- Stilbaai: 40 000
- Gouritzmond: 5 000
- Witsand: 4 500

This would more than double the population during the holiday season. Estimates of future growth in seasonal population numbers were not available on request.

3.4.4 Land-use

An estimated 63 km^2 (6300 ha) of irrigated land is found within the total 5 299 km^2 of this sub-area. The assurance of supply very much higher than that of the inland catchments of the Karoo and it is estimated that all land under irrigation is harvested annually. Opportunistic irrigation is therefore less prevalent here. Vineyards, lucerne and pasture are the dominant crop types under irrigation.

Of significance is the extent of invasive alien plant infestation in this sub-area. This coverage is estimated to be equivalent to approximately 530 km^2 of dense alien plant infestation, with a reduction in surface water runoff of 43 million m^3/a. This has an estimated impact on the yield of this sub-area of some 10 million m^3/a. The infestation is most prevalent in the Goukou and Duiwenhoks catchments, in which the reduction in yield contributes to 8,5 million m^3/a of the 10 million m^3/a. The Removal of Invasive Alien Plants Strategy (3.6) discusses this in more detail.

Approximately 27 km^2 of afforestation is found in this sub-area, all of which is located in the Duiwenhoks and Goukou River catchments. This has an average annual reduction in surface water runoff of 5 million m^3/a, with an estimated reduction in yield of 1 million m^3/a at the 98% level of assurance of supply. Refer also to the Afforestation Strategy (3.5).

3.4.5 Water Quality

The surface water in the upper reaches of the Duiwenhoks River and Goukou River catchments is of good quality. Water quality in the lower Gouritz River (J40 catchment) is classified as unacceptable due to high salinity, mainly from the cumulative contributions of the upstream Touws/Buffels/Groot and Olifants sub-areas. The quality of water arising from the Gamka sub-area has less impact on the quality of the Gouritz River water than the aforementioned two sub-areas. Information on the quality of surface water in the lower reaches of the Duiwenhoks and Goukou Rivers is available but still needs to be analysed. Managing salinity is further addressed under the Water Quality Management Strategy (2.4).

The WWTW at the coastal towns rely primarily on primary screening, de-gritting and the use of oxidation or evaporation ponds. During the peak season, the capacity of these basic systems is often exceeded, with the result that spills occur. At Riversdale for example, the WWTW sludge dams are situated in close proximity to the Goukou River. The works has reached its design capacity, posing a risk of spills during the peak season whilst seepage into the river from the ponds remains an ongoing risk. The Water Quality Management Strategy (2.4) addresses these concerns.

3.4.6 Yield Balance

Based on an equivalent 98% level of assurance of supply, the available yield at the Year 2000 level of development in this sub-area is as shown in Table 3.4.1 and the requirements as shown in Table 3.4.2.

TABLE 3.4.1 : AVAILABILITY IN THE GOURITZ/GOUKOU/DUIWENHOKS SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
GOURITZ/ GOUKOU/ DUIWENHOKS	66	1	2	2	0	2	10	**59**	0	**59**

TABLE 3.4.2 : REQUIREMENTS IN THE GOURITZ/GOUKOU/DUIWENHOKS SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
GOURITZ/ GOUKOU/ DUIWENHOKS	51	3	3	0	1	**58**	1	**59**

As shown in the above tables, requirements and available water are in balance. However it should be noted that the estimate of the impact (on yield) of the Reserve is based on DWAF's desktop methodology. Furthermore this was determined for riverine Reserve requirements only, as no methodology was available for estimating the estuarine Reserve requirement. This may ultimately be significant. Refer also to the Reserve and Resource Quality Objectives Strategy (2.1). The sizeable impact of invasive alien plants on the yield of this sub-area (10 million m^3/a) suggests that there is significant opportunity to further improve the yield, through clearing. The Removal of Invasive Alien Plants Strategy (3.6) addresses this in more detail and suggests priority areas in which to concentrate clearing efforts.

3.4.7 Future for this Sub-Area

The apparent state of balance in this sub-area should be cautiously interpreted. On-site inspections by RO officials suggest that there may be unlawful abstraction from the Duiwenhoks River, which is in fact depleting the inflow to the estuary. Over-abstraction from the Langtou River (J40C) is also suspected. This should be carefully reviewed during the verification of existing lawful use. Refer to Strategy 3.2 in this regard.

Under the *base and high scenario* for Year 2025, it is estimated that there will be a small change in the Year 2000 situation (in which the sub-area is in balance). This is primarily due to the shift in population from the rural to the urban areas, both within and outside of this sub-area. The *base scenario* estimates a small surplus (1 million m^3/a) as a result of reduced rural water requirement. The *high scenario* reflects a shortfall of 1 million m^3/a as a result of increased urban water requirements, offset to some extent by the increased usable return flows arsing.

3.5 THE COASTAL SUB-AREA

The Coastal sub-area consists of secondary drainage areas K1 to K7, which contain a total of 27 quaternary sub-catchments. The main rivers in the sub-area include the Hartenbos, Little Brak, Great Brak, Knysna, Bietou, Keurbooms, Groot and Bloukrans Rivers. Due to the varying nature of these catchments and the fact they are characteristic of individual short river systems, this sub-area has been further sub-divided into 3 groups, namely:

(i) Mossel Bay to George (K10A – K30C)
(ii) Wilderness Coastal Rivers (K30D – K40 E)
(iii) Knysna to Bloukrans (K50 – K70)

Figure 3.5.1 shows the Coastal Sub-area, which covers a total area of 4 459 km^2.

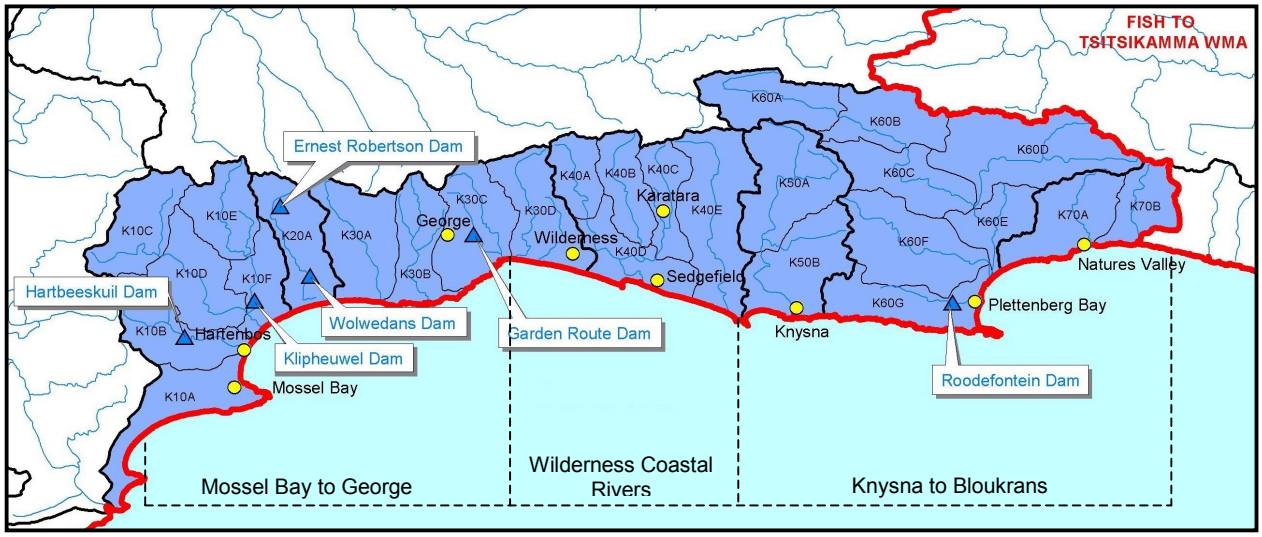

Figure 3.5.1 : The Coastal Sub-Area

3.5.1 Topography and Rainfall

Mossel Bay to George:

The Hartenbos River (K10B) rises in the coastal plain and enters the sea at Hartenbos. The Little Brak River rises in the Outeniqua Mountains and its course cuts through the coastal plain to the sea (K10C to F). The Great Brak River (K20A) rises in the Outeniqua Mountains and enters the sea at the resort town of Groot-Brakrivier. The Maalgaten (K30A) and Gwaing Rivers (K30B) both rise in the Outeniqua Mountains and exit to the sea near Herolds Bay. The Kaaimans River (K30C) also rises in the Outeniqua Mountains. Its main tributary, the Swart River, passes the town of George (K30B&C), and joins the Kaaimans itself just before it enters the sea. The mean annual precipitation (MAP) at tertiary catchment level is 497mm per annum for K10, 722mm per annum for K20, increasing further towards the east to 766mm per annum for K30.

Wilderness Coast Rivers:

The Touws River (K30D) flows into the Wilderness lagoon. It is connected to the Langvlei by the Serpentine River channel, which in turn is connected by a channel to the Bo Langvlei. Rondevlei is not connected. The Diep (K40A), Hoëkraal (K40B) and Karatara (K40C) Rivers drain into Swartvlei, which enters the sea close to the town of Sedgefield on the N2 (K40D). The Goukamma River (K40E) enters the sea near the holiday resort town at Buffelsbaai. The mean annual precipitation (MAP) at tertiary catchment level is 831mm per annum for K40.

Knysna to Bloukrans:

The Knysna River (K50A&B) drains into the Knysna lagoon. A few small streams drain the coastal strip between Knysna and Plettenberg Bay (K60G). The Piesangs River (K60G) enters the sea at Plettenberg Bay. The Bitou River (K60F) and the Keurbooms River (K60A to E) flow into the sea via the Keurbooms lagoon. The Matjies River (K70A) is a minor river that drains into the sea at Keurboomstrand. The Sout River (K70A) enters the sea just west of Nature's Valley, and the Groot River (K70A) flows into the sea slightly further east at Nature's Valley. The Bloukrans River (K70B) enters the sea in the Tsitsikamma Forest and Coastal National Park. The mean annual precipitation (MAP) at tertiary catchment level is 865mm per annum for K50, 781mm per annum for K60, increasing further towards the east to 950mm per annum for K70.

3.5.2 Main Water Resource Infrastructure

Mossel Bay to George:

The five dams in this sub-area are :

- Hartebeeskuil Dam (K10B) on the Hartenbos River supplies some water for local irrigation purposes and stockwatering but has a poor yield (0,85 million m^3/a) and poor water quality. The dam has a capacity of 7,2 million m^3 and is owned, operated and maintained by DWAF. There are no irrigation boards in place and the future of this dam remains uncertain, with little demand placed on it. As such no WUA is likely to take over the use, operation, maintenance and eventual ownership of this dam.
- Klipheuwel Dam (K10F) is an off-channel storage dam, which is filled via pumping from the Moordkuil River (a tributary of the Little Brak River), for supply to the town of Mossel Bay. The dam has a capacity of 4,2 million m^3. It is owned by DWAF, which also owns the pumpstation. The distribution pipeline is owned by the Mossel Bay Municipality.
- Ernest Robertson Dam (K20A) is situated on the upper reaches of the Great Brak River. It has a capacity of 0,42 million m^3. The dam is owned by Mossel Bay Municipality.
- Wolwedans Dam (K20A) on the Hartenbos River has a capacity of 24 million m^3. The dam is owned by DWAF and the distribution pipeline is owned by PetroSA. The dam is jointly operated and maintained by both organizations. Mossel Bay has an allocation out of the dam of 3,5 million m^3/a, which has yet to be taken up. The consequence of this is addressed in the Allocation and Licensing Strategy (3.3).
- Garden Route Dam (K30C) on the Swart River has a capacity of 8 million m^3. The dam is owned and operated by George Municipality and provides water to the town.

The Wilderness Rivers:

There are no dams of any significant size in this area. Direct abstraction on a run-of-river basis serves to supply the towns with water:

- Wilderness is supplied from the Touws River, but also from the Garden Route Dam.
- Sedgefield abstracts water from the Karatara River, supplementing its supplies with groundwater.
- Buffelsbaai abstracts water from the Goukamma River.

Knysna to Bloukrans:

Knysna, Belvedere and Brenton are supplied with water directly from the Knysna River, on a run-of-river basis supplemented by off-channel storage.

The main supply for Plettenberg Bay and Kranshoek is abstracted on a run-of-river basis from the Keurbooms River. This supply is supplemented by groundwater and by Roodefontein Dam on the Piesangs River which is owned by DWAF and operated and maintained by Plettenberg Bay Municipality. The dam has a capacity of 1,4 million m^3 (currently being raised to 2 million m^3) and also supplies water to the Jakkalsfontein farming concern. It only has a small catchment of its own and some water is pumped into it from the Keurbooms River.

Natures Valley abstracts from the Groot River in K70A. Irrigators also abstract water on a run-of-river basis with some storage in farm dams.

3.5.3 Population

It was estimated (ref: Gouritz WMA Report) that approximately 242 800 people resided in this sub-area. 10% of those were estimated as the rural population. The total population constituted approximately 56% of the overall population in the Gouritz WMA.

The estimates do not account for the seasonal influx of holiday makers to the resort towns in this sub-area. The following estimates were provided by the local authorities:

- Mossel Bay, Great Brak, Hartenbos: up to 50 000
- George and Wilderness: no information available on request
- Knysna: no information available on request
- Sedgefield: up to 10 000
- Plettenberg Bay: up to 55 000 (29 100 = permanent population)

The above figures indicate a possible doubling of the population in the larger coastal towns. In the smaller resort towns such as Sedgefield (permanent population less than 3000), the population could more than triple during the holiday season. No figures for anticipated future trends were available on request from the local authorities.

3.5.4 Land-use

An estimated 72 km^2 (7200 ha) of irrigated land is found within the total 4 459 km^2 of this sub-area, which in an average year is fully harvested. The more reliable rainfall within the coastal strip ensures a greater reliability and assurances of supply are higher than in the inland Karoo catchments. Of the total irrigated area, 33km^2 (3300 ha) occurs in the Knysna to Bloukrans area, with the remainder equally distributed between the other two areas.

An effective approximate 380 km^2 of dense invasive alien infestation is estimated, with a reduction in surface water runoff of 64 million m^3/a. This has an estimated impact on the yield of this sub-area of 21 million m^3/a. The infestation is most prevalent in the Knysna to Bloukrans catchments in which the reduction in yield is estimated to be 14 million m^3/a of the total for the Coastal sub-area. Refer also to the Removal of Invasive Alien Plants Strategy (3.6).

It is estimated that 572 km^2 of commercial afforestation and 17 km^2 of indigenous forest is found in this sub-area. The indigenous component occurs only in the Knysna to Bloukrans area. Of the 572 km^2 of commercial forest, 226 km^2 occurs between Knysna and the Bloukrans River, 204 km^2 in the Wilderness catchments and the remaining 142 km^2 between George and Mossel Bay. The reduction in surface water runoff due to afforestation in the Coastal sub-area is estimated to be 82 million m^3/a, which has an impact of reducing the 1:50 year yield of this sub-area by 14 million m^3/a. This is addressed under the Afforestation Strategy (3.5).

3.5.5 Water Quality

Water quality in all the rivers of the Coastal sub-area is generally classified as ideal and suitable for all domestic and irrigation water users. The few exceptions are the Brandwag River (K10B), the Groot Brak River (K20A), the Maalgaten River (K30A) and in the Hoëkraal River (K40B) in which the quality is classified as marginal for domestic and irrigation water users. The origin of elevated salts in these catchments is attributed to the catchment geology. Refer also to the Water Quality Management Strategy (2.4).

Water quality of the Plettenberg Bay coastal rivers was investigated in detail in the mid-1990's as part of the Plettenberg Bay Coastal Catchments Study (DWAF, 1996). It was found that all the rivers (Piesang, Bietou and Keurbooms Rivers) had similar background quality characteristics; brown colour, low pH and TDS, and elevated dissolved organic carbon (DOC) and iron concentrations. However manmade activities have caused water quality changes. For example, the Piesang River experiences elevated turbidity, whilst the Keurbooms, Bitou and Groot River estuaries all experience elevated *E. coli* counts during the summer months.

In George, the accumulation of tanning waste at the site of the old shoe factory may be impacting on groundwater quality. Furthermore, one of the two solid waste disposal sites at George (Gwaing site) is poorly managed and requires upgrading. The RO is however not in favour of further development of this solid waste site, due to the pending regional site that may become available at PetroSA for future use.

Disposal of woodwaste is a potential problem throughout the coastal catchment sub-area. Many saw mills operate without the necessary permits for dumping their waste. Leachate consisting of organic acids and of high COD concentration from sawdust and woodchips is undesirable from a water quality perspective. Woodwaste from treated wood, results in leaching of inorganic chemicals. The extent of unlawful disposal of this waste is not well established and the extent of impact on water quality has not been determined. The issues relating to solid waste are addressed under the Managing Solid Waste Strategy (2.3).

3.5.6 Yield Balance

Based on an equivalent 98% level of assurance of supply, the available yield at the Year 2000 level of development in this sub-area is as shown in Table 3.5.1 and the estimate of the water requirements in Table 3.5.2.

TABLE 3.5.1 : AVAILABILITY IN THE COASTAL SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Yield (1:50 Year)									
	Natural Resource		Useable Return Flows			Impact on Yield		Total Local Yield	Net Transfers In	Grand Total
	Surface Water	Ground water	Irrigation	Urban	Bulk Industry	Desktop Reserve Estimate	Invasive Alien Plants			
Mossel Bay to George	51	0	1	2	6[1]	11	2	**47**	0	**47**
Wilderness Rivers	23	0	1	0	0	14	5	**5**	0	**5**
Knysna to Bloukrans	23	1	0	2	0	8	15	**3**	0	**3**
COASTAL TOTAL	**97**	**1**	**2**	**4**	**6**	**33**	**22**	**55**	**0**	**55**

1) Consists primarily of the bulk industrial return flow from Petro SA.

TABLE 3.5.2 : REQUIREMENTS IN THE COASTAL SUB-AREA (million m^3/a, Year 2000)

SUB-AREA	Requirements (1:50 Year)							
	Irrigation	Urban	Rural	Bulk Industry	Afforestation (Yield Impact)	Total	Transfers Out	Grand Total
Mossel Bay to George	25	24	2	6	4	**61**	0	**61**
Wilderness Rivers	16	2	<1	0	5	**23**	0	**23**
Knysna to Bloukrans	2	6	1	0	5	**14**	0	**14**
COASTAL TOTAL	**43**	**32**	**3**	**6**	**14**	**98**	**0**	**98**

The reconciliation of the requirements and availability results in a **shortfall** of 43 million m^3/a for the whole of the Coastal catchment sub-area. The individual shortfalls in each of the areas making up the Coastal sub-area are:

Mossel Bay to George:	-14 million m^3/a
Wilderness Coast Rivers	-19 million m^3/a
Knysna to Bloukrans:	-10 million m^3/a
Total Shortfall (Coastal Sub-Area)	**-43 million m^3/a**

It should be noted that a significant proportion of the shortfall is attributed to the impact on yield (34 million m^3/a) of the preliminary Reserve determination, based on the desktop method. Furthermore, the desktop method used to determine the Reserve does not take account of the estuarine Reserve requirements. Refer to the Reserve and Resource Quality Objectives Strategy (2.1) and the Estuaries Strategy (2.2).

3.5.7 Future for this Sub-Area

The yield balance estimates were determined from large scale modelling. It is recommended that more detailed investigation be undertaken to establish whether the extent of the shortfall is as significant as it appears. In doing so the requirements and availability will be more reliably determined and interventions can then be targeted to address the resulting shortfall. This is further addressed under the Water Resource Availability (1.1) and Water Requirements (1.2) Strategies.

There is an urgent need to implement reconciliation interventions in this sub-area in order to alleviate the estimated current shortfall and to make provision for the Reserve. This is addressed under the Reconciliation of Water Supply and Demand Strategy (1.3). Based on the findings of pilot studies undertaken in other catchments of the Western Cape, the Reserve requirements are likely to increase substantially, once the Reserve is determined through more comprehensive methods and the Reserve requirements of the estuaries are determined. The Reserve and Resource Quality Objective Strategy (2.1) outlines the challenge and recommends the steps to be taken.

Whilst there is potential for further development of surface water yield in certain of these catchments, water trading should be considered as the only form of acquiring licences for new irrigation abstractions. Refer to the Allocation and Licensing Strategy (3.3). This is of particular relevance in those rivers that feed ecologically sensitive estuaries. Until the riverine Reserve requirements are confirmed and information becomes available from which the Reserve requirement of estuaries can be determined, the actual size of the deficit remains uncertain.

The Year 2000 shortfall (43 million m^3/a) is largely influenced by the estimated extent of the impact on yield of invasive alien plants (21 million m^3/a) and the impact of the preliminary Reserve (34 million m^3/a). The Year 2025 *base scenario* estimates an increase in the urban water requirement of some 18 million m^3/a. Taking the increase in usable return flows into account, the

net effect is a shortfall of 60 million m^3/a. Similarly, the corresponding *high scenario* estimates a shortfall of some 158 million m^3/a, due to the anticipated increase in urban water requirements.

Whilst the preliminary Reserve may eventually increase when the Reserve is ultimately determined, there is opportunity to improve the available yield in this sub-area through the targeted removal of invasive alien plants. This would provide an additional source of yield which could be used towards the provision for the Reserve in these ecologically sensitive catchments, where there is also a high demand for water from other users. This is addressed under the Removal of Invasive Alien Plants Strategy (3.6).

The potential for groundwater development throughout the Coastal sub-area (and the entire WMA) is addressed in detail in the Groundwater Strategy (1.4). To date only 1 million m^3/a of groundwater yield is developed. Good quality water is obtainable from the primary aquifers on the coastal plain where these are underlain by TMG. Precautions to prevent saline intrusion (from over-abstraction) must be implemented if the primary coastal aquifers are to remain a sustainable source of supply. The TMG outcrops between George and Storms River is a potential source for the towns in the area.

The following comments are relevant to the three smaller areas within the Coastal sub-area:

Mossel Bay to George:

WC/DM must be implemented by local authorities through broad based guidelines provided by DWAF. Refer to the Water Services WC/DM Strategy (4.1). George Municipality is looking at the potential to increase the yield of its Garden Route Dam through the removal of invasive alien plants from within its catchment. Furthermore, an agreement must be reached between the RO and Mossel Bay regarding the allocation from Wolwedans Dam, which has not yet to be taken up. The future requirements by PetroSA must also be established. The last overall planning analysis for Wolwedans Dam and the rest of the system supplying water to the Mossel Bay region (Mossel Bay, PetroSA, Groot Brak, Hartenbos and Klein Brak) was undertaken almost 20 years ago. The availability of water and the requirements of this region need to be urgently revisited through a review of the system as a whole. These aspects are further addressed under the Requirements, Availability and Reconciliation Strategies (1.1 to 1.3) and the Allocation and Licensing Strategy (3.3).

The Wilderness Rivers:

The question of the estuarine Reserve requirements is the dominant water resource challenge in this area. It may not be possible to postpone all water resource development, in light of the fact that the existing developed resource is already fully utilised. WC/DM measures must be implemented by the local authorities. The shortage of water (particularly in peak season), at towns such as Sedgefield, cannot be ignored. However, any schemes proposed by the local authority, should be designed to have minimum impact on the estuaries themselves. This is further addressed under the Estuaries Strategy (2.2). Design approaches such as off-channel storage and timing of abstraction out of the Karatara River must be considered.

Knysna to Bloukrans:

WC/DM must be implemented by local authorities, through broad based guidelines provided by DWAF. The potential for further development of yield may be possible through off-channel storage and pumping out of the Goukamma River, and out of the Knysna River. Roodefontein Dam is being raised by Plettenberg Bay Municipality to provide additional storage for proposed increased transfers out of the Keurbooms River. Options for abstraction were studied during the Plettenberg Bay Coastal Catchments Study (DWAF, 1996).

Throughout the coastal catchments, any consideration given to possible surface water schemes for municipal supply that might be considered, are likely to be based on off-channel storage of surplus water during high runoff periods. With the exception of the Keurbooms River option, other possible off-channel storage options have yet to be studied. The Allocation and Licensing Strategy (3.3) addresses this.

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PART 2 – THE STRATEGIES

STRATEGIC AREA 1: YIELD BALANCE AND RECONCILIATION

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1.2 Water Requirements
1.3 Reconciliation of Water Supply and Demand
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THE STRATEGIES (cntd.)

STRATEGIC AREA 7: SOCIAL

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STRATEGIC AREA 9: MONITORING AND INFORMATION

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STRATEGIC AREA 10: IMPLEMENTATION

10.1 ISP Implementation

STRATEGIC AREA 1: YIELD BALANCE AND RECONCILIATION

The provision of water to all sectors in the Gouritz WMA is the driving factor behind the need to understand how much water is currently available, what the requirements are, how this may change in the future and what can be done to best meet those requirements.

The climate within the Gouritz WMA is very variable, with the highest rainfall and runoff in the narrow band of coastal catchments. This reduces progressively towards the inland Karoo catchments. The coastal catchments are ecologically sensitive, which in turn places a greater demand on leaving water in the system to maintain the aquatic ecology in that region. In contrast, the inland catchments do not receive sufficient rainfall to sustain reliable supplies from surface water resources. As such there will be an increasing reliance placed on the groundwater resource, throughout this WMA. There is limited understanding of the groundwater resource in this WMA. The Department has done several groundwater studies and the Provincial Department of Agriculture intends to do further studies in the Olifants River valley in the near future.

In the absence of large regional water supply schemes, typical of the Berg and Breede WMAs for example, the water supply to urban and domestic users in the Gouritz WMA is more characteristic of local supply schemes. These are operated and managed by the local authorities. The Overberg Water Board is the only operating water board in the WMA and it operates and maintains the KKRWSS. Growth within the larger towns, and increases in seasonal demand at the coastal resorts, is placing certain local authorities under pressure to provide more water to the consumers. The smaller authorities do not necessarily have the technical expertise to plan for the future provision of water.

There are a number of interventions that can be taken, many of which fall within the broader context of water conservation and demand management. Consideration will be given to the development of new schemes, only once proactive steps have been taken to effectively implement alternative reconciliation interventions.

The reconciliation of requirements and availability for the Gouritz WMA is discussed in detail in Chapter 2 and at sub-area level in Chapter 3. The Availability, Requirements and Reconciliation Strategies that follow, provide a summary of the strategies flowing from that discussion.

Four strategies have been identified for development, namely:

1.1 Water Resource Availability
1.2 Water Requirements
1.3 Reconciliation of Water Supply and Demand
1.4 Groundwater

1.1	WATER RESOURCE AVAILABILITY STRATEGY
Management Objective	This strategy addresses the knowledge (together with the uncertainties), assumptions and unknowns about the current and future availability of water in the Gouritz WMA. This is an important component of determining reliable yield balance estimates.
Situation Assessment	This strategy must be read in conjunction with Chapter 3 of this document in which the details of water availability (yield) for each of the five sub-areas in the Gouritz WMA are presented. In summary, the best available information is that presented in the First Edition of the NWRS, 2004. This indicates that there is approximately 275 million m^3/a per annum of water available in this WMA from the currently developed surface and groundwater resources. The accuracy of estimates of water availability are predominantly influenced by the understanding of the hydrological (surface water) and geohydrological (groundwater) characteristics within the WMA. Of importance is the interaction between the surface and groundwater resource. This defines how aquifers become recharged and what component of surface water base flow is supplied from groundwater. The effects of climate change (including the contribution of snow melt) on surface water runoff and on aquifer recharge are not well understood. Refer to the Groundwater Strategy (1.4) and the Monitoring Networks and Data Capture Strategy (9.2). Streamflow gauging in the Gouritz WMA can be considered as reasonably adequate. Two site-specific exceptions, namely the lower Olifants River and the Langtou River (J40C) have been identified and are addressed under the Monitoring Networks and Data Capture Strategy (9.2). Within the Gouritz WMA water quality is not considered to be a significant constraint in terms of impacting on the resource. Naturally occurring salinity (due to geology) is found within the Great Karoo and the Olifants River sub-area. The salinity is exacerbated in the Olifants and Kammanassie River catchments as a result of irrigation return flows. Water quality in the coastal catchments is generally good. The Water Quality Management Strategy (2.4) addresses the related issues and concerns. The overall conclusion for this WMA being that water quality does not significantly impact on the availability of water. Users (including the ecology) have adapted to the situation. The impact of the Reserve is likely to ultimately play an important role in the availability of water and this is further discussed under the Reconciliation of Water Supply and Demand Strategy (1.3). The availability of water in the system supplying the Mossel Bay region (Mossel Bay, PetroSA, Groot Brak, Hartenbos and Klein Brak) was last undertaken almost 20 years ago. This system includes both municipal and DWAF owned dams, and the operation of these has changed considerably since then. Refer to the Reconciliation of Water Supply and Demand Strategy (1.3). It was identified during the ISP process that there may be some surplus return flows entering the Hartenbos Estuary.

1.1	WATER RESOURCE AVAILABILITY STRATEGY (cntd)
Strategic Approach	A total review of the availability and requirements of water within the Mossel Bay region is required, through a specific Reconciliation Strategy for that area. This must provide updated estimates of availability, requirements and then make recommendations as to possible interventions to meet the needs of that region. This is further addressed under the Water Requirements (1.2) and the Reconciliation of Water Supply and Demand Strategy (1.3). Until better hydrological data becomes available and until Reserves have been determined at higher levels of confidence, the water availability information provided by the NWRS and the Gouritz WMA Report (Report No P.WMA16/000/00/0203), and as tabled in Chapter 2 of this ISP, will be used in supporting management decisions in this WMA. No changes are recommended to these figures as a result of the ISP process of information gathering. The dynamic of aquifer recharge and the associated impacts of climate change need to be considered in future water resource planning
Management Actions	The following actions are required: • Implement a review of the water requirements and availability from the system supplying the Mossel Bay region. This study would be along the same lines as that proposed for the Western Cape Water Supply System, in the Berg and Breede ISPs. • If this review confirms that there is any surplus return flow entering the Hartenbos Estuary, this could be made available to address inequity - if such a need is identified. Alternatively it could be made available to any prospective user willing to bear the costs associated with acquiring it.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in conjunction with the Directorate : National Water Resource Planning. It is of Priority 2 – High.

1.2	WATER REQUIREMENTS STRATEGY
Management Objective	This strategy addresses the knowledge of, together with the uncertainties, assumptions and unknowns relating to the current and future water requirements in the Gouritz WMA. The objective is to improve on our knowledge and understanding of the requirements, which will in turn improve on the reliability of the yield balance.
Situation Assessment	Based on the best current available information (NWRS), the current water requirement within the Gouritz WMA is estimated at 339 million m^3/a (98% level of assurance of supply). **<u>Irrigation Water Requirements</u>:** Of the total water requirement in the WMA, irrigation accounts for an estimated 254 million m^3/a (75%). This estimate is based on a 98% assurance of supply. Within the Great Karoo catchments and the Olifants River catchment the assurance of supply is low and farmers rely on opportunistic irrigation when water is available. Over-allocation within the Olifants River Government Water Scheme has resulted in the combined allocation from the Stompdrift and Kammanassie Dams being 87,7 million m^3/a, which is 266% of their combined 1:50 year yield of 33 million m^3/a. Within the Great Karoo and Olifants River catchments, the actual volumes of water used for irrigation vary from year to year but are expected to be significantly more than the NWRS estimate of 160 million m^3/a (at the equivalent 98% assurance of supply). The actual extent of irrigation water use in the Olifants sub-area and the potential for any expansion is currently being investigated by the Department of Agriculture through the "*Oudtshoorn Landbou Water Ondersoek*" (OLWO) study. Whilst the future irrigation requirement in this WMA is reflected in the NWRS as being "zero", it is unlikely that there will be no irrigation expansion at all. However this can be managed through licensing and the general view is that expansion of irrigation in this WMA will be limited. Refer also to the Allocation and Licensing Strategy (3.3). Although certain studies indicate further yield is available from the Duiwenhoks River, actual flows observed during field investigations do not confirm this, suggesting that unlawful use is resulting in over exploitation. Furthermore the Reserve requirement of the estuary has yet to be determined. **<u>Urban Water Requirements</u>:** The urban water requirement in the WMA is comparatively smaller (52 million m^3/a) than that of irrigation. There is a shift in population density from the arid Karoo regions towards coastal towns where economic development provides employment opportunity. The Karoo towns of Oudtshoorn (Olifants sub-area) and Beaufort West (Great Karoo) are also experiencing some economic growth and increasing demands for water. Within the Olifants sub-area for example, the urban requirement of 10 million m^3/a is largely attributed to the provision of water to the town of Oudtshoorn. Refer to Figure 3.2 of Chapter 3 for the local authority boundaries. Whilst new irrigation development can be controlled through licensing, some urban and industrial requirement is likely to continue increasing. Local authorities need to be made aware of the shortages of water, the cost of water and the options they have for augmenting their supplies in the future. Trading with lei-water remains an option for all towns in which lei-water systems are still in place. This is addressed under the Supply to Local Authorities Strategy (6.1). The major urban users are the local authorities between Mossel Bay and Plettenberg Bay as well as Petro SA (out of Wolwedans Dam). The urban water requirement in the Coastal sub-area is estimated to be 32 million m^3/a.

1.2	WATER REQUIREMENTS STRATEGY (cntd)
Situation Assessment	The Year 2025 future requirement scenarios presented in the NWRS estimate future urban requirements to be in the order of 72 million m^3/a (base scenario) and a maximum of 161 million m^3/a (high scenario) for the WMA as a whole. Much of this is concentrated within the coastal belt and primarily between Mossel Bay and Plettenberg Bay (the Coastal sub-area). The base scenario is considered as the most likely to unfold. Neither scenarios take into account the savings that will be made through the implementation of WC/DM. Refer also to the Water Services: WC/DM Strategy (4.1). Meeting seasonal peak demands that occur during summer, and which regularly result in annual water shortages in the towns of Sedgefield and Plettenberg Bay in particular, and to a lesser extent in Knysna and George, present the greatest challenge to local authorities in terms of urban water supply in the coastal catchments of this WMA. These catchments are important from an economic, eco-tourism and environmental perspective. The Olifants sub-area is characterised by intensive irrigation, for which there is increasing competition for available water. Both of these areas are important to the economy of the region and interventions must be put in place to try and resolve the water shortages. Chapter 3 provides an indication of the extent of the influx of tourists to the coastal towns during peak season. **Rural Water Requirements:** The rural water requirement for the whole WMA is 11 million m^3/a, inclusive of the Reserve for basic human need of 25 *l*/c/d. The rural water requirement is expected to decrease marginally in the future.
Strategic Approach	Through the registration and verification process, the Department should assess the extent of over-allocation in the Olifants and Kammanassie River valleys. Thereafter, the equivalent requirements of irrigators at lower levels of assurance of supply must be evaluated so as to establish the actual extent of the shortfall in that sector. If farmers are willing to continue operating at low levels of assurance of supply, compulsory licensing need not necessarily be implemented. If not, re-allocation in the Olifants and Kammanassie catchments will need to be carried out through compulsory licensing and this will have an impact on all irrigators in those catchments. As a point of departure DWAF must ensure that it takes cognisance of the findings of the OLWO study being undertaken in the Oudtshoorn area by the Department of Agriculture. Where farmers have adapted their practices to utilise water at lower assurances of supply, consideration could be given to reduced catchment management charges for that water use. The Supply to Local Authorities Strategy (6.1) makes recommendation in terms of meeting future urban water requirements of which the coastal towns are of the highest priority. These recommendations should be implemented.
Management Actions	The following actions are required: • Implement the recommendations of the WC/DM Strategies (4.1 and 4.2). • The extent of water use by farmers in the drier regions of the Gouritz WMA needs to be established, modelled and the actual level of assurance of supply assessed. • In terms of managing future irrigation requirements, implement the recommendations of the Allocation and Licensing Strategy (3.3).
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in conjunction with the Directorate : National Water Resource Planning. It is of Priority 2 – High.

1.3	RECONCILIATION OF WATER SUPPLY AND DEMAND STRATEGY
Management Objective	There are a number of interventions that must be investigated and implemented in order to address the current shortfall in the Gouritz WMA and the anticipated future increase in shortfall. The available yield from developed infrastructure is already over utilised and the requirements are expected to increase. As such it is necessary to address these shortfalls through appropriate interventions.
Situation Assessment	The Gouritz WMA currently experiences an overall shortfall of 64 million m^3/a. The shortfalls within the three distinct regions of the WMA are as follows: • Great Karoo (Gamka and Touws/Buffels/Groot sub-areas): -18 million m^3/a • Olifants sub-area (Olifants/Kammanassie Rivers): - 3 million m^3/a • The Coastal Belt (Duiwenhoks to Bloukrans Rivers): -43 million m^3/a Refer to Figure 3.1 of Chapter 3 for geographical orientation in relation to these regions and the sub-areas within them. **The Great Karoo** In this arid region farmers have adapted their practices (crop selection for example) to suit low levels of assurance of supply and to make best use of water when it is available. There is no further surface water yield available. Urban and rural users will continue to primarily rely on groundwater supply, with little growth in urban requirement anticipated. Many inland towns throughout the WMA still make use of lei-water systems, the efficiency of which is not well known. Losses from the lei-water canals may be relatively insignificant from a WMA perspective but could well be of importance at a local supply level. **The Olifants Sub-area** Requirements exceed availability in this WMA and this has an impact on irrigators in the intensely cultivated Olifants and Kammanassie River valleys. Here farmers are aggressively competing for available water and there has been over-allocation of water in the past. The problem becomes progressively worse in a downstream direction where conveyance losses in poorly maintained canal systems and the use of unlined canals result in further reductions in assurance of supply (Refer to the Agricultural WC/DM Strategy – 4.2). Farmers in the western Kammanassie valley are particularly badly affected. The 225 km^2 of invasive alien plants found within the Olifants sub-area has an estimated impact on the yield of 4 million m^3/a and this offers some benefit through clearing.

1.3	RECONCILIATION OF WATER SUPPLY AND DEMAND STRATEGY (cntd)
Situation Assessment (cntd)	**The Coastal Belt** This region consists of: • The *Gouritz/Goukou/Duiwenhoks sub-area* (H80A to J40E quaternary catchments) which is estimated to be in balance (availability = requirements), and • The *Coastal sub-area* between Mossel Bay and the Bloukrans River (K10A to K70B quaternary catchments), which experiences the full shortfall of 43 million m^3/a. Much of the shortfall within the Gouritz WMA is attributed to the impact on yield of the preliminary Reserve, estimated to be approximately 41 million m^3/a. In particular, the impact within the Coastal sub-area is some 83% (34 million m^3/a) of the total for the WMA. Within the coastal belt, invasive alien plants account for a reduction in yield of 31 million m^3/a. Clearing could offer significant benefit towards meeting the requirements of the Reserve. Also the possible benefit of controlled fynbos burning to manage plant age, and in so doing reduce water demand may offer some potential. Indications are that there may be over abstraction of water from the Duiwenhoks River (H80A-F) and from the Langtou River (J40C). Furthermore the extent of unlawful afforestation throughout the coastal belt is not well established. In contrast to the Karoo and Olifants areas, the catchments of the coastal belt are well watered (particularly within the Coastal sub-area). However, the available yield is determined by the limited storage facilities that are currently in place. The developed yield of existing dams is given in Appendix 11. Once implemented the Reserve will further impact on the available and potential yield of the WMA, particularly within the rivers of the coastal belt. Potential for increased use of treated effluent has been identified at Plettenberg Bay, where there is a demand for water to irrigate golf estates and other recreational developments. Re-use holds potential, where large towns are in close proximity to these types of developments. In the Gouritz/Goukou/Duiwenhoks sub-area treated effluent discharged into rivers by WWTW is indirectly reused by irrigators further downstream. Mossel Bay has an allocation out of Wolwedans Dam of 3,5 million m^3/a, which it has not yet taken up, in view of cheaper water being available from the towns' other sources. These are the Ernest Robertson Dam and the off-channel Klipheuwel Dam (filled by pumping out of the Moordkuils River). The Mossel Bay allocation out of Wolwedans Dam (98% level of assurance) is reflected as a requirement in the yield balance, yet it remains unused and the Department (owner of Wolwedans Dam) does not receive payment from Mossel Bay for that allocation. Consequently this water is potentially available from the dam and could be re-allocated to other users who would be prepared to pay for it. The future requirements of PetroSA, out of Wolwedans Dam are also uncertain. The company receives water from the dam at a 99,5% assurance of supply (1:200 Year). There is some potential for development of surface water yield in certain of the coastal catchments, even if the Reserve requirements prove to be significant. Feasibility level investigation has been undertaken for potential additional abstraction to off-channel storage facilities, out of the Keurbooms River (Plettenberg Bay Coastal Catchments Study, DWAF, Phase 2, 1999). However, the Ecological Water Requirement (EWR) used would need to be converted to a Reserve and the extent of potential abstraction re-determined in line with the Reserve requirement. The development of groundwater from deep aquifers (TMG for example) holds potential in the WMA but requires further study to determine the yields available.

1.3	RECONCILIATION OF WATER SUPPLY AND DEMAND STRATEGY (cntd)
Strategic Approach	**The WMA as a whole** Before further detailed yield analysis studies are commissioned best use of expert opinion to give guidance to longer-term reconciliation interventions should be sought. 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 long-term (15-20 year) 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. Through registration and verification of existing lawful use, the extent of unused allocations will be determined, which will provide opportunity for trading of water allocations (refer to Strategy 3.3 - Allocation and Licensing). Also unlawful users will be identified and such use put to an end (refer to Strategy 3.2 - Verification of Existing Lawful Use). For urban supply and to address deficits in the coastal catchments, the following interventions appear to be favourable and are listed in order of priority (refer also to the Supply to Local Authorities Strategy - 6.1): • WC/DM by local authorities is to be implemented with some guidance from DWAF, where technical capacity is limited. • Removal of invasive alien plants holds potential throughout the coastal catchments, both for augmenting yield by clearing upstream of existing storage facilities (as undertaken in the Garden Route Dam catchment, for example) or to make provision for the Reserve. Other options include the trading of existing licences, to make better use of available water without further impacting on the yield. The Department will not give favourable consideration to licence applications for new schemes unless all other avenues have been properly explored, and the proposed scheme compares favourably both with regard cost and environmental impact. **The Great Karoo** In terms of agriculture, farmers have irrigated opportunistically for many years and have become accustomed to the low assurance of supply. The Department should continue to advise on WC/DM measures that can be implemented in the agricultural sector, through the WUAs. No further interventions are recommended. Local authorities in these dry inland areas will need to focus firstly on WC/DM before DWAF will consider the further development of the groundwater resource. There is no further potential to develop surface water yield. The purchase of lei-water (trading) by local authorities could offer certain towns an opportunity to augment their municipal supply. **The Olifants Sub-area** If farmers are willing to continue operating as they currently are, then re-allocation through compulsory licensing may not be required to resolve over-allocation of irrigation in this sub-area. Cognisance must also be taken of the contribution from this inland sub-area to the Reserve requirement of the lower Gouritz River and its estuary. Once completed, DWAF must take cognisance of the findings of the OLWO Study (Department Agriculture), and where relevant align the Gouritz ISP with it.

1.3	RECONCILIATION OF WATER SUPPLY AND DEMAND STRATEGY (cntd)
Strategic Approach (cntd)	**The Coastal Belt** As mentioned in the Water Resource Availability Strategy (1.1), a reconciliation of water availability and water requirements must be undertaken for the Mossel Bay supply system as a matter of urgency (last undertaken 20 years ago). Factors now impacting on the availability of water in this region include the implementation of the NWA, a shift in interventions priority (favouring WC/DM, effluent re-use, alien plant removal, groundwater use, etc), assumptions made that have not been realised, agreements that have not been signed, the needs of the resource poor, the ecological water requirements of the Great Brak estuary, WfW and the requirements of PetroSA. In terms of effluent re-use, there is potential in the Coastal sub-area for irrigation of recreational developments (golf estates, equestrian centres, etc). It can be expected that once the Reserve requirements of the rivers and estuaries have been determined and implemented, the Coastal Belt is likely to become more tacitly stressed than is currently the case. But greater certainty regarding the Reserve will improve the level of confidence for all estimates of water availability. More informed planning and management of these stressed areas will then be possible. The development of yield in the Keurbooms River, through off-channel storage has been studied and identified as a potential option for augmenting supply to Plettenberg Bay. This will need to be re-assessed at Reserve requirement level. Similar off-channel options on some coastal rivers (to provide for basic human needs and urban requirements) may be possible but none have been studied in any detail to date.
Management Actions	The following actions are required: • The ecological component of the Reserve and its resulting impact on the availability of water needs to be firmed up on in order to make informed decisions regarding applications for new licences. This is further addressed in the Reserve and Resource Quality Objectives Strategy (2.1) and the Allocation and Licensing Strategy (3.3). • Implement WC/DM in the urban and agricultural sectors, with technical guidance to be provided by the RO. • 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. Such a study has been carried out by George Municipality as an alternative to raising the Garden Route Dam. • Local authorities should consider the feasibility of trading with lei-water so as to augment municipal supplies as well as the exchange with irrigators to increase their use of treated effluent. • The impact of climatic effects on both surface and groundwater needs to be studied. • The controlled management of fynbos burning to reduce age and thereby water demand could be investigated further. • The trading of licences (at the Department's discretion) will be the recommended option to acquiring a licence.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in conjunction with the Directorate: National Water Resource Planning. It is of Priority 2 – High and of highest priority in the Olifants and Coastal sub-areas.

1.4	GROUNDWATER STRATEGY
Management Objective	The objective of this strategy is to develop the groundwater approach and initiate the actions required to implement conjunctive surface and groundwater management in the WMA.
Situation Assessment	This strategy is to be read in conjunction with the following Figures in Appendix 14: Figure A14.1: Aquifer Types and Hydrogeological Provinces Figure A14.2: Geohydrology Monitoring Points Figure A14.3: National Groundwater Database and DWAF Geohydrology Monitoring Points Figure A14.4: Groundwater Occurrence and Median Yield Figure A14.5: Aquifer Vulnerability Figure A14.6: Recharge to Groundwater Groundwater has in the past been viewed as an emergency or rural community and small town water supply. A Groundwater Development Strategy Study for the Central Karoo District Municipality has been undertaken to evaluate where groundwater could contribute. The Sustainable Utilisable Potential (SUP) of groundwater in this area (Gamka and portions of the Groot sub-areas) to contribute to agrivillages and poverty alleviation is significant provided that a holistic approach is adopted. The approach would include selection of appropriate technology, community training, and the integration of groundwater management and operations and maintenance in small scale supply schemes. 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. *The following resource availability and usage issues and concerns were identified:* • The groundwater component of the Ecological Reserve and the SUP of the different aquifers can only be determined at desk-top (low confidence) level unless there is significant improvement in input data; the exception being the Kammanassie area; • Stressed aquifers or aquifer zones and the cause(s) thereof need to be determined at high confidence levels as part of the compulsory licensing process, Reserve determination and evaluation of GAs; • There is a need to evaluate surface groundwater interaction in the Olifants River Basin; • Saline intrusion into the coastal primary aquifers can and must be prevented by sound groundwater management practise. The latter is immediately relevant along the coastal zone between Stilbaai and Mossel Bay where peak seasonal demands are experienced; • The TMG aquifer is a potential source of supply in the coastal towns between George and Plettenberg Bay; • Recharge Zone protection and Aquifer Protection protocols are required; • Potential to access the TMG underlying the Bokkeveld in the central area of the WMA could be considered; • It is necessary to revise and verify the current estimates of groundwater usage in the ISP area; • There is a need to develop a regional data base for the TMG aquifer; • Impacts of invasive alien plants and afforestation and abstraction for agriculture on the yields of the groundwater resources.

1.4	GROUNDWATER STRATEGY (cntd)
Strategic Approach	The experience gained in the KKRWSS and in the Oudtshoorn area as a whole has highlighted the consequences of fragmented management of groundwater and surface water. These are a reduction in flexibility as to what water one uses for what purpose and when it is used with regard to pattern of demand. It is necessary to develop a medium to long term approach to Quantitative Hydrogeology in IWRM for this region. It is necessary to focus on the development of a regional data and knowledge base and thereafter the design and implementation of a monitoring network. The KKRWSS provides a good wellfield laboratory for testing methodological approaches. It is not representative of the greater TMG domain in the WMA and further a field. It is necessary to evaluate the investment in the Kammanassie wellfield with respect to the potential long term yield of the TMG resource in this area as compared to elsewhere. Further groundwater resource development in the Beaufort West area is possible but additional wellfields further afield would be required and a more regional scale approach to resource evaluation, development and management adopted. The option of Aquifer Storage and Recovery (ASR) is considered with regard to conjunctive water management and re-use of treated effluent.
Management Actions	The following management actions are necessary: • Develop a Knowledge Management Strategy with the support of Business Information, the WRC, consultants and specialist input to: o Ensure that all relevant interaction with other divisions within DWAF and government is established and maintained and that the necessary information is exchanged regularly; o Negotiate with local authorities such that the cumulative impact of groundwater abstraction by private property developers, particularly along the coastal area is appreciated and acted upon in rezoning exercises; o Provide a degree of technical assistance to coastal local authorities dependent on groundwater, to manage the resource so as to prevent saline intrusion. Support and skills transfer is required to protect the groundwater resource from over abstraction and saline intrusion in these areas; o Promote communication between relevant divisions within the RO in the exchange of data, information and planning on different projects that would benefit from the involvement of the geohydrology division and vice versa; o Ensure reliable input to regulatory decisions.

1.4	GROUNDWATER STRATEGY (cntd)
Management Actions (cntd)	• Develop a Groundwater Monitoring Strategy to include: o Liaison with local and provincial government departments, donor organisations and within the RO and the WRC to obtain data and co-operation as regards monitoring protocol and sites, data sharing and a co-ordinated surface and groundwater data base; o Query of the WARMS system and correlation of registered use with available spatial data; o Verify groundwater use registered and amend groundwater GA's if necessary; o Expand the Geohydrological monitoring network and include selected private boreholes; o Update the hydrogeological data base with existing knowledge base; o Interpretation of groundwater data (water levels, groundwater quality, spring discharge and baseflow) in the context of climatic variations, changes in land-use activity (removal of invasive alien plants, changes in forestry); o Delineation of Recharge and Discharge Zone Management; o Development of Groundwater Protection protocols, particularly in coastal towns; o Evaluate the protection of primary aquifers against poor management and the use of septic tanks; o Groundwater in the Klein Swartberg area is used by agriculture in conjunction with surface water on a seasonal basis. It is a good pilot area to better understand resource usage and management; o Develop a conceptual flow model(s) based on IWRM domains within the WMA. This conceptual flow model will be used to design an appropriate monitoring network. • Commission a study to integrate groundwater exploration and development into the Presidential Poverty Relief Programme, particularly for the Karoo Districts; • Evaluate water quality variations, storage capacity and ASR options in the stretch from the west of Albertinia to Mossel Bay; • Evaluate groundwater supply options to Knysna from the TMG aquifer.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO, providing guidance to local authorities, water management institutions and individuals in co-operation with the Directorate: NWRP and Directorate: Hydrological Information. The Priority is 1 – Very high.

STRATEGIC AREA 2: RESOURCE PROTECTION

The aim of protecting water resources is to ensure their continuing availability for use, whilst also ensuring that sufficient water of appropriate quality remains in the resource to maintain the ecological functioning of the streams, rivers, wetlands and estuaries.

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 habitats, whilst Source Directed Controls focus on the control of water use at the point of potential impact, through conditions attached to water use authorisations (licences).

In the light of competing demands and historical impacts it will not be economically viable to protect all water resources to the same degree and as such, a classification system will group water resources into classes, each of which will be subject to a different level of protection and utilisation.

The establishment of the Reserve or a preliminary Reserve is a requirement before a water use licence can be issued. In the absence of a Comprehensive Reserve determination in the Gouritz WMA, ad-hoc preliminary Reserve determinations are often necessary, adding to the backlog of licence applications. Furthermore the RO has a lack of resources to ensure that the conditions attached to licences are being adhered to.

The current shortfall between water availability and requirements in the Gouritz WMA was determined without taking the likely Reserve requirements for the estuaries into account. This is the case due to the lack of available data to support Reserve determinations for estuaries. It is envisaged that these requirements may ultimately be substantial, placing further stress on the surface water resources of the coastal catchments, in particular.

The management of solid waste is an important component in protecting the water resources of the WMA. Appropriate management of solid waste disposal and rehabilitation of contaminated sites are important measures that need to be taken so as to reduce the impacts they may cause.

Three strategies have been identified for development, namely:

2.1 Reserve and Resource Quality Objectives
2.2 Estuaries
2.3 Managing Solid Waste
2.4 Water Quality Management

2.1	RESERVE AND RESOURCE QUALITY OBJECTIVES STRATEGY
Management Objective	The objective of this strategy is to address the uncertainties relating to the Reserve requirements, in the absence of a river classification system.
Situation Assessment	The Reserve (and Resource Quality Objectives) as required by the NWA is being implemented incrementally in the Gouritz WMA. The basic human need will receive priority and is accounted for in the planning of urban and rural water requirements. In terms of the Ecological Reserve component, desktop estimates based on the requirements of the rivers were used for determining the yield balance figures presented in Chapters 2 and 3 of this report. Where results show a balance or a negative balance (as is the case for the Gouritz WMA) no new abstraction licences for surface water abstraction without further resource development will be considered. Before any water use licence is issued a Reserve must be determined in accordance with the class of the Resource, and the impact of the proposed water use considered. In the absence of a river classification system, which is currently being developed, preliminary river classification is done and a preliminary Reserve determined. The process of undertaking many individual Reserve determinations can however be time consuming and resource intensive. In the Gouritz WMA, preliminary Reserves are being undertaken in an ad-hoc manner as and when a water use licence application is received. The selection of which method to use depends on the level of risk that can be accepted in the result. These three methods are: • The Rapid method • The Intermediate method • The Comprehensive method Appendix 3 shows the rivers on which preliminary Reserve determinations have been undertaken in the Gouritz WMA. All of these determinations have been based on the rapid method and none of them account for estuarine water requirements. In the Gouritz WMA, the Coastal sub-area between Mossel Bay and the Bloukrans River (quaternary catchments K10A to K70B) has been identified as the most stressed. The current yield balance is estimated to be a shortfall of –43 million m^3/a. Significant growth in the urban water requirement is expected in this region. Furthermore the Reserve estimates for the many ecologically important estuaries have yet to be determined. Both of these factors are likely to further impact on the availability of water in this region. The Reconciliation of Water Supply and Demand Strategy (1.3) has highlighted the need for a proper assessment of the water availability and water requirements of the Coastal sub-area, and in particular, a review of the system supplying the Mossel Bay region. This assessment will have to include a comprehensive Reserve determination for the rivers and the estuaries. The need for a comprehensive Reserve determination in the Coastal sub-area is based on the fact that the preliminary Reserve requirements and resulting impact on yield have been determined using desktop estimates. The impact on yield has been huge (34 million m^3/a within the Coastal sub-area alone). Other studies have shown that the comprehensive method for determining the Reserve may even produce larger impacts. It is extremely important that reliable Reserve determination figures be used to evaluate reconciliation options and that a balance be established between ecological, social and economic needs. To give effect to this, monitoring must be implemented as soon as possible to ensure good results for a comprehensive study.

2.1	RESERVE AND RESOURCE QUALITY OBJECTIVES STRATEGY (cntd)
Situation Assessment (cntd)	Information to support Groundwater Reserve determinations is insufficient, due to the lack of monitoring of surface and groundwater interaction. Where users do comply with the conditions of their licences, unlawful abstractors downstream effectively take this water from the river. The Duiwenhoks Estuary, for example, receives less inflow than studies suggest it should. The hydrology suggests that the river has surplus water, yet the estuary receives deficient flow due to probable unlawful abstraction upstream of it. This is further addressed under the Verification of Existing Lawful Use Strategy (3.2). Probable unlawful streamflow reduction activities (afforestation and invasive alien plants) in the coastal catchments could be impacting on water availability, which in turn will impact on the ability to meet the Reserve requirement. This is particularly evident (in terms of forestry) in the Swartvlei catchment. A flow gauging weir is being upgraded on the Knysna River for low flow monitoring, with the intention of implementing an Intermediate Reserve Determination for this river. The Plettenberg Bay Coastal Catchments Study included the evaluation of in-stream-flow requirements, which could, with some additional input be upgraded to a Reserve determination. As reflected in the Water Quality Management Strategy (2.4), only 50% of the quaternary catchments have sufficient data available from which to make some assessment of water quality in this WMA.
Strategic Approach	In terms of the NWA, all rivers will ultimately need Reserve determinations but this will take a number of years to achieve. DWAF is prioritising stressed catchments for Reserve determinations. Where there is currently pressure for issuing new licences, the extent of supporting data will dictate the confidence level at which the preliminary Reserve is undertaken. The coastal rivers and estuaries require first priority in implementing a Comprehensive Reserve determination. The order of priority within the coastal catchments should be based on the ecological importance of each catchment and this will need to be determined from existing information and studies to date. Thereafter the contribution from the Olifants sub-area to the Gouritz River Reserve must be established. In the Gouritz WMA, the needs must determined with respect to what information is required to support Reserve determinations for rivers, estuaries, groundwater and the water quality component of all three. As a minimum requirement, the provision of low flow monitoring to acquire data for more comprehensive Reserve determinations (as is being done on the Knysna River), should be extended to the other coastal rivers, particularly those which feed estuaries. Where water quality data is lacking (refer to Strategy 2.4), a monitoring programme needs to be put in place to collect the relevant data.
Management Actions	The following actions are required: • Information arising from the River Health programme should be used as a source of data for the purpose of Reserve determinations and to identify where preliminary Reserves are achieving the desired effect. • In-stream flow requirements determined in previous studies (such as the Plettenberg Bay Coastal Catchments Study), should be developed into equivalent Reserve requirements, where possible. • Additional resources need to be identified and obtained by the RO for ensuring that users are monitored and that they comply with the conditions attached to their licences. • RQOs must be set for water quality.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the RDM Office. This strategy is of Priority 1 – Very High.

2.2	ESTUARIES STRATEGY
Management Objective	The objective of this strategy is to address the problem of insufficient data being available to determine the Reserve requirements of the estuaries and the need to prioritise which estuaries are of greatest concern.
Situation Assessment	Many of the estuaries in the coastal catchments are of high ecological importance. To date there have been no Reserve determinations done on any of them, due to the fact that monitoring data is not available. A rapid / desktop method for preliminary Reserve determinations on estuaries is currently being developed, taking into account methods used on five provisional Estuarine Reserve estimates, undertaken in other parts of the country. It remains difficult to assess licence applications with any degree of confidence on those rivers feeding estuaries (National issue). Estuaries are not only reliant on base flow but also require flood peaks to scour them and maintain their dynamics. In-channel storage facilities can hamper this. Of particular concern are the short reach rivers of the Gouritz/Goukou/Duiwenhoks sub-area and the Coastal sub-area. On these rivers, even relatively small water use activities can create significant quantity and quality impacts on the estuaries, downstream. This has been observed on the Duiwenhoks River Estuary. Probable unlawful abstraction from the river appears to be resulting in an observed decrease of flow into the estuary. The Water Quality Management Strategy (2.4) addresses the problem of discharging treated effluent directly into the estuaries, from WWTW. This practise currently takes place in the Knysna Lagoon for example and is not in accordance with the required operation of that WWTW.
Strategic Approach	The uncertainty regarding the Estuarine Reserve requirement and its impact on the assessment of available yield, is of particular concern when evaluating yield balance. The strategic approach by the Department will be to develop and implement the modified desktop method for Estuarine Reserve determinations, to at least obtain a first estimate of the requirements. Loopholes in data will then be identified and appropriate monitoring implemented to gather the necessary data. Once sufficient data is available, the intermediate level of determination will provide a more comprehensive estimate of what the eventual Reserve requirement will be. In the interim, the RO should reconcile the recommendations of the numerous reports pertaining to the estuaries in the Gouritz WMA, and develop a strategy to implement them. In the event of any future development of surface water yield being considered in the coastal catchments, the use of off-channel storage and regulated abstraction on those rivers feeding estuaries, would be preferable. This would allow for estuarine dynamics to be maintained.
Management Actions	The following actions are required: • Refer to the Management Actions of the Reserve and Resource Quality Objectives Strategy (2.1). • The rapid/desktop level method for the determination of Estuarine Reserve requirements needs to be finalised and implemented. • Reconcile the information in the many available reports covering the coastal estuaries, the lakes and the wetlands of the Gouritz WMA. Prioritise these water bodies in order of ecological importance, identifying what information is available and implement studies to acquire the missing information.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the RDM Office. This strategy is of Priority 1 – Very High.

2.3	MANAGING SOLID WASTE STRATEGY
Management Objective	The objective of this strategy is to improve the management of solid waste in the WMA so as to minimise the pollutant impact on surface and groundwater resources.
Situation Assessment	The authorisation for the extension of or the establishment of a new solid waste disposal site (SWDS) is regulated under the Environmental Conservation Act. Under this Act the Minister of DWAF will issue a permit for any extension to or establishment of a SWDS. Where the site in question is likely to impact directly on a water resource, the Minister (DWAF) can also issue a water use licence in terms of Section 21g of the NWA – "*disposing of waste which may detrimentally impact on a water resource"*. A typical example being a large industrial SWDS situated in close proximity to a water resource. The approach in future will involve a licence being issued by the provincial Department of Environmental Affairs and Development Planning (DEADP) which will become the lead agent. This transfer of responsibility has been proposed for implementation in 2005. No formal agreement is yet in place. DWAF will remain involved in the protection of the water resource by commenting on the EIA which will result in a record of decision issued by DEADP, and DWAF could also issue a licence in terms of the NWA for the SWDS in question. This will form part of the approval process by DEADP. In the Gouritz WMA the management of SWDSs by local authorities is generally of a poor standard, particularly where many small sites are in operation as opposed to the preferable use of larger regional sites. The extension of the PetroSA SWDS to make provision for a regional SWDS is being investigated by the Eden/Klein Karoo Municipality. This is favoured by the Department as a preferred alternative to many small sites, which are not as easily monitored. The management of solid waste is more effective on a regional basis than the use of many small sites. As such the George (Gwaing) site for example, which is poorly managed and requires upgrading is favoured for closure by the RO. The possible use of the existing PetroSA site as a regional site would provide an alternative. This site already services the "Bail by Rail" system from as far a field as Knysna. Figure 3.2 of Chapter 3, shows the positions of the existing SWDSs, within the new municipal boundaries. Appendix 5 lists the sites and shows the responsible local authority for each whilst in Appendix 9 the old and new municipal names are shown. SWDSs located in close proximity to rivers pose a threat of pollution. The site at Calitzdorp (not yet permitted), adjacent to the Nels River is such an example. The unauthorised disposal of woodwaste from many saw-mills, poses a problem in terms of the leachate (organic and inorganic) arising from the waste. This problem is found to occur throughout the region between Albertinia and Plettenberg Bay. The known occurrence of contaminated land in this WMA is confined to some degree of creosote contamination in Knysna (Thesen's Island) and the accumulation of tanning waste in George (old shoe factory site). No official guidelines from DWAF are yet in place for rehabilitation of contaminated land. Draft procedures are being developed and are at inception report stage. Guidelines setting minimum requirements for the rehabilitation of SWDSs are in place and these are being implemented.

2.3	MANAGING SOLID WASTE STRATEGY (cntd)
Strategic Approach	The siting of new SWDSs should be based on the preferred use of larger regional sites that can be properly monitored and managed, as opposed to many small satellite sites. The possible expansion of the PetroSA site to further serve the needs of the region between Mossel Bay and Knysna is being investigated and is supported by DWAF. Certain of the smaller sites will be closed and rehabilitated. Priority must be given at national level for the development of strategic guidelines that will be used to define the requirements for rehabilitation of contaminated land. In the interim, the recommendations of the Remediation Working group must be implemented until a formal strategy is in place.
Management Actions	The following actions are required: • Ensure that all SWDSs have appropriate permits to operate. • The extent of unlawful dumping of greenwaste should be determined by the RO through an audit of saw mills operating in the region, to establish which are legally authorised to dispose their waste and which are not. • Saw-mills disposing of their waste without authorisation to do so, must apply for and receive authorisation before being able to continue operating. • Conditions need to be developed and set by the Department, defining what requirements need to be met for the disposal of woodwaste (National requirement). • The location of the SWDS at Calitzdorp must be assessed and the site either authorised, if it meets the necessary requirements, or relocated to an acceptable location and the existing site rehabilitated. • Monitoring is required to determine the impacts of the creosote that is leaching from the soil on Thesen's Island into the Knysna Estuary.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Waste Discharge and Disposal. It is of Priority 3 – Medium.

2.4	WATER QUALITY MANAGEMENT STRATEGY
Management Objective	Water quality needs to be appropriately managed to ensure that there is water of acceptable quality available to meet the needs of the environment and of all users in the WMA. Salinity concentration and nutrient content must be reduced to the most practically manageable levels. This strategy aims to address the problems associated with water quality in the Gouritz WMA and to recommend steps that can be taken to improve the quality where problems currently exist.
Situation Assessment	This strategy should be read in conjunction with the Managing Solid Waste Strategy (2.3) in which DWAF's involvement is also water quality related. A detailed assessment of surface water quality is not possible in the Gouritz WMA, due to the limitation introduced through lack of adequate monitoring data. This is even more pronounced when considering groundwater quality. As a result, this strategy serves to make best use of existing reports and local knowledge to provide some background into the current water quality issues in the Gouritz WMA. During the recently completed Gouritz Water Resource Situation Assessment Report (DWAF, 2002) the lack of data to support an assessment of surface water quality was identified as being most pronounced in the Gouritz River and its tributaries. Water quality in the coastal catchments around Plettenberg Bay was evaluated in detail in the Plettenberg Bay Coastal Catchments Study (DWAF, 1996). The latter focussed on the catchment of the Piesangs River and those rivers to the east thereof. **A) SURFACE WATER QUALITY - SALINITY** Figure 2.8.1 in Chapter 2 shows the mineralogical surface water quality characteristics in the Gouritz WMA. In general, elevated salinity occurs naturally over most of the Gouritz WMA, with the exception of most of the coastal catchments. Elevated salinity is caused by natural geology and high evaporation, which leads to an accumulation of salts. The situation in each of the five sub-areas is as follows: *Gamka Sub-area* Surface water quality is good in the upper reaches (north of Leeu Gamka). Insufficient data is available to make any assessment of the rest of the sub-area, with the exception of the catchments around Calitzdorp. The water quality in the Calitzdorp Dam (Nels River) is ideal and in the J25A and J25B quaternaries is classified as marginal, due to elevated salinity from natural causes. *Touws / Buffels / Groot Sub-area* Water quality is generally poor throughout this sub-area, with very high salinity occurring in the J11 catchments. Although the quality in the upper reaches of the Touws River is classified as ideal, this reduces progressively downstream to being unacceptable in quaternaries J12J & K. In the catchment of the Groot River (J13) quality is also unacceptable *The Olifants Sub-area* Water quality in the J30 catchments changes from ideal (J35A) to unacceptable in the lower reaches of the Olifants River (J35F). In most of the J30 catchments the quality is good to marginal. In addition to natural causes, elevated salinity is exacerbated by intensive irrigation activity along the Olifants and Kammanassie Rivers. *Gouritz / Goukou/ Duiwenhoks Sub-area* In the upper reaches of the Goukou River (H90 A & B) the water quality is ideal but deteriorates progressively downstream to a marginal quality in the lower reaches. Insufficient data is available for the Lower Gouritz River and as such, no assessment of the water quality is possible. Whilst adequate monitoring data is available for the Duiwenhoks River catchment (H80A-F), this has yet to be interpreted.

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2.4	WATER QUALITY MANAGEMENT STRATEGY (cntd)
Situation Assessment (cntd)	*The Coastal Sub-area* This region is the most comprehensively monitored in the Gouritz WMA, due to the ecological importance of the rivers, vleis and estuaries. With the exception of a few rivers, water quality throughout the K catchments is generally ideal and suitable for both domestic and agricultural use. The exceptions are K10B (Brandwag River), K20A (Great Brak River), K30A (Maalgaten River) and K40B (Hoëkraal River), in which water quality is classified as marginal, due to a degree of elevated salinity resulting from natural causes (geology). The Hartebeeskuil Dam (K10B) on the Hartenbos River has poor quality water (high salinity). The water is used for stockwatering and there are no formal users. During the Plettenberg Bay Coastal Catchment Study (DWAF, 1996), it was identified that the rivers within the scope of that study (Piesangs, Bitou and Keurbooms Rivers) were all of low salt content and classified as ideal. **B) SURFACE WATER QUALITY – HUMAN POLLUTION** In the Gouritz WMA, certain point source discharges pose a threat to the surface and groundwater resource. These include WWTW of local authorities as well as those operated privately, and industry. Some WWTW are poorly managed, whilst others are at full capacity, posing a risk of raw sewage spills. Vandalism of sewage reticulation infrastructure in the urban centres is not uncommon. Many of the smaller towns rely on the use of oxidation or evaporation ponds and there are a number of small private WWTW. The WWTW in the Gouritz WMA are listed in Appendix 4. Diffuse pollution from dense informal settlements is also of concern. Specific concerns are as follows: *The Olifants Sub-area* Vandalism of reticulation and pumpstation equipment is also a problem in the urban areas. Industrial expansion in Oudtshoorn and the resulting anticipated increase in load on the current WWTW requires that the local authority plan to increase sewage treatment capacity in order to manage the increasing load. *Gouritz / Goukou/ Duiwenhoks Sub-area* The sludge dams at the Riversdale WWTW are situated in close proximity to the Goukou River. The works has reached capacity. Spills and seepage into the river pose a risk. *The Coastal Sub-area* The Gwaing WWTW (George) has a nitrification problem and effluent does not meet the standards required by DWAF. The works was upgraded 3 years ago but the effluent quality is apparently now worse than before. Pumpstation overflows also occur and impact on the water quality of the Gwaing River. The Knysna WWTW discharges treated effluent directly into the Knysna Lagoon, rather than diverting it to a preferred upstream point on the river, to facilitate some dilution, before reaching the lagoon. At Great Brak seepage from soak-away facilities poses a threat to the estuary. Inadequately serviced dense settlements at George, the settlement in the Piesangs River catchment at Plettenberg Bay, and at Noetsie (Knysna) result in diffuse pollution into nearby streams and rivers. Treated effluent discharged from the Plettenberg Bay WWTW into the Gansevallei stream feeds into the Bietou River. The discharge licence recently expired and under the new licence, the local authority is now required to treat to special standards. Development in the coastal catchments and seasonal temporary population increases result in higher E.coli counts during the holiday season in the Bietou and Keurbooms Rivers.

2.4	WATER QUALITY MANAGEMENT STRATEGY (cntd)
Situation Assessment (cntd)	**C) GROUNDWATER QUALITY** With the exception of some local iron content problems that result in borehole clogging (KKRWSS for example) and adversely affect abstraction equipment, the quality of groundwater obtained directly from the TMG is generally excellent. North of the Swartberg Mountains, the Karoo aquifers yield good quality water, whilst the water quality in the Little Karoo is of higher salinity, brackish in colour and generally unfit for human consumption (but supportive of livestock). This is due to the natural geology. Good quality water is obtained from the primary aquifers on the coastal plain where these are underlain by (TMG) strata. The TMG outcrop between George and Storms River is a potential source for the towns in the area. Over abstraction from the primary aquifers along the coast can lead to contamination via saline intrusion. This is of particular concern at the coastal resort towns in which seasonal peak demands are supplied from groundwater, abstracted out of the primary coastal aquifers. The contamination of private boreholes in Beaufort West and the Leeu Gamka boreholes (used for agricultural purposes) by hydrocarbons from seepage out of sub-surface fuel tanks at petrol stations is known and clean up is underway in Beaufort West.
Strategic Approach	The historical practise of crop selection to suit water quality and availability should be continued in those areas where salinity is naturally occurring (Great and Little Karoo areas). Sustainable farming practise is possible and as such no significant interventions are proposed. Introduction of a waste discharge charge will implement the "Polluter Pays" principle. Co-operative governance between the Department and local authorities must be fostered, towards recognising and resolving their WWTW problems and water pollution arising from inadequately serviced dense settlements. Local authorities are responsible for the quality of effluent that they discharge, and the control of diffuse pollution arising within their areas of jurisdiction. The local authority should also be made accountable for ensuring that the private WWTW falling in their areas of jurisdiction meet the requirements of their discharge authorisations. Saline intrusion can and must be prevented by sound groundwater management practise, such as the monitoring of abstraction rates from the primary coastal aquifers and the introduction of more stringent GAs relating to groundwater abstraction in close proximity to the coast. Experience gained and money invested in the management and development of the KKRWSS should be extended to the management of groundwater water quantity and quality in the wider TMG environment.
Management Actions	**SURFACE WATER - SALINITY** The following actions are required: • Investigate options for improved salinity management and agricultural practices in the Olifants sub-area, where intense agricultural activities are adding to the natural salinity problem. • Assess and document the findings relating to water quality data that are available for the Duiwenhoks River catchment.

2.4	WATER QUALITY MANAGEMENT STRATEGY (cntd)
Management Actions (cntd)	**SURFACE WATER – HUMAN POLLUTION IMPACTS** The following actions are required: • Monitor the current points of discharge by polluters, what the extent of impact is, whether they are operating within the conditions of their licences and what measures are taken to intercept spills. Also map where the dense settlements are situated. • Industry and other polluters must undertake monitoring themselves to comply with the conditions of their licences. In turn it will be necessary for the appropriate managing authority (DWAF or the CMA) to undertake resource and quality monitoring in order to audit compliance to RQOs. • The WSDPs of local authorities should be extended to include any proposed extensions to their WWTW and to provide an indication of where the resulting points of discharge are likely to be. • The above actions to be included in the scope of a proposed assessment study (led by the Directorate: Waste Discharge and Disposal and assisted by the Directorate: Water Resource Planning Systems). Focus should be directed at the coastal catchments. This will then feed into the Reconciliation assessment study to be undertaken as a forerunner to a decision on the need for compulsory licensing. • WWTW discharging in close proximity to estuaries should pump their effluent to an upstream discharge point to facilitate dilution before entering the estuary itself. The financial constraints on the part of local authorities to implement such measures will need to be addressed. • Implement the recommendations of the dense settlement strategy (funded by DANIDA) in those areas where informal settlements pose a risk to the water resource. • Co-operative governance with the relevant local authorities is required to manage the impacts of diffuse pollution from informal settlements. • A national strategy is required to deal with contamination from sub-surface fuel tanks. Industry should be responsible for monitoring their impacts. **GROUNDWATER** The following actions are required: • Implement the management actions suggested in the Groundwater Strategy (1.4), the Managing Solid Waste Strategy (2.3) and the Monitoring Networks and Data Capture Strategy (9.2) • In the longer term, consider de-salination and surface / groundwater mixing in areas where the groundwater quality is poor and the demand for water high. However based on the current cost of desalination it is unlikely to be an affordable option for the agricultural sector.
Priority and Responsibility	The implementation of the **Water Quality Strategy** is the responsibility of the RO, together with the Directorate: Water Resource Planning Systems, taking cognisance of the National Water Quality Framework Policy. It is of Priority 3 – medium.

STRATEGIC AREA 3: WATER USE MANAGEMENT

The regulation of water use will be achieved through formal water use authorisation that will set conditions on water use. Conditions of use are the essential operational link between the need to protect water resources, and the need to use water for social and economic development.

In order to assess the actual extent of existing water use and the legality of that use, a process of verification has been introduced by the Department. This will serve to identify the geographical regions or water use sectors in which priority will be given to the introduction of compulsory licensing.

The need to have reliable estimates of the Reserve requirement was identified in the Reserve and Resource Quality Objectives Strategy (2.1). With that in hand, decisions regarding new applications for surface and groundwater abstraction will be more readily supported. In the interim, the Department is on the one hand is reluctant to categorically refuse any further abstraction licences, whilst on the other hand development is ongoing and requirements need to be met.

General Authorisations (GA) set limits within which water may be used without the need to issue a licence. This has the benefit of reducing the number of individual licence applications that need to be processed. On the other hand, where extensive use is made under GA, the impact on the resource and on other users can be detrimental.

The protection of both the surface and groundwater resource, must be balanced against the need to discharge waste into the environment. Although the resource cannot be completely protected from the impacts of pollution, this form of water use requires careful management to ensure that the risk of contamination is kept to the minimum.

The decommissioning of large commercial forestry operations in the Western Cape provides an opportunity for water to be "freed up" and made available to other users. In the Gouritz WMA, forestry is concentrated in the coastal region and provides employment and inexpensive building material. The future of afforestation is likely to change from large commercial operators to groups of small growers. Similarly where land is suitable and available, the opportunity exists to establish resource poor farmers.

The removal of invasive alien plants is an important reconciliation intervention option, through which reduced stream flow reduction adds to the available surface water runoff. There is a need to prioritise where clearing will have optimum benefit such that best use is made of available clearing budgets.

Seven strategies have been identified for development, namely:

3.1 General Authorisations
3.2 Verification of Existing Lawful Use
3.3 Allocation and Licensing
3.4 Compulsory Licensing
3.5 Afforestation
3.6 Removal of Invasive Alien Plants

3.1	GENERAL AUTHORISATIONS STRATEGY
Management Objective	General Authorisations (GAs) are in place for both surface and groundwater abstraction over significant areas in the Gouritz WMA. The objective of this strategy is to guard against excessive surface water abstraction, over abstraction of groundwater and ensure a regular review and appropriate implementation of the GAs.
Situation Assessment	GAs have been introduced to allow conditional water use, without the need for a licence. Although no licence is necessary, the use under a GA must still be registered. GA protocols are available for surface and groundwater abstraction, storage, irrigation with effluent, effluent discharge, and solid waste disposal. An area where the need for a GA protocol has been identified is for River Channel Modifications, such as the construction of culverts. Proposals have been made and are under review. In the Gouritz WMA revised GAs have been recently proposed. Those pertaining to surface water and groundwater abstraction are shown on Figures 3.1.1 and 3.1.2 as well as in Appendix 6. **SURFACE WATER GAs** The cumulative volume abstracted from surface water in the coastal catchments under the 25 *l*/s GA is of concern. The coastal sub-area currently experiences an estimated shortfall of 43 million m^3/a. Some of these catchments are not generally authorised for surface water abstraction (see Figure 3.1.1.). In those that are, the ever increasing number of abstractions under the GA are likely to have a significant impact. As a result more restrictive GAs for surface water abstraction are proposed in some of the coastal catchments. The current GAs and the proposed changes are set out below: • **Current** gazetted GA for surface water abstraction = 25 *l*/s: o for irrigation of up to 25ha of land at 6000 m^3/ha/a or; o for purposes other than irrigation, 100m^3/d (on any given day); o storage is limited to 50 000m^3. • **Proposed** GA for surface water abstraction = 15 *l*/s: o not exceeding 150 000m^3/a; o storage is limited to 50 000m^3. As at 1 March 2004 the proposed GAs described above and shown on Figure 3.1.1 had yet to be approved and gazetted, and are based on the latest proposals by RO.

3.1	GENERAL AUTHORISATIONS STRATEGY (cntd)
Situation Assessment (cntd)	**GROUNDWATER GAs** Current GAs for groundwater abstraction consist of four classes, namely zero, 60, 300 and 750 m^3/ha/a. The proposed GAs (see Figure 3.1.2) contain five classes of abstraction, namely zero, 45, 75, 150 and 400 m^3/ha/a and allow for up to 20m^3/d to be abstracted by small industrial users. The most notable changes proposed are: • More restrictive abstraction limits are proposed throughout the Gamka sub-area with the exception of three quaternary catchments (J22H, J23E & H). • Some relaxation is proposed in the southern half of the Groot sub-area (typically from 60 to 75 m^3/ha/a). • Some relaxation is proposed in the Olifants sub-area (typically from 60 to 150 m^3/ha/a). The most notable exceptions being J31A – C (Upper Olifants River catchments), reduced from 750 to 150 m^3/ha/a. Also the Upper Kammanassie River catchments (J34A & C) in which the proposed upper limit reduces from 750 to 400 million m^3/a. • More restrictive limits are proposed throughout the coastal belt. As at 1 March 2004 the proposed GAs described above and shown on Figure 3.1.2 had yet to be approved and gazetted, and are based on the latest proposals by RO.
Strategic Approach	GAs currently play an important role in easing the burden of licensing small abstractions from surface and groundwater in the Gouritz WMA, and can continue to do so. However it is apparent that generally authorised surface and groundwater abstraction, particularly in the coastal catchments, can have undesirable impacts. The introduction of more restrictive surface water abstraction GAs is a step in the right direction towards curtailing the extent of such impacts. The use of buffer zones should be considered to offer improved protection against the risk of saline intrusion (in the primary coastal aquifers) where new boreholes are established in close proximity to the coastline. Although it may not be possible to substantiate these negative impacts in the absence of monitoring, the precautionary principle must be applied and immediate action taken based on best understanding. The GAs in this WMA should be reviewed annually, and steps taken to implement monitoring wherever this can lead to improved management decisions. Where appropriate, GA limits may be extended or new GAs introduced (as has recently been proposed). The setting of, review of and amendments to GAs must be based on catchment specific decisions (down to quaternary level) in order for generally authorised water use to be properly managed.
Management Actions	The following actions are required: • The proposed change to the GA for surface water abstraction (25*l*/s to 15*l*/s) should be implemented. • Further changes to GAs for surface water abstraction could include seasonal abstraction only (during periods of high flow) into off-channel storage (the capacity of which is already limited under GA to 50 000m^3). • The proposed changes to the GAs for groundwater abstraction should be implemented, particularly the more restrictive changes. • Implement a programme of annual review of all GAs. • Implement the proposed GAs for river channel modification.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate : Water Abstraction and Instream Use. It is of Priority 2 - High.

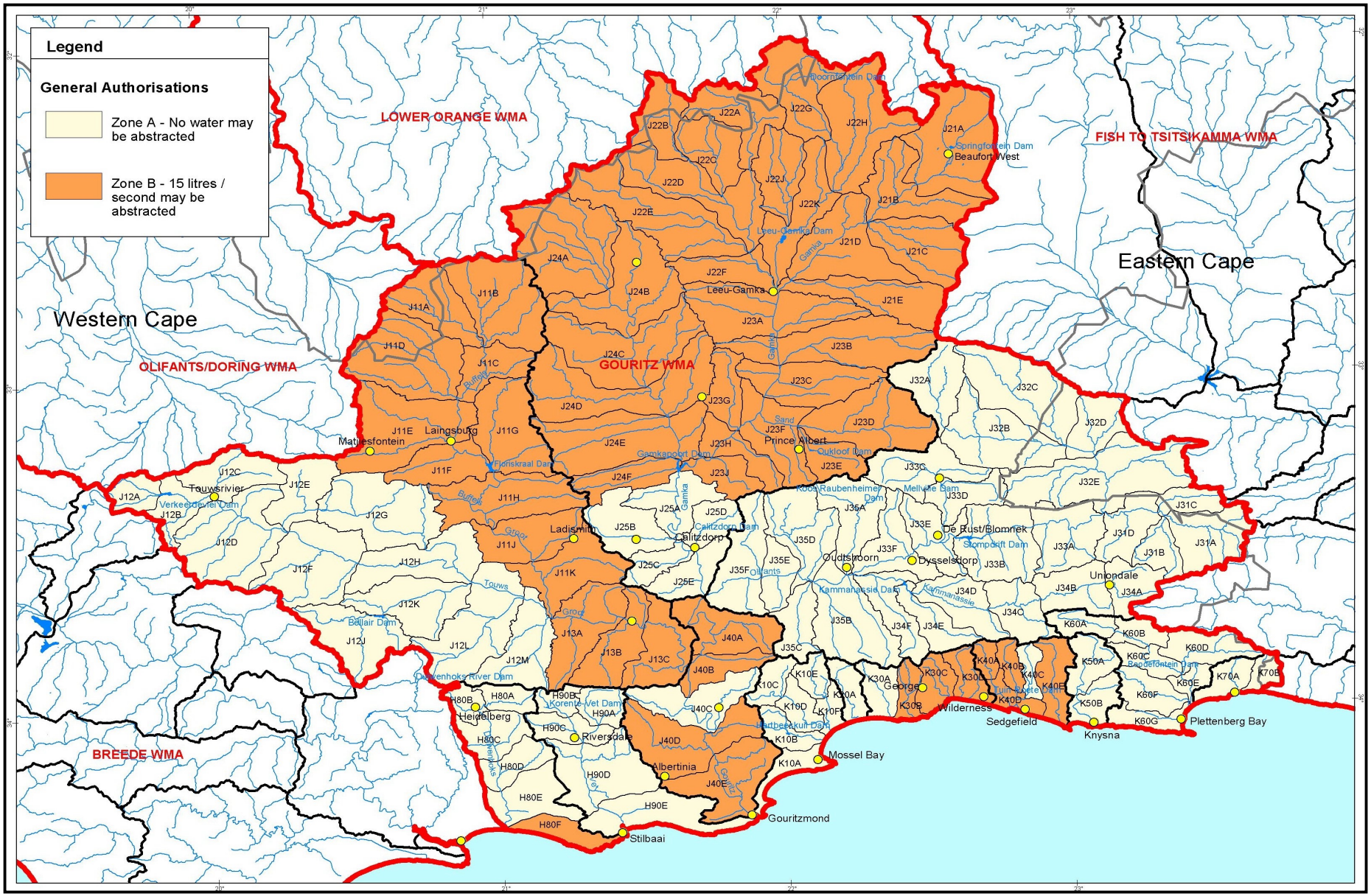

Figure 3.1.1: Proposed General Authorisations for Surface Water Abstraction

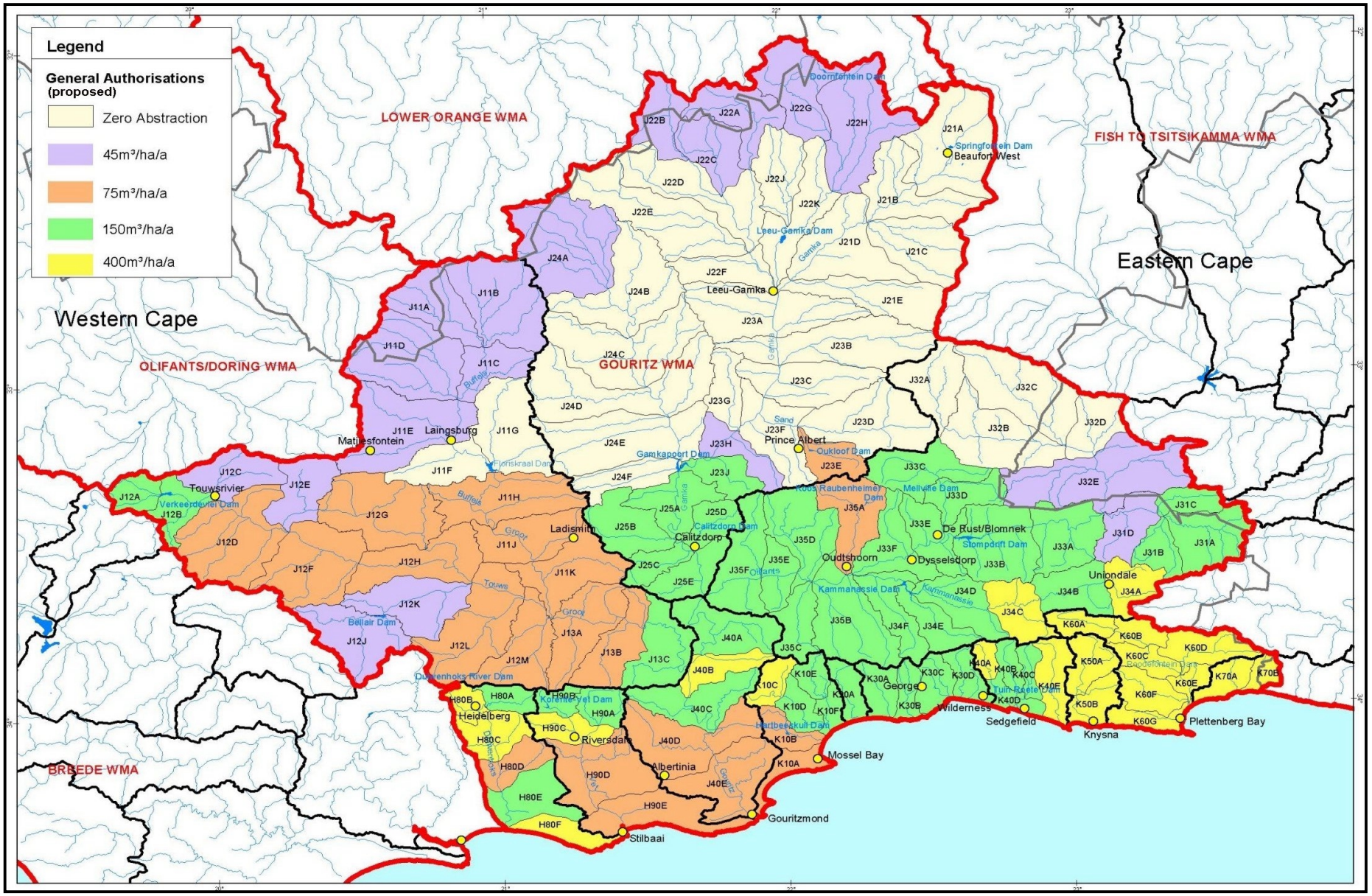

Figure 3.1.2: Proposed General Authorisations for Groundwater Abstraction

3.2	VERIFICATION OF EXISTING LAWFUL USE STRATEGY
Management Objective	The objective of this strategy is to establish the extent of existing water use, to verify that information and establish the lawfulness of that use. An important additional objective is also to stop unlawful water use.
Situation Assessment	One of the first steps towards the process of compulsory licensing is to establish the extent of existing lawful use. Users were required to register their use with the RO and this process has been completed. Checks carried out in certain areas of the Gouritz WMA indicate that the registered water use is within 20% of the Department's estimate. There is a misconception amongst some users that registration will secure them a certain allocation, which explains why some users may have over-registered. On the other hand some users may have under registered in the hope of paying less but using the same volume as they currently do. Others have simply made mistakes in submitting their registration. The verification of existing lawful use will serve to establish what the actual use is and then to verify whether it is lawful or not. The process will also serve to reconcile registration, identify and correct gross errors and enable improved future estimates of water use. This in turn will support effective management of the water trading strategy, which is to be encouraged in this WMA. The extent of over-allocation in the Olifants sub-area will have to be determined through the verification process. However it is understood that the degree of competition for available water by irrigators is more pronounced in this area than elsewhere in the WMA. This is not necessarily reflected in the yield balance due to the fact that water is supplied to the farmers in larger volumes but at lower assurances of supply. Only once this is reliably determined can a decision be made on how to best address the problem, and to decide if a reduction in allocations through compulsory licensing is necessary. If lower assurances of supply are acceptable to the irrigators in that region this may not be necessary. Some unlawful water users will be identified through this process and DWAF guidelines should be applied to deal with them. This is not restricted to irrigators but to all water users. Unlawful afforestation for example, is taking place between Knysna and Plettenberg Bay and is not easily identified. In the Duiwenhoks (H80A-F) and Langtou (J40C) River catchments possible unlawful abstraction of surface water may be taking place.

3.2	VERIFICATION OF EXISTING LAWFUL USE STRATEGY (cntd)
Strategic Approach	Through the process of registration and verification, the Department will identify unlawful water users, who will be held accountable for their actions. The Department will take a very stern approach to unlawful water use to ensure that this is stopped. This will be achieved through: i taking immediate steps against the users who have unlawfully developed since the NWA came into force; ii taking action against unlawful users under the 1956 Water Act, tackling clear cut cases first; iii assigning responsibility to WUAs to monitor the abstraction activities of their members. The ultimate solution to controlling unlawful water use and ensuring that the conditions of licences are being complied with is for WUAs to control the abstraction within their areas. In the Gouritz WMA, initial indications suggest that verification of actual water use reasonably confirms the use previously registered by farmers (approximately within 20%). The verification process will however be used to obtain a more reliable indication of irrigation water use in the Olifants/Kammanassie region, where significant over-allocation has taken place. The extent of any currently unexercised allocations must also be determined in order to better analyse current and future yield balances.
Management Actions	The following actions are required: • Verify the extent of existing use in accordance with guidelines produced by the Directorate: Water Abstraction and Instream Use, focusing on those catchments where competition for available water is most significant. • Determine lawfulness of the use and the extent of un-utilised allocations. • Delegate the responsibility for licence control for abstraction to WUAs. • Take action against unlawful users according to DWAF guidelines.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Water Abstraction and Instream Use. It is of Priority 1 – Very High.

3.3	ALLOCATION AND LICENSING STRATEGY
Management Objective	The objective of this strategy is to facilitate the process of dealing with new licence applications.
Situation Assessment	Table 2.6.3 in Chapter 2.6 shows that in the Gouritz WMA, at the Year 2000 level of development, there is an overall shortfall of 64 million m^3/a, of which the greater component (43 million m^3/a) is attributed to the Coastal sub-area. There are deficits in all the other sub-areas except the Gouritz/Goukou/Duiwenhoks area, which is in balance. There is therefore no water available for the issuing of new abstraction licences from surface water in most of the WMA. Although some surplus water does become available in the coastal catchments during seasonal periods of high flow, storage facilities are currently not available to take any advantage of this potential yield. At this stage only Reserve estimates based on the desktop / rapid method are available. Reserve requirements could increase significantly once comprehensive estimates become available. Furthermore, no Reserve estimates have been carried out for the estuaries in this WMA. This means that the current preliminary estimate of the overall Reserve requirement is likely to increase in the future, further impacting on the available yield of the infrastructure currently in place. There may be potential for development of some additional surface water yield in certain coastal catchments by developing storage infrastructure and schemes to take advantage of surplus water during periods of high flow. In the drier Karoo catchments, there is no, or very limited, additional yield available from the surface water resource. Some degree of water use authorisation trading has already taken place in the coastal catchments. This offers an alternative to new licences by making water available for more beneficial use. Other reconciliation interventions are also available, as outlined in the Reconciliation of Water Supply and Demand Strategy (1.3). The Groundwater Strategy (1.4) has identified that there is potential for the further development of the groundwater resource, and this should be encouraged in this WMA.

3.3	ALLOCATION AND LICENSING STRATEGY (cntd)
Strategic Approach	Because of the shortfalls identified in this WMA as well as the uncertainties with respect to water availability (refer to Strategy 1.1) and water requirements (refer to Strategy 1.2), the Department needs to adopt a highly conservative approach with respect to issuing new licences in this WMA. Where there is confirmed over-allocation, licences cannot be issued. In the Gouritz WMA, the priority must lie with the provision of water to the high value users in the urban sector, after ensuring that provision is made for the Reserve. This could enhance the eco-tourism potential of the coastal catchments and economic growth within the WMA. **NEW GROUNDWATER ABSTRACTION** New groundwater abstraction will be considered anywhere in the Gouritz WMA. In the Olifants sub-area, where further study is required to determine the interaction between the surface water and groundwater resource, new abstractions should be cautiously considered. An approach that will not entirely preclude the development of the resource in this sub-area could be that stringent monitoring conditions be attached to new licences for small-scale abstraction. In so doing this will improve the monitoring of the resource and provide a component of the data necessary to better understand the interaction between surface and groundwater. Large-scale abstraction schemes should not be considered until further study can support management decisions in that regard. Abstraction from the primary coastal aquifers in close proximity to the coast will also be cautiously considered, in light of the risk of saline intrusion. **NEW SURFACE WATER ABSTRACTION** The following area-specific strategic approaches will be adopted in terms of surface water abstraction in the Gouritz WMA: **Olifants Catchment:** No new licences for surface water abstraction or storage will be issued before a much more detailed analysis of the water requirements and water availability in that area has been undertaken. **The Rest of the Gouritz WMA**: No further surface water abstraction licences will be issued without the provision of sufficient storage to make that yield additionally available in specific catchments. These include the well-watered catchments of the Coastal belt where there may be opportunity to abstract surplus runoff during high flow periods only, and store that water off-channel, for subsequent use. An example of such a scheme being the potential further abstraction from the Keurbooms River for supply to Plettenberg Bay and surrounds. Throughout the WMA, trading of licences will be allowed (and promoted) within the limits set by the trading policy. No additional stream flow reduction activities will be licensed unless yield is provided through the provision of additional storage.

3.3	ALLOCATION AND LICENSING STRATEGY (cntd)
Management Actions	The following actions are required: • Consider the issue of licences for water use first on the basis as set out in this ISP. • Initiate an Area Planning Study aimed at assessing water availability and licensing opportunity on a per catchment basis. • Provide a schedule indicating the status of the water resource in terms of licensing opportunity, for reference and use by stakeholders. This need not wait for the Area Planning Study but should be based on best available knowledge. • Establish a time frame in which the studies mentioned previously will be done so as to provide an indication to prospective licence applicants of the delays they can expect. • Trading of water use authorisations should be encouraged as an alternative to new licence applications that are unlikely to be successful. • The opportunity should be taken during trading to review, and if necessary amend the conditions to the "traded" licence. • Advise stakeholders that trading is a suitable way in which to bring about change in the ownership of allocations. Ensure that regional staff are well acquainted with national trading policy. Allow trading in terms of national policy. • Where new schemes may be possible, appropriate conditions for abstraction should be attached to these licences. These include the use of off-channel storage facilities and the seasonal timing of abstraction. • Develop a firm approach with regard to the issue of licences for the use of groundwater.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Water Abstraction and Instream Use and the Directorate: Water Allocation. It is of Priority 1 – Very High.

3.4	COMPULSORY LICENSING STRATEGY
Management Objective	The objective of this strategy is to prioritise those stressed areas within this WMA, where the re-allocation of available water is necessary through compulsory licensing to address over-allocation of water resources, the implementation of the Reserve and to redress inequities of the past.
Situation Assessment	Compulsory licensing allows the water resource regulator to review the licences of users and to reduce the allocations licensed to individual users so as to return water to the system and/or make additional water available. Compulsory licensing is intended firstly for use in stressed catchments, but all users in all catchments will eventually have to be licensed. An order of priority will determine which catchments should be considered for compulsory licensing first. Key reasons for compulsory licensing are: • to address situations in which more water has been allocated to users than is actually available, which results in shortages, even during normal years if all users were to make full use of their allocations; • to address inequitable distributions of water from the past by redistributing water so that previously disadvantaged landholders are also able to receive a fair share; • to meet the needs of the Reserve (both ecological and basic human needs). The Reconciliation of Water Supply and Demand Strategy (1.3) identified two geographical areas in which there is concern in terms of availability of water. In the coastal catchments the ecological Reserve component may be significantly more than provisionally estimated, particularly once the Estuarine Reserve requirements have been established. Some of the individual coastal catchments should be prioritised. In the Olifants sub-area, water has been significantly over allocated to the irrigators. At a 98% level of assurance of supply, this is not reflected in the yield balance. This is explained by virtue of the fact that irrigators in that area actually operate at lower levels of assurance of supply. The extent of this over-allocation will be established during the verification of existing lawful use process (refer to Verification of Existing Lawful Use Strategy - 3.2). This over-allocation can be "corrected" through compulsory licensing. Alternatively farmers can agree to continue operating at low levels of assurance of supply. To implement compulsory licensing the Reserve must be determined for the particular reach of river, taking into consideration the downstream impacts and requirements.

3.4	COMPULSORY LICENSING STRATEGY (cntd)
Strategic Approach	A provisional order of priority for compulsory licensing in this WMA is as follows: 1) The coastal catchments (K10-K70) in which ecologically sensitive estuaries are located for which the Reserv7e requirements have yet to be determined. 2) The remaining coastal catchments that are also ecologically sensitive and important in sustaining the health of wetlands and vleis. 3) The intensely irrigated regions of the Olifants/Kammanassie river catchments (J33 / J34), where there is fierce competition for limited available water due to over-allocation. The order of priority may change as better information becomes available to support the decision making process.
Management Actions	The following actions are required: • The Comprehensive Reserve determination (and associated public participation) will need to be completed before re-allocation through the compulsory licensing process can be undertaken. • The adaptation of farming practices to operate under lower levels of assurance of supply must be taken into consideration before and / or during compulsory licensing. • In line with the recommendations of the Estuaries Strategy (2.2), a priority rating system needs to be developed, using best available information, so as to confirm which of the individual coastal rivers should be assigned highest priority. This should be initiated through a workshop type forum, in which the relevant specialists must be involved. • The priority rating for compulsory licensing in this WMA must in turn be fed into the national priority rating system to determine where these catchment lie in terms of national priority. • Determine the urgency for compulsory licensing after: o Verification of existing lawful use, o Considering updated yield balances, o Assessment of the ecological importance of the various estuaries.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Water Allocation and the Directorate: National Water Resource Planning. It is of highest priority – Rating 1.

3.5	AFFORESTATION STRATEGY
Management Objective	The objective of this strategy is to consider the future of afforestation in the WMA in the light of a significant reduction in the existing commercial forestry area, and the need for continued supplies to timber processors and possible demands for forestry by small growers and for equity.
Situation Assessment	In the Gouritz WMA, approximately 600 km^2 of land is under commercial timber, concentrated along the coastal strip of the WMA. This is almost exclusively pine, with some few small stands of eucalyptus. Forestry is an important land-use activity in the coastal catchments, supplying a number of saw-mills in the region and providing job opportunities both through primary and secondary production. The 600 km^2 (60 000 ha) of afforestation reduces the surface water runoff in this WMA by approximately 87 million m^3/a. The impact of this on the available 1 in 50 year yield is approximately 15 million m^3/a, with 14 million m^3/a of this in the Coastal sub-area. As identified in the Allocation and Licensing Strategy (3.3), there is potential for development of additional yield in these coastal catchments. However this yield is not available on a run-of-river basis but is dependent on the construction of new infrastructure. Forestry utilises water without requiring any infrastructure. But it also impacts on availability to other users, particularly by impacting on low flows for which compensatory releases cannot be made, as they can from dams. This is of greatest importance to the Reserve. Forestry is a primary user and as such there is no means of curtailing its use on a short-term basis. Restrictions cannot be applied during droughts as in the case of domestic users and irrigators. Consequently there needs to be relatively high confidence regarding the future water resource availability and the catchments requirements, before decisions can be taken regarding issuing of new licences for the development of plantations. In this regard, the ecological Reserve requirement and its impact on yield, remains the most significant uncertainty in terms of future planning. Due to the stressed nature of the Karatara River catchment (K40C), a recent application for a licence to develop of 4 ha of forestry in that catchment was not recommended by the RO. This would have called for about 4 000 m^3 of water per annum, equivalent to approximately 0,5 ha of irrigation. SAFCOL are decommissioning most of the Jonkersberg plantation, all of Bergplaas and Homtini and about of half of Buffelsnek plantation. This totals several thousand hectares of plantation and will result in significant releases of water. It is probable that there are small groups of unlawful forestry operators scattered within the coastal belt of this WMA. The extent of this problem is not known.

3.5	AFFORESTATION STRATEGY (cntd)
Strategic Approach	At present there appears to be very little opportunity for the issue of new licences for additional forestry. Further yield development in the coastal catchments is possible but there are currently significant deficits at the 98% level of assurance. Where a positive balance is brought about, for example through new infrastructure or the removal of invasive alien plants, applications for new forestry should be considered on merit, alongside other water users. Water Resource Managers must develop a clear picture of the water resource implications of all forestry operators (such as SAFCOL) who are downscaling in certain areas of the Western Cape. The operators of licensed plantations may have some claim to the water for trading purposes. Trading should be into equity or for urban use to encourage tourism and economic growth. If not licensed then this water returns straight to the State and decisions with regard to re-allocation can be made on the basis of overall resource availability (does this water become 'available' or does it just reduce the deficit?), the allocations strategy for that catchment, and on special demands (such as the establishment of small growers or resource poor farmers). Applications for new forestry required to compensate the anticipated loss in timber resources need to be considered sympathetically by the SFRA Licence Assessment Advisory Committee, particularly where this calls for the use of the same water that is being freed up. There will also be other calls on this water. Any water becoming available should be reallocated, as far as possible and reasonable, to poverty eradication/rural development. The RO should take note of SAFCOL's exit strategy, and of any plans for alternative uses suggested in that strategy. DWAF must also stay on top of any other possible closures. Alternative land use proposals (including small scale forestry) need to be assessed and, if the water is deemed available, could be granted at least provisional approval for planning purposes. It is important that SAFCOL be fully aware of their rights and responsibilities with regard to the water resource, particularly where the company is suggesting alternative water demanding activities in the place of existing forestry.
Management Actions	The following actions are required: • The RO to liase with SAFCOL and study their decommissioning and exit programme so as to develop an understanding both of the Water Resource implications and of any opportunity for establishing small growers and poverty eradication, both for equity and job creation. • The potential for re-allocating water arising out of the withdrawal of commercial forestry operators must be determined. • The SFRA Licence Assessment Advisory Committee should establish an approach to the licensing of new afforestation which takes account of the loss of area, the needs of small growers and of secondary producers. Forestry should be considered a water user just like any other. • The extent of unlawful afforestation must be established during the registration and verification process. • Unlawful afforestation should ideally be removed. • The licensing of new afforestation should be considered on the same basis as the licensing of any other water using activity – taking into account the particular nature of forestry as a water user.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Water Abstraction and Instream Use. It is of Priority 3 – Medium.

3.6	REMOVAL OF INVASIVE ALIEN PLANTS STRATEGY
Management Objective	In order to ensure long-term protection of the water resource, the removal and prevention of further spread of invasive alien plants needs to be implemented in this WMA. The objective of this strategy is to prioritise the areas in which optimum benefit can be achieved, through the removal of invasive alien plants, within available budgets.
Situation Assessment	Removal of invasive alien plants is an important reconciliation intervention in the Gouritz WMA. This is particularly relevant in those catchments that are stressed and also heavily infested. The Olifants/Kammanassie and the coastal catchments are good examples. In the former, clearing could provide additional water that could then become available to relieve the competition for available water. In the coastal catchments, increased surface water runoff would help to reduce the current shortfalls by making additional water available towards meeting the ecological Reserve requirements. Table 3.7.1 shows the distribution of invasive alien plants in the Gouritz WMA and the resulting reductions in yield (1 in 50 Year). The "Current Deficit" refers to the total water deficit in the different sub-areas. The clearing of invasive alien plants could do much to reduce this deficit.

Table 3.7.1 Invasive Alien Plant Infestation in the Gouritz WMA

Sub-Area	Infestation (km^2)	Yield Reduction ($x\ 10^6 m^3/a$)	Current Deficit ($x\ 10^6 m^3/a$)
GAMKA	68	0	-7
TOUWS / BUFFELS / GROOT	157	1	-11
OLIFANTS KAMMANASSIE	225	4	-3
GOURITZ/GOUKOU/DUIWENHOKS	527	10	0
COASTAL (Mossel Bay - George)	28	2	-43
COASTAL (George - Knysna)	76	5	
COASTAL (Knysna - Natures Valley)	276	14	
TOTAL	**1357**	**36**	**-64**

The 1357 km^2 of invasive alien plant infestation has an overall reduction in surface water runoff of some 121 million m^3/a, with a resulting impact of 36 million m^3/a on the 1 in 50 Year yield of which 21 million m^3/a is attributed to coastal sub-area.

3.6	REMOVAL OF INVASIVE ALIEN PLANTS STRATEGY (cntd)
Situation Assessment (cntd)	In the Gouritz/Goukou/Duiwenhoks sub-area, the surface water runoff could be increased by 10 million m^3/a through the complete removal of invasive alien plants. This sub-area is currently in balance, suggesting a lower priority but within this sub-area, some priority should be afforded to the Duiwenhoks River catchment for provision of estuarine flow requirements. The volume required has yet to be determined. In the Coastal sub-area, 21 million m^3/a could be gained, the majority of this through clearing of the catchments between George and Knysna. This would provide an additional source of yield which could be used towards the provision of the ecological Reserve requirement in these ecologically sensitive catchments, where there is also a high demand for water from other users. In so doing releases for the Reserve could be significantly smaller. The yield of the Stompdrift and Kammanassie Dams could potentially be increased by 4,1 million m^3/a, through complete removal of invasive alien plants. The actual extent of allocation to irrigators in this sub-area, will first need to be established and verified, before a decision on the priority for clearing invasive alien plants in this area, can be weighed up against that of the coastal catchments. The RO has done some work in prioritising areas in the Western Cape for clearing but this has yet to be written up into a formal strategy.
Strategic Approach	The priority in this WMA is to provide more water. The magnitude of impact of invasive alien plants on the water resource, and more importantly what would happen if there were no clearing, are numbers that should be on every water manager's desk. The removal of invasive alien plants is an important water conservation strategy and clearing has proved to be a viable reconciliation intervention (Garden Route Dam catchment for example). Whilst clearing must be focussed on areas where the maximum benefit to the water resource can be achieved, cognisance should also be taken of the opportunity for simultaneously creating job opportunities. Ensuring maximum benefit to the water resource is dependent on both the nature of downstream use and the availability of storage downstream of the areas being cleared. It is absolutely essential that the clearing operation is consistent with WfW plans and operations, including follow-up. This becomes even more important where water is estimated to have been freed up through clearing and has since been allocated to other users. Allocation schedules for water that is freed up through clearing must be established. Clearing will be most effective in those catchments where storage facilities currently provide yield and where development of potential yield is a possibility. Clearing upstream of existing dams and abstraction points, in the catchments between George and Natures Valley, is of highest priority. Thereafter, the Olifants sub-area given the high competition for available water. Provision for the eventual estuarine Reserve requirements in the Gouritz/Goukou/Duiwenhoks sub-area is also to be afforded a high priority. Finally, impacts need to assessed through monitoring – both the mapping of the extent of infestation, and actual benefits to the resource experienced through clearing.

3.6	REMOVAL OF INVASIVE ALIEN PLANTS STRATEGY (cntd)
Management Actions	The following actions are required: • The RO should formalise its current strategy on the clearing of invasive alien plants in the Western Cape, taking the current reconciliation of the Gouritz WMA into consideration. Priority catchments should be those coastal catchments, in which storage is currently available, followed by the Olifants sub-area, where there is competition for limited available water. • As more reliable information becomes available, it will be necessary to refine the strategy so as to ensure optimum use of available budget. • Where clearing is of benefit to a specific user or group of users, the clearing costs could be apportioned accordingly amongst them. • On an ongoing basis, the mapping of invasive alien plant removal and reconciliation of this with field data must be continued.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Working for Water. It is of Priority 2 – High.

STRATEGIC AREA 4: WATER CONSERVATION AND DEMAND MANAGEMENT

Water Conservation and Demand Management (WC/DM) has been identified by the Department as a national priority on account of the limited available resources, the impact of abstractions on the environment, and the cost effectiveness of these measures. Accordingly the Department will not issue licences for additional abstraction or new schemes until satisfactory WC/DM measures have been put in place. As part of the national WC/DM strategy, the Department is currently in the process of developing broad based guidelines on WC/DM in all sectors.

This national 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.

The national WC/DM Strategy is based on three basic principles, namely:

i Water institutions should strive to supply water efficiently and effectively, minimise water losses, and promote WC/DM among their consumers.
ii Users should not waste water, and should strive to use it efficiently.
iii WC/DM should be an integral part of water resources and water services planning processes. Where future schemes are proposed, the appropriateness and cost effectiveness of demand-side solutions must be considered alongside supply-side augmentation options.

The foundation of the WC/DM Strategy is the creation of a WC/DM culture within all water management and water services institutions and among water users. The main sectoral user within the Gouritz WMA is the agricultural sector. However, the Water Services Water Conservation and Demand Management Strategy is an important one, in that it offers the opportunity for local authorities to make better use of their existing water supply schemes for meeting the urban water requirement.

Water Conservation and Demand Management can mean many different things. It is necessary to consider Agricultural and Water Services WC/DM separately, due to the effect of climatic change, which has a greater impact on the agricultural sector than on the urban sector. It will require that the all interventions that can be taken be unpacked and compared on the basis of cost and potential water savings.

Two strategies have been identified for development, namely:

4.1 Water Services Water Conservation and Demand Management
4.2 Agricultural Water Conservation and Demand Management

4.1	WATER SERVICES WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGY
Management Objective	The implementation of WC/DM as defined in the National WC/DM strategy provides the opportunity for the urban and rural sectors to achieve more efficient water use. The objective of the strategy is therefore to promote and encourage effective WC/DM measures by local authorities, as an alternative to developing new sources of supply, or to postpone the need for new schemes or extensions to existing schemes. WC/DM in the agricultural sector is addressed separately in Strategy 4.2.
Situation Assessment	The National WC/DM Strategy currently being developed by DWAF aims at entrenching and insisting on efficient water management and use. This is an important reconciliation intervention that may go a long way towards postponing the implementation of new urban and rural water supply schemes. The levels of "unaccounted for" water at some local authorities in the Gouritz WMA are excessive. At Laingsburg, for example, more than 50% of the annual urban water consumption is unaccounted for. Although a low growth rate is anticipated in this area, WC/DM needs to be implemented to address these losses because there is a direct benefit to the local authority in terms of operating costs (reduced pumping costs for example). There are also significant losses in the Calitzdorp reticulation system. The efficiency of lei-water systems is not well established and could account for substantial losses. An estimate of the recoverable volumes has not been possible. Although these will be small from a WMA perspective, they might be significant at local supply level. The following towns still make use of lei-water systems: De Rust/Blomnek, Oudtshoorn, Beaufort West, Heidelberg, Riversdale, Van Wyksdorp and Prince Albert. An understanding of WC/DM by local authorities, including the benefits of stepwise tariffs and higher prices, is not yet entrenched.
Strategic Approach	The Department will continue to entrench the importance of implementing WC/DM as an effective reconciliation intervention, through the development of broad based guidelines. Local authorities will be required to implement and manage WC/DM initiatives and make best use of their available allocations. Some degree of technical assistance will also be available to those local authorities that do not have sufficient technical capacity to implement this effectively.

4.1	WATER SERVICES WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGY (cntd)
Management Actions	The following actions are required: • The potential extent of recoverable quantities of water that could arise from improved efficiency of lei-water systems should be determined. If viable, then targets should be set by local authorities to achieve that recovery. • In towns where the lei-water system is still in use, the efficiency of the system needs to be determined. It is important to establish how much water could potentially be available for an exchange between lei-water and other users (e.g. municipal potable supply). • The WSDPs of local authorities need to be reviewed by the RO to ensure that realistic and achievable WC/DM goals have been proposed. • Towns need to be identified where there are substantial problems and priority given to those local authorities in the WMA. To the best of its capacity and ability DWAF will encourage and technically assist them to understand and implement effective WC/DM, according to the broad principles and guidelines that are being developed by the Department. • The benefits and objectives of WC/DM need to be made clear to local authorities and to the individual users through public awareness and education. Provincial government will play a role in this process (Co-operative governance). • The results of the study by Laingsburg Municipality into their significant reticulation losses and the recommendations from that study should be used as an example to other local authorities of what steps can be taken towards effective WC/DM. • Where flat rates for all levels of consumption are still used, the benefits of stepwise tariffs for water use needs to be explained to the local authorities and implemented.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with the Directorate: Water Use Efficiency. It is of priority 1 – Very high.

4.2	AGRICULTURAL WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGY
Management Objective	The implementation of WC/DM as defined in the National WC/DM strategy provides the opportunity for the agricultural sector to achieve more efficient water use. The objective of the strategy is therefore to promote and encourage effective WC/DM measures in the agricultural sector.
Situation Assessment	In the Gouritz WMA there is a strong reliance on opportunistic irrigation in the drier regions, where farmers cultivate crops such as lucerne that can lie dormant in drier years. These farmers have accepted low levels of assurance of supply and have adopted their farming practises accordingly. The most significant losses in this WMA are evaporation losses and conveyance losses. The latter occurs in one of two primary ways, namely: • Canal or river losses incurred in conveying water from a dam to the farms where it is used for irrigation; • On farm losses from the point of abstraction to the field edge at which irrigation takes place. At an equivalent 98% level of assurance of supply, agriculture uses 75% (254 million m^3/a) of the available water in this WMA of which approximately 90 million m^3/a is available through controlled irrigation schemes. It is recognised that the biggest savings are to be made by the biggest water users, and agriculture can often save 20-50% by upgrading technology. In the Gouritz WMA, farmers are not particularly efficient due to the low assurance of supply across much of the WMA. This leaves significant room for savings but there must be incentive or financial gain for realistic implementation. Water saved by WC/DM in the agricultural sector can be used to off-set the reductions in allocations through compulsory licensing, or held by farmers to improve assurance. Given the lack of water for additional licensing in this WMA, WC/DM offers agricultural users one way in which to expand emerging farmer operations.
Strategic Approach	The Department will continue to entrench the importance of WC/DM as an effective reconciliation intervention in this sector, taking cognisance of the impacts of climatic change on this sector. The suite of tools comprising of Best Management Practices, water audits and benchmarks developed by the Directorate: Water Use Efficiency will be tested and refined in specific case studies. These to be implemented through the WUAs. It is important that water saved through WC/DM in the irrigation sector is not turned into an expansion of irrigated areas by the users. Rather, the objective is to bring more water back into the water supply systems, not to increase the area under irrigation. Users need to be aware that with compulsory licensing they may be required to cut back on their water use, and that if they have already done so through efficiency measures then this will be taken into account. If they however have merely extended their area under irrigation they should expect to be curtailed and have to reduce areas irrigated. This rationale is applicable to all areas in which compulsory licensing is a likelihood. Where it is not, savings arising out of WC/DM offers an opportunity for allocation to be made to the most beneficial use, which may not necessarily be expansion of irrigation.
Management Actions	The following actions are required: • In stressed areas determine the potential gains through improving efficiency. • The approach to adopt in implementation WC/DM in the agricultural sector must be decided on as part of the Reconciliation Strategy for the stressed areas.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation the Directorate: Water Use Efficiency. It is of Priority 4 – Low.

STRATEGIC AREA 5: INTEGRATION AND CO-OPERATIVE GOVERNANCE

The integrated nature of water resource management requires participation from various government departments, local authorities and water management institutions. A particular area of concern is the enforcement of regulations set up by one authority, onto another. As such, there are a number of challenges within water resource management that require a co-operative approach between various governmental role players.

The establishment of resource poor farmers is ultimately based on the availability of suitable land through the Department of Land Affairs and the provision of water to those farmers by DWAF. Whilst there may be land available, there is currently no surplus surface water available in the Gouritz WMA. Consequently, alternatives need to be sought in the quest to establish sustainable farming practices for resource poor farmers. This is likely to involve purchasing of existing water allocations. Compulsory licensing does provide an opportunity by which water may be re-allocated to resource poor farmers. The priority for compulsory licensing in this WMA is however primarily driven by over-allocation and the Reserve requirements (currently preliminary estimates). The establishment of small growers in place of the commercial forestry operations (SAFCOL for example) presents a further opportunity for redressing inequities whilst continuing the commercial forestry industry within this WMA.

Two strategies have been identified for development, namely:

5.1 Co-operative Governance
5.2 Redressing Inequities

5.1	CO-OPERATIVE GOVERNANCE STRATEGY
Management Objective	The management of the water resource is a complex and integrated function that involves a number of regulating authorities, many of which sit within the same tier of government. The objective of this strategy is to foster a co-operative approach between the various role players, so as to facilitate effective management of the resource.
Situation Assessment	Land Affairs issues, land-use issues and marine issues are all related to water resources in one or more ways. Improved co-operative governance between DWAF, local authorities as well as other government departments is necessary to ensure effective water resource management. To date a number of co-operative governance initiatives have been taken by the RO, which are functioning well. These include: • The Streamflow Reduction Activities Licence Assessment Advisory Committee (SFRA LAAC). This Committee makes decisions regarding the licence applications for all stream flow reduction activities, including afforestation. Representation on the committee for a particular region may vary but would typically include representation from Catchment Forums, DWAF, Land Affairs as well as the Provincial Departments of Environmental Affairs and Development Planning, Agriculture, Local Government and Housing, and various NGOs and other stakeholders. • The Irrigation Action Committee (IAC) involves DWAF, the Department of Agriculture, Cape Nature Conservation Board and the Department of Land Affairs. The IAC addresses, amongst other issues, the provision of water to resource poor farmers. • Sub-catchment stakeholder forums have been formed and extensive stakeholder consultation has taken place with a view to establishing a representative CMA. There are a number of shortcomings relating to the need for other co-operative governance structures in order to strive for truly integrated water resource management. These are briefly outlined below. • Local authorities require technical guidance from DWAF in order to best implement WC/DM initiatives. • The problems associated with the provision of adequate services to cope with normal and peak season demands, as well as those of informal settlements, requires addressing with local authorities. • Enforcing standards set by DWAF, for effluent treatment by local authorities (or private operators within their areas of jurisdiction), • Drought management is the responsibility of Land Affairs, whilst DWAF is responsible for flood management. • The transfer of Operation and Maintenance, followed eventually by the water infrastructure itself, is currently being undertaken between DWAF and appropriate Water Authorities. Structured agreements need to be put in place. • The Cape Nature Conservation Board (CNCB) is in the process of establishing a united conservation area in a corridor along the Gouritz River, from the mouth at Gouritzmond to Prince Albert. Appropriate zoning of Gamka-Poort Dam, which falls within this corridor, must be undertaken. • There is disjointed management of the groundwater resource, where there is a strong reliance on groundwater for both domestic and irrigation requirements. Local authorities are not well informed of the risks of over abstraction near to the coast where saline intrusion is taking place. • Land-use practices impact on the water quality of the rivers in the Olifants/Kammanassie region. Monitoring data by one authority is not necessarily made available to all, through a common database. • The rehabilitation of sand mine quarries in close proximity to the water resource is not being carried out to the satisfaction of DWAF. This activity is controlled by the Department of Mineral and Energy Affairs.

5.1	CO-OPERATIVE GOVERNANCE STRATEGY (cntd)
Strategic Approach	The importance of co-operation across Government Departments is now recognised more clearly than ever at all levels. Water is absolutely central to this, given the pivotal role it plays in all development. The historical approach to water supply of 'demand and we will deliver' has become one of 'if you require, or are going to require water, we will explore options with you.' DWAF does not wish to use the letter of the law to enforce compliance to properly manage the country's water resources. The approach is one of maximum information to and understanding by all water users, and co-operation and negotiation to ensure wise management and an equitable sharing of the resource. This requires ensuring that water has a permanent position on the planning agenda of other government departments and that their water use is within the constraints required to offer best protection to the resource and to other users.
Management Actions	The following actions are required: • Co-operative planning between DWAF and the Cape Nature Conservation Board (CNCB) and the Department of Environmental Affairs and Tourism (DEAT) is required wrt any proposed listed activity (those activities requiring an Environmental Impact Assessment). • Co-operation between WUAs, DWAF and Dept Agriculture is to be encouraged to facilitate a coherent approach to the management of a water resource, where more than one authority is involved. • Early warning of developments (land rezoning) needs to be identified in the IDPs of the district authorities, taking cognisance of the water to be supplied by other authorities. • Access and sharing of monitoring information between local authorities and DWAF is to be encouraged so as to avoid duplication of effort. • An integrated procedure (Dept Agriculture and DWAF) is required to deal with drought. • Co-operative governance between Land Affairs, Agriculture, DWAF and local authorities is required wrt the potential provision of water to resource poor farmers. • The preparation of Disaster Management Plans is the responsibility of Provincial government. Input from DWAF should be provided so as to review these plans and suggest improvements to them. • Local authorities must extend their responsibility to the management of all WWTW in their region, including those privately operated. • DWAF and the Dept Mineral and Energy Affairs must jointly ensure that operation and rehabilitation of sand mining and quarrying activities is in accordance with authorisation conditions (national strategy). • Diffuse pollution from informal settlements must be addressed between DWAF and the relevant local authorities in the WMA. • DWAF needs to support local authorities to better manage their surface and groundwater resources, particularly wrt establishing appropriate groundwater monitoring networks and in the prevention of saline intrusion along the coast. ` • Technical support needs to be provided by DWAF to local authorities for the implementation of urban WC/DM before new schemes are considered. • Co-operation is necessary between DWAF, Provincial government and Dept Agriculture to provide technical assistance with WC/DM implementation in the agricultural sector. • Co-operation with the Department of Health is required regarding water quality for human consumption and irrigation with sewage effluent.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in conjunction with the Directorate: Institutional Oversight. It is of priority 2 – High

5.2	REDRESSING INEQUITIES STRATEGY
Management Objective	The provision of water to resource poor farmers is of a high priority, where water is available to do so. The objective of this strategy is to establish where and how water might be available to further establish resource poor farmers or small growers (forestry).
Situation Assessment	In the Gouritz WMA, resource poor farmers have been established at Kranshoek (K60G), Matjiesrivier (K70A), Pacaltsdorp (K30B), Zoar (J25D), Albertinia (J40D) and at Dysselsdorp (J33F). Further development of resource poor farmers is dependent on availability of water and access to suitable land through the Departments of Land Affairs and Agriculture. In the Gouritz WMA, the availability of water is limited, as shown in the Water Resource Availability (1.1) and Water Requirements Strategy (1.2). As such, further irrigation development will be difficult through new allocations but the option of buying out existing allocations (trading), has been identified as the most feasible option. Alternatively water would have to be made available by reducing allocations to existing users through compulsory licensing. The Reconciliation of Water Supply and Demand Strategy (1.3) also identified the potential available water out of Wolwedans Dam that is allocated to, but currently unused by Mossel Bay. Although this water is expensive, it is nevertheless potentially available and could be bought out to establish resource poor farmers. However, a review of the system supplying Mossel Bay, PetroSA and surrounds has been recommended in the above strategy as the last overall planning analysis for Wolwedans Dam and the rest of the system supplying water to the Mossel Bay region was last undertaken almost 20 years ago. Availability to redress inequities will form part of the investigation. Where the requirements of these emerging farmers are small relative to the overall requirement in a particular area, it may be possible to meet their needs. However, with the exception of the Gouritz/Goukou/Duiwenhoks sub-area, there is generally a shortage of water throughout the WMA, with the Coastal sub-area being most affected (refer to Chapter 3). As such, if the requirements for establishing resource poor farmers are substantial, there is currently no surplus water available to do so. At present there are no indications of major demands for water to meet the needs of resource poor farmers and to address inequities. It is nevertheless important that a possible (potential) demand be assessed in this WMA.
Strategic Approach	It is part of the vision and mission of DWAF to address past inequities with regard to the way water has been allocated. One obvious strategy is to make water more readily available to resource poor farmers. In the case of the Gouritz WMA there is no surplus water available from current sources. This has meant that little or no new water can be made available for new irrigation. DWAF nevertheless has a responsibility to resource poor farmers and this can be met in the following ways: (i) If and where resource poor farmers have a requirement for water, and should that water be available, then these applications will be given priority over any other agricultural use. Where water does become available the possible use by the resource poor should be researched before any allocations are made to others. Water for this purpose could be obtained through trading, re-allocation, or in the case of the well-watered coastal region, through small-scale resource development. (ii) The redistribution of land out of the hands of the establishment and into the hands of the resource poor, with the concomitant water allocation, will be facilitated. The re-allocation of water to the resource poor through compulsory licensing is a drastic step, which must be taken in the face of major inequity and demand. This does not appear to be the situation at all in the Gouritz WMA, where there is no communal land. Pockets of demand and any broad trends need to be identified and taken into the planning process.

5.2	REDRESSING INEQUITIES STRATEGY (cntd)
Strategic Approach (cntd)	The shortage of water in this WMA and the marginal nature of much of the agriculture, does suggest that alternative ways of using water to help meet the needs of the rural poor need to be explored. Typically these would include reasonable subsistence allowances under Schedule 1, small grower forestry, and a focus on rural water supply schemes – perhaps offering more than the basic minimum where possible. Close negotiations should be entered into with the Departments of Agriculture and Land Affairs to ensure that expectations are not raised in the farming community. The limitations on the water resource must be very clear to these Departments. It is probable that, together with these Departments, some innovative solutions may be found. The regional planning for the establishment of small growers (forestry) must be integrated into the exit strategies of commercial forestry operators, where such a need is identified. This is discussed under the Afforestation Strategy (3.5).
Management Actions	The following actions are required: • First verify through study, the current and future requirements and the availability of water from the system supplying the Mossel Bay region in particular. Then assess the potential to make water available to resource poor farmers from that system. • Assess equity needs and develop a firm policy and strategy with regard to the allocating and licensing of water use by those who have been previously disadvantaged. • Prioritise the needs of the poor and seek ways in which water can be used to alleviate poverty. • Continued co-operative planning between DWAF, Dept Agriculture and Land Affairs, through the Irrigation Action Committee. • All groups of resource poor farmers must be included in the formation of the WUAs.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO, in consultation with the Directorate: Water Resource Finance and Pricing and the Directorate: Water Allocation. It is of priority 3 – Medium.

STRATEGIC AREA 6: INSTITUTIONAL DEVELOPMENT AND SUPPORT

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. WUAs (including Water Service Providers and Water Services Authorities) are such organisations.

The establishment of WUAs is in progress in the Gouritz WMA, with the constitutions of prospective WUAs being developed in terms of guidelines prepared by the Department. They are expected to be financially self-supporting from water use charges, determined and made in terms of the pricing strategy, and payable by members. A WUA falls under the authority of the CMA in whose area of jurisdiction it operates, if the agency has received powers from the Minister to direct the WUA's activities.

One strategy has been identified for development, namely:

6.1 Supply to Local Authorities

6.2 Water User Associations

6.1	SUPPLY TO LOCAL AUTHORITIES STRATEGY
Management Objective	The objective of this strategy is to align the ISP, the Water Service Development Plans (WSDPs) and the Integrated Development Plans (IDPs) in terms of the current and future sources of supply of all local and regional authorities in the WMA.
Situation Assessment	There are a number of local authorities (municipalities) in the WMA and these authorities are responsible for water supply to their users. By law they are required to produce plans (WSDPs and IDPs) that indicate their water requirements and how they intend to meet those requirements. It is imperative that the local authorities collaborate closely with DWAF (RO) to make sure that the sources of water are properly identified and evaluated in the Water Service Plans. Emphasis must in the first place be on demand side interventions such as WC/DM and re-use of water. Technical resource capacity, particularly at the smaller local authorities is often a limiting factor in terms of their ability to manage their current sources of supply, to plan for meeting future requirements and to implement WC/DM. Some may require more technical assistance from DWAF than others. At this stage, the department will, through the ISP provide indications of what it deems to be the most appropriate potential supply (source) options for towns in the Gouritz WMA. Once the CMA takes over the management of the Gouritz WMA, the ISP will become part of the CMS. The authorities will work together with the CMA within the framework of the CMS. In so doing the ISP will provide direction to local authorities about their water resources. However the actual provision of water to these towns remains the responsibility of the relevant local authority and not that of the Department. Through the WSDPs it will become evident which local authorities require technical assistance and direction. Strategies 1.1 to 1.3 identify the need for DWAF to reassess the water availability, current and future water requirements and potential reconciliation interventions within the system supplying the Mossel Bay region. The priority is for the local authorities needing additional water to firstly define realistic WC/DM targets and to identify how these targets will be achieved and implemented. Broad guidance will need to be provided to enable effective WC/DM to be implemented. Where possible, the ISP provides an indication (see Table 6.1.1) of the current and future sources of supply to towns in the WMA. There are no inter-basin transfers into the Gouritz WMA, and in the absence of large integrated regional supply schemes, there is a strong reliance on local supply schemes. Lei-water systems are still in place in may towns. The possibility has been identified in the Reconciliation of Water Supply and Demand Strategy (1.3) for water trading between the local authorities and the current holders of the lei-water allocations. In the coastal catchments, local authorities primarily make use of surface water and to a far lesser extent, of groundwater. The reliance on groundwater becomes more prevalent in the inland areas (Little and Great Karoo). The current developed groundwater yield in this WMA is approximately 64 million m^3/a of which only 1 million m^3/a is within the Coastal sub-area and a further 1 million m^3/a in the Gouritz/Goukou/Duiwenhoks sub-area. The Groundwater Strategy (1.4) identifies that there is further potential for development of groundwater yield throughout the WMA. Future supply to Uniondale includes a possible inter-basin transfer (via pipeline) from Haarlem Dam in the adjacent Fish – Tsitsikamma WMA. The local authority (Eden/Garden Route District Municipality) has commenced with a pipeline between the dam and Uniondale. The licence application for the transfer has yet to be approved by DWAF. The potable water supply schemes in each of the five sub-areas of the Gouritz WMA are summarised in Appendix 2.

6.1	SUPPLY TO LOCAL AUTHORITIES STRATEGY (cntd)
Strategic Approach	The Department's focus will firstly be on ensuring that adequate steps are taken by local authorities to implement the broad principles of WC/DM and that water re-use is considered. Where the development of new schemes for local supply is proposed, DWAF may provide technical guidance if required, and if possible and appropriate. The development of the groundwater resource in this WMA will be important in providing supply to local authorities, particularly where there is little opportunity for cost effective and sustainable further development of surface water resources. Through the ISP the Department provides indications of future local development options available to local authorities (see Table 6.1.1).
Management Actions	The following actions are required: • The WSDPs of local authorities need to be verified by the RO and if necessary aligned to the ISP. • The RO has looked at some options for dealing with the problem of peak season demands and these options need to be formally documented. • Through pilot studies carried out by the Department, local authorities can be guided in terms of implementing WC/DM, according to broad based principles. • Local authorities must set realistic WC/DM targets in their WSDPs and allocation plans developed for water arising out of WC/DM. • Provide guidance in the planning and development of local supply schemes. • Inform local authorities of the mechanisms and risks of saline intrusion through a groundwater awareness programme. • Undertake a water resource assessment study for the coastal towns so as to develop a strategy for meeting seasonal demands, with focus on implementing feasible WC/DM practices. • Where additional water is required, the focus must be on developing the local resource, in such a way that the costs are affordable.
Priority and Responsibility	The implementation of this strategy is the responsibility of the RO in consultation with Directorate: National Water Resource Planning. The Priority is 1 – Very high.

TABLE 6.1.1 CURRENT AND POTENTIAL SUPPLY OPTIONS TO TOWNS IN THE GOURITZ WMA

District Municipality (DM)	Local Municipality	Towns	Current Source of Supply	Future Source of Supply (1)
CENTRAL KAROO	Prince Albert	Leeu Gamka	3 boreholes – groundwater is untreated before use	Groundwater
		Prince Albert	Dorps River and 9 boreholes	Further 30% development of Dorps River yield as well as groundwater development. Also exchange with lei-water.
		Prince Albert Road	Relies on 1 borehole	Further development of the groundwater resource, if required.
		Klaarstroom	2 boreholes	Further exploitation of groundwater.
	Beaufort West	Beaufort West	Gamka (Beaufort West) Dam on the Gamka River and 18 Boreholes	Further development of groundwater resources from further afield. Artificial recharge of wellfield from Springfontein Dam surplus. Lei-water exchange.
		Merweville	Boreholes	Further development of the groundwater resource, if required.
	Laingsburg	Laingsburg	River Wells in the Wilgenhout and Buffels Rivers	Reduction of significant reticulation losses. Little demand increase is expected.
		Matjiesfontein	Relies on Groundwater	Zero rate of demand increase.
BOLAND	Breede Valley	Touwsriver	Small Off-channel Dam fed from a Spring	Potential development of the TMG to the west of Touwsriver.

(1) The future sources of supply are suggested options. Most of these require further study to determine their viability, both from a Reserve requirement as well as financial perspective, and appropriate order of implementation. These options are for secondary consideration, after implementation of appropriate water conservation and demand management, as well as other reconciliation interventions (effluent re-use, invasive alien plant removal, trading of authorisations, etc).

The Water Service Development Plans of local authorities need to be reviewed to ensure that local authorities have realistically estimated their future requirements.

TABLE 6.1.1 (cntd) CURRENT AND POTENTIAL SUPPLY OPTIONS TO TOWNS IN THE GOURITZ WMA

District Municipality (DM)	Local Municipality	Towns	Current Source of Supply	Future Source of Supply (1)
GARDEN ROUTE / KLEIN KAROO	Oudtshoorn	De Rust/Blomnek	Huis River Weir, run-of-river basis	Exchange with lei-water. Further development of the KKRWSS.
		Dysselsdorp	Klein Karoo Rural Water Supply Scheme (KKRWSS) – boreholes are stressed.	Further development of the KKRWSS from the TMG aquifer and Olifants River alluvium.
		Oudtshoorn	Koos Raubenheimer and Melville Dams and Rust en Vrede Diversion (Kango River)	Deep Aquifer drilling (TMG) as is being studied through the DAGEOS project and Cango limestone aquifer. Exchange with lei-water is a further option as well as the potential Kombuis Dam.
	Langeberg	Albertinia	7 boreholes and 1 spring as well as effluent re-use by emerging farmers.	Development of groundwater from further afield than is currently being utilised. Also possible scheme on the Wyers River (tributary of the Gouritz River).
		Gouritzmond	Surface spring water from Doordriftfontein	
		Heidelberg	Duiwenhoks Dam	Overberg Water via Duiwenhoks Scheme. Also lei-water exchange.
		Riversdale	Korentepoort Dam and run-of-river from Kristaalkloof.	Increase reservoir storage capacity and delivery pipeline from Korentepoort Dam. Also lei-water exchange.
		Stilbaai	6 boreholes in the coastal dunes and off-channel dam	Further development of groundwater resources in the area together with increasing reservoir capacity.
		Vermaaklikheid	To be determined	To be determined
	Mossel Bay	Herbertsdale	Abstractions from the Langtou River	
		Mossel Bay	Klipheuwel Dam, E Robertson Dam	Wolwedans Dam allocation (3,5 x $10^6 m^3/a$) has yet to be taken up. This allocation may be cheaper than the costs currently incurred for pumping out of the Moordkuils River into Klipheuwel Dam – comparison of costs required. Groundwater from the TMG aquifer is a further option.
		PetroSA	Wolwedans Dam at 99% level of assurance	Wolwedans Dam – establish PetroSA's future requirements. This is key for the future allocations from Wolwedans Dam and National Water Resource Planning for the region.
		Groot Brakrivier	Klipheuwel Dam, E Robertson Dam	Wolwedans Dam
		Hartenbos	Klipheuwel Dam, E Robertson Dam	Wolwedans Dam
		Klein Brakriver	Run-of-river from Great Brak	Wolwedans Dam
		INTERBASIN TRANSFER		
		Witsand	Water supplied from Heidelberg through Overberg Water. 1,8l/s is their quota. In peak season 3,5l/s supplied from a borehole.	Groundwater from Breede WMA (Potberg) piped across the Breede River. Unlawful abstraction of the apparent "surplus" Duiwenhoks water needs to be confirmed. Desalination of Breede River water.

(1) Refer to the Reconciliation of Water Supply and Demand Strategy (1.3) in which a review of the water availability and water requirements in the Mossel Bay region is recommended.

TABLE 6.1.1 (cntd) CURRENT AND POTENTIAL SUPPLY OPTIONS TO TOWNS IN THE GOURITZ WMA

District Municipality (DM)	Local Municipality	Towns	Current Source of Supply	Future Source of Supply
GARDEN ROUTE / KLEIN KAROO	George	George	Garden Route Dam	Invasive alien plant removal. Raising Garden Route Dam. Possible schemes on coastal rivers (Gwaing and Maalgaten) could be investigated. TMG potential in the Outeniqua Mountains.
		Wilderness	Garden Route Dam	From George
		Victoria Bay	Garden Route Dam	
		Herold's Bay	Garden Route Dam	
	Knysna	Belvedere Estate	Knysna Municipality & local borehole.	From Knysna River
		Brenton	Knysna Municipality	
		Knysna	Knysna River, run-of-river basis and off-channel storage	Boreholes along the Gouna River Valley as well as deep drilling into large regional fault system (200 – 300m deep). A dam on the Gouna River is a further possibility (no study done yet) and also additional off-channel storage.
		Rhenendal	Abstracts from the Goukamma River	
		Sedgefield	Abstraction from Karatara River	Off-channel storage for abstractions from the Karatara River.
		Buffelsbaai	Abstraction from Goukamma River	Off-channel storage for abstractions from the Goukamma River.
	Plettenberg Bay	Plettenberg Bay	Pumping from Keurbooms River. Also Roodefontein Dam as well as groundwater from 6 inland boreholes.	Off-channel storage adjacent to Keurbooms River. Raise Roodefontein Dam and increase pumping from Keurbooms River to meet peak demands. Saline intrusion limits the potential of the Keurbooms Aquifer.
		Keurboomstrand	Keurbooms aquifer via numerous wells and boreholes	Off-channel storage adjacent to Matjies River. Obtain share in Buffels River Dam. Obtain water directly from Plettenberg Bay works.
		Kurland	Small pool in Wit River, run-of-river	No scheme evaluated
		Nature's Valley	Natural Pool in Groot River, run-of-river pumping scheme	No scheme evaluated
	Kannaland	Zoar	Tierkloof Dam	Supply from Sewe-Weeks Poort to proposed storage reservoir at Zoar
		Calitzdorp	Calitzdorp Dam on the Nels River & boreholes to a lesser extent.	Additional allocation from Calitzdorp Dam and further development of groundwater resource (Rooiberg). Also attention to reticulation losses.
		Ladismith	Local Mountain Stream	
		Ladismith / Van Wyksdorp Rural Water Supply Scheme	Scheme not yet operational.	Boreholes on own private properties to supply water for domestic use.
		Van Wyksdorp	Supplied from a spring in the Rooiberg as well as boreholes.	Further development of the groundwater resource. Lei-water exchange is also a possibility.
WESTERN DISTRICT		Uniondale	Boreholes and run-of-river	Purchasing water from Haarlem Dam (IBT) or TMG Aquifer

6.2	WATER USER ASSOCIATIONS STRATEGY
Management Objective	The objective of this strategy is to ensure the formation of Water User Associations (WUAs) and the inclusion of all water users who wish to partake in water related activities for their mutual benefit and to perform dedicated water resource management functions.
Situation Assessment	WUAs are co-operative associations of individual water users who wish to undertake water-related activities at a local level for their mutual benefit. They do not only include agricultural users but also Water Services Providers and Water Service Authorities. The WUAs are at a second tier level to the CMAs and will act as the watchdogs over the activities of their members. Where a local authority falls within a particular WUA, that local authority remains responsible for the provision of water to its users. Although the process of establishing WUAs is in progress, to date none have yet to be formerly instituted in the Gouritz WMA. Although existing irrigation boards may form the biggest component of certain WUAs, the formation of a WUA does not merely involve transformation of existing irrigation boards. All users falling into the area covered by a particular WUA are to be incorporated within it. The exceptions to this are the urban water users who are monitored by their relevant local authority. In the agricultural sector in particular, disputes have arisen within this WMA over the use of water from a particular resource. In general, over abstraction and inefficient conveyance systems have had impacts on the assurance of supply to "downstream" users. The inclusion of users in a particular region into one WUA is part of a solution to resolving such disputes. Furthermore, users who have not previously been part of Irrigation Boards will through the formation of WUAs, be able to participate in water related activities for mutual benefit. Appendix 7 lists the irrigation boards in the Gouritz WMA, whilst Appendix 8 lists the Forums that have been established. Disputes are currently occurring over available water from existing resources out of the Oukloof Dam (operated by Cordiers Irrigation Board), where farmers upstream of the dam abstract directly from the Cordiers River. Those downstream are supplied via earth canals (significant losses) and receive lower assurances of supply. Similarly, over-allocation in the Stompdrift/Kammanassie irrigation area and the competition for limited available water is a problem. There are 4 irrigation boards currently supplied from the Olifants Government Water Scheme (Olifants and Kammanassie Rivers) and tributaries of rivers feeding that scheme. These are: • the Stompdrift – Kammanassie Irrigation Board (J31, J32, J33, J34,J35) that is supplied form the Stompdrift Dam, the Kammanassie Dam, the Olifants and the Kammanassie Rivers. • the Jan Fourieskraal Irrigation Board (J33F) is supplied from the Olifants River and the Stompdrift and Kammanassie dams. • the Klip River Irrigation Board is supplied from Bos River Dam and mountain streams • The Wynands River Irrigation Board is supplied from the Grobbelaars River and Koos Raubenheimer Dam. • In addition there are numerous private irrigators on other tributary rivers. In the Gouritz/Goukou/Duiwenhoks sub-area, over-utilisation by irrigators in the upper reaches of the Langtou River (J40C) is impacting on downstream users. Probable unlawful abstraction from the Duiwenhoks River is impacting the flow into the Duiwenhoks River Estuary. Whilst a WUA has been proposed for the Duiwenhoks River (H80A-C), one for the lower reaches of the Gouritz River (J40), which includes the Langtou River (J40C), has not. The challenge facing the establishment of WUAs in this WMA is the need to manage the potential tension between different water users.

6.2	WATER USER ASSOCIATIONS STRATEGY (cntd)
Situation Assessment (cntd)	There are 25 irrigation boards in the Gouritz WMA, which will be transforming into WUAs. Some irrigation boards may amalgamate with others into one WUA whilst other WUAs may be contain just one irrigation board (amongst its other members). Water Service Providers and Water Service Authorities will also form part of the transformation into WUAs. To date only one WUA has been formerly approved for establishment in the Gouritz WMA. This is the Crags (Rondebosch) WUA, situated at the Crags area near Plettenberg Bay and is a new WUA not including any irrigation board. Three other new WUAs (of no former irrigation boards) are also to be established in the future, namely Kruisrivier, Lemoenskloof and Van Rynsdorp. Of the 25 existing irrigation boards, the draft constitutions of two are awaiting review by the Minister for approval as WUAs. These are the Stompdrift/Kammanassie WUA (J31-J35) and the Jan Fourieskraal WUA (J33F). A further three irrigation boards have indicated their intention to the RO to group together under one WUA, namely: ⇨ Gamka River Irrigation Board (J25E) ⇨ Buffelsvlei-Gamka Irrigation Board (J25C) ⇨ Calitzdorp Irrigation Board (J25C, J25D)
Strategic Approach	The establishment of WUAs is a task defined at national level, and the particular approaches to be taken are not specific to this WMA. WUAs are one of the key institutions best able to allocate, manage and control water resource use by and within its membership. It is expected that there will be a significant degree of self-policing. The RO has a facilitating role in the establishment of WUAs and should take this on with vigour, ensuring that the process is as smooth as possible and that the associations put in place both meet the requirements of the Act and fulfil its objectives. Most important is that WUAs are properly representative of their users. A monitoring role may well be required. A team with public participation skills needs to take this forward and the RO should provide a strategy reflecting its capacity and capability to drive this process. This team is likely to be the same as that supporting the establishment of a CMA. The formation of WUAs in the Gouritz WMA will be best managed through utilising the resources of the existing irrigation boards that fall within each WUA. It is however apparent that there are disputes occurring between certain irrigation boards, where existing water resources are shared. The selection of which users will best be incorporated into each WUA requires careful consideration so as to ensure best management of the water resource on which these existing irrigation boards are dependent. Irrigation Boards and other users must be transformed into WUAs throughout the WMA in such a way that best facilitates the management of the resource. Irrigation boards operating upstream and downstream of a particular dam should be incorporated into one WUA, through which any current disputes over water use, can be best resolved. The remaining irrigation boards within the Olifants sub-area should be considered for inclusion under one WUA (this excludes the two pending approval already). Where Irrigation Boards are not present, new WUAs should be established. This would be applicable in the Langtou River catchment for example (J40) where over-abstraction from the river is impacting on downstream users. A WUA would be beneficial in the Duiwenhoks River catchment, to resolve the problem of probable unlawful abstraction and its impact on the estuary.

6.2	WATER USER ASSOCIATIONS STRATEGY (cntd)
Management Actions	The following actions are required: • A programme to see the balance of the irrigation boards transformed into WUAs needs to be established, taking the most water stressed areas and those in which disputes are occurring into consideration first. • DWAF should provide technical assistance to WUAs for implementing WC/DM in the agricultural sector, through the implementation of best management practices. • The WUAs will be expected to ensure that all users within the WUA are monitored, both in terms of abstraction and discharge.
Priority and Responsibility	The implementation of this strategy is the responsibility the RO in consultation with the Directorate: Institutional Oversight. It is of priority 2 – High.

STRATEGIC AREA 7: SOCIAL

The Department of Water Affairs and Forestry recognises that water resource management decisions should take due consideration of the social, economic and ecological impacts – this in addition to the considerations of the hydrology which have always driven decisions in the past. This multi-faceted decision base is becoming more and more necessary as the resource becomes ever more scarce.

It is important that DWAF highlights the social aspects of its agenda. These are already very clear in the quest for equity, in support for resource poor farmers, in the water supply and sanitation programme, and in the poverty alleviation drive, but it is nevertheless very important that DWAF never loses sight of its social responsibilities.

The protection of downstream inhabitants in the event of flooding is inadequate in the Gouritz WMA and would be best addressed through the implementation of early warning systems. The existing flood warning is inadequate, particularly along the Lower Gouritz River, where the effects of cumulative flood events from the significant upstream catchment area, could have disastrous impacts.

The Department has been tasked with the development of a National Flood Management Policy, which will form a part of a National Disaster Management Framework. Disaster management plans will be developed and fed into the National policy.

Contrary to flood risk, is the risk associated with water supply during periods of drought. Whilst the agricultural sector in much of this WMA has adapted to making best use of low assurances of supply, the urban sector regularly experiences water shortages and is less able to absorb such pressure.

The recreational use of state owned dams is being addressed through the development and implementation of a national strategy. No particular aspects relevant specifically to this WMA have been identified. As such, a local strategy pertaining to the use of state owned dams in the Gouritz WMA, has not been developed in this ISP.

One strategy has been identified for development, namely:

7.1 Disaster Management

7.1	DISASTER MANAGEMENT STRATEGY
Management Objective	The objective of this strategy is to prevent water related disasters and to mitigate the effects of disasters that may occur, through implementation of the strategies and policies that will come into effect through the National Disaster Management Act. Mitigation procedures that can be taken to alleviate the effects of drought need to be co-operatively and actively sought by DWAF, in conjunction with the Department of Agriculture.
Situation Assessment	Guidelines for the operation of large storage dams, the safe use of floodplains, the design of infrastructure exposed to flood risk and effective flood warning systems will be included in the Flood Management Policy. The Lower Gouritz River receives flood water from the Gamka, Buffels, Groot, Touws, Olifants and Kammanassie Rivers and their tributaries. Adequate flood warning systems are not in place to provide early warning to the Lower Gouritz area and as such flood management is inadequate. The Gamkapoort Dam on the Gamka River is ideally situated to play a key role in terms of flood warning, yet there is no automated flood warning system in place at the dam. The risk of synchronised hydrograph flood peaks (the cumulative effect) from two or more large upstream catchments is of particular concern in the lower Gouritz River. Similarly, the flood warning system on the Olifants River is an informal one, relying on word of mouth flood warning from one farmer to another. In the absence of proper telemetry, farmers upstream relay warnings to others downstream. The Floriskraal Dam on the Buffels River is owned by DWAF and operated by the Irrigation Board, supplying water to the Buffels River Government Water Scheme. The dam has 10 bottom outlet radial gates. These tend to draw in debris when opened and there is concern that the gates may not be able to be closed. As a result, the operators are reluctant to use them. As such it is unlikely that the dam is able to function within the Departments own dam safety criteria, particularly with respect to passing of flood peaks and the stability of the dam wall itself. Complete refurbishment of the gates is likely to involve extensive financial costs. An alternative is being considered by the Department, in which the gates will be permanently closed. Spillway capacity will then need to be increased to comply with the dam safety requirements. Large scale flooding occurs in the smaller coastal catchments that lie in the high rainfall region. There are no major dams on these short reach rivers and as such, little attenuation is available to reduce the flood peaks that occur in them. The Department of Agriculture is responsible, through the National Disaster Management Centre, for the development of mitigation procedures for managing the impacts of drought. DWAF should be inextricably involved in any remedial planning to manage the impacts of drought.
Strategic Approach	The Department will lead a specific working group, tasked with the development of a National Flood Management Policy, which will form a part of a National Disaster Management Framework. The development of Catchment Management Strategies as well as business plans of WUAs will also be required to make provision for water related disasters. In the Gouritz WMA, particular attention needs to be focussed on the establishment of strategically placed flood warning systems. Priority should be afforded to early flood warning in the lower reaches of the Gouritz River, where compounding flood peaks from the large upstream catchments pose a risk to human life and property damage. Best use should be made of the existing dams in the upstream catchments for the purpose of early flood warning. Co-operation between DWAF and the Department of Agriculture is required to implement appropriate water resource management during droughts. This must look into alternative sources of emergency supply during drought, which in this WMA can be provided by further exploitation of the available groundwater resource.

7.1	DISASTER MANAGEMENT STRATEGY (cntd)
Management Actions	The following actions are required: • The transfer of ownership of those dams that are identified as being potentially unsafe (Floriskraal for example) should be reconsidered until such time as remedial dam safety measures are taken. • The transfer of the operation and maintenance responsibility of such dams should be carefully structured in the agreements, so as to ensure that the responsible authorities have the necessary capacity to safely operate such dams in the event of flooding. • Priority should be given to the provision of suitable flood warning systems along the major tributaries of the Gouritz River. A flood warning system at Gamkapoort Dam is required as well as telemetry along the Olifants River. These systems should be integrated to provide early warning of flood risk to the Lower Gouritz River. • Early flood warning systems should be implemented along the rivers of the coastal catchments where development is most pronounced. • Disaster Management Plans for each DWAF owned dam in the WMA must be compiled by the RO in consultation with Provincial Disaster Management authorities and incorporated into the National Flood Management Policy. • The Disaster Management Plans must include remedial measures, such as alternative sources of supply in the event of non-supply from current sources. This would include the use of groundwater to meet emergency requirements where surface water is not available.
Priority and Responsibility	The implementation of this strategy is the responsibility the RO in consultation with the Directorate: Policy and Strategy Co-ordination. It is of priority 2 – High.

STRATEGIC AREA 8: WATERWORKS AND DEVELOPMENT

The policy on the transfer of ownership of existing State-owned and operated infrastructure is being developed. The optimal institutional arrangements for the development of new water resources infrastructure in general, and the development and management of schemes that include dams in particular, is also under investigation. At this stage the transfer of operation and maintenance responsibilities for irrigation schemes, to appropriate water management institutions, is being put in place. The transfer of ownership will be considered at a later stage once the operation and maintenance performance of the accepting institution has been monitored.

Two strategies have been identified for development, namely:

8.1 Operation and Maintenance of DWAF owned Infrastructure

8.2 Construction of New Works

8.1	OPERATION AND MAINTENANCE OF DWAF OWNED INFRASTRUCTURE STRATEGY
Management Objective	The objective of this strategy is to ensure appropriate and comprehensive Operation and Maintenance (O&M) Agreements for the transfer of this responsibility to independent water management institutions.
Situation Assessment	A policy for transferring of DWAF owned infrastructure to appropriate water management institutions is under investigation at national level. The current policy is that whilst the ownership of reticulation infrastructure such as pipelines, canals, pumpstations and abstraction works may be transferred, ownership of dams may not yet be transferred. A programme is already in place for the delegation of O&M responsibilities for irrigation schemes to WUAs. This is being carried out for the distribution infrastructure only (canals and pipelines). Where dams form part of a scheme, revised O&M agreements between DWAF and the WUAs need to be developed. Thereafter the WUAs will operate and maintain the dams according to such agreements. Table 8.1.1 presents the main dams in the Gouritz WMA that are owned by DWAF and shows the current status of the transfer of O&M responsibilities for the distribution infrastructure to the WUAs. Of the eighteen schemes listed in the table, the RO has indicated that official agreements are in place for the transfer of O&M of six of them to other institutions, namely: o Floriskraal Dam o Stompdrift Dam o Kammanassie Dam o Duiwenhoks Dam o Korente-poort and De Novo Dams which are part of the same scheme o The Klein Karoo Rural Water Supply Scheme
Strategic Approach	In accordance with the Departments Policy for the Transfer of Government Water Services Works, the Department will continue to transfer the ownership of infrastructure to Water Services Institutions (WSIs). Dams will receive particular attention but only the O&M responsibility will be initially transferred, until the associated obligations of the particular WSI have been monitored over a period of at least five years. Where dams form part of an integrated bulk water supply system, the infrastructure ownership will be retained by DWAF (notably Wolwedans Dam in this WMA). Eventual transfer of ownership of the assets will be considered pending the performance of the WUA in carrying out its O&M obligations. Those dams owned by DWAF that supply mainly domestic users, will have their O&M obligations (and eventual ownership) transferred to an appropriate WSIs, such as a local authority, Water Board or equivalent Water Service Authority or Provider.

8.1	OPERATION AND MAINTENANCE OF DWAF OWNED INFRASTRUCTURE STRATEGY (cntd)
Management Actions	The following actions are required: • The existing programme for the transfer of O&M responsibilities of irrigation schemes to WUAs, should be reviewed and expanded to cover: o the remaining eleven schemes which in the next 2 years will have their O&M agreements concluded with appropriate WSIs (ie. not only irrigation schemes but also water services schemes); o all schemes which in the next 5 years will have their ownership concluded with appropriate WSIs. • Develop revised O&M agreements for transfer of infrastructure. • Co-ordinate any regional transfer initiatives through consultation with the relevant WSIs and other affected role players. • Refurbish infrastructure to an acceptable operating / safety state before transferring the O&M thereof. • Facilitate the building of capacity within the WSI where this may not be adequate. • Monitor the operating and maintenance performance of the WSI.
Priority and Responsibility	The implementation of this strategy is the responsibility the RO in consultation with the Manager: National Transfers and the Directorate: Water Resource Finance and Pricing. It is of Priority 3 – Medium.

TABLE 8.1.1: STATUS OF TRANSFER OF GOVERNMENT OWNED SCHEMES

Scheme Name	River	Quat	Use	Status of O&M Transfer
Gamka (Beaufort West)	Gamka	J21A	Municipal.	Dam operated by Beaufort West Municipality & maintenance by DWAF; Dam to be transferred to municipality as water services scheme. Asset transfer to follow policy approval. Distribution pipeline owned by Municipality.
Leeu Gamka	Leeuw	J22K	Leeu Gamka River Irrigation Board	Dam operated by Irrigation Board & maintenance by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval. Distribution canal O&M by Irrigation Board.
Oukloof	Cordiers	J23E	Cordiers River Scheme	Dam operated by Irrigation Board & maintenance by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval. Distribution canal owned by DWAF. O&M by Irrigation Board.
Gamkapoort	Gamka	J25A	Buffelsvlei and Gamka River Irrigation Boards	Dam operated by Irrigation Board and by DWAF, with maintenance by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval.
Tierkloof Dam	Huis	J25B	Domestic supply to Zoar community.	Dam Operated by Kannaland (Zoar) Municipality & maintenance by Municipality and by DWAF. Asset to be transferred to them as a water services scheme, subject to policy approval. Distribution pipeline owned by municipality.
Floriskraal	Buffels	J11F, G,H	Buffels River Irrigation Scheme	O&M by Irrigation Board that is transforming to a WUA. O&M of radial gates by DWAF. Asset transfer to follow policy approval.
Verkeerdevlei	Donkies	J12B	Verkeerdevlei Irrigation Board	Dam operated by Irrigation Board & maintenance by Irrigation Board and by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval.
Miertjieskraal	Brand	J12M	Irrigation	Dam operation by Irrigation Board & DWAF. Dam maintenance by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval. Distribution canal owned by DWAF. O&M by Irrigation Board.
Stompdrift	Olifants	J33B	Olifants River Govt Water Scheme	Dam operation by Irrigation Board & DWAF. Dam maintenance by DWAF. To be transferred to WUA (Irrigation Board still to transform). Asset transfer to follow policy approval. Distribution canal owned by DWAF. O&M by Irrigation Board.
Kammanassie	Kamma-nassie	J34E		

TABLE 8.1.1 (cntd): STATUS OF TRANSFER OF GOVERNMENT OWNED SCHEMES

Scheme Name	River	Quat	Use	Status of O&M Transfer
Duiwenhoks	Duiwenhoks	H80A	Heidelberg town; Duiwenhoks Rural Water Supply Scheme; Duiwenhoks River Govt Scheme	O&M by Irrigation Board that is transforming to WUA. Asset transfer to follow policy approval
Korente-poort	Korente-Vette	H90B	Riversdale town; Korente-Vette Irrigation Scheme	O&M by Irrigation Board that is transforming to WUA. Asset transfer to follow policy approval
De Novo Dam	Vette	H90B	Part of Korente-Vette Irrigation Scheme, feeding into the irrigation system canals	
Hartebeeskuil	Hartenbos	K10B	Irrigation and stockwatering	Future uncertain. Very poor yield. Dam O&M by DWAF. No Irrigation Board or WUA in place
Klipheuwel	Off-channel	K10F	Mossel Bay	Dam O&M by Mossel Bay Municipality & DWAF. To be transferred to Municipality as water services scheme. Transfer of asset (Dam & pump station) to follow policy approval. Distribution pipeline owned by Municipality.
Wolwedans	Great Brak	K20A	PetroSA refinery and future supply to Mossel Bay	Dam and distribution pipeline: O&M by PetroSA & DWAF. Integrated System and will therefore remain DWAF property.
Roodefontein Dam	Piesangs	K60G	Irrigation and Plettenberg Bay town supply.	O&M by Plettenberg Bay Municipality. Asset to be transferred to them as a water services scheme. Alternatively a WUA to be established. Asset transfer to follow policy approval. Distribution pipelines owned by Municipality and the Trust managing the Jakkalsfontein farming concern.
KKRWSS	n/a	n/a	Domestic water supply to Dysselsdorp, rural domestic supply to farm workers and stockwatering.	Klein Karoo Rural Water Supply Scheme is a Water Services Scheme. Ownership is to be transferred to a Water Service Authority (Oudtshoorn Municipality in this case). Oudtshoorn Municipality may choose to run the scheme themselves, or appoint a Water Service Provider, such as Overberg Water, for the operation and maintenance of the scheme. DWAF is busy negotiating the terms of the transfer.

8.2	CONSTRUCTION OF NEW WORKS STRATEGY
Management Objective	The objective of this strategy is to identify new water resource infrastructure that could be constructed in the Gouritz WMA for the development of additional yield from both the surface and groundwater resource.
Situation Assessment	With the exception of the coastal catchments in which surplus winter water may be available for abstraction (subject to the Reserve being met), to off-channel storage facilities, there is very little potential for the further development of the surface water resource in this WMA. Where surface water development may be possible, the schemes are all local supply schemes and relatively small. **POTENTIAL SURFACE WATER SCHEMES** In the coastal catchments the following potential surface water schemes have been identified: Further abstraction out of the Keurbooms River This was investigated during the Plettenberg Bay Coastal Catchments Study (DWAF, 1996). It would entail the abstraction of surplus winter water by pumping from the Keurbooms River into a new off-channel storage facility, for supply via gravity pipeline to Plettenberg Bay. An increase in yield of between 3 and 6 million m^3/a would be possible. The current pumping capacity from Roodefontein Dam to Plettenberg Bay (96 *l*/s) is a limitation in terms of any additional use by Plettenberg Bay from the dam. Additional pumping capacity would therefore be necessary, in order to meet the peak seasonal demands at Plettenberg Bay out Roodefontein dam. Raising Roodefontein Dam This involves the raising of the existing dam wall. A 1,5m raising is currently in progress (due to be completed by end of 2003) to increase the storage capacity from 1,4 to 2,0 million m^3. In addition, water abstracted during high flow periods from the Keurbooms River into a new off-channel storage dam, would then be transferred into Roodefontein dam, when Roodefontein has spare capacity. From there, Plettenberg Bay would be supplied during peak demand periods. Dam on the Gouna River No study has been undertaken. This may be a possible site and in the event of it being studied, off-channel storage with abstraction of seasonal high flows out of the river should be the priority. Off-channel storage at Sedgefield The current limitation in the supply of water to the town of Sedgefield is largely due to the lack of off-channel storage. It may be an option to abstract seasonal high flows from the Karatara River into an off-channel storage facility. Possible schemes on coastal rivers Studies would need to be undertaken to determine the viability of developing the yield of certain coastal rivers using off-channel storage to store seasonal high flows. Raising the Garden Route Dam In addition to the option of removing invasive alien plants from upstream of the Garden Route Dam at George, there is also potential to raise the dam itself. Outside of the coastal catchments, there is a possible option for a dam (Kombuis Dam) on the Grobbelaars River at Oudtshoorn. Also there is a possibility for an IBT out of Haarlem Dam in the Tsitsikamma-Coega ISP area, piped to Uniondale in the Gouritz WMA.

8.2	CONSTRUCTION OF NEW WORKS STRATEGY (cntd)
Situation Assessment	**POTENTIAL GROUNDWATER SCHEMES** The potential for development of the groundwater resource within the TMG is described in the Groundwater Strategy (1.4). In particular the DAGEOS study is investigating the potential for municipal supply to the town of Oudtshoorn. This will be reliant on abstraction out of the TMG, with a focus on the Peninsula Aquifer. Expansion of the KKRWSS from its current capacity of 1,1 million m^3/a to 1,5 million m^3/a is a possible option. Groundwater abstracted from within the Breede WMA (Potberg) piped across the Breede River to supply the town of Witsand is an IBT option. Further groundwater resource development in the Beaufort West area is possible but additional wellfields further a field from the current wellfield would be required.
Strategic Approach	Some development of off-channel storage infrastructure in the coastal catchments for storing surplus water during periods of high seasonal flow may be possible. Elsewhere, the development of the groundwater resource, particularly out of the TMG, holds significant potential for further development. Precautionary measures (revised GAs for example) must be adopted to ensure the sustainability of groundwater from primary aquifers in close proximity to the coast. Saline intrusion must be prevented. The recommendations and suggestions made in the Groundwater Strategy (1.4) should be carefully considered and implemented.
Priority and Responsibility	The implementation of this strategy is the responsibility the RO in consultation with the Directorate: National Water Resource Planning. It is of Priority 4 – Low.

STRATEGIC AREA 9: MONITORING AND INFORMATION

The key to effective Integrated Water Resource Management lies in the need to understand to what extent the water resource is being used and by whom.

Water use is controlled through the issuing of authorisations or licences that define the limits within which that use may take place. As such monitoring must be in place to control the use of water and to ensure that it is within the conditions under which it is authorised.

The reliance on groundwater in the Gouritz WMA will continue to increase as the surface water resource becomes more stressed, and with limited potential for further surface water yield development. Very little information is available on which to base informed management decisions in terms of the aquifers in the WMA, and the Reserve requirement for the groundwater resource cannot be reliably determined.

Even effectively designed monitoring networks are of little use if the data collected from them is not processed, analysed and then disseminated to those authorities managing the resource. The sharing of information between the various authorities conducting monitoring, is not yet being effectively implemented. In the Western Cape a start has been made by getting all the co-operative governance partners involved in monitoring to co-ordinate a strategy, based on mutual needs and on achieving efficiencies by combining efforts in terms of both data collection and information management. DWAF is the obvious driver of this process and has been requested to maintain this role. More attention and resources are required if this is to keep its momentum. One of the core strategic approaches already adopted by this group is that no data should have exclusive ownership and that the sharing of data should be maximized to the benefit of all.

Two strategies have been identified and developed namely:

9.1 Abstraction Control Monitoring
9.2 Monitoring Networks and Data Capture

9.1	ABSTRACTION CONTROL MONITORING STRATEGY
Management Objective	To facilitate improved control and management of water abstractions, compliance with authorisations and reliable information on actual water use.
Situation Assessment	Monitoring and control of abstraction is important because it is probable that in certain areas of the WMA, unlawful water use (including exceedance of licensed volumes) is taking place. Through the ISP process to date, indications are that probable areas of concern include the Duiwenhoks River catchment (H80) and in the Langtou tributary (J40C) of the Gouritz River, where over abstraction may be taking place. The Duiwenhoks River feeds the ecologically important Duiwenhoks estuary and visual inspections by RO officials suggest that inflows to the estuary appear to be reducing. The more downstream users in the Langtou River catchment are experiencing lower assurances of supply than expected. Abstraction for irrigation purposes outside of schemes is currently difficult to control and would require continual policing to ensure compliance with the conditions of authorisations. The control of over abstraction for use is applicable to both surface and ground water resources. Abstraction control is generally managed through the installation of bulk meters at abstraction points from bulk infrastructure. Abstraction control by service providers and large private users from their own infrastructure is their responsibility but will ultimately become the responsibility of the WUAs who will be responsible for monitoring the collective water use of all members. The WUAs will bill their members for their respective water use. The monitoring of abstractions is necessary to ensure that, the volumes of water used are known and records are kept, tariff calculations can be made, sectoral water use can be determined and that users comply with their authorisations.
Strategic Approach	Control of over abstraction is going to become ever more critical as water becomes scarcer and competition for the resource intensifies. This is a particular concern in the case of relatively uncontrolled shared water, such as artesian aquifers accessed by many different users, and where dam releases are made for selective uptake by farmers further downstream. These are systems open to abuse. First indications suggest that farmers have over registered their water use in the Gouritz WMA and the extent of this must be determined through verification of exiting lawful use. Abstraction control must, as far as possible be delegated to WUAs, where users are expected to care for their collective interests through self-policing. Additional monitoring is always going to be required – particularly on behalf of the Reserve, which is in no position to fight for itself. To give effect to this, the RO needs to develop a strategy in which areas of concern are identified and the necessary resources obtained to implement abstraction control monitoring.
Management Actions	The following actions are required: • Review and document the acceptability of current monitoring of usage (what is currently monitored, how acceptable is it and what is required to meet the needs). • Ensure that the scope of appointment of WUA's outlines their responsibility in terms of self-policing. • Identify the extent of additional resources that would put the necessary monitoring in place to ensure that the requirements of the Reserve are not being impacted upon by unlawful abstraction. • Develop capacity within the CMA to undertake monitoring.
Priority and Responsibility	The implementation and co-ordination of this strategy must be driven at WMA level by the RO in consultation with the Directorate: Water Abstraction and Instream Use. It is of priority 2 – High.

9.2	MONITORING NETWORKS AND DATA CAPTURE STRATEGY
Management Objective	The design and implementation of effective monitoring networks and repository databases to ensure adequate quantification of the balance between sustainable water use and the protection of surface freshwater bodies and groundwater.
Situation Assessment	DWAF is currently in the process of developing a National Monitoring Strategy which seeks to: i Improve monitoring networks so that the resource can be accurately quantified for allocations and management accounting purposes; ii Improve on efficiencies in the gathering of information, particularly through institutional co-operation in data capture and management; iii Set and maintain standards for the capture, processing and management of information; iv Ensure that data is accessible to stakeholders without compromising data security. v Share and further develop the necessary capacity to achieve this. **A) <u>GROUNDWATER MONITORING</u>** Within the Gouritz WMA, groundwater monitoring is undertaken at monthly intervals (at least) at approximately 100 monitoring boreholes. The distribution and number of monitoring boreholes is insufficient to be able to target entire aquifer systems. Whilst these are not the only boreholes that are monitored, the remaining ones from which the RO receive data are either monitored at 3 monthly, 6 monthly or yearly intervals. This is not considered to be adequate. From information provided by the RO, it is unclear as to exactly what monitoring is undertaken at these 100 boreholes. The indication is that at some of them both water level and water chemistry are recorded. At others one or the other is recorded. The locations of the boreholes that are monitored (at least once a month) and from which data is compiled by the RO are shown on Figures A14.2 and A14.3 of Appendix 14. These are referred to as *"DWAF Geohydro-Monitoring Sites"*. At some of these sites monitoring is undertaken by the RO and at other sites it is left up to the wellfield operator. Examples include the KKRWSS operated by the Overberg Water Board and the Beaufort West wellfield, operated by the local authority. Current and future supply options are very dependent on groundwater. As such protection of the resource is necessary, through monitoring and through wise use informed by that monitoring. In particular, an understanding of the interaction between groundwater and surface water must be attained, as this is a key parameter in eventually determining a groundwater Reserve. Due to the vast size of the Gouritz WMA, coupled with the lack of resources at the RO, it is very difficult to currently improve on the monitoring of groundwater and the interpretation of recorded data. It is also possible to obtain further data by attaching monitoring conditions to new abstraction licences. This would offer an opportunity to expand the network and provide information to support Reserve determinations, for example. On the contrary however, licences cannot be issued without undertaking a Reserve, which is in turn requires information provided by monitoring.

9.2	MONITORING NETWORKS AND DATA CAPTURE STRATEGY (cntd)
Situation Assessment (cntd)	The possible further exploitation of the groundwater resource by expanding existing well fields (at Beaufort West for example), introduces additional monitoring requirements and data interpretation by the already under resourced capacity of the RO. A Reserve determination for surface and groundwater is required if the proposed DAGEOS (Deep Artesian Groundwater Exploitation for Oudtshoorn Municipal Supply) project, being investigated by Oudtshoorn Municipality, is to be implemented. The extent of saline intrusion occurring along the coast requires specific monitoring. As discussed in the GA Strategy (3.1.), changes to the GAs for groundwater abstraction in the immediate vicinity of the coast have been proposed by the RO. Ongoing monitoring will be required to determine if these intrusions are continuing or if yet stricter use restrictions are required. The contamination of local groundwater sources from seepage out of sub-surface tanks used to store hydrocarbon fuels has been observed at Beaufort West and Leeu-Gamka. **B) <u>SURFACE WATER MONITORING</u>** In the Gouritz WMA the main flow gauging concern is that gauging in the Olifants River catchment is not adequate. This is because the sites for construction of flow gauging weirs are limited. Impoundment behind weirs constructed in these relatively wide river sections will impact on farmers' abstraction points, already in place. Appendix 12 provides a list of all the flow gauging stations in each of the five sub-areas within the Gouritz WMA. The existing weir on the Knysna River is being upgraded to provide improved low flow data for an Intermediate Reserve determination of the estuary. The RO is also considering a stage recorder in the Goukamma Estuary at Buffelsbaai. The flow gauging station on the Langtou River, just upstream of Herbertsdale was washed away during flooding in 1997 and has yet to be replaced. Uncertainty regarding the extent of unlawful abstraction from this river suggests that it may be important to reconstruct this flow gauging station and reinstate monitoring at it. **C) <u>INFORMATION MANAGEMENT</u>** The following shortcomings with respect to information management in the Gouritz WMA have been identified during the ISP process: • Capturing of registration data is still in progress and verification of that data is required. • The mapping of invasive alien plants from 2001 aerial photography is not yet complete. • There is a need to improve the sharing of information between DWAF and local authorities. In the Gouritz WMA and at a broader level, the Western Cape, there has been a disjointed effort in managing the data that was available. This is currently being addressed through the co-ordinated development of a Western Cape Monitoring Strategy, involving all relevant monitoring institutions and local authorities. Certain local authorities undertake their own monitoring of their local resources and this information is not always made available to DWAF. Plettenberg Bay for example, undertakes groundwater monitoring, yet this information is not shared with the RO. Similarly, the information held by DWAF is also not readily available to other authorities and as such duplication of effort can result.

9.2	MONITORING NETWORKS AND DATA CAPTURE STRATEGY (cntd)
Strategic Approach	The RO should co-ordinate all water resource monitoring in this WMA. This should as a first priority determine and co-ordinate all existing monitoring, and secondly determine and co-ordinate all additional requirements for monitoring. In the Western Cape a start has already been made by getting all the co-operative governance partners involved in monitoring, to co-ordinate a strategy, based on mutual needs and on achieving efficiencies by combining efforts in terms of both data collection and information management. DWAF has proved to be an obvious driver in this process and has been requested to maintain this role. More attention and resources are required if this is to keep its momentum. One of the core strategic approaches already adopted by this group is that no data should have exclusive ownership and that the sharing of data should be maximized to the benefit of all. There are concerns regarding the possible mis-interpretation of organisation-specific data by others, and there will inevitably be the need for some cost recovery in certain instances – however these broad principles are endorsed and need to be carried forward through this strategy. The design of a monitoring system to meet the needs of this WMA should offer phased implementation, based on priorities. Priorities should be broken down to critical monitoring points within specific fields of concern, so that the most urgent areas can be attended to first. The extent of precautionary measures that need to be taken by polluters, and the effects of those measures, will be established through improved monitoring. The establishment of WUAs and the structure of their scope of appointment, will offer an opportunity to curtail the extent of unlawful use in the WMA. Develop and implement the Provisional Regional Monitoring strategy that has been drafted by the Western Cape RO and through that process establish what information should be shared, who should have access to it and what the level of integrity of the information will be.
Management Actions	In terms of groundwater monitoring, the following actions are required: • In accordance with the need to expand the national monitoring network, regional planning is needed on how to best expand the existing network in the Gouritz WMA. • The findings of the Water Research Commission study on the recharge within the Table Mountain Group Aquifer needs to be considered, with specific regard to the Gouritz WMA. • DWAF should facilitate the provision of technical assistance to local authorities such that they undertake appropriate monitoring of their individual groundwater schemes. • Investigate extent of impacts on groundwater from point source polluters in the WMA. • Ensure that through appropriate management at the point source, these impacts do not exceed DWAF's waste discharge limits, based on receiving water quality. • A strategy (national) is required to define appropriate design and monitoring requirements for the use of sub-surface fuel storage tanks, the prevention of leakage, and the responsibility for remedial measures. • Ensure that extensions to the existing monitoring network cover the coastal catchments such that saline intrusion can be monitored, and the impacts of abstraction can be determined on an ongoing basis.

9.2	MONITORING NETWORKS AND DATA CAPTURE STRATEGY (cntd)
Management Actions (cntd)	In terms of surface water monitoring, the following actions are required: • Investigate the need for reconstruction of the flow gauging station near Herbertsdale (Langtou River), particularly if monitoring from it would be able to provide some indication of the extent of possible unlawful abstraction upstream of the weir site. • Where new gauging stations are provided to replace existing gauges, the old gauge should be operated for a further period of at least five years so as to improve the calibration of the old gauge in order to improve the reliability of its historical flow record. • Revisit studies done on the potential sites for gauging weirs along the Olifants River and reconsider recommendations made wrt to establishing flow gauging sites. • The extent of precautionary measures that need to be taken by point source polluters, and the effects of those measures, need to be established through improved monitoring of discharge and the impacts on receiving rivers. For example, Plettenberg Bay WWTW discharge licence has been amended (during renewal) and now requires that effluent be treated to Special Standards, as opposed to General Standards, required previously. • In line with the above, attention should be paid to all the coastal catchments particularly those in which the bigger towns are situated. At George WWTW for example indications are that compliance is not being met and measures must be enforced on the basis of monitoring. In terms of information sharing, the following actions are required: • The WUAs should be equipped in such a way that they are able to access the relevant information on the HYDSYS system (or any other preferred system) for its own purposes. • Support the Western Cape initiative being driven by the RO to improve sharing and access to monitoring information. • Together with co-operating partners in the above initiative, the RO must set out the specific principles for monitoring in this WMA, in terms of: o Accuracy requirements o Data completeness o Time frames o Validation processes o Shared information • Motivate and seek funding for the implementation of improved monitoring networks in this WMA.
Priority and Responsibility	The implementation and co-ordination of this strategy must be driven at WMA level by the RO in consultation with the Directorate: Information Programmes and the Directorate: Hydrological Information. This of Priority 3 – Medium.

STRATEGIC AREA 10: IMPLEMENTATION

Implementation strategies are required to provide guidelines on how the ISP process should be taken forward, in terms of managing the process.

One strategy has been identified for development, namely:

10.1 ISP Implementation

10.1	ISP IMPLEMENTATION STRATEGY
Management Objective	To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Gouritz WMA. This will require willpower, funding and capacity.
Situation Assessment	The ISP is an internal document, developed almost exclusively by and on behalf of the DWAF. The ISP sets out the approaches which the Department is taking towards water management in the Gouritz WMA – and lists suggested actions towards achieving good management of the water resource. The wider public has had no input into this ISP – yet it is recognised that the approaches adopted have a significant impact on the populace of the Gouritz WMA. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy – but DWAF setting out how DWAF sees the situation, and the steps which DWAF views as most appropriate in dealing with the situation. The ISP is not a closed document but is to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document – exposing the thinking and planning of the Department in a way that has never been done before. 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 subject to the approach set out in the NWRS – and details this approach for the Gouritz WMA. It 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, nor is it without its flaws. As such the ISP may be adjusted and adapted when new information becomes available. Despite this the approaches and requirements of this ISP may not be ignored. The Implementation of the ISP is an enormous task. 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, and will always be, 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 align all parties concerned, leverage maximum funds, maximum capacity, and to bring optimum management to the WMA.

10.1	ISP IMPLEMENTATION STRATEGY (cntd)
Management Actions	The following actions are required: • Publish the ISP in hard-copy (perhaps even on the Web) for public input and comment. Copies will be presented to key stakeholders, and on request. It is not the intention to have a major drive for public input, but merely to create accessibility for input. • 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, are taken out forcefully both to local authorities, other direct water users such as agriculture, and the wider public. • Collate comment and consider this in revising and improving the ISP. • The ISP should, in any event, be open to continuous improvement, with possible updating on a bi-annual basis. • All Regional staff, Working for Water and other major stakeholders should have access to, or copies of, the ISP • 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! • The practicalities of implementation demands must always be considered. • 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.
Priority and Responsibility	The RO is responsible for implementing this strategy on an ongoing basis. It is of the highest priority (Priority 1) and the implementation is to be ongoing until the Gouritz CMA is established and the ISP is superseded by a CMS.

APPENDICES

Supporting Information Tables

Appendix 1	ISP Sub Areas
Appendix 2	Potable Water Supply Schemes
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Appendix 1: SUB AREAS IN THE GOURITZ WMA

Quaternaries	Rivers/River Reaches	Towns/Suburbs
Coastal (Quats K10-K70)		
K10A-K10F	Hartenbos River, Little Brak River	Mossel Bay, Klein-Brakrivier, PetroSA refinery
K20A	Great Brak River	Groot-Brakrivier
K30A-K30D	Maalgaten River, Gwang River, Kaaimans River, Swart River, Touw River	George, Pacaltsdorp, Wilderness, Victoria Bay, Herolds Bay
K40A-K40E	Diep River, Hoekraal River, Karatara River, Swartvlei River, Goukamma River	Sedgefield, Rhenendal, Buffelsbaai
K50A-K50B	Knysna River	Knysna
K60A-K60G	Piesangs River	Plettenberg Bay
K70A-K70B	Maatjies River, Sout River, Groot River, Bloukrantz River	Kurland, Nature's Valley
Gamka (Quats J21-J25)		
J21A-J21E	Gamka River	Beaufort West
J22A-J22K	Koekemoers River, Leeu River	Leeu Gamka
J23A-J23J	Gamka River	Prince Albert
J24A-J24F	Dwyka River	Merweville, Prince Albert Road
J25A-J25E	Gamka/ Dwyka River Confluence	Zoar, Calitzdorp
Gouritz/Goukou/Duiwenhoks (Quats H80,H90,J40)		
H80A-H80E	Duiwenhoks River	Heidelberg
H90A-H90E	Goukou River	Riversdale, Stilbaai
J40A-J40E	Gamka / Olifants River Confluence, Gouritz / Groot River Confluence	Albertinia, Gouritzmond
Buffels/Groot/Touws (Quats J11,J12, J13)		
J11A-J11K	Buffels River, Groot River/Touws River Confluence	Laingsburg, Ladismith
J12A-J12M	Touws River, Groot River	Touwsriver, Matjiesfontein
J13A-J13C	Buffels / Gouritz River Confluence	Vanwyksdorp
Olifants (Quats J31-J35)		
J31A-J31D	Olifants River	
J32A-J32E	Olifants Confluence	
J33A-J33F	Groot /Olifants RiverConfluence, Kango River, Grobbelaars River	De Rust, Dysselsdorp
J34A-J34F	Kammanassie River	Uniondale
J35A-J35F	Wynands River, Kansa River, Vlei River	Oudtshoorn

Appendix 2: POTABLE WATER SUPPLY SCHEMES IN THE GOURITZ WMA

Water Management Area	Scheme Name	Raw Water Source	River	Population supplied	Million m3/a	Limiting Factor
Coastal	Mossel Bay, Hartenbos, Kleinbrakrivier and Grootbrakrivier	Klipheuwel Dam (off channel) and Ernest Robertson Dams at present, Wolvedans Dam in future.	Klein Brak, Great Brak and Great Brak respecitvely.	41450+1400+6900 = 49750	5,8 (6,9 from futureWolvedans)	Treatment
	George	Garden Route Dam	Swart River	103800	5,8	Source
	Wilderness			3950		
	Wilderness East			2100		
	Sedgefield	Local Surface Supplies		1750	0,17	Not Known
	Knysna	Knysna River	Knysna River	30650	2,2	Not Known
	Plettenberg Bay	Keurboms River, Roodefontein Dam, 4 Boreholes	Keurbooms River	15600	1,79 (1,33+ 0,15 + 0,31)	Conveyance
Gamka	Beaufort West	Gamka (Beaufort West) Dam and 18 Boreholes	Gamka River	26350	0,61	Source
	Leeu Gamka	Boreholes		1350	0,05	Source
	Prince Albert	Small Dam	Dorps River	3800	0,31	Source
	Merweville	Boreholes		800	0,08	Not Known
	Zoar	Tierkloof Dam	Huis River	3100	0,25	Not Known
	Calitzdorp	Calitzdorp Dam and Boreholes	Nels River	3450	0,17	Source
Gouritz/Goukou/Duiwenhoks	Heidelberg	Duiwenhoks Dam	Duiwenhoks River	6800	1,2	Source
	Stilbaai	Boreholes		4300+200=4500	0,58	Not Known
	Riversdale	Korente-vet Dam and Kristalkloof	Korente-Vet River and Kristalkloof	9000	1,4	Source
	Albertina	Boreholes		3250	0,32	Not Known
Buffels/Groot/Touws	Laingsburg	Boreholes in river bed	Wilgenhout and Buffels Rivers	2250	0,89	Source
	Ladismith	Local Mountain Stream from Swartberg		4300	0,58	Source
	Touwsrivier	Small Off-channel Dam fed from a Spring		6200	0,68	Not Known
	Vanwyksdorp	Boreholes in the Rooiberg		400	0,03	Not Known
	Matjiesfontein	Boreholes		236	0,01	Source
Olifants	Oudtshoorn	Koos Raubenheimer and Mellville Dams	Klein Le Roux River	53800	5,4	Source
	De Rust	Huis River Weir		1900	0,14	Source
	Dysselsdorp	Klein Karoo Rural Water Supply Scheme (Boreholes)		8900+Rural Users +/- 22700	1,1	Wellfield Capacity
	Uniondale	Boreholes and run of river		3250	0,3	Source
	Herbertsdale	Not Known		400	0,04	Not Known

Appendix 3: AD-HOC RESERVE DETERMINATIONS UNDERTAKEN IN THE GOURITZ WMA

Quaternary Catchment	River	Purpose	Confidence Level
H80A	Duiwenhoks	Transfer of water rights	Low
H80C	Spiegels	Abstraction / Storage	Low
H90B	Korente	Transfer of water rights	Low
H90D	Goukou	Transfer of water rights	Low
H90E	Goukou / Melkfontein	Abstraction / Storage	Low
J33E	Vermaaks	Abstraction / Storage	Low
J35E	Olifants	Abstraction / Storage	Low
K10F	Moordkuil	Transfer of water rights	Low
K40C	Karatara	Stream flow reduction	Low
K50B	Knysna	Effluent discharge	Low
K60C	Keurbooms	Stream flow reduction	Low
K60E	Keurbooms	Stream flow reduction	Low
K60F	Bitou	Effluent discharge	Low
K60G	Piesangs	Abstraction / Storage	Low

Appendix 4: WWTW IN THE GOURITZ WMA

Water Management Area	Quaternary Catchment	Controlling Municipality	Name	(Ml/d)	Flow Description	Point of Discharge
Coastal	K10A	Mossel Bay Municipality	Mossel Bay	6.6	Avg Daily Flow	Hartenbos River
	K10F	Mossel Bay Municipality	Great Brak River	0.5	Avg Daily Flow	Great Brak River
	K30D	George Municipality	Holiday Inn Wilderness	0.1	Avg Daily Flow	To be determined
	K30D	Eden/Klein Karoo District Municipality	South Cape D.C. - Kleinkrans	0.4	Avg Daily Flow	To be determined
	K40E	Eden/Klein Karoo District Municipality	Suid Kaap R.S.C. - Rheenendal	?	Not determined	To be determined
	K40C	Eden/Klein Karoo District Municipality	Karatara Retirment Village	?	Not determined	To be determined
	?	?	Bay Water	?	Not determined	To be determined
	K40D	Knysna Municipality	Sedgefield	0.3	Avg Daily Flow	To sand dunes
	K50B	Brenton Transitional Local Council	Brenton-on-sea	<0.1	Avg Daily Flow	To sand dunes
	K50B	Knysna Municipality	Knysna	4.2	Avg Daily Flow	To Knysna estuary
	K50B	Knysna Municipality	Brenton-on-lake	<0.1	Avg Daily Flow	To Knysna estuary
	K50B	Knysna Municipality	Clearwater Bird Sanctuary	?	Not determined	To Knysna estuary
	K60G	Plettenberg Bay Municipality	Plettenberg Bay	2.7	Avg Daily Flow	To estuary
	K60G	Plettenberg Bay Municipality	The Crags	?	Not determined	To estuary
	K60G	Plettenberg Bay Municipality	Kranshoek Griekwa	?	Not determined	To estuary
Gamka	J22F	Central Karoo District Municipality	Leeu-Gamka	?	Not determined	To be determined
	J25B	Central Karoo District Municipality	Merweville	<0.1	Avg Daily Flow	To be determined
	J25D	Kannaland Municipality	Calitzdorp	?	Not determined	To be determined
	J25D	Kannaland Municipality	Zoar	<0.1	Avg Daily Flow	To be determined
Gouritz/Goukou/Duiwenhoks	H80C	Langeberg Municipality	Heidelberg	?	Not determined	To Duiwenhoks River
	H90C	Langeberg Municipality	Riversdale	?	Not determined	To be determined
	H90E	Langeberg Municipality	Stilbaai	?	Not determined	To be determined
	H90E	Langeberg Municipality	Gouriqua Rein's Nature Reserve	?	Not determined	To be determined
	J40C	Mossel Bay Municipality	Herbertsdale	?	Not determined	To be determined
	J40D	Langeberg Municipality	Albertinia	?	Not determined	To be determined
Buffels/Groot/Touws	J12B	Breede Valley Municipality	Touws River	0.4	Avg Daily Flow	To be determined
	J12G	Laingsburg Municipality	Matjiesfontein	0.7	Avg Daily Flow	To be determined
	J11J	Kannaland Municipality	Ladismith	0.2	Avg Daily Flow	To be determined
Olifants	J33F	Eden/Klein Karoo District Municipality	Dysselsdorp	0.9	Avg Daily Flow	To be determined
	J34A	Eden/Klein Karoo District Municipality	Uniondale	<0.1	Avg Daily Flow	To be determined
	J35A	Oudtshoorn Municipality	Oudtshoorn	3.1	Avg Daily Flow	To be determined

Appendix 5: SOLID WASTE DISPOSAL SITES IN THE GOURITZ WMA

Water Management Area	Quaternary Catchment	Area	Local Authority	District Municipality	Type of Site
Coastal	K10A	Mossel Bay	Mossel Bay Municipality	Garden Route/ Klein Karoo	Transfer Station
	K10A	Mossel Bay	Mossel Bay Municipality	Garden Route/ Klein Karoo	Transfer Station
	K10A	PetroSA	Mossel Bay Municipality	Garden Route/ Klein Karoo	Dumping Site
	K10A	Kwa Nonqaba	Mossel Bay Municipality	Garden Route/ Klein Karoo	Garden Dumping Site
	K20A	Groot Brakriver	Mossel Bay Municipality	Garden Route/ Klein Karoo	Recycling Station
	K20A	Groot Brakriver	Mossel Bay Municipality	Garden Route/ Klein Karoo	Great Brak Sawmills
	K30C	George	George Municipality	Garden Route/ Klein Karoo	Recycling Plant
	K30C	George	George Municipality	Garden Route/ Klein Karoo	Dumping Site
	K40D	Sedgefield	Knysna Municipality	Garden Route/ Klein Karoo	Old Dumping Site
	K50B	Knysna	Knysna Municipality	Garden Route/ Klein Karoo	Recycling
	K50B	Knysna	Knysna Municipality	Garden Route/ Klein Karoo	Garden Dumping Site
	K50B	Knysna	Knysna Municipality	Garden Route/ Klein Karoo	Old Dumping Site
	K50B	Knysna	Knysna Municipality	Garden Route/ Klein Karoo	Transfer Station
	K50B	Brenton	Knysna Municipality	Garden Route/ Klein Karoo	Garden Dumping Site
	K60G	Plettenberg Bay	Plettenberg Bay Municipality	Garden Route/ Klein Karoo	Dumping Site
	K60G	Plettenberg Bay	Knysna Municipality	Garden Route/ Klein Karoo	Plett Timbers
Gamka	J21A	Beaufort West	Beaufort West Municipality	Central Karoo	Dumping Site
	J23F	Prince Albert	Prince Albert Municipality	Central Karoo	Dumping Site
	J23F	Prince Albert	Prince Albert Municipality	Central Karoo	Incinirator
	J25D	Calitzdorp	Kannaland Municipality	Garden Route/ Klein Karoo	Dumping Site
Gouritz/Goukou/Duiwenhoks	H90C	Riversdale	Langeberg Municipality	Garden Route/ Klein Karoo	Dumping Site
	H90C	Riversdale	Langeberg Municipality	Garden Route/ Klein Karoo	Recycling Plant
	H90E	Stilbaai	Langeberg Municipality	Garden Route/ Klein Karoo	Dumping Site
	H90E	Stilbaai	Langeberg Municipality	Garden Route/ Klein Karoo	Garden Dumping Site
Buffels/Groot/Touws	J11E	Laingsburg	Laingsburg Municipality	Central Karoo	Dumping Site
	J11K	Ladismith	Kannaland Municipality	Garden Route/ Klein Karoo	Illegal Dumping Site
	J12C	Touws River	Breede Valley Municipality	West Coast	Dumping
Olifants	J33E	De Rust	Oudtshoorn Municipality	Garden Route/ Klein Karoo	Dumping Site
	J33F	Dysselsdorp	Oudtshoorn Municipality	Garden Route/ Klein Karoo	Dumping Site
	J33F	Dysselsdorp	Oudtshoorn Municipality	Garden Route/ Klein Karoo	Dumping Site(closed)
	J35A,J33F	Oudtshoorn	Oudtshoorn Municipality	Garden Route/ Klein Karoo	Dumping Site
	J35A,J33F	Oudtshoorn	Oudtshoorn Municipality	Garden Route/ Klein Karoo	Recycling Plant

Appendix 6: PROPOSED GENERAL AUTHORISATIONS IN THE GOURITZ WMA - GROUNDWATER

AREA	ABSTRACTION (m^3 / hectare / per annum)
Coastal (Quats K10-K70)	
K10A-B	75
K10D-F, K20A, K30A-D, K40B-D	150
K10C, K40A&E, K50A-B, K60A-G, K70A-B	400
Gamka (Quats J21-J25)	
J21A-E, J22D-F, J22J-K, J23A-D, J23F-G, J24B-F	0
J22A-C, J22G-H, J23H, J24A	45
J23E	75
J23J, J25A-E	150
Gouritz/Goukou/Duiwenhoks (Quats H80,H90,J40)	
H80D, H90D-E, J40D-E	75
H80A&E, H90A-B, J40A&C	150
H80B&C&F, H90C, J40B	400
Buffels/Groot/Touws (Quats J11,J13)	
J11F&G	0
J11A-E, J12C&E, J12J-K	45
J11H-K, J12D, J12F-H, J12L-M, J13A-B	75
J12A-B, J13C	150
Olifants (Quats J31-J35)	
J32A-D	0
J31D, J32E	45
J35A	75
J31A-C, J33A-F, J34B, J34D-F, J35B-F	150
J34A&C	400

Appendix 6 (continued): PROPOSED GENERAL AUTHORISATIONS IN THE GOURITZ WMA - SURFACE WATER

AREA	ABSTRACTION (l/s)
Coastal (Quats K10-K70)	
K10A-F, K20A, K30A, K40C, K50A&B, K60A-G, K70A&B	0
K30B-D, K40A&B, K40D&E	15
Gamka (Quats J21-J25)	
J25A-J25E	0
J21A-E, J22A-K, J23A-J, J24A-F	15
Gouritz/Goukou/Duiwenhoks (Quats H80,H90,J40)	
H80A-E, J40C, H90A-E	0
H80F, J40A, J40B, J40D, J40E	15
Buffels/Groot/Touws (Quats J11,J13)	
J12A-M	0
J11A-K, J13A-C	15
Olifants (Quats J31-J35)	
Not generally authorised for surface water abstraction	0

Appendix 7: EXISTING IRRIGATION BOARDS IN THE GOURITZ WMA

Water Management Area	Quaternary Catchment	Name	Scheduled Area (ha)	Quota (m3/ha/a)	Water Source
Coastal	K30B	Modder River	300	Portion of flow	Modder and Nornga Rivers
	K30C	Keurbos River	200	5000	Keurbos River
	Not known	Grootbosberg	384	Not known	Not known
		Crags (Rondebosch)			
Gamka	J22K	Leeu-Gamka	686	Not known	Leeu Gamka Dam
	J23 D,E,F	Oukloof	255	6330	Oukloof Dam
	J23F	Kweekvallei	169	Portion of flow	Springs in Swartberg
	J25B	Hoeko	673	Not known	Mountain streams (Kobus and Weltevrede Rivers)
	J25B	Opzoek	232	Portion of flow	Tributaries of Gamka River
	J25C	Buffelsvlei - Gamka	344	7900	Gamkapoort Dam
	J25C, J25D	Calitzdorp	521	3160approx.	Calitzdorp Dam, Nels River
	J25E	Gamka River	1563	6420 supplied 7900 official	Gamkapoort Dam, Buffelsvlei Gamka, Gamka Rivers
Gouritz/Gouka/Duiwenhoks	H80 A,B,C	Duiwenhoks River	1272	6000	Duiwenhoks River Dam
	H90 A,B,C	Korente - Vette	827	7000	Korente-vet River Dam
Touws/Buffels/Groot/	J11J	Buffelskloof	432	Not known	Not known
	J11K	Huis River	129	Not known	Spring, river
	J12B	Verkeerdevlei	282	Not known	Verkeerdevlei Dam
	J12G	Prins River	362	Not known	Prins River Dam
	J12M	Brand River	134	6100	Brand River flow, Miertjieskraal Dam
	J13A	Buffels River	2209	7620	Groot River, Floriskraal Dam
	J13B	Van Wyksdorp	90	Portion of flow	Tributary of Groot River
Olifants	J1K	Bleshoek	132	Not known	Not known
	J31, J32, J33, J34, J35	Stompdrift - Kammanassie	10871	6500	Kammanassie Dam, Stompdrift Dam, Olifants and Kammanassie Rivers
	J33F	Jan Fourieskraal	1282	6500	Olifants River, Stompdrift and Kammanassie Dams
	J35A	Wynands River	786	Not known	Grobbelaars River and Koos Raubenheimer Dam
	J35A	Klip River	815	4800, 8000	Bos River Dam and mountain streams

Appendix 8: FORUMS IN THE GOURITZ WMA

Water Management Area	Existing and Proposed Forums	Comment
Coastal	Hartenbos Forum	Established and Functioning
	Groot Brakrivier Forum	Established and Functioning
	George Forum	Established and Functioning
	Wilderness Great Lakes Forum	Established and Functioning
	Knysna Forum	Established and Functioning
	Plettenberg Bay Forum	Established and Functioning
Gamka	Groot Karoo Forum	Established and Functioning
	Calitzdorp Forum	Established and Functioning
	Prince Albert Forum	Established and Functioning
Gouritz/Goukou/Duiwenhoks	Duiwenhoks Forum	Established and Functioning
	Goukou Forum	Established and Functioning
	Klein Gouritz Forum	Established and Functioning
Buffels/Groot/Touws	Buffels River Forum	Established and Functioning
Olifants	Klein Karoo Forum	Established and Functioning

Appendix 9: MUNICIPALITIES IN THE GOURITZ WMA

OLD MUNICIPAL NAME	NEW LOCAL MUNICIPALITY	NEW DISTRICT MUNICIPALITY
Haarlem	Eden / Klein Karoo District Municipality	Eden/ Klein Karoo District Municipality
Klein Karoo		
South Cape		
Uniondale		
Central Karoo	Central Karoo District Municipality	
Murraysburg		
Calitzdorp	Kannaland Municipality	
Ladismith		
Vanwyksdorp		
Zoar		
Albertinia	Langeberg Municipality	
Gouritzmond		
Heidelberg		
Riversdale		
Slangrivier		
Stilbaai		
Friemersheim	Mossel Bay Municipality	
Groot Brakrivier		
Herbertsdale		
Mossel Bay		
George	George Municipality	
Wilderness		
De Rust/Blomnek	Oudtshoorn Municipality	
Dysselsdorp		
Oudtshoorn		
Greater Plettenberg Bay	Plettenberg Bay Municipality	
Knoetzie		
Belvidere Estate	Knysna Municipality	
Brenton		
Knysna		
Rheenendal		
Sedgefield		
Laingsburg	Laingsburg Municipality	Central Karoo District Municipality
Leeu Gamka	Prince Albert Municipality	
Prince Albert		
Beaufort West	Beaufort West Municipality	

Appendix 10: RESOURCE POOR FARMERS IN THE GOURITZ WMA

Appendix 9: Water Management Area	Quaternary Catchment	Area	Implementing Authority
Coastal	K60G	Kranshoek	??
	K70A	Matjiesrivier	??
	K30B	Pacaltzdorp	??
Gamka	J25D	Zoar	??
Gouritz/Goukou/Duiwenhoks	J40D	Albertina	??
Olifants	J33F	Dysselsdorp	??

Appendix 11: MAIN DAMS IN THE GOURITZ WMA

Area	Dam Name	Quat	Live Storage (Mm^3)	Yield (Mm^3/a)				Use	Owner
				Domestic	Irrigation	Other	Total		
Coastal	Hartebeeskuil	K10B	7,2	0	0,85	0	0,85	Future use uncertain, very poor yield.	DWAF
	Klipheuwel	K10F	4,2	4,0	0	0	4,0	Mossel Bay	Mossel Bay Municipality
	Wolwedans	K20A	24,2 (gross) 23,3 (live)	5,4 6,9	0	4,8	11,7 10,2	Petro SA refinery and future supply to Mossel Bay	DWAF
	Ernerst Robertson	K20A	0,42	1,8	0	0	1,8	Mossel Bay town supply	Mossel Bay Municipality
	Garden Route	K30C	8	5,8	0	0	5,8	George town supply	George Municipality
	Roodefontein Dam	K60G	1,4	0,15	0,54	0,31	1,0	Irrigation and Plettenberg Bay town supply	DWAF.
Gamka	Gamka	J21A	1,8	0,6	0	0	0,6	Beaufort West town supply	DWAF
	Doornfontein	J22G	4,4	0	0	0	Not known	Irrigation	Private
	Leeu Gamka	J22K	14,3	0	7,1	0	7,1	Irrigation (Leeu Gamka River Irrigation Board)	DWAF
	Oukloof	J23E	4,2	0	3,0	0	3,0	Irrigation (Cordiers River Scheme)	DWAF
	Gamkapoort	J25A	44,2	0	11	0	11	Domestic, livestock and irrigation (Buffelsvlei and Gamka River Irrigation Boards)	DWAF
	Calitzdorp	J25D	4,8	0,2	2,5	0	2,7	Calitzdorp town supply and irrigation (Calitzdorp Irrigation Board)	Calitzdorp Irrigation Board
Gouritz/Goukou/Duiwenhoks	Duiwenhoks river	H80A	6,4	1,2	6,6	0	7,8	Heidelberg town supply, Duiwenhoks Rural Water Supply Scheme and irrigation (Duiwenhoks River Govt Scheme)	DWAF
	Korentepoort	H90B	8,3	1,5	4,3	0	5,8	Riversdale town supply and irrigation (Korente-Vette Irrigation Scheme)	DWAF
Buffels/Groot/Touws	Floriskraal	J11F,G,H	50,3	0	18,6	0	18,6	Irrigation (Buffels River Irrigation Scheme)	DWAF
	Verkeerdevlei	J12B	5,5	0	2,3	0	2,3	Verkeerdevlei Irrigation Board	DWAF
	Bellair (no longer in use)	J12K	10,1	0	2,7	0	2,7	Irrigation	Bellair Irrigation Board
Olifants	Stompdrift	J33B	55,3	0	15	0	15	Irrigation (Olifants River Govt Water Scheme)	DWAF
	Kammanassie	J34E	35,8	0	18	0	18	Irrigation - (Olifants River Govt Water Scheme)	DWAF
	Koos Raubenheimer	J35A	9,2	2,2	0	0	2,2	Oudtshoorn town supply	Oudtshoorn Municipality
	Melville	J35A	0,4	1,3	0	0	1,3	Oudtshoorn town supply	Oudtshoorn Municipality

Appendix 12: FLOW GAUGING STATIONS IN THE GOURITZ WMA

Water Management Area	Staion No.	Place or Description	River / Pipeline	Latitude	Longitude	Catchment Area (km^2)	Record Period of primary Data	
							Start	Finish
Coastal	K1H001A01	Hartenbosch	Hartenbos River	34 06'11"	22 04'19"	n/a	Feb-1937	Jun-1977
	K1H002A01	Pine Grove	Beneke River	33 56'06"	22 07'17"	3.8	Jul-1958	Apr-2002
	K1H003A01	Welbedagt	Hartenbos River	34 06'18"	22 02'21"	135	Mar-1959	May-1961
	K1H004A01	Brandwacht	Brandwag River	34 01'55"	22 03'12"	215	Mar-1969	Apr-2002
	K1H004A02	Brandwacht	Brandwag River	34 01'55"	22 03'12"	215	Oct-1997	Jul-1998
	K1H004B01	Brandwacht	Brandwag River	34 01'55"	22 03'12"	n/a	Dec-1976	Oct-1987
	K1H005A01	Banff	Moordkuil River	34 02'23"	22 08'00"	198	Apr-1978	Mar-2002
	K1H005B01	Banff	Moordkuil River	34 02'23"	22 08'00"	n/a	Apr-1978	Apr-2002
	K1H010A01	Gauge Plate/Bridge Hartenbosch	Hartenbos River	34 07'02"	22 07'02"	n/a	Aug-1993	Mar-2002
	K1H015A01	Brandwacht	Right Canal From	34 01'55"	22 03'12"	n/a	Aug-1971	Mar-2002
	K1H015A02	Brandwacht	Right Canal From	34 01'55"	22 03'12"	n/a	Oct-1997	Nov-1997
	K1H016A01	Brandwacht	Left Canal From	34 01'55"	22 03'12"	n/a	Aug-1971	Mar-1988
	K1H017A01	Hartebeestkuil	Hartenbos River	34 05'47"	22 00'39"	100	Mar-1970	Mar-2002
	K1H017X01	Hartebeestkuil	Hartenbos River	34 05'47"	22 00'39"	n/a	Mar-1970	Mar-2002
	K1H018A01	Pine Grove	Beneke River	33 56'06"	22 07'50"	3.8	Jun-1963	Mar-2002
	K1H019M01	Little Brak River	Pipeline From	34 04'57"	22 08'35"	n/a	Mar-1992	Apr-2002
	K1H020A01	Klipheuvel	Little Brak River	34 05'11"	22 08'04"	165	Dec-1995	Apr-2002
	K1R001A01	Hartebeestkuil	Hartenbeeskuil Dam	34 05'45"	22 00'27"	100	Mar-1970	Apr-2002
	K2H001A01	Kleinberg	Great-Brak River	33 56'00"	22 10'04"	45	Apr-1952	Apr-1958
	K2H002A01	Wolvedans	Great-Brak River	34 01'40"	22 13'21"	131	May-1961	Apr-2002
	K2H002B01	Wolvedans	Great-Brak River	34 01'40"	22 13'21"	n/a	Jun-1962	Apr-2002
	K2H003A01	Wolvedans	Searle's Furrow From	34 01'25"	22 12'15"	n/a	Aug-1992	Apr-2002
	K2H004A01	Gauge Plate/Bridge Vishoek	Great-Brak River	34 03'03"	22 13'57"	159.1	May-1988	Apr-2002
	K2H005M01	Klein Bosch	Right Pipeline From	33 54'06"	22 10'29"	n/a	Jun-1958	Apr-2002
	K2H006A01	Grootburg	Great-Brak River	34 00'54"	22 13'15"	129	Mar-1992	Mar-2002
	K2H006X01	Grootburg	Great-Brak River	34 00'54"	22 13'15"	129	Mar-1992	Mar-2002
	K2H007A01	Wolvedans	Left Canal From	34 01'40"	22 13'21"	n/a	May-1961	Feb-1995
	K2H007B01	Wolvedans	Left Canal From	34 01'40"	22 13'21"	n/a	May-1961	Jan-1977

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Coastal	K2H008M01	Wolvedans	Pipeline from Great-	34 01'40"	22 13'21"	n/a	May-1961	Jan-1977
	K2H009A01	Brakriviers Spruiten	Great-Brak River	33 54'06"	22 10'29"	Not available	Jun-1958	Apr-1972
	K2H010M01	Great-Brak River	Pipeline From	34 01'58"	22 14'21"	n/a	Jun-1992	Apr-2002
	K2R001A01	Brakriviersspruiten	Ernest Robertson Dam	33 54'06"	22 10'29"	16.8	Jun-1958	Apr-2002
	K2R002A01	Wolvedans	Wolvedans Dam	34 00'49"	22 13'44"	128	Apr-1990	Mar-2002
	K3H001A01	Upper Barbierskraal	Kaaimans River	33 58'15"	22 32'54"	47	Mar-1961	Apr-2002
	K3H001B01	Upper Barbierskraal	Kaaimans River	33 58'15"	22 32'54"	n/a	Apr-1961	Mar-2002
	K3H002A01	George	Rooi River	33 56'00"	22 27'44"	1.04	Apr-1961	Mar-2002
	K3H003A01	Knoetze Kama	Maalgate River	34 00'21"	22 21'04"	145	Apr-1961	Apr-2002
	K3H004A01	Blanco	Malgas River	33 57'02"	22 25'21"	34	Apr-1961	Mar-2002
	K3H004B01	Blanco	Malgas River	33 57'02"	22 25'21"	n/a	May-1961	Aug-1973
	K3H005A01	Farm 162	Touws River	33 56'45"	22 36'48"	78	Apr-1969	Mar-2002
	K3H005B01	Farm 162	Touws River	33 56'45"	22 36'48"	n/a	Aug-1974	Mar-2002
	K3H006A01	George	Rooi River	33 58'15"	22 26'35"	6.2	May-1987	Dec-1993
	K3H007A01	George	Rooi River	33 58'20"	22 26'29"	6.3	Jun-1989	Mar-2002
	K3H008A01	George	Rooi River	33 58'21"	22 26'21"	6.33	Dec-1987	Dec-1993
	K3H009A01	George	Compensation Water	33 57'47"	22 30'56"	n/a	Aug-1989	Mar-2002
	K3H010A01	George	Swart River	33 57'53"	22 30'46"	35.6	Aug-1989	Mar-2002
	K3H010X01	George	Swart River	33 57'53"	22 30'46"	n/a	Aug-1989	Apr-2002
	K3H011A01	Klein Krantz	Duiwe River	33 58'55"	22 39'10"	33.2	Aug-1996	Mar-2002
	K3R002A01	Farm 149	Garden Route Dam	33 57'49"	22 30'53"	35.6	Aug-1984	Apr-2002
	K3R003A01	Ronde Valley	Rondevlei	33 59'36"	22 43'00"	1.4	Mar-1977	Apr-2002
	K3R004A01	Klein Krantz	Bo-lang Vlei	33 59'02"	22 40'36"	2.6	Mar-1977	Apr-2002
	K3R005A01	Klein Krantz	Onder-Lang Vlei	33 59'28"	22 38'08"	1.4	Mar-1977	Apr-2002
	K3R006A01	Wilderness	Touws River Estuary	33 59'38"	22 35'49"	0.4	Mar-1977	Mar-2002
	K4H001A01	Eastbrook	Koekraal River	33 58'47"	22 48'00"	111	Nov-1959	May-1993
	K4H001B01	Eastbrook	Koekraal River	33 58'47"	22 48'00"	n/a	Sep-1961	Nov-1990
	K4H002A01	Karatara Forest Res.	Karatara River	33 52'52"	22 50'19"	22	Apr-1961	Mar-2002
	K4H003A01	Woodville Forest Res.	Diep River	33 54'42"	22 42'21"	72	May-1961	Mar-2002
	K4R001A01	Ruygte Valley	Groenvlei	34 02'00"	22 51'08"	3.5	Mar-1977	Apr-2002

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Coastal	K4R002A01	Ronde Valley	Swart Vlei	33 59'21"	22 44'21"	13	Mar-1977	Mar-2002
	K5H001A01	Gouna Commonage Con	Gouna River	33 59'28"	23 02'33"	91	Nov-1959	Oct-1984
	K5H002A01	Milwood Forest Res.	Knysna River	33 52'24"	23 01'54"	133	Aug-1961	Mar-2002
	K5H002A02	Milwood Forest Res.	Knysna River	33 53'24"	23 01'54"	133	Nov-1996	Mar-1998
	K5R001A01	Knysna	Knysna Lagoon	34 02'54"	23 02'50"	n/a	Feb-1992	Mar-2002
	K6H001A01	M'kama	Keurboms River	33 48'10"	23 08'10"	165	Aug-1961	Mar-2002
	K6H001B01	M'kama	Keurboms River	33 48'10"	23 08'10"	n/a	Jul-1977	Mar-2002
	K6H002A01	Newlands	Keurboms River	33 56'18"	23 22'04"	764	Sep-1961	Jun-1981
	K6H002B01	Newlands	Keurboms River	33 56'18"	23 22'04"	n/a	Oct-1961	Aug-1981
	K6H003A01	Roodefontein	River Outlet	34 03'57"	23 20'04"	n/a	Jan-1996	Feb-2002
	K6H018A01	Plettenbergbaai	Keurboms River	34 00'06"	23 24'10"	n/a	Apr-1997	Apr-2002
	K6H019A01	Newlands	Keurboms River	33 56'41"	23 22'04"	n/a	Oct-1997	Apr-2002
	K6R001A01	Roodefontein	Roodefontein Dam	34 03'57"	23 20'04"	27.8	Oct-1995	Apr-2002
	K7H001A01	Lotterings Forestry Res	Bloukrans River	33 57'15"	23 38'30"	57	Jun-1961	Apr-2002
	K7H001A02	Lotterings Forestry Res	Bloukrans River	33 57'15"	23 38'30"	57	Oct-1995	Mar-1998
Gamka	J2H001A01	Klipfontein	Gamka River	33 05'00"	21 56'27"	10292	Nov-1911	Jan-1921
	J2H002A01	Buffels Vallei	Nels River	33 31'55"	21 41'35"	182	Dec-1911	Dec-1922
	J2H003A01	Kleinberg	Gamka River	33 31'34"	21 38'43"	17815	Jan-1924	Aug-1944
	J2H005A01	Zoar	Huis River	33 29'40"	21 28'50"	253	Feb-1955	Mar-2002
	J2H005B01	Zoar	Huis River	33 29'40"	21 28'50"	n/a	Oct-1973	Apr-2002
	J2H006A01	Opzoek	Boplaas River	33 29'26"	21 29'15"	22.5	Feb-1955	Apr-2002
	J2H006B01	Opzoek	Boplaas River	33 29'26"	21 29'15"	n/a	Sep-1975	Dec-1976
	J2H007A01	Opzoek	Joubert River	33 29'26"	21 30'50"	25	Feb-1955	Apr-2002
	J2H007B01	Opzoek	Joubert River	33 29'26"	21 30'50"	n/a	Feb-1976	Nov-1990
	J2H008A01	Gauge plate/ Bridge Calitzdorp	Gamka River	33 32'45"	21 41'00"	18199	Jul-1980	Jan-1981
	J2H009A01	Abrahams Kraal	Gamka River	32 54'15"	21 58'37"	n/a	Nov-1974	Dec-1974
	J2H010A01	Huis River	Gamka River	33 30'06"	21 37'27"	7805	Sep-1982	Apr-2002
	J2H010B01	Huis River	Gamka River	33 30'06"	21 37'27"	n/a	Sep-1982	Apr-2002
	J2H011A01	Kraal Doorn	Left Canal From	33 29'26"	21 42'19"	n/a	Apr-1920	Mar-2002

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Gamka	J2H012A01	Kraal Doorn	Left Canal From	33 29'26"	21 42'19"	n/a	Oct-1919	Mar-2002
	J2H012B01	Kraal Doorn	Left Canal From	33 29'26"	21 42'19"	n/a	Mar-1983	Apr-1990
	J2H013A01	Stinkfontein	Right Main Canal	32 37'18"	22 00'27"	n/a	Oct-1958	Jan-2002
Gouritz/Gouka/Duiwenhoks	H8H001A01	Dassjes Klip	Duiwenhoks River	34 15'02"	20 59'33"	790	Apr-1967	May-2002
	H8H002A01	Broken Hill	Duiwenhoks River	34 01'10"	20 56'04"	271	Jul-1971	Oct-1984
	H8H003A01	Kliphoogte	Duiwenhoks River	33 59'47"	20 57'00"	148	Jan-1964	May-2002
	H8H003B01	Kliphoogte	Duiwenhoks River	33 59'47"	20 57'00"	n/a	Dec-1985	Feb-1990
	H8H003X01	Kliphoogte	Duiwenhoks River	33 59'47"	20 57'00"	n/a	Jan-1964	May-2002
	H8R001A01	Kliphoogte	Duiwenhoks River	33 59'47"	20 57'00"	148	Oct-1963	May-2002
	H9H002A01	The Camp	Vet River	34 00'24"	21 12'06"	89	Apr-1963	Mar-2002
	H9H004A01	Aan De Kruis River	Kruis River	34 00'52"	21 17'25"	50	Apr-1969	May-2002
	H9H005A01	Farm 216	Goukou River	34 05'32"	21 17'43"	228	Apr-1969	Apr-2002
	H9H005B01	Farm 216	Goukou River	34 05'32"	21 17'43"	n/a	Dec-1973	Apr-2002
	H9H005B02	Farm 216	Goukou River	34 05'32"	21 17'43"	n/a	Jan-1974	Nov-1986
	H9H006A01	Groote Bosch	Left Canal From	34 01'21"	21 24'31"	n/a	Feb-1970	Apr-2002
	H9H006B01	Groote Bosch	Left Canal From	34 01'21"	21 24'31"	n/a	Feb-1970	Apr-2002
	H9H007M01	The Camp	Right Pipeline From	34 00'24"	21 12'06"	n/a	Oct-1980	Mar-2001
	H9H009A01	The Camp	Right Pipeline From	34 00'24"	21 12'00"	n/a	Feb-1982	May-2002
	H9H010A01	Krantz Kloof	Korente River	34 00'16"	21 10'00"	37	Nov-1967	May-2002
	H9H010X01	Krantz Kloof	Korente River	34 00'16"	21 10'00"	n/a	Oct-1968	May-2002
	H9H012A01	Stilbaai	Goukou River	34 22'00"	21 24'52"	1569	Sep-1996	Apr-2002
	H9R001A01	Krantz Kloof	Korinte-Vet Dam	34 00'16"	21 10'00"	37	Mar-1966	May-2002
	J4H001A01	Gauge plate/ Bridge Bonavontuur	Gourits River	34 11'08"	21 45'13"	44686	Mar-1912	Jul-1931
	J4H002A01	Zeekoedrift	Gourits River	33 58'50"	21 39'12"	43451	May-1964	Apr-2002
	J4H003A01	Weyers River	Weyers River	34 01'53"	21 35'15"	95	Apr-1965	Apr-2002
	J4H003A02	Weyers River	Weyers River	34 01'53"	21 35'15"	95	Oct-1997	Nov-1997
	J4H003B01	Weyers River	Weyers River	34 01'53"	21 35'15"	n/a	May-1966	Oct-1986
	J4H004A01	Langfontein	Langtou River	33 59'15"	21 46'37"	99	Mar-1967	Nov-1996
	J4H004B01	Langfontein	Langtou River	33 59'15"	21 46'37"	n/a	Aug-1986	Oct-1986

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Touws/Buffels/Groot	J1H002A01	Floris Kraal	Buffels River	33 15'00"	20 58'00"	3328	Sep-1922	Oct-1928
	J1H003A01	Poortfontein	Doring River	33 45'29"	20 56'54"	352	Feb-1923	Feb-1932
	J1H004A01	Laingsburg	Buffels River	33 12'08"	20 51'15"	3072	Nov-1920	Oct-1955
	J1H005A01	Floris Kraal	Buffels River	33 17'29"	20 59'27"	4001	Jul-1931	Sep-1946
	J1H006A01	Adams Kraal	Brand River	33 45'49"	21 08'06"	323	Jan-1938	Oct-1977
	J1H007A01	Rietgat	Touws River	33 33'49"	20 44'10"	2898	Mar-1938	Jul-1948
	J1H008A01	Buffelsfontein	Groot River	33 45'29"	21 28'13"	12773	Apr-1964	Apr-1978
	J1H009A01	Miertjes Kraal	Brand River	33 49'32"	21 08'10"	252	Apr-1965	Dec-1983
	J1H010A01	Zandfontein	Touws River	33 34'19"	20 42'10"	2900	Mar-1969	Jan-1981
	J1H012A01	Baviaans Krans	Groot River	33 39'10"	21 10'29"	5565	Mar-1971	Jan-1981
	J1H013A01	Riverside	Touws River	33 44'11"	21 10'46"	2015.1	May-1971	Jan-1981
	J1H015A01	Lot B	Bok River	33 21'16"	19 43'12"	8.8	Jul-1974	Mar-2002
	J1H016A01	Verlorenvlei	Smalblaar River	33 17'19"	19 43'43"	30	Jun-1974	Mar-2002
	J1H017A01	Buffelfontein	Sand River	33 46'52"	21 26'31"	254	Nov-1980	Apr-2002
	J1H018A01	Okkerskraal	Touws River	33 41'50"	21 08'46"	5837	Apr-1982	Mar-2002
	J1H019A01	Buffelsfontein	Groot River	33 45'00"	21 26'41"	12493	Jun-1982	Apr-2002
	J1H022A01	Tyger Kloof	Prins River	33 30'53"	20 45'12"	757	Feb-1926	Apr-2002
	J1H023A01	Tyger Kloof	Canal From	33 20'53"	20 45'12"	n/a	Aug-1985	Apr-2002
	J1H024A01	Zandfontein	Left Canal From	33 42'40"	20 35'52"	n/a	Jan-1926	Apr-2002
	J1H025A01	Zandfontein	Right Canal From	33 42'40"	20 35'52"	n/a	Jan-1926	Apr-2002
	J1H026A01	Zandfontein	Bifurcation Box	33 42'40"	20 35'52"	n/a	Jan-1926	Nov-1982
	J1H028A01	Floris Kraal	Buffels River	33 17'28"	20 59'27"	4002	Feb-1964	Mar-2002
	J1H028A02	Floris Kraal	Buffels River	33 17'28"	20 59'27"	4002	Aug-1997	Oct-1997
	J1H029A01	Miertjes Kraal	Left Canal From	33 49'41"	21 08'04"	n/a	Nov-1979	Apr-2002
	J1H030A01	Miertjes Kraal	Right Canal From	33 49'41"	21 08'04"	n/a	Apr-1980	Apr-2002
	J1H031A01	Miertjes Kraal	Brand River	33 49'41"	21 08'04"	251	Apr-1982	Apr-2002
	J1R001A01	Tyger Kloof	Prins River	33 30'53"	20 45'12"	757	Jan-1926	Apr-2002
	J1R002A01	Zandfontein	Bellair Dam	33 42'40"	20 35'52"	558	Jan-1926	Apr-2002
	J1R003A01	Floris Kraal	Floriskraal Dam	33 17'28"	20 59'27"	4001	Nov-1956	Mar-2002
	J1R003A02	Floris Kraal	Floriskraal Dam	33 17'28"	20 59'27"	n/a	Apr-1997	Dec-1997
	J1R004A01	Miertjes Kraal	Mierttjieskraal Dam	33 49'41"	21 08'04"	251	Jan-1977	Apr-2002

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Olifants/Kammanassie	J3H001A01	Kromhoogte	Kammanassie River	33 40'10"	22 25'15"	1506.5	Jun-1912	May-1922
	J3H002A01	Tuintjeskraal	Traka River	33 23'00"	23 06'56"	3039	Oct-1912	Sep-1928
	J3H003A01	Klaarstroom	Groot River	33 20'05"	22 32'12"	426	Feb-1913	Dec-1964
	J3H003B01	Klaarstroom	Groot River	33 20'05"	22 32'12"	426	Dec-1962	Dec-1964
	J3H004A01	Pardekloof	Olifants River	33 28'37"	23 01'48"	4252	Oct-1923	May-1993
	J3H005A01	Klippe Drift	Klip River	33 46'45"	22 19'25"	95	Mar-1926	Dec-1947
	J3H007A01	Welgevonden	Olifants River	33 38'32"	22 11'31"	9090	Oct-1942	Oct-1943
	J3H008A01	Rietvallei	Olifants River	33 32'08"	22 28'00"	6236	Mar-1949	May-1956
	J3H009A01	Warm Water	Olifants River	33 39'44"	21 46'28"	10928	Mar-1949	Jun-1950
	J3H010A01	Welbedag	Klip River	33 46'10"	22 18'56"	98	Jun-1963	Oct-1978
	J3H010B01	Welbedag	Klip River	33 46'10"	22 18'56"	n/a	Jun-1963	Apr-1974
	J3H011A01	Warm Water	Olifants River	33 39'32"	21 46'26"	10927	Jul-1950	Feb-2002
	J3H012A01	De Rust	Groot River	33 28'32"	22 32'54"	688	May-1964	Jul-1994
	J3H012B01	De Rust	Groot River	33 28'32"	22 32'54"	n/a	Aug-1987	Oct-1990
	J3H013A01	Groenefontein	Perdepoort River	33 22'06"	22 10'56"	29	Apr-1966	Apr-2002
	J3H013B01	Groenefontein	Perdepoort River	33 22'06"	22 10'56"	n/a	Feb-1974	Sep-1988
	J3H014A01	De Kombuys	Grobelaars River	33 25'13"	22 14'31"	151	Oct-1966	Apr-2002
	J3H014B01	De Kombuys	Grobelaars River	33 25'13"	22 14'31"	n/a	Jun-1982	Mar-2002
	J3H015A01	De Kombuys	Little Le Roux river	33 25'37"	22 15'15"	70	Apr-1966	Mar-2002
	J3H015B01	De Kombuys	Little Le Roux river	33 25'37"	22 15'15"	n/a	Dec-1982	Mar-2002
	J3H016A01	Wilgehoute	Wilge River	33 32'39"	22 58'29"	32	Apr-1967	Mar-2002
	J3H016B01	Wilgehoute	Wilge River	33 32'39"	22 58'29"	n/a	Dec-1979	Apr-1988
	J3H017A01	Paardendrift	Kandelaars River	33 40'39"	22 08'00"	348	Apr-1969	Apr-2002
	J3H017B01	Paardendrift	Kandelaars River	33 40'39"	22 08'00"	n/a	Apr-1971	Mar-2002
	J3H018A01	Koetze Kraal	Wynands River	33 28'03"	22 00'04"	137	Jun-1969	Mar-2002
	J3H018A02	Koetze Kraal	Wynands River	33 28'03"	22 00'04"	137	Mar-1997	Mar-1998
	J3H019A01	Buffels Bosch River	Wynands River	33 29'36"	21 59'58"	147	May-1969	Oct-1971
	J3H020A01	Vogelfontein	Meul River	33 27'37"	21 57'43"	35	Aug-1974	Feb-2002
	J3H020B01	Vogelfontein	Meul River	33 27'37"	21 57'43"	n/a	Oct-1974	Nov-1990
	J3H021A01	Pardekloof	Olifants River	33 28'29"	23 01'23"	4270	Jul-1982	Feb-1993

Appendix 12 (continued): FLOW GAUGING STATIONS IN THE GOURITZ WMA

Olifants/Kammanassie	J3H021B01	Pardekloof	Olifants River	33 28'29"	23 01'23"	n/a	Aug-1982	Feb-1993
	J3H022A01	De Rust	Left Canal From	33 28'32"	22 32'54"	n/a	Feb-1985	Mar-1987
	J3H023A01	Pardekloof	Olifants River	33 28'37"	23 01'48"	4252	Nov-1923	Dec-1964
	J3H024A01	Kammanassie	Left Main Canal From	33 38'34"	22 24'54"	n/a	Oct-1922	Mar-2002
	J3H025A01	Kammanassie	Right Canal From Dam	33 38'34"	22 24'54"	n/a	Oct-1920	Mar-2002
	J3H026A01	Kammanassie	Left Canal From	33 38'34"	22 24'54"	n/a	Oct-1920	Apr-2002
	J3H027A01	Kammanassie	Canal From River	33 38'34"	22 24'54"	n/a	Oct-1920	Mar-2002
	J3H028A01	Kammanassie	Canal From Furrow 2	33 38'34"	22 24'54"	n/a	Oct-1920	Mar-2002
	J3H029A01	Kammanassie	Kammanassie River	33 38'34"	22 24'54"	Not available	Aug-1922	Mar-2002
	J3H030A01	Doornkraal	Right Main Canal	33 30'42"	22 35'08"	n/a	Nov-1963	Mar-2002
	J3H031A01	Doornkraal	Le Roux Pipeline	33 30'42"	22 35'08"	n/a	Nov-1963	Nov-1967
	J3H031M01	Doornkraal	Le Roux Pipeline	33 30'42"	22 35'08"	n/a	Nov-1967	Mar-2002
	J3H032A01	De Cango	Little Le Roux river	33 24'37"	22 16'56"	61	May-1977	Mar-1992
	J3H033M01	De Cango	Main Pipeline to	33 24'37"	22 16'56"	n/a	May-1973	Dec-1986
	J3H034M01	De Cango	Pipeline From	33 24'37"	22 16'56"	n/a	Jul-1979	May-1990
	J3H035M01	De Cango	Pipeline From Rus	33 24'37"	22 16'56"	n/a	Jul-1979	Apr-1990
	J3H036A01	Kromhoogte	Kammanassie River	33 40'10"	22 25'15"	Not available	May-1916	Oct-1917
	J3H037A01	Kromhoogte	Left Canal From	33 40'10"	22 25'15"	Not available	Jul-1912	Sep-1922
	J3H038A01	Kromhoogte	Right Canal From	33 40'10"	22 25'15"	Not available	Jul-1912	Sep-1922
	J3H039A01	Tuintjeskraal	Traka River	33 23'00"	23 06'56"	3039	Jan-1913	Mar-1917
	J3H040A01	Klaarstroom	Groot River	33 20'05"	22 32'12"	426	Oct-1913	Dec-1964
	J3H041A01	Warm Water	Pipeline From	33 39'32"	21 46'26"	n/a	Mar-1964	May-1969
	J3H042A01	Welgevonden	Marnewicks River	33 34'32"	22 35'00"	23	May-1990	Apr-2002
	J3H043A01	Voorzog	Vermaaks River	33 34'26"	22 32'15"	22	Apr-1990	Apr-2002
Olifants/Kammanassie	J3R001A01	Kammanassie	Kammanassie Dam	33 38'34"	22 24'54"	1505	May-1922	Apr-2002
	J3R001Z01	Kammanassie	Outlets for 4 Canals	33 38'34"	22 24'54"	n/a	Nov-1938	Dec-1976
	J3R001Z02	Kammanassie	Outlets for 4 Canals	33 38'34"	22 24'54"	n/a	Sep-1941	Oct-1943
	J3R002A01	Farm 67	Stompdrift Dam	33 30'42"	22 35'08"	5235	Nov-1963	Apr-2002
	J3R002K01	Farm 67	Stompdrift Dam	33 30'42"	22 35'08"	5235	Nov-1963	Jan-1984
	J3R003A01	De Cango	Koos Raubenheimer	33 24'37"	22 16'56"	61	May-1973	Feb-1987

Appendix 13: REPORT LIST IN THE GOURITZ WMA

Water Management Area	Report Title	Author	Ninham Shand Reference	Report Date
General	Veld types of South Africa. Botanical Survey of South Africa, Memoirs, 57. Pretoria, RSA : Botanical Research Institute. p 146	Acocks, J P H	551.45 ACO	1988
	Evaluation of groundwater use in South Africa. Unpublished DWAF	Baron and Seward		2000
	Handy Reference Manual on the Impacts of Timber Plantations on Runoff in SA.	CSIR	627.14:634.0 SOU	1995
	Satellite Image of the Gouritz WMA in 1995	CSIR		1996
	South African National Land-cover Database project produced for the Agricultural Research Council of South Africa	CSIR		1999
	A Regional Profile of the Southern African Population and its Urban and Non-urban Distribution. 1970 - 1990	Development Bank of Southern Africa	312.8:311.313 DCV	1991
	National Livestock Census	Department of Agriculture	31.636 SOU	1994
	System Yield Analysis, Department of Water Affairs and Forestry, DWAF Report No. P K000/00/0796, Report No. 7 of 12	Ninham Shand and BKS for DWAF	NS REP 2438	1996
	Quality of domestic water supplies, Volume 1 : Assessment Guide	Department of Water Affairs and Forestry	628.1.003 WAT	1998a
	Eco Info Database. Prepared and held by DWAF Institute for Water Quality Studies, Department of Water Affairs and Forestry	DWAF Institute for Water Quality Studies		1999a
	Skuifraam Feasibility Study System Analysis, Department of Water Affairs and Forestry, DWAF Report No. P G100/00/0896	A Sparks and P R Little of Ninham Shand	NS REP 2677	1999a
	Surface and other Augmentation Options, Department of Water Affairs and Forestry, DWAF Report No. B J000/00/0999	E J Larsen of Ninham Shand Inc.	NS REP 2936	1999b
	Maximum dam sizes to be used in potential yield analyses for Provincial Water Resource Situation Assessments, Department of Water Affairs and Forestry	Stewart Scott Consulting Engineers		1999c
	Profile on Water Management in the Berg, Breede, Gouritz and Olifants/Doring Water Management Areas : The Utilization and Availability of Water	Ninham Shand for Dept. of Water Affairs and Forestry	NS REP 3152	2000
	Water Balance Model : A decision support system for reconnaissance level planning	Department of Water Affairs and Forestry		2000a
	National Demographic Study	Department of Water Affairs and Forestry		2000b
	Reconnaissance investigation into the development and utilisation of Table Mountain Group artesian groundwater, using the E10 catchment as a pilot study	Umvoto Africa/SRK Consulting Joint Venture		2000c

Appendix 13 (continued): REPORT LIST IN THE GOURITZ WMA

General	Official South African Local Government Yearbook 1997 – 1998	Gaffney Group	058.7 OFF	1998
	Methodology for incorporation of alien vegetation impacts in the national water balance model. Memorandum to Department of Water Affairs and Forestry	Görgens, A		1998
	A decision support system for an initial "low□confidence" estimate of the quantity component of the Reserve for rivers. Unpublished discussion document available at http://www.ru.ac.za.departments/iwr	Hughes, DA and Münster, F		1999
	Instream flow assessments for regulated rivers in SA using the Building Block Methodology. Aquatic Ecosystem Health and Management, 1, 109□124	King, J and Louw, D		1998
	The impact of Invading Alien Plants on Surface Water Resources in South Africa: A Preliminary Assessment	Le Maitre, D C, Versfeld, D B, and Chapman, R A		1999
	The Surface Water Resources of South Africa, Volumes 1 to 6. Report to the Water Research Commission, Pretoria	Midgley, D C, Pitman, W V and Middleton, B J	551.48(680) MID+CD	1994
	The Contribution of Plantation Forestry to the Problem of Invading Alien Trees in South Africa: A Preliminary Assessment	Nel, Van Wilgen and Gelderblom		1999
	Interim Adjustment of WR90 Quaternary Naturalised Flows to Reflect CSIR Afforestation-Related Streamflow Reduction Activities	Ninham Shand (Pty) Ltd		1999
	The Development of the New Sediment Yield Map of Southern Africa. Water Research Commission Publication No. 297/2/92	Rooseboom et al	627.157 WAT	1992
	The Distribution of South Africa's Population, Economy and Water Usage into the Long□term Future: Report on Phase 2. Report No. PRSA/00/2200, to the Department of Water Affairs and Forestry	Schlemmer, L, MarkData (Pty) (Ltd), and Eric Hall & Associates		2001
	Groundwater harvest potential of the Republic of South Africa	Seward, P and Syemour, A		1996
	Assessment of the ambient groundwater quality on a national scale in the Republic of South Africa. WRC Project K5/841	Simonic, M		2000
	Groundwater resources of the Republic of South Africa. WRC Project 483	Vegter, J R		1995
	Alien Invading Plants and Water Resources in South Africa. Report to the Water Research Commission, Pretoria	Versfeld, D B, Le Maitre, D C and Chapman, R A		1997
	Alien Invading Plants and Water Resources in South Africa: A Preliminary Assessment, Water Research Commission, WRC Report No. TT99/98	D B Versveld, D C le Maitre and R A Chapman	628.11:504.73 VLR	1998

Appendix 13 (continued): REPORT LIST IN THE GOURITZ WMA

Coastal	Plettenberg Bay Coastal Catchment Study. Water Quality Summary Assessment, Volume 1: Main Report. Report No. 10 of 12	DWAF	NS REP 2441	1996
	White Paper on Wolwedans Dam : Report on the Proposed Mossel Bay (Wolwedans Dam) Government Water Scheme. WP 3-88	DWAF	WPE-88	1998
	The effect of alien vegetation on Water Resources Planning for the Town of George, Working for Water	E J Larsen of Ninham Shand and C Marais	NINHAM SHAND PROPOSAL P0723	2001
Olifants	Herevaluering van Waterbronne - Uitgebreide Oorsig van Aanvullende Skemas. Verslag Nr. 2843/6848, Oudtshoorn Municipality	Ninham Shand Raadgewende Ingenieurs	NS REP 2843	1998
	Klein Karoo Rural Water Supply Scheme	Ninham Shand	NS REP No 2930	1999
Various	Estuaries of the Cape: Part II: Synopsis of available information on individual systems. Report No. 32 – Verlorenvlei (CW13)	Sinclair, S.A., Lane, S.B and Grindley, J.R	627.61 (687) SOU	1986

Appendix 14: GROUNDWATER INFORMATION FIGURES

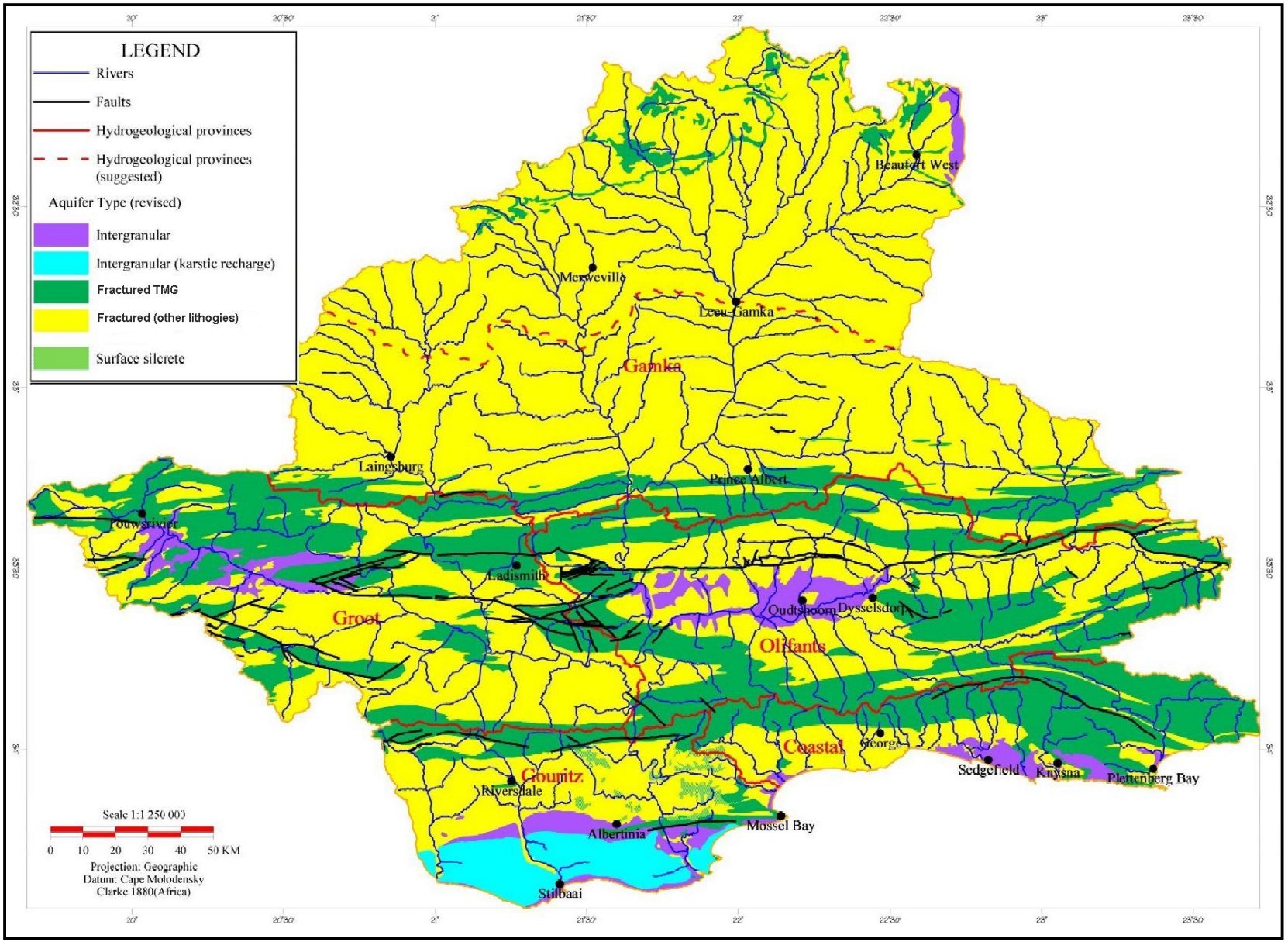

Figure A14.1: Aquifer Types and Hydrogeological Provinces

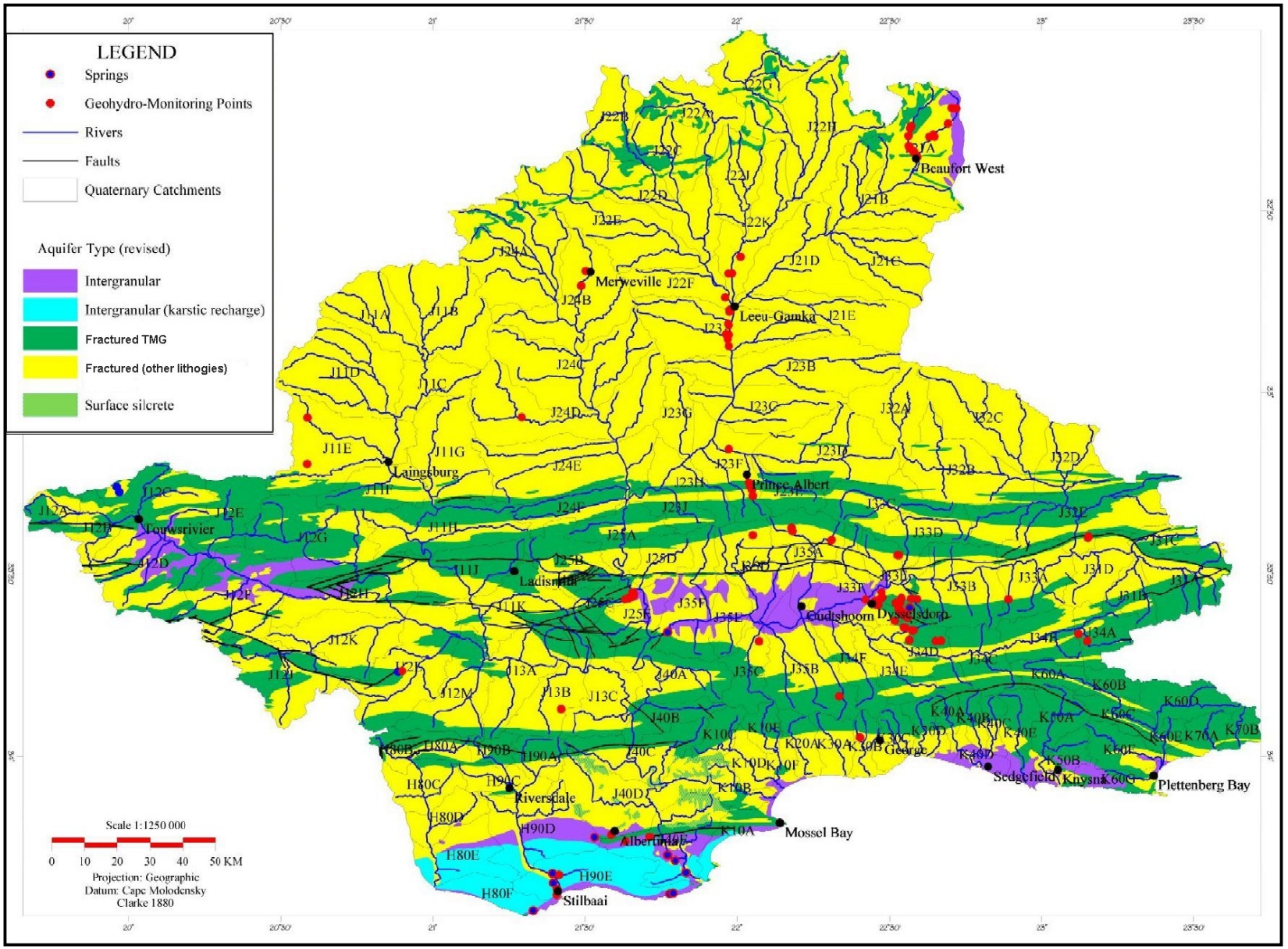

Figure A14.2: Geohydrology Monitoring Points

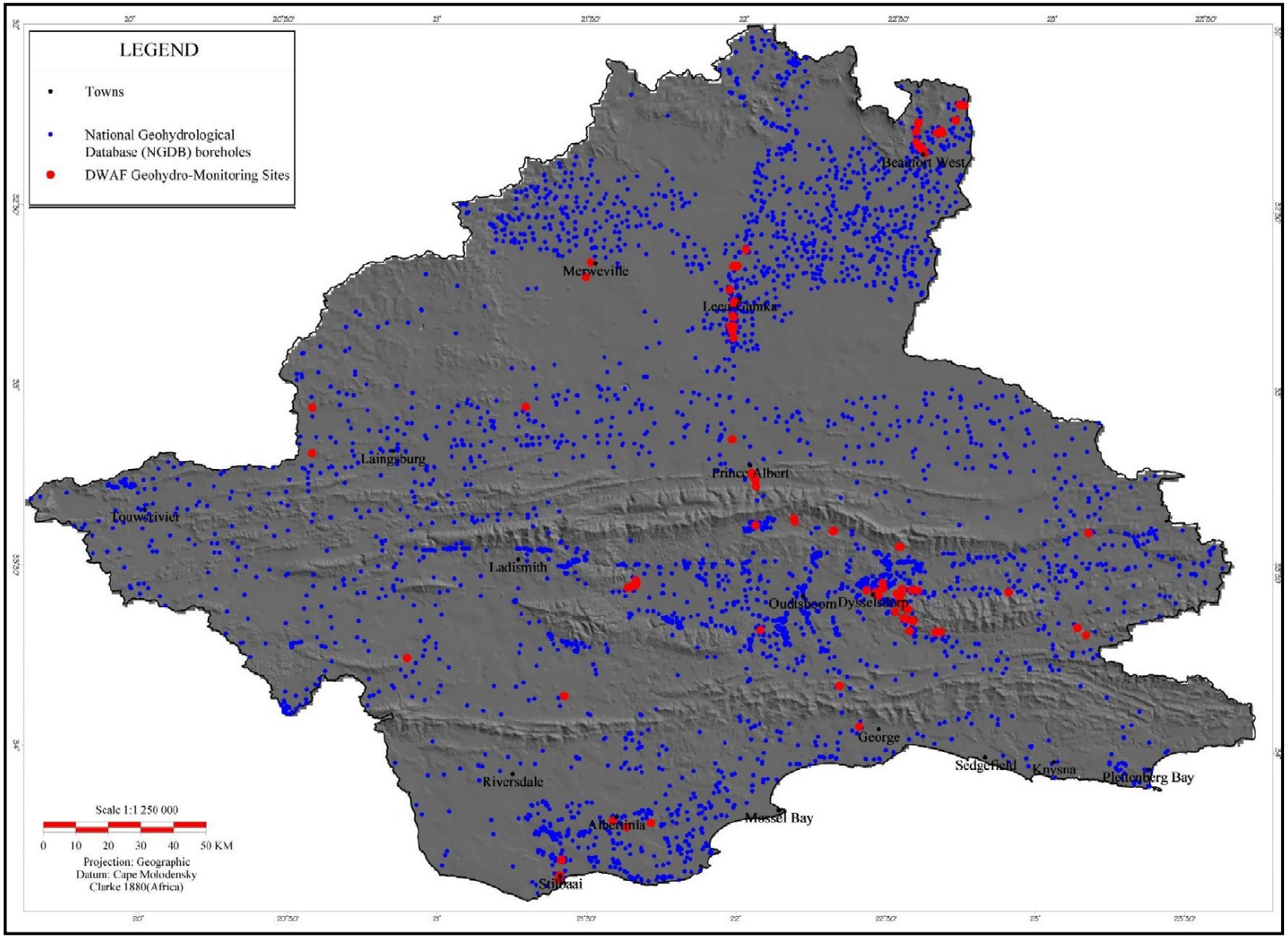

Figure A14.3: National Groundwater Database and DWAF Geohydrology Monitoring Points

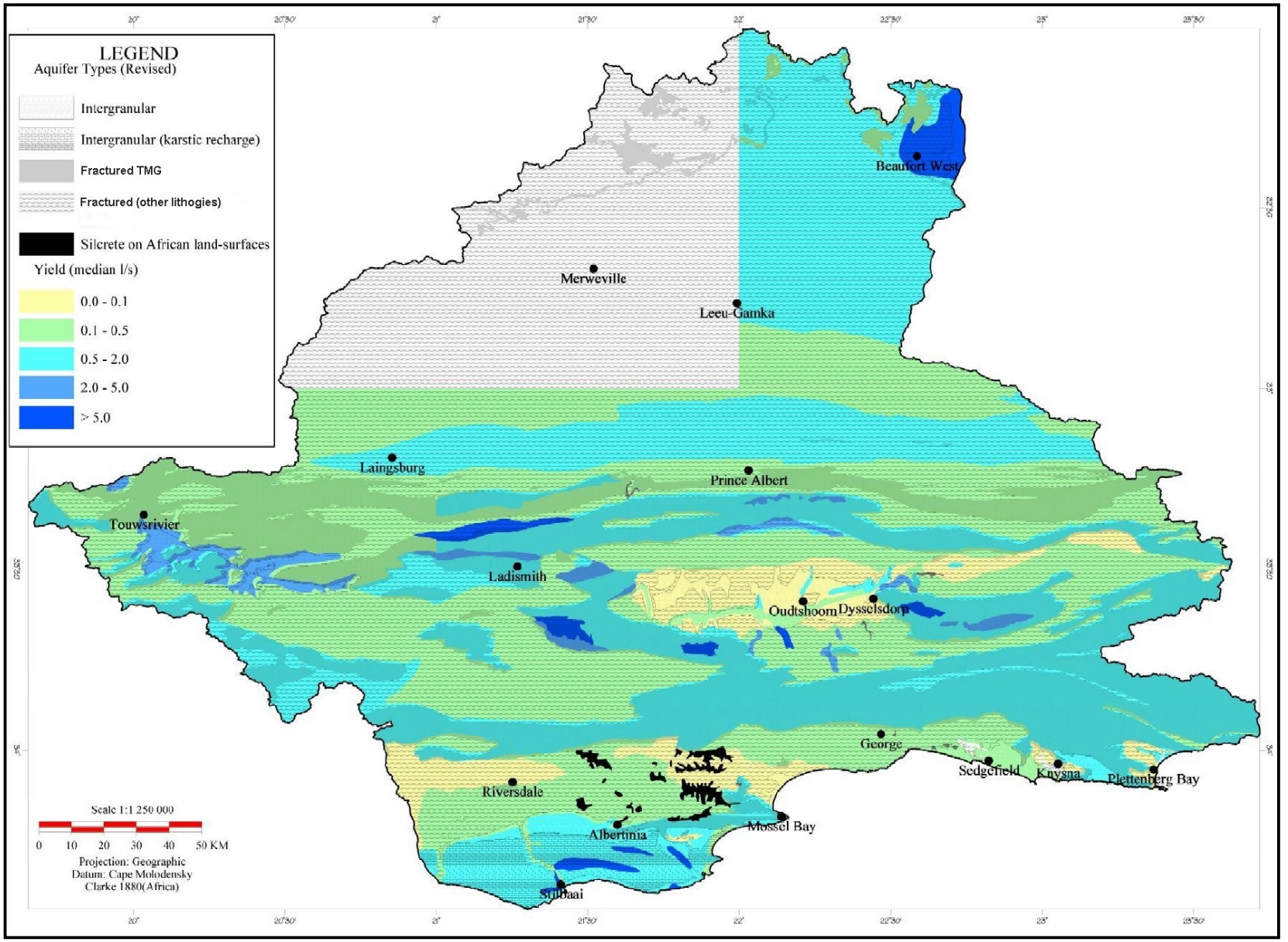

Figure A14.4: Groundwater Occurrence and Median Yield

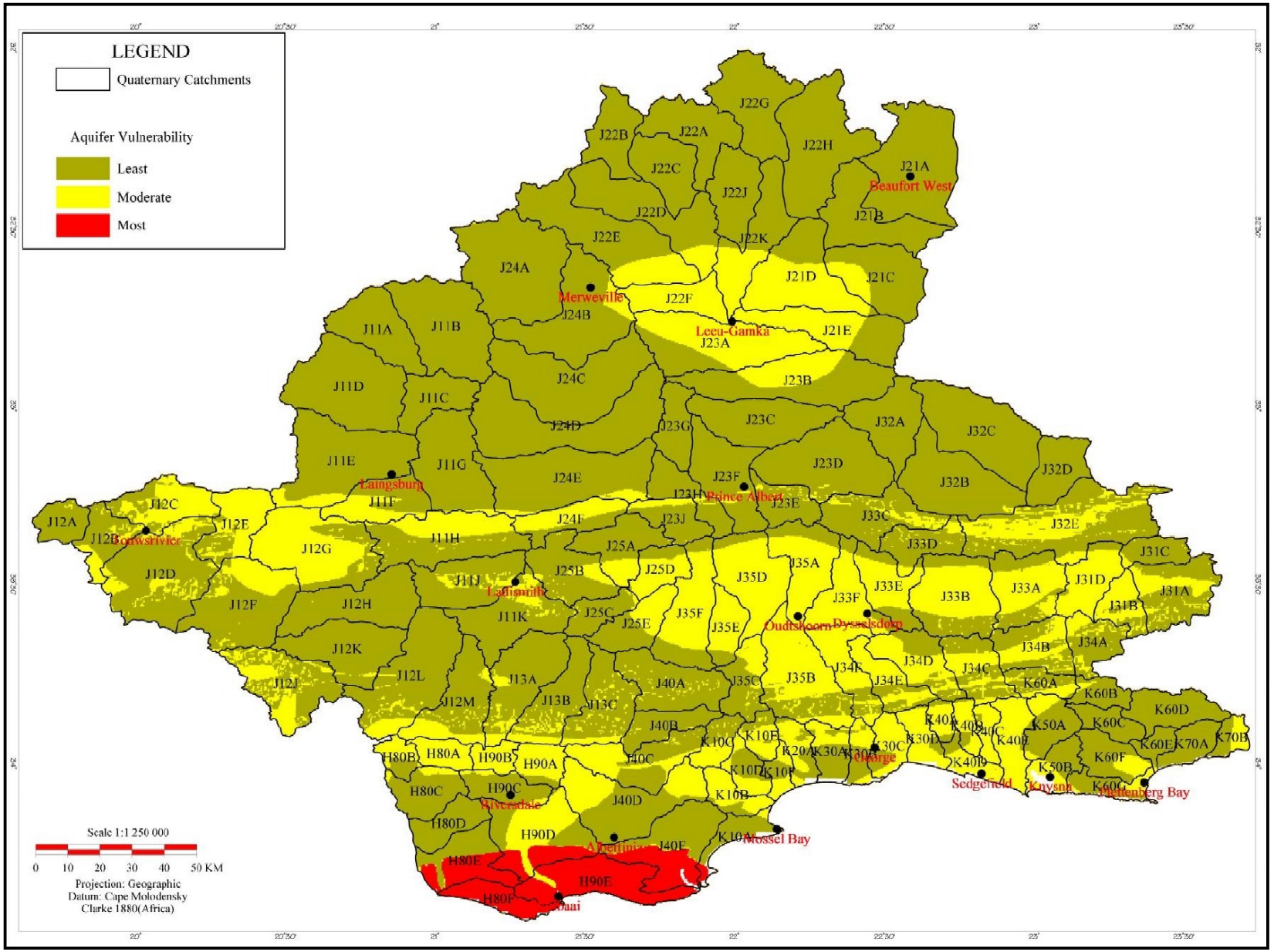

Figure A14.5: Aquifer Vulnerability

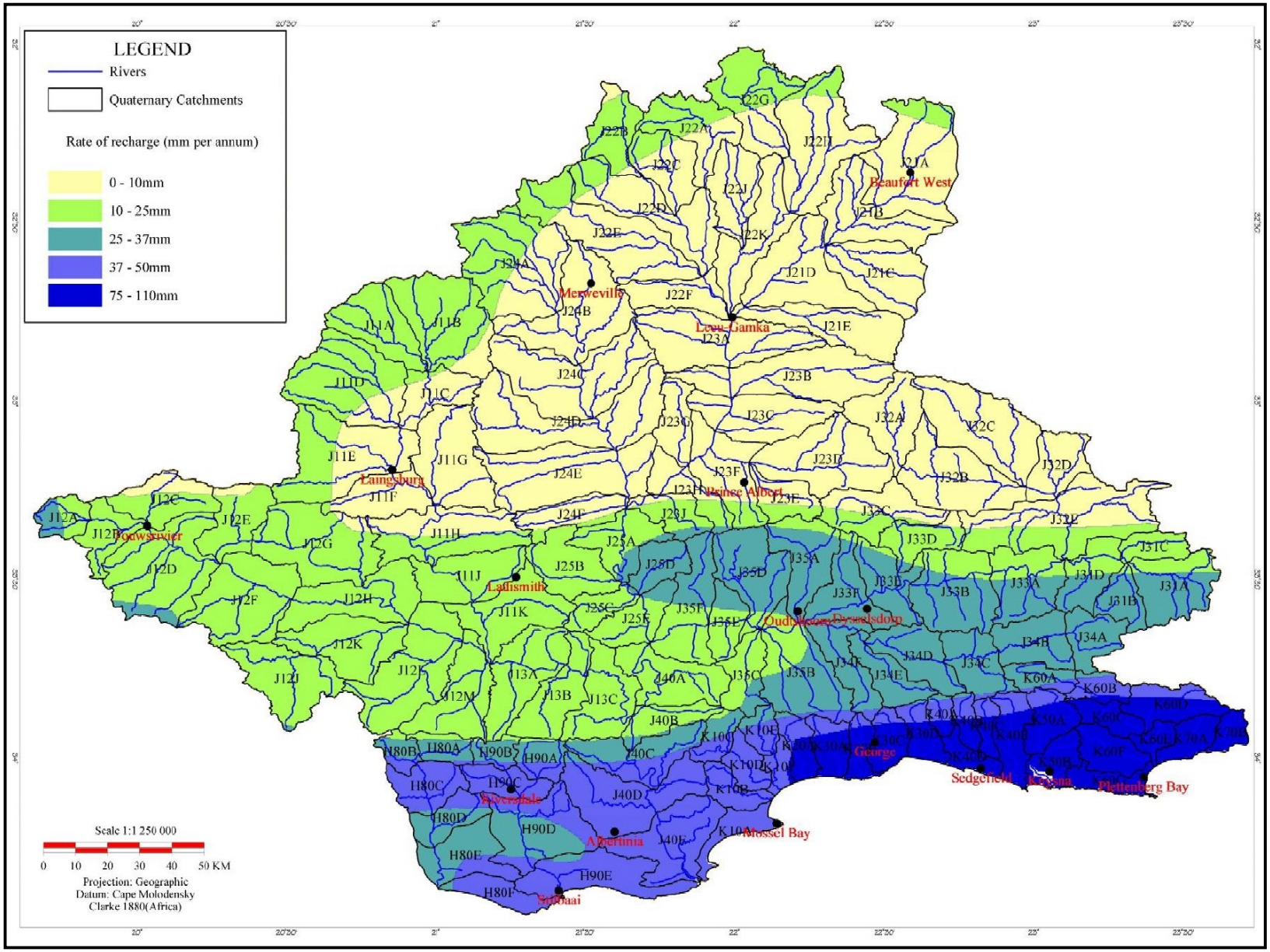

Figure A14.6: Recharge to Groundwater