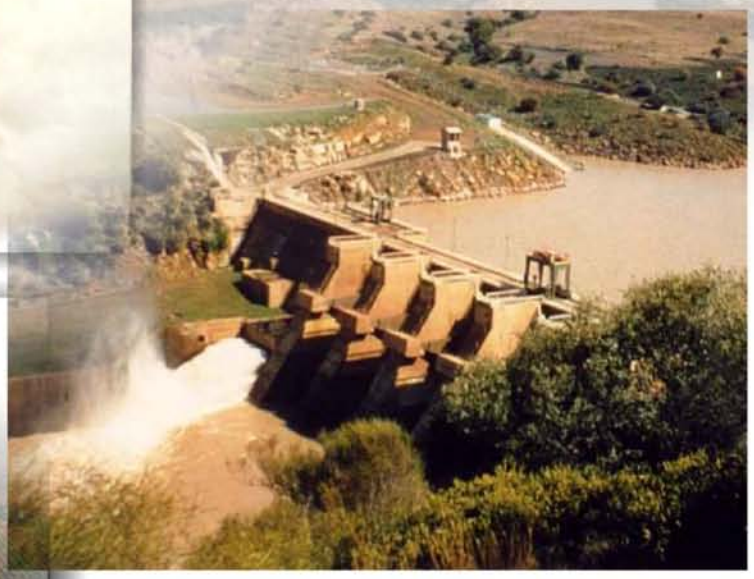
Report Number: P RSA D000/00/0104

DEPARTMENT OF
WATER AFFAIRS AND FORESTRY
Directorate: National Water Resource Planning

Internal Strategic Perspective
Orange River System : Overarching



February 2004

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Department of Water Affairs and Forestry
Directorate National Water Resource Planning

INTERNAL STRATEGIC PERSPECTIVE
FOR THE
ORANGE RIVER SYSTEM OVERARCHING (WMAs No 13 & 14)

Title:	*Internal Strategic Perspective for the Orange River System Overarching*
DWAF Report No:	*P RSA D000/00/0104*
Consultants:	*PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3*
Status of Report:	*Version 1*
Version Controller:	*Ms T Malaka (From Central Cluster)*
Date:	*February 2004*

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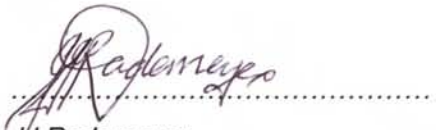

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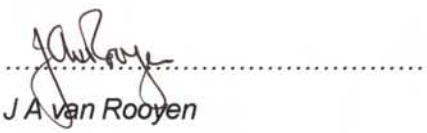

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REFERENCE

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INVITATION TO COMMENT

This report will be updated on a regular basis until it is eventually superseded by the Catchment Management Strategies of the two Orange WMAs. Water users and other stakeholders in the Upper and Lower Orange WMAs 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.GOV.ZA/DOCUMENTS/
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- On CD which can be obtained from DWAF Map Office at:
  157 Schoeman Street, Pretoria (Emanzini Building)
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  MAILTO:APM@DWAF.GOV.ZA

  or from the Version Controller (see box overleaf)

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

- Internal Strategic Perspective Orange River System Overarching (*This Report*) (Report No: P RSA D000/00/0104)
- The National Water Resource Strategy, First Edition 2004
- The Upper Orange WMA - Overview of Water Resources Availability and Utilisation (Report No: P WMA 13000/00/0203)
- The Lower Orange WMA - Overview of Water Resources Availability and Utilisation (Report No: P WMA 14000/00/0203)
- The Upper Orange WMA – Water Resources Situation Assessment

(Report No: P WMA P13000/00/0101)

- The Lower Orange WMA – Water Resources Situation Assessment (Report No: P WMA P14000/00/0101)

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VERSION CONTROL

INTERNAL STRATEGIC PERSPECTIVE ORANGE RIVER SYSTEM OVERARCHING

Version 1	February 2004
(List of Previous Versions)	(Dates)
Current Version Controller	T Malaka Private Bag X995 Pretoria 0001 +27 12 392 1465 malakat@dwaf.gov.za

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

Internal Strategic Perspective for the Orange River System Overarching

Executive Summary

Introduction

The Overarching Internal Strategic Perspective (ISP) of the two Orange River Water Management Areas (Upper and Lower) is described in this document, and represents the Department of Water Affairs (DWAF) view on how Integrated Water Resource Management should be practiced in these two Water Management Areas (WMAs).

The emphasis in this document is on aspects that are of an overarching nature, presenting strategies that deal with issues resulting from the interdependencies between the two WMAs, which exist due to the upstream-downstream orientation of these WMAs.

Detailed ISPs, one for each of the two Orange WMAs, are presented in separate reports ***(DWAF, 2003e & 2003f)*** *covering water resource management aspects that are specific to each WMA. It is important that these specific WMA ISP reports be read in conjunction with this Overarching document, to obtain a holistic view of the water resource management practices in the Orange River System.*

*The information in the report has been compiled from past studies, but more importantly, it captures the knowledge of DWAF officials that are active in the different spheres of water resource management of the Orange River System. In the drafting of the perspectives or strategies contained in this document, cognisance was taken of the legal requirements of the National Water Act and the strategic direction or framework given by the National Water Resource Strategy (NWRS)****(DWAF, 2003c)****.*

Water resource management is carried out in a changing environment and it should be recognised that this ISP is based on the prevailing situation and conditions at the time of compiling the document. It is the intention of DWAF to regularly update this document to keep the information and strategies relevant.

Overview of the two Orange River Water Management Areas

The Orange River rises in the eastern highlands of Lesotho where it is known as the Senqu River and is the largest and longest river in South Africa. From the Upper Orange WMA, the river flows through the

Lower Orange WMA where it discharges into the Atlantic Ocean some 2 300 km from its origin in Lesotho. The two WMAs making up the Orange River System and the supporting transfers are shown in ***Figures 2.1*** *and* ***2.2.***

Substantial variation in climatic conditions occur over the two catchments, with the Mean Annual Precipitation (MAP) reducing from 1 500 mm in Lesotho and 1000 mm in the RSA in the Upper Orange to 20 mm along the western coast in the Lower Orange WMA. This tendency is reversed when considering potential annual evaporation, which increases from 1200 mm in the Upper Orange to 3000 mm in the Lower Orange water management areas.

Major impetus to modern economic development was given by the discovery of the first diamond in June 1870 near a fountain frequented by early transport riders. This prompted the usual diamond rush and lead to the establishment of the towns Koffiefontein and Jagersfontein. In the Upper Orange WMA Bloemfontein, the capital of one of the former boer republics, later developed into the only city in the Upper Orange WMA. Minerals and water from the Orange River were the key elements for economic development in the Lower Orange WMA. Copper was discovered near Springbok in 1850 and the first diamond in the county in 1866 when a young boy found a transparent stone on the south bank of the Orange River. The first irrigation scheme of note was built at Upington, which was originally established as a trading station for items such as copper, iron, assegais, ivory, skins and tobacco. Construction of the weir at Boegoeberg for irrigation purposes began in 1906. Irrigation development in the Upper Orange WMA was stimulated by the construction of several dams. Great expansions of irrigation was made possible along the Orange River in both WMAs by the construction of Gariep and Vanderkloof dams in the Upper Orange WMA during the 1970's. Two large hydropower stations were also constructed at Gariep and Vanderkloof Dams.

Approximately 6 % of the country's Gross Domestic Product (GDP) originates from this area (5% from Upper Orange WMA & 1% from Lower Orange WMA). The potential for economic growth can be found in the agriculture sector converting to higher value products. Agriculture, mining, trade and Government are the main sectors contributing to the GDP in the two WMAs.

Extensive inter-catchment transfer schemes have been developed for the transfer of water within the water management area as well as to other water management areas. The most significant transfers being from Katse Dam via the Lesotho Highlands Water Project to the Upper Vaal water management area and from Gariep Dam via the Orange-Fish tunnel to the Fish to Tsitsikamma water management area.

The main storage dams in the Orange River WMAs are:

- *Gariep and Vanderkloof Dams on the Orange River (Vanderkloof sub-area), which command the two largest reservoirs in South Africa. Hydropower for peaking purposes is generated at both sites.*
- *Armenia and Egmont Dams on tributaries in the Caledon sub-area. Welbedacht Dam lays on the main stem of the Caledon River, with Knellpoort Dam an off-channel storage dam that supplements the water supply to Bloemfontein.*
- *Rustfontein, Mockes and Krugersdrift Dams are situated on the Modder River, and the Tierpoort and Kalkfontein Dams on the Riet River.*

Katse and Mohale dams in Lesotho are not located in the two WMAs, but have a significant impact on the available water in the Orange River, as the bulk of the water flowing in the Orange River is generated in Lesotho. Katse Dam is located in the Senqu sub-area in Lesotho and is used for the transfer of water to the Upper Vaal WMA. Mohale Dam, which was recently completed are located in the same sub-area, and started to impound water in 2003. This dam is also used to support the transfer to the Upper Vaal WMA.

Resource Availability

Fifty seven percent of the natural runoff is generated in Lesotho and 33% in the Upper Orange WMA and the remaining 10% in the Lower Orange WMA. The bulk of the surface water in the Lower Orange Water Management Area is therefore found in the main stem of the Orange River, with virtually all coming from the Upper Orange Water Management Area. Most of the runoff generated in the Lower Orange is coming from the Fish River in Namibia and is only entering the main Orange River close to the river mouth.

Groundwater is an extremely valuable source in both WMAs and in particular in the Lower Orange WMA where approximately 60% of the water used in the tributary catchments is from groundwater. Although the total volume groundwater used is insignificant in comparison with the surface water resources, groundwater is the only source in large areas.

The surface water resources of the Orange River Catchment have been the subject of various studies aimed at developing and maintaining a reliable hydrological database. The hydrological data that are currently used to operate the system typically covers the period October 1920 to September 1988. There is a fairly high level of confidence in the in the yield estimates of the surface water in the system although some of the hydrology is relatively old.

For effective Integrated Water Resources Management it is required to have a clear understanding of the current and future water resources available in the WMAs. This includes the quantities of usable water in terms of spatial distribution and any factors that may affect the yield of the system and requires an operational analysis on an annual basis. With regards to the resource availability it is required to attend to the following:

- *Assess the need to update the hydrology on a continuous basis and in particular for areas with relative old hydrology and areas where a higher resolution hydrological data and system models is required for local water sources under stress.*
- *The hydrology for the whole system should be updated after the occurrence of a severe drought event. By 2008 it will be possible to extend the shorter hydrology records by another 20 years, which is quite a substantial extension and it recommended to at least re-evaluate the extension of the hydrology at that time if a severe drought event has not occurred before then.*
- *The main variables that impacts on the salinity loads in the system should be assessed on a continuous basis to establish the need to update the TDS model and to commission studies accordingly.*

Water Requirements

Present land use in the area is mostly under natural vegetation with livestock farming (sheep, goats, cattle and some game) with large parts falling within conservation areas. Extensive areas under dry land cultivation, mostly for the production of grains, are found in the north-eastern parts of the water management areas. Large areas under irrigation for the growing of grain, fodder crops, grapes etc. have been developed along the main rivers, mostly downstream of dams.

Irrigation is by far the dominant water use sector in the Orange River WMAs, representing 88% of the total gross water use of 1 996 million m³/a estimated for the year 2000. This figure excludes the transfers out of the WMAs. Only 12% are used by the urban, industrial, mining and rural sectors. Transfers from the Orange amounts to 2 159 million m^3/annum and is mainly from the Upper Orange WMA and Lesotho. Expected future growth will mainly be as result of 12 000ha allocated to resource poor farmers and limited growth in urban/ industrial and mining sectors which will mainly be as result of developments in the Bloemfontein, Thaba 'Nchu area. The projected requirement for 2025 is 2 134 million m³/a excluding the transfers. New transfer schemes out of this area is not expected before 2025.

Water Balance Reconciliation

The supply situation in the Orange River System is such that there is a surplus of 333 million m³/a in the system at the year 2000 development level. This surplus reduce significantly to 158 million m³/a by 2003

with the commissioning of Phase 1B of the Lesotho Highlands Project and will diminish over the next fifteen to twenty years due to the development of the 12 000 ha allocated to resource poor farmers and the natural growth in urban / industrial and mining requirements. At 2025 development level a deficit of almost 50 million m³/a is expected. The surplus is currently used for hydropower generation for Eskom, however, recent analysis indicated that the projected risk of curtailments in the water supply to the consumptive users is such that relatively small allocations can be made for power generation purposes. The utilisation of this surplus by Eskom does not only include the releasing of the available surplus through the hydropower turbines but also operating rules that benefit hydropower generation. These rules typically include the release pattern from Gariep Dam, the storage control curves in both Gariep and Vanderkloof dams, etc. As the surplus in the system reduces over time it will therefore be required to gradually move away from the rules that benefit hydropower generation to ensure that the existing users are supplied at the required risk levels.

Based on the given water balance information, which indicated that intervention measures may be required in the next 15 to 20 years, reconciliation can be obtained through any of or combinations of the following options:

- *Reduction in operational losses in the Orange River System, which are currently estimated at 270 million m³/a. The operating losses can be reduced through improved release management and/or by constructing an operating dam in the Lower Orange.*
- *Water conservation and demand management measures. This would focus on irrigation as the largest water user sector in the system. It is however perceived that most savings will be taken up by the users themselves to expand their irrigated areas.*
- *Utilise the storage volume below the current minimum operating level in Vanderkloof Dam. The effect on hydropower as result of this possible option can be significant and is currently being determined and discussed with Eskom.*
- *Construction of Boskraai Dam in the Orange River between Gariep Dam and the Lesotho border or Mashai Dam in the Senqu. The main emphasis on these dams is to transfer water to the Vaal System but they can also be used to improve the water supply situation on the Orange River.*
- *Additional options from the current Lower Orange Management Study (LORMS) also include the utilising of spills from the Vaal by means of real time modelling and a storage dam at Vioolsdrift or Boegoeberg.*

Water Quality

Water quality of the surface water in the Upper Orange is generally good except for the high sediment load in the Caledon and the salinity problems in the Lower Riet. The water quality in the Lower Orange has, however, been severely impacted upon by extensive upstream developments. It is possible that

the water quality problems in the Orange is coming from the Vaal as water quality in the Vaal becomes worse as one proceed along the Vaal. Under normal operating conditions very little water from the Vaal reach the Orange River and it is mainly under flood conditions that large volumes will enter the Orange. Potentially toxic cyanobacterial bloom events are also occurring in the central region of the Orange River. The water quality issues in the catchment at the over-arching level relate to the management of the water quality passed down between WMAs and can therefore not be solved on a WMA basis alone.

An integrated water quality management tool need to be developed for the Orange River Basin to allow for the rational assessment of the factors that impact on water quality. This is a complex system and water quality will have to be modelled in more detail.

Ecological Reserve Determination

The instream and estuarine flow requirements were determined for the Orange River downstream of Vanderkloof Dam in the Orange River Replanning Study (ORRS) (more or less at intermediate level but the methodology differ from that currently used). These ecological requirements (±280 million m³/a) are currently being released from Vanderkloof Dam. As part of the Lower Orange River Management Study (LORMS), modified Desktop level estimates of the environmental requirements were made for the section of the Orange River from the Vanderkloof Dam to the Orange River mouth as well as for the estuary. These in-stream and estuarine flow requirements are used in the current Lower Orange River Management Study (LORMS) to perform sensitivity analysis. Analysis from the LORMS showed a reduction in the system yield of approximately 100 million m³/a when the modified desktop level environmental flow requirements are used in place of the ORRS environmental flow requirements. A comprehensive Reserve must however still be determined for the Orange River. In the mean time it is essential that proper monitoring must be set in place to monitor the ecological health of the river and the estuary and to collect sufficient data as required for a proper Reserve determination.

Lesotho has determined and implemented updated IFRs for the Senqu River in Lesotho. The updated releases are more than that specified in the original Treaty between RSA and Lesotho on the LHWP and will most likely increase the Orange River System yield by about 30 to 60 million m^3/a while transfers to the Vaal will decrease.

Water Use Management

The operation of this system requires continuous analysis of the projected water requirements, return flows and available surplus as well as communication and liaison with the major users. The system is also operated to manage water quality (TDS) by using blending or dilution. The system therefore requires continuous management of the existing and planned water resource systems to optimally manage the system from an operating cost, water quality and assurance of supply point of view.

Groundwater resources play an important role in the supply of local water requirements in the Orange River system and are therefore discussed in the individual WMA ISP documents.

Essential to the operation and planning of the Orange River System is the record keeping and feedback of water use information, return flow volumes and losses. The lack of accurate water use information for irrigation schemes and low flows in the Orange River main stem has been cited as a cause of concern.

International aspects and implications

The National Departments are responsible to draft and implement strategies and policies regarding international shared river basins. The most important international connections that affects the Orange River System is the Lesotho Highlands Water Project (LHWP), which transfers water from Lesotho and the section of the Orange River along the RSA / Namibia border, where water is abstracted by RSA and Namibian users. Two thirds of the total yield realised by the dams in Lesotho and in the Upper Orange WMA, is transferred to the Upper Vaal and Fish to Tsitsikamma WMAs, and released to the Lower Orange WMA for use by the RSA and Namibia.

The Government of Lesotho has recently commissioned a study to investigate the feasibility of schemes to supply in local water requirements. The impacts of these possible water resource developments in the Lesotho Lowlands on the water balance of the Orange River system must be assessed. The possibility of combined utilisation of future water resource developments should be considered.

Current Namibian requirements are in line with the existing proposed 50 million m³/a permanent allocation to Namibia and 60 million m³/a temporary allocation until 31 December 2007. There are however uncertainties with regards to the growth in the water requirements for Namibia and an agreement with regards to the maximum abstraction and payment of water abstractions by Namibia from the Orange River, needs to be formalised.

It is important to ensure that international water use is based on sound agreements among shared basin states and that current and future water use data are exchanged to facilitate efficient planning and management. The existing agreements and results from the LORMS and Lesotho Lowland study should be used for guidance in this regard.

The communications of issues or future planning will be done at the national level through the appropriate government Department.

System Operation

The utilisation of the water resource is optimised by allowing maximum hydropower generation, without adversely impacting on the long-term reliability of supply to the users in the system. For this purpose operating analysis are undertaken on an annual basis to determine the surplus available in the Orange River System which can be used for the generation of hydro-power over and above that released for normal downstream requirements.

As long as there is still a surplus available in the Orange River System, it would be possible to apply operating rules that benefit hydropower generation without impacting on the reliability of supply of the other users. These operating rules will however have to be adjusted over time to compensate for the increasing transfer from the LHWP and the growth in demands that is imposed on the system.

Monitoring and Information Systems

There are a number of shortcomings that have been identified in the monitoring system. These include water quality, flow measurements to gauge power generation releases, river losses, flows at the Orange River mouth, low flows along the main stem of the Orange River mainly in the Lower Orange, and biomonitoring. A comprehensive water monitoring system needs to be developed to address all the monitoring requirements in the Orange River System.

ISP Implementation Strategy

The implementation of the overarching ISP is expected to take place through the Central Cluster (Cluster Manager) as more than one WMA are under consideration. The Central Cluster incorporates the Gauteng, North West, Free State and Northern Cape Provinces and is responsible for Water Services and Forestry functions within these Provinces and Water Resources Management in the Vaal and Orange basin and the Crocodile-Marico WMA.

The ISP is intended to act as DWAF's perspective on how the Orange River catchment's water resources should be managed. The final ISP will be put out and be open to comments from local authorities, water user associations and other water related forums and interested stakeholders. Mechanisms are to be put in place to capture anomalies and it is intended that formal updates of the document will occur periodically until such time as the Catchment Management Agencies are technically functional and Catchment Management Strategies developed for both WMAs.

Internal Strategic Perspectives for the Central Region: Orange River System Overarching

Table of Contents

ABREVIATIONS

Acronym	Meaning
BP	Business Plan
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
Dir: HI	Directorate: Hydrological Information
Dir: NWRP	Directorate: National Water Resource Planning
CMS	Catchment Management Strategy
Dir: OA	Directorate: Option Analysis
Dir: PSC	Directorate: Policy and Strategic Co-ordination
Dir: WRPS	Directorate: Water Resource Planning Systems
Dir: RDM	Directorate: Resource Directed Measures
Dir: WCDM	Directorate: Water Conservation and Demand Management
Dir: WDD	Directorate: Water Discharge and Disposal
Dir: WUE	Directorate: Water Use Efficiency
DWAF	Department of Water Affairs and Forestry
GDP	Gross Domestic Product
GGP	Gross Geographical Product
IDP	Integrated Development Plan
ISP	Internal Strategic Perspective
LHWP	Lesotho Highlands Water Product
LORMS	Lower Orange River Management Study
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff

Acronym	Meaning
NWA	National Water Act
NWRS	National Water Resource Strategy
ORRS	Orange River Replanning Study
WDM	Water Demand Management
WC	Water Conservation
WMA	Water Management Area
WSDP	Water Services Development Plan
WRPM	Water Resource Planning Model
WRSAS	Water Resource Situation Assessment Study
WUA	Water User Association

CHAPTER 1: BACKGROUND TO THE UPPER AND LOWER ORANGE WMA OVERARCHING INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE UPPER AND LOWER ORANGE WMAs

Figure 1.1 shows the location of the Upper & Lower Orange WMAs, which lies predominantly within the Free State and Northern Cape, but also occupies portions of the Eastern and Western Cape Provinces.

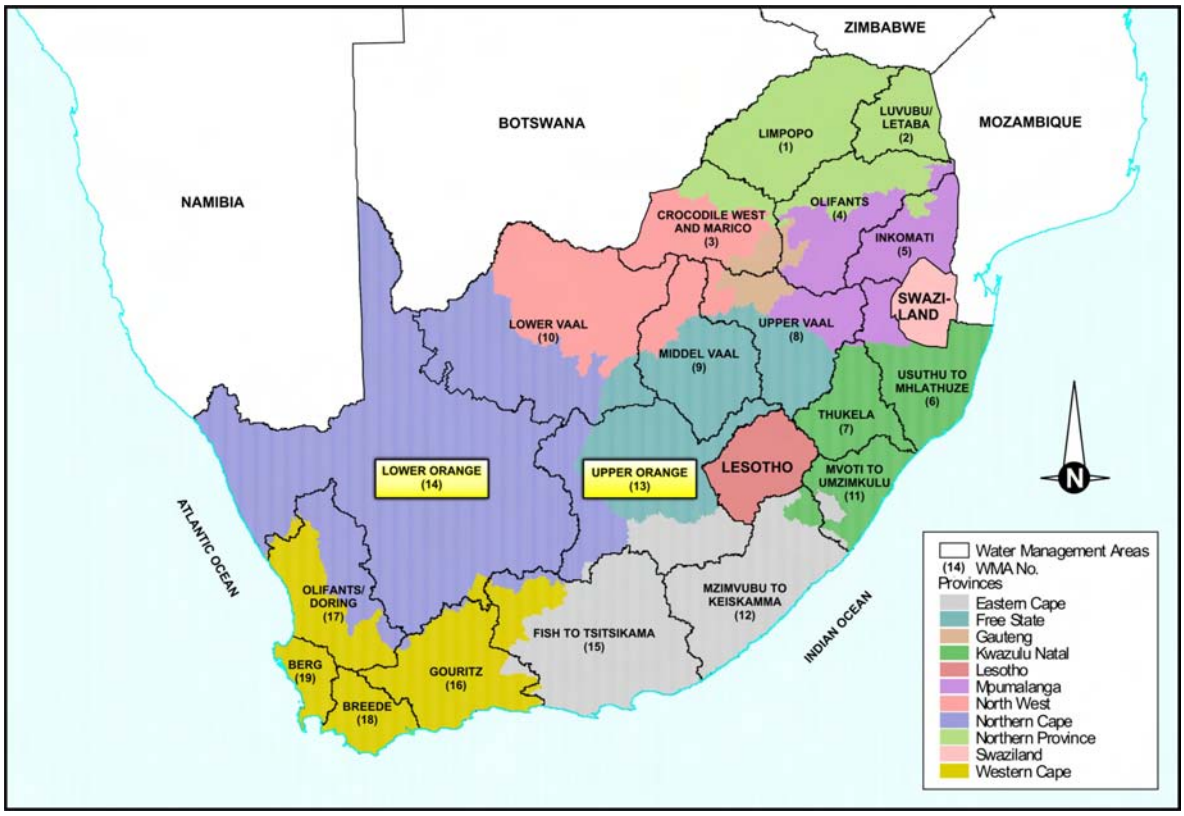

Figure 1.1: Location of the Upper and Lower Orange WMAs

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 Resource 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.

- 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. Furthermore, the way in which the resources are protected, used, developed, conserved, managed and controlled needs to form an integral part of other planning initiatives at provincial, district and local authority level. These relationships are shown in **Figure 1.2** below.

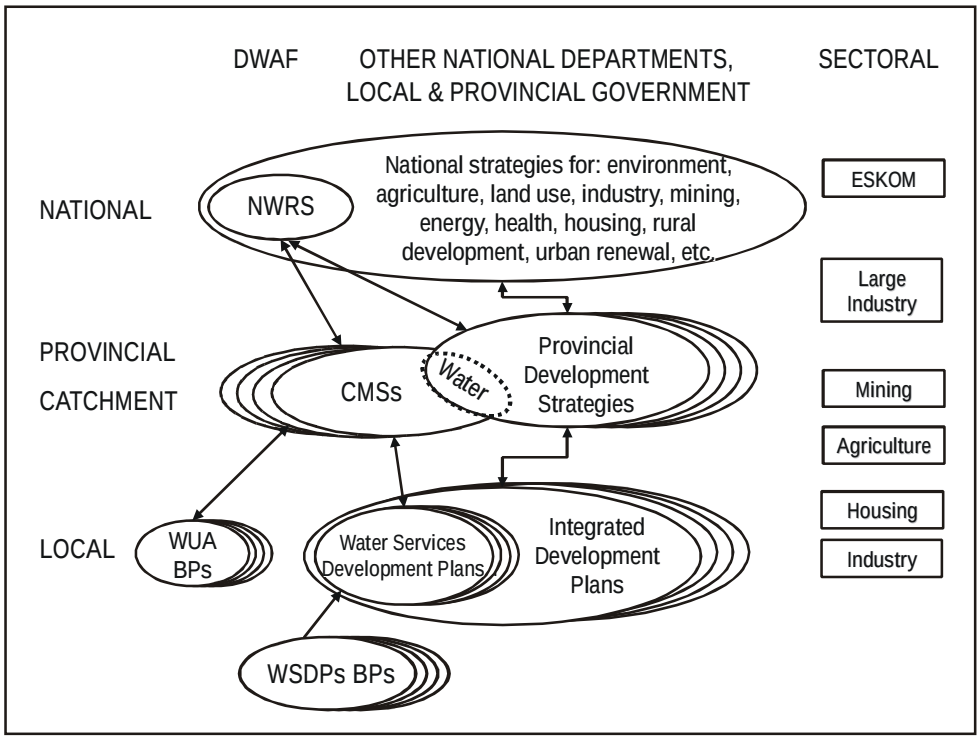

Figure 1.2 : Integrated planning approach at various levels of government in South Africa

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 detail Water Management Area ISPs for the WMAs in the Central Planning Region was preceded with a process where an Overarching ISP was compiled for the Orange River System. The purpose of the Overarching ISP was to develop strategies that cover issues related to both of the Orange River WMAs and relates to the interdependency that exists among the WMAs due to their geographical locations relative to each other. The overarching ISPs fall in the same category as the NWRS as it guides the management of water resources affecting more than one WMA while the ISPs for each individual WMA fall in the category of a CMS.

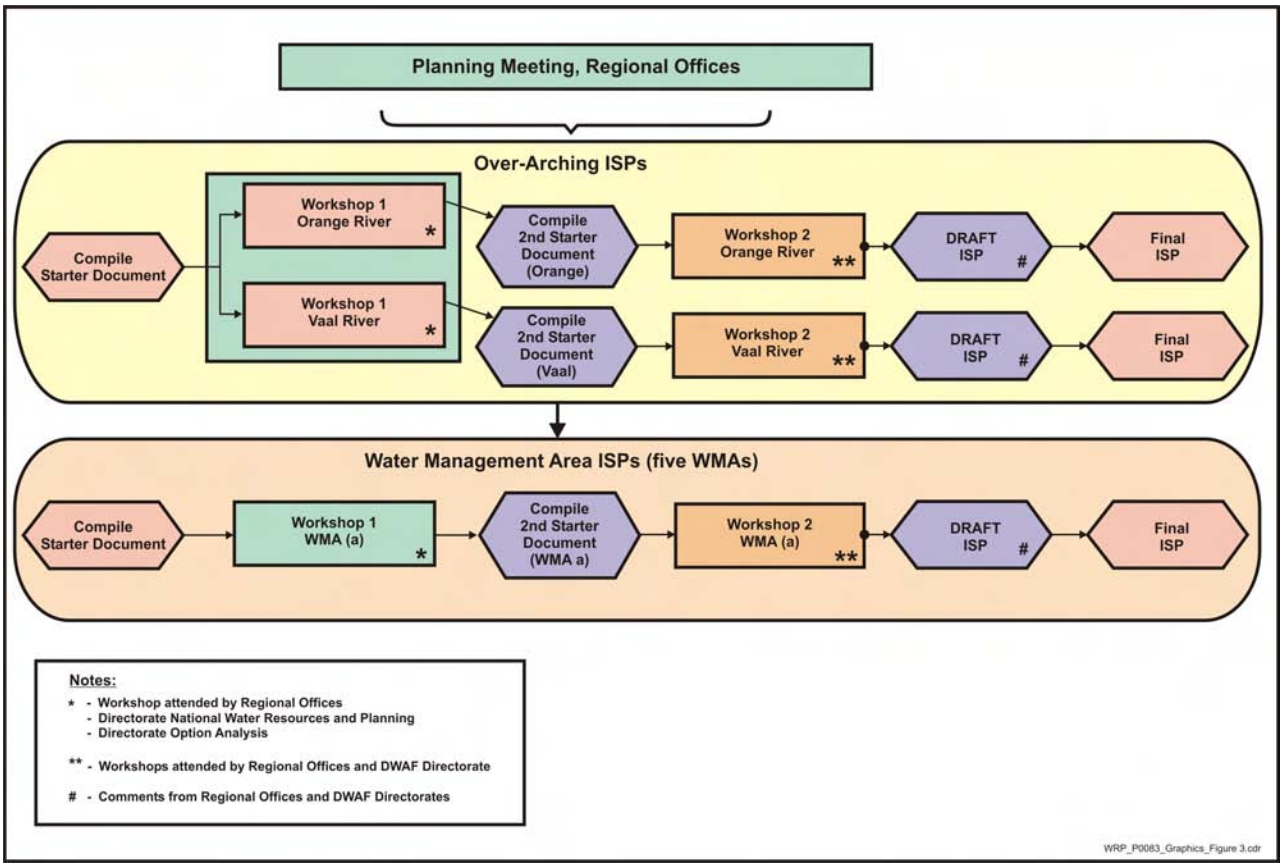

Figure 1.3 : Schematic showing ISP development process

The process for the development of the overarching and the individual ISPs for the Orange River system is shown in **Figure 1.3**. The Overarching ISP for the Orange River was developed in five stages as follows:

i) Determining the current status of water resource management and relevant water resource management overarching issues and concerns in the Upper and Lower Orange WMAs. This was achieved through interviews with individual members of DWAF's RO in Bloemfontein and Kimberley 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 Orange River Overarching ISP was prepared internally within the Department, and captures the Department's perspectives. Once approved by DWAF Management, it is intended that the Regional Office will make the ISP available to Water User Associations (WUAs), Water Service Providers (WSPs), Water Service Authorities (WSAs) and other forums for discussion and comment. These comments will be considered and worked into later versions of the ISP. By adopting this procedure this ISP becomes a working document, which will be progressively updated and revised by DWAF. Public participation forms part of the CMS process, for which the ISP serves as a foundation (see **Paragraph 1.5**).

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

1.3.3 Updating of the ISP Report

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

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

Updating and Version Control

The actual frequency of ISP revision will be determined by the number and extent of revisions to management approaches as reflected in Strategy amendments. All updates to this report, particularly with respect to amendment to the Strategies, need to be passed on to and vetted by the Catchment Manager for the Upper and Lower Orange WMAs. The current incumbent is Ms T Malaka, 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 Strategy on water requirements, availability and reconciliation was updated with comments received from the public participation process in the second half of 2002. To enable the finalisation of the NWRS, these figures were "closed" 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 1.4**.

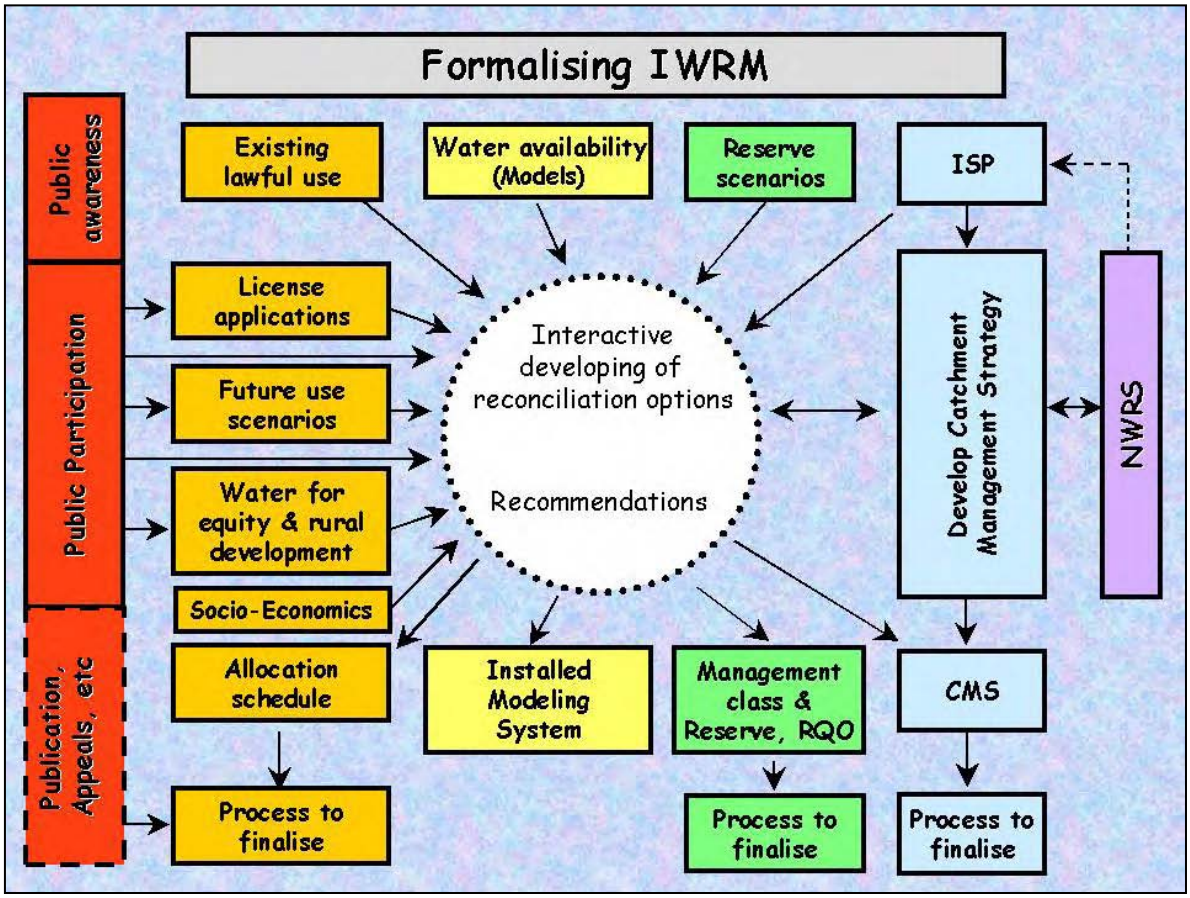

Figure 1.4: Diagram showing the Integrated Water Resources Management approach adopted by DWAF

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.

It will be difficult to classify the rivers before this process, as the implications will be almost impossible to determine. Reserve determinations (regardless of how comprehensively they may have been done), will remain at the preliminary level until the classification is formalised in this 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 (**Appendix A** 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 (**Appendix A: Strategy no 9**) of this ISP.

1.7 WATER QUALITY MANAGE

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 Gariep Dam for freshening the saline water Fish and Sundays rivers in the Eastern Cape, 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 2.2** and **8.1** in **Appendix A** 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 licenses to ensure that both the Groundwater Reserve and other downstream users do not end up being the losers.

The realisation in this and other ISPs is that groundwater offers a huge resource of water, which can be tapped, and that this can be a very significant supplement to the national water resource.

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. Far more significant in terms of both quantity and quality is the release of water to allow for canoeing and other water sports downstream (The Upper Vaal, Dusi and Fish River canoe marathons being prime examples). These activities can bring very significant economic benefits to the WMAs concerned, and where water releases can be accommodated, particularly through alignment with the needs of the ecological Reserve or other downstream users, then so much the better.

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

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

In this ISP refer to **Strategy 6.1**.

1.10 CO-OPERATIVE GOVERNANCE – the place of the ISP

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

The implementation of the overarching ISP is expected to take place through the Central Cluster (Cluster Manager) as more than one WMA are included in the area under consideration. The Central Cluster incorporates the Regional Offices of Gauteng, North West, Free State and Northern Cape Provinces and is responsible for Water Services and Forestry functions within these Provinces and Water Resources Management in the Vaal and Orange basin and the Crocodile-Marico WMA.

CHAPTER 2: BROAD PERSPECTIVE OF THE WATER SITUATION IN THE ORANGE RIVER CATCHMENT AND RELATED STRATEGIES FOR RESOURCE MANAGEMENT

2.1 INTRODUCTION

In this chapter summarised information from the NWRS and the "Overview of Water Resources Availability and Utilisation" reports for the Upper and Lower Orange River WMA is included to provide the reader with the required background of the water situation in the Orange River catchment. This information will enable the reader to better understand the overarching strategies as obtained from the ISP process. When more detailed background information is required, the reader is referred to the NWRS document (**DWAF, 2003c**) chapter 2 and the appendices and secondly to the "Overview of Water Resources Availability and Utilisation" reports (**DWAF, 2003a & 2003b**) for each WMA, which was used as the basis for the NWRS document. These reports should in general provide sufficient detail for most readers. The reader is however strongly advised to read these two reports. Even more detail can be obtained from the "Water Resources Situation Assessment Study" prepared for each Water Management Area, as these reports were used as the base to compile the Overview reports. Inputs to the "Water Resources Situation Assessment Study" reports were mainly obtained from existing reports of previous detailed studies of which the Orange River Replanning Study (ORRS) is the most recent.

This chapter is structured to capture the background and related strategies on a logic and descriptive basis. A broad overview of the overarching strategies that were identified in the Orange River System is also included. This will at the same time serve as an introduction to the detailed descriptions of the strategies that are presented in **Appendix A.** The tables in **Appendix A** present the strategies in a structured format which includes management objectives, background information in support of the motivation for the strategies, management actions that are required for the implementation as well as lists of related issues that were raised at the workshops or captured from study reports. The tables also contain cells to indicate the priority or relative importance of each strategy as well as which of the DWAF directorates would be responsible for implementation.

In addition to the water resource system specific issues listed in **Appendix A**, issues or strategies that were identified for consideration at national level are excluded from this document and will be dealt with through a separate workshop that will focus on all the National Issues. These items typically cover aspects that should be under the Minister's control, relate to national policy, or were identified in several other WMAs and therefore require a high level of coordination.

The development of the strategies has been formulated with the IWRM process in mind (see **Figure 1.4**) and the generic structure, according to which the strategies are presented, follows the broad framework of the National Water Act.

2.2 GENERAL CATCHMENT DESCRIPTION

The catchment description focuses on the Orange River. The Orange River was sub-divided into two WMAs, the Upper Orange WMA and the Lower Orange WMA. The location and borders of the two WMAs are shown in **Figure B-1 of Appendix B.** Although the Vaal River is a

tributary of the Orange River it has been described in the Vaal River Overarching document (DWAF, 2003g). The Riet River, which is in fact a tributary of the Vaal River will be included in this document as it is part of the Upper Orange WMA.

The Upper Orange water management area lies predominantly within the Free State, but also covers portions of the Eastern and Northern Cape provinces. It borders on Lesotho in the east as well as on six other water management areas. The Orange River is the main river in the water management area. The Caledon River, which forms the border between South Africa and Lesotho over most of its length, is the largest tributary to the Orange River within the Upper Orange water management area. Other sizeable tributaries are the Kraai and Riet Rivers. The Riet River, however, first flows into the Vaal River, which then joins the Orange River a short distance further downstream. Refer to **Figure 2.1** for the location and general layout of the Upper Orange Water Management Area.

Figure 2.1: Upper Orange WMA Base Map

The climate over the water management area is cool to temperate and ranges from semi-arid to arid. Rainfall mainly occurs as summer thundershowers, and reduces dramatically from as high as 1000 mm per year in South Africa at locations in the east to about 200 mm per year in the west. In Lesotho, which is the source of most of the water in the Upper Orange water management area, rainfall varies between 600 mm per year to about 1500 mm per year. Potential evaporation is well in excess of the rainfall.

Extensive inter-catchment transfer schemes have also been developed for the transfer of water within the water management area as well as to other water management areas.

The most significant transfers being from Katse Dam via the Lesotho Highlands Water Project to the Upper Vaal water management area and from Gariep Dam via the Orange-Fish tunnel to the Fish to Tsitsikamma water management area. Transfer rate for the Lesotho Highlands

Water Project at year 2000 was 491 million m^3 per year and will be increased to about 835 million m^3 per year when Mohale Dam is commissioned in 2003. Water is transferred at a constant rate irrespective of the water levels or demand situation in the Vaal River System, based on the volume as agreed on by RSA & Lesotho. On route the water is used to generate hydropower for use in Lesotho before it is released into the Ash River in the Upper Vaal WMA.

Transfer from Gariep Dam located in the Gariep key area through the Orange Fish tunnel to the Fish to Tsitsikama WMA to supply the irrigation requirements in the Eastern Cape as well as to supply a part of the requirement for Port Elizabeth. The transfer varies slightly from year to year due to the irrigation requirements of the ±51 500ha listed under the Orange/Fish transfer scheme, which vary from year to year due to variations in rainfall and evaporation. Due to salinity problems within the irrigation scheme more water than the allocation has to be released from Gariep Dam to improve the water quality. This is mainly done during periods when Gariep Dam is spilling. This might however not be adequate especially during long dry periods. Future growth in this transfer will mainly be affected by the growing demand for Port Elizabeth, as well as the 4 000 ha allocated to resource poor farmers in the Fish to Tsitsikama WMA. Some trading has already taken place where farmers along the Orange River bought allocations from Fish River farmers. This will slightly reduce releases to the Fish River and correspondingly increase releases downstream of Vanderkloof Dam into the Orange River.

In the natural state the quality of surface water in the water management area is good, particularly water which flows from the Highlands of Lesotho in the Senqu River. Water in the Caledon River is naturally of high turbidity and carries a concerning high sediment load. Irrigation return flows has a major impact on salinity in the lower Riet River and water is transferred to the Riet River from Vanderkloof Dam, partly for blending and water quality management purposes. A natural pan below Krugersdrift Dam also adds salinity to the Modder River.

The quality of groundwater is naturally good in the eastern high rainfall parts of the water management area, becoming more mineralised and brackish in the drier areas and in the vicinity of salt pans.

Present land use in the water management area is mostly under natural vegetation with livestock farming (sheep, cattle and some game) as the main economic activity. Extensive areas under dry land cultivation, mostly for the production of grains, are found in the north-eastern parts of the water management area. Ficksburg is famous for the cherry orchards in the region. Large areas under irrigation for the growing of grain and fodder crops have been developed along the main rivers, mostly downstream of irrigation dams. There is no afforestation in the water management area.

Bloemfontein and Thaba 'Nchu represent the main urban and industrial development in this water management area. Mining activities have significantly declined and currently mainly relate to salt works and small diamond mining operations.

The Upper Orange water management area (see **Figure 2.1**) was divided into sub-areas comprising the following catchments:

- Catchment of the Caledon River in South Africa (Caledon RSA sub-area).

- Catchment of the Kraai River together with that of Orange River between the Lesotho border and the Caledon River confluence (Kraai sub-area).

- Orange River catchment between the Caledon confluence and the Vaal River confluence (Vanderkloof sub-area).

- Catchment of the Riet River together with Modder tributary (Riet/Modder sub-area).

The geographic extent of **the Lower Orange water management area** largely corresponds with that of the Northern Cape Province, with very small components falling within the Western Cape and Free State Provinces on the southern and eastern boundaries respectively. It borders on Namibia in the north-west and on Botswana in the northern extreme. The Lower Orange water management area is the most downstream of five water management areas covering the Orange/Vaal River Basin, with most of it's water requirements being met from releases from major dams in the Upper Orange WMA. It also borders on three other water management areas. The Orange River is also the main river in this water management area.

The Lower Orange water management area is characterised by a harsh climate with minimal rainfall and prolonged droughts, sometimes to be terminated by severe flooding. Rainfall usually occurs during late summer to autumn. The area experiences the lowest mean annual rainfall in the country, which ranges between 20 mm at the coast and 400 mm on the eastern boundary. Potential evaporation can be as high as 3 000 mm per year and in general is several times more than the rainfall. South of the Orange River and westwards the geology is complex with a variety of rich mineral deposits and shallow, rocky soils.

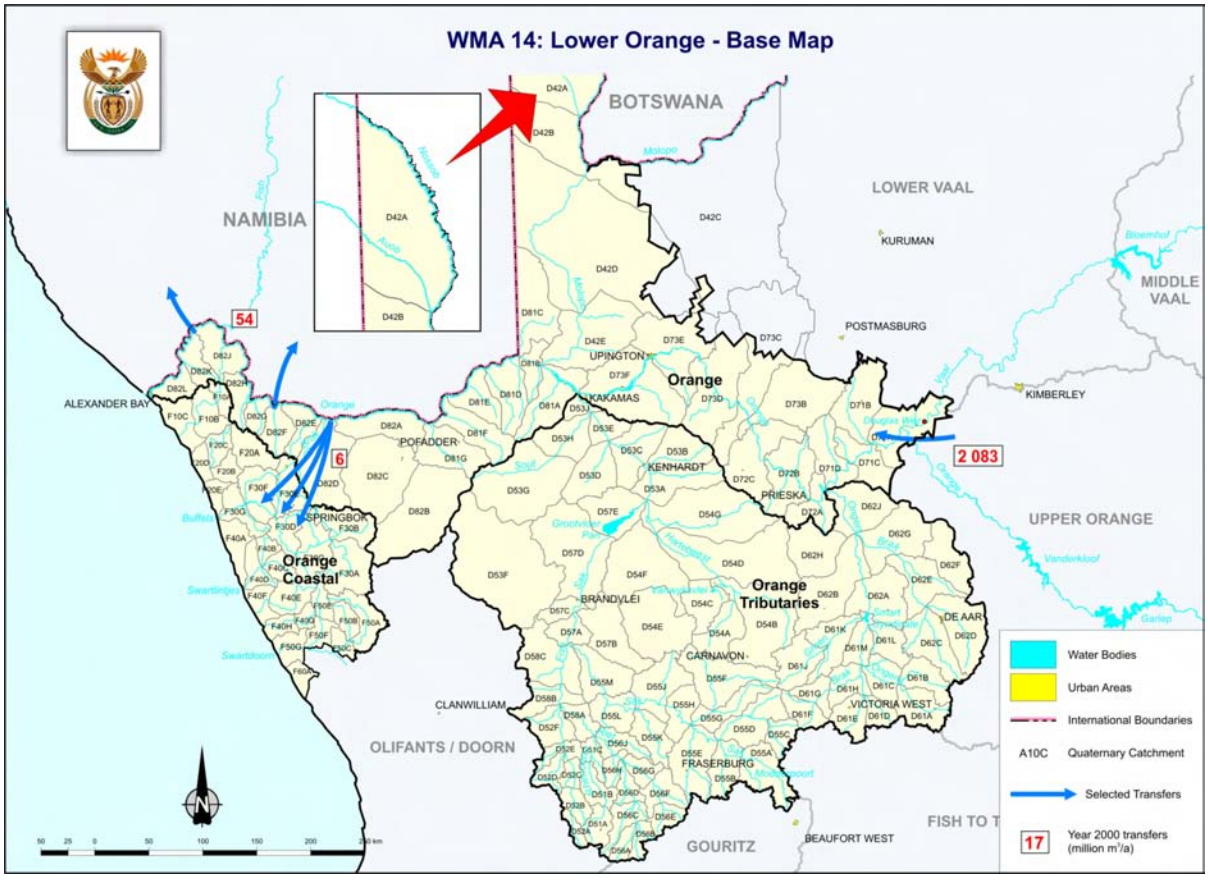

Figure 2.2: Lower Orange WMA Base Map

The Orange River, which forms a green strip in an otherwise arid but beautiful landscape, also forms the border between South Africa and Namibia over about 550 km to the west of the 20 degree longitude. The Vaal River, the main tributary to the Orange River, has its confluence with the Orange River about 13 km west of Douglas. Other tributaries are the Ongers and Hartebeest Rivers from the south, and the Molopo River and Fish River (Namibia) from the north. There are a number of highly intermittent watercourses along the coast, which drain directly to the ocean. Refer to **Figure 2.2** for the location and general layout of the water management area.

Minerals and water from the Orange River were the key elements for economic development in the region, and still remain so. Since the early explorations large mining operations were established, related to the diamonds and other minerals found in the water management area

From a land use perspective, the water management area almost totally still remain under natural vegetation. Sheep and goat farming is practised over most of the area, with large parts falling within conservation areas. Cultivation is restricted to isolated patches where somewhat higher rainfall occurs, and irrigation in the narrow ribbon of fertile alluvial soils along the Orange River. Large mining operations occur in various parts of the water management area (some of the diamond mining activities along the coast are not being reflected on the map). There are no large urban developments or power stations in the water management area. Due to the arid climate, no afforestation occurs. Invading alien vegetation is found along some tributary water courses and on the banks of the Orange River.

In the natural state the quality of water in the Orange River was good, although of high turbidity during flood flows. Water from the tributary streams tends to be of high salinity. Both the flow regime and water quality in the Orange River has, however, been severely impacted upon by extensive upstream developments. Salinity in the Orange River has increased due to the transfer of high quality water away from the Orange River (in Lesotho and the Upper Orange water management area) and as a result of high salinity irrigation return flows along the Orange River. Poor quality water from the Vaal River, which contains a high proportion of irrigation return flows as well as treated urban effluent, may also periodically enter the Orange River.

The Lower Orange was divided into three sub-areas as shown on **Figure 2.2**.

- The Orange sub-area includes the Orange River over the whole of its length through the water management area, together with minor tributary streams.
- The Orange Tributaries sub-area includes the catchments of the Ongers and Hartebeest Rivers.
- The Orange Coastal sub-area includes the mostly dry watercourses, which lead directly to the ocean.

Orange River General: The Orange River rises in the eastern highlands of Lesotho where it is known as the Senqu River and is the largest and longest river in South Africa. From the Upper Orange WMA, the river flows through the Lower Orange WMA where it discharges into the Atlantic Ocean some 2 300 km from its origin in Lesotho (See locality map in **Appendix B, Figure B-1**).

Major impetus to modern economic development was given by the discovery of the first diamond in June 1870 near a fountain frequented by early transport riders. This prompted the usual diamond rush and lead to the establishment of the towns Koffiefontein and Jagersfontein. In the Upper Orange WMA Bloemfontein, the capital of one of the former boer republics, later developed into the only city in the Upper Orange WMA. Minerals and water from the Orange River were the key elements for economic development in the Lower Orange WMA. Copper was discovered near Springbok in 1850 and the first diamond in the county in 1866 when a young boy found a transparent stone on the south bank of the Orange River. The first irrigation scheme of note was built at Upington, which was originally established as a trading station for items such as copper, iron, assegais, ivory, skins and tobacco. Construction of the weir at Boegoeberg for irrigation purposes began in 1906. Irrigation development in the Upper Orange WMA was stimulated by the construction of several dams. Great expansions of irrigation was made possible along the Orange River in both WMAs by the construction of Gariep and Vanderkloof dams in the Upper Orange WMA during the 1970's. Two large hydropower stations were also constructed at Gariep and Vanderkloof Dams.

Approximately 6 % of the Gross Domestic Product (GDP) originates from this area (5% from Upper Orange WMA & 1% from Lower Orange WMA). The potential for economic growth can be found in the agriculture sector converting to higher value products. Agriculture, mining, trade and Government are the main sectors contributing to the GDP in the two WMAs.

The main storage dams in the Orange River WMAs (See in **Figure B-2 in Appendix B**).are:

- Gariep and Vanderkloof Dams on the Orange River (Vanderkloof sub-area), which command the two largest reservoirs in South Africa. Hydropower for peaking purposes is generated at both sites.

- Armenia and Egmont Dams on tributaries in the Caledon sub-area. Welbedacht Dam lays on the main stem of the Caledon River, with Knellpoort Dam an off-channel storage dam that supplements the water supply to Bloemfontein.

- Rustfontein, Mockes and Krugersdrift Dams are situated on the Modder River, and the Tierpoort and Kalkfontein Dams on the Riet River.

Katse and Mohale dams in Lesotho are not located in the two WMAs, but have a significant impact on the available water in the Orange River, as the bulk of the water flowing in the Orange River is generated in Lesotho. Katse Dam is located in the Senqu sub-area in Lesotho and is used for the transfer of water to the Upper Vaal WMA. Mohale Dam, which was recently completed are located in the same sub-area, and started to impound water in 2003. This dam is also used to support the transfer to the Upper Vaal WMA.

For more detailed information the reader is referred to the two reports, one for the Upper Orange WMA (**DWAF, 2003a**) and one for the Lower Orange WMA titled (DWAF, 2003b) "Upper/Lower Orange Water Management Area Overview of Water Resources Availability and Utilisation".

2.3 RESOURCE AVAILABILITY

Fifty seven percent of the natural runoff is generated in Lesotho and 33% in the Upper Orange WMA and the remaining 10% in the Lower Orange WMA. The bulk of the runoff generated in

the Lower Orange is coming from the Fish River in Namibia (approximately 60% of the Lower Orange runoff) and is only entering the main Orange River close to the river mouth. The bulk of the surface water in the Lower Orange Water Management Area is therefore found in the main stem of the Orange River, with virtually all flowing into the river from the Upper Orange Water Management Area.

Although the surface water resources of the Orange River is already heavily regulated through the many large dams in the system, potential has been identified for the re-regulation of releases from Vanderkloof Dam as well as the storage of more flood flows from the Upper Orange and Vaal Rivers. These options could contribute to the improved management of the Orange/Vaal River System, and facilitate more water being made available for use. No meaningful potential for surface water regulation exists in the Orange Coastal sub-area.

Groundwater is an extremely valuable source in both WMAs and in particular in the Lower Orange WMA where approximately 60% of the water in the tributary catchments is from groundwater. Although the total volume groundwater used is insignificant in comparison with the surface water resources, groundwater is the only source in large areas. Groundwater resources will have a small impact on issues of an overarching nature and are dealt with in detail in each of the WMA ISPs. More detail is therefore given in the Upper and Lower Orange ISP reports (**DWAF, 2003e & 2003f**).

The surface water resources of the Orange River Catchment have been the subject of various studies aimed at developing and maintaining a reliable hydrological database. The hydrological data that are currently used to operate the system typically covers the period October 1920 to September 1988.

There is a fairly high level of confidence in the in the yield estimates of the surface water in the system although some of the hydrology is relatively old. Extending the hydrology for the Gariep and Vanderkloof incremental records will not include a more severe drought than that already captured in the October 1920 to September 1988 record period. The observed records at Oranjedraai and Roodewal gauging stations for the period 1989 to 2000 confirmed this. Although this hydrology can be extended by 15 years it is expected to have a relative small impact on the system yield. The hydrology for the Lower Orange downstream of Vanderkloof Dam that was obtained from the WR90 (WRC Study) represents less than 3% of the total natural runoff and will also not affect the yield determined for Gariep and Vanderkloof dams as well as for most of the other major dams.

For effective Integrated Water Resources Management it is required to have a clear understanding of the current and future water resources available in the WMAs (Future development of the resource is discussed in **section 2.6**). This includes the quantities of usable water in terms of spatial distribution and any factors that may affect the yield of the system and requires an operational analysis on an annual basis. With regards to the resource availability it is required to attend to the following:

- Assess the need to update the hydrology on a continuous basis and in particular for areas with relative old hydrology and areas where a higher resolution hydrological data and system models is required for local water sources under stress. Detail of local water resource conditions will be given in the ISPs for individual WMAs.

- The hydrology should be updated after the occurrence of a severe drought event. By 2008 it will be possible to extend the shorter hydrology records by another 20 years which is quite a substantial extension and it recommended to at least re-evaluate the extension of the hydrology at that time if a severe drought event has not occurred before then.

- The main variables that impacts on the salinity loads in the system should be assessed on a continuous basis to establish the need to update the TDS model and to commission studies accordingly.

2.4 WATER REQUIREMENTS

Present land use in the area is mostly under natural vegetation with livestock farming (sheep, goats, cattle and some game) with large parts falling within conservation areas. Extensive areas under dry land cultivation, mostly for the production of grains, are found in the north-eastern parts of the water management areas. Large areas under irrigation for the growing of grain, fodder crops, grapes etc. have been developed along the main rivers, mostly downstream of dams.

Bloemfontein and Thaba 'Nchu represent the main urban and industrial development and is located in the Upper Orange water management area. Two large hydropower stations were constructed at Gariep and Vanderkloof Dams. Large mining operations occur in various parts of the Lower Orange WMA.

Irrigation is by far the dominant water use sector in the Orange River WMAs, representing 88% of the total gross water use of 1 996 million m^3/a estimated for the year 2000. This figure excludes the transfers out of the WMAs. Only 12% are used by the urban, industrial, mining and rural sectors.

Based on the scenarios for population and economic growth, initial estimates of possible future water requirements were made for the period until 2025 (DWAF, 2003a & 2003b). In addition, provision was made for known and probable future developments with respect to power generation, irrigation, mining and bulk users as described under the respective sub-areas where applicable. A total requirement of 60 million m^3/a and 63 million m^3/a was used for Namibia and Lesotho respectively with an assumption of zero growth from 2000 to 2025. Quantification of the projected future requirements for water includes the development of an additional 4 000 ha of irrigation as was approved for poverty relief and the settlement of emerging farmers in the Upper Orange WMA, and 4 000 ha of irrigation for the Lower Orange WMA. The 4 000 ha allocated to the Fish – Tsitsikama WMA as well as 28 million m^3 for urban requirements (mainly Port Elisabeth) are included in the growth in the transfer through the Orange – Fish tunnel. The relevant provincial governments are currently developing processes to manage these allocations and indications are that the first allocations will be made during 2003.

Within the spectrum of population and economic growth scenarios, a base scenario was selected for estimating the most likely future water requirements, 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 projected base scenario requirement for 2025 is 2 134 million m^3/a and includes irrigation, urban, rural and mining requirements.

Large transfer schemes have also been developed for the transfer of water within the Upper Orange water management area as well as to other water management areas. There is one

major transfer out of the Upper Orange WMA (LHWP and (Orange Fish Tunnel) as well as the water use by Namibia along the common border, which is for the purpose of this description also listed as a transfer out of the Lower Orange WMA. Although the transfer from the LHWP to the Upper Vaal WMA is not a transfer from the Upper Orange WMA, it directly effects the flow in the Orange River.

Releases from Gariep and Vanderkloof dams to supply in the requirements of the downstream users are made through the hydropower turbines at both dams. These releases therefore represent a non-consumptive use by Eskom for the generation of hydropower. Eskom is also utilising the current surplus in the Orange River system (Gariep and Vanderkloof dams) to generate hydropower. The utilisation of this surplus does not only include the releasing of the available surplus through the hydropower turbines but also operating rules that benefit hydropower generation. These rules typically include the release pattern from Gariep Dam, the storage control curves in both Gariep and Vanderkloof dams etc. The surplus as given in **Section 2.5** is based on the assumption that the hydropower generation and related rules has no effect on the surplus yield and only utilises the releases from Gariep and Vanderkloof dams for downstream users, to generate hydropower. As the surplus in the system reduces over time, it will therefore be required to gradually move away from the rules that benefit hydropower generation to ensure that the existing users are supplied at the required risk levels.

The information on water use in the system will be significantly improved by the recently completed registration process, which is followed up by the verification of existing lawfull use. Results from this exercise have to be compared with the water use figures used in the water balance. This may have a negative effect on the water balance of the system as it is possible that the finally accepted registered lawfull use may be in excess of the water requirements currently used in the water balance calculations. Although the regional offices have completed the main initiative regarding the registration of water use, the Department is still receiving registrations from users in the catchment. The verification process will therefore have to be continued to determine the validity of each subsequent registration.

It is important that during this process comparisons be made on a regular basis to establish if the water requirements used in the current water balances are being exceeded by the total of the registration database.

The available data on water requirements need to be on the same level of certainty for both WMAs, the Vaal and the Fish/Sundays systems, to be able to develop scenarios for reconciliation as the resource is shared by more than one WMA.

2.5 WATER BALANCE

For the purpose of this water balance the total yield at a 1 in 50 year assurance level is compared to the water requirements, also converted to represent the requirement at a 1 in 50 year assurance level. Although the two sub-areas located in Lesotho (Caledon & Senqu) is not part of the two Orange River WMAs, they were both included in the water balance as they fulfil a key role in the overall water balance. The supply situation in the Orange River System is such that there is a surplus in the system at the year 2000 development level, which will reduce significantly due to the completion of the Phase 1B of the Lesotho Highlands Project in 2003 and even further over the next fifteen to twenty years as result of the minor growth in the future projected water requirements in the system. Eskom is using the water that is released for

downstream use as well as the surplus water in the system to generate hydropower. This "surplus" available for hydropower generation is, however, small in relation to the releases for downstream use (333 versus 2 110 at year 2000) and will decrease as already indicated. Recent operating analysis indicated that the projected risk of curtailments in the water supply to the consumptive users is such that only relatively small allocations can be made for power generation purposes.

More than half the current (year 2000) surplus of 333 million m³/a in the Orange River will be taken up with the commissioning of Mohale Dam in 2003 and the associated transfer to the Vaal System (See **Tables 2.1 & 2.2**). Although **Tables 2.1 and 2.2** is prepared for the Upper Orange WMA, the releases from the Upper Orange to support the demands along the main stem of the Lower Orange is included in the transfers out of the Upper Orange, as indicated for the Vanderkloof sub-area. For the purpose of the Overarching ISP, these two tables will provide the required water balance results, as the water balance for Lower Orange Coastal and Tributaries sub-areas has no effect on the overarching water balance and will therefore be dealt with in the Lower Orange ISP document. **Table 2.1** represents the water balance as obtained from the Overview report, Upper Orange (**DWAF, 2003a**).

Table 2.1: Year 2000 water balance for the Upper Orange WMA (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	(1)
Senqu Lesotho	523	0	523	23	491	514	9
Caledon Lesotho	31	0	31	40	0	40	(9)
Caledon RSA	178	0	178	105	59	164	14
Kraai	44	0	44	103	0	103	(59)
Riet / Modder	137	242	379	351	29	380	(1)
Vanderkloof	3 534	0	3 534	346	2 809	3 155	379
Total	4 447	2	4 449	968	3 148	4 116	333

1) Brackets around numbers indicate negative balance. Surpluses are shown in the most upstream sub-area where they first become available.

2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.

The effect of Mohale Dam is illustrated in **Table 2.2** and it can be seen that the surplus is reduced from 333 million m³/a to 158 million m³/a. As already mentioned, water has been reserved for 12 000 ha new irrigation development (net requirement of approximately 114 million m³/a) for poverty relief, which will reduce the surplus to 44 million m³/a once implemented.

Table 2.2: Year 2003 water balance for the Upper Orange WMA with Mohale Dam included (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in (2)	Total	Local require-ments	Transfers out (2)	Total	(1)
Senqu Lesotho	867	0	867	23	835	858	9
Caledon Lesotho	31	0	31	40	0	40	(9)
Caledon RSA	178	0	178	105	59	164	14
Kraai	44	0	44	103	0	103	(59)
Riet / Modder	137	242	379	351	29	380	(1)
Vanderkloof	3 359	0	3 359	346	2 809	3 155	204
Total	4 616	2	4 618	968	3 492	4 460	158

The water balance for the year 2025 as obtained from the Upper Orange WMA Overview report (**DWAF, 2003a**) is shown in **Table 2.3** and indicates a surplus of 90 million m³/a. At 2025 development level it is expected that the 12 000 ha allocated to resource poor farmers will have been developed in full. It is therefore not possible to have a surplus of 90 million m³/a available in year 2025, when the year 2003 water balance with the effect of the 12 000ha and Mohale Dam included, already showed a surplus of only 44 million m³/a.

Table 2.3: Year 2025 water balance for the Upper Orange WMA as obtained from the Overview Report (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield (1)	Transfers in	Total	Local require-ments (2)	Transfers out	Total	(3)
Senqu Lesotho	867	0	867	23	835	858	9
Caledon Lesotho	30	0	30	40	0	40	(10)
Caledon RSA	273	0	273	104	118	222	51
Kraai	45	0	45	138	0	138	(93)
Riet / Modder	160	301	461	410	52	462	(1)
Vanderkloof	3 359	0	3 359	347	2 878	3 225	134
Total	4 734	2	4 736	1 062	3 589	4 646	90

After some investigation to clarify the anomaly, the following adjustments were made:

- The transfer to the Eastern Cape through the Orange Fish tunnel was increased by 40 million m³/a to accommodate the 4 000ha allocated to the Fish-Tsitsikama WMA. This requirement was not included in the volume given for the transfer out of the Vanderkloof sub-area in **Table 2.3.**

- The local yield in the Caledon RSA sub-area was increased in **Table 2.3** to represent the increase in yield of the Novo transfer scheme. The effect of this increase in yield on the Vanderkloof sub-area yield was however not taken into account in the figures given in **Table 2.3**.

- The 4 000ha allocated to the Upper Orange WMA was included in the Kraai sub-area in **Table 2.3** and it was decided that it should rather be included under the Vanderkloof sub-area.

The adjustments as described above were included and the results are shown in **Table 2.4.** From the adjusted water balance it is evident that there will be a deficit in the system at the year 2025 of approximately 50 million m³/a. When a linear water demand growth pattern is assumed between 2003 and 2025, the available water from the existing system will be fully utilised by 2020. It is important to note that for the purpose of the water balances used in the NWRS, all the demands and yields were converted to a 1 in 50 year assurance level. The deficit given in **Table 2.4** is therefore also representative of a 1 in 50 year risk level.

Table 2.4: Year 2025 adjusted water balance for the Upper Orange WMA (million m³/a)

Sub-area	Available water			Water requirements			Balance
	Local yield (1)	Transfers in	Total	Local require-ments (2)	Transfers out	Total	(3)
Senqu Lesotho	867	0	867	23	835	858	9
Caledon Lesotho	30	0	30	40	0	40	(10)
Caledon RSA	273	0	273	104	118	222	51
Kraai	45	0	45	103	0	103	(58)
Riet / Modder	160	301	461	410	52	462	(1)
Vanderkloof	3 264	0	3 264	384	2 918	3 302	(38)
Total	4 639	2	4 641	1 064	3 629	4 688	(47)

The remaining surplus of approximately 44 million m³/a at 2003 (effect of 12 000 ha included) is clearly not sufficient to cover the expected growth in urban/industrial/mining requirement as a deficit of nearly 50 million m³/a is expected by 2025. (The remaining surplus of 44 million m³/a is therefore reserved for high priority users)

The Orange River still has potential to transfer significant volumes to the Vaal System over and above that transferred through the existing Phase 1 (Katse and Mohale dams and Matsoku Weir) of the LHWP. To achieve this, additional infrastructure will however be required. Any future development of transfer schemes to support the Upper Vaal WMA will have to provide sufficient water resources to support the transfer and maintain the assurance of supply to all users in the Orange River System.

Factors that can have a significant impact on the water balance given above include:

- The indicated surplus was determined without taking into account the effect of water conservation and demand management (WCDM) on the projected water requirements. It is anticipated that the impact of certain WCDM measures will result in a reduction of the net requirements to be supplied from the system. (See the WCDM strategy for more detail).

- The environmental requirement used in the water balance was obtained from the ORRS and the figures may change when a comprehensive estimate is made.

- The ORRS indicated significant operational losses and a potential increase in yield if improvements can be made that will reduce these losses.

- The increase in releases from Katse and Mohale dams for the environment as recently implemented in Lesotho will increase the surplus available in the Orange.

- There are uncertainties with regards to the international requirements for Lesotho and Namibia. Indications of these requirements will be obtained from the LORMS and Lesotho Lowlands Study, which is currently in process.

The current Lower Orange Management Study (LORMS) commissioned jointly by the Namibian and South African governments has the purpose of investigating management measures for the Lower Orange River system (mainly along the river reach that coincide with the border between the two countries) and will during part of the process develop an updated water balance for the system. All of the above mentioned factors will be considered in the updating of the balance. The findings and water balances derived from this study will have to be incorporated into the ISP documentations at a later stage.

2.6 WATER BALANCE RECONCILIATION OPTIONS

From **Tables 2.1** to **2.4** it is clear that although there is a surplus available in the system at the 2000 development level, it is expected that the surplus will reduce over time and that there will be a small deficit in the system by the year 2025.

The resource is shared by more than one WMA and includes the Upper and Lower Orange WMAs, the Vaal system with transfers through the LHWP to the Upper Vaal WMA as well as the Fish/Sundays water supply system with transfers from Gariep Dam through the Orange Fish Tunnel. Reconciliation therefore needs to be done for both the Upper and Lower Orange WMAs at the same time, taking into account the future requirements of the Vaal and the Fish/Sundays water supply systems.

As mentioned in **Section 2.4**, it is important to remember that at the point when intervention is required, Eskom should already have moved away from the rules that benefit hydropower generation to ensure that the existing users are supplied at the required risk levels.

2.6.1 Intervention measures

A holistic planning effort will be required to identify the optimum bulk water storage and supply infrastructure layout that will make optimal use of the local water resources in the Orange River

WMAs. The ORRS and LORMS are the two most recent studies in this regard, and possible intervention measures as obtained from these two studies are listed below.

Based on the given water balance information, which indicate that intervention measures may be required in the next 15 to 20 years, the management actions listed in **Table A1** in **Appendix A** should be implemented. Reconciliation can be obtained through any of or combinations of the following options:

- Reduction in operational losses in the Orange River System, which are currently estimated at 270 million m³/a. The operating losses can be reduced through improved release management and/or by constructing an operating dam in the Lower Orange at Boegoeberg or Vioolsdrift. The most feasible measures to reduce the operating losses should be assessed and implemented. This aspect is being assessed as part of the LORMS and indications are that up to 170 million m³/a can be saved by means of a re-regulating dam at Vioolsdrift. Although the possible re-regulating dams are located in the Lower Orange they will have a direct effect on the availability of water in the Upper Orange WMA.

- Water conservation and demand management measures. This would focus on irrigation as the largest water user sector in the system. It is perceived that water conservation and demand management measures in the irrigation sector will mainly improve the efficiency of water use and that any savings will be taken up by the users themselves to expand their irrigated areas. It is therefore anticipated that the overall Orange River System water balance will not be significantly influenced by WCDM in the irrigation sector. It could however be used to address inequities if required at a later stage, after the allocated 12 000 ha had been taken up.

- Utilise the storage volume below the current minimum operating level in Vanderkloof Dam. This option can increase the yield by as much as 231 million m³/a, but will have a direct impact on hydropower generation as hydropower cannot be generated below the current minimum operating level. The effect on hydropower as result of this possible option is currently being determined and discussed with Eskom.

- Construction of Boskraai Dam in the Orange River between Gariep Dam and the Lesotho border. This dam can be used to improve the water supply situation on the Orange River as well as to transfer water to the Vaal System. The Boskraai Dam was identified in the ORRS study as one of the best options for possible future transfers from the Orange to the Upper Vaal. This dam is located across the Orange and Kraai Rivers just upstream of the confluence of the Kraai and Orange Rivers.

- Proposed possible developments from Lesotho Lowlands study may be utilised by the RSA as a joint development by both countries. Although the Lesotho Lowlands study is aimed at the developing of local resources to meet the local water requirements in Lesotho it is possible for the RSA to contribute to the proposed development to also meet water requirements in the RSA. The existing Orange-Senqu Commission should be used to communicate RSA's requirements in terms of the study to the Government of Lesotho.

- Results from the current LORMS should be evaluated as further possible options to supply in the future requirements. The possible options that are investigated in the LORMS include the following of which some have already been discussed above:
    - Using the Lower Level Storage in Vanderkloof Dam.
    - Utilising spills from the Vaal River by means of real time modelling.
    - Decrease operational losses by means of re-regulating dams.
    - Large Storage dam at Boegoeberg or Vioolsdrift.
    - Making more water available through WCDM.

2.6.2 Compulsory licensing

Compulsory Licensing is a procedure defined in Section 43 of the National Water Act, which has the purpose of correcting imbalances in water allocations and can be used to address the following:

- Correct the imbalance if the current water balance is negative.
- Make additional water available for the Reserve.
- Meet reasonable equity demands.

Based on the current surplus supply situation and the fact that a positive water balance is projected for the following fifteen to twenty years, the implementation of Compulsory Licensing is not considered a priority in the Orange River System as a whole. It is possible that there are locally stressed catchments in the system which may require Compulsory Licensing, however, those were identified during the development of the detailed WMA ISPs and are included in the relevant documents (**DWAF, 2003e & 2003f**).

Environmental requirements for the main stem of the Orange River as obtained from the ORRS are currently supplied from the system and are included in the water balance above, together with the desktop estimates for the remaining areas as given in the NWRS. There is therefore no eminent need for allocation corrections to satisfy the existing environmental requirements. Estimations of the environmental requirements for the main stem of the Orange River as indicated by the current LORMS study is higher than that obtained from the ORRS. It is therefore possible that the Reserve, which still needs to be determined, might eventually put more strain on the water balance.

Allocations to address inequities in water allocation have already been made by means of the 12 000 ha allocated to resource poor farmers and the effect of the allocations was included in the water balance. These allocations must first be taken up, before more will be considered for which compulsory licensing might be an option to make it possible. There is therefore no immediate need to enter into compulsory licensing for this purpose.

2.7 STRATEGIES FOR WATER RESOURCE MANAGEMENT RELATED TO BOTH WMAs

2.7.1 Water Resource Protection

The two aspects that were dealt with under water resource protection are the ecological Reserve and water quality management.

Water Quality : Water quality of the surface water in the Upper Orange is generally good except for the high sediment load in the Caledon and the salinity problems in the Lower Riet. The water quality in the Lower Orange has, however, been severely impacted upon by extensive upstream developments. It is possible that the water quality problems in the Orange is coming from the Vaal as water quality in the Vaal becomes worse as one proceeds along the Vaal. Under normal operating conditions very little water from the Vaal reach the Orange River and it is mainly under flood conditions that large volumes will enter the Orange. Potentially toxic algae bloom events are also occurring in the central region of the Orange River. The water quality issues in the catchment at the over-arching level relate to the management of the water quality passed down between WMAs and can therefore not be solved on a WMA basis alone. The large urban, industrial and mining developments are located in the Upper Vaal WMA and to a lesser extent in the Middle Vaal WMA. This is the case of the poor water quality being passed down to the Lower Vaal and Orange WMAs. The water quality variables of concern at a system level are eutrophication and salinity. There are water quality variables of concern relating to specific WMA or sub-catchments within a WMA. These will be dealt with in the individual WMA ISPs. The water quality is currently being managed by releases of clean water used to dilute the water quality to meet salinity targets.

Water Quality Objectives (WQOs) are being put in place for the management of water quality. WQOs have been set in a number of the catchments. These are generally a result of a negotiation process through the Forums as part of a situation assessment or the development of water quality management plans. The setting of the WQOs may or may not have involved a process to determine the feasibility of implementation, the allocation of waste loads between dischargers, and the downstream effects of the WQOs set. The impact of the implementation of source directed strategies on the instream water quality in terms of improvement has in general not been investigated. The integration of all these factors needs to be investigated and an integrated water quality management tool developed for the Orange River Basin to allow for the rational assessment of the factors that impact on water quality. This is a complex system and water quality will have to be modelled in more detail.

In addition to the practice of blending, the Department of Water Affairs and Forestry is busy implementing the source control measures through the licencing, EIA and EMPR processes. These factors influence mining, industry and sanitation system discharges. These practices of source control and best practice should continue.

Ecological Reserve Determination: The instream and estuarine flow requirements were determined for the Orange River downstream of Vanderkloof Dam in the ORRS (more or less at intermediate level but methodology differ from that currently used and accepted). These ecological requirements (±280 million m^3/a) are currently being released from Vanderkloof Dam.

Lesotho has determined and implemented updated IFRs for the Senqu River in Lesotho. The updated releases are more than that specified in the Treaty between RSA and Lesotho and will most likely increase the Orange River System yield by about 30 to 60 million m^3/a.

As part of the LORMS, modified Desktop level estimates of the environmental requirements were made for the section of the Orange River from the Vanderkloof Dam to the Orange River mouth as well as for the estuary. These in-stream and estuarine flow requirements are used in the LORMS study to perform sensitivity analysis. Analysis from the LORMS showed a reduction in the system yield of approximately 100 million m^3/a when the modified desktop level environmental flow requirements are used in place of the ORRS environmental flow requirements. A comprehensive Reserve must however still be determined for the Orange River. In the mean time it is essential that proper monitoring must be set in place to monitor the ecological health of the river and the estuary and to collect sufficient data as required for a comprehensive Reserve determination. Indications from the LORMS are that the ecological requirements can be higher than that currently released and it is therefore important not to allocate the surplus in the system as result of the higher ecological releases from Lesotho. The water quality requirements for the environment have not been fully addressed in any of the current available environmental flow assessments. A draft management plan for the Orange River estuary has been produced.

The implementation of the IWRM process requires an ecological Reserve as a basic building block or input to the process. The preliminary determination from the ORRS will be used for the main stem of the Orange River until better estimates have been determined for the Orange River and the main tributaries. The Orange River Reserve will have to be determined in close co-operation with the Vaal River Reserve Determination.

2.7.2 Water Use Management

Operational Management: System management measures are implemented to optimally utilise the available water resources, in terms of short-term benefits and to maintain the reliability of supply over the long-term. The aim is to postpone the need for the development of new costly infrastructure for as long as possible into the future while saving operating costs over the short-term.

The operation of the Orange River System is linked to the operation of the Vaal River System and the Lesotho Highlands Project. The Vanderkloof and Gariep Dams in the Orange River System are operated to support all the downstream users and at the same time to generate hydropower with the releases for downstream users as well as with the surplus available in the system (see **Section 2.4** for more detail). Allowing maximum hydropower generation optimises the utilisation of the water resource, without adversely impacting on the long-term reliability of supply to the users in the system. There is an annual review of the operations of the dams to optimise power generation and water availability. The operation of this system requires continuous analysis of the projected water requirements and return flows, current state of the dams and requires communication and liaison with the major users. The system is also operated to manage water quality (TDS) by using blending or dilution. The system therefore requires continuous management of the existing and planned water resource systems to optimally manage the system from an operating cost, water quality and assurance of supply point of view.

The Orange River System is well regulated with releases being made from the system of dams and transfers to meet downstream water requirements. The water volume released can travel large distances to the users through arid and semi-arid areas. Water is also transferred into the system via pipelines and canal systems. There are losses associated with these conveyance

systems. These losses can affect the yield of the system and implementation dates of future augmentation schemes. These losses need to be quantified through measurement and the efficiency of the systems improved.

Hydropower generation at Gariep and Vanderkloof Dams forms an important component of Eskom's peak generation capability. Fluctuating releases from hydropower turbines impact negatively on some users between Vanderkloof Dam and Marksdrift. In turn, upstream transfers of water negatively impact on the water availability for power generation.

The Caledon/Modder transfer system as well as other sub-systems within the Riet/Modder catchment are however not analysed on an annual basis. Models and the required data already exist for this purpose and it should be considered to include these systems as part of the annual analysis.

Essential to the operation and planning of the Orange River System is the record keeping and feedback of water use information and return flow volumes. The lack of accurate water use information for irrigation schemes has been cited as a cause of concern.

Groundwater: Groundwater resources play an important role in the supply of local water requirements in the Orange River system and are particularly important in the Lower Orange WMA. Details are however given in the individual WMA ISPs.

Licensing Strategy: The process of verification of the current registered water use has started but is not yet completed. Satellite imagery is used for verification purposes and the required tools for this process are already in place. The verification process started in the areas where the most problems were experienced.

The existing WARMS information management system are being used to manage water use licenses data and to capture data of the actual requirements / discharges of users.

The issuing of licences for water abstraction is and should be considered within the framework as given in **Appendix A Table A.3.4**.

Licensing is the mechanism defined in the NWA to control water use within a sustainable level given the current and future water availability estimates. The issuing of licences is important to protect the water resources and allow the use of the resource for economic benefit in a manner that is equitable among competing users.

Public Health and Safety: The Department's current commitments are associated with:

- Managing floods and drought disasters by direct intervention on the ground.
- Reducing pollution and preventing serious or hazardous pollution events and promoting dam safety.

Flood management at Gariep and Vanderkloof Dams aims to not have the Orange River floods in phase with floods from the Vaal River as this is of major importance with respect to the protection of developments along the Lower Orange River. To achieve this, flood peaks are basically reduced and released over a longer period.

The annual hydropower operational analysis is used to determine the surplus or deficit in the system. During dry periods when there is a short-term deficit in the system, the required curtailments will be imposed on the system by taking into account the assurance of supply allocated to the various users.

Potentially toxic cyanobacterial bloom events are occurring in the central region of the Orange River and nutrient management strategies regarding this issue need to be addressed.

2.7.3 Water Conservation and demand Management

The efficient and optimal use of water is important in a water scarce country like South Africa. Water conservation and demand management (WCDM) is crucial in achieving the objective of efficient use of water. However, a cohesive and practical implementation of WCDM should be adopted. This implies that the effects on return flow volumes and economics should be considered. The results of the implementation of WCDM should be coupled to monitoring to assess the affects of the measures implemented on the projected water requirements.

2.7.4 Water Pricing and Financial Assistance

The pricing strategy will be conducted in accordance with the process specified in the NWRS. The application of the pricing policy is expected to curtail the use of water in particular the future use of the surplus where the full cost for the water will be charged.

The implementation of the waste discharge charge system (WDCS) will play an important role in the Orange River system. The WDCS will encourage the implementation of recycling, source control measures and effluent treatment. This will reduce water requirements and improve the water quality of the receiving water.

2.7.5 Iternational aspects and implications

Countries sharing the Orange Senqu river basin include the Republic of Botswana, Kingdom of Lesotho, the Republic of Namibia and the Republic of South Africa.

The National Department is responsible to draft and implement strategies and policies regarding international shared river basins. These strategies are guided by international protocols that define the basic framework for water management across international boarders.

The most important international connections that affects the Orange River System is the Lesotho Highlands Water Project (LHWP), which transfers water from Lesotho, the possible developments from the Lesotho Lowlands Study and thirdly the section of the Orange River along the RSA / Namibia border, where water is abstracted by RSA and Namibian users.

International water supply sharing therefore mainly includes Namibia in the Lower Orange WMA and Lesotho in the Upper Orange WMA. It is important to ensure that international water use is based on sound agreements among shared basin states and that current and future water use data are exchanged to facilitate efficient planning and management. To address this need a study was recently initiated by ORASECOM (Orange-Senqu River Commission) which an international organisation representing the Governments of the Republic of Botswana, Kingdom of Lesotho, The Republic of Namibia and the Republic of South Africa. The proposed study basically involves developing an Integrated Water Resource Management Plan for the Orange Senqu river basin.

Local water resource developments in Lesotho (excluding the LHWP) have historically been small, with little impact on the water resources of the Orange River System. This situation could change with the possible development of the water resources in the Lowlands of Lesotho. The Government of Lesotho has recently commissioned a study to investigate the feasibility of such schemes. The impacts of the possible water resource developments in Lesotho Lowlands on the water balance of the Orange River system must be assessed and the possibility of combined utilisation of future water resource developments can also be considered. The use of the same modelling systems as applied in RSA should be considered in the study for compatibility and consistency purposes.

Allocations to Namibia have been identified during previous studies and the current LORMS has been commissioned to investigate improved options for the joint management of the Lower Orange River. Current Namibian requirements are in line with the existing proposed 50 million m^3/a permanent allocation to Namibia and 60 million m^3/a temporary allocation until 31 December 2007. There are however uncertainties with regards to the growth in transfers to Namibia and an agreement with regards to the maximum abstraction and payment of water abstractions by Namibia from the Orange River, needs to be formalised. Results from the LORMS should be used for guidance in this regard.

2.7.6 Monitoring and Information Systems

There are a number of shortcomings that have been identified in the monitoring system. These include water quality, flow measurements to gauge power generation releases, river losses, flows at the Orange River mouth, low flows along the main stem of the Orange River mainly in the Lower Orange and biomonitoring. A comprehensive water monitoring system needs to be developed to address all the monitoring requirements in the Orange River System.

Note should be taken of existing National Monitoring Programmes (National Eutrophication Monitoring Programme; National Microbiological Monitoring Programme; National Chemical Monitoring Programme; etc). It is further important that all CMAs should be committed to the establishing of the database for the National Status Reporting.

2.8 ISP IMPLEMENTATION STRATEGY

The implementation of the overarching ISP is expected to take place through the Central Cluster (Cluster Manager) as more than one WMA are under consideration. The Central Cluster incorporates the Gauteng, North West, Free State and Northern Cape Provinces and is responsible for Water Services and Forestry functions within these Provinces and Water Resources Management in the Vaal and Orange basin and the Crocodile-Marico WMA.

The ISP is intended to act as DWAFs perspective on how the Orange River catchment's water resources should be managed. The Implementation of the ISP is an enormous task. 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 leverage maximum funds, maximum capacity, and to bring optimum management to the WMA.

The final ISP will be put out and be open to comments from local authorities, water user associations and other water related forums and interested stakeholders. Mechanisms are to be put in place to capture anomalies and it is intended that formal updates of the document will occur periodically until such time as Catchment Management Agencies are technically functional and Catchment Management Strategies developed.

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Appendix A

Orange River System Overarching Strategies

Strategies Table of Contents

INTRODUCTION TO STRATEGY TABLES

The first 2 chapters of the Orange Overarching WMA ISP describe the ISP process, paints a broad perspective of the water situation in the WMA and provides a description of the key issues that have to be dealt with. The crux of the ISP is located in a series of strategy tables presented in **Appendix A**. The strategy tables for each area present the management objective (what we are trying to achieve); an assessment of the situation along with a motivation as to why the strategy is required; the required actions; responsibilities; priorities; and relevant supporting references. A version control is attached for future versions of this Internal Strategic Perspective (ISP).

The issues raised in the situation assessment and at the workshops were grouped into those that are knowledge gaps, specific directives, requirements or guidelines and listed in the situation assessment section of the strategy tables. Management actions were developed to address the issues when appropriate.

Some issues are clearly applicable to all WMAs in the country and for some a national policy to guide the strategy needs to be developed first. These issues and aspects were identified and flagged for consideration at **National Level**.

The table below provides a brief description of the elements contained in the strategy tables and was included to create some common understanding of what is meant by these elements.

Definitions of terminology used in the Strategy Tables

Management Objective	Description of what DWAF is trying to achieve
Situation assessment	Description of the current situation
Motivation	Reasons why the strategy is required
Management actions (M)	Solutions to fill Gaps, adhere to Directives and to meet requirements.
Gaps (G)	Lack of knowledge, data or incomplete / non-existent processes that are required.
Directives (D)	Indicating the way, manner or direction in which something should be done.
Requirement (R)	A need or specific requirement

A.1 WATER BALANCE AND WATER RESOURCE RECONCILIATION STRATEGIES

A.1.1 RESOURCE AVAILABILITY

Management objective:	Ensure reliable estimates of the water resources (surface and groundwater) are available to effectively conduct Integrated Water Resources Management. The factors impacting on the water resources need to be clearly defined and understood.
Situation Assessment:	**Surface water resources** The surface water resources of the Orange River System have been the subject of various studies aimed at developing and maintaining a reliable hydrological database and Decision Support System (DSS) for management. The DSS consists of a series of water resource simulation models capable of simulating both water and salinity (Total Dissolved Solids (TDS)) balances. DWAF officials use these models as decision support tools to assess the capability (availability) of the water resource in development and operational planning. The models and hydrological data that are currently used to operate the system are summarised below: a. Hydrological time series database for the period October 1920 to September 1996 for Lesotho, Modder Riet as obtained from the VRSAU study. For the Orange River catchment from Lesotho border to Vanderkloof Dam including Caledon River the hydrology data covers the period October 1920 to September 1987 and was obtained from the Orange River System Analysis Study Phase 1. The hydrology for the Orange River downstream of the Vanderkloof Dam is the WR90 hydrology covering the period from October 1920 to September 1989. Hydrology for the Fish River (Namibia) was updated as part of the LORMS and covers the period October 1920 to September 2000. b. The WQT model that has been coarsely calibrated for TDS. c. The Water Resources Planning Model (WRPM) configured to simulate both water quantity and salinity (TDS). d. Scaled down system of the WRPM for use in the annual hydropower analysis of the system. (See referenced) There is a reasonably high level of confidence in the estimates of the available surface water resources in the Orange River (error to be expected within 10%). Results from the annual hydropower analysis also proved this as the simulated projected water levels in Gariep and Vanderkloof Dams correlated well with the observed levels. Extending the hydrology for the Gariep and Vanderkloof incremental records will not include a more severe drought than that already captured in the October 1920 to September 1988 record period. The observed records at Oranjedraai and Roodewal gauging stations for the period 1989 to

Situation Assessment: (Continued):	2000 confirmed this. Although this hydrology can be extended by 15 years it is expected to have a relative small impact on the system yield. The hydrology for the Lower Orange downstream of Vanderkloof Dam that was obtained from the WR90 (WRC Study) represents less than 3% of the total natural runoff and will also not affect the yield determined for Gariep and Vanderkloof dams as well as for most of the other major dams. The hydrology should be updated after the occurrence of a severe drought event. **(G1)** By 2008 it will be possible to extend the shorter hydrology records by another 20 years which is quite a substantial extension and it recommended to at least re-evaluate the extension of the hydrology at that time if a severe drought event has not occurred before then. The salinity model needs to be recalibrated at the same time. **(G2).** There is a gap in the understanding of the interaction of groundwater and surface water resources. The surface water resources analysis tools also lack specific modules to simulate this interaction.**(G3)** This item has been identified in various WMA ISPs and **will be taken up as a National Level**. **Groundwater resources** will have a small impact on issues of an Overarching nature and are dealt with in more detail in each of the WMA ISPs. *Other **d**irectives or **r**equirements identified from available information:* **R1**. For effective Integrated Water Resources Management it is required to have a clear understanding of the current and future water resources available (surface and groundwater) in the WMA. This includes knowing the quantities of usable water in terms of spatial distribution and any factors that may affect the yield of the system and requires an operational analysis on an annual basis. **D1**. The hydrological database should be updated (extended) under the following circumstances: ● When a significant drought event, comparable to that of the 1980's is added to the record. ● Updating the hydrological data for the purpose of re-calibrating the TDS model. (See **Directive 2** below.) **D2**. The TDS (salinity) model should be re-calibrated when it is found that the land use activities have changed significantly to have a substantial impact on the decisions that are taken with the model.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Assess the need to update the current hydrological database, which hydrology should be updated and the period to which the data should be updated. This should be done after a severe drought period or at least evaluate the need again every 5 years. **{G1, D1}**	Dir: NWRP (Priority 2)
	M2 Recalibrate the salinity model for the Orange River when it is found that land use activities or other main variables that impact on the salinity loads in the system have changed significantly. Commission studies accordingly. This will however be addressed as part of the Integrated Water Quality Study. Refer to A2.1 **{G2, D2}**	Dir: NWRP (Priority 2)
	M3. Model and undertake operating analysis on an annual basis. This should include projections of the supply situation for a twenty-year planning window. **{R1}**	Dir: WRPS (Priority 1)
References:	a) Orange River System Analysis Phase 1 & 2 (Report no. PD000/00/1092) b) Vaal River System Analysis Update-Summary Report (Report no. PC000/00/19496) c) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697)	

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A.1.2 WATER USER REQUIREMENT STRATEGY

Management objective:	Ensure that the knowledge base on the existing water requirements in the WMAs is realistic and updated on a regular basis. Furthermore, maintain and update water requirement projection scenarios for planning and management purposed.
Situation Assessment:	**Water use data** The actual water use data are collated from the different DWAF offices and bulk users on an annual basis and currently captured in a spreadsheet database. This information is compared with the projected water requirements in order to make adjustments (over the short-term) for use in the annual operating analysis. The total gross water use for the year 2000 was estimated at 1 996 million m^3/annum for the combined Upper and Lower Orange WMAs and excludes the transfers. Transfers from the Orange amounts to 2 159 million m^3/annum and is mainly from the Upper Orange. **Water requirement projections** The water requirement projections are adjusted on an annual basis. The projections are used in the annual operational analysis using the Water Resources Planning Model and the relevant data sets used for the annual hydropower analysis. There is some doubt about the irrigation demands and return flow volumes as there are no observed data available **(G1).** It is possible that the actual irrigation abstractions can differ by up to 100 million m^3/annum with that based on the scheduled areas and quotas or crop requirements. The return flows are based on an assumption of 10% to 15% of the volume released for irrigation. The Lower Orange River Management Study (LORMS) is addressing some of these issues. Cognisance must be taken of the results of the LORMS when they are made available. It is however possible that further refinement of the data will be required after the completion of the current verification of the registered data, which is not part of the LORMS. Although the urban, industrial and mining water use represent a very small portion of the total system's water requirements, it will be essential to support the future projected water demands to maintain these essential economic activities

Situation Assessment: (Continues)	The Namibian historical entitlement and possible future development is not yet agreed upon **(G2)**. Some indications of the possible future growth has been determined as part of the LORMS. Local water resource developments in Lesotho (excluding the LHWP) have historically been small, with little impact on the water resources of the Orange River System. This situation could change with the possible development of the water resources in the Lowlands of Lesotho, which is investigated as part of the Lesotho Lowlands Study. **Registration of water use:** This process has been largely completed and indications are that the registered use is much higher than the allocations. The process of verification of actual water use and lawfulness is in progress. *Other **d**irectives, or **r**equirements identified from available information:* **R1**. Indications are that the registered water use is more than that used in the model. It is therefore essential to compare the data in the model with verified use once the verification process is completed. **D1**. Although water use data for the larger cities is available, it is necessary to plan for future updates, which will include different demand projection scenarios such as with and without various levels of water demand management and conservation.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Improve the water use database by including more reliable water use data for irrigation, rural and supplies from boreholes. **{G1}**	Dir NWRP (Priority 2)
	M2. The process of verification of existing lawful use should be completed as a priority. Comparisons should be made between the lawful use and the water use data applied in the water resource system models. **{R1}**	Region (Priority 1)
	M3. DWAF must request that the water demand projections for towns and cities be checked on an annual basis by the Local Authorities and that a full update of the projections be made on a 5-year basis, after release of the National Census. This information must be included in the WSDPs and should be approved by DWAF. The responsibility of these updates however lies with the municipalities. The DWAF should then check the larger water balance and communicate back to the Local Authorities. **{D1}**	Dir NWRP (Priority 2)
	M4. Use results and recommendations from the LORMS to finalise the agreement between RSA and Namibia with regards to their water rights and future use from the Orange as well as the operating rules regarding the water use from the Orange River System. **{G2}**	Dir OA (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) c) Lower Orange River Management Study (LORMS) d) Orange River Water Balance – Orange River Continuous Study (Report no. PD 000/00/4903)	

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A.1.3 WATER BALANCE RECONCILIATION STRATEGY

Management objective:	Manage the water resources to maintain a surplus or balance between the available water resources and the water requirements through progressive implementation of management measures. The aim is to schedule and implement low cost measures first, whereby the more costly measures (usually large capital intensive developments) are postponed.
Situation Assessment:	**Water Balance Perspective:** Available information on the water balance of the Orange River System indicates that the system currently (year 2000 level) has excess supply capability. With the implementation of Phase 1B of the Lesotho Highlands Project, (Mohale Dam and transfer tunnel) and allowing for future growth in the water requirements in the system, the excess will diminish to reach a balance between supply and demand within the next 15 to 20 years. The surplus calculated at the year 2000 demand level is 333 million m^3/a (See **Tables 2.1** to **2.4** in **Section 2.5**). When Phase 1B of the Lesotho Highlands Scheme is implemented in 2003 the surplus will reduce to 158 million m^3/a. When the effect of the 12 000ha for resource poor farmers is included in the year 2003 water balance, the surplus will reduce further to only 44 million m^3/a. This will reduce over time due to the growth in the urban/industrial/mining requirements to a deficit of 47 million m^3/a by 2025. The 2025 water balance includes the water requirements for the 12000 ha of additional irrigation to be developed as a poverty eradication initiative. The 12000 ha are to be split equally between the Upper Orange, Lower Orange and the Fish-Tsitsikama WMAs. The water for the Fish-Tsitsikama WMA is to be supplied as part of the transfer from the Upper Orange WMA. A comprehensive ecological requirement has been determined by Lesotho for the Senqu River in Lesotho downstream of the LHWP. The effect of the implementation of this ecological Reserve on the water balance of the Orange River needs to be investigated. Preliminary indications are that this will increase the water available in the Orange River by approximately 30 to 60 million m^3/a **(G3)**. This reserve has been accepted by Lesotho and has already been implemented. A comprehensive ecological Reserve has not been determined for the Orange River. The water balance was calculated using an estimation of the environmental requirement obtained from the ORRS. (For more detail the reader is referred to Strategy Table A2.1.) The releases from Gariep and Vanderkloof dams that is made to supply the requirements of the downstream users are simultaneously used by Eskom to generate hydropower. These releases are therefore driven by the downstream requirement and not by Eskom,s requirement. On an annual basis the surplus yield available in the system is determined which, can be used by Eskom whenever they need it within that planning year. The utilisation of the surplus does not only include the releasing of the surplus through the turbines but also operating rules that benefit hydropower generation. These rules typically

Situation Assessment: (Continues)	include the release pattern from Gariep Dam, the storage control curves in both dams to minimise spilling etc. The surplus available as given in this ISP document excludes the negative effect of these operating rules on the water balance which means that these operating rules need to be adjusted or removed to be able to obtain the surplus as indicated. **Measures to Improve Supply:** Below is a list of measures that have been identified to improve the capability of supply. The order in which the measures are listed are based on URV as determined in the ORRS for some scenarios and serves as an initial indication of a possible order **(G1**) to implement the options. 1. Reduction of Operating Losses *Motivation:* The operating losses are currently estimated at 270 million m^3/annum. These losses are incurred due to the long stretch of river between Vanderkloof Dam and the river mouth with the associated lag time when making adjustments to the releases from Vanderkloof Dam to react to prevailing conditions. These conditions are typically tributary inflow events as well as changes in the water requirements for irrigation and evaporative losses due to short-term changes in climatic conditions. *Option 1:* Reduce the operating losses downstream of Vanderkloof Dam through improved release management. *Option 2:* Further reductions in the operating losses could be achieved by constructing an operating dam in the Lower Orange River (at Vioolsdrift or Boegoeberg) to improve the physical regulation capabilities. 2. Water conservation and demand management measures *Motivation:* In previous studies the need for a comprehensive assessment of the potential of water conservation and water demand management was recommended. This would have to focus on irrigation agriculture, as the largest user sector in the system. Further details on water conservation and demand management is provided in Strategy A4. 3. Utilise the storage volume below the current minimum operating level in Vanderkloof Dam. *Motivation:* The Orange River Re-planning Study indicated that the lowering of the minimum operating level (m.o.l) in Varderkloof Dam is the most cost effective of the infrastructure development options considered. It was estimated that the increase in yield through this option could be as high as 305 million m^3/annum. When water level in Vanderkloof Dam is below the current m.o.l. it will not be possible to generate hydropower at the dam and water can then also not be released into the canal systems to supply water to irrigation along the Orange and to the Riet/Modder system. *Requirements:* To implement this option it is required to develop infrastructure, including the installation of pumps, to be able to supply water into the canals when the water level is below the current intake level. The effect on hydropower must also be determined and results need to be discussed with Eskom. 4. Lesotho Lowlands Development. Lesotho has embarked on a water supply study of the Lesotho Lowlands. The study is aimed at developing the local water resources to meet the local water requirements. The Department must keep in touch with

Situation Assessment: (Continues)	developments and may be able to contribute to the proposed development to meet the water requirements in the RSA. Three possible dam sites are currently being investigated for water supply to the towns of Leribe (dam located in the Hlotse River), Butha-Buthe and Mapotsoe (dam in Ngoajane River) and Mohales Hoek and Mafeteng (dam in Makaleng River). The first two possible dams are located in tributaries of the Caledon River and the third in a tributary of the Senqu River. **(G2)** 5. The Boskraai option is intended to improve the water supply situation in the Orange River and simultaneously increase the transfers to the Vaal. This focus of this option in the ORRS was to increase transfers to the Vaal System although it can be used to support any other growth in the Orange River System or users linked to the Orange System by means of transfers. For more detail in this regard the reader is referred to Strategy **Table A.1.4**. 6. Mashai Dam (LHWP phase 2) located in Lesotho was mainly intended to increase the transfers to the Vaal System and will therefore impact negatively on the water supply situation in the Orange River downstream of the dam unless the dam is used as Boskraai Dam to also support users along the main Orange River. Options Currently investigated as part of the LORMS include the following of which some has already been listed above: **(D4)** - Lower Level Storage in Vanderkloof - Utilising spills from the Vaal by means of real time modelling. - Decrease operational losses using re-regulating dams - Large storage dams at Boegoeberg or Vioolsdrift - Making water available through WCDM ***D**irectives or **r**equirements identified from available information:* **R1**. Given that the water resource availability and water requirements for the Integrated Orange River System is effectively in balance, it is required to closely monitor the water balance situation on an ongoing basis. This will ensure intervention planning can be adjusted to account for any changes that may have an impact on the projected water balance.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Complete the current Lower Orange River Management Study and implement the recommendations. The deliverable from the study will be a revised water balance, revised date of when intervention is required, and a series of management measures and development options to be considered for implementation. **{D4}**	Dir OA (Priority 1)
	M2. The impacts of possible water resource developments in Lesotho Lowlands on the water balance of the system must be assessed. The possibility of combined utilisation of future water resource developments should be considered. **{G2}**	Dir OA (Priority 1)

	M3. Assess the impact of revised In-stream Flow Requirements (IFR) from the LHWP dams and the desktop estimates for the Orange River on the water balance of the Orange River system. The availability of revised IFRs was raised at the 2nd workshop of the Vaal River Overarching ISP This impact will be evaluated as part of the LORMS study. [Directorate National Water Resource Planning] **{G3}**	Dir NWRP (Priority 1)
	M4. Details of agreements with users (for cheap power) and the electricity supply situation will be determined as part of a current study to determine the economic implications of developments in the Orange River. **{G4}**	Dir OA (Priority 1)
	M5. Monitor the projected supply situation through annual operating analysis to ensure the required management measures are implemented on time. **{R1}**	Dir NWRP (Priority 1)
	M7: Reduce the water allocations for hydropower generation (directly and indirectly) to Eskom in order to maintain the reliability of supply to the consumptive users. **{D1}**	Dir WRPS (Priority 1)
	M8: Evaluate and implement as required the measures identified in the LORMS to improve the medium to long-term supply situation. **{D3}**	Dir WRPS (Priority 2)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) c) Lower Orange River Management Study d) Orange River Water Balance – Orange River Continuous Study e) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06)	

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A.1.4 TRANSFERS AND RESERVATION OF WATER

Management objective:	Reserve adequate water resources to support the transfers out of the Orange River System and secure internal transfers as well as the water supply to existing users within the borders of the Upper and Lower Orange WMA.s
Situation Assessment:	There are transfers into and out of the Orange River WMAs as well as transfers between sub-catchments. The Lower Orange WMA is almost totally dependent on releases from the Upper Orange as the runoff generated in the Lower Orange is negligible. There is therefore an existing release obligation between the Upper and Lower Orange Water Management Areas as set out in the NWRS. Detail of the various transfers as well as possible future transfers is given below. **Existing transfers out of the Orange River WMAs:** There are two major transfers out of the Upper Orange WMA, as well as the water use by Namibia along the common border, which is also listed as a transfer out of the WMA for the purpose of this description.. 1.From Katse & Mohale dams in Lesotho (Katse key area) to Vaal Dam in the Upper Vaal WMA. Water is transferred at a constant rate irrespective of the water levels or demand situation in the Vaal River System, as specified in the Treaty. The water is used to generate hydropower for use in Lesotho before it is released into the Wilge key area of the Upper Vaal WMA. The impact of updated Lesotho IFR on the transfers from the LHWP to the Vaal System were recently determined. RSA and Lesotho still need decide whether the Treaty transfer volume need to be adjusted accordingly. **(G1)** 2.Transfer from Gariep Dam located in the Gariep key area through the Orange Fish tunnel to the Fish to Tsitsikama WMA to supply the irrigation requirements in the Eastern Cape as well as to supply a small part of the requirement for Port Elizabeth. The transfer varies slightly from year to year due to the irrigation requirements of the ±51 500ha listed under the Orange/Fish transfer scheme, which vary from year to year due to variations in rainfall and evaporation. Due to salinity problems within the irrigation scheme more water has to be released from Gariep Dam to improve the water quality. This is mainly done during periods when Gariep Dam is spilling. This is not enough water to provide adequate dilution during long dry periods. Future growth on this transfer is minimal and will mainly be affected by the growing demand for Port Elizabeth. Water allocated to the irrigation of 4 000 ha by resource poor farmers in the Fish to Tsitsikama WMA will be transferred as and when this land is developed. Since the year 2000 until October 2003, 1 936ha of water allocations representing a total volume of 19.7 million m³/a has been transferred as part of trading agreements between irrigators, from the Eastern Cape to the Orange River Main Stem. There are uncertainties with regards to the current trading of water rights from the Eastern Cape back to the Orange River. **(G2)** Is there for example a maximum allowed for transfer, does the transfer include water released to Eastern Cape for dilution purposes, etc. This issue will be addressed as part of the national strategies. 3.Water is abstracted along the common border by Namibia for irrigation purposes. The total abstraction at year 2000 development level was estimated at 42 million m³/a and is expected to increase to 58 million m³/a in

Situation Assessment: (Continues)	2005. These requirements together with the urban/mining requirement is in line with the current proposed 50 million m³/a permanent allocation to Namibia and 60 million m³/a temporary allocation until 31 December 2007. 4. Water is abstracted along the common border by Namibia for urban and mining purposes. The total abstraction at year 2000 development level was 12 million m³/a and is expected to increase to 16 million m³/a in 2005. There are uncertainties with regards to the growth in transfers to Namibia. An agreement with regards to the maximum abstraction and payment of water abstractions by Namibia from the Orange River needs to be formalised. **(G3)**. **Release obligations between the Upper and Lower Orange WMAs** 1. The releases from the Upper Orange WMA to the Lower Orange River WMA can be subdivided into two main components: • The flow in the Orange River that has to be discharged from the most downstream point in the Upper Orange WMA to the Lower Orange River WMA to supply the water requirements including the needs for the environment along the Lower Orange River. These requirements are an integral part of the Orange River System, which uses Gariep and Vanderkloof dams as the water resource. Growth in this requirement is expected to be low, driven primarily by the development of the 4 000 ha earmarked for resource poor farmers in the Lower Orange WMA as well as the urban requirements which is a very small component of the total water demand. The system is currently managed not to allow further irrigation development with the exception of the 4 000ha as no additional water can be allocated from the existing infrastructure. Namibia is currently investigating the possibility of substantial increase in irrigation on the Namibian side of the border. This will however require additional infrastructure or water conservation and demand management actions. These are currently being investigated as part of the LORMS. When the Reserve for the Lower Orange has been determined, the release obligation to the Lower Orange will be adjusted accordingly. • The transfer from Marksdrift in the Orange River to Douglas Weir on the Vaal River. This transfer is used to supply the irrigation requirements along the Orange/Vaal canal as well as to augment the irrigation supply from Douglas Weir and to improve the water quality in Douglas Weir. The town of Douglas also obtains water from this transfer. Growth in this transfer is expected to be minimal as irrigation is the main user. **Existing transfers within the Orange River WMAs.** There are six transfers within the WMAs and will be discussed in detail in the individual WMA ISP documents. **Future transfers from the Orange River WMAs:** 1. The transfer from the LHWP (Upper Orange) to the Upper Vaal WMA will be increased with the commissioning of Mohale Dam and transfer tunnel in 2003. 2. New transfer schemes are most unlikely to occur in the near future. Possible transfers do include the increase of the LHWP transfer to the Vaal by means of Mashai Dam on the Senqu River and the transfer from Boskraai Dam,

Situation Assessment: (Continues)	located just upstream of the confluence of the Orange and Kraai Rivers and will be constructed across both the rivers. The development of further phases of the LHWP is not expected to go beyond the possible Mashai Dam. These transfers to augment the Vaal system will be required by 2025 as based on the reconciliation given in the Vaal Overarching ISP document. Current planning information indicates the augmentation to the Vaal could either be from the Thukela Water Project or from the further phases of the LHWP. *Other **d**irectives or **r**equirements identified from the status information:* **D1.** The LORMS will provide updated data with regards to the transfers to the Lower Orange WMA. **D2.** Future transfer schemes must not reduce the required assurance of supply to existing users. These schemes will therefore have to provide sufficient water resources to support the transfer and to maintain the assurance of supply to the users in the Orange River System. Alternatively water allocations need to be traded to supply to the remaining users at the required assurance.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Results from the LORMS must be evaluated with regards to release obligations between the Upper and Lower Orange WMAs. **{D1}**	Dir OA (Priority 1)
	M2. Results from the LORMS must be evaluated and further actions should then be taken to obtain an agreement between the RSA and Namibia with regards to the future legal water abstractions by Namibia from the Orange River. **{G3}**	Dir OA (Priority 1)
	M3. Assess the impact of the revised Instream Flow Requirements (IFR) from the LHWP on the transfers to the Upper Vaal WMA.. **{G1}**	Dir NWRP (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) c) Orange River Water Balance – Orange River Continuous Study	

Strategy Version control:	**Version no:**	Final
	Date:	January 2003
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A.1.5 COMPULSORY LICENSING

Management objective:	Ensure the equitable sharing of the available water resources for the Reserve and activities to maintain the economic and social structures that rely on the water resources of the Orange River System.
Situation Assessment:	Considering the three variables (Reserve, water for equity, and a negative water balance) that could drive the need for Compulsory licensing, the status is as follows: ● Due to the current excess supply situation as indicated in the Reconciliation Strategy, there is no need to implement compulsory licensing on the grounds of water supply constraints. ● Releases are currently made to supply the environmental requirements at the estuary based on the EFR as determined in the ORRS. Currently the Reserve has not yet been determined for the WMAs and no urgent Reserve issues were identified during the Overarching Workshops that pointed to the need for Compulsory Licensing on the basis of pressures brought upon by the Reserve. ● Allocations to address inequities in water allocation have already been made by means of the 12 000ha of irrigation land allocated to emerging and resource poor farmers. These allocations must first be taken up before more will be considered. Only at that stage will compulsory licensing be considered as a possible option for further allocations. ● Although the above status indicates that Compulsory Licensing is not a priority in the whole Orange River System, it may be required in selected tributaries. This need will be determined in the WMA ISP workshops and reflected in the WMA ISPs. There may be other factors that would need to the considered in determining the priority for Compulsory Licensing in the Orange River System **(G1)**. It was recommended by the ISP workshop that the priority of Compulsory Licensing be reconsidered at the annual updating of the ISP.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Reconsider the priority for Compulsory Licensing at the annual updating of the ISP. **{G1}**	Dir. NWRP (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.2 WATER RESOURCES PROTECTION STRATEGY

A.2.1 RESERVE AND RESOURCE QUALITY OBJECTIVES

Management objective:	To assess the need for, and to implement a comprehensive Reserve determination, although this has not been prioritised. The Reserve determination for the Orange River System will be co-ordinated with the Reserve determination for the Vaal River System.
Situation Assessment:	System instream and estuarine flow requirements were determined in the ORRS (more or less at intermediate level but methodology differ from that currently used) for the Orange River downstream of Vanderkloof Dam. A draft management plan for the Orange River mouth has been produced. Some of the recommendations in the plan include monitoring at the mouth to determine the flows entering the estuary by establishing a gauging station. This flow gauging station will also assist with the estimation of river losses. The ORRS ecological requirements (±280 million m^3/a) has since 1997 been released from Vanderkloof Dam. As part of the LORMS, modified Desktop level estimates of the environmental requirements were made for the section of the Orange River from the Vanderkloof Dam to the Orange River mouth as well as for the estuary. These in-stream and estuarine flow requirements are used in the LORMS study to do sensitivity analysis. Analysis from the LORMS showed a reduction in the system yield of approximately 100 million m^3/a when the modified desktop level environmental flow requirements are used in place of the ORRS environmental flow requirements. A comprehensive Reserve must however still be determined for the Orange River **(G1)**. I the mean time it is essential that proper monitoring must be set in place to monitor the ecological health of the river and the estuary and to collect sufficient data as required for a proper Reserve determination. The water quality requirements for the environment have not been fully addressed in any of the current available environmental flow assessments **(G2).** Lesotho has determined and implemented updated IFRs for the Senqu River in Lesotho. Indications are that the updated releases for ecological purposes (from Katse and Mohale dams) will most likely increase the Orange River System yield by about 30 to 60 million m^3/a compared to the releases specified in the Treaty between RSA and Lesotho. This will most likely be required to offset the anticipated higher requirements for the ecology lower down in the river. A study to establish a water quality management plan for the Modder Riet system has been initiated by the Free State Regional Office and includes the determination of a comprehensive Reserve. Specific issues and concerns with regards to the environmental flow requirements include the following: - Gariep and Vanderkloof dams are also operated for hydropower generation. The operation of these dams result in flow patterns that most likely exceed

Situation Assessment: (Continues)	the minimum flow rates specified by the current IFRs. This problem will however decrease over time as the surplus in the system has reduced significantly and is still reducing. With no surplus available in the system, Eskom will only be able to release according to the downstream requirements which is more in phase with the natural flow pattern. - The implementation of the Reserve will require flow measurements at the river mouth and accurate low flows at strategic points in the system. - The draft management plan for the mouth requires the opening of channels at the river mouth as well as the collection of data to monitor the health of the mouth. DWAF favours the determination of a Comprehensive Reserve on all reaches of the Orange River, including the estuary. This is not, however, a priority, given the current surplus in the system. Given, too, the more urgent needs in other catchments, and the serious catchment constraints facing the RDM office, it is felt that a Reserve at intermediate level will serve for the moment. This must, however, be under taken within Upper Orange as soon as possible. The need for a Comprehensive Reserve should be re-considered annually along with the water balance & reconciliation and should be phased in as new infrastructure comes on line.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Continue to release the in-stream and estuarine flow requirements as determined in the ORRS. These requirements are included in the annual operating analysis and form part of the schedule of releases currently made from the dam. **{R1}**	Dir. WRS (Priority 1)
	M2. Establish a committee to monitor the ecological health of the river and estuary and with respect to the higher releases in winter for hydropower generation purposes. This committee must also ensure that the actions to obtain the required data for the Reserve determination are in place as early as possible. **{G1, G2 R2}**	Dir. NWRP (Priority 1)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) b) Lower Orange River Management Study (LORMS)	

Strategy Version control:	**Version no:**	Final
	Date:	January 2004
	Author:	ISP Study

A.2.2 WATER QUALITY MANAGEMENT

Management objective:	The protection of the water quality of the Orange River System requires the development of an integrated water quality management plan. The plan for the Orange River System will have to integrated with a similar initiative for the Vaal River System
Situation Assessment:	Most of the runoff in the Orange River Basin is generated in the Upper and Middle Vaal WMAs as well as in the Upper Orange WMA (Lesotho) where the rainfall is high. The Lower Vaal and Lower Orange WMAs receive very little rain and are dependent on the upstream WMA for much of their water. The Vaal and Orange River Systems are well regulated, with major dams on the main stems of both rivers and a number of transfers conveying water into and out of the catchments. Mainly unregulated spills occur from the Vaal River into the Lower Orange WMA, downstream of Vanderkloof Dam. Most of the water required in the Lower Orange WMA is released from Vanderkloof Dam located in the Upper Orange WMA. Poor quality water from the Vaal System enters the Orange River at the confluence of the rivers just downstream of Douglas. The Orange River is suffering the consequences with no support from the Vaal with regards to the loss in the Orange River. This issue needs to be addressed **(G4)**. The water quality in the Lower Orange WMA is therefore highly dependent on the quality received from the upstream WMAs, indicating that system wide management of the water quality is necessary. There is substantial land use development in the Orange River Basin, in particular in the Upper Vaal WMA, with the associated impacts on the water quality. Due to the increased land use the water quality in the Orange River System has been deteriorating, in particular with respect to salinity. There are also signs of eutrophication in places and occasional outbreaks of blue-green algae have been experienced. This is not only due to the poor water quality from upstream WMAs but can also be attributed to activities within each of the WMAs relating to agriculture, mining and urbanisation. Water Quality Objectives (WQO) are specified and serve as the mechanism within water quality management plans, to protect the water quality of the resources. In the Orange and Vaal River Systems, the WQO will have to be developed with full cognisance of downstream impacts to cater for the interdependence of the WMAs. A fully integrated water quality management plan would therefore be the only way to derive appropriate WQO in each WMA and to specify the minimum WMA cross boundary water quality objectives **(G1)**. There are areas of the Orange River System, which have high natural erosion rates. These rates can be accelerated with land use development such as agriculture, mining and urbanisation. The water quality situation assessments in the Modder-Riet River system have cited turbidity as a water quality variable of concern. The sources are wash-off from agricultural land and urbanisation. Another source of increased sediment load is the diamond diggings on the banks of the Orange and Vaal Rivers. The Caledon River is also a source of high sediment loads due to naturally high erosion rate and poor land use

Situation Assessment: (Continued)	practices. The extent of the sediment problem in the Orange River needs to be assessed and the sources addressed **(G2)**. Irrigation agriculture is a significant land use in the Orange River System. The analysis of water quality data collected in the river systems for situation assessments have shown that irrigation return flows are a source of pollution. The pollution includes salinity and nutrients. The return flow volumes also play an important role in the catchment water balances. The hydrological models have been calibrated by assuming a certain return flow percentage (typically 10%). The return flow percentage has not been confirmed and if the percentage is significantly different from the modelling assumptions, the calibration of the hydrological and water quality models will be called into question. The effect of more efficient irrigation practices on return flow volumes and qualities also need to be understood as they affect the catchment water balances and waste load discharges **(G3).** Specific issues and concerns with regards to water quality includes the following: - The proposed Integrated Water Quality Management study should be developed in close liaison with the Integrated Water Quality Management Plan for the Vaal River System. The study could be a single study of the Vaal and Orange River. This decision will be made during the drawing up of the terms of reference. - The studies should identify and quantify sources of pollution and their impact. - The study should consider methods of integrating quantity and quality management more closely. - Salinity is the primary variable of concern but nutrients should also be considered. - The setting of attainable WQO and allocations of waste load should be made. - Particular attention should be given to the quality objectives of the water transferred from one WMA to the other. - Monitoring and remedial measures should be developed to manage the situation where WMA border WQO are violated. - Appropriate water quality modelling tools should be developed as part of the study to simulate the indicated interdependencies. Consideration should be given to the integration of small-scale catchment models with the larger system models. - Water quality management options should be identified and tested using the developed and installed modelling systems. - The study should focus on using available data and modelling tools to develop management plans and prevent large-scale re-calibration of models. - The Senqu River in Lesotho is currently a source of high quality water for the Orange River, however, transfers out of the catchment (current and in future) as well as developments in the catchment will most likely result in further deterioration of the downstream water quality and need to be evaluated in detail. - The application of the Waste Discharge Charge System (WDCS) in terms of the transfer of load across WMA should be considered.

	- The extent of the sedimentation problem should also be investigated.
Situation Assessment: (Continues)	The water quality of the Orange River system needs to be protected to ensure that the current water uses can be successfully continued. ***D**irectives or **r**equirements identified from available information:* **R1**. Several needs or requirements exist with regards to the licensing processes. There is for example a need to streamline the licensing process for the small mining (diggers) operations. Municipalities tend to go ahead with the development of sewerage works before a formal licence has been issued and they can currently not be prosecuted. Co-ordination and communication seems to be a common need.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1:** A study must be carried out to develop an integrated water quality management plan of the Orange River System and should include the effect of the poor quality water from the Vaal entering the Orange River **{G1, G4)}**	Dir : WQM (Priority 1)
	M2: The extent of the sediment problem in the Orange River needs to be assessed. The recently completed survey of Gariep Dam needs to be analysed. If required, the assessment of the sediment should be included in the integrated water quality study. The ongoing communication with Lesotho on land use practices should be continued. **{G2}**	DIR NWPR (Priority 3)
References:	a) Vaal River System Analysis Update-Summary Report (Report no. PC000/00/19496) b) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697)	

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A.3 WATER USE MANAGEMENT STRATEGY

A.3.1 GENERAL AUTHORISATION STRATEGY

Management objective:	To optimise the use of General Authorisation limits and rules with a view to cutting down on unnecessary administrative efforts of water use activities that can be allowed without individual water use licences. Both the DWAF and the users falling in the General Authorisation category would save resources (time and money) by not having to apply for and process licenses for the specified low impact water use activities. Details regarding what general authorisation is required in the catchments are discussed in the WMA specific ISPs and the only requirement from an overarching perspective is to ensure that relevant General Authorisation should be coordinated among the WMAs where appropriate.

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A.3.2 LICENSING STRATEGY

Management objective:	Licensing of water use (as defined in the National Water Act) should be considered on a continuous basis when applications are received. The objective is to allocate available water in the Orange River according to the criteria in the NWA equitable between the Upper and Lower Orange.
Situation Assessment:	**Considerations for water abstraction licences:** Due to the current small potential excess of water in the Orange River System the issuing of licences for water abstraction could only be considered under specific conditions as listed below. *Directives and guidelines to apply when evaluating new licences:***(D1)** The issuing of licences for water abstraction should be considered within the following framework: ● Apply the allocation priorities as defined in the Water Act. ● Along the Orange River main stem the surplus is shared between the WMAs and allocations should be made at National Level. ● 114 million m³/a of the surplus of 158 million m³/a is reserved for the 12 000ha allocated to resource poor farmers and the rest for high value use, who will have to pay the full cost of the of water supply. ● New abstraction licenses supplied from the Orange River will result in the longer term, in additional intervention measures and therefore have to bear the full cost of water supply from the Orange River System. ● All new license applicants will have to prepare plans of how water conservation and demand management measures will be implemented. ● Existing users that apply for additional licenses will have to prove that they are using their existing resources efficiently and that WCDM is being practiced. ● Water quality impacts of any new licence must be assessed. ● When the trading of water allocations is considered, the net impact of the water users on the water balance needs to be taken into consideration. The existing trading policy on in- sectoral trading should be applied. A trading policy and mechanism needs to be developed for inter sectoral trading and across WMA trading. This policy will be developed at National Level. An assessment of the ground water resources should be completed to determine the water availability to existing and possible future users, before licenses can be granted. See detail in the individual WMA ISPs.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Apply the guidelines and directive indicated above in the evaluation of new licences. **{D1}**	Region (Priority 1)

Strategy Version control:	**Version no:**	Final
	Date:	January 2004
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A.4 WATER CONSERVATION AND DEMAND MANAGEMENT MAIN STRATEGY

A.4.1 WATER CONSERVATION AND WATER DEMAND MANAGEMENT

Management objective:	To make more effective and efficient use of the existing available water resources in all water user sectors. This will enable DWAF and Catchment Management Agencies to conserve water and avoid or delay the construction of further expensive schemes for transfers and storage when these may not be necessary if demand is properly managed.
Situation Assessment:	The principles of Water Conservation and Demand Management (WC&DM) are well entrenched in the National Water Act and DWAF is currently in the process of developing a national water conservation strategy. This process also includes the development of sectoral strategies. In the Orange River Re-planning Study the need was identified to undertake a comprehensive assessment of the potential for water conservation and demand management in the Orange River System. The efficiency of water use in the irrigation sector has also been identified as a key issue in the National Water Resource Strategy. Since the water use for irrigation is by far the largest of the sectors, the focus of such an investigation should be on the irrigation sector. It will be essential to obtain the co-operation of the users in the system in order for any water conservation and demand management initiative to be successful. Convincing motivations are required to illustrate the benefits to the users themselves. The established Water User Associations will have to be mobilised to partake in such an endeavour. Guidelines as to what can be realistically achieved in terms of WCDM as well as the economic viability/sustainability of the application of WCDM need to be considered **(G1)**. The implications of the practical application of WCDM on the water requirement projections and return flows for the Orange River System is not clear and need to be determined. WCDM will have an impact on the implementation dates of future augmentation schemes, which needs to be determined **(G2)**. The existence of operation losses in the system was identified in previous system analysis studies as well as through the experience gained in recent years where improved release management is practiced. The current (2002) estimate of the operating losses is 270 million m^3/annum but is due to inaccurate low flow data not a very accurate estimation **(G3)**.

Situation Assessment: (Continued)	*Factors to consider in planning for Water Conservation and Demand Management in the Orange River System:* 1. Although the concept of WC&DM seems attractive, WC&DM needs to be applied in a cohesive and realistic manner. Although reductions in the water use may be achieved with the application of WC&DM, these reductions may come with a lowering of the return flow volumes and a subsequent reduction in the effective saving. 2. As indicated above certain WC&DM measures have an impact on return flow volumes, which will alter the composition (blend of return flow sources) with the result that the water quality could be improved. 3. WCDM could, through reductions in return flows, impact on the river ecology and wetlands and these aspects should be assessed in all cases. ***D**irectives or **r**equirements:* **D1.** The National and Sectoral strategies currently under development through the Directorate Water Conservation must be applied in the Orange River System as soon as it becomes available. **D2.** Not withstanding the indicated surplus in supply of the Orange River System, WC&DM has significant benefits and this awareness should continue through initiatives such as the Water Cycle Management Initiative. **D3.** A hydraulic river model has already been calibrated for the Orange River downstream of Vanderkloof Dam and can be used as part of the process to reduce the operational losses. **R1.** Careful planning is required to ensure cost recovery of water supply remains at levels that are viable, both to service providers and local authorities when implementing WC&DM measures. **R2.** WC&DM must be included in the planning of new projects requiring water from the Orange River System. **R3.** Operational losses are significant and measures to reduce these losses should be investigated and implemented.

MANAGEMENT ACTIONS			
Required actions, responsibilities and priorities:	**M1.**	As there is currently a small surplus available in the Orange River System after water has been allocated to redress inequities and releases for the ecological requirements have been made, it is can be promoted that improved water use efficiency by irrigators can be used by the irrigators themselves to extend their area under irrigation. **{G2, D1}**	Dir: WC Dir: WRP Priority 2
	M2.	Develop a water demand and return flow model that can be used for scenario planning. **{G1}**	Dir: WRP Priority 2

	M3. All applicants for new licences for water use should provide the necessary plans or reports to show how water conservation and demands management measures are applied in terms of any existing use and will be applied to new use to ensure the efficient use of water. This is of particular relevance to Local Authorities and use in towns **{R2}**	Dir: NWRP Priority 1
	M4. Compile a consolidated summary document that presents the available information and status quo regarding the operational losses. Recommendations should be given regarding improvements to the river flow-gauging network to improve the estimates of the operating losses. Specific attentions should be given to the low flow recording ability of certain gauging weirs. The operational model as set up for the Orange River should be utilized to obtain a better indication of the operational losses and possible management/development options to reduce the operational losses. (The Operational Model of the Orange River was recently completed as part of a WRC Project). Obtain results from the LORMS, which also investigated measures to reduce the operating losses in the system. **{G3. D3, R3}**	Dir: OA Priority 1
	M5. Implement the recommended measures to reduce operating losses and monitor the operating losses. Compile annual reports on the achievements of the measures. **{R3. G3}**	Region Priority 1
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06) c) DWAF & Eskom operational contract	

Strategy Version control:	**Version no:**	Final
	Date:	January 2003
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A.5 INSTITUTIONAL DEVELOPMENT SUPPORT STRATEGY

A.5.1 INTERNATIONAL LEVEL

Management Perspective:	The **National Department** is responsible for the drafting and implementation of strategies and policies regarding international shared river basins. These strategies are guided by international protocols that define the basic framework for water management across international boarders. From a WMA perspective, it will be required to communicate all issues relating to the international transfers through the appropriate National Department. The most important international connections that affects the Orange River System is the Lesotho Highlands Water Project (LHWP), which transfers water from Lesotho and the section of the Orange River along the RSA / Namibia border, where water is abstracted by RSA and Namibian users.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	International negotiations and institutional arrangements are handled at National Level. From a WMA management perspective, it will be required to communicate all issues relating to the international transfers through the appropriate National Department.	IDC Priority 1

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	Date:	January 2004
	Author:	ISP Study

A.6 SOCIAL AND ENVIRONMENTAL STRATEGY

A.6.1 POVERTY ERADICATION

Management objective:	The main objective is to contribute to the eradication of poverty through the provision of basic Community Water Supply and supply to viable Industrial/urban growth. Due to a significant rural composition of the population and dependence on agriculture, make specific allowances for irrigation water to resource poor farmers.
Situation Assessment:	Surplus water available within the Orange River System (Gariep & Vanderkloof dams) was allocated for use by resource poor farmers for the development of 12 000 ha of irrigation. 4 000ha of the total allocation is located in the Upper Orange WMA, 4000ha in the Fish - Tsitsikama WMA and 4000ha in the Lower Orange WMA. The aim of this allocation is for poverty relief and rural development. None or very few of these developments have yet taken place although some are in process. Potential irrigation areas were identified in the ORRS for possible future development. In the LORMS investigations for potential irrigation areas and crops are focussed on the area along the RSA-Namibian border. From an overarching point of view it is important to note that the source (Gariep and Vanderkloof Dams) from which the water was allocated for the 12 000 ha, is utilised by all three WMAs under consideration. Detail planning of where and when these developments will take place will be decided on a WMA basis and will therefore be discussed in the individual WMA ISP documents.

Strategy Version control:	**Version no:**	Final
	Date:	January 2003
	Author:	ISP Study

A.6.2 ENVIRONMENTAL STRATEGY

Management objective:	Ensuring that there is a balance between the need for development (ie including all activities undertaken by DWAF) and the need to protect the natural and social environment for the benefit of all.
Situation Assessment:	No specific issues were identified for the overarching ISP. The reader is referred to **Chapter 1 Paragraph 1.5** of this report with regards to DWAF's responsibility.

Strategy Version control:	**Version no:**	Final
	Date:	January 2003
	Author:	ISP Study

A.7 WATER INFRASTRUCTURE DEVELOPMENT AND MANAGEMENT MAIN STRATEGY

A.7.1 INFRASTRUCTURE DEVELOPMENT AND SUPPORT

Management objective:	Provision of adequate water resource development infrastructure (storage) and bulk water supply infrastructure to sustain a social and economic growth while protecting the environment.
Situation Assessment:	A holistic planning effort will be required to identify the optimum bulk water storage and supply infrastructure layout that will make optimal use of the local water resources in the Orange River WMAs. (The reader is also referred to Strategy **Tables A.1.3 & A.1.4** as it already fully described in these two tables)

Strategy Version control:	**Version no:**	Final
	Date:	January 2004
	Author:	ISP Study

A.7.2 SYSTEM MANAGEMENT

Management objective:	Implement system management measures to optimally utilise the available water resources, both in terms of short-term benefits and to maintain the reliability of supply over the long-term. The aim is to postpone the need for the development of new costly infrastructure for as long as possible into the future while saving operating costs over the short-term. Optimise the utilisation of the water resource by allowing maximum hydropower generation without adversely impacting on the long-term reliability of supply to the users in the system.
Situation Assessment:	Releases from Gariep and Vanderkloof dams are managed by the Free State DWAF Regional Office in close co-operation with Eskom with regards to the releases for hydropower generation as well as with the Lower Orange WMA and Fish/Tsitsikama WMA regarding their individual requirements. Operating analyses are undertaken on an annual basis by WRPS to determine the surplus available in the Orange River System which can be used for the generation of hydro-power over and above that released for normal downstream requirements. A hydropower operating rule was developed to allow for the specific needs set by Eskom but to simultaneously supply the existing users at their required assurance of water supply. The allocated additional releases for power generation has decreased over time, mainly due to the storage and transfer of water by the LHWP but also as a result of growth in the water requirements in the catchment. Until such time as there is still a surplus available in the Orange River System, it would be possible to apply operating rules that benefit hydropower generation without impacting on the reliability of supply of the users. These operating rules will however have to be adjusted over time to compensate for the increasing transfer from the LHWP and the growth in demands imposed on the system. Results from the operating analysis will also be used to indicate the extent of curtailments that need to be imposed on the system during drought conditions to protect the resource against total failure. Rules that clearly state how restrictions should be imposed on the various user sectors and if restrictions should be imposed on the Caledon / Moldder transfer schemes and systems when shortages occur in Gariep and Vanderkloof dams, do not exist **(G1)**. The Caledon/Modder transfer system as well as other sub-systems within the Riet/Modder catchment are however not analysed on an annual basis. Models and the required data already exist for this purpose and it should be considered to include these systems as part of the annual analysis. *Other **d**irectives, or **r**equirements identified from the status information:* **R1.** Hydropower operating rules need to be adjusted to accommodate the effects of updated hydrology and demands and changed Eskom

	requirements. **R2.** Results from the LORMS as well as updated data should be incorporated in the annual operating analysis. **R3.** Operating rules need to be verified by means of system analysis and should be implemented in practice. **R4**. Given that the water resource availability and water requirements for the Integrated Orange River System is effectively in balance, it is required to closely monitor the water balance situation on an ongoing basis. This will ensure intervention planning can be adjusted to account for any changes that may have an impact on the projected water balance.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Undertake annual operating analysis to determine the operating rules to apply as defined in the Situation Assessment as well as hydropower operating rules when required, including analyses to determine availability of excess yield for power generation. **{R1}**	Dir: WRPS (Priority 1)
	M2. Develop and implement drought allocation rules, which will result in restrictions in supply during drought periods. **{R3}**	Dir: OA (Priority 1)
	M3. Incorporate the updated data from the Lower Orange River Management Study into the annual operating analysis.**{R2}**	Dir: OA (Priority 1)
	M4. Develop and implement strategies to minimise operating losses and maintain continuous supply to the users. See **Strategy A.4.1** management actions **M4** & **M5** for more detail **{R3,R2}**	Dir: OA (Priority 1)
	M5: Only when all the users have been supplied at their required assurance levels, can consideration be given to make freshening releases through the Orange-Fish tunnel for dilution purposes. This should also be in agreement with Eskom. **{R4 }**	Dir: WRPS (Priority 1)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) b) Lower Orange River Management Study (LORMS) c) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06)	

Strategy Version control:	**Version no:**	Final
	Date:	January 2004
	Author:	ISP Study

A.7.3 PUBLIC HEALTH AND SAFETY

Management objective:	The water resource needs to be protected, and it must be ensured that users in the Orange River Catchment area are safe from the effects of poor water quality that can create health problems (e.g. cholera). Strategies must be in place to deal with floods and droughts.
Situation Assessment:	The Department's current commitments are associated with: • Managing floods and drought disasters by direct intervention on the ground. • Reducing pollution and preventing serious or hazardous pollution events and promoting dam safety. DWAF's (and the CMAs) future commitments under National Disaster Management Act, which is to be promulgated in 2003, will be: - DWAF/CMA will be required to become involved in supporting and enforcing disaster management planning by all relevant authorities. - Drafting a National Flood Management Policy (DWAF). - Dam safety policy (DWAF). - Co-operating with the Department of Agriculture on drought relief strategies and policy formulation.Dam safety policy (DWAF). - Pollution control of water resources (i.e. limiting health hazards such as cholera).Dam safety policy (DWAF). Flood management at Gariep and Vanderkloof Dams, so that it is not in phase with floods from the Vaal River, is of major importance with respect to the protection of developments along the Lower Orange River. To achieve this, flood peaks are basically reduced and released over a longer period. The annual operational analysis is used to determine the surplus or deficit in the system. During dry periods when there is a short-term deficit in the system the required curtailments will be imposed on the system by taking into account the assurance of supply allocated to the various users. *Other **d**irectives, or **r**equirements identified from the status information:* **R1.** Public health and safety strategy should comply with the requirement given above.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1** Compliance with the above-mentioned requirements.	ISP team (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) National Water Act of 1998	

Strategy Version control:	**Version no:**	Final
	Date:	January 2004
	Author:	ISP Study

A.8 MONITORING AND INFORMATION MANAGEMENT MAIN STRATEGY

A.8.1 MONITORING NETWORKS AND DATA CAPTURING

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 protection for surface freshwater bodies and groundwater.
Situation Assessment:	An extensive monitoring network of flow gauges, rainfall stations and water quality sampling and analysis are in operation and has been used as the source of data for the water resource system analysis and water quality management studies. During these studies recommendations were made to upgrade the monitoring network, usually to fill a particular data deficiency that was identified for a specific analysis or application. Numerous recommendations have been made for the monitoring of various variables relating to the management of the water resources of the system. Variables that have been listed as being inadequately monitored (data not available) include streamflow, rainfall, water quality, water abstractions and river health indicators. The inaccuracy of the observed low flows in the Orange River downstream of Vanderkloof Dam is one of the main requirements of overarching nature **(G1)**. Groundwater monitoring, with specific reference to groundwater levels, monitoring is inadequate. Groundwater monitoring will be addressed in the individual WMA ISPs in more detail. The need for monitoring in support of the Reserve has also been expressed. *Other **d**irectives or **r**equirements identified from the status information:* **D1.** Details of the various data related problems and shortcomings is given the recommendations of the relevant study reports and these should be consulted to evaluate and prioritise the monitoring needs. **D2.** A prioritised implementation programme should be one of the deliverables of the assessment. The programme should incorporate the monitoring needs for the determination of the Reserve, the proposed IWQMS and the operation of the systems. **D3.** Follow the requirements as laid down in the NWRS (Chapter 3 Part 6).

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Undertake an assessment of all the requirements for monitoring across the range of overarching water resource management activities. Previous study reports should also be consulted in this regard as well as inputs from the Regional Office and CMAs. **{G1, D1, D2}**	Regional Offices NC (Priority 1)
	M2. Design the monitoring network to prevent duplication and include data from other organisations and countries. **{D1, D2, D3}**	HI (Priority 2)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. PD000/00/6697) b) Orange River System Analysis Phase 1 & 2 (Report no. PD000/00/1092) c) Vaal River System Analysis Update-Summary Report (Report no. PC000/00/19496)	

Strategy Version control:		
	Version no:	Final
	Date:	January 2003
	Author:	ISP Study

A.9 ISP IMPLEMENTATION

Management objective:	To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Upper and Lower Orange River WMAs. This will require willpower, funding and capacity.
Situation Assessment:	The ISP is an internal document, developed almost exclusively by and on behalf of the Department of Water Affairs and Forestry. The ISP sets out the approaches which the Department is taking towards water management in the Upper and Lower Orange River WMAs and lists suggested actions towards achieving good management of the water resource. The wider public has had no direct input into this ISP – yet it is recognised that the approaches adopted have a significant impact on the populace of the Upper and Lower Orange River WMAs. 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** itself sees the situation, and the steps which **DWAF** views as most appropriate in dealing with the situation. Years of interaction with the public have had an important influence 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. The ISP is not yet a document of recognised status. The ISP is subject to the approach set out in the NWRS – and details this approach for the Upper and Lower Orange River WMAs. 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 and better ideas are presented. Despite this the approaches and requirements of this ISP may not be ignored.

Situation Assessment: (Continues)	The Implementation of the ISP is an enormous task. Never before have all the hopes and expectations of the Department been gathered together into one document. 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 leverage maximum funds, maximum capacity, and to bring optimum management to the WMA. The NWRS gives us firmer ground now that it is coming on line. The ISP needs to be acknowledged by Legal Services and the Water Tribunal as the next level of accepted planning. For the ISPs to be accepted like this they would need to have stakeholder approval. We need a national strategy aimed at giving the ISP this authority

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Publish the ISP in hard-copy, on CD, and perhaps even on the Web, for public input and comment. Copies will only 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.	Regional Offices (Priority 1)
	M2. 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 WCDM, are taken out forcefully both to local authorities, other direct water users such as agriculture, and the wider public.	Regional Offices (Priority 1)
	M3. Collate comment and consider this in revising and improving the ISP.	Regional Offices (Priority 1)
	M4. There is a need to develop materials – suitable for the provincial cabinet, the various management committees, the mayor's forum. Also to support the Water Services Development Plan, Organised Agriculture, Emerging Farmers, etc. This should be suited to the preparation of the Provincial Growth and Development Strategy, and other regional and provincial planning activities.	Regional Offices (Priority 1)

Required actions, responsibilities and priorities: **(Continues)**	**M5**. The ISP should, in any event, be open to continuous improvement, with possible updating on a bi-annual basis.	Regional Offices (Priority 1)
	M6. All Regional staff, Working for Water, Eskom, and other major stakeholders should have access to, or copies of, the ISP	Regional Offices (Priority 1)
	M7. 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!	Regional Offices (Priority 1)
	M8. The practicalities of implementation demands must always be considered.	Regional Offices (Priority 1)
	M9. 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	Regional Offices (Priority 1)
Implementation	The implementation is to be ongoing until the Upper and Lower Orange River WMAs is established and the ISP is superseded by a CMS	

Strategy Version control:	**Version no:**	Final
	Date:	January 2003
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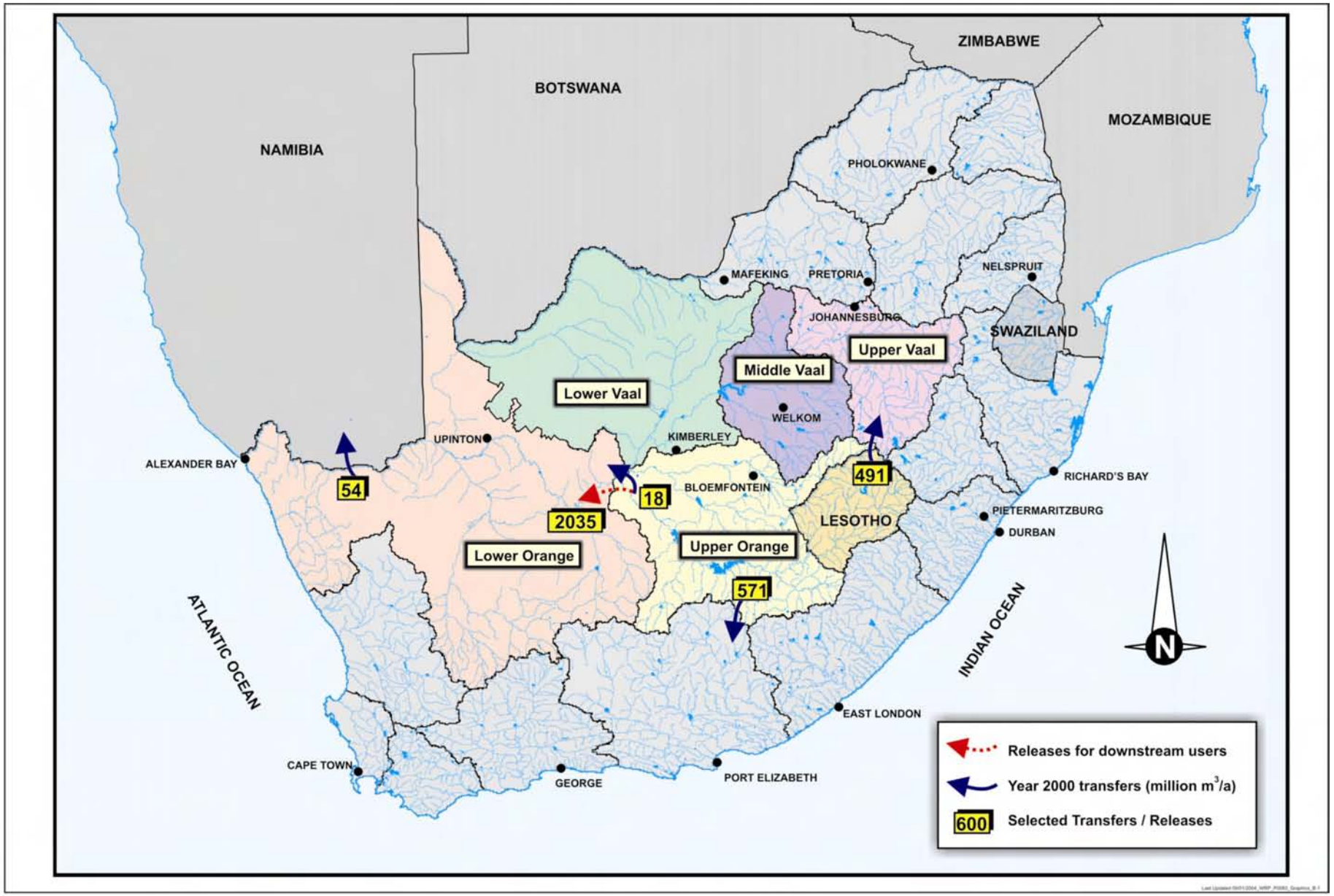
Appendix B

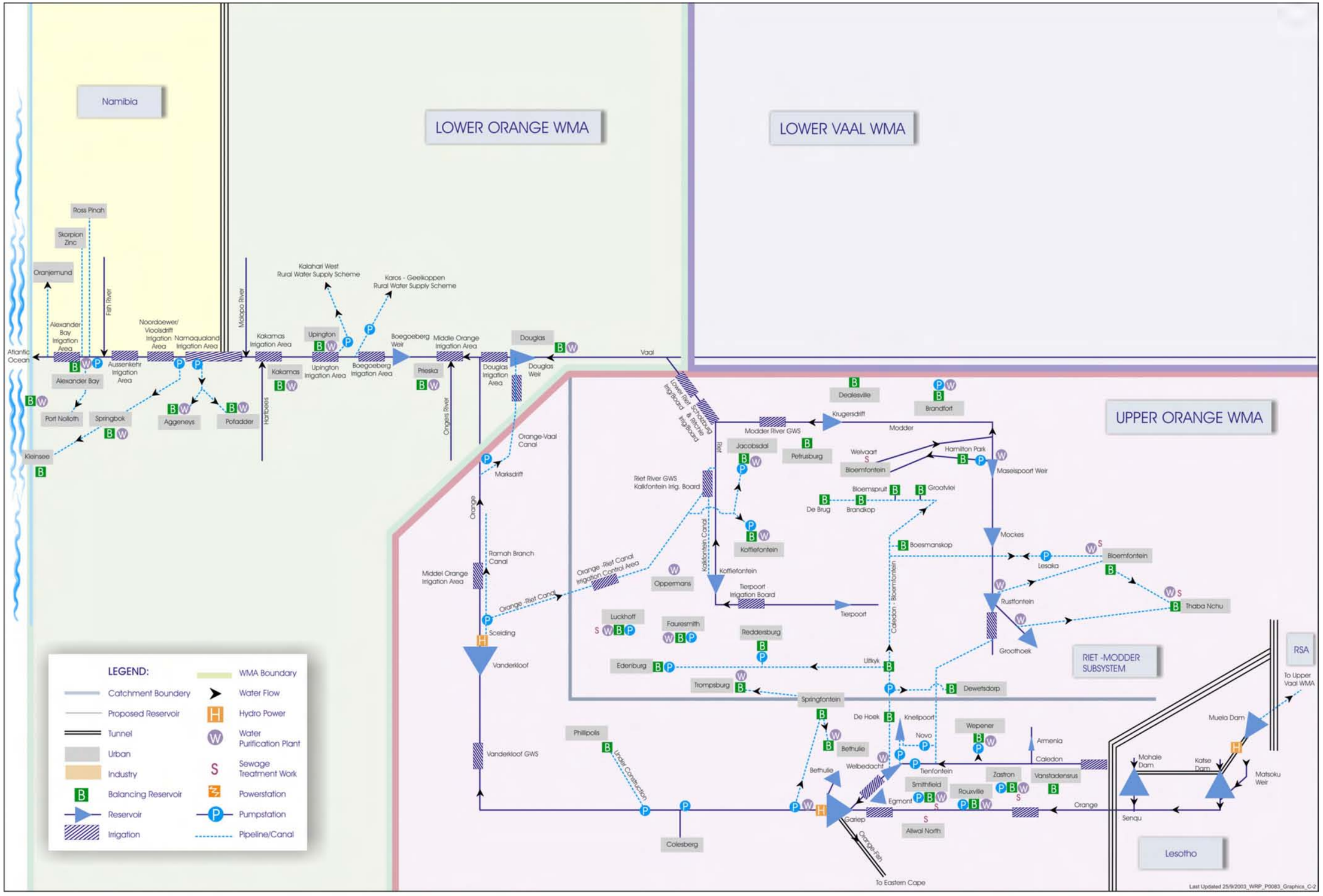


PDNA WMB V3 WRP

INTERNAL STRATEGIC PERSPECTIVE:
ORANGE RIVER SYSTEM: OVERARCHING

Locality Map and Major Transfers

B-1



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INTERNAL STRATEGIC PERSPECTIVE:
ORANGE RIVER SYSTEM: OVERARCHING

Schematic of the Integrated Orange River System **B-2**