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	

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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)	

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

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.

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

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
	Author:	ISP Study

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
	Author:	ISP Study

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

Strategy Version control:	**Version no:**	Final
	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	

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