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

Olifants Water Management Area

Internal Strategic Perspective

Version 1 : February 2004

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DEPARTMENT OF
WATER AFFAIRS
& FORESTRY

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OLIFANTS RIVER WATER MANAGEMENT AREA

INTERNAL STRATEGIC PERSPECTIVE

VERSION 1

February 2004

Department of Water Affairs and Forestry

Directorate National Water Resource Planning

INTERNAL STRATEGIC PERSPECTIVE

FOR THE

OLIFANTS WATER MANAGEMENT AREA (WMA No 4)

APPROVAL

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INVITATION TO COMMENT

This report will be updated on a regular basis until it is eventually superceded by the Catchment Management Strategy.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

ELECTRONIC VERSION

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

- Olifants WMA Internal Strategic Perspective (*This Report*)
  (Report No: P WMA 04/000/00/0304
- The National Water Resource Strategy, First Edition 2004
- The Olifants WMA - Overview of Water Resources Availability and Utilisation (Report No: P WMA 04/000/00/0203)
- The Olifants WMA – Water Resources Situation Assessment
  (Report No: P 04/000/00/0101)

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EXECUTIVE SUMMARY

1. INTRODUCTION

The Internal Strategic Perspective (ISP) for the Olifants WMA aims to ensure synergy within the Department of Water Affairs and Forestry (DWAF) regarding water resources management. The ISP presents a common and consistent Departmental approach to guide officials when addressing water management related queries and evaluating water licence applications and represents DWAF's view on how Integrated Water Resource Management (IWRM) should be practised in this WMA.

2. WATER LEGISLATION AND MANAGEMENT

The NWA is the principal legal instrument relating to water resource management in South Africa. It is now being incrementally implemented. The NWA introduces far-reaching concepts such as the NWRS, the First Edition of which will be published in the first quarter of 2004. This NWRS is being progressively developed to set out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, development, conservation, management and control of the country's water resources.

3. BACKGROUND AND APPROACH

Water is one of the key and most fundamental and indispensable of all our natural resources. It is fundamental to life (and the quality of life), the environment, food production, hygiene, industry, and power generation. Water can be the limiting factor when it comes to economic growth and social development, especially in South Africa where it 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

DWAF is striving for an integrated planning and management approach, referred to as IWRM. The ultimate aim of this IWRM process is to arrive at:

1 An allocation schedule that meets the requirements of the National Water Act (NWA) (Act 36 of 1998);

2 Water resources yield and other models that are representative of the flow regime of the river systems in the area;

3 Management class scenarios for the river (ie Reserve and Resource Quality Objectives set);

4 A Catchment Management Strategy for each Water Management Area.

These deliverables can only be finalised once the Catchment Management Agencies (CMA) assume responsibility for managing the water resources of their respective Water Management Areas (WMA). In the interim, DWAF's Regional Offices will continue to manage the water resources in their area of jurisdiction until such time as they can hand over these management functions to established and fully operational CMAs. In accordance with the NWA, DWAF (the Minister) will still remain ultimately responsible for the management of the water resources.

In light of this responsibility, DWAF's (including all relevant Directorates in the Department) corporate perspective on how the water resources should be managed, needs to be formally expressed in order to manage the water resources in a consistent and predictable manner. The purpose of the ISP is to document these perspectives and offer sound motivation to demonstrate proper and reasonable governance.

4. OVERVIEW OF THE OLIFANTS WMA

The Olifants River originates in the Highveld of Mpumulanga. The river initially flows northwards before curving in an easterly direction through the Kruger National Park and into Mozambique. The Olifants WMA falls within three provinces via Gauteng, Mpumulanga and the Limpopo provinces.

The topography is characterised in the southern part by gently rolling hills before the river cuts through the Drakensberg to enter the relatively featureless lowveld region. The rainfall is strongly seasonal occurring mainly in summer. The mean annual precipitation varies from 500 mm in the Lowveld region, reaching 1000 mm in the mountains and reducing to 700 mm in the south in the Mpumulanga Highveld. The potential evaporation is well in excess of the rainfall.

The WMA has been divided into 4 sub-areas for the purposes of discussing the issues and developing the strategies for the WMA. The sub-areas are the Upper Olifants, Middle Olifants, Steelpoort and Lower Olifants Sub-areas. The location of the sub-areas is shown in **Figure 2.1**.

The Upper Olifants Sub-area is the most urbanised of the four sub-areas with the majority of the urban population located in Witbank and Middelburg. The population in these urban centres is projected to grow in the future. There are extensive coal mining activities in the sub-area both for export through Richards Bay and for use in the 6 active coal fired power stations in the sub-area. The presence of coal also led to the establishment of the steel manufacturing industries located in Middelburg and Witbank.

The population in the Middle Olifants Sub-area is largely undeveloped with scattered rural settlements. The predominant land use is agriculture with extensive irrigation taking place from Loskop Dam. There are a number of platinum and chrome mines being developed in the Middle Olifants Sub-area. The mines have increased the water requirements in the area both due to direct water use and the influx of people into the area to work on the new mines.

The Steelpoort Sub-area is largely rural with agriculture the predominant land use. There is vanadium and chrome mining and mineral processing taking place in the sub-area. The demographics of this sub-area are also affected by the new mining developments in the WMA with the population of Burgersfort projected grow.

The Lower Olifants Sub-area is also rural in character with the main urban centre being Phalaborwa. Extensive irrigation takes place along the Olifants River, in the Blyde River catchment and in the upper reaches of the Ga-Selati catchment. Eco-tourism is an important industry with a number of private game parks and the Kruger National Park (KNP) located in the sub-area. There is mining with the main mining activity being the copper and phosphorus mining taking place in the vicinity of Phalaborwa.

5. WATER AVAILABILITY

The surface hydrology in the Upper Olifants Sub-area has been modelled and a monthly record covers the period October 1920 to September 1995. The Water Resources Yield Model (WRYM) and the Water Resources Planning Model (WRPM) have been set up for the sub-area. The WRPM is however not used on an annual basis to assess the available water in the sub-area, to apply water restrictions during drought periods or to manage water quality. Although the WRPM and the WRYM can be used to determine the water availability of the large management units set up for the sub-area, there is some uncertainty related to the availability of groundwater and surface water at the local level for which more detailed hydrological models are required. There are substantial sewage treatment plant return flow volumes in the Klipspruit, Witbank Dam and Witbank and Middelburg Dam to Loskop Dam catchments. The return flows contribute to the base flow into Loskop Dam and have been cited as a cause of eutrophication in the upper reaches of the Loskop Dam and the Klein Olifants River.

The hydrology of the Middle Olifants Sub-area covers the period 1920 to 1991. The WRYM has been set up for this region. The model was used during the feasibility study for the Rooipoort Dam and/or the dam on the Steelpoort River. Stochastic analyses were also undertaken during the feasibility study. The groundwater resources in this sub-area vary from limited to good. The high yields are located in the Springbok Flats. The groundwater in the Springbok Flats is used extensively for irrigation and domestic supply. There are reports that the groundwater levels have been receding in many of these areas due to over exploitation. The full potential of the groundwater resource as a source of supply is not well known and needs to be accurately quantified as it has been earmarked as a source of supply for many of the rural communities in this sub-area in particular the Nebo Plateau.

The available hydrology in the Steelpoort Sub-area has been modelled and naturalised flow records covering the period 1920 to 1995 have been generated. These records were used in the WRYM during the feasibility study to assess the bulk water supply options in the Steelpoort Valley. Groundwater is an important source of supply in this sub-area for irrigation and domestic use. A study has been carried out to quantify the groundwater resources in the Steelpoort sub-area. The water quality of these resources is under threat from the mining and agricultural activity in the sub-area.

The available hydrology of the Lower Olifants Sub-area covers the period 1920 to 1989. The majority of the sub-area is dry with an MAP of less than 500 mm except for the area along the escarpment where the MAP can reach 1000 mm. The Blyde River catchment has a high rainfall and the water emanating from the Blyde River makes an important contribution to the base flows in the lower reaches of the Olifants River passing through the Kruger National Park.

The availability of the groundwater resource in the WMA in general has not been accurately assessed. Groundwater plays an important role in supplying the rural areas with water for domestic and stockwatering use.

6. WATER REQUIREMENTS

The water requirements in the Upper Olifants Sub-area are projected to grow in the urban areas of Witbank and Middelburg. Substantial growth has been projected for the Witbank area. The basis for these projections needs to be reviewed as the projections have a significant impact on the timing and planning of augmentation for the sub-area.

The growth in the water requirements in the Middle Olifants Sub-area is largely due to the new mining operations being established in the Dilokong Corridor. The extent of the mining operations and the projected growth in water requirements as regards the influx of people to the area is not fully known. A study to determine the requirements is nearing completion. There are a number of irrigation schemes in this area that have fallen in to disuse. The schemes are being revived as poverty eradication initiatives and the use of water on the schemes will grow steadily back to their water allocations as the schemes come back on line. Although these irrigation requirements have been included in the water requirements for this sub-area given in the reconciliation in section 3 of this report, the water requirements not being used has eased the deficit situation in the sub-area.

The water requirements in the Burgersfort area of the Steelpoort Sub-area are growing due to the influx of people being housed in the town. The extent of the growth is being determined as part of a water requirement study which covers the

Middle Olifants and Steelpoort Sub-areas. Like the Middle Olifants Sub-area, there are irrigation schemes that have fallen into disuse. Plans are being implemented to revive these schemes as part of poverty eradication initiatives.

The water requirements in the Lower Olifants Sub-area are not foreseen to grow significantly. The water requirements in the Phalaborwa area are likely to drop with the implementation of treatment and the recycling of water by Foskor and the advent of underground mining by Palabora Mining Company. The water requirements in this area need to be confirmed.

7. WATER BALANCE RECONCILIATION

The year 2000 water balance shows that there is a deficit of 192 million m^3 in the WMA. The deficit includes the effect of the environmental water requirements (EWR) on the yield of the system. The EWR as determined in the NWRS are not currently supplied in full. However even if the effect of the EWR is taken out of the balance equation, a small deficit will still exist in the system. The WMA is therefore under stress and with the current level of water infrastructure development no further abstractions can be allowed.

The reconciliation of the existing use and the EWR is an important issue in the WMA which needs to be resolved. The solution involves reconciling the needs of the river system with the social, financial and economic impacts of having less water available for abstraction. A full participation process will be needed to achieve a solution. The efficient use of water will feature strongly in developing the solutions.

The water balance reconciliation shows that the deficit will grow in the future to 241 and 279 million m^3/a in the year 2025 for the base case and high case growth scenarios respectively. This further highlights the shortage of water in the WMA.

The general approach to be adopted for new applications for water can be summarised as follows: -

- Before any new allocations are considered, users will have to prove that water is and will be used efficiently in future.
- Trading of allocations especially within a water sector will often be the preferred option for a user to obtain an allocation. Trading between sectors is however problematic. As an example, providing the future mining requirements with water by means of trading from agriculture would mean the “loss” of thousands of hectares of irrigation with the concomitant impact on existing employment and the social and economic fabric of the area. This level of trading would thus be ruled out as an option.
- Eradication of alien invasive plants to “free” up water for other users is also an option to be considered.

However the future water balances show that the magnitude of the future requirements is such that further development of the resource (both surface and groundwater) is inevitable. The raising of Flag Boshielo Dam is already underway and the development of new dams in the Middle Olifants and Steelpoort Sub-areas are currently being planned by DWAF. The potential sites are at Rooipoort on the Olifants and/or a dam on the Steelpoort River.

The groundwater overview study given in Appendix A, showed that the groundwater resource could be further exploited to meet the water requirements. Groundwater is going to play an important role, particularly in the rural areas, in meeting the future water requirements.

There is very little scope to further develop the surface water resources in the Upper Olifants Sub-area. Future requirements will have to be met by transferred water at full cost. This will only be considered after the implementation of WC&DM and the development of local resources have been considered. There is extensive coal mining in the Upper Olifants Sub-area, which has an impact on the hydrological cycle by increasing the recharge to the groundwater system. This “additional water” and the water stored in the underground workings could be used to increase the yield in the Upper Olifants Sub-area. The extent of this increase needs to be quantified.

8. WATER QUALITY

In the Upper Olifants Sub-area Water Quality Management Plans have been developed for the Klipspruit, Witbank Dam and Middelburg Dam catchment areas. The Water Quality Objectives (WQO) set during these processes are being used to manage the catchments. The WQO however do not recognise the water quality Reserve, which was not available at the time of setting the WQO. Cognisance needs to be taken of the water quality Reserve. The Reserve should be phased in where necessary as part of IWRM process. The water quality in this sub-area is under threat from the coal mines. Some 62 million m^3/a is predicted to decant from workings post closure. The management of these decant volumes is being addressed by the mining industry with a number of projects addressing treatment and irrigation management options. A water quality management plan needs to be developed for the Upper Olifants sub-area.

The water quality problems in the Middle and Steelpoort Sub-areas are salinity, eutrophication, toxicity and sediment. The salinity and eutrophication problems are due to the irrigation return flows, mining impacts and sewage treatment plant discharges. Pesticides and herbicides have been cited as the cause of the toxicity problems but this needs to be confirmed by monitoring. The sediment is related to poor agricultural practise due to overgrazing in the rural areas. The production of sediment, particularly in the Middle Olifants Sub-area causes operational problems at the downstream Phalaborwa Barrage. The release of water to maintain the base flow into the KNP has led to fish kills due to the sediment laden waters.

In the Lower Olifants Sub-area, the water quality is influenced by the water quality of the return flows from the mining complex around Phalaborwa in the Ga-Selati River. This water quality is poor and impacts on the Olifants River. The water emanating from the Blyde River is of a good quality and together with the good quality water from the Mohlapitse River maintains the water quality in the Olifants River in the KNP at an acceptable quality. The operation of this system needs to be formalised and maintained in the future until the operation of the new infrastructure is in place.

9. COOPERATIVE GOVERNANCE

It will be necessary to ensure that IWRM and co-operative governance takes place within the Olifants River WMA. DWAF will adopt a close co-ordination and a common management approach. An effective communication strategy to involve provincial, district and local authorities in the management process is needed to ensure that IDPs, WSDPs and other development planning and implementation takes place within the constraints and development potential of the available water resources. This approach must also include the way in which this ISP will be updated on a regular basis.

10. INSTITUTIONAL DEVELOPMENT

Without the buy-in and co-operation of the various water management institutions in the Olifants River WMA, it will be impossible to give adequate effect to all the management objectives, strategies and actions mentioned in this ISP. An effort needs to be made to ensure adequate institutional development and communication between all stakeholders. The process of establishing the CMA should be continued with the submission of the proposal to the Minister of the Department for acceptance.

11. MONITORING AND INFORMATION MANAGEMENT

Co-ordinated and appropriate monitoring and water related information storage and retrieval systems need to be collated, further developed and centralized in order to provide proper planning and other public data. A comprehensive strategy will need to be developed in due course.

12. INTERNATIONAL

The Olifants WMA falls within the Limpopo River Basin, which is shared by South Africa, Botswana, Zimbabwe and Mozambique. As the Olifants River flows directly from South Africa into Mozambique, where it joins the Limpopo River, developments in South Africa directly impact upon Mozambique.

Joint utilization of the water resources of the Olifants River is facilitated through the bilateral Joint Water Commission between South Africa and Mozambique. International co-operation with respect to the use and management of the watercourses in the Limpopo River Basin, was overseen by the Limpopo Basin

Permanent Technical Committee (LBPTC) with membership by South Africa, Botswana, Zimbabwe and Mozambique. The LBPTC was replaced by the Limpopo Water Course Commission, established in November 2003.

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LIST OF ABBREVIATIONS

Acronym	**Meaning**
BP	Business Plan
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
Dir: HI	Directorate: Hydrological Information
Dir: NWRP	Directorate: National Water Resources Planning
Dir: OA	Directorate: Option Analysis
Dir: PSC	Directorate: Policy and Strategic Co-ordination
Dir: WRPS	Directorate: Water Resources 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
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
NWA	National Water Act
NWRS	National Water Resource Strategy
WC	Water Conservation
WC&DM	Water Conservation and Demand Management
WDM	Water Demand Management
WMA	Water Management Area
WSDP	Water Services Development Plan
WQO	Water Quality Objectives
WRSAS	Water Resource Situation Assessment Study
WUA	Water User Association

GLOSSARY OF TERMS

Aquifer	Any strata or a group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to borehole(s) and / or springs (a supply rate of 0.1 L/s is considered as a usable quantity). Latin: aqua water and ferre to carry
Borehole	Drilled hole used to abstract, recharge or monitor groundwater
CM	Catchment Management It is the holistic and integrated management of South African water resources at catchment level. Its aim is to achieve a balance between development and the protection of our water resources and to involve people in water resources decision-making processes
Catchment	An area of land from which any rainfall will drain into the water course or watercourses and flow to a common point, has definable physical boundaries.
CMA	Catchment Management Agency A water management institution which manages Water Management Area (WMA)
CMS	Catchment Management Strategy A strategy for a water management institution which manages Water Management Area (WMA)
Dissolved solids	Minerals and organic matter dissolved in water.
DWAF	Department of Water Affairs and Forestry DWAF is the national custodian of South Africa's water and forestry resources. It is primarily responsible for the formulation and implementation of policy governing these two sectors.
EIA	Environmental Impact Assessment EIA is a project specific process, which looks at how a proposed development might impact on the environment, and at how those impacts might be mitigated.
GIS	Geographical Information System A GIS is a computer-based tool for mapping and analysing things that exist and events that happen on Earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualisation and geographic analysis benefits offered by maps.
Groundwater	All subsurface water occupying voids within a geological stratum.
IEM	Integrated Environmental Management IEM has become the umbrella term, or toolbox, within which all environmental assessment processes, and environmental management practices, reside. IEM has become a guiding philosophy - the interface for the various environmental management processes and is the umbrella covering EIA, SEA and EMP.
IDP	Integrated Development Plan
WMA	Water Management Area It is an area established as a management unit in the national water resource strategy within which a catchment management agency will conduct the protection, use, development, conservation, management and control of water resources. There are 19 WMAs in SA.
WRC	Water Research Commission The WRC's terms of reference are basically to promote co-ordination, communication and co-operation in the field of water research; to establish water research needs and priorities; to fund research on a priority basis; and to promote the effective transfer of information and technology.

WRM	Water Resource Management WRM ensures management of our water resources to ensure the sustainable utilisation of a very limited resource.
WRMC	Water Resource Management Committee WRMC resulted from a need to consider and discuss WRM issues in more detail and to facilitate co-ordination on water resources activities and approaches.
WSDP	Water Services Development Plan A WSDP focuses on water services, the supply thereof and sanitation. The focus of a WSDP is to provide effective water services to the consumers in accordance with the aims of the Government. It is also a tool to ensure effective, sustainable and economical water services that is managed as a business.
Well	See borehole.
Wellfield	A group of boreholes in a particular area used for groundwater abstraction purposes.
Yield	Volume of water per unit of time that can be obtained from a borehole

PART A

CHAPTER 1: BACKGROUND TO THE OLIFANTS WMA INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE OLIFANTS WMA

Figure 1.1 shows the location of the Olifants WMA, which falls within the Gauteng, Mpumalanga and Limpopo Provinces.

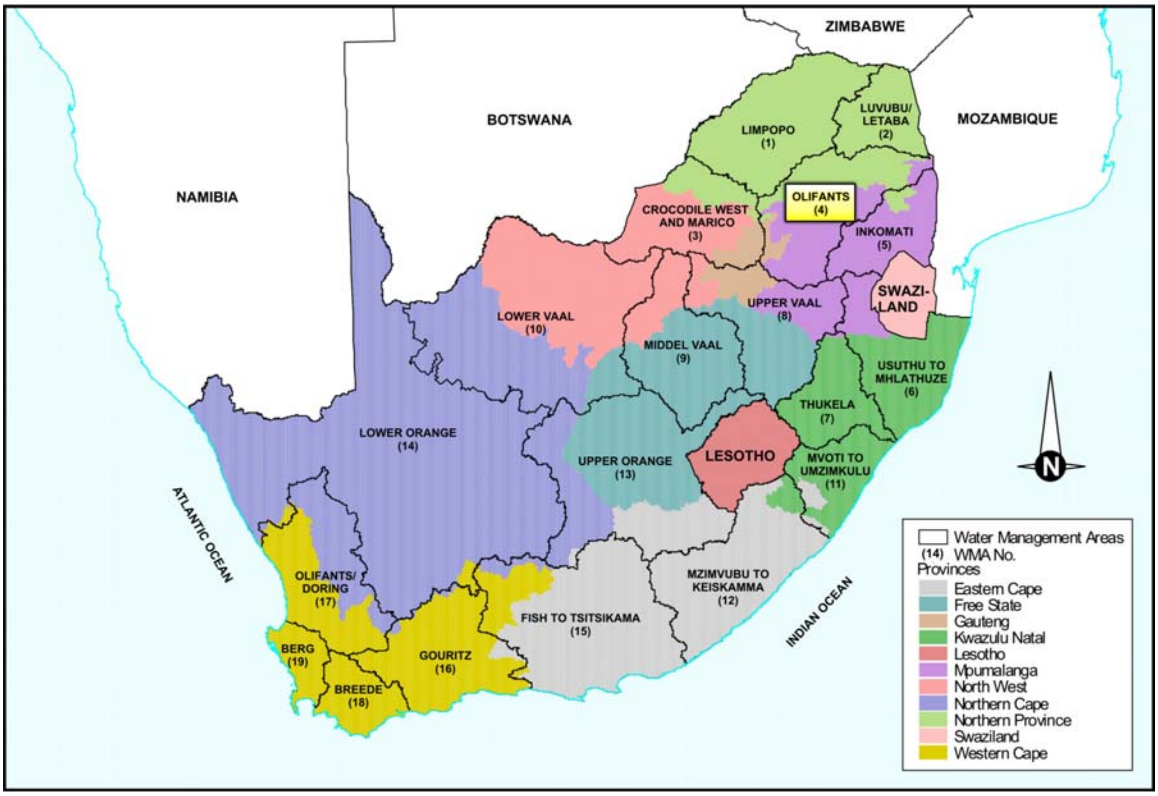


Figure 1.1: Location of the Olifants WMA

1.2 WATER LEGISLATION AND MANAGEMENT

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

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

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

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

- Water will be regarded as an indivisible national asset. The Government will act as the custodian of the nation's water resources, and its powers in this regard will be exercised as a public trust.
- Water required to meet basic human needs and to maintain environmental sustainability will be guaranteed as a right, whilst water use for all other purposes will be subject to a system of administrative authorisations.
- The responsibility and authority for water resource management will be progressively decentralised by the establishment of suitable regional and local institutions, with appropriate community, racial and gender representation, to enable all interested persons to participate.

1.2.1 The National Water Act (NWA)

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

1.2.2 The National Water Resource Strategy (NWRS)

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

- The National framework for managing water resources;
- The framework for preparation of catchment management strategies in a nationally consistent way;
- Information, in line with current legislation, regarding transparent and accountable public administration; and

- The identification of development opportunities and constraints with respect to water availability (quantity and quality).

1.2.3 Catchment Management Strategies (CMS)

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

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

1.3 INTERNAL STRATEGIC PERSPECTIVES (ISPs)

1.3.1 The Objectives of the ISP Process

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

1.3.2 Approach Adopted in Developing the ISP

The ISP for the Olifants WMA was developed in five stages as follows:

i) Determining the current status of water resource management and relevant water resource management issues and concerns in the Olifants WMA. This was achieved through interviews with individual members of DWAF's RO in Nelspruit 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 Olifants 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 Olifants WMA. The current incumbent is Mr J van Aswegen, 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 superseded by the WMA report and the NWRS.

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

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

1.4 INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

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

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

This integrated planning and management approach is intended, through co-operative governance and public participation, to enable water managers to meet the needs of all people for water, employment, and economic growth in a manner that also allows protection and, where necessary, rehabilitation of aquatic ecosystems. Above all, Integrated Water Resource

Management (IWRM) will enable water managers to use our precious water resources to assist us in poverty eradication and removal of inequity.

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

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

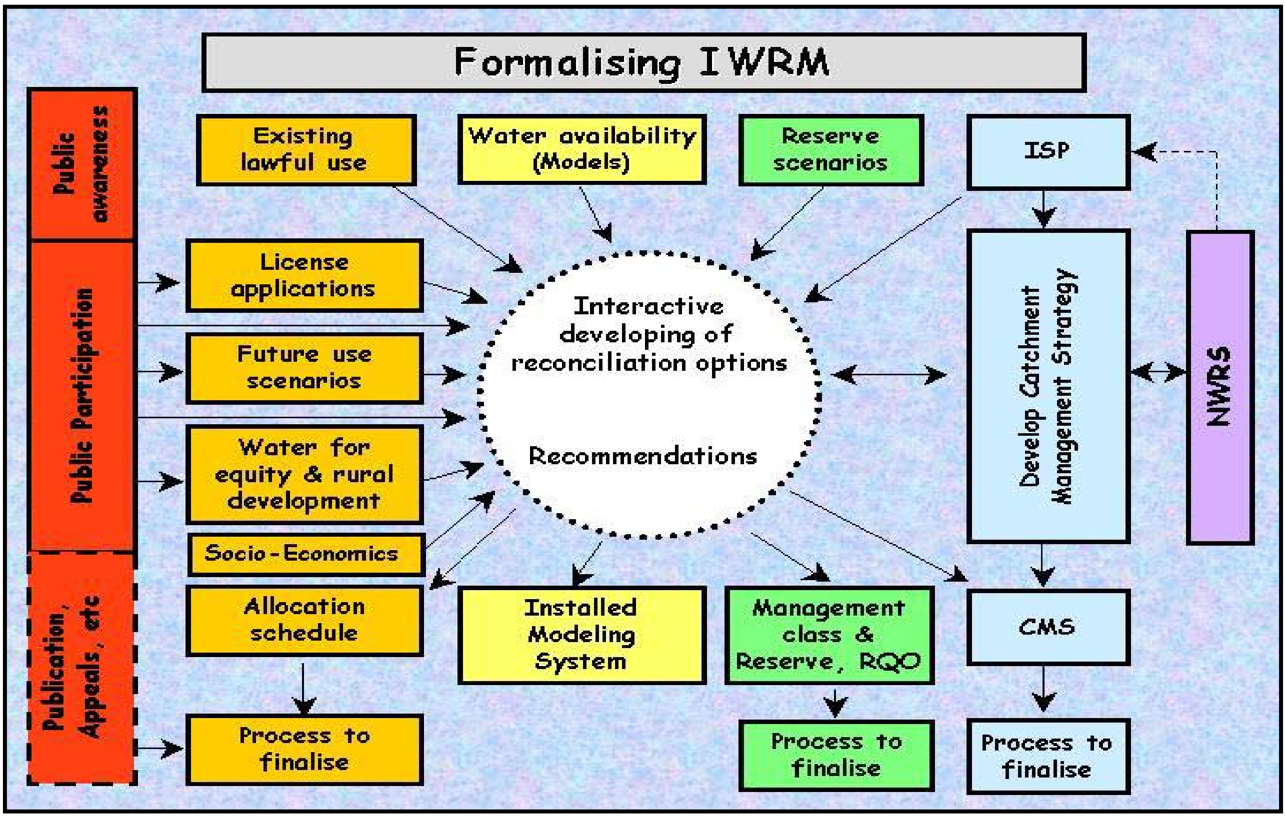


Figure 1.2: Diagram showing DWAF Integrated Water Resources Management approach

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

- Existing use and the lawfulness of that use must be verified, all users (existing and new) must apply for licences, a good understanding of future use scenarios must be developed and water required for equity purposes and rural development must be clearly understood.
- Water availability must be understood as thoroughly as possible with "best available" existing information used to model all possible reconciliation options.
- Reserve scenarios must be developed for all significant resources in the catchment, for instance, the river flow requirements for all possible classes that may be considered.

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

The processes will then enter a very intensive, interactive phase of developing realistic reconciliation options. This would entail, for example, the selection of a specific management class to be scrutinised for its impact on the number of licences that could be issued for use, with its concomitant impacts on the social and economic structure of the catchment.

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

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

1.5 CARING FOR THE ENVIRONMENT

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

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

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

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

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

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

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

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

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

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

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

1.6 THE SOCIAL ENVIRONMENT

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

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

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

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

Consultation and public participation are cornerstones of the social component of any strategic document. These requirements are repeatedly stressed throughout the National Water Act. This ISP has been prepared as DWAF's position statement with respect to the management of water resources and, although strategies and plans have been captured without consultation with the stakeholders, it remains an open and transparent document where the understanding of the Department, its visions and its principles are made clear for all to see and to interact with. This is amplified in the Implementation Strategy (**Part B: Strategy no 9**) of this ISP.

1.7 WATER QUALITY MANAGEMENT

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

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

Quantity and quality can no longer be managed in isolation of each other. Decanting from the closed mining operations is a major concern. It should be properly addressed in the planning phase. Environmental Management Plans must clearly indicate what measures will be taken to prevent the pollution from decanting after mines closure. 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.
- 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 1.3, 2.2, 3.3, 4.1 and 7.1 in **Part B** 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 Olifants, 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.

CHAPTER 2: GENERAL OVERVIEW OF THE OLIFANTS WMA

2.1 INTRODUCTION

A general overview of the Olifants WMA is given in this chapter to provide background to the water issues in the WMA. The information is taken from the NWRS (DWAF, 2004a) and the "Overview of Water Resources Availability and Utilisation" reports for the Olifants WMA (DWAF, 2004b). These reports should be consulted if further details are required.

In the NWRS, the Olifants WMA is divided into 4 sub-areas viz the Upper Olifants, Middle Olifants, Lower Olifants and Steelpoort Sub-areas. See **Figure 2.1** for the location of these areas. This sub-division has been maintained for the ISP but sub-catchments within the sub-areas may be referred to when discussing specific strategies.

2.2 NATURAL CHARACTERISTICS

The Olifants River originates near Bethal in the Highveld of Mpumalanga. The river initially flows northwards before curving in an easterly direction through the Kruger National Park and into Mozambique where it joins the Limpopo River before discharging into the Indian Ocean. The Olifants WMA corresponds with the South African portion of the Olifants River catchment but excludes the Letaba River catchment. The area of the Olifants WMA is 54550 km^2. The Olifants WMA falls within three provinces viz Gauteng, Mpumalanga, and the Limpopo Province. The main tributaries are the Wilge, Elands and Ga-Selati Rivers on the left bank and the Steelpoort, Blyde, Klaserie and Timbavati Rivers on the right bank.

The topography is characterized in the southern part of the catchment by rolling gently sloped hills, before the river cuts through the Drakensberg to enter the relatively featureless Lowveld region. Largely attributable to the topography, distinct differences in climate occur. The climate varies from cool in the southern Highveld region of the WMA through temperate in the central parts to sub-tropical east of the escarpment. The rainfall is strongly seasonal occurring mainly in summer. The mean annual rainfall falls in the range 500 mm in the Lowveld region, reaching 1000 mm in the mountains and reducing to 700 mm in the South in the Mpumalanga Highveld region of the WMA. The potential evaporation is well in excess of the rainfall.

The Olifants WMA is dominated by tropical bush and savanna, with smaller areas of false and pure grassveld. Small amounts of inland tropical forest occur in the northern and eastern boundaries of the WMA.

The geology consists mainly of hard rock formations, with the occurrence of the Bushveld Igneous Complex as the most prominent feature. The eastern limb of this formation cuts through the northern part of the WMA. Rich coal deposits occur in the Upper Olifants Sub-area in the vicinity of Witbank and Middelburg. A large dolomitic intrusion extends along the Blyde River, curving westwards along the northern extremity of the WMA.

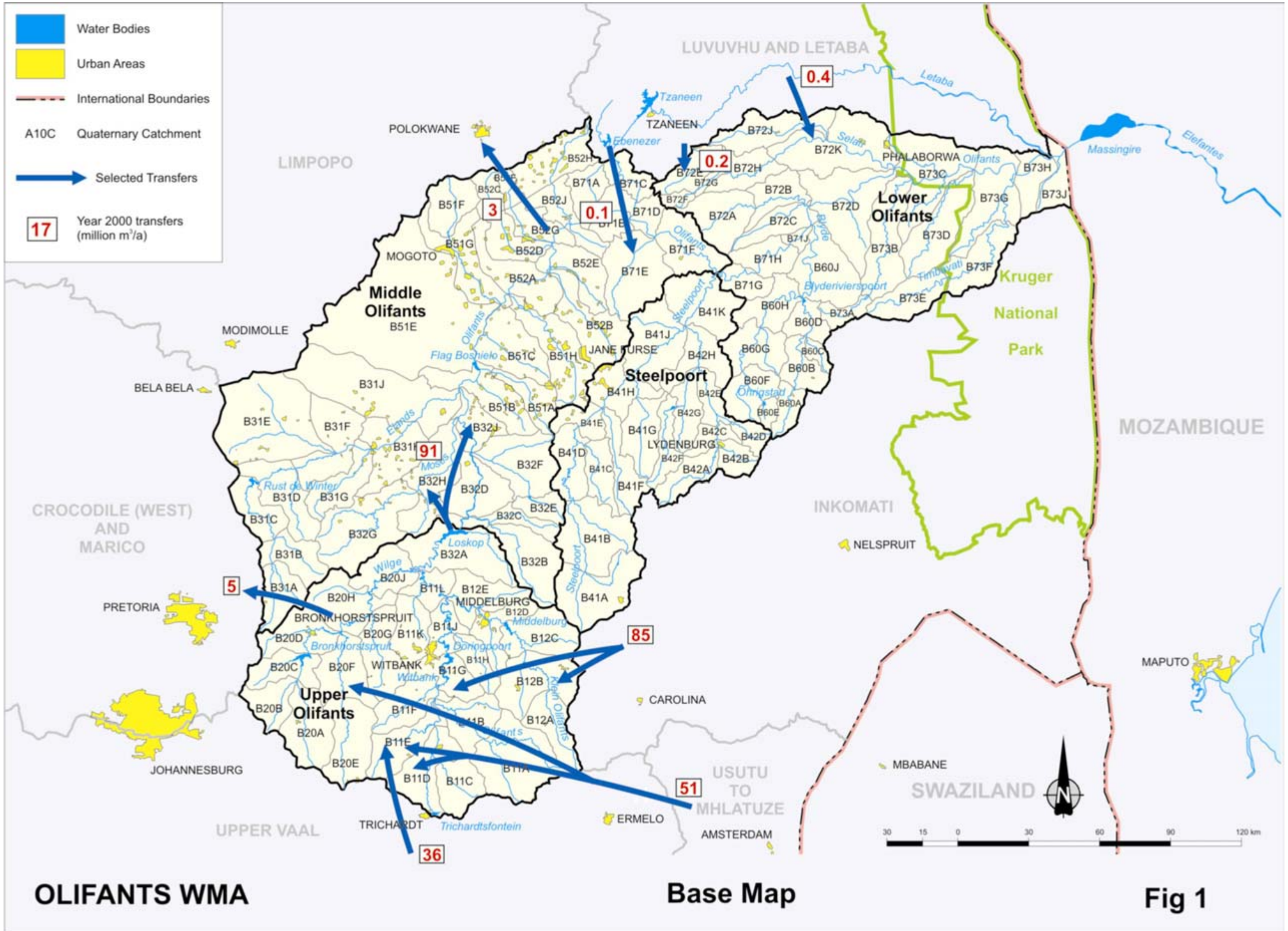


Figure 2.1: Layout of Olifants WMA showing sub-area boundaries and transfers (Taken from DWAF, 2004b)

The WMA has extensive coal reserves located in the upstream southern region of the catchment in the vicinity of Witbank and Middelburg. The downstream eastern portions of the catchment have minerals such as copper in the Phalaborwa area, with chrome and vanadium in the Steelpoort valley. The platinum reefs along the Lebowakgomo to Burgersfort axis (Dilokong Corridor) are also starting to be extensively exploited.

The Olifants River flows through the Kruger National Park before entering Mozambique. The Kruger National Park is world renowned and is important from an eco-tourism point of view. Several private game reserves are found in the vicinity of and adjoining the Kruger National Park, with other conservation areas scattered throughout the WMA.

2.3 DEVELOPMENT

The level of development in the catchment is influenced by the mineral deposits. The main economic activity being concentrated in the mining and industrial centres of Witbank and Middelburg, near Phalaborwa and in the Steelpoort where a variety of minerals are found. Some of the largest thermal power stations in the world are located in the Upper Olifants Sub-area. Extensive irrigation occurs in the vicinity of Loskop Dam, along the lower reaches of the Olifants River, near the confluence of the Blyde and Olifants Rivers as well as in the Steelpoort valley and upper Selati catchment. Much of the central and north western areas of the WMA are largely undeveloped, with scattered rural settlements.

2.4 CATCHMENT ECONOMY

The economic activity in the Olifants WMA is diverse and ranges from mining, power generation, metallurgic industries, irrigation, dry land and subsistence agriculture to eco-tourism. The Olifants WMA generates about 5% of the Gross Domestic Product (GDP) of South Africa. The largest economic sectors in terms of gross geographic product are: -

- Mining 22,1%
- Manufacturing 18,2%
- Electricity 15,9%
- Government 15,6%
- Agriculture 7,0%

There are a large number of mining activities in the Olifants WMA of which coal mining is dominant. The other mining activities include copper, chrome, platinum, vanadium and phosphorus. The strength of the manufacturing industry can be attributed to the relatively cheap supply of coal which particularly contributes to the success of the steel industry in the Middelburg and Witbank areas.

At about 7% of the Gross Geographical Product (GGP), agriculture makes a meaningful contribution to the economy of the WMA. This is mainly attributable to the favourable conditions for dryland and livestock farming as well as extensive irrigation in the in the WMA. Other farming activities, such as trout and game farming, also contribute to a successful tourism industry.

2.5 INTERNATIONAL

The Olifants WMA falls within the Limpopo River Basin, which is shared by South Africa, Botswana, Zimbabwe and Mozambique. As the Olifants River flows directly from South Africa into Mozambique, where it joins the Limpopo River, developments in South Africa directly impact upon Mozambique.

Discussions have been held between Mozambique and South Africa as far back as 1971 with the development of the Massingir Agreement of 1971. This agreement dealt specifically with the building of the Massingir Dam. Mozambique is proposing to raise the Massingir Dam.

The principles of the Helsinki Rules were used prior to 2000 to guide the relations between South Africa and neighbouring states. In 1995, the SADC countries established the 1995 Protocol dealing with Shared Watercourse Systems. The 1995 Protocol was repealed in September 2003 and replaced with the 2000 Protocol which is now used to guide management and development on Shared Watercourse Systems.

Joint utilization of the water resources of the Olifants River is facilitated through the bilateral Joint Water Commission between South Africa and Mozambique. International co-operation with respect to the use and management of the watercourses in the Limpopo River Basin, was overseen by the Limpopo Basin Permanent Technical Committee (LBPTC) with membership by South Africa, Botswana, Zimbabwe and Mozambique. The LBPTC was replaced by the Limpopo Water Course Commission, established in November 2003.

2.6 DEMOGRAPHY

This section on demography has been adapted from DWAF (2004b). A detailed study of the population distribution in the country and of the expected future demographic and economic changes was conducted to serve as background to the estimation of future water requirements. Demographic information pertinent to the Olifants WMA is captured below and the population figures for the year 2000 are given in **Table 2.6**.

Table 2.6: Urban and rural population (year 2000) (Adapted DWAF (2004b))

Sub-area	Urban population	Rural population	Total
Upper Olifants	597 882	125 126	**723 008**
Middle Olifants	231 226	1 353 223	**1 584 449**
Steelpoort	28 352	184 547	**212 899**
Lower Olifants	54 691	208 074	**262 765**
Total	**912 151**	**1 870 970**	**2 783 121**

Mirroring the predominantly rural character of the WMA is the population distribution, with 67% of the people classified as living in rural areas. Furthermore, close to 60% of the total population live in the Middle Olifants Sub-area, mostly in scattered informal villages with limited services and commerce. The only major urban centers are Witbank and Middelburg in the Upper-Olifants Sub-area, where over 80% of the population reside in an urban environment.

The total population of the WMA represents about 7% of the national population, which closely corresponds to the proportionate contribution to the GDP from the Olifants WMA. However, distribution of wealth is highly skewed between the urban and rural areas, and large differences in the standard of living prevail.

Similar to the national demographic trends, and mainly attributable to the impacts of HIV/AIDS and of increasing urbanization, little if any increase in population in the rural areas is expected beyond the year 2005. The future demography will also largely be influenced by economic opportunities and potential. Projections therefore are for continued strong population growth in the Upper Olifants Sub-area, attracted by the urban, industrial and mining developments.

Growth in the population is also projected with respect to the Steelpoort and Middle Olifants Sub-areas, where future mining developments are likely to have a strong impact relative to the current low population base in these areas.

2.7 INSTITUTIONS

The institutions that are important from a water management perspective in the WMA are: -

- The bilateral Joint Water Commission between South Africa and Mozambique.
- Limpopo Water Course Commission with membership by South Africa, Botswana, Zimbabwe and Mozambique.
- Irrigation boards (the irrigation boards are being transformed to Water User Associations)
- Water User Associations
- Water Boards- Lepelle and Ekangala
- District and local municipalities
- Olifants reference group established as part of a public participation process to establish the CMA.
- Olifants River Forum
- Interim Catchment Management Committees set up during the CMA process

The process of preparing the proposal was started in 1999. The comments of the reviewers have been addressed and the proposal will be finalised soon. One of the recommendations of the proposal is that the Interim Catchment Management Committees established during the CMA consultation process be continued until the CMA is formally established.

2.8 WATER RELATED INFRASTRUCTURE

Several major dams have been constructed in the WMA. The Olifants River is highly regulated. The most significant dams in the WMA are the following: -

- The Witbank and Middelburg Dams, which meet the urban and industrial demands of the Witbank and Middelburg centres.
- The Bronkhorstspruit Dam which supplies Bronkhorstspruit and the Western Highveld Region in the Elands River catchment with water for domestic and industrial use. There is also a supply for irrigation.
- The Renosterkop and Rust De Winter Dams are used to supply water for domestic use to the Western Highveld Region and for irrigation.
- Loskop Dam is used primarily to supply irrigation water to the Loskop Irrigation Board. Some water is supplied to the Western Highveld Region for domestic use.
- Flag Boshielo Dam was constructed to mainly supply water for irrigation, domestic use and support the transfer of water to Polokwane for domestic use. Many of the irrigation schemes have fallen into disrepair. Some of the irrigation schemes are in the process of being revitalised. The water allocation from Flag Boshielo Dam to the schemes that are in the process of being revitalized is being temporarily used to supply the growth in the mining demand. The dam is to be raised by 2005 and the increased yield will then supply the mines while the yield of the original dam will revert back to the revitalised irrigation schemes.
- Blyderivierspoort Dam, which supplies water for irrigation, local industrial and domestic demands and supports the supply from the Phalaborwa Barrage to the urban and industrial centre at Phalaborwa.

2.9 ECOLOGICALLY IMPORTANT AREAS

There are a number of ecologically important areas within the Olifants WMA and various conservation areas have been proclaimed in the WMA:

- Blyde River Canyon Reserve
- Klaserie Game Reserve
- Thorny Bush Game Reserve
- Umbabat Nature Reserve
- Timbavati Nature Reserve
- Wolkberg Wilderness Area
- The Dawns Nature Reserve
- Selati Game Reserve
- Mount Sheba Game Reserve
- Sterkspruit Nature Reserve

- Lydenburg Nature Reserve
- Gustav Klingbiel Nature Reserve
- Ohrigstad Dam Nature Reserve
- Loskop Dam Nature Reserve

The most well known conservation area is the Kruger National Park (KNP) located in the Lower Olifants sub-area of the Olifants WMA. There are other ecologically important areas in the WMA, which have not been proclaimed as conservancy areas. The more important areas are discussed below.

The Mohlapitse River was identified during the ecological Reserve determination study as an ecologically important area due to the numerous cool mountain streams that join the Olifants River. The mix of hot and cold waters provides habitat with a high diversity and numerous red data and endemic fish species and frogs occur in these environments. The Mohlapitse River also has several wetlands. It is important to maintain the status quo as far as flow and water quality regimes are concerned in this area of the WMA.

There are also numerous pans and wetlands located in the Upper Olifants Sub-area. Many of these pans and wetlands are under threat by mining. This is due to undermining, mining through or the use of the pans for the storage and evaporation of saline mine water.

There are also numerous gorges. The more important gorges are located:

- Upstream of the Mozambique border in the Kruger National Park.
- The transition from the Highveld to the Lowveld.
- Upstream of Loskop Dam.

2.10 ECOLOGICAL RESERVE

A preliminary estimate of the Reserve was determined using the Desktop methodology for the water balances presented in the NWRS. Since the development of the NWRS, a significantly improved preliminary Reserve has been determined for the Olifants WMA using the comprehensive methodology. The river has been classified using a preliminary classification system available at the time of the study. Once a classification system has been formally established, the preliminary classification will be revised to fit in with the new system. The final determination and decisions about the Reserve will be taken during the IWRM process, which will balance ecology, economics, social impacts in an integrated way. During this process, the ecological management class and the schedule for the implementation of the Reserve will be determined (see Strategy 2.1 for more detail).

In the meantime the status quo will be maintained. The current minimum flow requirement set for the KNP at the Phalaborwa Barrage will be maintained. This minimum flow requirement is maintained by flow from the largely undeveloped Mohlapitse River and flows from the Blyde River. The operation of the system of dams will be further optimised to better meet the ecological water requirements wherever possible. The provision of the ecological water requirements has been catered for in the planning and design of the raising of Flag Boshielo Dam and will be planned for in the proposed new developments at Rooipoort Dam and/or De Hoop Dam. The ecological water requirements to be catered for in the planning of the new dams will be their proportional contribution to the ecological water requirements.

CHAPTER 3: BROAD MANAGEMENT OVERVIEW OF THE WATER RESOURCES SITUATION IN THE WMA

3.1 INTRODUCTION

The purpose of this Chapter is to present a broad overview of the water resources situation of the WMA as presented in the NWRS. The key issues that have been identified in the WMA through the workshop process and documented in the NWRS are presented in this chapter. Part B of this report contains the more comprehensive strategies and management actions proposed for the Olifants WMA during the workshops.

3.2 WATER AVAILABILITY

3.2.1 Surface Water

The available water resource is made up of surface water and groundwater. The mean annual runoff (MAR) for the Olifants WMA is 2042 million m^3/a and the ecological Reserve requirement is estimated using the desktop methodology to be 460 million m^3/a. The surface water resource is supplemented by return flows. The naturalised Mean Annual Runoff and Ecological Reserve (million m^3/a) are listed in **Table 3.2.1(a)** for the four sub-areas. The available yield in the year 2000 is reflected in **Table 3.2.1(b)**.

Table 3.2.1(a): Naturalised MAR and Ecological Reserve (million m^3/a) in the year 2000 (Taken from DWAF (2004b))

Sub-area	Natural MAR (1)	Ecological Reserve (2)
Upper Olifants	466	83
Middle Olifants	481	69
Steelpoort	396	94
Lower Olifants	699	214
Total	**2 042**	**460**

1. Quantities given are incremental, and refer to the sub-area under consideration only.
2. Total volume given, based on preliminary estimates of the Reserve determined with the Desktop methodology.

Table 3.2.1(b): Available yield in the year 2000 (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Natural resource		Usable return flow			Total local yield	Trans-fers in	Grand Total
	Surface water	Groundwater (2)	Irrigation	Urban	Mining and Bulk	(1)		
Upper Olifants	194	4	2	34	4	238	171	409
Middle Olifants	100	70	34	5	1	210	91	301
Steelpoort	42	14	3	1	1	61	0	61
Lower Olifants	74	11	5	2	8	100	1	101
Total	**410**	**99**	**44**	**45**	**14**	**609**	**172**	**781**

1. After allowance for the impacts on yield of ecological component of Reserve, river losses, alien vegetation, dry land agriculture and urban runoff.
2. The groundwater availability is underestimated. See section 3.2.3 and Groundwater Overview given in Appendix A

The surface water hydrology has been modelled using the WRSM90 model to produce time series of monthly flows. The model is calibrated using the best available return flow, abstraction, afforestation, water infrastructure, rain and flow data. In general the irrigation water use and irrigation return flow data is not accurate or actual irrigation water use is not available. The demands are modelled using irrigation areas and unit irrigation requirements. A number of recommendations are made in the hydrology reports regarding the shortcomings in the input data with recommendations on improvements particularly to the flow and rainfall monitoring networks. The available hydrology is incoherent with the hydrological records in the different sub-areas covering different time periods. The decision to update the hydrology will depend on the availability of more accurate model input and the occurrence of drought events that affect the hydrological characteristics and hence the yield of the system.

The Water Resources Yield Model (WRYM) has been set up for the entire WMA using the historic hydrological sequences as input. A stochastic analysis has not been undertaken to determine the stochastic yields of the system. The Water Resources Planning Model (WRPM) has only been set up for the Upper Sub-area but is not actively applied to manage the system. The WRPM needs to be set up for the entire WMA and used to manage the system.

The approach to be adopted is to set up the WRYM for the entire WMA using the available hydrology. The WRYM will be used to assess the need to update the hydrology. This need will also be influenced by the completion of the verification of existing lawful use and the schedule for compulsory licencing.

3.2.2 Surface Water Availability Issues in Sub-areas

Upper Olifants Sub-area

The surface hydrology in the Upper Olifants sub-area has been modelled and a monthly flow record covers the period October 1920 to September 1995. The model calibration achieved was good but there is a need for more detailed irrigation abstraction data, further flow measurements in the Wilge River and Olifants River upstream of Loskop Dam to improve the calibration. The available record is however sufficiently accurate for use in the WRYM and WRPM to plan and operate the major water supply infrastructure in the sub-area.

The water availability in this sub-area is impacted on by coal mining. The mining process impacts on the natural hydrological system by disturbing the integrity of the overlying rock and soil strata resulting in increased infiltration and recharge of the groundwater system. This “additional” water, although of poor quality, represents extra water which can be utilised in the sub-area. The quantity of the “additional” water needs to be determined. The water volumes stored in the mine workings can also be utilised as dams during drought periods to augment the yield of the system.

The WRYM and the WRPM have been set up for the sub-area. The WRPM is however not used on an annual basis to assess the available water in the sub-area, to apply water restrictions during drought periods or to manage water quality. Although the WRPM and the WRYM can be used to determine the water availability of the large management units set up for the sub-area, there is some uncertainty related to the availability of groundwater and surface water at the local level for which more detailed hydrological models are required.

Middle Olifants Sub-area

The hydrology of the Middle Olifants Sub-area covers the period 1920 to 1991. As for the Upper Sub-area, the record is sufficiently accurate to plan and operate the major infrastructure. The WRYM has been set up for this region. The model was used during the feasibility study for the development of the bulk water supply in this area. Stochastic analyses were also undertaken during the feasibility study. The WRPM has not been set up for this sub-area of the WMA.

Steelpoort Sub-area

The hydrology in the Steelpoort Sub-area has been modelled and naturalised flow records covering the period 1920 to 1995 have been generated. These records were used in the WRYM during the feasibility study to assess the bulk water supply options in the Steelpoort Valley.

Lower Olifants Sub-area

The hydrology of the Lower Olifants Sub-area covers the period 1920 to 1989. The majority of the sub-area is dry with an MAP of less than 500 mm except for the area along the escarpment where the MAP can reach 1000 mm. The Blyde River catchment has a high rainfall and the water emanating from the Blyde River makes an important contribution to the base flows in the lower reaches of the Olifants River passing through the Kruger National Park. The base and drought flows in the lower reaches of the Selati River are maintained by return flows from the Foskor mining complex. The return flows are largely discharges from the tailings dams. Extensive programs are being investigated by Foskor to recycle much of this effluent, which will impact on the flows and water quality in the lower Selati. These flows also contribute water to the drought flows in the Olifants River flowing through the KNP.

The rapid drawdown of the Blyderivierspoort Dam during the dry 2003/2004 rainfall period suggested that the dam may not be able to supply the historic yield determined for the dam. The water balance for the dam needs to be revisited in terms of the dam operation and hydrology. A stochastic analysis needs to be undertaken to determine the yield of this system.

3.2.3 Groundwater

A detailed overview of the groundwater situation in the WMA is given in **Appendix A**. The utilized groundwater volumes given in **Table 3.2.1(b)** are underestimated. The total of 99 million m^3/a listed in the table is probably much higher. The exact volume as well as the groundwater potential should be checked in more detail in the future.

The contribution from groundwater to surface water base flows needs to be considered when determining the total surface and groundwater availability.

The groundwater occurrence is controlled by the prevailing lithology. The high groundwater yields in the WMA are associated with the weathered pockets in the hard rocks which underlie the WMA and the dolomites. The highest groundwater yields are associated with the dolomite aquifer. The annual recharge estimates and the borehole yields are given in **Figure 5** and **Figure 4** in **Appendix A** respectively. Groundwater is extensively used for rural water supplies and stockwatering in the WMA.

Some aquifers cross the current WMA boundaries. A management framework should be established to ensure cooperation between affected CMAs and the proper management of the groundwater resource.

Upper Olifants Sub-area

The majority of this sub-area is underlain by Karoo age sediments which have been intruded by Dolerite sills. The yields in the sediments are low at <0,5 l/s. The greatest occurrence is in the dolerite dykes which have a yield of 0,5 l/s to 2,0 l/s.

The largest yields are associated with the Malmani dolomite which is located in the headwaters of the Wilge River. The typical borehole yields are 25 l/s. The base flow of this river is fed by springs emanating from the dolomites. The dolomite aquifer supplies the town of Delmas and agriculture. The dolomite aquifer is a potential source of water to supply future water requirements in the area. In the Western Highveld Augmentation study, these dolomite areas were identified as a possible future source of water. A major concern is the increased risk of sinkhole formation due to overabstraction. The sustainable yield of groundwater from the dolomites needs to be determined and a groundwater management plan should be developed.

The groundwater quality in the sub-area is generally good with conductivity varying from <70 mS/m to 150 mS/m. However the sub-area is influenced by mining. There is therefore the potential for seepage from workings and discard dumps to pollute the local groundwater resources. Similarly the groundwater quality could also be impacted on by recharge from irrigation areas.

Middle Olifants Sub-area.

The yields of boreholes are typically low and range from 0,5 l/s to 2 l/s except for the area underlain by Basalt where yields range from 2 l/s to 5l/s. The extensive irrigation in the Springbok Flats is supplied by groundwater drawn from the Basalts. In fact over abstraction has led to lowering of groundwater levels in the Springbok Flats area. Groundwater is an important source of water to supply the current and future domestic and irrigation requirements of the extensive rural population. There is an area of dolomite from which water is abstracted to supply irrigation at the Zebedelia Estates. This area is also reported to be over abstracted.

The quality of groundwater is naturally of a high standard. There are however areas where elevated nitrates are found from fertilizer applications and poor agricultural practice.

Steelpoort Sub-area

The borehole yields in this sub-area range from 0,5 l/s to 2,0 l/s. There is however an extensive area of dolomite in the sub-area. The dolomites are mostly undeveloped except in the Lebowakgomo area where water is abstracted for irrigation at the Zebedelia Estates (Middle Olifants Sub-area). The dolomites will form an important source of water in the future for bulk water supply. The spring flow from the dolomites contributes to the river base flows. The contribution needs to be quantified before the source is developed.

The exploitation of deep (>900 mbgl) aquifers is being investigated by DWAF. Exploration boreholes are to be drilled to determine the feasibility of these aquifers as a resource.

The water quality is good with areas of high nitrate from the sanitation systems of the rural settlements and poor agricultural practice.

Lower Olifants Sub-area

The borehole yields are generally between 0,5 l/s and 2,0 l/s. The yields increase to 5 l/s in local areas around Phahalborwa and Hoedspruit. The groundwater is used for domestic and stockwatering. The water quality is generally good with isolated areas with elevated nitrate concentrations.

3.3 WATER REQUIREMENTS

3.3.1 Current Water Requirements

The water requirements for the year 2000 are summarized by sector in **Table 3.3.1**. The bulk of the water used in the Olifants WMA is by the irrigation sector, which represents 57% of the total requirements. Power generation represents 19% and urban, industrial and mining together a further 19%.

Table 3.3.1: Year 2000 water requirements (million m^3/a) for the Olifants WMA (Taken from DWAF (2004b))

Sub-area	Irrigation	Urban	Rural	Mining and bulk Indus-trial	Power generati on	Affore-station	Total local require ments	Trans-fers Out (5)	Grand Total
		(1)	(1)	(2)	(3)	(4)			
Upper Olifants	44	62	6	20	181	1	314	96	410
Middle Olifants	336	15	28	13	0	0	392	3	395
Steelpoort	69	3	5	17	0	1	95	0	95
Lower Olifants	108	7	5	43	0	1	164	0	164
Total	**557**	**87**	**44**	**93**	**181**	**3**	**965**	**8**	**973**

1. Includes component of Reserve for basic human needs at 25 ℓ/c/d
2. Mining and bulk industrial water uses which are not part of urban systems.
3. Includes water for thermal power generation only.
4. Quantities given refer to impact on yield only.
5. Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. The total reflects transfers out of WMA.

Most of the water used in the Upper Olifants Sub-area is for cooling in the thermal power stations, which is a highly consumptive use of water and requires a relatively high quality of water.

As a result of the large irrigation developments downstream of Loskop Dam, requirements for water in the Middle Olifants Sub-area are dominated by irrigation. Although the most populous sub-area, water use for urban and rural purposes is relatively low, because of the primary nature of the water use by these sectors. Irrigation and mining are the largest water use sectors in the Steelpoort and Lower Olifants Sub-areas, which reflect the nature of the land-use in these areas.

3.3.2 Future Water Requirements

This section of the ISP is a summary of the information presented in DWAF (2004b).There are many factors which influence the requirements for water. These include climate, nature of the economy (i.e. irrigated agriculture, industrialized) and standards of living. Of these, climate is relatively stable, while in most cases control can be exercised over the growth in irrigation water requirements. Population and economic activity, however, have their own inherent growth rates which are dependent on a wide spectrum of extraneous influences. Population growth and economic growth, which also relates to socio-economic standards, are therefore regarded as the primary determinants with respect to future water requirements.

Based on the scenarios for population and economic growth, initial estimates of possible future water requirements were made for the period until 2025. 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. (Specific quantities, rather than a general annual growth rate, were allowed for in these sectors.)

Within the spectrum of population and economic growth scenarios, a base scenario was selected for estimating the most likely future water requirements. This is built on the high scenario of population growth and more equitable distribution of wealth leading in time to higher average levels of water services. The ratio of domestic to public and business (commercial, communal, industrial) water use for urban centers in the year 2000, for the respective centers, is maintained. A possible upper scenario of future water requirements, is also given, based on the assumption that there will be high population growth and a high standard of services (socio-economic development); together with a strong increase in the economic requirements for water, where the public and business use of water would increase in direct proportion to the gross domestic product. The purpose of the upper scenario is to provide a conservative indicator in order to prevent the occurrence of possible unexpected water shortages. No adjustments have been made for reflecting the impacts of increased water use efficiency.

The future growth in water requirements in the Olifants WMA is expected to be in the Upper Olifants, Middle Olifants and Steelpoort Sub-areas. The growth predicted for the Upper Olifants sub-area is driven by growth in the urban water requirements of the Witbank and Middleburg local authorities. Eskom is also reviewing the power generation of the coal fired power stations in the Upper Olifants Sub-area. Allowance has been made in the water requirement projections for an increase of 38 million m^3/a for power generation. This allowance volume however still needs to be confirmed to reflect the latest planning by Eskom.

The water requirement growth in the Middle Olifants and the Steelpoort Sub-areas is driven by the growth in mining. A number of platinum and chrome mines are planned or currently being developed in this area. These developments have socio-economic impacts with influx of people into the area to work on the mines. Burgersfort in the Steelpoort Sub-area will house the mine staff for a number of the mines. The extent of the impacts and the changes to the water requirements are being investigated in a study (DWAF, 2003). The study area is the Dilokong Corridor which includes parts of the Steelpoort and Middle Olifants Sub-areas as well as Polokwane and Mokopane Regions. The water requirement projections need to be revised to reflect the findings of the study once they are available. DWAF is also busy with the planning process for new dams during which the figures will be finalised.

No meaningful change in the rural requirements for water is foreseen. Although a dire need exists for improved water supply systems for some rural communities, sufficient resources will be made available for all basic human needs.

Quantification of the projected future requirements for water is presented in **Tables 3.3.2(a)** and **(b)** for the base and high scenarios respectively.

Table 3.3.2(a): Year 2025 base scenario water requirements (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Irrigation	Urban 1	Rural 1	Mining and bulk industrial 2	Power generation 3	Affore-station 4	Total local require-ments	Transfers out	Grand Total
Upper Olifants	44	93	6	20	219	1	**383**	82	**465**
Middle Olifants (5)	336	23	33	38	0	0	**430**	2	**432**
Steelpoort (5)	69	4	5	17	0	1	**96**	0	**96**
Lower Olifants	108	7	6	43	0	1	**165**	0	**165**
Total	**557**	**127**	**50**	**118**	**219**	**3**	**1 074**	**7**	**1 081**

1. Includes component of Reserve for basic human needs at 25 ℓ/c/d
2. Mining and bulk industrial water uses which are not part of urban systems
3. Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well)
4. Quantities given refer to impact on yield only
5. Water Requirements for the Middle Olifants and Steelpoort Sub-areas reflect current knowledge and will be revised once the results of study (DWAF, 2003) become available.

Table 3.3.2(b): Year 2025 high scenario water requirements (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Irrigation	Urban	Rural	Mining and bulk industrial	Power generation	Affore-station	Total local require-ments	Transfers out	Grand Total
		1	1	2	3	4			
Upper Olifants	44	149	6	20	219	1	**439**	57	**496**
Middle Olifants (5)	336	26	33	38	0	0	**433**	8	**441**
Steelpoort (5)	69	6	5	17	0	1	**98**	0	**98**
Lower Olifants	108	13	6	43	0	1	**171**	0	**171**
Total	**557**	**194**	**50**	**118**	**219**	**3**	**1 141**	**13**	**1 154**

1. *Includes component of Reserve for basic human needs at 25 ℓ/c/d*
2. *Mining and bulk industrial water uses which are not part of urban systems*
3. *Includes water for thermal power generation only. (Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well)*
4. *Quantities given refer to impact on yield only*
5. Water Requirements for the Middle Olifants and Steelpoort Sub-areas reflect current knowledge and will be revised once the results of study (DWAF, 2003) become available.

3.3.3 Water Requirement Issues in Sub-areas

Upper Olifants Sub-area

The water requirements in the Upper Olifants Sub-area are projected to grow significantly in the urban areas of Witbank and Middelburg. The initial projections were obtained from the local authorities during a study (DWAF, 2000) to develop an integrated modelling tool for the Loskop Dam catchment. The projections were later revised and reported in the VRESS Study (DWAF, 2001) on augmenting the supply from the Eastern subsystem. The revised growth in the water requirements for Witbank was substantially increased and Middelburg's reduced. DWAF needs to assess the projected water requirements for Witbank and Middelburg as these requirements impact on augmentation volumes and timing of the next schemes. DWAF needs to interact with these local authorities to explain DWAF's position regarding WC&DM and development of local groundwater resources.

The coal mining industry in this sub-area is projected to decline over the next 20 years. There is therefore uncertainty over the future of many of the smaller towns in this area that have been developed almost exclusively for the mines.

Middle Olifants Sub-area

There are a number of irrigation schemes in this area that have fallen into disuse. The schemes are being revived as poverty eradication initiatives and the use of water on the schemes will grow steadily as the schemes come back on line. Although these irrigation requirements have been included in the water requirements for this sub-area given in the reconciliation, the water requirements currently not being used has eased the deficit situation in the sub-area.

The growth in the water requirements in the Middle Olifants Sub-area is largely due to the new mining operations being established in the Dilokong Corridor. The extent of the mining operations and the projected growth in water requirements as regards the influx of people to the area is not fully known. A study (DWAF, 2003) to determine the requirements in this area is nearing completion. The updated water requirement figures will be available in a few months time. The new information together with the planned new infrastructure needs to be incorporated into the reconciliation for the WMA.

Steelpoort Sub-area

The water requirements in the Burgersfort area are growing due to the influx of people being housed in the town. The extent of the growth is being determined as part of the study (DWAF, 2003). Like the Middle Olifants sub-area, there are irrigation schemes that have fallen into disuse. Plans are being implemented to revive these schemes as part of poverty eradication initiatives.

Lower Olifants Sub-area

The water requirements in this area are not foreseen to grow significantly. The water requirements in the Phalaborwa area are likely to drop with the implementation of treatment and the recycling of water by Foskor and the advent of underground mining by Palabora Mining Company. The water requirements in this area need to be confirmed.

3.4 RECONCILIATION OF WATER REQUIREMENTS AND AVAILABILITY

3.4.1 Current (Year 2000) Reconciliation Situation

The reconciliation of the water requirements with the available resource for the 2000 year is given in **Table 3.4(a)**. The transfers used to meet the power station requirements in the upper regions of the WMA are included together with the transfers of water from the WMA to adjacent WMAs.

Table 3.4(a): Reconciliation of water requirements and availability for the year 2000 (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Available water			Water requirements			Balance
	Local yield	Transfers in (2)	Total	Local re-quirements	Transfers out (2)	Total	(1)
Upper Olifants	238	171	409	314	96	410	(1)
Middle Olifants	210	91	301	392	3	395	(94)
Steelpoort	61	0	61	95	0	95	(34)
Lower Olifants	100	1	101	164	0	164	(63)
Total for WMA	**609**	**172**	**781**	**965**	**8**	**973**	**(192)**

1) Brackets around numbers indicate a 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 water balance in **Table 3.4(a)** shows that there is a 192 million m^3/a deficit in the Olifants WMA for the current level of water infrastructure development. The deficit is in the Middle, Steelpoort and Lower Olifants Sub-areas with the Upper Olifants Sub-area being in balance.

The deficit shown in **Table 3.4(a)** includes the effect of the ecological water requirements (EWR) on the yield of the system. The EWR as determined in the NWRS are not currently supplied in full. However even if the effect of the EWR is taken out of the balance equation a small deficit still exists in the system.

The reconciliation of the existing use and the EWR is an important issue in the WMA and will have to be resolved. A balance will have to be found between the EWR to maintain a sustainable river and the social, financial, and economic impacts of having less water available for abstraction. The compulsory licencing process shown in **Figure 1.2**, will eventually have to be used to find this balance. During this process innovative solutions will be sought in a full participation process involving all users. The efficient use of water will obviously feature strongly in developing the solutions.

The current deficit situation in the WMA, even without allowance for the EWR, shows that the WMA is already under stress. This implies that no further abstractions can be allowed from the resource at the current level of water supply infrastructure development. The supply of the future water requirements is addressed in the next section.

3.4.2 Future Reconciliation Situation

The reconciliation for the base case and high case water requirement projection scenarios for the year 2025 is given in **Tables 3.4(b)** and **3.4(c)** respectively. The figures in the Tables show that the deficit is expected to increase to 241 million m^3/a and 279 million m^3/a by 2025 for the base case and high case scenarios respectively. The balance highlights the shortage of water in the WMA.

The **Tables 3.3.2(a)** and **3.3.2(b)** show an increase in water requirements. The estimate of the future requirements in the Middle Olifants and Steelpoort Sub-areas has increased significantly since the NWRS. The mining and urban requirements in the Mogalakwena catchment may also put an additional burden on this WMA. The reasons for the growth in the requirements are discussed in Section 3.3. The study (DWAF, 2003) commissioned to determine the water requirements is in its final stages and the improved information will be incorporated into the reconciliation planning in these areas.

The general approach to be adopted for new applications for water can be summarised as follows: -

- Before any new allocations are considered, users will have to prove that water is and will be used efficiently in future.
- Trading of allocations especially within a water sector will often be the preferred option for a user to obtain an allocation. Trading between sectors is however problematic. As an example, providing the future mining requirements with water by means of trading from agriculture would mean the “loss” of thousands of hectares of irrigation with the concomitant

impact on existing employment and the social and economic fabric of the area. This level of trading would thus be ruled out as an option.

- Eradication of alien invasive plants to "free" up water for other users is also an option to be considered.

However the future water balances show that the magnitude of the future requirements is such that further development of the resource (both surface and groundwater) is inevitable. The development of new dams in the Middle Olifants and Steelpoort Sub-areas are currently being planned by DWAF.

The reconciliation options in the sub-areas are discussed below.

Upper Olifants Sub-area

The application of the WRPM showed that excessive curtailment of the water supply from Witbank Dam would be experienced by 2005, from Middelburg Dam by 2015 and Loskop Dam is already experiencing curtailments. The inclusion of the ecological Reserve in the model further increases the level of curtailments. The surface water resources of the Upper Olifants sub-area are fully developed in terms of major water supply infrastructure and the balances in **Tables 3.4(b)** and **3.4(c)** assumed that the future requirements would be met by transferred water at full cost. The reconciliation strategy for this sub-area is therefore to apply WC&DM, trading of water rights, and the development of local groundwater resources. The further development of surface water resources with dams will only be considered if the dams provide an incremental increase in the yield of the system. The possible future use of treated mine water should also be considered once the excess volume has been determined. Only once these avenues have been exhausted will the transfer of water from outside the WMA be considered at full cost.

The Western Highveld in the Elands River catchment is reported to be experiencing shortages. A study is currently underway to investigate augmentation options for this region. A number of options were investigated which included transfers from the Apies/Pienaars, groundwater development and further transfers from the Bronkhorstspruit Dam. The option that will be implemented is the extension of the Rand Water pipeline from Mamaelodi to feed directly into the water supply network.

Extensive wastage of water is also reported in the Western Highveld Region. There are extensive WC&DM initiatives being launched in the area to reduce the demand.

Table 3.4(b): Reconciliation of water requirements and availability for the year 2025 base case scenario (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Available water			Water requirements			Balance	Potential for develop-ment
	Local yield (1)	Transfers in (5)	Total	Local re-quire-ments (2)	Transfers out	Total	(3)	(4)
Upper Olifants	256	209	465	383	82	465	0	0
Middle Olifants	212	77	289	430	2	432	(143)	152
Steelpoort	62	0	62	96	0	96	(34)	87
Lower Olifants	100	1	101	165	0	165	(64)	0
Total for WMA	**630**	**210**	**840**	**1 074**	**7**	**1 081**	**(241)**	**239**

1. Based on existing infrastructure and infrastructure under construction in the year 2000. Also includes return flows resulting from growth in requirements
2. Based on growth in water requirements as a result of population growth and general economic development, including an additional 25 million m^3/a mining requirements in the Middle Olifants sub-area. Assumed no general increase in irrigation. This balance will be revised when the updated water requirements are available.
3. Brackets around numbers indicate a negative balance.
4. Based on raising of Flag Boshielo Dam and the construction of Rooipoort and De Hoop Dams
5. Upper Olifants growth in urban requirements are assumed to be met with transferred water

Table 3.4(c): Reconciliation of water requirements and availability for the year 2025 high scenario (million m^3/a) (Taken from DWAF (2004b))

Sub-area	Available water			Water requirements			Balance	Potential for develop-ment
	Local yield (1)	Transfers in (6)	Total	Local re-quire-ments (2)	Transfers out (5)	Total	(3)	(4)
Upper Olifants	287	209	496	439	57	496	0	0
Middle Olifants	213	52	265	433	8	441	(176)	152
Steelpoort	63	0	63	98	0	98	(35)	87
Lower Olifants	102	1	103	171	0	171	(68)	0
Total for WMA	**665**	**210**	**875**	**1141**	**13**	**1154**	**(279)**	**239**

1. Based on existing infrastructure and infrastructure under construction in the year 2000. Also includes return flows resulting from growth in requirements
2. Based on growth in water requirements as a result of population growth and general economic development, including an additional 25 million m^3/a mining requirements in the Middle Olifants sub-area. Assumed no general increase in irrigation. This balance will be revised when the updated water requirements are available.
3. Brackets around numbers indicate a negative balance.
4. . Based on raising of Flag Boshielo Dam and the construction of Rooipoort and De Hoop Dams
5. Not including possible future transfers to Limpopo WMA for Polokwane and Mokopane.
6. Upper Olifants growth in urban requirements are assumed to be met with transferred water

Middle Olifants Sub-area

In the Middle Olifants sub-area the reconciliation strategy will be to make irrigation water temporarily available to supply the mines until the Flag Boshielo Dam has been raised. The irrigation water will then be returned to the schemes. The groundwater resources in the sub-area are also being investigated to meet the growing water requirements.

The further development of new infrastructure is currently being planned by DWAF. The final planning will incorporate the results of the water requirement study in this area. The options being assessed are a dam at Rooipoort on the Olifants and/or a dam at De Hoop on the Steelpoort together with the bulk water supply pipelines. The dams will be planned to be able to release their proportional contribution to the ecological Reserve. The water from these dams will come at a high cost and irrigation and afforestation developments will be unlikely to afford the water. The water will be largely used to supply the mines and domestic requirements.

Steelpoort Sub-area

Groundwater is an important source of supply in this sub-area for irrigation and domestic use. A study has been carried out to develop a groundwater management plan for the groundwater resources in the Steelpoort Sub-area.

Lower Olifants Sub-area

The future water requirements of the Lower Olifants Sub-area that are supplied from the Olifants River will be catered for in the planning of the new infrastructure. There are problems with the operation and performance of the Blyderivierspoort Dam.

3.5 WATER QUALITY

3.5.1 Upper Olifants Sub-area

In the Upper Olifants Sub-area Water Quality Management Plans have been developed for the Klipspruit, Witbank Dam and Middelburg Dam catchment areas. The Water Quality Objectives (WQO) set during these processes are being used to manage the catchments. The WQO however do not recognise the water quality Reserve, which was not available at the time of setting the WQO. Cognisance needs to be taken of the water quality Reserve. The Reserve should be phased in where necessary as part of IWRM process. The water quality in this sub-area is under threat from the coal mines. Some 62 million m^3/a is predicted to decant from workings post closure. The management of these decant volumes is being addressed by the mining industry with a number of projects addressing treatment and irrigation management options.

The water quality in the Loskop Dam has deteriorated over time. The water quality is still however good being maintained by the good quality water from the Wilge River catchment. WQO have not been set for the Loskop Dam to protect users. The water quality of the groundwater is being threatened by mining activities. An integrated water quality management plan is needed for the Upper Olifants Sub-area.

3.5.2 Middle Olifants and Steelpoort Sub-areas

The water quality problems in these sub-areas are salinity, eutrophication, toxicity and sediment. The salinity and eutrophication problems are due to the irrigation return flows and sewage treatment plant discharges. The toxicity problems have been related to the use of pesticides and herbicides in the irrigation schemes. The sediment is related to poor agricultural practise due to overgrazing in the rural areas. The production of sediment, particularly in the Middle Olifants Sub-area causes operational problems at the downstream Phalaborwa Barrage. The release of water to maintain the base flow into the KNP has led to fish kills due to the sediment laden waters.

The extent of the toxicity problem needs to be determined through a monitoring program. The current irrigation return flow volumes and qualities need to be quantified and the changes that will occur if irrigation practises are changed in the future.

3.5.3 Lower Olifants Sub-area

In the Lower Olifants Sub-area, the water quality is influenced by the water quality of the return flows from the mining complex around Phalaborwa in the Ga-Selati River. This water quality is poor and impacts on the Olifants River. The water emanating from the Blyde River is of a good quality and together with the good quality water from the Mohlapitse River maintains the water quality in the Olifants River in the KNP at an acceptable quality. The operation of this system needs to be formalised and maintained in the future until the operation of the new infrastructure is in place.

3.6 COOPERATIVE GOVERNANCE

It will be necessary to ensure that integrated water resources management and co-operative governance takes place within the Olifants River WMA. DWAF will adopt a close co-ordination and a common management approach. An effective communication strategy to involve provincial, district and local authorities in the management process is needed to ensure that IDPs, WSDPs and other development planning and implementation takes place within the constraints and development potential of the available water resources. This approach must also include the way in which this ISP will be updated on a regular basis.

3.7 INSTITUTIONAL DEVELOPMENT

Without the buy-in and co-operation of the various water management institutions in the Olifants River WMA, it will be impossible to give adequate effect to all the management objectives, strategies and actions mentioned in this ISP. An effort needs to be made to ensure adequate institutional development and communication between all stakeholders. The process of establishing the CMA should be continued with the submission of the proposal to the Minister of the Department for acceptance.

3.8 MONITORING AND INFORMATION MANAGEMENT

Co-ordinated and appropriate monitoring and water related information storage and retrieval systems need to be collated, further developed and centralized in order to provide proper planning and other public data. A comprehensive strategy will need to be developed in due course.

CHAPTER 4: INTRODUCTION TO STRATEGY TABLES

The first two chapters of the document describe the ISP process, paint a broad perspective of the water situation, and provide 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 **Part B**. Strategy tables for each strategic 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).

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**.

Table 4.1 below provides a brief description of the elements contained in the strategy tables and is included to creating some common understanding of what is meant by these elements.

Table 4.1: 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 and motivation to support the specific elements listed below.
Management action (M)	Solutions to fill in information gaps, adhere to directives and to meet requirements.

REFERENCES

DWAF (2004a) Department of Water Affairs and Forestry **National Water Resource Strategy First Edition** 2004.

DWAF (2004b) Department of Water Affairs and Forestry, Report No: P WMA 04/000/00/0203 **The Olifants WMA – Overview of Water Resources Availability and Utilisation** 2004.

DWAF (2003) Department of Water Affairs and Forestry, Report No: PB1 B000/00/6906 **Water Requirements Assessment Study for Future Economic Development in the Dilokong Corridor and Environs** 2003.

DWAF (2001) Department of Water Affairs and Forestry, Report No: PC110/00/0800 **Vaal River System : Prefeasibility Study to determine the need for Augmentation of the Eastern Sub-system : Main Report** 2001.

DWAF (2000) Department of Water Affairs and Forestry, Report No: P 04000/00/0101 **Development of an Integrated Water Resource Model of the Upper Olifants (Loskop Dam) Catchment : Summary Report** 2000.

DWAF (1995) Department of Water Affairs and Forestry, Report No: WQ B402/00/02/95 **Steelpoort River Catchment Groundwater Management Plan** 1995

APPENDIX A

OLIFANTS WMA

OVERVIEW
OF
GROUNDWATER OCCURRENCE, RESOURCES, AVAILABILITY, ISSUES AND STRATEGIES

TABLE OF CONTENTS

TABLE OF CONTENTS

OLIFANTS CATCHMENT

GROUNDWATER OCCURRENCE, RESOURCES, AVAILABILITY, ISSUES AND STRATEGIES

1. INTRODUCTION

The Olifants catchment WMA covers a total area of 54 550km^2 The catchment has been subdivided into 4 sub-areas as follows:

- The Upper Olifants, covering an area of 12 250km^2, and incorporating quaternary catchments B11A – K, B12A – E, B20A – J, and B32A
- The Middle Olifants, covering an area of 22 550km^2, and incorporating quaternary catchments B31A – J, B32B – J, B51A – H, B52A – J, B71A – F
- The Steelpoort sub-area, covering an area of 7 135km^2, and incorporating quaternary catchments B41A – K B42A – H, and
- The Lower Olifants, covering an area of 12 600km^2, and incorporating quaternary catchments B60A – J, B72A – K, B73A – J.

The WMA comprises 2 main rivers, the Olifants and the Steelpoort, together with numerous smaller rivers. The distribution of the main catchments, the quaternary catchments and main settlements is shown on Figure 1.

The WMA comprises Highveld in the upper Olifants, Bushveld in the NW and west of the Drakensberg escarpment, the mountainous escarpment area and, in the eastern, i.e., downstream portion of the catchment, Lowveld.

The towns of Witbank and Middleburg are in the upper Olifants, an important coal mining area. Delmas is situated in the far SW of the catchment in an important agricultural area. The developing eastern limb mining belt occurs within the escarpment area NW of Burgersfort between the Steelpoort and Olifants river. Lydenburg in the central SE of the catchment is an important agricultural area. Agriculture also dominates the NW and the Springbok flats where the Zebedelia estates are present.

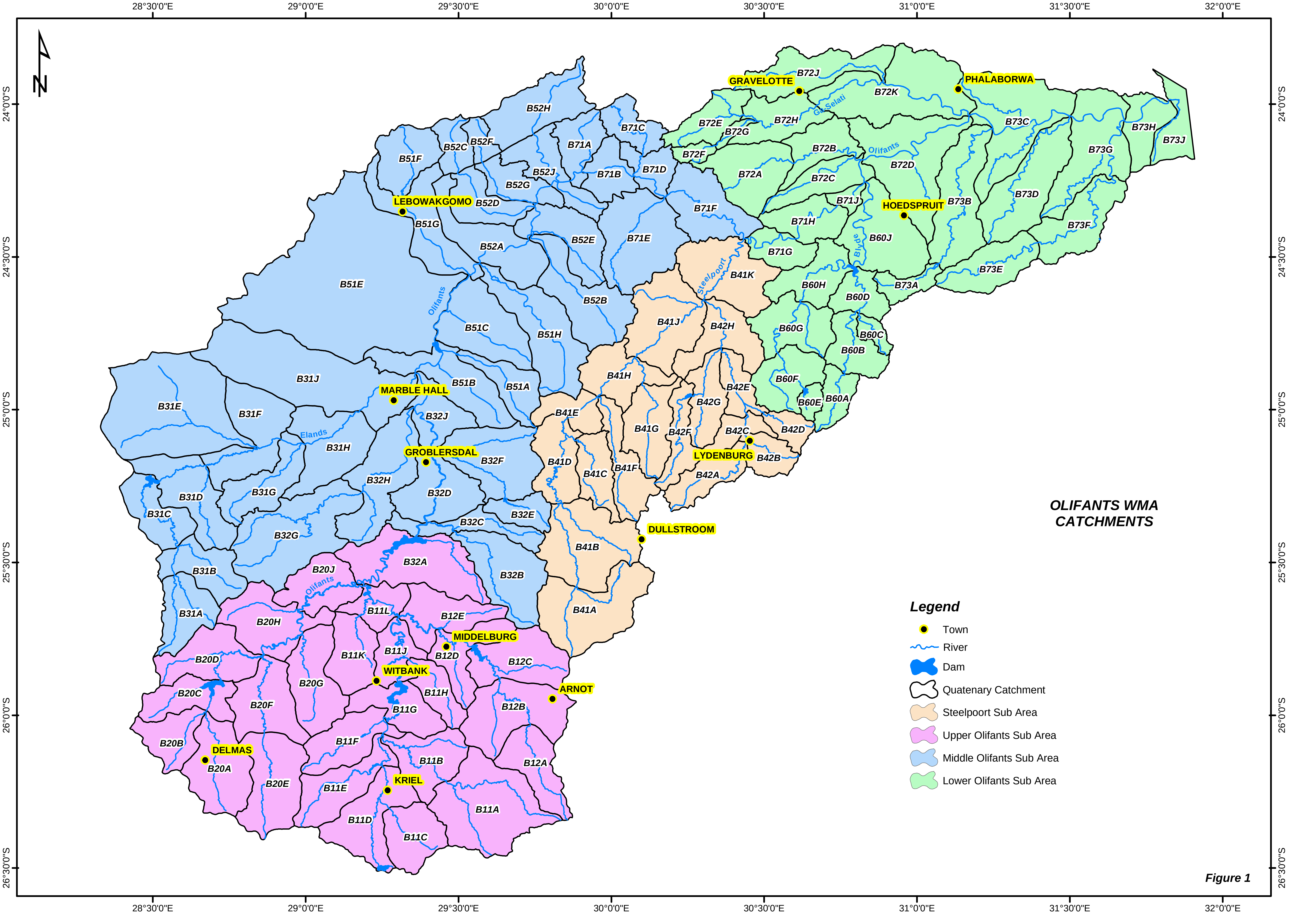
The mining town of Palabora is situated in the Lowveld adjacent to the Kruger National Park which comprises the far eastern portion of the WMA. Large parts of the centre of the catchment comprise traditionally settled areas, including Sekhukhune of the old Lebowa, and parts of the old Gazankulu east and north of Burgersfort and in the Lowveld.

2. GROUNDWATER OCCURRENCE AND RESOURCES OVERVIEW

The overview of the groundwater resources is discussed according to groups of Quaternary Catchments sharing similar lithology and morphological characteristics. The distribution of the lithologies of the region with respect to hydrogeology is illustrated on the simplified lithostratigraphical map of Figure 2.

Groundwater occurrence is controlled by the prevailing lithology of any given area. The entire Olifants catchment is underlain by hard rocks with aquifers developed in secondary features associated with weathering pockets, structure and, in dolomite areas, karst features. Structural and karst features are important and higher borehole yields are generally associated with these features. The highest groundwater resources are associated with the dolomite aquifer. Favourable groundwater resources are also found in the Karoo basalt and in valley areas underlain by norite and gabbro of the Bushveld Igneous Complex.

The average hydrogeological characteristics for each of the main lithostratigraphic sub-divisions of the WMA are given in Table 1.



OLIFANTS WMA
CATCHMENTS
Legend
Town
River
Dam
Quatenary Catchment
Steelpoort Sub Area
Upper Olifants Sub Area
Middle Olifants Sub Area
Lower Olifants Sub Area
GRAVELOTTE
PHALABORWA
HOEDSPRUIT
LEBOWAKGOMO
MARBLE HALL
GROBLERSDAL
LYDENBURG
DULLSTROOM
MIDDELBURG
WITBANK
ARNOT
DELMAS
KRIEL
Olifants
Elands
Steelpoort
Blyde
Gt. Selati

Figure 1

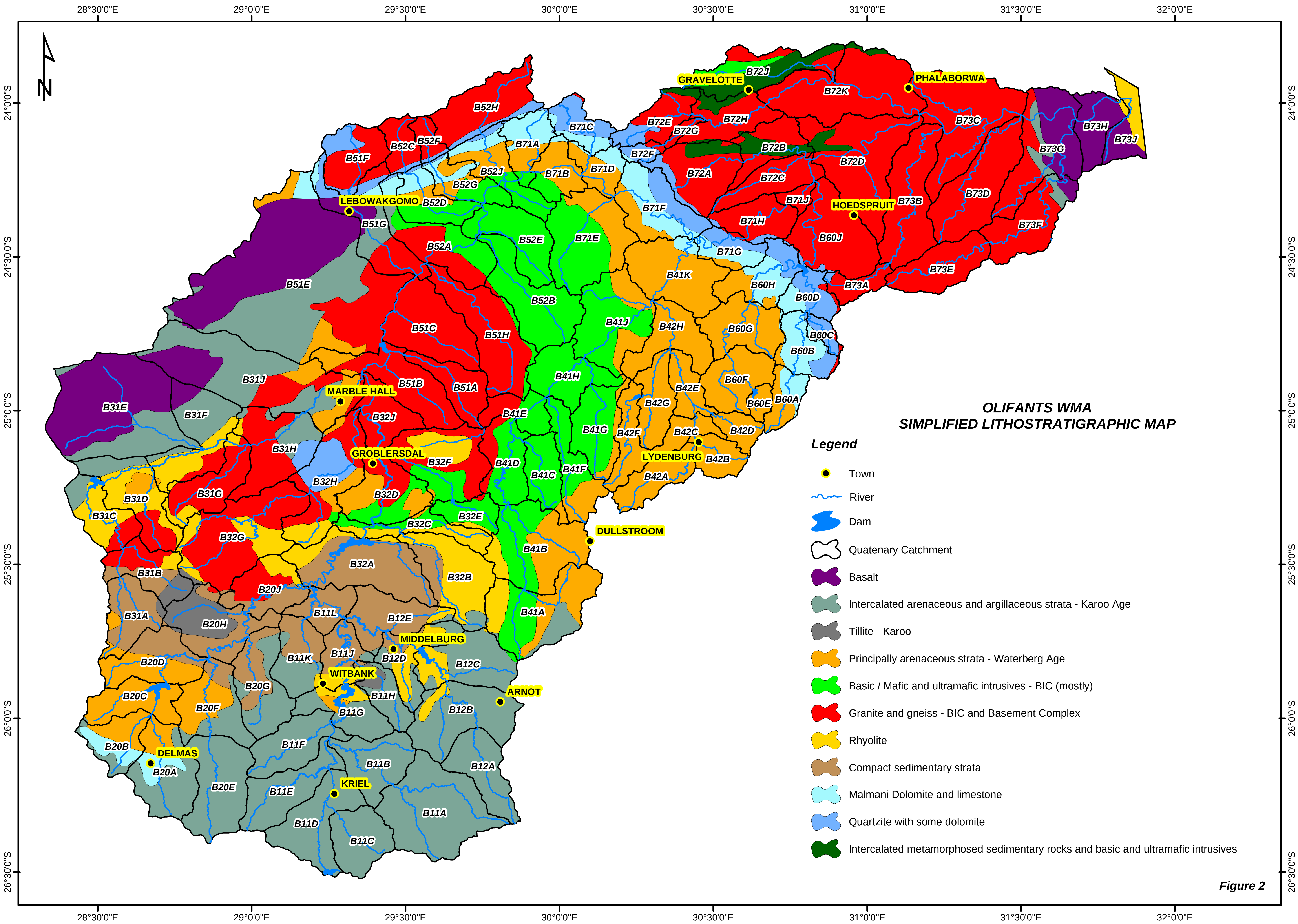

OLIFANTS WMA
SIMPLIFIED LITHOSTRATIGRAPHIC MAP
Legend
Town
River
Dam
Quatenary Catchment
Basalt
Intercalated arenaceous and argillaceous strata - Karoo Age
Tillite - Karoo
Principally arenaceous strata - Waterberg Age
Basic / Mafic and ultramafic intrusives - BIC (mostly)
Granite and gneiss - BIC and Basement Complex
Rhyolite
Compact sedimentary strata
Malmani Dolomite and limestone
Quartzite with some dolomite
Intercalated metamorphosed sedimentary rocks and basic and ultramafic intrusives
GRAVELOTTE
PHALABORWA
LEBOWAKGOMO
HOEDSPRUIT
MARBLE HALL
GROBLERSDAL
LYDENBURG
DULLSTROOM
MIDDELBURG
WITBANK
ARNOT
DELMAS
KRIEL
28°30'0"E
29°0'0"E
29°30'0"E
30°0'0"E
30°30'0"E
31°0'0"E
31°30'0"E
32°0'0"E
24°0'0"S
24°30'0"S
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S
N
Figure 2

TABLE 1
SUMMARY OF TYPICAL HYDROGEOLOGICAL CHARACTERISTICS

Report Section	Lithology	Area within catchment (km²)	Average borehole yield (l/s)	Average range of depth of water level (mbgl)	Typical borehole depth (m)	Aquifer type	Groundwater quality DWAF class
2.1.1	Karoo age siltstone and sandstone	7250	< 0.5 0.5 - 2 along dyke contacts	5 - 20	30 - 60	Intergranular and fractured	0 - 1 Occasionally 2
2.1.2	Delmas dolomite	210	0.1 - > 50	3 - 68	100 - 250	Fractured and karst	0 Pockets of NO_3 due to agriculture
2.1.3	Pretoria Group quartzite and shale (Bronkhorstspruit area)	1230	< 0.5 - 2	20 - 30	40 - 100	Intergranular and fractured (shale) Fractured (quartzite)	0
2.1.4	Waterberg Sandstone and Quartzite	3275	< 0.5 Occasionally > 3	< 10 - > 40	40 - 120	Fractured	0
2.2.1	Nebo granite	6630	< 0.5 Up to 2 in fracturing	10 - 20	40 - 100	Intergranular and Fractured	0 - 1 Isolated NO_3 in settlements Isolated F
2.2.2	Rhyolite and felsite	2675	< 0.1 Occasionally < 0.5	10 - 50	70 - 150	Fractured	0
2.2.3 2.4.2	Basalt (Springbok flats) and KNP	2730	2 - 5 Sometimes > 10	10 - 50	50 - > 150	Intergranular and fractured	1 NO_3 problem in Springbok flats
2.2.4	Clarens SST	2830	1 - 2	10 - 20	30 - 70	Intergranular and fractured	0
	Mudstone and shale (Irrigasie) Sandstone (Ecca)		> 0.5	10 - 20	802 - 120	Intergranular and fractured	2 or 3
2.3.1.	Norite and gabbro	5800	0.5 - 2 Occasionally > 5	10 - 20	30 - 80	Intergranular and fractured	0 or 1 Isolated NO_3 in settlements
2.3.2	Pretoria Group quartzite and shale Escarpment areas	6200	0.5 - 2 Occasionally up to 5	< 10 - > 40	40 - 150	Fractured	0
2.3.3	Dolomite	1615	< 1 - > 5 Potentially >20	0 - > 50	30 - 250	Fractured and karst	0 Pristine in many areas
2.3.4	Black reef quartzite	2120	0.5 - 2 > 5 in dolomite	10 - 30	50 - 100	Fractured	0 Pristine in escarpment
2.4.1	Granite (Lowveld)	9200	0.5 - 2 Occasionally > 5	5 - 15	30 - 80	Intergranular and fractured	1 Isolated NO_3 in settlements

2.1. THE UPPER OLIFANTS SUB-AREA

2.1.1. AREAS UNDERLAIN BY INTERBEDDED ARGILLACEOUS AND ARENACEOUS SEDIMENTS OF KAROO AGE INTRUDED BY DOLERITE SILLS (CATCHMENTS B11A, B, C, D, E, F, B12A, B, C, B20E, AND PARTS OF B11G, H, AND K, B12D, B20A AND B)

This area comprises the eastern Highveld and is generally flat to gently undulating. It is mainly agricultural but with a substantial mining infrastructure, particularly around Witbank, Middleburg and south towards Bethal where the Karoo age coal deposits are widely exploited.

The Karoo sandstones and siltstones, which cover an area of 7 250km^2, are intruded by numerous dolerite dyke and sills. Groundwater occurrence is within weathered near surface zones and deeper fracturing and within strip aquifers associated with dolerite dyke intrusions. The aquifers are intergranular and fractured. Groundwater resources are widespread but limited with borehole yields generally <0.5 l/s. Groundwater occurrence is better developed along dolerite contact linear or strip aquifers where yields of 0.5 – 2.0 l/s are present. The water table is generally shallow and mostly between 5 and 20mbgl. Boreholes vary in depth from 30 – 60m.

Groundwater is extensively used for domestic water supply and stock watering in the agricultural areas.

Rehabilitated open cast pits tend to encourage recharge and locally recharge well above average can be anticipated over small areas. Groundwater monitoring programmes have been implemented at numerous mines.

The aquifer represents important source for stream base flow in the headwaters of the Olifants and its tributaries. Protection of the aquifers from mining impacts is crucial.

GROUNDWATER QUALITY

The natural groundwater quality is mostly Class 0 with conductivities <70mS/m. Class 1 quality occurs around Witbank and south of Middleburg predominantly in the coal mining areas where conductivities range between 70 and 150mS/m. Locally conductivities >150mS/m are present, due to mining activity. With the exception of the areas of elevated TDS and SO_4, overall the groundwater quality is generally acceptable for potable use

Impacts from coal mines and associated stock piles and waste rock dumps due to acid mine drainage and seepage of water high in TDS, conductivity and SO_4 is problematic in many areas. Remediation programmes have been implemented at some of the mines to protect both the groundwater and surface water from undesirable impacts, however, this will be an ongoing process.

2.1.2. THE CENTRAL PORTIONS OF CATCHMENT B20A AND B UNDERLAIN BY MALMANI DOLOMITE

An east - west trending outcrop of dolomite covering an area of approximately 210km^2 occurs across these two catchments forming an important and heavily exploited aquifer. This dolomite is the eastern extension of the extensive hemispherical dolomite outcrop that lies between Johannesburg and Pretoria to the west of the Olifants WMA.

Tributaries of the Bronkhorstspruit River, including the Koffiespruit, rise in this area, sourced from springs occurring along the NE contact of the dolomite with the overlying Pretoria Series strata. The drainage forms a dendritic pattern flowing north and NE, and wetlands occur along the stream channels. Several pans occur in the area.

The dolomite forms flat to gently undulating topography at an elevation of approximately 1600mamsl. The town of Delmas lies within the dolomite in B20A and is reliant on the dolomite aquifer for it's water supply. The area is agriculturally important and irrigation is widespread.

Geology

The dolomite strikes NW – SE and dips to the NE at 15^0. The dolomite is dark grey to grey, massive and characterised by the occurrence of chert rich and chert poor horizons. The dolomite is variously weathered and fractured with extensive development of karst, particularly in the chert rich horizons. To the south the dolomite is overlain by a thin cover of Karoo strata, (2.1.1. above).

The dolomite is intruded by numerous dolerite dykes. The main strike trend is SW – NE with subordinate NW – SE and N – S trends. A major dyke transects the central part of the outcrop, sub-paralleling the Delmas Bapsfontein road. The dykes are assumed to compartmentalise the dolomite, however, the upper 30m or so of the dolerite are weathered and thus the compartmentalising effect is not evident where the water table is <30mbgl.

Reported yields vary from 0.1l/s to >50l/s and yields of 25l/s or more are commonly encountered. Boreholes vary in depth from 100 – 250m, with an average of 150m. This wide range of yield and drilling depth is characteristic of the anisotropic conditions always associated with dolomite aquifers, and emphasises the need for correct borehole siting.

In a recent hydrocensus (2003) water levels were measured in 43 boreholes. These varied between 3.18mbgl in vlei areas and 68.30mbgl around Delmas where a depression has been caused by abstraction for the town water supply.

Groundwater Use

The aquifer is heavily exploited. The study undertaken in 2003 confirmed that current abstraction for Delmas amounts $3.13Mm^3/a$ and an estimated $6.19Mm^3/a$ is abstracted for irrigation. Expansion of the Delmas wellfield and additional irrigation under construction will increase the abstraction to approximately $10.45Mm^3/a$. Spring flow into the tributaries of the Bronkhorstspruit is estimated as $7Mm^3/a$.

Groundwater Quality

Field measurements of pH and EC were made in 17 boreholes in 2003. The pH are in the range 7 to 8.6, with the majority between 7.5 and 8.2, confirming the alkaline nature of the dolomitic water.

The EC varies between 22.8mS/m and 86mS/m, with only 3 measurements above 70mS/m and therefore Class 1 water. The range of EC is consistent with the good quality usually associated with dolomitic groundwater.

Water samples from 12 selected boreholes were analysed for NO_3 and F. Nine of the 12 samples fall into Class 0 (Ideal quality) while 2 have nitrate content above the maximum allowable limit of 20mg/l when expressed as N. The nitrate values confirm the generally good quality of the groundwater although the elevated levels in some boreholes point to isolated pollution from agricultural activities. Fluoride is <0.2mg/l in all samples.

Overall the results confirm the good quality of the groundwater and it's suitability for use for potable supply. Care must, however, be taken to avoid abstracting groundwater from areas with NO_3 pollution.

2.1.3. Areas underlain by Pretoria Group Quartzite and Shale (Catchments B20B, C, D and F).

Quartzite and shale form a broad east – west trending zone which dips below Karoo cover to the east before reappearing east of Middleburg (see section 2.3.2). It includes the eastern part of the Magaliesberg Range and covers an outcrop area of some 1 $230km^2$. Bronkhorstspruit Dam lies in B20C on shale behind the dam wall built on the Bronkhorstspruit River where it traverses a quartzite ridge. Apart from the Magaliesberg range the topography is mostly flat to gently undulating

Land use is entirely agricultural with widespread dependence on groundwater for homesteads and stock watering. The groundwater resources are not sufficiently abundant to support irrigation.

Intergranular and fractured aquifers are developed within these Pretoria Group lithologies associated with weathering and fracturing of the bedrock. Groundwater resources are widespread but areally limited. Borehole yields are generally <0.5 l/s to 2.0 l/s from boreholes generally varying between 40 and 100m depth. Water levels are 20 – 30mbgl.

GROUNDWATER QUALITY

Groundwater quality is generally good with conductivity below 70mS/m (Class 0) and suitable for domestic and stock watering uses.

2.1.4. AREAS UNDERLAIN BY WATERBERG SANDSTONE (CATCHMENTS B11J, K, L, B12E, B20D, G, H,J, B31A, B, B32A).

Sandstone and quartzite of Waterberg age form an extensive east - west trending outcrop covering 3 275km^2 of the WMA from east of Pretoria in B31A to north and east of Witbank. These strata form ranges of hills and rolling countryside. The area is structurally complex with numerous major faults and fracture zones.

The area is agricultural, mostly stock farming but with maize and other arable crops grown in flat areas. Minor areas of irrigation are shown on Figure 3.

Groundwater occurrence is entirely within fractures within the rock mass. Groundwater resources are generally limited with sustainable borehole yields often <0.5l/s, although higher yields (>3l/s) are found along fault and fracture zones. Water levels are variable and controlled by topographic position and tend to be between 10mbgl in low lying areas to >40mbgl in higher topography. Borehole depths are also variable depending upon topography and depth of fracturing and mostly between 40 and 120m.

GROUNDWATER QUALITY

The groundwater quality is generally good, Class 0 with conductivities <70mS/m.

2.2. MIDDLE OLIFANTS

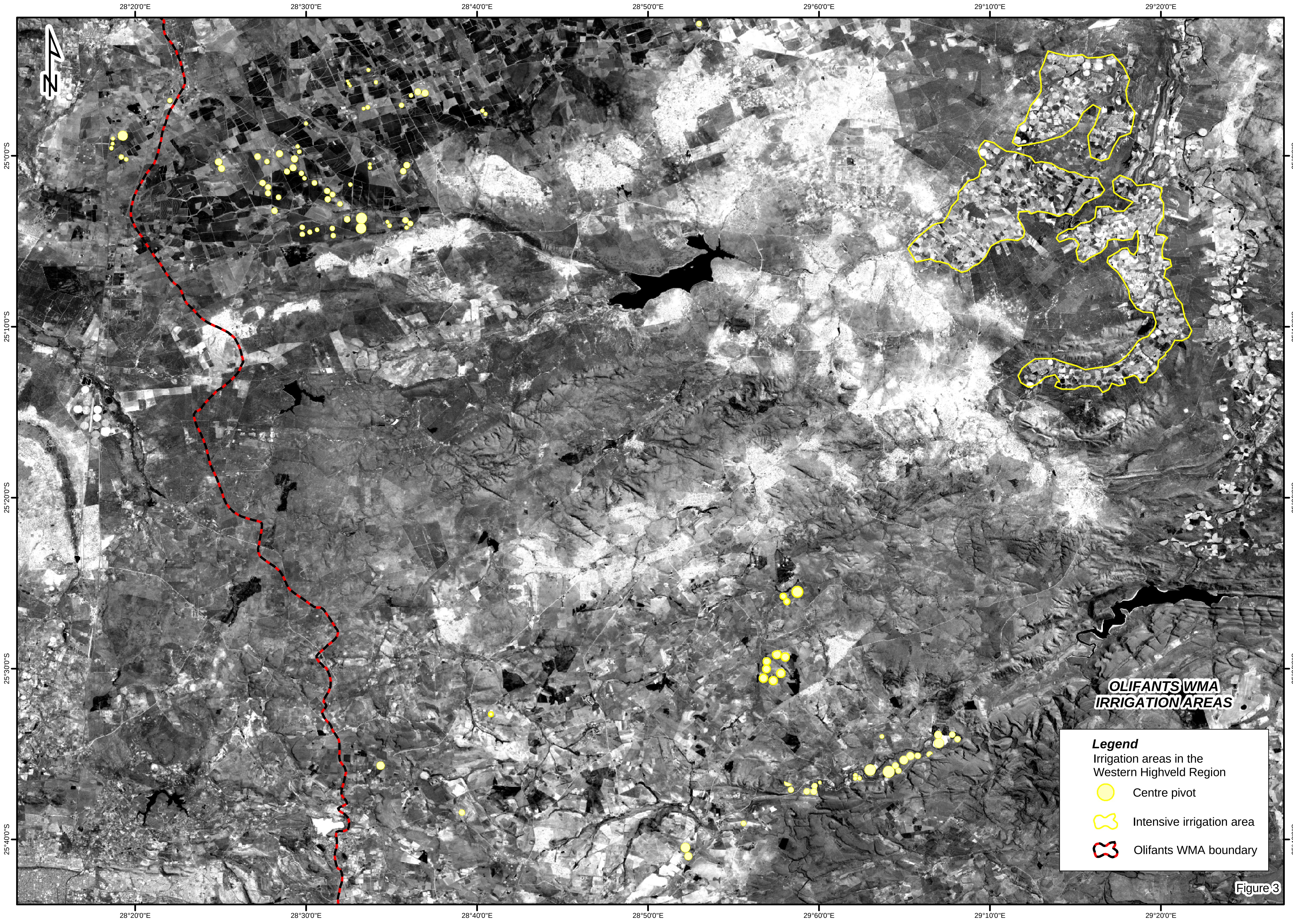
2.2.1 NEBO GRANITE (CATCHMENTS B20J, B31G, H, J, B32D, F, G, H, J, B41E, B51A – C, E, F, H, B52A, C, F, H).

Nebo granite and gneiss is widespread in the central NW of the WMA covering an area of approximately 6 630km^2. The granite forms generally rolling countryside interspersed with granite hills and koppies.

The Nebo granite is characterised by shallow weathering and extensive areas of sub outcrop. Fracturing is extensive and prominent regional and sub-regional fractures traverse the granite.

Groundwater occurrence is controlled by the presence of weathering and, in particular, structural features. Groundwater is widespread but generally poorly developed and borehole yields are usually < 0.5 l/s although yields of up to 2 l/s are feasible along the strip aquifers associated with the major fault zones. Water tables are within a relatively constant range between 10 and 20mbgl. Borehole depths are mostly between 40 – 100m.

Much of this granite area lies within communal land with widespread dependence on groundwater for domestic water supply and stock watering.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28°40'0"E
28°50'0"E
29°60'0"E
29°10'0"E
29°20'0"E
25°0'0"S
25°10'0"S
25°20'0"S
25°30'0"S
25°40'0"S
N
OLIFANTS WMA
IRRIGATION AREAS
Legend
Irrigation areas in the Western Highveld Region
Centre pivot
Intensive irrigation area
Olifants WMA boundary
Figure 3

GROUNDWATER QUALITY

Groundwater quality is mostly good and predominantly Class 0 or Class 1. Localised occurrences of elevated NO_3 are reported at some settlements and isolated zones of elevated fluoride occur.

2.2.2. FELSITE AND RHYOLITE (PARTS OF CATCHMENTS B31C, D, F, B32B, G & H)

Felsite and rhyolite are particularly fine grained lava known for their marginal groundwater occurrence. These lavas form outcrops totalling 2 675km^2 around the granite as shown on the lithostratigraphic map of Figure 2. Weathering is extremely limited and usually the felsite and rhyolite sub-outcrop.

These areas are characterised by rolling countryside. They are entirely agricultural with very limited groundwater resources and marginal groundwater development potential.

Aquifers are associated with local structural features. Sustainable borehole yields are always <0.5l/s, but often sustainable yields are not feasible even at low discharges. Groundwater levels are highly variable 10 – 50 mbgl depending upon topographic position from boreholes which are between 70 – 150m deep.

The resources are suitable for isolated stock watering only and cannot be considered as a potential source for reticulated supply.

GROUNDWATER QUALITY

Groundwater quality is good.

2.2.3. BASALT OF KAROO AGE (PARTS OF CATCHMENTS B31E,F & J, B51E & G)

Basalt covers 2 730km^2 in the NW of the WMA. It forms the Springbok Flats SE of Warmbaths (Bella Bella), Nylstroom and Naboomspruit. The area is characterised by extensive agriculture with significant irrigation abstraction and the distribution of centre pivots (September 2002) is shown on the northern part of Figure 3. Borehole yields of 10 l/s or more are common from aquifers developed within deep weathering and well developed fracturing. Over abstraction in the past 20 years or so led to a lowering of the water table, depletion of the aquifer, reduction in borehole yields to sub-economic levels and subsequent reduction in the number of centre pivots in the commercial farming areas of the Springbok Flats. This was due to uncontrolled groundwater use and absence of management.

The basalt is often deeply weathered and fractured and a well developed aquifer is present in many areas. The contact zone between the basalt and the underlying Clarens Formation Sandstone is also heavily fractured and weathered and also forms an exploitable aquifer.

Borehole yields average 2 – 5l/s but yields >10l/s are common. Water tables range from 10 – 20mbgl. The depth of the boreholes is controlled by weathering and fracturing within the basalt and the depth to the underlying sandstone contact, and can vary from 50 - >150m.

GROUNDWATER USE

There is moderate groundwater development potential in the far north from boreholes with sustainable yields of 2 – 5l/s. According to the DWAF Register there are 10 reticulated public water supply boreholes for the area located in the basalt and basalt sandstone contact aquifer north of Magareng. These are reported to deliver a total of 50.5m^3/h.

A detailed investigation of the groundwater resources of the basalt aquifer in Moretele II district north of Marapjane was undertaken in the mid 1980's. This confirmed that up to 35l/s could be abstracted from this area. Although the boreholes could yield up to 20l/s, sustainable yields were set at 3l/s to minimise the adverse impacts of irrigation abstraction to the north.

GROUNDWATER QUALITY

Conductivities are generally 70 – 150mS/m, Class 1. The groundwater quality is often impacted by elevated NO_3 resulting from fertiliser application and poor agricultural practise.

2.2.4. ARGILLACEOUS AND ARENACEOUS SEDIMENTS OF KAROO AGE (CLARENS SANDSTONE, IRRIGASIE FORMATION AND ECCA FORMATION SHALE AND SANDSTONE) (CATCHMENTS B31E, F, J B51E & G)

These strata form a wide outcrop covering 2 830km^2 in the NW of the WMA immediately south of the basalt. They form the southern boundary of the Springbok Flats and hence flat topography. The Clarens sandstones forms occasional remnant hills in the Moretele II District south of Settlers.

The SW and NE areas of the outcrop are communal land (Moretele II and Mokerong respectively) with dependence on available groundwater for potable supply and stock watering. The central area is agricultural and groundwater is used for homesteads and stock watering.

The Clarens Sandstone of the Upper Karoo is fractured and weathered to depths >50m and yields of 1 – 2l/s are feasible from boreholes 30 – 70m deep. There is extensive reliance on groundwater for domestic supply to rural communities where the Clarens Formation is present.

Mudstone, (Irrigasie Formation) and shale, sandstone and coal of Ecca age, occur SE of and underlie the Clarens sandstone. Here groundwater occurrence is controlled by fracturing and weathering which is often poorly developed. Boreholes yields are generally <0.5 l/s, with marginal yields in the Irrigasie Mudstones. Boreholes are 80 – 120m deep. Water levels are generally 20 – 30mbgl.

GROUNDWATER QUALITY

Groundwater quality is good in the Clarens sandstone outcrop areas, with DWAF Class 0 or 1 the norm.

Groundwater quality can be poor in the Lower Karoo strata with elevated TDS. DWAF Class 2 or 3 water is frequently encountered due to naturally elevated TDS associated with the low permeability marls and carbonaceous shale.

The resources of these strata are generally suitable for limited domestic supply and isolated stock watering, but groundwater use can be constrained by water quality.

2.3. STEELPOORT VALLEY SUB-UNIT

2.3.1. NORITE AND GABBRO OF THE BUSHVELD IGNEOUS COMPLEX (CATCHMENTS B32C, E, B41A, B, C, D, E, F, G, H, J, B52A, B, D, E, B71E).

Norite and gabbro underlie 5 800km^2 of the WMA and outcrop over wide arch sub-paralleling the eastern escarpment, (Figure 2). These igneous strata form a landscape comprising a series of deep valleys and rugged mountains. Regional fracturing and faulting intersects much of the outcrop and displacements are frequently evident.

Much of the area comprises communal land of the old Lebowa with widespread dependence on groundwater for domestic supply and stock watering. The mining activities within the Steelpoort Valley and the development of new platinum mines in the eastern limb of this complex between Burgersfort and Atok mine have a significant impact on the groundwater resources.

Groundwater resources are widespread in the valley and flat areas where weathered and fractured aquifers occur. Borehole yields of 0.5 – 2 l/s are common, with >5 l/s locally available, especially along intruding dyke contact zones and other structural features. Borehole depths average 30 – 80m and water tables are generally 10 – 20mbgl.

The mining activities taking place in the Middle Steelpoort valley and between Burgersfort and Atok mine (catchments B41H & J, B52E and B71E) are a potential source of conflict between the local inhabitants and the mine infrastructural requirements. The new mines being developed will all impact on the availability of groundwater to some extent due to dewatering requirements and potential adverse quality impacts.

GROUNDWATER QUALITY

Groundwater quality is generally good with conductivities <70mS/m (Class 0) or between 70mS/m and 150mS/m (Class 1). Isolated NO_3 pollution is present in the settlements and the potential for pollution due to mining activities must be recognised.

2.3.2. AREAS UNDERLAIN BY SEDIMENTARY STRATA OF THE PRETORIA SERIES (FROM NORTH TO SOUTH B52J, B71A, B, D, E, B41K, H, B60F, G, B42A, B, C, D, E, F, G, THE SOUTHERN PART OF B41F, EASTERN PART OF B41B AND B41A)

These sedimentary strata outcrop over an area of some 6 200km^2 forming a broad hemisphere from south of Lydenburg to north of Lebowakgomo. The landscape is characterised by a series of valleys and ridges west of the escarpment.

Much of the north western outcrop area comprises communal land with extensive groundwater use for domestic supply and stock watering. Agricultural activities, grazing, dry land and some irrigation, cover the eastern and southern areas around Lydenburg, Dullstroom and Ohrigstad.

Groundwater resources are widely developed, especially in fracturing within the sandstones and along sandstone/shale contacts. Borehole yields over most of the outcrop are 0.5 – 2 l/s, with yields up to 5 l/s in areas south of Lydenburg, Dullstroom, and south and east of Ohrigstad. Water levels vary considerably depending upon the topographic position, with <10m in the bottomland valley areas to >40m in upland areas. Borehole depths typically range from 40 – 150m, with the majority between 40 and 70m.

GROUNDWATER QUALITY

Groundwater quality is generally good with conductivity below 70mS/m (Class 0) and suitable for domestic and stock watering uses.

2.3.3. MALMANI DOLOMITE ALONG THE ESCARPMENT (NORTHERN PORTIONS OF B52D, G, J AND B71A, SOUTHERN PART OF B71C, NORTHERN PART OF B71D, SOUTHERN PART OF B71F, G, B60A, B, D, H)

Malmani dolomite outcrops to the east of the Pretoria Series strata forming a wide arc as illustrated on Figure 2. The dolomites form extensive areas of rugged terrain and are mostly undeveloped.

The aquifers within the dolomite are likely to form an important as yet undeveloped resource with significant potential for development as bulk water supply.

The area is ecologically sensitive and impacts of abstraction would need to be understood. The dolomite aquifer is a major contributor to base flow in this area.

North of Lebowakgomo the dolomite outcrop extends west and forms a small outcrop in catchment B51E, (Middle Olifants sub-area). Here groundwater is abstracted from the dolomite for the Zebedelia estates. This aquifer is reported to be over exploited and requires assessment and intervention to protect the long term sustainable resources.

Groundwater occurrence in the dolomite is enhanced in karst zones and zones of fracturing and solutional weathering. Sustainable yields can be significant and in excess of 5l/s. Water levels vary depending upon topographic position from 0m at springs and seepages to >50m in mountainous terrain.

GROUNDWATER QUALITY

The groundwater quality is pristine in most areas, (Class 0). The dolomite is vulnerable to contamination from agricultural practise, feedlots, etc., and this vulnerability must be recognised by users and developers.

2.3.4. BLACK REEF QUARTZITE (PARTS OF CATCHMENTS B32H, B51F, B52C, F & H, B71C, F & G, B72F, AND B60C, D & H)

The west dipping Black Reef Quartzite underlies the Malmani Dolomite forming the massive cliffs of the escarpment. To the north and west the topography becomes subdued. This outcrop covers some 1 850km^2 of the WMA.

The escarpment areas are agricultural and/or tourist areas withy limited development. Groundwater resources are widespread and fractured aquifers within the quartzite have the potential to deliver sustainable yields of 0.5 – 2l/s or more.

The escarpment area is pristine and ecologically sensitive.

To the north and west north of Lebowakgomo (Thabamoopo in the middle Olifants sub-area) groundwater resources are available for domestic supply and stock watering. Sustainable yields of 0.1 to 0.5l/s are reported to be available from boreholes drilled 50 – 100m deep. Water levels are 10 –30mbgl.

A small area (275km^2) of interbedded dolomite and quartzite occurs in B31H and B32H west of Groblersdal. Here groundwater is abstracted to support irrigation supplied from surface water. The extent of the irrigated area is illustrated in Figure 3.

GROUNDWATER QUALITY

Groundwater quality is pristine in the escarpment areas, Class 0, with conductivities <70mS/m. In settled areas and areas used for agriculture conductivities may exceed 70mS/m.

2.4. LOWER OLIFANTS

2.4.1. CATCHMENTS WITHIN THE LOWVELD MOSTLY UNDERLAIN BY GRANITE (B72A, B, C, D, E, G, H, J, K, B71H, J, B60J, B73A, B, C, D, E, F, B81D

Most of the Lower Olifants is underlain by Granite. Granite covers an area of 9 200km^2.

This Lowveld area is gently undulating and characterised by large agricultural development including irrigation and wide tracts of game management areas, including the western portion of the Kruger National Park, with little groundwater development. The area below the escarpment north of the Abel Erasmus pass (Naphuno 2) and south of Hoedspruit (northern part of Mapulaneng) are heavily settled. Groundwater is widely used in these areas for domestic supply and stock watering.

The groundwater resources are generally moderately developed and widespread. Aquifers within the granite are confined to weathering and fracturing zones. Borehole yields are generally 0.5 to 2 l/s, although areas between Gravelotte and Phalaborwa, and east of Hoedspruit have well developed aquifers with borehole yields of >5 l/s. Water levels are between 5 and 15mbgl, boreholes tend to be between 30 and 80m deep.

GROUNDWATER QUALITY

The area is characterised by Class 1 groundwater quality with conductivities between 70 and 300mS/m. Isolated occurrences of NO_3 are reported in the settled areas.

2.4.2. CATCHMENTS B73G, H AND J

These 3 catchments cover the far eastern portion of the Olifants Catchment within the Kruger Park. They are underlain by 970km^2 of Upper Karoo basalt and rhyolite.

Groundwater is only used for isolated game management boreholes. Impacts from activities within these catchments are unlikely.

3. GROUNDWATER RESOURCES

3.1. GENERAL

As discussed above groundwater is available throughout almost all of the Olifants catchment in varying quantities depending upon the hydrogeological characteristics of the prevailing lithology. The Olifants WMA is characterised by a widely varying geology and lithology, each with distinctive groundwater occurrence, complicated by the diverse topography.

The entire region is underlain by hard rocks with aquifers developed in secondary features associated with weathering pockets, structure (fracturing, jointing and faulting) and, in dolomite areas, karst features. Structural and karst features are important and higher borehole yields are generally associated with these features. The most abundant groundwater resources are associated with the dolomite aquifer, especially around the Delmas area. As noted above, the dolomite of the escarpment area are undeveloped and significant development potential is likely to be associated with the dolomite in this area.

The norite aquifer between Burgersfort and Atok mine also possess substantial development potential, and the impacts of the mining developments now taking place in this area need to be carefully managed.

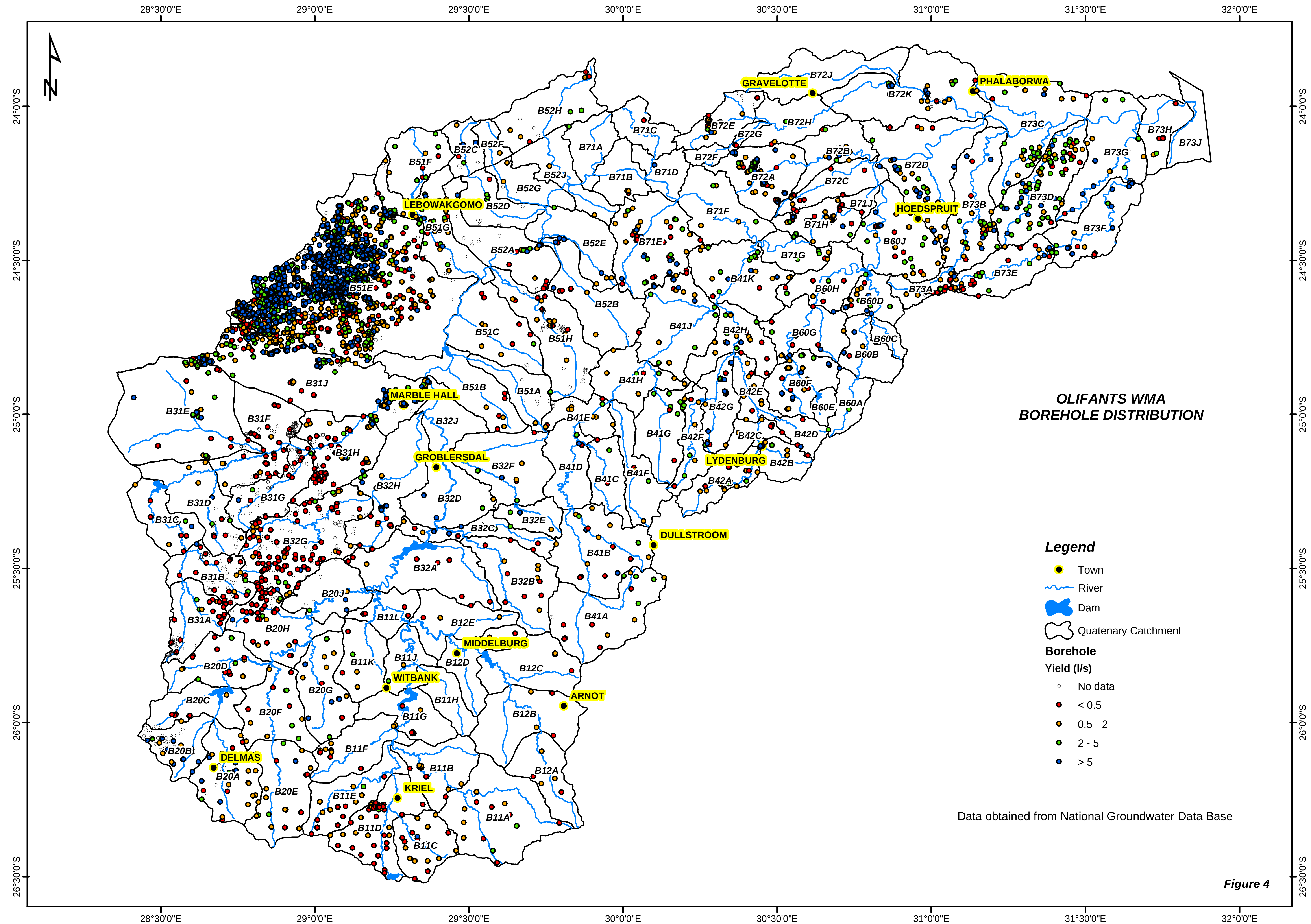
Records for 7 139 boreholes are held on the National Groundwater Data Base (NGDB) of the Department of Water Affairs and Forestry, as illustrated on Figure 4. Yield information is available for 5690 of these boreholes. Yields are reported to vary from 0 (for 230 boreholes) to 20 l/s for 10 boreholes, and the average yield for all the boreholes is approximately 2 l/s. This does not represent the average sustainable yield since many of the yields are blowing yields reported by drillers, rather than yields determined from proper pumping tests. Nevertheless, the data can be used to provide a very broad order of magnitude estimate of annual abstraction across the WMA using the average yield and assuming each borehole is pumped for 2 - 6 hours per day. On this basis current groundwater abstraction is between 30Mm^3/a and 90Mm^3/a from the 5460 boreholes with a reported yield.

Overall the available groundwater resources within the catchment are under utilised although this clearly depends both on the groundwater occurrence and the demand. Even weaker groundwater occurrence areas can often provide more than the RDP level of 25 litres per head per day. Groundwater is the main source for rural water supplies.

3.2. RECHARGE

An assessment of aquifer recharge provides an indication of the sustainable groundwater resources.

The mean annual rainfall over the catchment varies between 700mm in the Highveld region (Delmas Witbank area) to 1000mm along the southern escarpment reducing to some 500mm in the Lowveld. The rainfall is seasonal with most occurring during the



OLIFANTS WMA
BOREHOLE DISTRIBUTION
Legend
Town
River
Dam
Quatenary Catchment
Borehole
Yield (l/s)
No data
< 0.5
0.5 - 2
2 - 5
> 5
Data obtained from National Groundwater Data Base
28°30'0"E
29°0'0"E
29°30'0"E
30°0'0"E
30°30'0"E
31°0'0"E
31°30'0"E
32°0'0"E
24°0'0"S
24°30'0"S
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S
N
GRAVELOTTE
PHALABORWA
LEBOWAKGOMO
HOEDSPRUIT
MARBLE HALL
GROBLERSDAL
LYDENBURG
DULLSTROOM
MIDDELBURG
WITBANK
ARNOT
DELMAS
KRIEL
B72J
B72K
B72H
B72E
B72G
B72F
B72B
B72D
B72A
B72C
B73C
B73H
B73J
B73G
B73B
B73D
B73F
B73E
B73A
B71C
B71A
B71B
B71D
B71F
B71E
B71G
B71H
B71J
B52H
B52C
B52F
B52J
B52G
B52D
B52A
B52E
B52B
B51F
B51G
B51E
B51C
B51H
B51B
B51A
B60J
B60H
B60D
B60G
B60C
B60B
B60F
B60E
B60A
B41K
B41J
B41H
B41G
B41E
B41D
B41C
B41F
B41B
B41A
B42H
B42E
B42G
B42F
B42C
B42D
B42B
B42A
B31J
B31E
B31F
B31H
B31G
B31D
B31C
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B32B
B20J
B20H
B20D
B20C
B20G
B20F
B20B
B20A
B20E
B11L
B11K
B11J
B11H
B11G
B11F
B11B
B11E
B11D
B11C
B11A
B12E
B12D
B12C
B12B
B12A
Figure 4

summer months. The annual recharge is estimated to vary significantly over the WMA, as illustrated on Figure 5. The highest recharge of >100mm (>10% of rainfall) occurs along the escarpment while the Lowveld and the central area north of Marble Hall have the lowest recharge with 10 – 15mm (±2% of rainfall). Recharge in the Highveld region is estimated to be between 25 and 75mm per annum (4 – 8% of MAP).

Using these figures, groundwater recharge over the entire 54 550km^2 WMA is estimated to be approximately 1 900 Mm^3/a. The escarpment account for 6% of the land area of the catchment and approximately 16% of the recharge (300Mm^3) confirming the importance of the escarpment mountains for the groundwater system and associated baseflow. The Highveld region in the south of the WMA is an important recharge area and provides base flow to the headwaters of the Olifants drainage. The Highveld region covers 24% (13 100km^2) of the WMA and receives 36% (680Mm^3/a) of recharge.

The recharge estimates for the catchments of the WMA indicate that overall the available groundwater resources are under utilised. It is, however, stressed, that the exploitation potential depends upon both the mode of groundwater occurrence and the water demand to be satisfied. As noted above, even weaker groundwater occurrence areas can usually provide more than the RDP level of 25 litres per head per day within a reasonable distance of the user, conversely, bulk abstraction for town supply is only locally feasible in any aquifer other than the dolomite. Development for bulk abstraction requires extensive knowledge of the hydrogeology of the area in question and the undertaking of detailed field investigations.

4. GROUNDWATER ISSUES AND ASSOCIATED STRATEGIES

Management objectives in relation to sustainable and equitable utilisation of the available resources can be broadly summarised as follows:

4.1. BROAD MANAGEMENT OBJECTIVES

- Water demands must be matched to available resources. Only if groundwater is proved to be inadequate should surface water be considered as a source.
- Groundwater resources form an integral part of integrated water resources development planning and management.
- The conjunctive use of surface and groundwater where feasible is to be encouraged to maximise the optimal use of available water resources.
- Develop local groundwater resources in preference to piping surface water long distances.
- Equitable availability of (ground)water resources to all users.
- Management of available resources to ensure long term sustainability.
- Develop knowledge of the groundwater resources.
- Promote awareness of groundwater conservation.
- Identification of applications for sole use, or conjunctive use, of groundwater.

4.2. OVERALL STRATEGIC APPROACH

At this stage the magnitude of the groundwater resources within the region as a whole is not well documented and the development of an increased understanding of the availability and distribution of the groundwater resources is therefore a priority. This requires the preparation of a catchment wide assessment of the groundwater resources and the continual updating of this assessment.

The overall strategic approach to the development and management of the groundwater resources of the region must include:

- Optimal development of the available groundwater resources using a proper scientific approach, i.e.,

  1. suitable assessment of the aquifers and available resource,

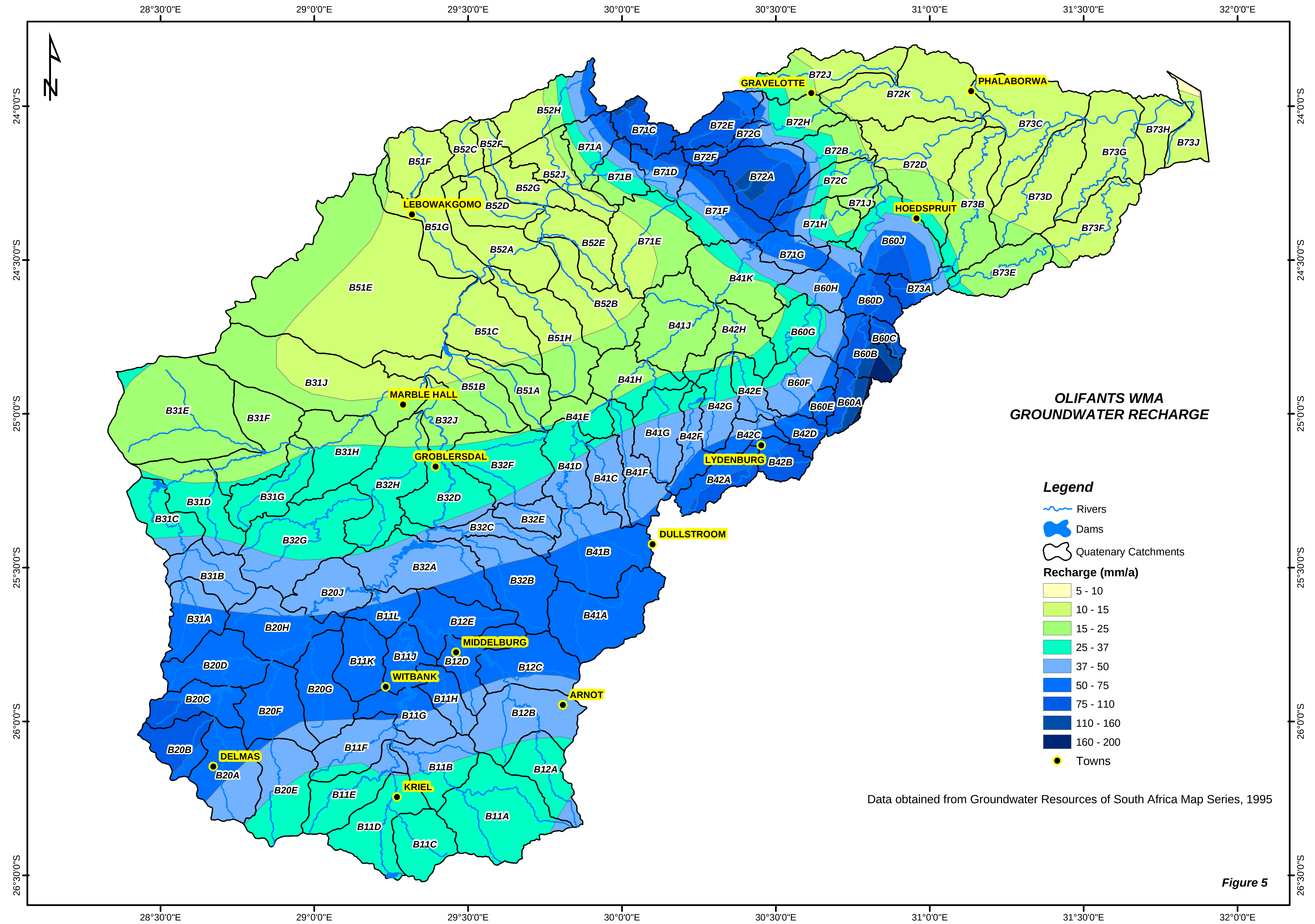

OLIFANTS WMA
GROUNDWATER RECHARGE
Legend
Rivers
Dams
Quaternary Catchments
Recharge (mm/a)
5 - 10
10 - 15
15 - 25
25 - 37
37 - 50
50 - 75
75 - 110
110 - 160
160 - 200
Towns
GRAVELOTTE
PHALABORWA
LEBOWAKGOMO
HOEDSPRUIT
MARBLE HALL
GROBLERSDAL
LYDENBURG
DULLSTROOM
MIDDELBURG
WITBANK
ARNOT
DELMAS
KRIEL
28°30'0"E
29°0'0"E
29°30'0"E
30°0'0"E
30°30'0"E
31°0'0"E
31°30'0"E
32°0'0"E
24°0'0"S
24°30'0"S
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S
Data obtained from Groundwater Resources of South Africa Map Series, 1995

Figure 5

2. application of photogeological and geophysical methods for correct selection of drilling sites,
3. construction of boreholes according to DWAF and SABS standards to ensure longevity and protection of the aquifer from pollution,
4. controlled testing of boreholes and selection of correct pumps and operational recommendations.
5. groundwater quality assessments

- Long term aquifer, wellfield and borehole management to avoid over-exploitation and ensure long term sustainability.

- The protection of the available groundwater resources (quantity and quality) to ensure long term sustainability. This requires:

  i) the application of optimal development procedures as noted above,
  ii) the implementation of a programme to promote awareness amongst users and to educate users on water conservation and demand management,
  iii) delineation of wellhead protection zones,
  iv) protection of wellhead zones from water spillage, damage by cattle drinking, etc.
  v) Positioning of new boreholes well away from settlements and population concentrations, and pipe water to the settlement, where the groundwater resources are suitable to do this.

- Equitable availability to all users

- Groundwater quality objectives and management strategies

- Implement study of interrelationship between surface and groundwater. This will incorporate the study of the relationship between groundwater abstraction and stream flow in drainage source areas, for example in the Highveld region and in the escarpment area.

Equitable availability of water to all users forms the cornerstone of the entire water management strategy. This requires that the water resources, including groundwater, are available to all users and utilised for the benefit of all. In particular management decisions will/may be needed in the future to re-allocate water from some existing users to new users, e.g., from existing irrigation users to emerging farmers or community water supply in areas of shortage, via compulsory licensing.

As noted elsewhere, groundwater resources are usually sufficient to meet the RDP level of supply within a reasonable distance of all users.

4.3. GROUNDWATER AVAILABILITY

This involves issues such as groundwater abundance, over exploitation, shortages during drought, licensing, etc.

The availability of groundwater for abstraction is controlled by the aquifer characteristics of permeability and storage. These parameters are variable and hence areas with differing lithology, and even within the same lithology, will have differing groundwater resources and thus differing groundwater development potential. As noted in Section 2, borehole yields vary widely across the region due to the varying lithologies and anisotropic nature of the aquifers.

In areas of heavy demand in relation to the resources, groundwater availability becomes a management issue, and accordingly if over exploited, even dolomite aquifers can eventually fail. The licensing of groundwater use combined with the assessment of the overall available resources is thus an important component of active aquifer management.

Of particular concern, especially since this affects the rural population disproportionally, are shortages of water during drought. This is particularly the case in areas of low resources and low capacity, (i.e., limited number of boreholes) and/or where boreholes have been poorly sited (intersecting shallow water horizons vulnerable to drought and also contamination). To cope with these eventualities the following strategy is required:

- Scientific siting of boreholes
- Correct drilling procedures and borehole design and construction
- Testing of boreholes to confirm the long term sustainable yield
- Collection of samples and analyses for potability
- Equipping of boreholes with the correct capacity pump set at the correct depth
- Implement policy to educate users on water conservation
- Implement water demand management practices.

4.4. GROUNDWATER QUALITY

As demonstrated in Section 2 and shown on Table 1, the overall quality of the groundwater throughout the WMA is good. The distribution of TDS, for example, confirming this good assessment, is illustrated on Figure 6.

Groundwater pollution is an increasing threat. Pollution of groundwater can result from:

- domestic use
- agriculture
- mining
- waste disposal

Pollution emanating from settlements, especially informal settlements, is difficult to control. Elevated nitrate levels (NO_3 >10mg/l) in groundwater occur in some water supply boreholes in the traditionally settled areas of the catchment. In particular the following must be considered:

- Groundwater pollution occurs when latrine density is high. This results in a pollution plume of increased salinity and nitrate around the settlement.

- Abstraction from boreholes for water supply located within plumes has to be terminated, i.e., water quality monitoring must be implemented to determine when and if there is an unacceptable deterioration in groundwater quality.

- Groundwater must be abstracted from outside possible impacted areas, i.e., boreholes and wellfields have to be located well away from potential pollution sources.

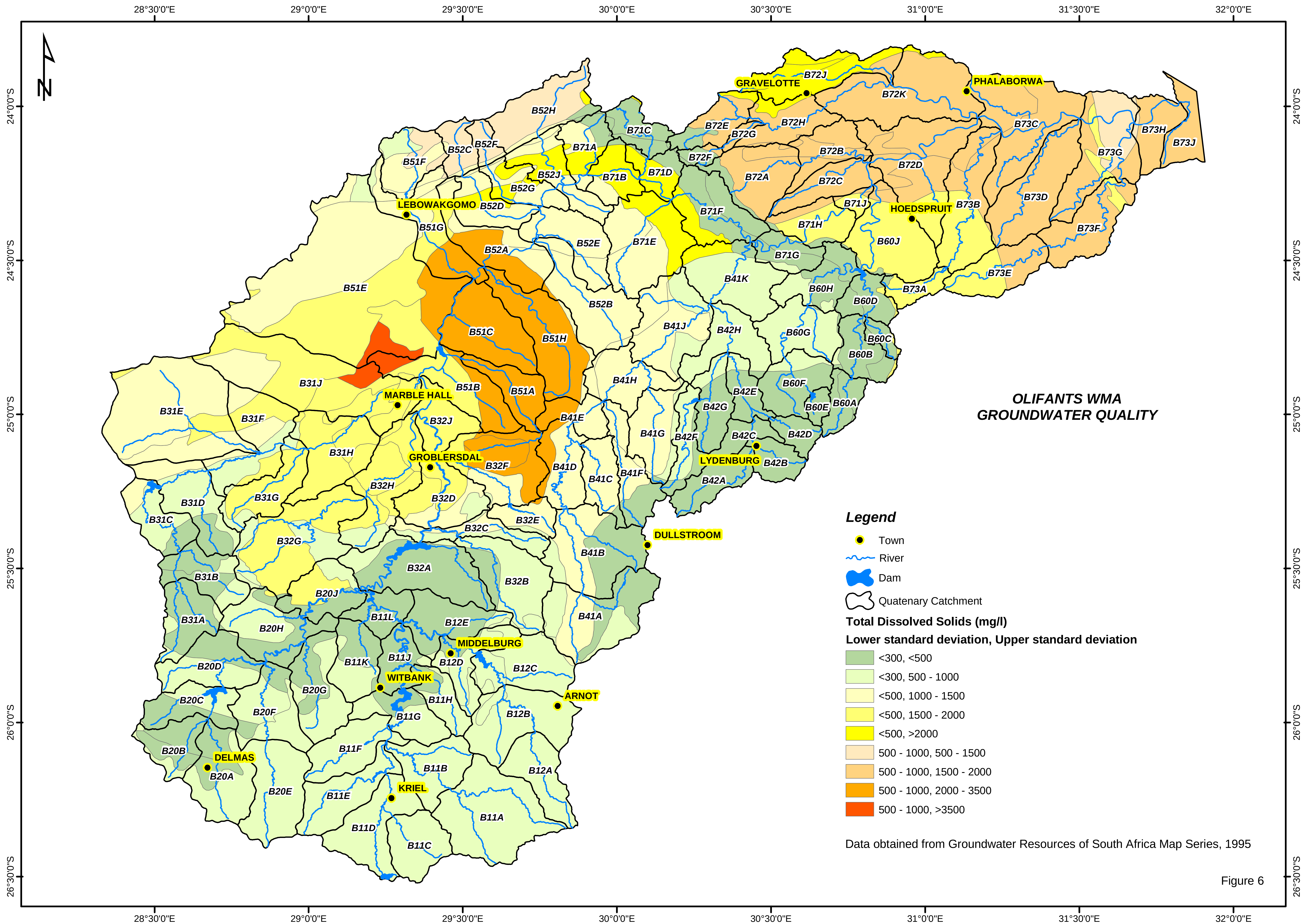
- Education concerning the need for, and ways of, protecting the groundwater resources is required.

- Standards for borehole positioning, construction and protection, as specified by DWAF and SABS, must be enforced.

- Impacts of agricultural practise on groundwater quality must be assessed, especially with regard to over use of fertilisers, and surface runoff of nitrate and phosphate rich water entering drainages and the groundwater resources which then provide base flow, concentrations of cattle in feedlots and kraals and overgrazing which results in soil erosion, increased runoff and enhances the risk of NO_3 entering the groundwater system.

- Wellhead protection areas must be established in accordance with DWAF guidelines.

The impact of groundwater pollution from mining and waste disposal can be controlled and remediated according to the requirements of DWAF. Mines and waste disposal sites must prepare EMPRs, EIA and closure plans which will identify and put preventative and remediation measures, including monitoring, in place.



OLIFANTS WMA
GROUNDWATER QUALITY
Legend
Town
River
Dam
Quatenary Catchment
Total Dissolved Solids (mg/l)
Lower standard deviation, Upper standard deviation
<300, <500
<300, 500 - 1000
<500, 1000 - 1500
<500, 1500 - 2000
<500, >2000
500 - 1000, 500 - 1500
500 - 1000, 1500 - 2000
500 - 1000, 2000 - 3500
500 - 1000, >3500
Data obtained from Groundwater Resources of South Africa Map Series, 1995
Figure 6
28°30'0"E
29°0'0"E
29°30'0"E
30°0'0"E
30°30'0"E
31°0'0"E
31°30'0"E
32°0'0"E
24°0'0"S
24°30'0"S
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S
GRAVELOTTE
PHALABORWA
LEBOWAKGOMO
HOEDSPRUIT
MARBLE HALL
GROBLERSDAL
LYDENBURG
DULLSTROOM
MIDDELBURG
WITBANK
ARNOT
DELMAS
KRIEL
B72J
B72K
B52H
B71C
B72E
B72G
B72H
B73C
B73H
B73J
B52C
B52F
B71A
B72F
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B72C
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B73B
B51G
B71F
B71H
B60J
B73F
B52E
B71E
B52A
B71G
B73E
B41K
B60H
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B51E
B52B
B60D
B41J
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B31J
B41H
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B42G
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B60A
B31E
B31F
B32J
B41E
B41G
B42F
B42C
B42D
B31H
B32F
B41D
B42B
B41C
B41F
B42A
B32H
B31G
B32D
B31D
B31C
B32C
B32E
B32G
B41B
B32A
B31B
B32B
B20J
B41A
B31A
B11L
B12E
B20H
B20D
B11K
B11J
B12D
B12C
B20G
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- A census of operational and abandoned mines is required to assess any potential groundwater pollution threat and determine the need for remediation.

- Pollution of groundwater by mining effluent and acid mine drainage, particularly in the coal mining areas of the Highveld region in the Upper Olifants catchment. The possibility of decant from abandoned mines must be considered and any impacts identified and remediated. Prevention and remediation measures may be needed. Monitoring programmes may need to be established/maintained.

Waste disposal sites offer a potentially serious hazard due to poor management and lack of operating controls. The pollution risk from waste disposal sites throughout the WMA needs to be assessed and remediated.

It is important that mines, industry and waste dumps have valid licences and approved EMPR's/EIA's where necessary.

4.5. DEVELOPMENT APPROACH

This requires a thorough assessment of the groundwater resources be undertaken before confirming the water source.

- Develop groundwater as first priority for any scheme.
- Ensure conjunctive use where groundwater resources alone are inadequate to satisfy the demand.
- Ensure development is undertaken following sound scientific principles. Selection of borehole sites, borehole design and construction, testing, equipping and management operations must adhere to DWAF and SABS standards, as a minimum.

4.6. GROUNDWATER DEVELOPMENT PROCEDURES

Groundwater development projects should be undertaken by recognised professional hydrogeologists. All contracting works must be undertaken according to a proper technical specification and bill of rates to ensure:

- correct drilling technique,
- borehole construction meets the DWAF and SABS specifications for longevity and pollution protection,
- adequate testing procedures are followed,
- water quality is determined by analysis in an accredited laboratory,
- management recommendations for the optimum long term sustainable use of the groundwater resource are prepared and implemented.

The adoption of correct development procedures is a pre-requisite for the sustainable utilization of the groundwater resources.

5. SPECIFIC ISSUES AFFECTING INDIVIDUAL OR GROUPS OF QUATERNARY CATCHMENTS

5.1. MINING AND INDUSTRIAL ACTIVITIES

As noted elsewhere in this overview report the Highveld region represents an important area contributing significant base flow to the surface drainage. This area is characterised by numerous working, abandoned and planned open cast and underground coal mines. These mining activities have resulted in a real threat to the prevailing natural groundwater quality, and thus the surface water quality, from mine effluent. Furthermore, impacts to groundwater quantity resulting from dewatering around open pit mines, and increased recharge to backfilled pits leading to decant of poor quality water are a problem. Most mines in the area are adopting active management and remediation programme to ensure compliance with the appropriate legislation, nevertheless it is important that cognisance of the potential and actual threats to the groundwater system is made.

Pollution control measures need to be implemented and enforced. EMPRs may need updating and closure plans required for mining to assess impacts of decant. Monitoring programmes to be established/maintained.

An additional threat to groundwater quality is the impact of agricultural activities due to the use of fertilisers. This aspect requires investigation to determine the contribution agriculture makes to the PO_4 and NO_3 levels in groundwater.

Many new mines are being planned and developed in the norite and gabbro of the Bushveld Igneous Complex in the Steelpoort valley, in the valley between Burgersfort and Atok mine and to the west of Lebowakgomo. Although many of these mines will be supplied with water piped from the Olifants River, the mines place a strain on the groundwater resources, particularly in terms of quality and dewatering impacts.

The following need to be considered:

- Conflicts between the demands of the local population, and dewatering and quality impacts can be anticipated. The mines will need to undertake sympathetic and responsible development to minimise impacts on the groundwater resources.

- Groundwater pollution from the mining activities can be anticipated. It is important that the mines comply with EMPR's and mine closure plans.

- The eastern limb mining area has suffered from extensive overgrazing, leading to run off and soil erosion problems.

- Impacts from other mines and industry elsewhere in the Middle and Lower Olifants need to be assessed, e.g. the mines at Palabora which are environmentally sensitive since effluents will flow to the Kruger park either as polluted groundwater or via the Olifants River, the mines at Gravelotte, the Ferrochrome Smelters north of Lydenburg and at Steelpoort, etc.

5.2. THE MALMANI DOLOMITE IN THE DELMAS AREA (CATCHMENTS B20A & B)

This dolomite forms an important aquifer and is heavily utilised, as discussed in Section 2.1.2. Several issues are unique to these dolomites and require attention.

- The dolomite strike trends to the NW and crosses the catchment boundary near Bapsfontein. To the SW the dolomite crosses the boundary into the Upper Vaal WMA under a thin cover of Karoo strata. Abstraction from the dolomite aquifer within the catchment could impact on the resources available within either the Crocodile West or Upper Vaal WMA, and visa versa.

  Whether or not this is an issue is unclear at this stage. An investigation is required to determine regional groundwater flow directions, distribution of aquifers within the dolomite rock mass, compartmentalisation due to dolerite dyke intrusions and the impact of abstraction on the groundwater watersheds which may or may not coincide with the surface water catchment boundaries.

- The dolomite aquifer is an important strategic water resource that requires active management to ensure long term sustainability of both quantity and quality. Knowledge of the volume of the groundwater resources available, and the impact of existing use, contribution to spring/surface water flow and the reserve requirements is essential before decisions concerning further abstraction can be made.

  This requires the implementation of a monitoring programme of both quantity and quality involving regular measurement of abstraction volumes, water levels and periodic water quality analysis.

- Active management could include the deliberate lowering of the water level in the aquifer to release storage that can then be replenished during periods of above average rainfall. Research has shown that the recharge to dolomite aquifers increases more rapidly than the increase in rainfall, thus dolomite aquifers replenish very quickly. Utilising storage within the aquifer in this way will capture flood peaks and provide an increase in aquifer yield.

- A study to investigate the feasibility of artificially recharging the aquifer could be implemented. Artificial recharge means that 100% of water placed into the aquifer is stored, none is lost to evapotranspiration.

- Sinkholes are present in the area, including a recent one that has appeared near Bapsfontein due to over abstraction and lowering of the water table in this area. It is known that pumping of groundwater from dolomite can cause sinkholes to develop, especially in areas where the ground is already unstable and water levels are allowed to fluctuate regularly.

  It is important to understand the extent of this problem in order to implement avoidance measures. This will require:

  - The mapping of the present distribution of sinkholes.
  - Measures will be required to limit the impact of abstraction on the formation of sinkholes, particularly in areas where housing and settlements are present.
  - Land use planning should prohibit/restrict the development of settlements in the dolomitic areas.

- Springs

  - Springs must be protected, particularly where these are used for water supply to urban and rural communities.

  - The impact of development on spring flow must be considered when implementing groundwater abstraction schemes.

5.3. COMMUNAL LAND AREAS

Much of the catchment comprises traditionally settled areas and groundwater is relied on by a large number of people for their domestic and stock watering needs. Issues of particular concern to these areas include:

- Availability of water during drought. This is difficult to deal with in areas of low resources and requires implementation of a strategy of correct borehole siting and construction, as discussed in section 4.3. above..

- A programme of educating people on water conservation and implementation of water demand management where practical will be helpful.

- Pollution of the resources from latrines and increasing population, with elevated TDS and NO_3. This requires the implementation of a strategy of education and training to protect borehole head areas from water spillage, damage by cattle drinking, etc. New boreholes should be positioned well away from settlements, and water piped to the settlement, where the groundwater resources are suitable to do this.

- Impacts of overgrazing on groundwater recharge, soil erosion and surface runoff need to be addressed.

5.3. BASALT

The groundwater resources of the basalt of the Springbok flats are favourable to development to irrigation. However, the resources are being/have been seriously depleted in many areas. Implementation of the following could assist in ensuring sustainability of the resources.

- Issuing of licenses for irrigation abstraction. A study to determine the available groundwater resources is required. Once the available resources and current use are known, licensing for additional abstraction or reduction in abstraction can be undertaken.

- The impact of over abstraction for irrigation needs to understood, although this is self regulating to some extent since farmers reduce irrigation if borehole yields decline to below economic volumes due to lowering of water levels.

6. MONITORING

Effective groundwater management and monitoring is essential for long term sustainability of the supply and to protect the resource. The NWA requires the Minister to establish national monitoring systems for water resources to collect appropriate data and information necessary to assess:

- The quantity, quality and use of water in water resources
- The rehabilitation of water resources
- Compliance with resource quality objectives
- The health of the aquatic ecosystems
- Atmospheric conditions which may influence water resources, and,
- Other data and information which may be necessary.

Resources currently available for monitoring are inadequate.

DWAF have a regional monitoring network covering part of the dolomite outcrop area in the Delmas area. Catchment wide monitoring is not undertaken and is not presently envisaged due to a lack of funds. However, implementing and then maintaining a monitoring network is fundamental to the management of not only the dolomite but all the other aquifers and will be a significant responsibility of the CMA. A monitoring network of strategically positioned boreholes needs to be implemented without further delays.

Underdeveloped areas, i.e., areas with unutilised groundwater resources development potential can be identified and earmarked for future development. Likewise areas where the available resources are overdeveloped should be identified and alternative water sources considered to alleviate abstraction stress and to augment the groundwater.

The monitoring programme needs to be implemented, maintained and improved following a suitable implementation strategy which will include:

- Undertake a census of all current groundwater monitoring.
- Implement a groundwater monitoring programme at selected key localities, including abandoned mines and important wellfields/boreholes. This will involve water level measurements and water quality sampling.
- Implement strategy of routine abstraction monitoring in areas of heavy groundwater use, i.e., water supply boreholes and wellfields.
- Establish a monitoring protocol to include frequency of water abstraction and water level measurements and groundwater sampling, and the range of constituents to be analysed for, (as a minimum this must incorporate pH, TDS, conductivity, macro anions, macro cations, Fe, F, and NO_3). Samples collected near working and abandoned mines will also need to be analysed for parameters relevant to the mining operation, e.g. pH and SO_4 at old coal mines.
- Integrate any current local monitoring with the catchment wide monitoring programme.

The information will then be used to develop a regional monitoring strategy incorporating both surface and groundwater monitoring to meet the specific situation within the WMA.

- Establish status of existing monitoring programmes
- Integrate all monitoring information within the catchment
- Update the National Groundwater Data Base (NGDB)
- Establish system of data management and responsibility
- Implement groundwater abstraction, groundwater level and groundwater quality monitoring in strategic localities throughout the WMA.
- Determine resources needed to undertake the groundwater monitoring programme.

A data base needs to be established/maintained by the responsible management authority, (the CMA). This data base will record all monitoring data collected in the region and will be the NGDB or compatible with the NGDB. A custodian of the information data base is required.

7. INFORMATION

Availability of up to date information is important for development and management. Information is available from a number of sources, including:

- General background information is available on the published 1:2 500 000 Groundwater Resources of the Republic of South Africa prepared by J.R. Vegter (1995).
- Regional information is available from the published 1:500 000 hydrogeological maps of Johannesburg 2526, Pietersburg 2326 (being revised and republished), Nelspruit 2530 and Phalaborwa 2330. More detailed information for certain areas can be obtained from DWAF.
- More detailed information, especially for communal land areas, can be obtained from the National Groundwater Data Base (NGDB) of DWAF.

Olifants WMA Strategies

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B.1 WATER BALANCE AND WATER RESOURCE RECONCILIATION STRATEGIES

B.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:** As discussed in Chapters 2 and 3, the water resources vary spatially across the catchment. The water resources are substantially regulated and are almost fully developed. There are however still opportunities for the development of water supply dams in the Steelpoort River and/or at Rooipoort on the Olifants River. A number of studies have been undertaken on the surface water resources of the Olifants WMA. A study of the entire Olifants River Basin was undertaken by Theron, Prinsloo, Grimsehl and Pullen (TPGP) with the reports published in 1991 [Ref 1]. Naturalised monthly flow records covering the period 1925 to 1986 were generated for the entire Olifants River Basin in this study. The historic sequences were used to determine the historic yields of the major dams in the system. No stochastic analysis of the yield of the whole system was undertaken during this study. Since the completion of the 1991 Olifants River Basin study, the studies have concentrated on specific areas to address specific issues in the WMA. As part of the Loskop Dam catchment study, the hydrology of the Loskop Dam catchment (Upper sub-area) has been updated to cover the period October 1920 to September 1996 [Ref 2]. Stochastic models have also been fitted to the naturalised flows. The Water Resources Yield Model (WRYM) and the Water Resources Planning Model (WRPM) have been set up for the Upper Sub-area, which have allowed for the determination of the stochastic yields of the major dams and of the system in the Loskop Dam catchment. In addition a mine module has been included in the WRPM, which allows for the impact of mining on the catchment yield and water quality to be assessed. The WRPM was also calibrated to model water quality (sulphate) and can be used to develop management plans for water quality in the Loskop Dam catchment.

The bulk water supply to the Middle Olifants area has been investigated at the pre-feasibility level. During this process the original TPGP hydrology in the Steelpoort catchment has been updated to cover the period 1920 to 1995 and used as input to the WRYM set up for the catchment. The feasibility of the Rooipoort Dam has also been investigated using the WRYM using hydrology covering the period 1920 to 1991. The yield characteristics of the dam were determined using stochastic hydrology.

The WRYM set up for the entire water management area using the historic hydrological sequences has been used to determine the historic yield of the Massingir Dam in Mozambique. This model has also been applied to provide an initial assessment of the impact of the implementation of the ecological Reserve on the yield of the major dams in the system. The hydrology used for this study covered the period 1920 to 1989 dictated by the length of the hydrological records available for the Lower Sub-area. The yield characteristics of the Massingir Dam have not been determined using stochastic hydrology.

The WRPM used by the Department to plan future schemes, investigate the operation of the system and the management of water demands during drought periods has not been set up for the entire WMA. The WRPM has been set up for the Upper Sub-area (Loskop Dam catchment) but as yet is not actively applied to manage the water resources in this area. There is therefore uncertainty regarding the yields of the system.

The WRYM and WRPM are not generally at a high enough resolution to define the availability of local water resources in tributary catchments. These resources would typically be developed to provide water to users located away from the main stem and therefore cannot receive water from the major water supply infrastructure. Models that provide spatial and time step output at a higher resolution will be needed to determine the available surface water resources particularly in stressed areas of the WMA or where the impacts of discharges have to be assessed at a local level.

The water quality of the surface water in the catchment is under threat from a number of land use activities in the catchment. These activities include mining, sewage treatment plant return flows, irrigation return flows, stormwater runoff from urban areas and sediment resulting from poor agricultural practise in some areas of the catchment. The water quality in the Upper sub-area is dominated by the impacts of coal mining activities, in the Middle Sub-area by runoff from rural settlements and erosion due to poor agricultural practise, in the Steelpoort Sub-area by agriculture, rural settlements and mining and in the Lower sub-area by mining and agriculture. The availability of the water in the future could also be affected by water quality.

Areas of alien vegetation have been reported in the Water Resources Situation Assessment Report (WRSAR) [Ref 3] of the WMA. These areas of alien vegetation can be removed to increase the water availability in the WMA.

The specific situations regarding water availability in the Sub-areas are discussed below :-

Upper Olifants Sub-Area

There is extensive opencast and underground coal mining taking place in this sub-area. The mining process, particularly opencast and high extraction underground mining, impacts on the integrity of the rock, sub-soil and soil strata overlying the coal seams creating preferential flow paths for the ingress of water and eliminating any perched aquifers. The overall affect is a higher recharge rate from the surface to the groundwater system than the natural system. This "additional water", although of poor water quality, represents extra water available in the catchment. During the mine operation, this water is pumped out to allow mining to take place and is used on the mining operations, stored or released during floods when capacity is available to assimilate the poorer quality mine water. When mining stops, the mine workings will fill up and the poorer quality water will decant into the river system. If this mine water can be treated to acceptable quality, it will be a source of water that can be utilised in the stressed Olifants WMA.

A number of studies have been funded by the mines, Coaltech and Water Research Commission (WRC) to investigate intermine flow in the coal fields of the Upper Sub-area. These studies have predicted the water quality and quantity of the decant volumes as well as the locations of the decant points.

The water availability in the Klipspruit catchment is affected by return flows from the Witbank Municipality's Ferrobank and Klipspruit Sewage Treatment Plants, discharges of neutralised Acid Mine Drainage from the Brugspruit works and to a lesser extent by decants and seeps from defunct mine workings not collected for treatment at the Brugspruit works. These return flows contribute base flow to the Loskop Dam.

Lower Olifants Sub-area

The base flow in the lower reaches of the Selati River (downstream of Foskor) is dominated by return flows from the Foskor tailings dams. These flows contribute to the base flows in the Olifants River flowing through the Kruger National Park (KNP) particularly during drought periods. Foskor is preparing to implement the phased introduction of water treatment and recycling of the return flows. This will reduce the base flow but improve the water quality in the Olifants River flowing through the KNP.

Groundwater resources:

The groundwater resources in the Olifants WMA are an important source of water in the WMA. The groundwater resources are currently used for the supply of urban and agricultural water requirements, particularly in the rural areas of the WMA. The availability of groundwater varies across the WMA.

The areas that are extensively used are the dolomite areas in headwaters of the Wilge River Catchment for domestic and irrigation supplies. Dolomitic water is used to supply the town of Delmas. The groundwater in the Springbok Flats area in the Middle Sub-area is also well used for irrigation and domestic use. An outcrop of Malmani dolomite is an important source of supply for the Zebedelia Estates. The groundwater resources are reportedly over exploited in these areas.

Some aquifers cross the current WMA boundaries. A management framework should be established to ensure cooperation between affected CMAs and the proper management of the groundwater resource.

	There is still potential for the further development of the groundwater resources. The groundwater maps given in the WRSA report [Ref 3] give an overview of the exploitable groundwater resources and the extent of the link between groundwater and surface water. Detailed studies will be required at the local level to determine the sustainable yield of any groundwater resources that are to be exploited in the future.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The WRYM should be set up for the whole system using the available surface hydrology. The new development options must be included in the WRYM. The results of running the WRYM must be used to determine the need to update the hydrology and introduce more sophisticated models in parts of the WMA. The most appropriate time to update the hydrology will also depend on the finalisation of the verification of existing lawful use and the schedule for the compulsory licencing process.	Dir NWRP (High)
	M2. Develop higher resolution hydrological data and system models for targeted local resources where a smaller time step (than monthly) and spatial discretisation is needed to accurately assess the water availability. Consideration should be given to how this refined data will link to the larger scale database and models.	Dir: NWRP (Medium)
	M3. The WRC, Coaltech and individual mine studies need to be reviewed and incorporated into the Integrated Water Resources Planning Model set up for Loskop Dam to determine the impact on availability and to develop a water quality management plan for the Upper Sub-area (See **Strategy 2.2** for more details**)**.	Mpumalanga Regional Office (High)
	M4. Groundwater will have to be further exploited for rural water supplies. The information in Appendix A provides an overview of the potential groundwater in the WMA. However more detailed groundwater studies will be required at the local level to determine the sustainable yield and management of the local groundwater resource. The impacts on surface water flows due to the abstraction of groundwater must also be addressed in these studies. These studies could be done by the local and district municipalities or in some cases by DWAF	Limpopo and Mpumalanga Regional Offices (High)
	M5. The possibility of developing the deep and alluvial aquifers in the Middle Sub-area should be investigated to provide water for rural water supplies and to meet the short term water requirements of the Middle Sub-area until the new water supply infrastructure is constructed.	Dir. NWRP

	M6. A proper management framework between CMAs in the Limpopo and Olifants WMAs should be established to ensure sustainable management of the aquifers crossing the WMA boundaries.	Limpopo and Mpumalanga Regional Offices (High)
Interfaces:	**References** 1. DWAF Report No PB000/00/3391 "Water Resources Planning of the Olifants River Catchment : Model Runoff Simulation". 2. DWAF Report No PB B100/00/498 "Development of an Integrated Water Resource Model of the Upper Olifants (Loskop Dam) Catchment : Hydrology". 3. DWAF Report No P 04000/00/0101, "Olifants WMA : Water Resources Situation Assessment : Main Report".	

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B1.2 WATER USER REQUIREMENT STRATEGY

Management objective:	Ensure the knowledge base on the water requirement in the WMA is realistic and updated on a regular basis. Furthermore, maintain and update water requirement projection scenarios for planning and management purposes.
Situation Assessment:	**Water use data:** The water use data for the WMA is not currently collected and maintained in a central database. Given the stressed nature of the catchment, this practise should be instituted and the water use of the different sectors checked against projections. Comprehensive detailed observed data on water use for irrigation is not available for irrigation areas not supplied from Departmentally run bulk water supply infrastructure. Similarly the return flow volumes, losses and qualities are not well quantified. The registration of water use has been completed. The process of verification of existing lawful use has not yet started. This verification process is essential input to the compulsory licensing process and the calibration of hydrological models. **Water requirement projections:** The water requirement projections for the four sub areas as given in the NWRS are discussed in Chapter 3. The water requirements for the year 2000 are given in Tables 3.3.1, 3.3.2(a) and 3.3.2(b). Irrigation is the largest water use sector in the WMA. There is uncertainty about the irrigation water requirements from two points of view viz the existing lawful use and the actual water used and return flows from irrigation. The verification process will provide the existing lawful irrigation use. Consideration must also be given to the use of water meters or regular use of satellite imagery and unit irrigation requirements to determine more accurately the irrigation water use. The approach to be used to assess the irrigation water requirements and return flows will be dealt with at the National Level. The next largest user located in the WMA is power generation. There are 6 active Eskom coal fired power stations located in the Upper Sub-area. The electricity demand is projected by Eskom to grow faster than originally estimated. The utilisation and capacity of these power stations is to be increased resulting in an increase in the water requirements. The water requirements are however met with water transfers from outside the WMA. The management of the supply to these stations is carried out at the national level and does not impact on this WMA. The major growth in the water requirements in the WMA will be mining water requirements in the Dilokong Corridor in the Middle Sub-area. The growth will be due to both the direct use by the new mines as well as due to spin off industries and the influx of people into the area. The future water requirements in the Middle Sub-area are being investigated in the Kayamandi Study [Ref 1], which is nearing completion. The urban water requirements have been projected to grow especially in the

Upper Sub-area. The Olifants River has also been earmarked as a source of water to meet the water requirements of Polokwane and Mokopane. There is uncertainty regarding the growth in the projected water requirements for the Middelburg and Witbank Municipalities as well as for the Western Highveld region. The Witbank Municipality projection for 2025 has been substantially increased and Middelburg Municipality lowered [Ref 2]. Substantial growth was reported for the Western Highveld Region [Ref 2] in the Loskop Dam study. These values were subsequently revised downwards during the VRESS study [Ref 3]. The approach used to determine these projections needs to be reviewed with the local authorities as well as the level of WC&DM implemented as these requirements have an impact on the timing and quantity of supply augmentation.

Water requirement issues specific to the sub-areas are discussed below.

Upper Olifants Sub-area

The water requirement projections for the major towns, particularly Witbank and Middelburg in the Loskop Dam catchment were determined during the Loskop Dam catchment study. These projections were revised during the Eastern sub-system (VRESS) study. The water requirements for Middelburg being lowered and the Witbank requirements increased.

A number of the towns and mines in this sub-area are supplied with transferred water. A number of mines will be approaching the end of their lives in the next 10 to 20 years. This will impact on the sustainability of these towns many of which house mine staff. The water requirements of these towns will therefore also be impacted on.

There is therefore uncertainty about the projected water requirements in this sub-area. The projections differ significantly from those in the NWRS.

Middle Olifants Sub-area

The crops in this area are being changed in many cases from cash crops to more permanent crops such as citrus. There have also been improvements in the canal systems in terms of loss reduction. These reductions in losses together with reductions in return flow volumes due to crop changes and possibly irrigation methods could effect the return flow volumes to the Olifants River. The future water requirements and the cropping methods need to be determined.

There is uncertainty as to the water requirement projections in the Western Highveld Region. Shortages in supply to this area have been reported. The water requirements have been investigated in the Western Highveld Augmentation Study and a WC&DM study has been initiated.

There is recent rapid expansion of mining activities in the Dilokong Corridor in the Middle Sub-area. A number of platinum and chrome mines are being established in these areas. This has led to an influx of people into the Burgersfort area in the Steelpoort Sub-area. Many of the mines are establishing housing estates in Burgersfort. The water requirements of the mines for operation and the people operating the mines in this dry region of the WMA are growing. Discussions have been held with the mining companies and a study has been launched to more accurately determine the water requirements in these areas. These water requirements are essential input to the planning of the further infrastructure. The Kayamandi study [Ref 1] will provide information in this regard.

	Lower Olifants Sub-area The water requirements in the Lower Sub-area are dominated by the industrial and mining demands of Palabora Mining Company (PMC) and Foskor. Lepelle Northern Water manages the water infrastructure supplying this area from the Phalaborwa Barrage. The water requirements of PMC have changed with the advent of underground mining while Foskor is embarking on a program of treatment and recycling of the effluent discharges to the Selati. The extent of the changes in the water requirements of this sub-area needs to be investigated.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The Water Requirement Assessment Study recently undertaken [Ref 1] has been initiated to determine the water requirements in the Middle and Steelpoort Sub-areas. The initial results are becoming available with the level of assurance of the different water users still to be determined. These results should be brought into the water reconciliation and the planning of the new water infrastructure.	Dir. NWRP (High)
	M2. The water demand study of the Western Highveld study has been completed as part of the Western Highveld Augmentation Study. The results of this study need to be reviewed to address the water projections and water reconciliation issues in this area.	Dir. NWRP (High)
	M3. The water requirements of the towns in the Upper Sub-area need to be confirmed. This should be done by looking at the WSDPs and through direct contact with the local authorities.	Mpumalanga Regional Office (High)
	M4. A central database to manage the water projection information should be developed and the actual water use compared to the projections on an annual basis.	Dir NWRP (High)
	M5. The verification process to determine existing lawful use should be started. Once completed comparisons should be made between the lawful use and the water use data applied in the water resource system and hydrological models.	Mpumulanga Regional Office (High)
	M6. See International Strategy B5.1 for management actions regarding International Requirements.	

	M7. An investigation of the water requirements of the Phalaborwa area needs to be carried out to update water requirements.	Dir NWRP (Medium)
Interfaces:	**References** 1. DWAF Report No PB 1 B000/00/6906, "Water Requirements Assessment Study for Future Economic Development in the Dilokong Corridor and Environs". 2 DWAF Report No PB B100/00/0298, "Development of an Integrated Water Resource Model of the Upper Olifants River (Loskop Dam) Catchment : Summary Report". 3 DWAF Report No : PC110/00/0800, "Vaal River System : Pre-feasibility study to determine the need for Augmentation of the Eastern Sub-system : Main Report", 2001	

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B1.3 WATER RECONCILIATION STRATEGIES

Management objective:	Maintain a balance between the water requirements and water availability (now and in the future) by applying the priorities defined in the National Water Act. At the same time ensure equitable sharing of the water as well as making appropriate allowance for poverty eradication initiatives.
Situation Assessment:	**Surface Water** The reconciliation of the water requirements and availability as presented in Chapter 3 of this ISP document highlights the water shortage in the WMA. There is currently a deficit of 192 million m^3/a in the WMA, which includes the impact of the Reserve as determined using the desktop methodology. The deficit was determined using the water requirement information, which does not include the effects of WC&DM. The only release currently made for the ecology is a flow of 0,54 m^3/s released from the Phalaborwa Barrage to the Kruger National Park. The impact of the deficit on other users is thus far less than implied by the figure of 192 million m^3/a. However even without the allowance for the ecological Reserve, the system already has a small deficit. As shown in Table 3.3.2(a) and 3.3.2(b), the water requirements in the WMA are growing strongly and are expected to continue into the future. The water balances given in Tables 3.4(c) and 3.4(d) show the increase in the deficit for both the low and high growth scenarios. To alleviate the current problem and provide for future growth, a decision has been made to increase the yield of the system by raising Flag Boshielo Dam as well as to build another major dam either at the Rooipoort site on the Olifants River and/or at the De Hoop site in the Steelpoort River (Ref 1). DWAF is in the process of finalising the planning for the Rooipoort/Steelpoort scheme. The planning will use the latest water requirement information for the Steelpoort and Middle Olifants Sub-areas, which will be provided by the study (Ref 2) which is nearing completion. The results of this planning will change the water balances for the Middle Olifants and Steelpoort Sub-areas as given in the NWRS (Shown in Tables 3.4(b) and 3.4(c)). The dams will be planned to meet the ecological water requirements (EWR). The dams however will only be expected to supply water to meet their proportional contribution to the EWR. Releases from other major dams and contributions from the other tributaries will make up the balance of the EWR over time. The new water supply infrastructure will make water available in the Middle Olifants and Lower Olifants along the main stem of the Olifants River. The water from these dams will however be very expensive and will have to be allocated to users that can pay the full cost of the water. It is also very likely that this dam development will be the last major development that will be done in the WMA and water will have to be allocated judiciously. The yield can also be transferred to users in Mokopane and Polokwane, but such transfers will significantly add to the cost of the water making it even more important that water is used efficiently. Other supply options in these areas must be investigated fully before any transfers are approved.

The new infrastructure will only address the shortages downstream of the dam/s and the requirements higher up in system will have to be solved in other ways. The options are local dam development, groundwater, trading, removal of aliens, re-use of mine water and WC&DM.

Groundwater

Groundwater resources are an important source of supply in the WMA. Groundwater is particularly important in the supply of water for domestic and agricultural use in the rural areas. Groundwater is used extensively from the dolomites in the Delmas area and in the Springbok Flats. The conjunctive use of surface and groundwater could play an important role in meeting the water requirements in the rural areas of the catchment. The availability of groundwater as a resource and the quantities currently used are not well quantified.

There is the potential to use the extensive (estimated at 2 billion m^3) storage volumes available in the mine workings in the Upper Sub-area to meet the water requirements. The water stored in these workings could be used to supply (with treatment) surface water supplies during periods of drought.

Reconciliation Strategy

Current (Year 2000) situation

The current situation in the WMA is one of deficit as shown in Table 3.4(a). These deficits have been calculated with the effect of meeting the EWR on the yield. However even if the calculation had been done without including the EWR a small deficit would still have resulted.

The reconciliation between the existing use and the EWR is an important issue which has to be resolved. A balance will have to be found between EWR needed to maintain a sustainable river system and the social, financial and economic impacts of having less water for abstraction. The compulsory licencing process will eventually have to be used to achieve a balance. This will involve the development of innovative solutions through a full participation process involving all users. The efficient use of water will obviously feature strongly in these solutions.

However, it must be realised that this WMA (even without the allowance for the EWR) is under water stress. No more abstractions can therefore be allowed for the resource at the current level of water infrastructure development.

The current approach to the operation of the system is to maintain the status quo as far as the implementation of the ecological Reserve is concerned. The good quality water from the Mohlapitse River and the water released from the Blyde River will be used to maintain the current flow requirements in the reaches of the Lower Olifants Sub-area passing through the Kruger National Park. The operation of the system must be optimised to make releases count in terms of meeting the IFR requirements wherever possible. The future environmental management classes and the implementation of the ecological Reserve will be determined during IWRM process.

Future Reconciliation Situation

Tables 3.4(a) and 3.4(b) show an increase in the deficit due to growth in the water requirements in the Upper Olifants, Middle Olifants and Steelpoort Sub-areas. This is due to growth in the urban water requirements in the Upper Olfants Sub-area and mining expansions in the Middle Olifants and Steelpoort Sub-areas as discussed in Strategy 1.2.

The broad principles to be followed in assessing an application for new water are :

- The practise of Water Conservation and Demand Management (WC&DM) must be practised by all users ie water must be used efficiently.
- Trading of water allocations between users, especially within the same sector will be permitted. Trading between sectors is problematic. As an example, if the future mining requirements were to be provided with water through trading from agriculture, thousands of hectares of irrigation would be lost with the concomitant impact on employment and the social and economic fabric of the area. This level of trading would be ruled out as an option.
- Removal of streamflow reduction activities such as alien vegetation to make water available for other uses.

It is however clear that the magnitude of the future water requirements is such that further development of the resource, both groundwater and surface water is inevitable.

The available modelling tools need to be consolidated to set up the WRYM and WRPM for the entire WMA. The modelling of water quality in the form of TDS and sulphate should be included in the modelling system. This modelling system will be needed to assess the planned infrastructure, implementation of the ecological Reserve, for use in the compulsory licensing process and the operation of the system.

Water reconciliation issues specific to Sub-areas are discussed below.

Upper Olifants Sub-area

Yield analysis undertaken for the Upper Olifants Sub-area using the WRYM and stochastic hydrology showed that the yields from the dams in this sub-area are currently meeting the water requirements at an adequate assurance of supply. However based on the available water requirement projections, the analysis also showed that the Witbank Dam, Bronkhorstspruit Dam and Loskop Dam will not be able to supply the projected demands at an adequate assurance of supply by 2005 [Ref 1].

The application of the WRPM to the Witbank Dam catchment showed that curtailments to the water supply from the dam would reach unacceptable levels by 2005, which implies that the Witbank Dam needs augmentation. The principles outlined above must be applied to the supply to Witbank before the transfer of water from outside the catchment to support Witbank can be considered. The possible use of Dooringpoort Dam or a supply from Middelburg Dam through the existing pipeline should be considered.

The mining industry in the catchment has also been investigating a number of initiatives to use the current and post closure excess decant water from the mine workings. The initiatives include treatment and direct reuse and irrigation. There are also large storages in the underground workings that can sustain the supply during dry periods. These elements need to be brought into a catchment management strategy for the sub-area in which water quality and the yield of the system can be considered. The use of water transferred from the Vaal Dam via the pipeline to be constructed from Vaal Dam to the Trichardtsfontein Dam should also be considered as a source of supply for the Upper Sub-area. The water supplied from this source will be at full cost.

The main demand on the Loskop Dam is irrigation with water also being supplied to towns such as Groblersdal and Marble Hall as well as the Western Highveld region in the Middle Sub-area. The Loskop Dam is currently over utilised with the water requirements exceeding the 20 year recurrence interval yield of the system. No increase in supply from this dam can be considered. The only consideration could be the trading of irrigation water rights between users.

Middle and Steelpoort Sub-areas

Substantial growth in the water requirements in the Western Highveld Region in the Middle sub-area has been predicted. Currently Bronkhorstspruit Dam contributes to the supply to this area. The Western Highveld Augmentation Study has been initiated to investigate the reconciliation options in this area. The options being considered are the import of water from Erwat in the Upper Vaal WMA to Bronkhorstspruit Dam, supply from the Apies/Pienaars catchment, further development of the local groundwater resources and the Delmas dolomites, WC&DM and the expansion of the Rand Water network. The option that is to be implemented is the expansion of the Rand Water network by extending the Mamelodi pipeline to connect directly into the water supply infrastructure.

The water requirements in the Middle and Steelpoort Sub-areas are growing rapidly with the development of mines and the associated influx of people. The development of the mines has a beneficial economic input into the Olifants WMA, in particular the poorer Middle and Steelpoort Sub-areas. The mines will contribute significantly to the local and national economy and to poverty eradication. The development of these mines requires a significant volume of water at a high level of assurance. This is not readily available to allocate given that these catchments are in deficit and this water must be "found" if development is to take place. Trading and groundwater development are options currently being exercised. The trading option has been the temporary allocation of water allocated to the abandoned irrigation schemes in the sub-area from Flag Boshielo Dam. Once Flag Boshielo Dam has been raised, the increased yield will supply the mines and the water will be returned to the irrigation schemes, which are in the process of being revitalised. The removal of a significant area of invasive alien plants is also being considered as a way of adding water to the system, which could then be allocated.

The future water supply infrastructure of a dam at Rooipoort and/or at De Hoop on the Steelpoort River ([Ref1]) will be used to reconcile the deficit in these areas in the long term. However the final planning, construction and filling of the dams could take between 8 years and 10 years.

Lower Oifants Sub-area

The water requirements of the Phalaborwa area in the Lower sub-area are met by abstractions from the Barrage with support from the Blyderivierspoort Dam. This system is currently in balance. However the updated future water requirements in this area need to be brought into the water balance to determine the future water reconciliation situation.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The impact of WC&DM on the water requirements and return flows needs to be assessed (See Strategy B4.1)	(see referenced Strategy)
	M2. An assessment of the level of the available modelling tools needs to be undertaken and the tools upgraded to an appropriate level to satisfy the operational and planning requirements for the WMA.	Dir: NWRP (High)
	M3. The DWAF must insist on detailed groundwater studies and management plans where groundwater resources are to be developed for local supplies. These studies should also address the extent of the link between surface and groundwater.	Regional Offices (High)
	M4. A study is underway to reconcile the water requirements and water availability to finalise the water infrastructure to be implemented in the Middle Olifants and Steelpoort Sub-areas	Dir NWRP (High)
	M5. The water reconciliation approach needs to be communicated to the water users in the WMA and implemented.	Regional Offices (High)
	M6. The water reconciliation situation in the Upper Sub-area needs to be addressed as an integral part of the development of a plan to manage the water quality in this sub-area. (See Water Quality Management Strategy 2.2)	Dir NWRP (High)
Interfaces:	**References** 1. DWAF Report No PB500/00/1398 "Pre-feasibility study on bulk water supply in the Middle and Steelpoort River Area". 2. DWAF Report No PB1 B000/00/6906 "Water Requirements Assessment Study for Future Economic Development in the Dilokong Corridor and Environs". 3. DWAF Report No PB B100/00/0298, "Development of an Integrated Water Resource Model of the Upper Olifants River (Loskop Dam) Catchment : Summary Report".	

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B1.4 TRANSFERS AND RESERVATION OF WATER

Management objective:	Secure sufficient transfers into the Olifants WMA to augment the local water resources and reserve adequate water resources to support the transfers out of the WMA
Situation Assessment:	**Existing transfers into the Olifants WMA:** The inter basin transfers (Shown in Figure 2.1) into the Olifants WMA are listed below: 1. There are transfers from the Grootdraai Dam, the Komati system and the Usutu system. These transfers are used to supply the power stations of Kriel, Matla, Kendal, Duhva, Komati, Arnot and Hendrina. A number of towns and coal mines located along the pipeline routes in the Olifants WMA are supplied with water from the transfer schemes. 2. Transfer from the Letaba-Luhvuvu into the Lower Olifants sub-area to meet mining and urban demands. The NWRS requires that water will be reserved in the source catchments to continue with these transfers. **Existing Transfers out of the Olifants WMA are** : 1. Transfer from the Olifantspoort to Lebowakgomo and Polokwane in the Sand River catchment. 2. Transfer from the Premier Mine Dam to Cullinan and Premier Diamond mine The volumes of water transferred (year 2000) are listed in the Table below.
Situation Assessment: (Continued)	(see table below)

Description of transfer	Use	Volume (million m^3/a)
Transfers in		
Ebenezer Dam to Lower sub-area	Urban	0,1
Mogoboya Ramadike Dam to Sedan	Urban	0,2
Groot Letaba River to Consolidated Murchison Mine	Mining	0,4
Grootdraai Dam to Matla power station	Eskom	35,4
Jericho Dam to Kendal power station	Eskom	4,0
Jericho Dam to Matla power station	Eskom	32,0
Nooitgedacht Dam to Duhva power station	Eskom	40,0

Nooitgedacht Dam to Hendrina and Arnot power stations	Eskom	45,0
Total in		**172,1**
Transfers out		
Olifantspoort weir to Polokwane	Urban	2,6
Bronkhorstspruit Dam to Premier Diamond Mine	Mining	2,7
Bronkhorstspruit Dam to Cullinan	Urban	2,3
Total out		**7,6**

Possible future transfers into the Olifants WMA are:

1. The water resources in the Upper Sub-area are fully utilised with little opportunity to further develop the water resources. The sources of supply to a number of the towns in the sub-area, in particular Witbank and Middelburg will need augmenting. After the implementation of WC&DM, trading options, mine water and proof that the local resources are fully utilised, the growing demands will have to be met by transfers at full cost. The exact volumes need to be determined with the planning undertaken at the national level.
2. The water demand of the power stations is increasing due to increase projections in electricity demand. The supply to the power stations is an issue to be planned, implemented and operated at a national level. The planning to augment the supply to Sasol Secunda and Eskom has advanced to a point where a decision is imminent on the construction of a pipeline from Vaal Dam to Trichardsfontein Dam. The future water requirements of the mines and towns in the Upper Olifants Sub-area could be supplied from this pipeline.
3. The transfer of water from the Apies/Pienaars system into the Elands River or possibly a supply from the Vaal Dam pipeline to meet the demands of the Western Highveld was being considered as options in the Western Highveld Augmentation study. The supply in this area is however to be augmented by extending the Mamelodi Rand Water pipeline into the area.

Future transfers out of the Olifants WMA:

1. Transfer from Flag Boshielo Dam to Mokopane and Polokwane.

   The strategy to be followed for transfers is:

- The growth in water requirement for the power stations will be met through transfer possibly via the Vaal Dam pipeline.
- Other transfers into the WMA will only be considered after all local options of supply have been fully exhausted.
- Transfers out of the WMA will only be considered after their local sources have been optimally utilised.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The Department needs to actively engage with the towns in the Upper Sub-area to inform them of the water reconciliation position in the Olifants WMA. The Department must inform the water users of their options for supply, the cost implications and the licensing process to be followed.	Mpuma-langa Regional Office (High)
	M2. The Western Highveld study has been initiated and will address the future supply options for the Western Highveld Area.	Dir NWRP (High)
	M3. Given the stressed nature of the Olifants WMA, transfers to Mokopane and Polokwane cannot be implemented at this stage. The transfer is a possibility in the future with the construction of the new dam infrastructure development.	Dir NWRP (High)
	M4. The future volumes of the transfers into and out of the WMA need to be determined.	Dir NWRP (High)

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B1.5 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 Olifants WMA.
Situation Assessment:	*Status Quo:* Compulsory licensing is a procedure, stipulated in the National Water Act, with the purpose to rectifying imbalances in the utilisation of the water resources in a catchment. During compulsory licensing water could, without compensation, be redistributed to ensure sufficient water for the Reserve, redress inequities and correct on over allocation of the resource to achieve a balance of available water and requirements. The priority for compulsory licensing will be determined after the Flag Boshielo raising and the construction of the new water infrastructure (Rooipoort/ Steelpoort dams) has been finalised as well as the after verification of existing lawful use and the setting up the system models has been completed. Implementing Compulsory Licensing in a catchment is a significant undertaking that require considerable resources and the Department of Water Affairs and Forestry must therefore prioritise catchments for Compulsory Licensing due to human resource and other constraints. The Olifants WMA is a stressed catchment. The further development of water resources in the WMA will make up the current deficit and meet some of the projected water requirements. Compulsory licensing therefore has to be undertaken in the WMA to enable the ecological Reserve to be implemented and future water to be supplied for equity such as the small scale irrigators. The compulsory licensing process depends on a number of inputs, which include water availability (updated hydrology and groundwater resources), models, verification of existing lawful use, accurate projections of future water requirements and the comprehensive ecological Reserve. In the case of the Olifants WMA the water needed for international obligations is also an input.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The Department needs to start communicating with the water users that a compulsory licensing process will be undertaken in the catchment. The compulsory licensing process needs to be explained.	Regional Offices (High)
	M2. The necessary basic inputs needed in a compulsory licensing process need to be put in place and a schedule for implementation needs to be determined.	Regional Offices (High)

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B.2 WATER RESOURCES PROTECTION MAIN STRATEGY

B.2.1 RESERVE AND RESOURCE QUALITY OBJECTIVES

Management objective:	A preliminary ecological Reserve has been determined for the Olifants River WMA using the comprehensive methodology. An implementation schedule of the ecological Reserve needs to be determined in the light of the stressed nature of the catchment.
Situation Assessment	As mentioned throughout this ISP, it is important that water be used to stimulate economic growth, but on the other hand make sure the health of the ecology and the environment at large are not compromised. The NWA makes specific reference to the importance of the natural riverine ecosystems and their role in supporting all forms of life. The water for the Reserve (basic human needs and the water requirements of the ecology) has been prioritised in the National Water Act to reflect this importance. The only release currently being made for ecological reasons in the WMA, is a minimum flow of 0,54 m^3/s (17 million m^3/a) from the Phalaborwa Barrage to the lower reaches of the Olifants River passing through the Kruger National Park. Agreement has been reached with the RDM office of DWAF concerning the ecological flow releases from the raised Flag Boshielo Dam. The required release structures have been included in the dam design so that the maximum ecological release requirement of 18 m^3/s can be achieved. The Desktop estimate of the ecological Reserve was used to determine the available water used in the water balances for the WMA. These water balances as presented in Chapter 3 of this ISP, showed that large deficits would result if the Reserve were to be implemented. The Desktop estimate was followed by a determination of the ecological Reserve using the comprehensive methodology and applying the preliminary classification system available at the time of determining the Reserve [Ref 1] The reserve considered both flow and water quality but has not been optimised by assessing the socio-economic impacts of implementing the Reserve. Due to the large impacts of implementing the Reserve on the water reconciliation in the WMA, an incremental approach is to be adopted to the implementation of the Reserve. The implementation steps are as follows :- • The current releases to the KNP must continue. • The operating rules for the Flag Boshielo Dam will be determined and releases will be made after the raising has been completed. Monitoring and controls must be put in place to ensure that the ecological releases pass down the whole river. • The preliminary Reserve determined using the comprehensive

	methodology will be optimised by: - Considering the socio-economic impacts of selecting various ecological management classes. - Determining the relative contributions to be made by the tributaries from a quality and quantity point of view for the Reserve. - Determine the releases and operating rules for the new dams. • Release from new dams of their proportional contribution to the ecological water requirements. • The water quality and quantity requirements and releases for the Reserve in the Upper Sub-area will be considered during the study to develop a water quality management plan for the area. • The final implementation of the Reserve will be completed during the compulsory licencing process. A specific issue relating to the implementation of the Reserve, is the operation of the Phalaborwa Barrage. The Barrage is sedimented up due to excessive sediment loads from upstream. This makes the operation of the sluice gates at the Phalaborwa Barrage to meet the ecological Reserve flow requirements difficult. A sediment management plan is required for the Barrage to achieve the required downstream flow patterns at an acceptable water quality as far as sediment is concerned.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The current approach in terms of providing water for ecological flows will be maintained. However the operation and monitoring of the system will be reviewed to optimise the provision of water to meet the ecological flow requirements.	Dir NWRP (High)
	M2. The future management classes and the implementation schedule for the Reserve will be determined during the process of the IWRM and compulsory licensing.	Regional Offices (High)
	M3. A sediment management plan needs to be developed for the Phalaborwa Barrage.	Regional Offices (High)
Interfaces:	**References** 1. DWAF Report No PB000/00/5399 "Olifants River Ecological Water Requirements Assessment : Main Report".	

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B.2.2 WATER QUALITY MANAGEMENT

Management objective:	The Department has a mandate to manage water resources in a sustainable manner. In other words, it realises that in its pursuit to stimulate development and socio-economic growth, that there will be a negative water quality impact on the environment. The main objective is therefore to ensure a sound and reasonable balance between development impacts and the protection of the resource. Fitness for use by all users (especially downstream users) and protection of the natural ecosystems must be used as the basis for strategy development.
Situation Assessment:	The water quality of the surface water in the WMA is under threat from a number of land use activities in the catchment. These activities include mining, sewage treatment plant return flows, irrigation return flows, stormwater runoff from urban areas and sediment resulting from poor agricultural practise in some areas of the catchment. In general across the WMA, the stormwater runoff and sewage treatment plants associated with the urban centres in the WMA contribute nutrients and microbiological contamination to the receiving water. These are often associated with poorly maintained and overloaded sanitation systems. The approach to the management of water quality in the WMA is to develop Water Quality Management Plans for sub-catchments in a phased manner. The approach used is to undertake a situation assessment as a first phase followed in subsequent phases by the development of the management plan. During this process water quality objectives (WQO) are set at key points in the sub-catchments. The WQO are based on the DWAF water quality guidelines and in some cases input from a public consultation process. The management plan developed is to maintain the WQO or to achieve them in a phased manner. **Upper Olifants Sub-area** The water quality in the Upper Sub-area of the WMA is dominated by the intensive coal mining activities. The mining is currently located in the Witbank and Middelburg Dam Catchments as well as the Spookspruit and Klipspruit Catchments. Currently the coal mining activities in the Wilge Catchments are low and the water quality is good in this catchment. The water quality in terms of salinity has deteriorated in the Witbank and Middelburg Dams over time. The deterioration in these dams has been managed with the introduction of the controlled release schemes in these catchments. The acidic decants and seepage from many of the old underground mine workings in Klipspruit catchment are collected and neutralised at the Brugspruit WTW before discharging to the Brugspruit (a tributary of the Klipspruit). A White Paper was produced describing a phased approach for the management of water quality in the Klipspruit. The water quality in the Loskop Dam is being maintained at a satisfactory level by the good quality water in the Wilge River.

The quality of the mine water varies depending on the local geology. The mine water is acid in the Klipspruit, Spookspruit and parts of the Middelburg Dam catchment. Associated with the low pH waters are heavy metals such as iron, aluminium, and manganese. Mine water is generally high in dissolved solids with sulphate the dominant or indicator anion and calcium and magnesium the cations. Some of the waters contain high sodium particularly in the Middelburg Dam catchment.

The information collected during the Loskop Dam Study indicated that at 1995 development levels, the coal mines generate some 8 million m^3 of excess mine water during an average rainfall year. These volumes of water are currently managed by a controlled release scheme established in the Middelburg and Witbank Dam catchments. The principle upon which the scheme is based is to make releases of neutral mine water during periods of high flow when assimilative capacity is available in the river system and the downstream dams. The tons of salt that can be released is calculated using water quality objectives established during the development of the Water Quality Management Plans for the Middelburg and Witbank Dam Catchments [Ref 1]. This approach is successful in handling excess water during medium to high rainfall periods. During dry periods, there is insufficient assimilative capacity to deal with the excess water.

Estimates have been made that post closure some 171 000 m^3/d (62 million m^3/a) will be realised as decant from the mines in the Loskop Dam catchment. If these volumes of water are not managed, the impact on the water quality of the surface water resources of the upper sub-area will be significant. In addition to the EMPR and licensing processes used by Department of Water Affairs and Forestry to manage the mine water, the coal mining industry through Coaltech have initiated a number of studies which includes the use of excess mine water for irrigation, forestry woodlots to intercept seepage from tailings dams, feasibility studies of treatment processes and increasing the re-use and recycling of mine water.

There are 6 active coal fired power stations in the Olifants River catchment. The activities regarding pollution of surface and groundwater resources by the Power Stations is managed by means of licensing procedures. The atmospheric deposition of emissions from the Power Stations have been cited as a source of salinity both in the Olifants and the Upper Vaal WMAs [Ref 2].

Middle Olifants Sub-area

This area is characterised by agriculture and extensive rural settlements. The agriculture includes commercial irrigation particularly from the Loskop Dam. The water quality problems in this sub-area include salinity issues, sedimentation and nutrients. There are a number of mines being established in this sub-area.

The impact of irrigation return flows on the water quality is not well quantified. The return flows are thought to contribute nutrient loads and possibly pesticides and herbicides to the surface water resources.

High nutrient concentrations have been measured in the groundwater in this sub-area. This is possibly due to pit latrines.

The sedimentation problems are associated with poor land practise such as overgrazing and poor agricultural practises. The rivers are sedimented up and water infrastructure has to be specifically designed to manage sediment. Such a structure is the Leballelo weir on the Olifants river where settlement tanks had to be constructed on the banks of the river to treat the water before being pumped to the mines. There are sediment problems at the Phalaborwa Barrage which present problems in making ecological flow releases to the Kruger National Park.

The management of the pollution related to the mining activity in the sub-area is managed by means of the EMPR and licensing processes. Consideration should be given to the setting up of monitoring programs to ensure compliance particularly with the establishment of the new mines.

Steelpoort Sub-area

The predominant land uses in this sub-area are agriculture, mining and rural settlements. There are also mineral processing plants associated with the mines in the area. The water quality has salinity, nutrient as well as some heavy metals. The mining industry is being managed by means of EMPR and licensing process which has improved the water quality situation in the sub-area.

Lower Olifants Sub-area

The land use in the Lower sub-area includes mining located around Phalaborwa and in the upper reaches of the Selati river (Key Area 16) as well as agriculture practised along the banks of the Olifants River (Key Area 14) and in the Blyde River (Key Area 15) catchment. The water quality in the Lower Selati at Phalaborwa is influenced by the return flows from the mining activities in particular Foskor. The water quality problems are being addressed through the licensing process with plans being prepared by Foskor to treat and recycle much of its water.

The water quality in the lower reaches of the Olifants River is generally of reasonable quality. The quality is being maintained by the good quality water from the Mohlapitse River and the Blyde River.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** A study needs to be initiated to develop a water quality management plan for the Upper sub-area. This plan should result include water quality management and address the water reconciliation issues in the sub-area.	NWRP
	M2. The controlled release scheme will continue to be used to manage the excess mine water generated in the Upper Sub-area until the catchment management strategy is developed for this area. **(Issue 3)**	Mpuma-langa Regional Office (High)
	M3. Atmospheric deposition and its impacts on the water resources will be looked at the national level. The EIA process will be used currently to assess control emissions in terms of air quality	National level
	M4. Irrigation impacts in terms of return flows will be quantified with the implementation of research projects and monitoring programs. The research projects will be implemented at the national level while the monitoring will be implemented by the Regional Office	Regional Offices (High)
	M5. A communication approach will be adopted whereby the Department through the Forums, WSDP and licensing processes will influence the priorities and resource allocations of the local authorities to address the stormwater, solid waste and sewage treatment plant water quality issues.	Regional Offices (High)
	M6. A similar co-operative governance approach will be adopted with the Department of Agriculture as far as land use planning and practises are concerned. The existing water quality models need to be expanded to cover the whole WMA.	Regional Offices (High)
Interfaces:	**References** 1. DWAF Report No WQ B100/000/01/93 "Olifants River Basin " Technical support document for Witbank Dam water quality management plan". 2. Herold, CE and Görgens, A. (1991), "Vaal Dam salinity assessment with particular reference to atmospheric deposition" prepared by Stewart, Sviridov and Oliver in association with Ninham Shand for DWAF.	

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B.3 WATER USE MANAGEMENT MAIN STRATEGY

B.3.1 SCHEDULE 1 WATER USE STRATEGY

Management objective:	To optimise the use of Schedule 1 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 Schedule 1 category would save resources (time and money) by not having to apply for and process licences for specific low impact water use activities.
Situation Assessment:	**General** **Schedule 1 of the National Water Act (NWA)**, permits the use of relatively small quantities of water, mainly for domestic purposes (including non-commercial gardening and stock-watering), but also allows use in emergency situations and for certain recreational purposes. The Act does not specify generally-applicable numerical limits to any of the Schedule 1 uses. The extent of such uses must however be reasonable with regard to the users' needs, and not excessive in relation to the capacity of the resource and the needs of other users. Such limits may, if necessary, be determined locally, to suit local needs and local circumstances. Item 2(e) of Schedule 3 allows a catchment management agency, after notifying and consulting Schedule 1 users, to place limits on the taking of water. Whilst there is no formal requirement for users to register a Schedule I use, catchment management agencies will have to assess the extent of the uses, and impose limits on them where it is necessary in particular areas. Smallholder subsistence irrigation (ie vegetable gardens for own use and poverty eradication) is classified as Schedule 1 use. There is an extensive rural population in the WMA surviving by subsistence farming. Schedule 1 water use is important for the development of these small scale farmers. This section of the WMA population may trade in crops for their own use. A definition of the commercial activity allowed under Schedule 1 needs to be established. Given the stressed nature of the Olifants WMA , compliance control measures are required to ensure users adhere to the water use conditions that are permitted under Schedule 1 water use. Particular attention will be given to the use of water for the irrigation of large gardens associated with the properties being established along the Olifants River in the Lower Olifants Sub-area.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** A definition of the extent of commercial activity that can be undertaken using Schedule 1 water is being developed at the National Level	Regional Offices (High)
	M2. Develop and implement compliance control measures to enforce Schedule 1 water use conditions or persuade users to apply for a water use Licence. Particular attention will be given to the properties along the Olifants in the Lower Sub-area.	Regional Offices (Medium)

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B.3.2 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.
Situation Assessment:	**General** A general authorisation allows limited water use, conditionally, without the need for a licence. Limits are placed on water use under general authorisation depending on the nature of the use, and the capacity of the resource to accommodate the use without significant degradation. For most water uses the extent of use will be different at different locations, because the quantity of water available for use, and its quality, varies. In addition to the limits placed on the use, additional conditions (relating, for instance, to monitoring and reporting requirements) may also be attached to general authorisations in terms of section 29 of the National Water Act (NWA). General Authorisation applies for a limited time period, during which time they may be reviewed and amended, and after which they must be revised to suit changed circumstances or be extended. The general authorisations are currently being reviewed. Given the stressed nature of the WMA, no general authorisations for abstraction and storage from surface water have been promulgated. The general authorisations should be developed specifically for the WMA. The responsibility lies with the Regional Office to develop general authorisation for the WMA.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. The Regional Office must review the existing General Authorisations and make amendments as needed.	Regional Offices (High)

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B.3.3 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 licences should be considered in accordance with the framework as presented below:
Situation Assessment:	**Considerations for water abstraction licences:** The Olifants WMA is stressed and in deficit. No licences can therefore be considered for additional water above the existing lawful unless a local groundwater resource can be developed to meet the additional water requirement. The impact of the development of this local water resource on the yield of the system will have to be determined before a licence can be issued. The principle to be adopted in meeting requests for water is the trading of water allocations between users and uses after the application of WC&DM and the development of local groundwater resources has been demonstrated by the applicant. The following should be considered :- • Trading of water rights (including afforestation). The purchase of water rights from the irrigation sector in particular should be considered. However, DWAF will have to carefully assess the socio-economic impacts of the selling of water rights between sectors. • Addressing flow reduction activities such as alien vegetation. The removal of alien vegetation or afforestation can make additional water available in the system, which could potentially be abstracted.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. The trading policies must be applied in considering a licence application.	Regional Offices (High)

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B.4 WATER CONSERVATION AND DEMAND MANAGEMENT MAIN STRATEGY

B.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 the Catchment Management Agency (and indeed DWAF) to conserve water and avoid or delay the construction of further expensive schemes for transfers and storage when these may not be necessary if water is used efficiently.
Situation Assessment:	**National Perspective:** 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 that are backed by knowledge gained through pilot studies carried out in selected sectors. **Olifants River WMA Perspective:** WC&DM is actively promoted by the Department of Water Affairs and Forestry through the EIA, EMPR and licencing process in the mining and industrial sectors. The re-use or recycling of water is one of the cornerstones of the hierarchy of water quality management for the mining and industrial sectors. The mines and industries have in many instances embraced recycling and the volume of water used per unit product produced has been adopted as a key performance indicator. The extent of the application of WC&DM in the WMA in the local authorities and the agricultural sector are not fully known and therefore the extent of the savings that can be achieved by applying WC&DM is not established. 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 flow in the receiving streams. The extent of the savings that can be made through WC&DM in the Olifants WMA need to be determined. In the water reconciliation strategy, a period of about 10 years will exist in the Middle, Steelpoort and Lower sub-areas during which a deficit in the water balance exists until the new water supply infrastructure is operational. In the Upper sub-area the water reconciliation showed that the system is currently under stress in places. The water resources in the Upper sub-area are developed with only local groundwater and possibly the use of treated mine water as the only long term sources of water in the WMA. Water will have to be transferred into the WMA at full cost to supply the water requirements.

	WC&DM is therefore going to play an important role in meeting the interim water deficit in the Middle and Lower sub-areas as well as meeting the current and projected water deficits in the Upper sub-area. This approach will address the enormous waste of water reported in areas such as Western Highveld Region.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** WC&DM is going to play an important role in water reconciliation in the WMA. DAF will actively promote WC&DM through Forums and in dealings with proponents in the licensing, EMPR and EIA processes.	Mpuma-langa Regional Office (High)
	M2. The water reconciliation situation at Middelburg and Witbank local authorities are critical. The local authorities are looking at augmentation options It is essential that DWAF holds discussions with these local authorities to promote WC&DM.	Mpuma-langa Regional Office (High)
	M3. Initiate a reconnaissance level study to determine the following: a. Assess the current, planned and potential WC&DM measures with the purpose of developing reliable estimates of the savings that can be expected. The study will make use of existing findings of studies such as the Kayamandi and Western Highveld Studies c. Undertake water resource modelling to determine the impact of WC&DM on availability, quality as well as the flow requirements for the ecology. d. Devise plans for the realisation of the National and Sectoral strategies in the Olifants WMA e. Assess the impacts of WC&DM on cost recovery with respect to the economic impacts on Local Authorities and Service Providers.	Dir: WC (High)
	M4. The findings of the study must be built into the planning models set up for the WMA.	Dir: NWRP (High)
	M5. Use the results of the WC&DM study to develop future water requirement projections with various WC&DM scenarios.	Dir: NWRP (High)

	M6. The water use and implementation of WC&DM should be monitored so that the actual impact of the WC&DM measures on the water requirements can be determined.	Regional Offices (High)

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B.5 INSTITUTIONAL DEVELOPMENT SUPPORT MAIN STRATEGY

B.5.1 INTERNATIONAL LEVEL

Management objective:	Draft and implement strategies and policies in line with SADC and other international protocols that South Africa has ratified and agreed to follow.
Situation Assessment:	The Olifants River discharges into Mozambique. A Joint Technical Committee has been established to deal with water issues common to the two countries. Amongst the issues that have to be dealt with are: • The international obligation in terms on the volume of water that needs to be provided to Mozambique from the Olifants River. • The impact that the backwater of the proposed raising of the Massingir Dam will have on the Olifants River gorge in the Kruger National Park. The Massingir Agreement of 1971 will have to be renegotiated with Mozambique. • The notification process for the new water infrastructure in the Middle Olifants Sub-area should be continued.

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 agreements through the appropriate channels at National Level.	International Development Co-ordination

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B.5.2 CO-OPERATIVE GOVERNANCE

Management objective:	Co-operative governance (ie liaison and integration of planning between government departments, district and local authorities) needs to be factored into the overall integrated water resources management arena to ensure a compounded benefit to all users in the catchment. Follow principles and policies laid down in the NWA and NWRS. Proper management capacity at all levels of water resources management needs to be put in place in order to ensure that this process is adequately implemented. What efforts will the Department make to ensure this happens?
Situation Assessment:	Certain water resource management functions remain with the Minister. Co-ordination at a national level will always remain necessary, especially at policy and regulation level. The proposal for establishing a Catchment Management Agency is being finalised for submission to the Minister of the Department of Water Affairs and Forestry. Once approved, the process of setting up the Board and populating the structures can begin. Co-operative governance needs to be encouraged in the WMA. The issues relating to the future development in the WMA can only be successfully dealt with through proper co-operation.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** There is a need to co-ordinate and encourage communications between the various government and regional and local authorities. A communication strategy and innovative means of communicating current and planned activities must be developed.	Regional Offices (High)
	M2. It should be made clear what portion of the water available in each of the WMA's (local and imports through transfers) is under the control of National Government on the one hand and the individual CMA's on the other.	Dir NWRP (High)
	M3. The CMA process needs to be finalised and the CMA established.	Mpuma-langa Regional Office (Medium)

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B.6 WATER INFRASTRUCTURE DEVELOPMENT AND MANAGEMENT MAIN STRATEGY

B.6.1 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:	The raising of the Flag Boshielo Dam has been approved. A record of decision has been received for the dam and the raising will be completed by 2005. A decision has been taken to construct new water supply infrastructure in the Olifants WMA. The infrastructure could consist of a dam at Rooipoort on the Olifants River and/or a dam at De Hoop on the Steelpoort River as well as bulk supply lines. The study to optimise the system has started. The scheme is scheduled for commissioning by 2009. The water supply infrastructure networks operated in the Middle Sub-area as the Leballelo pipeline, the Arabie supply scheme and the Olifantspoort supply system. The optimisation of the operation of these systems needs to be investigated.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** A study to optimise the operation of the water supply infrastructure in the Middle sub-area needs to be undertaken.	Regional Offices (High)
	M2. The raising of Flag Boshielo Dam must be continued.	Dir: NWRP (High)

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B.6.2 SYSTEM MANAGEMENT

Management objective:	Implement system management measures to optimally utilise the available water resources, in terms of short-term benefits and to maintain the reliability of supply over the long-term.
Situation Assessment:	At present there is no system management practised in the Olifants WMA. The WRPM is normally used for this purpose and is successfully applied in the Vaal and Orange River systems. The application of the model can be used to implement the ecological Reserve, operate the system to maintain water quality and implement water demand restriction programs during drought periods. The WRPM is normally run on an annual basis to determine the operating rule for the system The Olifants WMA is a stressed system with the majority of the WMA currently in deficit from a water balance point of view. The WRPM set up for the Loskop Dam catchment in the Upper sub-area needs to be set up for the entire WMA. The model must also include water quality. Once set up the model should be run on an annual basis to determine the annual operating rules, future schemes if any and any transfers that may be needed into the WMA.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Set up the WRPM for the WMA and apply the model on an annual basis	Dir: NWRP (High.)
	M2. Develop and implement a Drought Management Plan for the WMA.	Dir: NWRP (Medium)

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B.6.3 PUBLIC HEALTH AND SAFETY

Management objective:	We need to protect the water resource, and ensure that users in the Olifants WMA are safe from the effects of poor water quality that can create health problems (eg cholera), and we need to ensure that strategies are in place to deal with floods and droughts as these impact on the socio-economic environment.
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. • Develop operating and procedur emanuals for dams and promote dam safety. DWAFs (and the CMAs in some cases) 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) and Dam safety policy (DWAF). • Co-operating with the Department of Agriculture on drought relief strategies and policy formulation. • Pollution of water resources (ie limiting health hazards such as cholera).

MANAGEMENT ACTIONS		
	M1. To determine if a flood management policy and procedure exists. If the procedures are deemed to be inadequate, an appropriate procedure should be developed.	Dir Hydrology (Medium)
	M2. The dam safety procedures and operating manuals need to be checked and updated if necessary	Mpuma-langa Regional Office (Medium)

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B.7 POVERTY ERADICATION

Management objective:	The main objective is to contribute to the eradication of poverty through : • The provision of basic community water supply and creation of employment in developing community water supply and sanitation infrastructure. • Making water available for irrigation by Resource Poor Farmers (RPF) • Ensuring that water is available and does not limit economically productive activities associated with urban centres, major industry and mining.
Situation Assessment:	The Olifants WMA is an economically important area contributing 5% to South Africa's GDP. The continued growth in the economy will generate wealth for the country which will contribute to the eradication of poverty. The provision of water at an adequate assurance of supply and water quality is essential to sustain the projected economic growth. The Department must therefore continue to plan and operate the Olifants WMA to meet the water requirements at an adequate assurance of supply and to protect the water quality of the water resources. The water transferred into the WMA to meet the Upper Olifants sub-area future requirements is imported at a high cost. Similarly, water supplied from new infrastructure will be judiciously allocated to users who can afford the water costs. Poverty eradication schemes are unlikely to be sustainable if the full cost is applied. Opportunities will therefore have to be found where the existing water allocations are made available for poverty eradication schemes. Similarly water saved through WC&DM, particularly in the agricultural sector can be used. The Department must identify opportunities and facilitate the transfer of water allocations from the commercial irrigation sector to RPF.

MANAGEMENT ACTIONS			
	M1.	Opportunities for poverty eradication by means of irrigation schemes should be identified by the Department and the process of transfer of water allocations facilitated by the Department	Regional Office (High)
	M2.	Contact other Departments such as the Department of Land Affairs to identify opportunities for poverty eradication projects	Regional Office (High)

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B.8 MONITORING AND INFORMATION MANAGEMENT MAIN STRATEGY

B.8.1 MONITORING NETWORKS AND DATA CAPTURING

Management objective:	To design and implement 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. What has been identified as a shortcoming is the definition of all the monitoring needs and a coordinated monitoring programme in order to support the process of Integrated Water Resource Management, as defined in **Section 1.3** of this document. A general need was identified to improve and increase the flow measurement gauging stations in the system. Specific recommendations can be found in previous study reports, which will form the point of departure for the proposed study described under **Management Action M1**. A national data management system should be maintained to capture and distribute data in support of water resource management functions. Such a management system is currently being developed by DWAF for use by all and controlled at a **National Level**. The approach to be adopted is that the Olifants CMA will co-ordinate the monitoring activities in the WMA. The CMA will be responsible for assessing the current sources of data, monitoring programs and to determine the monitoring needs of the WMA.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Undertake a study to assess, identify and recommend all monitoring requirements that are needed to support Integrated Water Resource Management. The Regional Offices will take the lead with support from other directorates and institutions.	Regional Offices (Medium)

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B.8.2 INFORMATION MANAGEMENT

Management objective:	In order to base management decisions on reliability data and information it is required to have information management and decision support systems that are accessible and are updated on a regular basis.
Situation Assessment:	*Status Quo:* With reference to the situation assessment of the **Water Resource Availability Strategy 1.2** there are currently four main models and associated databases that have been applied to the Olifants WMA. The models are : 1. Water Resources Simulation Model 2000 (WRSM2000) – This is a rainfall-runoff model with calibration features that is used to produce hydrological time series data. 2. Water Quality (TDS) Calibration model – Employed to calibrate the salinity sub-models using historical data. This model has been applied to the Upper sub-area. 3. Water Resource Yield Model (WRYM) – Water resource network simulation model used to determine operating rules and determining the yield of the system. The WRYM has been applied to the Middle Olifants during the feasibility studies on the Steelpoort and Olifants Rivers. 4. Water Resources Planning Model (WRPM) – This model can be used to integrate all the sub-system components that make up the Integrated Olifants River System and simulate both salinity and quantity operating rules. The WRPM is used to undertake development and operational planning with distinguishing features such as a water allocation procedure, the ability to simulate dilution and blending rules and the simulation of changed system configurations and operating rules for a pre-defined planning horison. This model has only been set up for the upper sub-area and needs to be extended to cover the entire WMA.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. The full implementation of the modelling systems needs to be undertaken on the Olifants River system. The necessary databases and information collection systems need to be established and maintained. Consideration should also be given to develop new functionality that will be required to undertake the challenges of Integrated Water Resource Management as spelled out in **Section 1.3** of this document.	Dir: NWRP (Medium)

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B.9 IMPLEMENTATION STRATEGY

Management objective:	To ensure that the approaches put forward by the Department through this ISP are tadopted and implemented in the WMA. This will require willpower, funding and capacity.
Situation Assessment:	The ISP is an internal document, developed almost exclusively by and on behalf of the Department of Water Affairs and Forestry. The ISP sets out the approaches which the Department is taking towards water management in the Olifants WMA – 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 Olifants WMA. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy – but DWAF setting out how DWAF 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 Olifants WMA. It carries significant weight in expressing HOW water resource planning and management will be carried out in the WMA. It is not, however, an inflexible document, nor is it without its flaws. As such the ISP may be adjusted and adapted when new and better ideas are presented. Despite this the approaches and requirements of this ISP may not be ignored.

Situation Assessment: (Continued)	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:	The following actions are required: 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. 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. Collate comment and consider this in revising and improving the ISP. 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. The ISP should, in any event, be open to continuous improvement, with possible updating on a bi-annual basis.

Required actions, responsibilities and priorities:	All Regional staff, Working for Water, (Rand Water, Eskom and the mining industry), and other major stakeholders should have access to, or copies of, the ISP Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP is not ruled out! The practicalities of implementation demands must always be considered. Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets.

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