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Edition 2

REPORT

Integrated Water Quality Management Plan for the Olifants River System

Overarching IWQMP for the Olifants River System



WATER IS LIFE - SANITATION IS DIGNIT







DEPARTMENT OF WATER AND SANITATION

Water Resource Planning Systems Series

Development of an Integrated Water Quality Management Plan for the Olifants River System

Overarching IWQMP for the Olifants River System

Study Report No. 13 P WMA 04/B50/00/8916/14

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FOREWORD

The Minister of the Department of Water and Sanitation in the National Water Resources Strategy 2013 states that this is the decade of equity and redistribution. She further states that the dynamics of water, equity, development and growth are complex where water resource management lies at the heart of our aspiration to achieve growth, sustainable development and poverty reduction. There can be no growth and development without water, so water must be at the heart of all our planning, financing and governance frameworks.

Water, however needs to be of a quality that is fit for use for particular users. The Olifants Water Management Area (WMA) is a highly utilised and regulated catchment and like many other WMAs in South Africa, its water resources are stressed in terms of water quantity and quality. In the Upper Olifants, the source of the Olifants, the number of mining operations has grown significantly in the last 15 to 20 years, resulting in increased excess contaminated mine water that needs to be managed. Downstream users such as irrigators and urban and rural water users are impacted and in turn have their own impacts on the water resources. In many areas of the WMA the fitness for use has been severely compromised. There is therefore an urgency to ensure that water resources in the Olifants WMA are able to sustain their level of uses, improved where necessary and maintained at their desired states. The DWS National and Regional Offices, from a water planning perspective, identified the need to develop an Integrated Water Quality Management Plan for the WMA in order to manage the quality of its' water resources.

This IWQMP developed for the Olifants WMA provides a way forward in terms of ensuring that the water resources in the WMA are managed in a sustainable manner to support growth and development. Where the water quality has deteriorated to such an extent that it can no longer be used for the intended use, or it no longer sustains the ecology at a level for which the area has been classified, then the implementation of the plan should provide measures that will ensure an improvement over time. The plan recognises that water is fundamental to social and economic growth and development, also considering the protection of the ecology. It emphasises the interconnectedness of the various sectors and actions needed to support its' implementation.

The DWS, Provincial Office or mandated Water Management Institution, will be the lead agent for water resource management within the Olifants WMA and as such will take the lead in a number of key water resource management functions, of which water quality management is a key aspect that needs to be integrated into all other functions. However, the management of water quality in the Olifants WMA, can no longer be the sole mandate of DWS, but needs to be a government-wide task (including the Departments of Agriculture, Environment, Minerals, Co-operative Government and Traditional Affairs, Local Government and Health), to be implemented under the leadership of the DWS, with both the private sector and civil society playing a key role. Within this context, the successful implementation of the IWQMP for the Olifants WMA calls for an inclusive approach to managing water quality.

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APPROVAL

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EXECUTIVE SUMMARY

The Department of Water and Sanitation (DWS) from a planning perspective identified the need to develop an overarching Integrated Water Quality Management Plan (IWQMP) for the Olifants WMA in order to manage the water resources and needed to take cognisance of, and align to a number of studies and initiatives that had been completed to date. The plan needed to establish clear goals relating to the quality of the relevant water resource in order to facilitate a balance between protection and use of water resources.

The main objective of the study is to develop management measures to maintain and improve the water quality in the Olifants WMA in a holistic and sustainable manner so as to ensure sustainable provision of water to local and international users. The management measures will be of an overarching nature and will deal with the broader Olifants WMA while taking the strategies and plans developed at the sub-catchment level into account.

The key to the successful management of the water quality in the Olifants River System is the formulation of management measures that will integrate all the relevant aspects that have a bearing on the water resources. In this respect an assessment of the physical, economic, social, institutional, statutory and ecological aspects in the system was undertaken to understand the current situation and therefore be in a position to assess existing management options and proposed new options that will be able to handle the existing as well as anticipated future challenges (DWS Report number: P WMA 04/B50/00/8916/3).

In respect of compliance of total dissolved solids (TDS) and ortho-phosphate against the proposed water quality planning limits, the following are noted for the sub-catchments (Table E-1).

Sub- catchment	Number of MUs	Number of MU with data	Percentage MUs non-compliant for TDS where data is available	Percentage MUs non- compliant for ortho- phosphate where data is available
Upper Olifants	31	28	68%	100%
Middle Olifants	14	9	78%	100%
Lower Olifants	13	10	20%	20%,
Steelpoort	11	11	45%	Data very limited
Letaba	7	5	86%	43%
Shingwedzi	4	Only 2 have limited data	Non-perennial rivers, accurate picture	so limited data does not give an

Table E-1: Summary of percentage of compliance for TDS and orthophosphate

One of the most important aspects of the IWQMP was the development of a monitoring and information plan – this is one of the deliverables that has emanated from this project. This report also describes some of the actions that will be required in respect of monitoring, however further detail is included in the monitoring plan. An important aspect will be the setting up of a monitoring task team consisting of representatives from each sub-catchment to workshop a collaborative programme for monitoring that should see all users, including communities, participating and contributing to monitoring and data collection.

Another consideration as part of the plan is stakeholder engagement and development of awareness material at various levels. This aspect also needs to consider whether there are any other organisations to partner with - for example national and provincial departments of environmental affairs, health, mineral resources and agriculture. In addition to these strategic partners, other potential partners might include local businesses, environmental organisations, schools and associations. Partnerships can be valuable mechanisms for leveraging resources while enhancing the quality, credibility and success of communication and implementation efforts.

The plan is divided into the strategic management areas for domestic, mining, agriculture, industry and recreation describing the background and context to water quality for each sector and the main management objectives for each sector. The management measures with associated actions are described. An implementation matrix highlights the actions, priority areas, timelines (short, medium or long term) as well as the implementing party and the WMI's role.

With the above in mind, the structure of the IWQMP for the Olifants WMA is based around four core strategic areas and their associated goals.

Strategic Area 1: Protecting water resources to maintain the goods and services that are accrued from functioning ecosystems

We understand that we need to protect water resources to enable their sustainable development so that future generations also enjoy the benefits that are accrued from water use

- **Goal 1.1**: The majority of riverine and wetland systems are maintained with the intent to improve the status of the ecosystems wherever possible.
- **Goal 1.2**: Water in, or from, water resources in the Olifants WMA is fit for use.

Strategic Area 2: Developing water resources to support social and economic growth

We recognise the need to ensure that water is fit for use to support the growth and development of society and the economy of the Olifants WMA

- **Goal 2.1**: Adequate water of appropriate quality is allocated to meet the social objectives of economic development, service delivery and equity/redress.
- Goal 2.2: All waste/ water containing waste generated by households and by economic activities is disposed of/ discharged lawfully and safely.

Strategic Area 3: Managing water quality and associated risks to underpin resilience

We recognise that managing water quality and associated risks are a critical dimension of the water security that underpins our resilience

- Goal 3.1: Effective monitoring of source and non-point source pollution demonstrates that adaptive and climate resilient IWQM is being implemented at the WMA and sub-catchment levels.
- **Goa 3.2**: Compliance with water use authorisations is improved year on year.

Strategic Area 4: Governing to ensure cooperative water resource management and development

We understand that we, as key stakeholders, across Government, the private sector and civil society need to jointly cooperate to ensure that water quality is effectively managed

- **Goal 4.1**: Institutional capacity and operational and financial systems are strengthened to enable effective IWQM.
- **Goal 4.2**: Key partnerships are established, while stakeholder engagements and knowledge management are strengthened and maintained in support of IWQM.

Each of these strategic areas is dealt with separately in this Overarching Plan. There is some overlap between these strategic areas, so linkages are highlighted where relevant. The Implementation Plan identify and prioritise critical concerns at sub-catchment level;

- Focus on identified short- to medium-term actions;
- Provide a framework for actions and roles and responsibilities and
- Provide a framework to monitor and report on progress for the proposed targets.

The Implementation Matrix provides the Strategic Area, the associated goals and objective and the actions require to implement. The structure is illustrated in Figure E-1:



Figure E-1: Structure of the Implementation Matrix

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LIST OF ACRONYMS

AMD	Acid Mine Drainage
СВО	Community Based Organisation
COGTA	Department of Cooperative Government and Traditional Affairs
DWS	Department of Water and Sanitation
DAFF	Department of Agriculture, Forestry and Fisheries
GLOBAL G.A.P	Global Good Agricultural Practice
IDP	Integrated Development Plan
IWQM	Integrated Water Quality Management
IWQMP	Integrated Water Quality Management Plan
KNP	Kruger National Park
LIMCOM	Limpopo River Commission
MOSA	Middle Olifants South Africa
MUTT	Management Unit Task Team (voluntary)
MWCB	Mine Water Co-ordinating Body
NDP	National Development Plan
NGO	Non-governmental Organisation
NWA	National Water Act (Act 36 of 1998)
NWRS	National Water Resource Strategy
ORWRDP	Olifants River Water Resource Development Project
ΡΑΑ	Protected Areas Act (Act 57 of 2003)
POP	Persistent Organic Pollutant
RDM	Resource Directed Measures
RQOs	Resource Quality Objectives
SADC	Southern Africa Development Community
SALGA	South African Local Government Association
SDGs	Sustainable Development Goals

SPLUMA Spatial Planning and Land Use Management Act	
TDS	Total Dissolved Salts
WC/WDM Water Conservation/Water Demand Management	
WMA	Water Management Area
WMI	Water Management Institution
WMS	Water Management System
WQM	Water Quality Management
WQPL	Water Quality Planning Limits
WWTW	Wastewater Treatment Works

1. INTRODUCTION

1.1 Background

South Africa is facing a considerable water challenge that is not easily resolved when one considers the multi-faceted nature of this challenge. The complexities are many and, if not addressed effectively, have the potential to significantly limit the economic growth potential of the country. Whilst there are concerns about how sufficient supplies of water can be provided (the current situation in Cape Town serves as a useful example), there is a concomitant concern with regards to the deterioration of water quality in rivers, streams, dams, wetlands, estuaries and aquifers and how this will increasingly impact on the economy, on human health, and on aquatic ecosystems.

Poor water quality reduces the amount of water available for use in that more water must be retained in our river systems to dilute the pollution to acceptable standards. It also increases the costs of doing business as many enterprises are forced to treat water before using it in their industrial processes. Municipalities also incur additional costs as the cost of municipal water treatment increases. The deterioration in water quality also impacts on human well-being with productivity falling as more work days are lost due to water-related illnesses and, finally, it threatens economic sectors such as agriculture by impacting on crop yields, making crops vulnerable to import restrictions due to the irrigation water not meeting required international standards.

Some of the impacts of water quality deterioration are immediately visible, such as in the case of major fish kills, while others are more insidious and long term in nature. The impacts upon the water resource quality (including habitat and biota) can be significant, if not disastrous. So, whilst water quality is an economic and developmental issue, it is equally an environmental concern that begs questions in terms of ensuring sustainable development.

1.2 Complexities

Over the years the country has focused its attention on a few water quality challenges that have had very significant impacts upon water resources, and have required significant resource requirements to address. The challenges have largely been related to nutrient enrichment and eutrophication, salinization, acid mine drainage and alkalinisation, sedimentation and pollution within urban settings. Whilst resources have been utilised to address these issues, the situation is still in decline. This is made worse by the fact that the development and diversification of the economy is introducing new and emergent forms of pollution, many of which are not effectively monitored and even fully understood, such as endocrine disruptors and persistent organic pollutants, amongst others.

Recent droughts and the increasing understanding of the variability of climate change and climate uncertainty, reflect the need to conserve water; therefore, water quality management (WQM) becomes critical under circumstances of water scarcity. This will

require water users to adopt and apply existing but and innovative technologies such as water reuse, often from contaminated sources where treatment would be required.

Equally, there will be a need to strengthen our regulatory approaches including the authorisation of water use and the necessary compliance monitoring and enforcement regimes. To date there have been challenges in terms of systems as well as those of capacity, and as a result there have been not only delays in obtaining the necessary authorisations but only limited compliance monitoring and enforcement. The fact that new applications for development require authorisations from different sector departments, has served to further frustrate and impede development. This has resulted in increasing levels of unlawful activity. All at a time when our need is to conserve and be more efficient in our use of limited water resources.

Within the water sector, there has been relative uncertainty related to the establishment of water management institutions. Research with regards to governance and the challenges of institutional development has shown that this is often iterative and time consuming, and hence the situation with regards to institutional development at transboundary, water management area, catchment or sub-catchment scales are all in varying states of flux.

Institutions are important as they provide a recognized conduit for processes and the alignment of these across sectors, institutions or line functions. Often, the alignment required is not as it should be and the nature of WQM is such that these processes do cross a range of technical, administrative and spatial boundaries.

Alignment in planning across these various boundaries is becoming increasingly important and, whilst the difficulties are understood, the need for government to champion this is critical. There are insufficient enabling resources (human and financial in particular) and therefore, there is a need to ensure that there is efficiency in how the existing resources are utilised and the benefit maximised.

Lastly, our ability to make effective decisions is being severely hampered by the lack of reliable data and information to support the decision-making process. In recent years, there has been a decline within the monitoring networks at a time when there is a need to expand networks and improve information management systems. There has been progress by DWS in terms of systems and their development, but there is still more to do.

1.3 A Watershed Moment

Changes in approach are required to halt the ongoing deterioration of water quality and the impact that this has upon the social economy of South Africa. There are numerous challenges and the broader political environment of the country has also created some uncertainty with regards to how water resources are to be managed or developed.

Recognising these challenges, the DWS has developed an Integrated Water Quality Management (IWQM) policy and strategy (DWS, 2017a, DWS 2017b) that provides guidance in terms of strengthening the approach to WQM.

The 2017 IWQM Policy recognises that managing water quality is a complex problem. Contrary to historical views that relatively simple command and control approaches could be used to manage water quality, it is now recognised that in the water quality domain, human and bio-physical systems interact, increasing the complexity of water quality management. In dealing with complex systems, the pathway is often affected by unexpected events and developments, calling for course corrections and new approaches. This Policy, therefore, is firmly rooted in the recognition that the only way to manage the complex challenge of water quality in South Africa is through the adoption of adaptive management, a process that calls for flexibility, and for structured learning throughout the process to inform and amend Policy and practice over time. Adaptive management is also rooted in the understanding that there are many different sets of knowledge that must be brought together to address the challenge, including social, political, earth sciences and financial analysis. This must be supported by integration in the action plan. The management of water quality requires the bringing together of a wide range of knowledge in a structured process that allows co-learning, co-creation, and co-adaptation to move forward.

In addition, the 2017 IWQM Policy is designed to enable government in partnership with civil society and the private sector, to address the issue of water quality across the country. This then underlines the core concept that the management of water quality can no longer be the sole mandate of DWS alone, but rather is a government-wide task, to be implemented under the leadership of the Department of Water and Sanitation, with both the private sector and civil society playing a key role. Within this context, the 2017 IWQM Policy calls for an inclusive approach to managing water quality in the country.

The 2017 IWQM Strategy has been developed to provide a structured, pragmatic approach towards achieving the intent of the 2017 IWQM policy. To this end the strategy has five strategic goals, namely:

- **Goal 1:** Aligned Policy, Legislation and Strategy
- Goal 2: Good Governance
- Goal 3: Efficient and Effective WQM Practice
- Goal 4: Innovative Finance
- Goal 5: Effective Knowledge and Information Management

These strategic goals are understood as the key dimensions that will unlock improved approaches to WQM, and will in effect give rise to IWQM. It is, however, understood that this will not be realised within the short- to medium-term. Therefore, the development of a set of priority actions, through an IWQM Implementation Plan, noted that within the next three years these priority actions will focus upon:

• Strengthening the DWS leadership on IWQM and identifying WQM Champions;

- Mobilising partnerships and coordinating action by establishing the "Community of Practice" to initiate and maintain a sector wide engagement;
- Realising impact by initiating processes to effectively address core issues of eutrophication, salinization, urban pollution, sedimentation, and acidity/alkalinisation. This will include the improvement in key procedures. The development of IWQM plans, such as this IWQMP developed for the Olifants WMA, are a priority in supporting this drive;
- Improving our information management by strengthening the data and information systems; and
- Building and strengthening capacity and awareness regarding WQM and its importance.

The translation of these priorities into the Integrated Water Quality Management Plan (IWQMP) for the Olifants River WMA will create important alignment in processes and, importantly, will be a valuable testing ground for the new 2017 IWQM Policy and Strategy.

2. THE OLIFANTS WATER MANAGEMENT AREA

2.1 Overview

The Olifants River System, which comprises the Upper, Middle and Lower Olifants River sub-catchments, as well as the Steelpoort, Letaba and Shingwedzi sub-catchments, is a highly utilised and regulated catchment. Like many other Water Management Areas (WMA) in South Africa, its water resources are critically stressed in respect of both water quantity and quality. This is due to the accelerated rate of development that has been experienced and the general scarcity of water resources. There is therefore an urgency to ensure that water resources in the Olifants River System are able to sustainably maintain their current levels of use, noting that further degradation of the system could have dire socio-economic impacts.

The Olifants River originates at Trichardt, east of Johannesburg, and flows through to the Kruger National Park. The Letaba River, drained by the Groot Letaba River with its major tributaries being the Klein Letaba, Middle Letaba, Letsitele and Molototsi rivers, joins the Olifants River upstream of the border into Mozambique. Thereafter the Olifants joins the Limpopo River before discharging into the Indian Ocean. The Shingwidzi River flows through the Kruger National Park becoming the Rio Shingwidzi in Mozambique where it confluences with the Rio Elefantes downstream of the Massingir Dam (Figure 1).

This study has focussed on the South African sector of the Olifants River system and does not deal with the Mozambique sector, however the improvement in the South Africa portion of the Olifants River system, will ultimately have a positive impact on the Massingir Dam and the lowest reaches of the Rio Elephantes which is controlled by inflows from upstream (South Africa).





2.2 Socio-Economics

Formal economic activity in the system is highly diverse and is characterised by commercial and subsistence agriculture (both irrigated and rain fed), diverse mining activities, manufacturing, commerce and tourism. Large coal deposits are found in the eMalahleni and Middelburg areas (Upper Olifants) and large platinum group metal (PGM) deposits are found in the Steelpoort, and copper and phosphate in the Phalaborwa areas. The catchment is home to several large thermal power stations, that are strategically important and which provide energy to the country as a whole. Extensive agriculture can be found in the Loskop Dam area, the lower catchment near the confluence of the Blyde and Olifants Rivers as well as in the Steelpoort Valley, the upper Selati catchment and the upper catchments of the Groot Letaba. A large informal economy exists in the Middle Olifants, Middle Letaba and Shingwedzi sub-catchments, with many resource-poor farmers directly dependent upon ecosystem goods and services. The WMA has many important tourist destinations, including the Blyde River Canyon and the Kruger National Park (KNP). Land use in the Olifants River System is diverse and consists of irrigated and dryland cultivation, improved and unimproved grazing, mining, industry, forestry and urban and rural settlements.

The demographic characteristics of the Olifants Catchment are varied from upstream to downstream with the highest diversity of demographic groups typically occurring in the southern (upper) reaches and less diverse groups in the northern (lower) reaches. This is attributed to the variation in economic development of the landscape. Toward the southern extent of the catchment urbanisation and land use intensity increases toward Gauteng province and the cities of Emalahleni and Middelburg. The northern reaches are less developed, characterised by a greater proportion of smaller towns, settlements and rural land uses.

A large proportion of the catchment is not economically active (45%), with a further quarter (24%) of the population being unemployed. Only a third of the population (31%) are employed of which 68% are employed in the formal sector (Figure 2). The most common income groups between households are the R 9 601 to R 19 600 and the R 19 601 to R 38 200 a month belonging to 20% and 21% of households, respectively. 14% of households earn no income at all (Figure 3). These employment and income characteristics are again skewed toward higher levels of employment and economic activity toward the southern reaches of the catchment, with lower levels towards the less developed northern reaches.



Figure 2: Employment status (Age 15-64) demographics in the Olifants Catchment (Census 2011)



Figure 3: Income group per households in the Olifants Catchment (Census 2011).

2.3 Water Resources

The water requirements in the Olifants WMA and adjacent supply areas to Polokwane and Mokopane have increased substantially in recent years. The growth in water demands due to developments in power generation, mining, the steel industry, urban development, ecotourism and agriculture, has all placed additional pressure upon a limited resource. In particular, the mining industry has grown significantly and as result the pressures on the resource from a water quality perspective have also increased.

These pressures, placed onto a WMA that has limited water resource development opportunities, mean that the Olifants River Catchment is currently one of South Africa's most stressed catchments both from a water quantity and water quality perspective. In response, there have been a significant number of studies over recent years, with the aim of improving the longer-term water resource management trajectory.

There are several large dams located in the upper and middle reaches of the Olifants River catchment. Mirroring the economic development of the country, the earlier dams were focused upon supply to large irrigation schemes, while the later additional dams were constructed to meet growing domestic, industrial and mining water requirements as the

economy diversified. These dams are all operated independently of each other rather than as an integrated system.

While the majority of water users obtain their water from the major dams, there is also a significant amount of water abstracted for irrigation purposes using from farm dams and run-of-river abstraction. There is also a significant supply of water from groundwater to irrigators and the mines. The Olifants River catchment is really dominated by three distinctive zones that cover the three sub-catchments, namely the Upper, Middle and Lower



catchment (In the upper part of the catchment, water use is mainly for power generation, mining and urban use, although there is some run-of-river irrigation practised. In the upper parts of the Wilge Bronkhorstspruit and there is significant abstraction for irrigation groundwater from (dolomite). In the middle part of the catchment most water is used for irrigation, while at the lower end of the catchment the **KNP** requires that there is sufficient flow in the river to maintain the ecological integrity of the system.

These conflicting requirements pose a significant challenge in the water reconciliation process.

Figure 4).

In the upper part of the catchment, water use is mainly for power generation, mining and urban use, although there is some run-of-river irrigation practised. In the upper parts of the Wilge and Bronkhorstspruit there is significant abstraction for irrigation from groundwater (dolomite). In the middle part of the catchment most water is used for irrigation, while at the lower end of the catchment the KNP requires that there is sufficient flow in the river to maintain the ecological integrity of the system.

These conflicting requirements pose a significant challenge in the water reconciliation process.

Figure 4: Zones of the Olifants River Catchment

2.4 Water Resource Quality

The water quality of a particular body of water is determined by measuring the physical, chemical, aesthetic and biological characteristics (drivers). Typically, the fitness for use of the water is determined by comparing the physical, chemical, aesthetic and biological characteristics (drivers) of a water sample against water quality guidelines or standards for a particular water use. For example, in South Africa, drinking water quality standards (SANS 241) are designed to enable the provision of clean and safe water, after treatment, for human consumption, thereby protecting human health. The South African Water Quality guidelines (DWAF, 1996) (or updates thereto) are available for the domestic, livestock watering, irrigation, recreational sectors and aquatic ecosystems.

Declining water quality has become a global issue of concern as human populations grow, industrial and agricultural activities expand, and climate change threatens to cause major alterations to the hydrological cycle.

In the Upper Olifants the number of mines and the mining operations have grown significantly in the last 15 to 20 years, resulting in growth increases in excess mine water that needs to be managed. In most cases the fitness for use has been severely compromised. The river systems do not have assimilative capacity for further pollutant loads. In addition, the water reconciliation and dam system operation and effects of the prolonged drought are such that there is no water available in the dams to provide dilution water to maintain the salinity in the downstream rivers at a suitable level. The end result is that to prevent further deterioration no further diffuse or point source loads can be accepted in the river systems. In fact, in the Koringspruit, Boesmanskransspruit, Tweefonteinspruit, Noupoortspruit, Woestalleenspruit, Spookspruit and the Klipspruit, salinity load will have to be removed from the system to achieve the water quality planning limits (WQPLs) determined for the specific Management Units and the downstream dams.

The Wilge River catchment is mostly in compliance, however, is showing increased salinity levels. As this system has been classified as a Class II river, it is important that any increased salinity trends are reversed over time.

This sub-catchment is also the area in which the major wastewater treatment works are located. Noting that in the last Green Drop assessment not one WWTW achieved Green Drop status, nutrient enrichment and microbiological contamination is a serious concern in this sub-catchment.

In the Middle Olifants, while the salinity decreases dramatically, meaning that there would be some assimilative capacity, there are still some increasing trends that need to be halted, specifically coming from Loskop Dam as well as the Moses and Elands tributaries. In addition, in terms of GLOBAL G.A.P certification, an important consideration is that the irrigators downstream of the Loskop Dam need to comply with strict chemical, physical and microbiological water quality for export requirements. Higher salinity would also imply that subsistence farmers irrigating from the river would have poorer yields because of soil salinization over time. The impact of using any remaining assimilative capacity could therefore have serious economic implications for the area. The Flag Boshielo Dam is bounded by the Schuinsdraai Nature Reserve declared in March 1993 and designated as such under the Protected Areas Act (Act 57 of 2003) (PAA).

Sanitation practices in the Middle Olifants are also linked closely to groundwater contamination. Groundwater protection aspects in this sub-catchment are therefore very important, as water augmentation from groundwater is also important in this sub-catchment.

The Lower Olifants sub-catchment falls in the Kruger to Canyons Biosphere Reserve and the Kruger National Park, and essentially bears the brunt of the upstream impacts in the Olifants, and specifically the impacts from the Phalaborwa industries and mines in the lower portions of the Ga-Selati River. Any available assimilative capacity in the upstream regions of the Ga-Selati should not be exploited as this would put further burdens on the already impacted downstream regions. This relates to both salinity and nutrients. There are a number of areas that have been designated Protected Areas under PAA, including the Blyde River area which has been classed as a Class I. This area supplies good quality water to the Olifants and due to the classification should not be developed: the major portion falls with a Nature Reserve and the Kruger to Canyons Biosphere Reserve. Nutrient enrichment is of concern related to those areas (specifically Ohrigstadt and Rietspruit) where intensive agriculture takes place, as well as where larger WWTW are located.

In the Steelpoort sub-catchment, there are a number of areas that have been designated Protected Areas under PAA, specifically in the areas of the of the upper Steelpoort sub-catchment, including the Dorps River. This area supplies good quality water to the Olifants and development in respect of mines and industries in the Steelpoort should be managed to maintain the current chemical and physical water quality.

The upper portions of the Letaba sub-catchment (MU69) are located within the Kruger to Canyons Biosphere Reserve and several smaller protected areas (Wolkeberg Wilderness Area and the Nature Reserve: Co-operation and Development), and releases of very good chemical and physical quality water downstream of Tzaneen Dam are noted. However downstream of this area, large sprawling settlements (and to a much lesser extent irrigation) impact considerably on any available assimilative capacity in respect of nutrients.

In all respects where an area has been classified based on, amongst other aspects, its' water users and development, it's location in a sensitive area, or designation as a source water, Section 12(2)(b) (ii) and (iii) and 12(2)(c) of the National Water Act (Act 36 of NWA) should be explored. This allows for the *establishment of procedures that are designed to* satisfy the water quality requirements of water users as far as is reasonably possible, without significantly altering the natural water quality characteristics of the resource (12(b)(ii)); and to set out water uses for instream or land-based activities which activities must be regulated or prohibited in order to protect the water resource (12(b)(iii)); and

provide for such other matters relating to the protection, use, development, conservation, management and control of water resources, as the Minister considers necessary (12 (2)(c).

In respect of compliance of total dissolved solids (TDS) and ortho-phosphate against the proposed water quality planning limits, the following are noted for the sub-catchments (Table 1).

Sub-catchment	Number of MUs	Number of MU with data	Percentage MUs non-compliant for TDS where data is available	Percentage MUs non-compliant for ortho-phosphate where data is available
Upper Olifants	31	28	68%	100%
Middle Olifants	14	9	78%	100%
Lower Olifants	13	10	20%	20%,
Steelpoort	11	11	45%	Data very limited
Letaba	7	5	86%	43%
Shingwedzi	4	Only 2 have limited data	Non-perennial rivers, s not give an accurate p	so limited data does victure

 Table 1: Summary of percentage of compliance for TDS and orthophosphate

Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 illustrate the compliance for six variables of concern (based on data that were available for assessment) total dissolved solids, sulphate, ammonia, chloride, ortho-phosphate and magnesium).



Figure 5: Compliance against the WQPLs in the Upper Olifants (TDS, SO_{4,}, ortho-PO₄, Mg, CI, pH and NH₃)



Figure 6: Compliance against the WQPLs in the Middle Olifants (TDS, SO4, ortho-PO4, Mg, Cl, pH and NH3)

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Figure 7: Compliance against the WQPLs in the Lower Olifants (TDS, SO4, ortho-PO₄, Mg, Cl, pH and NH₃)

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Figure 8: Compliance against the WQPLs in the Steelpoort (TDS, SO4, ortho-PO₄, Mg, Cl, pH and NH₃)



Figure 9: Compliance against the WQPLs in the Letaba (TDS, SO4, ortho-PO₄, Mg, CI, pH and NH₃)

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In reflecting upon protecting water resource quality, one should consider both resource directed aspects as well as source directed aspects.

Resource Directed Aspects

Part 1 of the National Water Act (Act 36 of 1998) (NWA) provides for the first stage in the protection process, which is the development by the Minister of a system to classify the nation's water resources. The system provides guidelines and procedures for determining different classes of water resources. Once the classification has been done, the Minister is required to use the classification system to determine the class and resource quality objectives (RQO) of all or part of those water resources considered to be significant. The purpose of the RQO is to establish clear goals relating to the quality, quantity and ecological components of the relevant water resources. In determining RQOs a sustainable balance must be sought between the need to protect and sustain water resources on the one hand, and the need to develop and use them on the other.

In the Olifants WMA the classification and development of RQO has been completed and gazetted (GN 466, NWA, Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment, 22 April 2016). A copy is included as Appendix C to this report. The Management Classes for the WMA are illustrated in Figure 10. As part of the classification and development of RQOs a visioning exercise was undertaken for the WMA, which is a collective statement from all stakeholders of their future aspirations of the relationship between the stakeholders (in particular relating to their quality of life) and the water resources in the catchment. The Reserve, updated during 2016/ 2017, has been gazetted for comment.



Figure 10: Management Classes for the Olifants WMA

Source Directed Aspects

The Olifants River system faces water quality challenges impacting on both surface water and groundwater including salinisation, sedimentation, nutrient enrichment, microbial and agrochemical pollution, all at different scales within the sub-catchments of the WMA. Pollution originates from both point and non-point sources, such as discharges from municipal wastewater treatment works and diffuse source pollution from mine tailings facilities, urban areas and agricultural lands. In respect of the Olifants WMA, diffuse sources of pollution are dominant.

Over the years significant catchment development, including industrial growth and power stations, widespread mining activities, especially in the upper catchments, irrigation and formal and informal urbanisation have impacted on the surface water and groundwater resources of the Olifants River System.

The major issues identified as existing or potential threats to the water quality of the Olifants River System include:

- Mining;
- Wastewater discharge;
- Urban run-off;
- Industrial; and
- Agricultural activities.

Mining

The main mining activity in the Olifants catchment is related to coal, platinum, vanadium, chrome, copper and phosphate. The coal mining is located in the upper reaches of the catchment around eMalahleni, Middelburg and Delmas. The platinum, chrome and vanadium mines are located in the Steelpoort and Middle Olifants areas of the WMA while the copper and phosphate mining occur in the Lower Olifants around Phalaborwa. The coal mining in the upper areas of the Olifants catchment is extensive and is still expanding.

The management of mining activities in the WMA is crucial to the management of water quality both in the short-term to alleviate the current salt loads being released, and long-term to manage the impacts of mine closure and mine decants. While the complex dynamics of this situation is accepted in terms of maintaining base flows in the system, permitting active mining, and promoting wider socio-economic imperatives, a major intervention in terms of current mining development practices is required if the upper Olifants river catchment is to remain sustainable into the future.

In terms of the mines in the upper catchment, the excess high salinity mine water in these mining systems has been managed using the controlled release scheme which started in 1996. However, with the growth in the volumes of excess water, there is insufficient assimilative capacity available in the system for the controlled release scheme to continue to deal with the excess water. Urgent attention is now required to upgrade the water management system to achieve compliance.

Many mines are reaching the end of their economic lives and the mine workings will start filling up with water and will, ultimately, start to decant this water to nearby streams and rivers. This water will be polluted and the volumes (and associated salt loads) will be large enough to impact significantly on the regional water quality. The major mining houses are aware of this problem and plans are being developed to treat the excess mine water before discharge. Mine water reclamation schemes have already been constructed which are supplying water for potable use to the local municipalities. These schemes have to be developed and coordinated to address the future decant volumes. The reclamation of the excess mine water has been earmarked as the future source of water to meet the growing water requirements in the upper areas of the Olifants catchment. Financial viability of mine closure remains an issue.

There are several defunct mines in the Upper Olifants catchment. Some of these mines are abandoned (ownerless) and are already decanting into the river system. Acid mine drainage (AMD) from abandoned and operational coal mines is already impacting on the Olifants River, specifically in the upper catchment.

The Upper Olifants Catchment, in particular, has been the pilot for many interventions, most notable is the Implementation readiness of the Waste Discharge Charge System, the Establishment of the Mine Water Coordinating Body and the Government Task Team on mining.

In 2017, the Mine-water Management Policy was developed and gazetted for comment. The Policy was drafted in collaboration with the Department of Mineral Resources and Environmental Affairs, and presented policy positions regarding:

- 1. Integrated approaches to mining closure
- 2. Apportionment of liabilities
- 3. Optimum use of appropriate /Best Available Technology
- 4. Classification and differentiation of mines
- 5. Promotion of sustainable mining development
- 6. Duty of care
- 7. Environmental Vigilance and Continuous Improvement
- 8. Institutional arrangements on infrastructure management/ transfer after Mine closure

Wastewater Discharges

The majority of the wastewater treatment works associated with the local municipalities are producing an effluent which does not meet their licence requirements. The works are discharging water which contains high organic, nutrient and microbiological loads to the river systems. The organics result in reduction in dissolved oxygen concentrations and anaerobic conditions which detrimentally impacts on the health of the aquatic system. The high nutrient concentrations lead to eutrophic conditions in the river systems and dams. The trophic status of the upper reaches of Loskop Dam which receives effluent from the

major treatment works of the Emalahleni and Steve Tshwete Local Municipalities has been classified as eutrophic with periodic outbreaks of the toxic blue green algae.

Not only do the wastewater treatment works have to be operated and maintained correctly but the license conditions should be reviewed to implement more stringent discharge standards regarding nutrients in particular phosphorus. Concerns have been expressed about the impacts of nutrient enrichment downstream of wastewater treatment discharges (e.g. the Klein Olifants River). Excessive growth of filamentous algae has occurred downstream of discharges which has impacted on the habitats of aquatic organisms.

Mismanagement of wastewater treatment works and sewage pollution from smaller towns throughout the catchment area are also on the increase resulting in nutrient enrichment in a number of catchments. The lack of compliance of wastewater discharges from the many wastewater treatment plants in the WMA is a growing threat and is of serious concern. The Green Drop reports are indicative with 38% of treatment systems in Mpumalanga Province being in a critical state during 2011. By 2013, this situation had deteriorated to 54%.

In addition, design capacity must be assessed in terms of the volumes being received and the plans to upgrade where necessary due to population increases, or different types of effluent being received. Vandalism and staff safety at the wastewater treatment works (WWTW) must also be considered, as this may influence the final effluent quality.

Urban run-off

The issue of urbanisation is linked to the above concerns related to wastewater treatment works to some degree, however it also relates to the uncontrolled development and urban sprawl that is being experienced in many of the urbanised centres of the upper, middle and lower catchment areas, but also to growth in settlements in many smaller towns. Lack of, poor and improper planning is leading to large quantities of pollutants entering storm water return flows, as well as runoff from un-serviced areas which are draining to various tributaries that report to the Olifants, Letaba and Shingwedzi rivers. Informal, unsewered human settlements along the river banks of tributaries or in the close vicinity of the mainstem rivers are posing a threat to regional water quality and ecological integrity, especially eutrophication (nutrient enrichment) and human health. Integrated planning approaches are needed to be addressed through relevant institutional structures to improve the situation.

Industrial pollution

There are large steel foundries located in Middelburg and eMalahleni. The coal mining in the upper catchment is associated with large thermal power stations. The Phalaborwa Complex and Foskor located in the lower reaches of the Ga-Selati River catchment are home to mineral production facilities.

Concerns have been raised about the impacts of the industrial developments on the water resources within the Olifants WMA. While the new mines and industries are being designed to achieve compliance with best practice guidelines and regulations, the majority of the mines and industries are old with legacy issues which require upgrades of the water management systems. Water quality deterioration in the vicinity of the industrial and mining complexes has been identified as a potential threat and needs to be addressed to understand the extent of the impact.

Agricultural activities

Extensive irrigation occurs in the vicinity of the 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. Rain-fed cultivation is undertaken in the southern and north-western parts, with grain and cotton as main products. Intensive irrigation farming is practised in the upper parts of the Klein Letaba River catchment (upstream and downstream of the Middle Letaba Dam), and particularly along the Groot Letaba (downstream of the Tzaneen Dam) and Letsitele rivers.

Fertilizers, herbicides and pesticides from agricultural activities are also having a negative impact on water resources in the WMA, which is also a contributing factor to the increase in nutrient levels that are observed. Agricultural runoff has the potential to contribute nutrients and toxic organic chemicals associated with herbicides and pesticides to the water resource. The potential certainly exists in the Olifants WMA for contributions of these pollutants to the river system from agricultural areas. The water quality monitoring network has not allowed for the quantification of the contribution of organic pollutants from agriculture, in particular the intensive irrigation areas to the river system.

The intensive irrigated agriculture and afforestation in the Letaba River has resulted in the use of a wide range of pesticides over the past decades. Most of these pesticides are categorised as Persistent Organic Pesticides (POPs).

The unacceptable phosphate values that occur all the way into the Kruger National Park, in addition to emanating from the wastewater treatment works, are also attributable to the use of fertilizers for intensive agriculture. Elevated levels of Chlorophyll-*a* due to increased algal growth are of concern in the Olifants River WMA as a result of the high nutrients, river regulation and high lowveld temperatures.

In summary the main water quality concerns relate to salinisation, release of metals and pesticides (including herbicides) into the environment, elevated nutrient levels and microbiological contamination, all of which have a variety of impacts on fitness for use of the resource. Over and above this there are concerns about the impacts that water quality is having on the aquatic (and associated) ecosystems of the catchment. Sporadic fish kills and crocodile deaths are all very visual expressions of ecosystem degradation.

2.5 Governance

The ability to effectively manage the water resources of the Olifants River system is of considerable concern. From a governance perspective, there are differing dimensions that reflect the ability to manage the resource. Typically, this would reflect the establishment of new institutions, the ongoing development of existing institutions, the development of staff capacity, the levels of engagement with stakeholders, the continued development of management support systems to enable effective decision making as well as the various financial mechanisms that underpin our ability to function. Under the current context in the Olifants WMA these are all in various states of flux and are not fully effective.

From a water resource management perspective, the uncertainties related to the Catchment Management Agencies and Water User Associations have had impact upon

strategic issues (i.e. the development of a Catchment Management Strategy) as well as the day to day operational matters (i.e. Implementation activities, monitoring, regulation etc). This has had impact upon the DWS Provincial Offices and the maintenance and ongoing development of staff capacity has been difficult within this context.

Nonetheless, there are a considerable number of Water User Associations and Irrigation Boards that operate within the WMA that provide useful localised capacity in terms of operational water resource management such as monitoring, reporting and localised compliance.

Institutional challenges are also experienced across many of the municipalities where inadequate technical staff capacity and a lack of sufficient funding disempowers their ability to manage infrastructure and effectively regulate activities. In this regard, the management and operation of WWTWs is of significant concern.

The engagement of civil society and the private sector with regards to water resource management has not been insignificant and there are a number of forums and platforms that have supported this engagement. The establishment of the Mine Water Coordinating Body (MWCB), and the Middle Olifants South Africa (MOSA) reflect the real possibilities that exist for the development of partnerships that can support collective action.

The implementation of support programmes, funded and guided by international cooperating partners, can provide very useful support to the ongoing strengthening of governance regimes. In this regard, the implementation of the RESILIM (Olifants) programme under the guidance of the Association for Water and Rural Development (AWARD) has provided valuable financial and technical support to the improvement of water resource management within the WMA.

The ability to make ongoing management decisions is influenced by the levels of monitoring and the status of supporting information management systems. There are significant concerns regarding the status of monitoring within the Olifants WMA. Some of the key concerns that have been highlighted throughout the project (Reports P WMA 04/B50/00/8916/3, P WMA 04/B50/00/8916/7 and P WMA 04/B50/00/8916/3 13) include:

- Lack of integration between the monitoring programmes of the National Programme and Provincial Offices and data is not always uploaded to the WMS database;
- There appears to be limited co-ordination between the Resource Quality Information Services and the Departmental Provincial Offices/ WMIs regarding the location of monitoring stations, sampling frequency and analyses performed;
- There is a lack of integration between various governmental organisations and other organisations undertaking catchment studies with regards to the monitoring programmes and monitoring;
- Data from the monitoring stations have in many instances proved to be incomplete (information gaps) or insufficient (limited data sets). The data sets were fragmented and in some cases their reliability was questionable;

- Monitoring stations were not always suitably located and thus in some instances the most downstream point on the tributaries were too high up in the catchment.
- Not all monitoring points include flow measurements which limit the extent of water quality analysis at some points, and the determination of loads; and
- Not all chemicals of concern are adequately monitored, for example, there are inadequate or non-existent data on pesticides, nutrients and metals.

These challenges mean that effective decision making with regards to IWQM is constrained. Whilst, the Water Management System (WMS) provides a useful tool for accessing data and generating information to support management decisions, the system is not always fully utilised by DWS staff. Ongoing training of DWS staff and improvements to the system are needed.

Lastly, financial constraints are experienced across the sector and this inhibits various key actions that are needed to ensure more effective WQM. Therefore whilst there are infrastructure focussed issues that require a significant injection of finance, there are equally issues relating to the ongoing financing of core staff complements in the DWS as well as other relevant Government Departments, NGOs and the private sector.

2.6 The Need to Act

The pressures on the water resources of the Olifants WMA will only increase with time. The current water quality challenges will potentially only get worse as new and emergent forms of pollution complicate an already complex situation. The need to strengthen matters of governance are imperative and these need to be supported by drives to improve key dimensions of the WQM business. During the situation analysis the identified issues of concern₇ included:

- Data collection, handling and management;
- Lack of Water Quality Planning Limits for the middle and lower Olifants;
- Impacts of mining activities and mine closure;
- Management of wastewater treatment works discharges;
- Urbanisation and improved planning;
- Irrigation return flows;
- Implementation of the Waste Discharge Charge Strategy;
- Ongoing research;
- Improved monitoring; and
- Integrated management.

There is, therefore, a need to develop effective management measures to maintain and improve the water quality in the Olifants WMA. The management measures will need to be

of an <u>overarching</u> nature and will deal with the broader Olifants WMA while taking the strategies and plans developed at the sub-catchment level into account. As such, the overarching IWQMP for the Olifants WMA needs to take cognisance of and align to a number of studies and initiatives that have been completed to date, as well as other ongoing initiatives.

3. INTEGRATED WATER QUALITY MANAGEMENT CONTEXT

The development of the IWQMP for the Olifants catchment has run in parallel with the development of the IWQM Policy and Strategy. Whilst the focus of the IWQM Policy and Strategy provides the overall framework for WQM in the country, the IWQM Plan for the Olifants provides a localised framing in the Olifants catchment. Provided below is a high-level summary of the IWQM Policy and Strategy, and its resulting implementation priorities, whilst taking cognisance of the broader developmental agenda.

3.1 The global developmental agenda

Domestication of the Sustainable Development Goals (SDGs) adopted in December 2015, is aimed at ending poverty, protecting the planet, and ensuring prosperity for all as part of a sustainable development agenda. South Africa, as a signatory to the SDGs, must strive to meet specified targets under each of the SDGs. Water quality has a direct bearing on our ability to meet the goals of ending poverty, ending hunger and achieving food security, ensuring healthy lives and promoting sustainable economic growth. In relation to Goal 6: Ensure the availability and sustainable management of water and sanitation for all, water quality is particularly relevant. Under Goal 6, there are three targets that are particularly relevant to water quality:

- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;
- By 2030, implement integrated water resources management at all levels, including through trans-boundary cooperation as appropriate; and
- By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

These SDGs mirror the sustainable socio-economic development path of South Africa as outlined in the National Framework for Sustainable Development (2008): "South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration".

The global indicators, targets and monitoring framework for the SDG's have been set. South Africa is now in a process of building on those platforms to domesticise those indicators and targets to ensure that they are relevant and specific to South Africa.

Africa's Agenda 2063 draws from the Pan African vison of having a continent that is peaceful and prosperous (African Union Commission, 2014). Furthermore, the Pan African vision envisages more involvement of its citizens in driving the sustainable development agenda. The uptake of these frameworks into National Policies is key to ensuring their success.

South Africa's Vision for IWQM mandates that everyone has a role to play in improving resource water quality, especially in those critical areas where rural and peri-urban inhabitants depend

directly on the water resource itself. This improved water quality is crucial to improve socioeconomic and environmental development. The National Development Plan (NDP) acknowledges water to be a strategic resource and highlights that the country is water-scarce (National Planning Commission, 2012). In addition, the DWS is in the process of developing the National Water and Sanitation Services Masterplan, which looks to operationalise the NDP.

The IWQM Policy has already advocated for their alignment with the broader development agenda. However, like the IWQM Policy, the SDG's require a core champion to ensure coordination and oversight, the functioning institutions and the relevant resources (both human and financial) assigned for its achievement. Trans-boundary uptake of these indicators is also crucial, and the existing platforms, such as River Basin Organisations, and any other structures that support transboundary management should participate in the setting and achieving of targets.

3.2 Transboundary alignment

South Africa sits in a position of relative privilege (compared to its neighbours) when it comes to the shared water basins, being positioned upstream in the transboundary basins of Orange-Senqu, Limpopo and the Inkomati. As a signatory of the SADC Revised Protocol on Shared Watercourses, this obligates South Africa to cooperate on the management of the shared water resources and to ensure that use of these shared resources is sustainable, equitable and reasonable and the basin states shall jointly prevent, reduce and control pollution.

Furthermore, South Africa has entered into several bilateral and international agreements that govern the management of transboundary water resources and ensures that South Africa is compliant with those protocols. Chapter 10 of the National Water Act (Chapter 10) specifically deals with International Water Management and provides for institutions to implement these protocols.

The following recommendations were made to the Limpopo River Basin Commission (LIMCOM) to stabilise the deterioration in water quality and to start rehabilitating some of the most polluted river reaches and tributaries:

- Water quality monitoring and information generation as with most trans-boundary basins, monitoring of water quality, data storage and dissemination across the Limpopo River Basin is not ideal. The monitoring of heavy metals in the last 2-3 years has provided the evidence required, not only to understand the causes of the crocodile deaths that occurred in recent years, but also the sources of pollution, so that they can be better managed in future. Therefore, it was recommended that LIMCOM develop minimum standards for water quality monitoring and information systems, and then encourage all the basin countries to adhere to these.
- Extension of the Groundwater Resources Information Project (GRIP) This has kicked off in the South African part of the Limpopo Basin and should be implemented in all the member states to enlarge and improve the data sets in these countries for future evaluations. This will help improve the understanding around the groundwater reserve, its quality and the recharge required.

- Water quality objectives the development of a common set of water quality objectives for the Limpopo Basin should be facilitated by LIMCOM, and then basin states should be encouraged to develop and implement their own objectives and strategies for their tributary rivers to meet these mainstem river objectives.
- Pollution source management Once water quality management objectives have been developed and accepted by all the basin states, LIMCOM should encourage them to develop source management objectives to control pollution sources. LIMCOM can facilitate this process and ensure that the linkages to other components of the basin management strategy are developed.

Creating working transboundary water governance structures requires the development of trust between stakeholders and an effectively functioning governance framework requires that information is easily available and accessible, as well as reliable. The Southern Africa Development Community (SADC) strategy advocates that member states must communicate on the IWRM approach, and cooperate on water, climate change, variability and water-related disasters. To this end, there is currently a strategy under development for the Limpopo Basin to assist the basin states with their monitoring compliance. Water quality is one of the aspects to be monitored, however, it should be noted that whilst the legal framework around this for shared water courses is complex, there is strong cooperation between South Africa and Moçambique in this regard.

In addition, there exists the Inco-Maputo agreement between South Africa and Mozambique that has a specific Annexure on water quality monitoring. However, to date, there are no clear steps for implementing it.

Overall compliance monitoring needs to be improved and prioritised. However, the willingness for cooperation in uncertainty is a good foundation from which to move forward for both South Africa and Mozambique in dealing with issues around the Olifants system.

3.3 IWQM Alignment

The Government Planning system is outlined in Figure 11. The Medium Term Strategic Framework (MTSF) is the mechanism of implementation of the National Development Plan.



Figure 11: Government Planning System

With the domestication of the SDGs, it has been proposed that the reporting needs to align with the outcomes of the SDG process. The adoption and domestication of the SDGs is a process that needs to align with the overarching NDP, and ensure the targets and indicators, once developed, are incorporated into the rest of the Policies and Strategies.

The IWQM Policy places the IWQM in context with regards to National horizontal, vertical and transboundary policies as it recognised the crucial need for integration, including the National Water Resources Strategy (NWRS) and other plans developed by, amongst others Department of Agriculture Fisheries and Forestry, Department of Mineral Resources, Spatial Planning and Land use Management Act (SPLUMA) and Integrated Development Plans (IDP).

3.4 The IWQM Policy Response

The status quo of WQM across the country is not encouraging and without a change in how we cooperate to manage water, land use and development options, worsening water quality will continue to decrease the socio-economic benefits from and increase the costs associated with use of the country's water resources.

Recognising these challenges, this **Policy is designed to enable government, as a whole, in partnership with civil society and the private sector, to address the issue of water quality across the country**. *It brings together the best elements of existing, but fragmented, water quality management* and the principles of the Second Edition of the National Water Resources Strategy. This Policy draws upon international experience, to add new Policy positions to the foundation *provided by existing national Policy, in order to craft a new way forward for water quality management in South Africa.*

Historically, water quality management has been the sole mandate of the Department of Water and Sanitation. However, there are other government departments whose mandates have profound impacts on water quality, most critically those of the: Departments of Environmental Affairs, Mineral Resources, Agriculture, Health, Human Settlements, Education, Co-operative Government and Traditional Affairs, National Treasury, Trade and Industry, together with their provincial counterparts where relevant, and municipalities. Recognising these operational challenges, a fundamental and new framework permeating this Policy is that integrated water quality management is a government-wide task, to be implemented under the leadership of the Department of Water and Sanitation, with both the private sector and civil society playing key roles. Within this context, the 2017 Integrated Water Quality Management Policy calls for an inclusive approach to managing water quality in the country.

The 2017 IWQM Policy recognises that managing water quality is a complex problem. Contrary to historical views that relatively simple command and control approaches could be used to manage water quality, it is now recognised that in the water quality domain, human and bio-physical systems interact, increasing the complexity of water quality management. In dealing with complex systems, the pathway is often affected by unexpected events and developments, calling for course corrections and new approaches.

This Policy, therefore, is firmly rooted in the recognition that the only way to manage the complex challenge of water quality in South Africa is through the adoption of adaptive

management, a process that calls for flexibility, and for structured learning throughout the process in order to inform and amend Policy and practice over time. Adaptive management is also rooted in the understanding that there are many different sets of knowledge that must be brought together to address the challenges, including social, political, earth sciences and financial analysis. The management of water quality requires the bringing together of a wide range of knowledge in a structured process that allows co-learning, co-creation, and co-adaptation to move forward.

Vision and Values for IWQM

The IWQM Policy Responses to the challenges are aligned to The Constitution of South Africa and aims to support the vision for water management, **"Sustainable, equitable and secure water for a better life and environment for all."**

The country's vision for Integrated Water Quality Management is therefore:

"Government, in partnership with private sector and civil society, secures water that is fit for use, for all, forever!"

/e and

systems-based management approach, in close alliance with the private sector and civil society, that will improve resource water quality in South Africa, prevent pollution and ecological degradation, support ecologically sustainable economic and social development, and informed use of the nation's water resources.

Policy Pillars for IWQM

The IWQM Policy, comprised of 17 Policy Principles, is constructed around four pillars which, when implemented, will result in the attainment of the vison and goals (Figure 12). These values support the vision, guide the principles, and reflect the ethos for managing water quality in South Africa.



Figure 12: The four pillars of the Integrated Water Quality Management Policy

Each pillar is elaborated in greater detail in the IWQM Policy and describes the:

- The problem/challenge that needs to be resolved through Policy;
- The response that is required to mitigate the challenge; and
- The summary statements for the Policy.

3.5 The IWQM Strategic Response

The IWQM Strategy is an integral part of the National Water Resource Strategy (NWRS) which notes that a paradigm shift in sustainable resource development is needed to support inclusive growth. Water quality, is articulated throughout the NWRS as a core element of the strategy, but the central role of water quality is not fully distilled. Therefore, this IWQM Strategy provides the strategic intent required to ensure that WQM supports the implementation of the NWRS.

This IWQM Vision is brought to life through 5 core mission statements of intent, namely:

- To support a consistent inter-departmental approach to how water quality is managed in our country.
- To foster and support cooperative and integrated approaches to IWQM across sectors, including the private sector and civil society.
- To adopt an adaptive management approach in which co-creation and co-learning by key players is entrenched and supported by the exchange of data and information.
- To drive programmes to build technical and managerial capacity for longer-term improvement in water quality.

• To undertake initiatives to progressively realise improvements in water quality in key systems with the intention of redressing priority water quality issues and showing that, as a country, we can halt the deterioration of our water resources.

In responding to the Vision and Mission for IWQM, this Strategy is based upon 5 Strategic Goals, which derive from the four IWQM Policy Pillars (Figure 13).



Figure 13: Policy Pillars and Strategic Goals

The five Strategic Goals are:

- **Goal 1:** Aligned Policy, Legislation and Strategy: In order to support our drive to be more inclusive in our approach, there is a need to find ways to improve the alignment between policy and legislative instruments, as well as in our strategic approaches. This will take time and considerable effort, but will prove critical.
- **Goal 2**: Good Governance: An inclusive approach will require that we find ways to improve functional roles and responsibilities. This will require innovative approaches to the way we structure our approaches both within Government and externally with non-Governmental actors.
- **Goal 3**: Efficient and Effective WQM Practice: The need to be more adaptive in our responses to WQM will require increasingly efficient and effective practices within catchments. This will require a critical review of all these processes and practices at various levels within the WQM system.
- **Goal 4:** Innovative Finance: To date there has been too much dependence upon funds from the national fiscus to support WQM. Noting that financial resources are limited in South Africa, there is a need to be more innovative in generating the funds that are needed to support more effective IWQM.
- **Goal 5**: Effective Knowledge and Information Management: The old adage that you cannot manage what you do not measure holds true. This requires a renewed and strengthened drive to improve the national monitoring networks and to strengthen and consolidate our information management systems. Our adaptive management approach is based upon the support of these networks and systems.

During the Assessment and Policy development phases, a large number of issues were identified. These were collated into clusters, taking into consideration the policy responses, resulting in



eleven Strategic Issue areas. These align with the IWQM Strategic Goals as in the Figure 14, below.

Figure 14: The IWQM Strategic Goals and Objectives

Key Strategic Objectives and Strategic actions have been identified for each of these Strategic Goals.

3.6 Towards IWQM implementation

Implementation is the process that turns strategies into the action plans and activities that must be carried out to accomplish strategic objectives and goals. As such, implementation is as important, perhaps even more important, than the strategy itself. Noting the importance of the strategic approach towards implementation, it is critical to develop a clear and structured approach that provides a practical, cost-effective and pragmatic basis for implementation.

Implementation needs to be supported by ensuring that capacitated staff, sufficient resources, appropriate structures, supportive systems and an enabling culture are all available. It is important to recognise that despite the development of various methodologies and instruments over the last 25 years, all with the aim to enhance water quality management, the status of water resource quality continues to worsen.

Strategy experts will note that strategies often fail because without a clear and full fully understanding the challenges, and racing to develop and implement various interim solutions, that there is often an over emphasis on form over function. This results in a failure to address real issues like creating improved, efficient and effective actions, and that often there is no creation of active learning environments that enable staff and stakeholders to jointly learn and develop adaptive responses.

There is therefore a need for a change in approach to ensure that the trajectory of declining water resource quality is checked, and that we start to create the right capacity to strengthen our management of water resources whilst working towards a longer-term vision of on-going IWQM that is supported and enabled through adaptive management approaches.

The approach in the development of the IWQM implementation plan has therefore been to focus upon actions and activities that enable improved IWQM, with a sense that success will result in further success.

The IWQM Strategy provided a significant suite of 11 Strategic Issues, 21 Objectives and 62 Actions to fulfil the 5 Strategic Goals. Phased and pragmatic implementation of these actions are required, and this section below aims to illuminate the process for prioritisation.

It is not possible to address all of the many water quality challenges simultaneously; insufficient human and financial resources as well as information and systems constraints prevent this. Therefore, the focus of this strategy is on delivering beneficial change for prioritised challenges.

Core considerations for the formulation of the implementation plan include:

- Focus on short- to medium-term timeframes, while building a platform for future strategies in line with the policy and visions for water quality management;
- **Prioritise critical concerns**, while ensuring that other issues are addressed through ongoing management or monitoring for future prioritisation and action;
- Ensure relevance at national, catchment and local scales, while ensuring horizontal alignment across sectors and institutions at each scale;
- **Provide the strategic intent and framework for actions** to be described in the implementation plans; and
- Enables adaptive response to changing circumstances and achievements based on effective on-going monitoring and evaluation.

4. STRATEGIC FRAMEWORK FOR THE OLIFANTS WMA

4.1 A Vision for the Olifants WMA

The 2017 national IWQM Strategy recognises the various dimensions that underpin the business of IWQM. These being aligned policy, cooperative governance, strengthened WQM practices, improved monitoring and information systems, and capacitated and engaged stakeholders. This provides a governance framework for ensuring that IWQM is effected nationally as it essentially provides the framework for the IWQM business.

The 2017 IWQM Policy and Strategy provide a renewed drive to strengthen the management of water quality, and to support sustained growth and development. Noting that the IWQMP of the Olifants River is a subset of the Catchment Management Strategy it is useful to note that catchment plans are often structured around the concepts of resource protection, resource development, the management of disasters and risk, and governance frameworks. This is indeed a useful framework when holistically considering sustainable resource development and the management of water quality.

This is mirrored in the WQM business process where one finds the notion of resource protection, resource development and the monitoring and auditing that supports the management of risk (Figure 15). This is all underpinned and enabled by an institutional framework.



Figure 15: The WQM Business

Aligning with the vision for the 2017 IWQM Strategy, the vision for IWQMP in the Olifants WMA is:

Government, in partnership with private sector and civil society, secures water in the Olifants water management area that is fit for use, for all, forever.

In adopting this vision:

- We understand that we need to protect water resources to enable their sustainable development so that future generations also enjoy the benefits that are linked to and derived from water use;
- We recognise the need to ensure that water is fit for use to support the growth and development of society and the economy of the Olifants WMA;
- We recognise that managing water quality and associated risks are a critical dimension of the water security that underpins our resilience; and
- We understand that we as key stakeholders, across Government, the private sector and civil society need to jointly cooperate to ensure that water quality is effectively managed.

4.2 Strategic Areas and Goals for Implementation

With these in mind the structure of the IWQMP for the Olifants WMA is based around four core strategic areas (Figure 16):

- Strategic Area 1: Protecting water resources to maintain the goods and services that are accrued from functioning ecosystems;
- Strategic Area 2: Developing water resources to support social and economic growth;
- Strategic Area 3: Managing water quality and associated risks to underpin resilience; and
- **Strategic Area 4:** Governing to ensure cooperative water resource management and development.



Figure 16: Four Strategic areas for the Olifants IWQMP

The vision can be translated into more tangible outcomes against which a more detailed implementation plan can be developed.

Strategic Area 1: Protecting water resources to maintain the goods and services that are accrued from functioning ecosystems

We understand that we need to protect water resources to enable their sustainable development so that future generations also enjoy the benefits that are accrued from water use

- **Goal 1.1**: The majority of riverine and wetland systems are maintained with the intent to improve the status of the ecosystems wherever possible.
- **Goal 1.2**: Water in, or from, water resources in the Olifants WMA is fit for use.

Strategic Area 2: Developing water resources to support social and economic growth

We recognise the need to ensure that water is fit for use to support the growth and development of society and the economy of the Olifants WMA

- **Goal 2.1**: Adequate water of appropriate quality is allocated to meet the social objectives of economic development, service delivery and equity/redress.
- **Goal 2.2**: All waste/ water containing waste generated by households and by economic activities is disposed of/ discharged lawfully and safely.

Strategic Area 3: Managing water quality and associated risks to underpin resilience

We recognise that managing water quality and associated risks are a critical dimension of the water security that underpins our resilience

- Goal 3.1: Effective monitoring of source and non-point source pollution demonstrates that adaptive and climate resilient IWQM is being implemented at the WMA and sub-catchment levels.
- **Goal 3.2**: Compliance with water use authorisations is improved year on year.

Strategic Area 4: Governing to ensure cooperative water resource management and development

We understand that we, as key stakeholders, across Government, the private sector and civil society need to jointly cooperate to ensure that water quality is effectively managed

- **Goal 4.1**: Institutional capacity and operational and financial systems are strengthened to enable effective IWQM.
- **Goal 4.2**: Key partnerships are established, while stakeholder engagements and knowledge management are strengthened and maintained in support of IWQM.

Each of these strategic areas is dealt with separately in the following chapters. There is some overlap between these strategic areas, so linkages are highlighted where relevant. The contributions of the strategic actions to multiple objectives will be cross referenced in the implementation plan that will stipulate roles and responsibilities, time frames for attaining targets, and the mechanism for monitoring and evaluation.

5. STRATEGIC AREA 1: PROTECTING WATER RESOURCES TO MAINTAIN THE GOODS AND SERVICES

This strategic area focuses on the sustainability aspects of the IWQMP and, therefore, focuses on the effective management of the water resources and freshwater ecosystems, to ensure that these resources continue to provide the goods and services upon which society and the economy depend. Therefore, there are two key goals:

- **Goal 1.1**: The majority of riverine and wetland systems are maintained with the intent to improve the status of the ecosystems wherever possible.
- **Goal 1.2**: Water in, or from, water resources in the Olifants WMA is fit for use.

In support of this, a number of studies as part of the RDM have been undertaken and completed. During the classification study the following provisioning, regulating and cultural aspects were taken into consideration and need to be considered further when developing the WQPLs. These include:

Provisioning services:

- river water for domestic use (the Basic Human Needs (BHN) component of the Reserve);
- livestock watering and grazing;
- sand and clay harvesting and use;
- use of plant resources;
- harvesting and use of wild food and medicinal products;
- hunting resources; and
- fishing resources.

Regulating services:

- value of flood attenuation;
- value of base flow maintenance;
- value of water purification; and
- carbon sequestration values.

Cultural services:

- value of river-based adventure tourism;
- value of recreational angling;
- ecotourism value;
- property values; and
- scientific and educational value.

Considering the classes set for the Olifants catchment (Figure 10), the vision is for a catchment that will include management of water quality using source directed measures, as well as regulatory and institutional structures, with concerted and regular monitoring and compliance management to ensure the successful implementation of the management classes and RQOs.

Setting of WQPLs will therefore help to achieve the management class and RQOs for particular areas, as they are set at a finer resolution, and take local users and water uses into account.

The objective of using WQPLs is to provide a mechanism through which the balance between sustainable and optimal water use and protection of the water resource can be achieved. What is important is that WQPLs are aligned to the RQOs and do not contradict the objectives gazetted.

Setting WQPLs will allow for the realisation of the catchment vision by giving effect to the water quality component of the gazetted (RQOs).

For example, WQPLs at a finer spatial scale will assist the Environmental Official to, for example, assess an IWULA as well as set relevant conditions and manage and control the water users in the sub-catchment in a manner that will allow for sustainable use and development.

The strategic measures developed to support this Strategic Area include:

- Strategic Measure 1-A: Meeting Resource Quality Objectives
- Strategic Measure 1-B: Groundwater protection
- Strategic Measure 1-C: Conserving ecological infrastructure
- Strategic measure 1-D: Catchment and land use planning

5.1 Strategic Measure 1-A: Meeting Resource Quality Objectives

The NWA requires that all significant water resources in South Africa be classified using a Water Resource Classification System to determine the hydrological and water quality conditions required to maintain ecosystem functioning. In the Olifants WMA, the classification and development of RQOs has been completed and gazetted (GN 466, NWA, Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment, 22 April 2016).

In this respect, as an area that has been classified, Section 12(2)(b) (ii) and (iii) and 12(2)(c) of the National Water Act (Act 36 of NWA) should be explored for those areas where further development or stricter developmental conditions will be required. These sub-sections allow for the establishment of procedures that are designed to satisfy the water quality requirements of water users as far as is reasonably possible, without significantly altering the natural water quality characteristics of the resource (12(b)(ii)); and to set out water uses for instream or land-based activities which activities must be regulated or prohibited in order to protect the water resource (12(b)(iii)); and provide for such other matters relating to the protection, use, development, conservation, management and control of water resources, as the Minister considers necessary (12(2)(c).

The key challenge for the water management area is now to monitor progress towards the attainment of these objectives and undertake appropriate adaptive responses to ensure that these objectives are achieved.

Therefore, the objective for this strategic measure is:

To ensure effective management of the water resources and freshwater ecosystems, so that these resources continue to provide the goods and services upon which society and the economy depend, including provisioning, regulating and cultural services.

In support of this, two actions have been identified.

Action 1-A.1: Implement operational actions as per the sub-catchment plans to ensure compliance with RQOs and Reserve requirements

The various sub-catchment plans have highlighted a range of detailed actions to support the management of water quality within these sub-catchments. These have focused on the broad response areas of monitoring, research, awareness and capacity building, regulation and financing. Ensuring that these actions are implemented will be critical to ensure that the RQOs are achieved. Towards this end, DWS will need to review all the sub-catchment plans, review current resources and then determine what can be undertaken.

Action 1-A.2: Develop and implement an annual priority action plan towards ensuring impactful improvements in water quality

Based upon monitoring of the water resource quality, it will be critical to develop interventions that can realise the RQOs and reflect improvements in water quality. To this end, it will be important to develop an annual intervention plan that lays out the priority actions to support the improvement in water quality and the achievement of the RQOs. The development of a supporting scorecard that will allow progress to be tracked will be important.

5.2 Strategic Measure 1-B: Groundwater protection

Groundwater resources are important to meeting the water use requirements across the Olifants water management area. As with many parts of the country more needs to be done to monitor groundwater resources and to develop an improved understanding the status of the resource. The groundwater quality in the Olifants catchment varies significantly from Ideal/Good in the recharge areas to Marginal throughout the water management area. Groundwater quality in certain areas such as the Upper Olifants Coal Area is deteriorating due to AMD which has a serious impact on the local surface water resources due to decanting interflow. However, what is a concern throughout the study area is the steady increase of nitrates in the groundwater and is directly linked to irrigation practices (i.e. The Springbok Flats) and high-density populated areas – three specific areas have been identified where regional nitrate pollution as the result of sanitary practices (pit latrines) are probably the main cause. Local groundwater resources in the Giyani Region (QC B82G–Little Letaba River) are significantly impacted by nitrate pollution and the effect is probably irreversible.

Therefore, the objective for this strategic measure is:

To strengthen our understanding of the groundwater resources of the Olifants water management area in order to develop targeted protection approaches

In support of this, one key action has been identified.

 Action 1-B.1: Develop a groundwater protection plan based upon improved understanding of groundwater resources

Water resources within the Olifants water management area are already over allocated and will increasingly constrain development if not more effectively managed. The development of groundwater resources will become increasingly important and will need to be managed to ensure sustainability. This will require further research and study to gain a better understanding of the extent and location of groundwater resources. The impact of

developments on the quality of groundwater resources also needs to be better understood. Studies to understand the groundwater situation will be a critical precursor to developing a protection plan to ensure that this valuable resource is not over exploited.

5.3 Strategic Measure 1-C: Conserving ecological infrastructure

Ecological infrastructure refers to the various functioning ecosystems that provide a range of goods and services upon which society depends. This includes healthy catchments, rivers, wetlands and natural habitats and the effective management and restoration of these networks. This does include the important Strategic Water Source Areas. This supports in the provision of improved water quality, in flood attenuation, in the reduction of sediment loads and in increasing winter baseflows that can support water quality dilution. Of particular concern is the continued degradation of wetlands across the catchment and these wetlands play a very significant role in terms of water quality management.

Therefore, the objective for this strategic measure is:

To promote the co-ordinated development and management of water, land and related resources to ensure that ecological infrastructure sustainably provides the goods and services that ensure ongoing water security

In support of this, two actions have been identified.

 Action 1-C.1: Identify priority ecological infrastructure components and associated goods and services

Whilst there have been supporting projects such as the National Freshwater Ecosystem Priority Areas, upon which this can be developed and extended, it is important to develop a spatial and temporal understanding of the types of ecological infrastructure that exist within the Olifants water management area and to capture the various goods and services that these provide in terms of water quality management. These would need to be prioritised towards improved water quality management using a suite of criteria that would need to be developed.

Action 1-C.2: Develop and implement plans for the management of priority ecological infrastructure

Based on the findings from the mapping exercise (above) it will be important to develop plans for the ongoing management and protection of these areas. These plans would include practical management initiatives, but importantly would also have to reflect strategic matters with regards to institutional and regulatory approaches. The plan would have to include costings and an investment framework so that there are sufficient resources at hand to undertake the various management actions.

5.4 Strategic Measure 1-D: Catchment and land use planning

Land use activities have the most significant impact upon water resource quality and yet the management of land resources and the activities that take place fall outside of the remit of the DWS and its water management institutions. Longer-term land use planning integrated with longer-term water resource planning is becoming increasingly important and was the focus of earlier drives within the water sector to understand "water for growth and development". Whilst,

the water sector understands the importance of land use activities upon water quality management, the value of water quality management is not always that evident to water users, unless they themselves have very specific water quality requirements. To some extent this has changed with the Acid Mine Drainage (AMD) crisis in certain parts of the country, while the current drought has underscored the impact that water can have on economic development.

Nonetheless, the difference horizontally across the various government sector departments as well as vertically between national, provincial and local government present real challenges in effecting integrated planning.

Therefore, the objective for this strategic measure is:

To ensure that water quality management considerations are integrated into the various land use and catchment management planning processes

In support of this, two actions have been identified.

 Action 1-D.1: Undertake analysis to understand the importance of water quality and water quality management upon the economics of the Olifants water management area

Whilst there has been a long history of water quality challenges within the Olifants water management area, there has not been an assessment of the impact that this has upon the social economy. This study will prove critical in assisting the various stakeholders to fully understand the importance of effective water quality management. Equally, this will help to justify the financial investments that are required to effectively manage water quality.

Action 1-D.2: Integrate water and water quality considerations into land use planning processes and to inform future land use, based on water availability

Based on the findings from the economic analysis, a series of intersectoral planning sessions will be held to align the various planning instruments across these sectors. In considering these intersectoral plans there would specific attention focused upon addressing:

- Mine water management;
- Metal management;
- Nutrients and microbial management;
- Salinity management; and
- Emerging contaminants management.

It is envisaged that, based on the findings from these interventions, the reconciliation strategy for the Olifants water supply system may need to be amended (under Strategic Measure 2).

6. STRATEGIC AREA 2: DEVELOPING WATER RESOURCES TO UNDERPIN GROWTH

Water underpins the socio-economic growth of the Olifants WMA and there are concerns that the increasing levels of stress across the region will have negative impacts on this development. Noting the impact that water quality can have on the 'health' of the resource as well as the users who require water that is 'fit for use'; water quality is, therefore, a developmental issue. With this in mind the goals for this strategic area are:

- Goal 2.1: Adequate water of appropriate quality is allocated to meet the social objectives of economic development, service delivery and equity/redress.
- Goal 2.2: All waste/ water containing waste generated by households and by economic activities is disposed of/ discharged lawfully and safely.

Reconciliation Strategies are developed by the Department, the overall objective of which is to meet legitimate current and future water requirements in the specific catchment being studied and its links to, and dependencies on, adjacent catchments. The sub-objectives of the development of a reconciliation strategy include the development of a water reconciliation strategy for the catchments' water supply system and the implementation and maintenance of the water reconciliation strategy.

The reconciliation strategy is developed to:

- Address growing water demands as well as all serious water quality problems experienced in the catchment that would affect water availability;
- Identify water resource management and development options;
- Provide reconciliation interventions both structural and administrative/regulatory; and
- Facilitate communication and strengthen the partnership between DWS and key stakeholders in the catchment.

Due to the pressures on the system there has been a significant number of studies undertaken. These include the following.

Olifants Reconciliation Strategy

The Olifants Reconciliation Strategy Study was completed in 2012. The study recommended the most cost-effective interventions to reconcile the growing water requirements and possible supply augmentation options. Once the Strategy was developed, it needed to be implemented to ensure sustainable water use in the water supply system. To support the implementation of the Olifants River Reconciliation Strategy, the DWS commissioned the Continuation of the Olifants River Water Supply System Water Reconciliation Strategy – Phase 1 Study.

Letaba Reconciliation Strategy

The Letaba Reconciliation Strategy (including the Luvuvhu, Shingwedzi and Mutale catchments) was completed in September 2014. The Reconciliation Strategy incorporated approved water resource development projects such as the Groot Letaba Water Development Project (GLeWaP),

which is a key initiative by the DWS to support the social and economic development strategy for the Limpopo Province.

Olifants River Water Resources Development Plan

The purpose of the ongoing Olifants River Water Resources Development Project (ORWRDP) is to meet the needs for water (both domestic and mining) in the middle part of the Olifants River catchment, and in the adjacent Mogalakwena and Polokwane Municipal areas. The project will facilitate improvements in social conditions in the area and will enable much needed economic development. With mining as the main economic stimulant and major user of water, the opportunity arises to share in the economies of scale to also enable the improved supply of water to urban and rural domestic users and, in particular, to impoverished communities in the area (DWS 2015b).

The ORWRDP comprises two main phases:

- Phase 1 involves the raising of the Flag Boshielo Dam wall on the Olifants River by 5 m (ORWRDP-1) which was completed in 2005; and
- Phase 2 involves the development of additional water resource infrastructure (the De Hoop Dam on the Steelpoort River and bulk raw water distribution infrastructure) in the middle Olifants catchment (ORWRDP-2).

The project faces challenges as a result of changing water requirements and the difficulty of reconciling these new water requirements with the available water resources. A substantial portion of the mining water requirements have also shifted from the Sekhukhune District Municipality (DM) area to the Mogalakwena Local Municipality (LM) area since the start of the project. The configuration of the project infrastructure required changes and augmentation to water resources which needed to be investigated. It was therefore decided to do a technical review of the planning and design work done so far and, where necessary, recommend changes in a Technical Review Report that would be used to inform the due diligence process embarked upon by the National Treasury to consider issuing an explicit guarantee by government or fiscal funding.

To date, the ORWRDP has linked closely with the Olifants Reconciliation Strategy update and all information used has been consistent between the two studies. The infrastructure capacities as determined by the ORWRDP have been included into the WRPM for various scenarios analysed.

Preliminary management options and recommendations to improve water supply within the WMA were identified through previous reconciliation and other studies. Some of the aspects are considered below. The IWQM dimensions of these need to be considered on an ongoing basis as part of an adaptive management regime.

Water Conservation /Water Demand Management (WC/ WDM) - Irrigation

Water Management Plans (WMPs) for the Loskop and Hereford Irrigation Boards showed that there are approximately 13 million m^3/a of avoidable losses in their water distribution systems. The 21 million m^3/a currently in the water balances will have to be reduced accordingly and the

implications for the water resource supply risks need to be assessed as part of future analysis. Interventions to strengthen WC/WDM in the irrigation sector will require further investigation.

WC/ WDM - Urban

Although some of the Local Municipalities do have successful WC/ WDM initiatives underway (such as Steve Tshwete Local Municipality and Tshwane Metropolitan Municipality, i.e. Bronkhorstspruit), engagement of many of the municipalities is not as it needs to be and there is a need to strengthen the levels of engagement at the "Steering Committee" level. The knowledge gap at the municipal level with regards to the importance of WC/ WDM is significant and needs redress if municipalities and local users are to be more efficient with their water use. The use of case studies and examples of successes can be powerful in demonstrating what can be achieved and how these can be translated into benefits to the Supply System.

WC/ WDM - Mining

Whilst the ORWRDP identified some specific interventions to take place, and the targets for these interventions have most probably already been reached through activities undertaken by the mining sector, there is a need to support ongoing improvements in the way that the mining sector manages their water use and water quality impacts. Many mines are working towards reducing all raw water inputs through several reuse interventions inside the mine fence. The Joint Water Forum is playing a key role in supporting the improved understanding of the status of water resources as well as in sharing best practice approaches to water management.

Eliminate unlawful water use

Some validation and verification work has started on an *ad hoc* basis by DWS: Mpumalanga Provincial Office. To date directives have been given to offenders where water use transgressions have occurred. The Validation and Verification process is now a DWS: National Office Function and PSP support is being utilised. Previously enforcement of certain obvious illegal users has taken place upstream from Middelburg Dam and in the Ogies area. The current water balances assumed that the first reductions in unlawful would have commenced in 2016 and there is an expectation that with increased enforcement of compliance that maximum savings will be attained over a 10-year period.

Development of groundwater resources

Groundwater development was understood, in the 2012 Strategy, as the largest contributor to making more water available. However, more recent desktop investigations indicated that the actual amount of ground water available might be substantially less than was estimated in the 2012 Strategy. A detailed investigation into this intervention is now underway by DWS and this will support the development of a groundwater protection strategy under Action 1-B.1.

Removal of invasive alien plants

The Working for Water Programme of the Department of Environmental Affairs has cleared a total of 359 km² of the potential area of 1990 km2 (2012 Strategy) colonized by alien invasive

plants (AIPs). This achievement has to be translated into estimated volumes of water saved and tracked against the intervention targets. This intervention spans the complete planning horizon of the current Strategy. Ongoing support for this programme is a key part of the reconciliation strategy and will realise water resource quality benefits across the water management area.

Treatment of mine water

There are several mining companies that have already constructed, or who are planning to construct, mine water treatment plants in the Upper Olifants River Catchment. The SSC maintains a list of the structures already in place as well as those planned for the future on a six-monthly basis and the Strategy will be adapted accordingly. This intervention was on schedule, but the current full implementation target was revised due to delays in the implementation of some of the schemes.

The role of the Joint Water Forum and the Mine Water Coordinating Body in providing guidance and support towards improved mine water management approaches cannot be underestimated.

Municipal effluent re-use

Polokwane and Mokopane have historically treated their municipal effluent and sold the treated water to mining and industrial water users. eMalahleni has the biggest potential for effluent reuse, but it is unclear if the local municipality has started any such initiative. This intervention will have to be monitored on an ongoing basis and treatment capacity will needs to be upgraded as effluent volumes increase in accordance with the water requirement projections, spanning the whole planning horizon. The current planned treatment works, and adjusted projections of water requirements will affect the current projected targets, and these will have to be revised in future.

The strategic measures that will be developed to support this Strategic Area will include:

- Strategic Measure 2-A: Water resources assessment
- Strategic Measure 2-B: Water conservation and water demand management
- Strategic measure 2-C: Water Allocation

6.1 Strategic Measure 2-A: Water resources assessment

Water resources within the Olifants WMA are heavily utilised. Whilst there have been a number of assessments with regards to water resources of the Olifants water supply system, the development and improvement of our understanding of these water resources needs to be undertaken systematically and reviewed regularly. Water demands change over time and the impacts of climate variability also influence what water is available and where and when it is available. These need to be considered against the current yield of the system and the need for further infrastructure development.

To date, water quality dimensions are included in the reconciliation strategy studies, but it has been recognised that these need to be strengthened.

Therefore, the objective for this strategic measure is:

To undertake the necessary programmatic actions, on an ongoing basis, that enable water resource managers to understand, over time, the quantity and quality dimensions of water availability and water use within the Olifants water management area, to support improved decision making

In support of this, two actions have been identified.

• Action 2-A.1: Undertake validation and verification of water use

An important dimension of fully understanding water resource availability is to have a detailed understanding of the patterns of water use and actual water volumes used within the water management area. There have been a number of drives to ensure that water users are registered and there have been water use validation and verification studies; however, these have largely focused upon abstractive water use. Experience across the country has shown that many water users have typically not registered their effluent discharge loads and so a drive to obtain a more complete understanding of the discharge loads would provide the basis for developing a more complete picture of future allocation.

Action 2-A.2: Ensure that water quality management aspects are fully integrated into the amended Reconciliation Study for the Olifants WMA

When developing the Reconciliation Strategy for a catchment, a water quality assessment is undertaken. However, the recommendations made do not necessarily consider the impacts on water quality. The 2011 Reconciliation Strategy will be updated in the near future and it is important to ensure that the update incorporates water quality aspects, and the important linkage between water quantity and quality. This integrated water quality management plan can provide a basis for key considerations into this amended reconciliation strategy.

• Action 2-A.3: Update water availability studies as this may impact on load allocations

Based on the findings of the validation and verification, in conjunction with the reconciliation strategy, there will be an improved understanding of water availability and allocable load. This will prove essential in the adjudication of future water use authorisation applications and will provide the firm justification for the decisions.

6.2 Strategic Measure 2-B: Water conservation and water demand management

The water availability analyses to date reflect that the water resources of the Olifants WMA are limited. Therefore, water use efficiency becomes increasingly critical.

The introduction of WC/ WDM measures is often considered as the savings that can be found in respect of decreasing the volumes of unaccounted for water. This is specifically the case when undertaking the reconciliation strategies for the catchments. However, there are several other components that contribute to WC/ WDM and include water resource management aspects, distribution management, consumer demand management and return flow management. These aspects can have varying degrees of beneficial impacts upon the management of water quality. Often this implies more effective operation and maintenance of infrastructure and this can have significantly positive impacts on water quality.

Therefore, the objective for this strategic measure is:

To support and coordinate actions that improve the efficiency of water use within the Olifants water management area.

In support of this objective, five actions have been identified.

• Action 2-B.1: Strengthen WC/ WDM conditions for all WULs

An important drive is to get the basis for water use practice resolved through the water use license conditions. Whilst new licenses have WC/WDM measures incorporated, older licenses do not necessarily have these conditions. In this process, and noting the status of water resources, the need to develop more stringent conditions may be required.

Action 2-B.2: Develop and implement improved measures for efficient scheme/ system operation

Following the water availability study, an investigation may be conducted around the possibility of adopting more sophisticated scheme operating rules to conserve water in the Olifants water supply system, this would need to consider possible losses within the conveyance systems and potential options for water reuse. These scheme operating rules would be used to better:

- Mine water management;
- Metal management;
- Nutrients and microbial management; and
- Salinity management.

Action 2-B.3: Implement and support priority alien vegetation clearing projects and river maintenance plans

Working closely with the DEA's Natural Resource Management Programme, and Provincial programmes, the implementation of clearing programmes for invasive alien plants under the Working for Water banner should be prioritised.

Action 2-B.4: Develop and implement WC/ WDM plans for urban areas (using WSDP/ IDPs)

There are significant water losses within urban centres. These losses are often accounting or 'paper' losses, but there are also significant water losses from aging and poorly operated and maintained infrastructure. Improvements to reduce losses that can be as high as 40% in some urban centres are crucially important and can have meaningful beneficial impacts upon water quality.

Whilst technical and management capacity constraints are significant within many municipalities, there are opportunities to counter these challenges through the development of effective partnerships. The SWPN can support in this as can the mines that have qualified technical staff.

Action 2-B.5: Develop and implement WC/ WDM plans for the agricultural, mining and industrial sectors

There have been some initiatives from the different water use sectors to become increasingly efficient in their water use. This has demonstrated that there is an increasing understanding that beyond efficiency, water users should be looking to treat and reuse their effluents rather than simply discharge the effluents to a water course. Key partners such as the MWCB and WISA can provide support in sharing best practices and transferring knowledge regarding innovations in these spaces. Collective action in this regard is important and can be the basis for significant gains within the catchment.

6.3 Strategic Measure 2-C: Water Allocation (Reform)

With an improved understanding of water availability, noting that improved water use efficiency can realise savings, additional water use allocations may be possible. Noting that from a water quality management perspective load is allocable, it will be important to fully understand what can be allocated before the achievement of RQOs is hampered or that the maintenance of a management class may be threatened.

Redressing social inequities through water reallocation remains a critical central issue for the water sector. Water Allocation Reform (WAR) describes a suite of processes that are aimed at the equitable, productive, and sustainable allocation of water. As such, the focus is on activities to promote applications to use water that will:

- Redress past imbalances both for race and gender;
- Support sustainable and efficient water use;
- Support socio-economic initiatives; and
- Support of government programmes aimed at poverty eradication, job creation, economic development and rural development (i.e. the broad government development objectives).

Within this context the allocation of waste loads is equally important and needs to be carefully considered when undertaking further water use allocations.

Therefore, the objective for this strategic measure is:

To support socio-economic development within the Olifants WMA through the authorisation of sustainable and efficient water use

In support of this, two actions have been identified.

Action 2-C.1: Develop a water quality allocation plan for prioritised water quality constituents

Using the WARMS database, and the outcomes of the validation and verification process, the development of a water quality allocation plan will be important in understanding how discharge related water use is taking place within the water management area. This allocation plan will then indicate where additional allocations are possible spatially, as well as the associated water quality constituents and permissible loads.

Action 2-C.2: Allocate water that is fit for use
Based upon the allocation plan, water use will be allocated and authorised accordingly. For this process a suite of criteria will be developed to guide this in terms of allocation reform. At this stage, there is no identified need for a compulsory licensing process, but it must be noted that the increasing pressure being placed upon the water resources of the Olifants WMA may ultimately require such a process to be undertaken.

7. STRATEGIC AREA 3: MANAGING WATER QUALITY AND ASSOCIATED RISKS TO UNDERPIN RESILIENCE

There is a multi-faceted challenge with regards to monitoring and information management. Insufficient funding is a challenge that hampers the improvement of our monitoring networks and this needs to be addressed. At the same time, there is a need to continue improving the data and information management systems that are used to support management and decision making. To this end the goals for this strategic area are:

- Goal 3.1: Effective monitoring of source and non-point source pollution demonstrates that adaptive and climate resilient IWQM is being implemented at the WMA and sub-catchment levels.
- **Goal 3.2**: Compliance with water use authorisations is improved year on year.

As the pressure on our water resources increases, the ability to ensure that we can meet these requirements with an agreed level of reliability becomes increasingly difficult. In the Olifants WMA the water resource requirements are already facing very significant pressure, whilst recognising the need to protect the environment and ensuring sustainability. This is indeed complex and there is a need for a pragmatic and structured approach to establishing a regulatory framework within the water management area that key actors and stakeholders will understand and support with time.

The implementation of many of the aspects of this IWQMP will require adequate resources, including the funding of initiatives or the institutions that are responsible for implementing functions. Business planning of government departments, agencies, companies and other institutions is the mechanism through which these resources are mobilised and allocated. Therefore, alignment between the IWQMP and these business plans is critical.

South Africa has an extremely variable climate, characterised by strong seasonal and inter-annual variability. The Olifants WMA is no different and in recent years has suffered from droughts as well as flash floods that have caused considerable damage. In addition to this, there are pollution incidents that also require rapid response. This has been witnessed through sporadic fish kills as well as that of crocodiles below Loskop Dam. The coordination of responses to disaster is one that requires sound cooperative governance across differing spheres of government.

The strategic measures that will be developed to support this Strategic Area will include:

- Strategic measure 3-A: Monitoring and information
- Strategic Measure 3-B: Water use compliance
- Strategic Measure 3-C: Adaptation and risk management
- Strategic Measure 3-D: Climate change resilience

7.1 Strategic Measure 3-A: Monitoring and information

Good water quality monitoring enables effective enforcement and compliance. Added to this, the timely sharing of data and information allows the development of relevant and applicable WQM interventions, which have a high likelihood of succeeding. Updating of the monitoring network and

monitoring services (such as online monitoring) enables effective enforcement and compliance of laws and regulation and supports the systems-based adaptive management approach.

Therefore, the objective for this strategic measure is:

To develop and maintain adequate monitoring networks and information management systems to produce and store data and produce management information and knowledge products that enable effective decision making and stakeholder awareness.

In support of this, three actions have been identified.

 Action 3-A.1: Improve the water quality monitoring networks to provide data that enables effective decision-making

Currently, there are some gaps within the monitoring network, both in terms of physical monitoring points, and in terms of what variables are being monitored at various points. This needs to be addressed urgently and should support:

- Mine water management;
- Metal management;
- Nutrients and microbial management;
- Salinity management; and
- Emerging contaminants.

Action 3-A.2: Ensure water quality monitoring data is collected, verified as accurate, stored on appropriate data systems and translated into useful information to support decision-making

The IWQM Policy states that data is a strategic asset. Therefore, all data collected needs to be verified for accuracy, captured and translated into useful information to support decision-making for WQM.

Action 3-A.3: Improve existing information management platforms/systems to enhance reporting and dissemination

Data and information that are collected needs to captured on agreed information management platforms for ease of translation into reports and information dissemination.

7.2 Strategic Measure 3-B: Water use compliance and enforcement

Poor administration of water use authorisations has historically created significant backlogs in dealing with applications. Weak compliance monitoring and enforcement is currently enabling the discharge of water containing waste to go unchecked, and for many water users not to meet the conditions of their water use licences. Often, the conditions under which authorisations are given change and appropriate management actions or appropriate effluent treatment is not sufficiently applied prior to discharge. This is exacerbated by increasing non-point source pollution as a result of poor or uncontrolled land use management practices.

Therefore, the objective for this strategic measure is:

To ensure that water use is compliant with water use authorisations in accordance with licence conditions and to monitor and report upon the status of compliance monitoring and enforcement within the Olifants WMA.

In support of this, four actions have been identified.

Action 3-B.1: Maintain a database of registered water users

The WARMS system needs to be updated and maintained on a regular basis. This information is not only important in supporting compliance monitoring and enforcement, but is also required to support the WDCS.

 Action 3-B.2: Undertake compliance monitoring of all water use authorisations and address backlogs

There have been institutional and resource challenges that have resulted in delays in the authorisation process as well as subsequent compliance monitoring. Resources need to be directed to achieve this.

 Action 3-B.3: Enforce lawful water use (e.g. utilise directives and administrative penalties)

Resource and capacity constraints have hindered the DWS' ability to enforce water use authorisation conditions. The IWQM Policy introduces the concept of Administrative Penalties, which gives the regulator a stronger instrument with which to ensure compliance. These need to be utilised together with a strategic process to strengthen the approach to enforcement.

 Action 3-B.4: Implement a system to track water use authorisations (information management system)

In support of the above mentioned actions, the ability to track and monitor compliance is important to ensure effective WQM and its ongoing improvement over time. This will support the DWS and WMIs in becoming more consequent and consistent in approach.

7.3 Strategic Measure 3-C: Adaptive risk management

Water quality needs to be managed adaptively and our responses to WQM challenges will require increasingly efficient and effective practices within the Olifants WMA. This will mean critical reviews of these processes, practices and reporting at various levels within the WQM system to support the Department's ability to manage adaptively.

Therefore, the objective for this strategic measure is:

To ensure that adaptive management responses enable the effective management of priority risks to ensure the effective management of water quality in the Olifants WMA.

In support of this, six actions have been identified.

 Action 3-C.1: Identify opportunities and modalities to enable more adaptive responses in managing water quality In order to respond adaptively, current data and information are required in an accessible form to inform how best to manage water quantity and water quality going forward. The ongoing development of the Water Management System, together with ongoing training, will be important to support these decision making processes.

Action 3-C.2: Develop and Implement Non-Point Source Strategy

The Olifants WMA, particularly the Upper Olifants, has a significant contribution of pollution from diffuse sources. This type of pollution can no longer be ignored if water quality in the resource is to be effectively managed. Therefore, an appropriate NPS strategy needs to be adopted and implemented.

Action 3-C.3: Identify, prioritise and monitor high-risk polluters and other key risk areas to ensure improved water quality

The Department has limited resources, and is not able to tackle all polluters in appropriate ways. It becomes a strategic need to develop a list of high-risk polluters that are non-compliant and focus energy and resources towards ensuring compliance for these. This will send a strong message to other polluters, and will encourage wider compliance.

Action 3-C.4: Implement an annual priority action plan towards ensuring impactful improvements in water quality

Annual planning to prioritise actions is required to ensure that resources, both financial and human, are used effectively and efficiently. The role of the Chief Directorate: Water Quality Management is important in providing guidance in the development of these plans, but equally in overseeing progress.

Action 3-C.5: Report annually on the status of water quality in the Olifants water management area

The conversion of data into accessible information is important as a way to track progress and to manage adaptively. By reporting on progress, the Department ensures that the public is informed and this will build confidence in its actions.

Action 3-C.6: Use decision-support protocols to support water quality management decisions

To ensure a consistent approach to IWQM at all levels of management, a decision-support protocol must be developed that outlines the steps necessary to achieve effective WQM.

7.4 Strategic Measure 3-D: Climate change resilience

Due to the geography of the area, and drawing from the country's prediction of how the western parts of the country will be drier and the eastern side will be wetter, the Olifants WMA is likely to experience increased high-intensity rainfall events. Noting the configuration of the catchment, this result in rapid runoff responses with flash flooding, together with increased risks to the water quality of the area. The current Reconciliation Study of the Olifants WMA has not incorporated climate change impacts into the planning, which introduces further risks to the estimates of water availability. Increases in temperature will result in a decrease in water resource availability mainly

due to increased evaporation, impacting on important water bodies such as water storage reservoirs.

Introducing climate adaptation measures and mitigation measures into the Olifants WMA is important for the area and is important for building resilience for its inhabitants to counteract the negative impacts anticipated from climate change.

Therefore, the objective for this strategic measure is:

To undertake measures that ensure increased resilience to the uncertainty introduced by climate change

In support of this, two actions have been identified.

 Action 3-D.1: Link water quality management dimensions into the Long-Term Adaptation Strategies (LTAS) and the Provincial Climate Adaptation Strategies and others

The LTAS and provincial climate change strategies give a good indication of the climate trends that can be expected over the next few decades. It becomes important that these are translated into the planning instruments for water quality, such as the Reconciliation Studies and IWQM plans.

Action 3-D.2: Undertake research into the impacts of climate change on the water quality of the Olifants WMA

The impacts of climate change on water quality, health, environment and society are not clearly understood. In order to manage effectively, research needs to be undertaken by the Water Research Commission, in consultation with the National and Provincial offices of DWS to better understand these impacts and their consequences.

8. STRATEGIC AREA 4: GOVERNING TO ENSURE COOPERATIVE APPROACHES

The institutional fabric within the water sector is complex. Despite significant effort, and a number of programmatic interventions (such as the Institutional Reforms and Realignment programme), the sector is still unsure of the way forward with regards to both sector and water management institutions. Towards stabilising the institutional and governance arrangements that support WQM in the Olifants, the goals are:

- Goal 4.1: Institutional capacity and operational and financial systems are strengthened to enable effective IWQM.
- **Goal 4.2**: Key partnerships are established, while stakeholder engagements and knowledge management are strengthened and maintained in support of IWQM.

The establishment of CMAs has taken far longer than was originally surmised. This is to some extent because the complexities of undertaking such an institutional restructuring process for a national Department were underestimated. This is indeed complex and has implications in terms of financial aspects, in terms of operational aspects and continuity in this regard, as well as implications for staff. The process has therefore been iterative to allow for correction and adjustment as well as phased to enable progressive and constructive development.

At this stage, the Provincial Offices of DWS act as the CMA prior to establishment and as the institutional model for water resource management becomes clarified.

There are a large number of Water User Associations and catchment forums that provide a useful basis for ongoing localised engagement with stakeholders. There has been an increasing recognition of the important role that the private sector and civil society have to play in supporting IWRM and is in fact a cornerstone of the concept of IWRM and is reflected as such in the National Water Resource Strategy (NWRS).

A financial strategy that blends fiscal support, revenue from water use charges and other sources of finance will be needed. It must distinguish between ongoing operational costs and once-off interventions, and provide appropriate mechanisms to obtain and, in some cases, ring-fence these funds.

Finally, there are opportunities for adopting economic instruments that change individuals' behaviour with respect to water resources management. These may be in the form of levies (such as the Waste Discharge Charge System) or incentives (such as matching funds for initiatives).

Whilst there have been some difficulties in the discourse between the private sector and Government, work such as the United Nations CEO Water Mandate has brought to the fore the realisation that there is indeed a shared risk with regards to water. As such, this provides a valuable basis for constructive discourse and conjunctive action.

Civil society continues to play an invaluable role in acting as a watchdog over the various dimensions of water resource management. Particular NGOs and Civil Society groups have played an important role in strengthening water quality management by improving awareness and building capacity, by acting as a mediator or as liaison with marginalised groups, in advocating for

improved and innovative approaches in management, and by raising the flag on various issues where action or implementation has failed, or is, failing.

Over and above the institutional dimensions, and through the course of many recent studies in the Olifants WMA, there has been considerable stakeholder engagement. This needs to continue and must be actively supported.

The strategic measures that will be developed to support this Strategic Area include:

- Strategic Measure 4-A: Institutional and financial arrangements
- Strategic Measure 4-B: Partnerships
- Strategic Measure 4-C: Stakeholder engagement
- Strategic Measure 4-D: Knowledge management

8.1 Strategic Measure 4-A: Institutional and financial arrangements

Governance in the Olifants WMA needs to be strengthened through improved institutional and financial arrangements, enhanced technical and managerial capacity, and drawing upon private sector and civil society to become more actively engaged through partnerships or engagements through forum structures. This is critical to enable effective water quality management.

The institutional frameworks enabled by the NWA and other legislation have been in transition for some time. This has also created some uncertainty regarding roles and responsibilities, but most significantly has opened up the space for considerable amounts of non-compliance and unlawful water use.

It is equally imperative to address the financing mechanisms that underpin our institutions. To date, there have been insufficient financial resources to effectively undertake all the activities that are required to manage water quality.

Therefore, the objective for this strategic measure is:

To ensure adequate institutional and financial capacity to fulfil the mandate given to the various institutions in terms of managing water quality within the Olifants WMA

In support of this, four actions have been identified.

 Action 4-A.1: Strengthen and build on existing institutional capacity in the Olifants WMA

Many of the staff that operate in the Olifants are well capacitated. It becomes important to ensure that there is knowledge and skills transfer to sustain institutional capacity in the area. When the CMA is established in the Olifants, it will be essential to draw upon existing capacity for continuity.

 Action 4-A.2: Develop a financing strategy to enable effective water quality management

With limited financial resources, and given the number of actions that require implementation, an effective financing strategy to improve WQM is crucial. This will assist

to ensure that the limited funds are used more effectively and efficiently to improve water quality in the Olifants WMA. This will ultimately aid in enabling more adaptive and effective decision-making.

Action 4-A.3: Implement the Waste Discharge Charge System

The Department urgently needs to finalise the WDCS Business Plans for the Upper Olifants and ensure that its data and billing systems are ready for implementation. The WDCS provides an economic incentive for polluters in the area and the Department to improve water quality in the Upper Olifants catchment.

8.2 Strategic Measure 4-B: Partnerships

These include those organisations that have voluntarily come together, to address specific gaps in water resource management, and to support Government through collective action initiatives. Examples of these are the Strategic Water Partners Network, the Mine Water Coordinating Body, the Joint Water Forum, amongst others that operate in the Olifants WMA. These partnership/stewardships allow for improved engagement with the Department and decision making around localised actions being implemented. Through these initiatives, there is collective ownership of the decisions being made, building and sharing of knowledge, and increased leadership within localised areas within the Olifants WMA. The gap created by the limited resources within Government means that the private sector and civil society need to become more actively engaged in managing the country's water quality.

Therefore, the objective for this strategic measure is:

To jointly achieve IWQM in the Olifants, where appropriate, with other sector departments, private sector and civil society.

In support of this, four actions have been identified.

• Action 4-B.1: Strengthen and build on existing partnerships such as the Mine Water Coordinating Body, Strategic Water Partners Network and the Joint Water Forum.

These partnerships have shown a strong track record of implementation and achieving success, and lessons can be learned and shared for further initiatives.

• Action 4-B.2: Foster inter-sectoral co-operation with government departments

Cooperation with relevant partners is required to effectively improve water quality management, and will underpin key processes such as the exchange of information, joint and aligned planning, as well coordinated approaches to regulation and enforcement.

Action 4-B.3: Establishment of MUTTs and catchment committees/ new partnerships as and where required

In support of Action 4-B.2, the concept of establishing a Management Unit Task Team (MUTT) allows for a flexible platform to tackle localised issues in the Olifants subcatchments, in an *ad-hoc* way, as and when required on a voluntary basis. The MUTTs are intended to be far more operational and effective at dealing with WQM issues and as such should not be understood as being platforms for engagement only. Rather they should be seen as a opportunity where specific objectives are set (eg. removing a certain pollution load from a MU) and where local partnerships between for example, mines, industries and the local municipality are established to achieve the target load reduction. The MUTT would consist of technical experts who would set the targets and consider solutions that would be shared between the various role players contributing to a specific problem in the MU. Each partner would then take responsibility for implementing and reporting on the outcomes of against the set target. Once a problem has been satisfactorily resolved, it may be possible to dissolve the MUTT.

To avoid duplication, new partnerships or MUTTs should only be established if there are no other existing platforms that can, or are appropriate to subsume the additional mandate.

Action 4-B.4: Maintain networks with transboundary and other water management institutions

The challenges with water quality are prevalent across a number of countries, basins and catchments, both within and outside South Africa. Sharing of lessons learnt not only strengthens relationships with other institutions, but also improves the way in which the country's water resources are managed. The DWS has supported a number of international arrangements to support the ongoing development of capacity, and these need to be fostered to ensure that capacity at various levels is built.

8.3 Strategic Measure 4-C: Stakeholder engagement

Meaningful engagement with stakeholders, at national, provincial, local and transboundary levels, is important to ensure that the IWQM Policy and Strategy, and Olifants IWQM Plan are successfully implemented, monitored and reported on. Ensuring that the correct platforms are established, properly resourced and maintained is important to the stakeholder engagement process. It is also equally important to understand what the existing platforms are for engagement in the absence of the more formalised catchment management forum and to strengthen those existing platforms going forward will be of significant benefit to the management of water quality.

Therefore, the objective for this strategic measure is:

To ensure that all stakeholders are well informed and are enabled to contribute to water quality management in the Olifants water management area.

In support of this, two actions have been identified.

 Action 4-C.1: Ensure engagement that enables more active participation of civil society at transboundary, national and catchment levels

There is a need to formalise engagements and platforms for stakeholders. The uncertainties with regards to WMIs has created some challenges in creating the institutional stability needed to manage water quality. There have been a number of catchment management forums established in the Olifants catchment but there is not, at this stage, a a coherent stakeholder engagement strategy that provides the strategic framework that guides these engagements.

• Action 4-C.2: Strengthen existing platforms for stakeholder engagement regarding the various water quality issues of concern

There are a number of existing platforms for selective stakeholder engagement, such as the Olifants River Forum and the Joint Water Forum, which will need to be strengthened going forward. There may be a need to strengthen specific platforms in order to support specific sector based approaches such as mine water management, metals management, nutrients and microbial management; and salinity management.

8.4 Strategic Measure 4-D: Knowledge Management

The effective management of information is critical to strengthening the institutional capacity, and to build capacity within the Department. Furthermore, because the IWQM Policy calls for peoplecentred IWQM and a well-informed society, this can only be achieved through effective knowledge management.

Therefore, the objective for this strategic measure is:

To ensure that reliable information is easily available and in an accessible form to all stakeholders, including Government, Private Sector and Civil Society.

In support of this, two actions have been identified.

 Action 4-D.1: Develop and implement a communication strategy and awareness campaign to improve knowledge and share information

A communication plan is needed for the Olifants WMA to inform, consult, involve, collaborate and where possible empower the relevant key stakeholders. The purpose of targeting these stakeholders is to solicit their input, create awareness and guide external stakeholders on water quality management issues in the Olifants WMA, strengthen their understanding of the policy, and strategy and their implications, and strengthen collaborative systems. This also ensures the successful implementation by getting buy-in from the various stakeholders and promotes more meaningful engagement, and improves the accountability of the Department.

The continuation of the newsletters (under this project) as a means of enabling ongoing awareness creation will be an important part of this strategy.

Action 4-D.2: Ensure information sharing platforms and systems are current and accessible to improve IWQM capacity for decision-making and engagement

Decision-making can only be effective when dealing with reliable, current information that is in an accessible form. This means that the existing information sharing platforms need to be updated with the relevant, verified information at regular intervals. Noting that the importance of integrated approaches to WQM is understood, it will be critically important that water quality information is available to stakeholders and water users in order to support these more integrated approaches.

9. WAY FORWARD

This IWQMP developed for the Olifants WMA provides a way forward in terms of ensuring that the water resources in the six sub-catchments are managed in a sustainable manner to support socio-economic growth and development. Where the water quality has deteriorated to such an extent that it can no longer be used for its intended use, or it no longer sustains the ecology at a level for which the area has been classified, then the implementation of the plan should provide measures that will ensure an improvement over time.

The plan recognizes that water is fundamental to growth and development, both socially and ecologically, and, equally importantly, it emphasises the interconnectedness of the various sectors and the actions needed to support its² implementation. Understanding the roles and responsibilities of the partners in this process is critical and while some may be immediately obvious, others may need to be developed as implementation proceeds. It must be noted that while this document, the overall *IWQMP for the Olifants WMA*, is a water management area plan, it needs to be read in association with the specific subcatchment plans.

The DWS Provincial Office or mandated Water Management Institution, such as the Catchment Management Agency, will be the lead agent for water resource management within the Olifants WMI and will take the lead in a number of key water resource management functions, of which water quality management is one of the key aspects that needs to be integrated into all other functions.

Key aspects for the Provincial Office or mandated WMI, specifically in respect of water quality include:

- Maintaining ongoing participation and establishing catchment forums to support coordination;
- Improving the level of understanding by various levels of stakeholders of the water resources and water uses in the WMA;
- Improvement of monitoring and information management systems in collaboration with other relevant government departments and institutions;
- Leading the implementation of compliance monitoring and enforcement;
- Implementing water use regulation including water use registration;
- Implement RDM monitoring programmes;
- Manage pollution incidents; and
- Championing water issues in the various sectors of the WMA and associated planning instruments to support integration.

In support of these actions the DWS Provincial Office must ensure adequate resources are available within its business plan and financial strategy, as well as encouraging and supporting other lead agents to find additional financial resources within their own planning processes.

In respect of the DWS, National Office, as the custodian of the nation's water resources, DWS National Office has a key role in supporting the progressive implementation of this plan, both financially and technically. There is, therefore, a requirement for the DWS National and Provincial offices to work in a harmonised manner to implement the plan.

Other spheres of Provincial Government provide the regional planning and policy that support sustainable growth and development. In addition, while supporting implementation, they have a clear oversight mandate. For this strategy, there is strong emphasis on the DWS Provincial Office to collaborate with the Departments of Environment Affairs, Agriculture Forestry and Fisheries, Health, and Mineral Resources, with regards to various aspects of resource and natural asset conservation.

There is also a critical need to develop sound working relations with the Department of Cooperative Government and Traditional Affairs (CoGTA) and the South African Local Government Association (SALGA) in terms of supporting Local Municipalities to improve wastewater treatment and water quality management at municipal level. In this respect, local government has a clear mandate to support local economic growth and development and do this through the development of Integrated Development Plans (IDP). This process is currently led by the District Municipalities, while the Local Municipalities provide various services. Within these Local Municipalities there are various water resource impacts that need to be addressed and regulated by DWS. It is therefore important that there is a good relationship between the District and Local Municipalities and DWS. Similarly, a good relationship between DWS, SALGA and CoGTA at National and Provincial level is key, with specific reference to support in the implementation of the Municipal Management Strategy, which has specific plans for wastewater treatment.

Other important role players that must be included in the implementation process are:

- Research and Academic Institutions such as the Water Research Commission and tertiary educational institutions that need to help undertake research and capacity building in water quality management aspects, such as research of emerging contaminants and innovative treatment technologies.
- Corporate business and industry have a real interest in ensuring that sound water resource management supports their ongoing development and investments in the Olifants WMA. They have a key role to play in mitigating adverse impacts and through stewardship programmes that highlight the need for responsible water resource management as well as innovation. As these businesses are key components of the social economy, it will be important for them and the DWS Regional Office and other mandated agencies to have constructive engagements to ensure impacts are mitigated and the conditions of water use authorisations are implemented.
- Various Non-Governmental Organisations (NGO) and Community-Based
 Organisations (CBO) have significant roles in ongoing water resource

management. Their roles vary according to circumstance but range from research and development, through to action and implementation, and often include an important communication channel and links to broader society. The organizations are key partners that must play a supporting role in implementing the strategy.

Water legislation and the associated policy and strategies have included considerable stakeholder engagement allowing **citizens** to become involved in water resource management in a way that was previously not possible. This has enabled considerable capacity building to take place to allow individuals and stakeholder groups to participate constructively. The DWS Provincial Office and the relevant catchment agency therefore need to be fully engaged with individuals and stakeholder groups to allow:

- Continued participation in regional and local decision-making and governance processes through forums and other structures;
- Engagement with actions and projects as well as to assist in monitoring, protecting and restoring water resources;
- Building and sharing knowledge; and
- Playing a leadership role in the communities and championing local resource protection.

Measuring and refining implementation

The DWS Provincial Office and the relevant WMIs will take the lead in monitoring implementation of the plan and will develop an implementation scorecard that will annually measure the progress of implementation in respect of timeframes and resource allocation.

While monitoring on some of the actions, such as quality and quantity measurements, are technical, there are several actions that are less easily measureable. The DWS therefore needs to determine a set of suitable indicators and methods for monitoring progress on each action. It is proposed that this is done at the various forum level meetings so that all stakeholders agree on the measures to be used. The DWS can then work with the appropriate government departments, organisations and institutions as part of the collaboration to track these measures over time. Progress on other actions, including the collection of information or the formation of further plans and strategies in the Olifants WMA, and partnerships, should be monitored through the completion of the action or evidence of progress against the action.

The DWS Provincial Office or mandated WMIs will provide reports on implementation progress to ensure that responsible parties and stakeholders are kept abreast of progress and developments. Finally, monitoring and refining the implementation plan needs to feed into the development of the Catchment Management Strategy when this is developed.

APPENDIX A: PROJECT STEERING COMMITTEE MEMBERS

Title	Surname	First Name	Organisation
Mr	Atwaru	Yakeen	Dept. of Water and Sanitation
Mr	Bierman	Bertus	Joint Water Forum/ Lebalelo WUA
Dr	Burgess	Jo	Water Research Commission
Dr	Cogho	Vic	Glencore
Mr	Dabrowski	James	Private Consultant
Mr	De Witt	Pieter	Dept. of Agriculture, Forestry and Fisheries
Mr	Dooge	Nico	Glencore
Dr	Driver	Mandy	SANBI
Ms	Fakude	Barbara	Dept. of Water and Sanitation
Mr	Gouws	Marthinus NJ	Dept. of Agriculture, Rural Development and Land Administration
Mr	Govender	Bashan	Dept. of Water and Sanitation
Mr	Govender	Nandha	Strategic Water Partnership Network
Mr	Grobler	Geert	Dept. of Water and Sanitation
Dr	Gyedu-Ababio	Thomas	IUCMA
Mr	Harris	James	Olifants River Forum
Mr	Jezewski	Witek	Dept. of Water and Sanitation
Mr	Keet	Marius	Dept. of Water and Sanitation
Mr	Khumalo	Frans	COGTA
Mrs	Kobe	Lucy	Dept. of Water and Sanitation
Mr	Kruger	Dirko	Agri-SA
Ms	Kubashni	Mari	Shanduka Coal
Mr	Le Roux	Roelf	Magalies Water
Mr	Leballo	Labane	Lepelle Water
Mr	Lee	Clinton	South 32
Mr	Linström	Charles	Exxaro
Mr	Liphadzi	Stanley	Water Research Commission
Mr	Llanlev	Simpson	Department of Science and Technology
Mr	Mabada	Hangwani	Dept. of Water and Sanitation: Limpopo
Mr	Mabalane	Reginald	Chamber of Mines
Mr	Mabogo	Rudzani	Dept. of Mineral Resources
Mrs	Mabuda	Mpho	Dept. of Water and Sanitation
Mr	Mabuda	Livhuwani	Dept. of Water and Sanitation
Mr	Macevele	Stanford	Dept. of Water and Sanitation: Mpumalanga
Mr	Machete	Norman	Limpopo Provincial Administration
Mr	Madubane	Max	Dept. of Mineral Resources
Mr	Maduka	Mashudu	Dept. of Mineral Resources
Mr	Malinga	Neo	Dept. of Water and Sanitation
Mr	Mannva	КСМ	Dept. of Agriculture. Forestry and Fisheries
Mr	Masenva	Reuben	Dept. of Mineral Resources
Ms	Maswuma	Z	Dept. of Water and Sanitation
Mr	Mathebe	Rodnev	Dept. of Water and Sanitation
Ms	Mathekga	Jacqueline	Dept. of Mineral Resources
Ms	Mathev	Shirley	Dept. of Mineral Resources
Ms	Matlala	Lebogang	Dept. of Water and Sanitation
Mr	Matodzi	Bethuel	Dept. of Mineral Resources
			Dept of Agriculture Rural Development and
Mr	Mboweni	Manias Bukuta	Land Administration
Mr	Meintijes	Louis	National Water Forum TAU SA
Mr	Mntambo	Fanvana	Dept. of Water and Sanitation: Moumalanga
Mr	Modipane	BJ	House of Traditional Leadership

Ms	Modjadji	N	Lepelle Water
Dr	Molwantwa	Jennifer	IUCMA
Mr	Морашо	Victor	Dept. of Economic Development,
	wongwe	VICIOI	Environment and Tourism
Mr	Moraka	William	SALGA – National
Mr	Morokane	Molefe	Dept. of Mineral Resources
Mr	Mortimer	Μ	Dept. of Agriculture, Fisheries and Forestry
Mr	Mosefowa	Kganetsi W	Dept. of Water and Sanitation
Ms	Mosoa	Moleboheng	Dept. of Water and Sanitation
Mr	Mphaka	Matlhodi	SANBI
Mr	Mthembu	Dumisani	Dept. of Environmental Affairs
Ms	Mudau	Stephinah	Chamber of Mines
Mr	Mudau	Stephinah	Chamber of Mines
Ms	Muhlbauer	Ritva	Anglo
Ms	Muir	Anet	Dept. of Water and Sanitation
Mr	Mulaudzi	Masala	Dept. of Water and Sanitation
Mr	Musekene	Lucky	Dept. of Water and Sanitation
Dr	Mwaka	Beason	Dept. of Water and Sanitation
Mr	Nditwani	Tendani	Dept. of Water and Sanitation
Ms	Nefale	Avhashoni	Dept. of Water and Sanitation
Mr	Nethononda	В	Dept. of Environmental Affairs
Mr	Nethwadzi	Phumudzo	Dept. Mineral Resources
Mr	Nokeri	Norman	Lepelle Water
Mr	Oberholzer	Michael	Dept. of Mineral Resources
Ms	Olivier	Dorothy	Dept. of Mineral Resources
Mr	Opperman	Nic	Agri-SA
Mr	Parrott	Brenton	Delmas WUA: Representing irrigators in the Upper Olifants Area
Mr	Phalandwa	Musa	Eskom
Mr	Po	Jan	Dept. of Agriculture, Fisheries and Forestry
Dr	Pollard	Sharon	Award
Mr	Potgieter	Jan	National Dept. of Agriculture
Ms	Ralekoa	Wendy	Dept. of Water and Sanitation
Mr	Ramatsekia	Rudzani	Dept. Mineral Resources
Ms	Rammalo	Albertina	MDW
Mr	Ramovha	Matshilele	Dept. Mineral Resources
Mr	Ramphisa	Philip	Platreef Mine
Mr	Raphalalani	Israel	Dept. of Water and Sanitation
Mr	Retief	Hugo	AWARD
Mr	Riddell	Eddie	SANParks – KNP
Mr	Roman	Henry	DST
Mr	Rossouw	Ossie	Lebalelo WUA
Mr	Schmahl	Carel	Lepelle Water
Mr	Selepe	Marcus	IUCMA
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Ms	Shaw	Vicki	Mine Water Coordinating Body (MWCB)
Ms	Sigwaza	Thoko	Dept. of Water and Sanitation
Ms	Sinthumule	Ethel	Dept. of Mineral Resources
Ms	Sithole	Nelisiwe	Mpumalanga Provincial Dept. of Agriculture
Ms	Skosana	M	Dept. of Water and Sanitation
Mr	Surendra	Anesh	Eskom
Mr	Surmon	Mark	Palabora Mining Company
Ms	Tandi	Zokufa	Dept. of Water and Sanitation
Mr	Tloubatla	L	Dept. of Water and Sanitation

Mr	Tshivhandekano	Aubrey	Dept. of Mineral Resources
Mr	Tshukudu	Rabeng	Mpumalanga Provincial Government
Ms	Ugwu	Phindile	Dept. of Mineral Resources
Mr	Van Aswegen	Johann	Dept. of Water and Sanitation
Mr	Van Den Berg	Ockie	Dept. of Water and Sanitation
Mr	Van der Merwe	Alwyn	Eskom
Mr	Van Niekerk	Peter	Dept. of Water and Sanitation
Mr	Van Rooyen	Marius	Mpumalanga Provincial Dept. of Agriculture
Mr	Van Stryp	Johan	Loskop Irrigation Board: representing
			irrigators in the Middle Olifants Area
Mr	Van Vuuren	Jurie	Lower Blyde WUA: representing irrigators in
			the Lower Olifants Area
Mr	Venter	Jacques	SANParks – KNP
Mr	Viljoen	Pieter	Dept. of Water and Sanitation
Ms	Willard	Candice	Dept. of Science and Technology

APPENDIX B: BROADER STAKEHOLDERS WHO CONTRIBUTED TO THE PLAN

Name	Organisation
Adivhaho Rambuda	DWS, Bronkhorstpruit
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André Venter	Letaba Water User Association
Aneshia Sohan	Sasol
Angelika Möhr	SRK
Anna-Manth	OFF (MCCI)
Ansia de Jager	JWF
Avhafuni Ratombo	DWS, Bronkhorstspruit
Avril Owens	SRK
Ayanda Mtatwa	DWS: MWM
Betty Marhaneleh	LDARD: Mopani
Betty Nguni	DWS
Bongani Mtzweni	Samancor
Brenda Lundie	Sasol Satellite Operations
Cara Stokes	Kungwini Wise
Carina Koelman	DARDLEA
Caroline Shai	DWS, Compliance
Cecilia Mkhatshwa	City of Tshwane
Celiwe Ntuli	DWS
Charles Linström	Exxaro
Charlotte Khoza	Lepelle Northern Water
Christo Louw	DWS
Craig Zinn	Mpumamanzi Group
Danny Talhami	Clover Hill Club Share block
David Paila	Glencore Lion
Dayton Tagwi	DWS
Decia Matumba	SALGA
Derrick Netshitungulu	Nkwe Platinum
Dr James Meyer	Topigs SA
Eben Ferreira	Keaton Energy Mining Vanggatfontein Colliery Delmas
Eddie Ridell	KNP
Edwin Mamega	DAFF
Elmien Webb	Glencore
Emile Corradie	Bosveld Phosphate
Faith Mugivhi	ASA Metals/ Dilokong Chrome Mine
Farah Adams	Golder Associates Africa
Gavin Tennant	Agri-Letaba
Geert Grobler	DWS
Gloria Moloto	DWS, Bronkhorstspruit
Gloria Sambo	Agriculture

Heather Booysen	Samancor
Hugo Retief	AWARD
Imani Munyai	Wescoal Mining
Jakes Louw	Joint Water Forum
James Ndou	Modikwa Platinum Mine
Jan de Klerk	Sasol
Jaques Venter	SANparks
Jerry Penyene	AFASA
Johan van Stryp	Loskop Water Forum
Johanes Mathungene	LEPELLE/ farmer
Johannes Senyane	Two Rivers Platinum Mine
John Gearg	Wescoal/JKC
Joseph Phasha	DWS, Compliance
Kamo Meso	DWS
Karabo Motene	Glencore Mototolo Platinum Mine
Kerry Beamish	Rand Carbide
Kgaowelo Moshokwa	Anglo American Coal- Goedehoop Colliery
L.D Mutshaine	DWS: MWM
Leah Muoetha	Lepelle Northern Water
Lebo Mosoa	DWS
Lebohang Sebola	Lepelle Northern Water
Lee Boyd	Golder Associates Africa
Lee-Ann Ryan-Beeming	Glencore Eastern Chrome Mines
Lerato Maesela	LEDET
Linda Desmet	Palabora Mining Company
Love Shabane	DAFF
Lucas Masango	Private
Lulu Moya	Greater Giyani Municipality
M.S Makuwa	LEDET
Mahlakoane Foletji	DAFF: LUSM
Marcia Mofokeng	DWS: Letaba CMF
Marie Helm	DA Councillor, Mopani District Municipality
Martha Mokonyane	Mbuyelo Group (Pty)Ltd (Vlakvarkfontein and Rirhandzu Collieries)
Mashweu Matsiela	Industrial Development Corporation
Mathabo Kgosana	DWS, Planning and technical support
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Movwape Ntchabeleng	DAFF
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Musa Lubambo	DWS, Bronkhorstspruit
Ndwamato Ramabulama	DAFF
Nico Dooge	Glencore

Nnzumbeni Tshikalange	DWS
Nomathemba Mazwi	Resource Protection and Waste
Nonceba Noqayi	DWS, Mbombela
Nonki Lodi	AFASA
P.K Dzambuken	DWS: Tzaneen
Palo Kgasago	DAFF
Percy Ratombo	DWS
Phillemon Mphahlele	Municipal Health Services
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Pieter Pretorius	Loskop Irrigation Board
Pieter Viljoen	DWS
Portia Munyai	DWS
Pumale Nkuna	DWS:Mpumda
Raisibe Morudu	Thembisile Hani LM
Ramasenya Meso	DWS
Reginah Kganyago	DWS
Resenga Shibambo	DWS, Enforcement
Reynie Reyneke	EXXARO
Robert Davel	Mpumalanga Agriculture (provincial affiliate Agri SA)
Sabelo Mamba	Small Enterprise Finance Agency
Sakhi Mamashole	FOSKOR
Sakhile Mndaweni	DWS, National Office
Salome Sathekge	Polokwane Municipality
Siboniso Mkhaliphi	DWS
Simon Moewg	NEPRO
Solomon Tshikovhele	DWS: HO
Stanford Macevele	DWS: MP
Stephan Kitching	Wescoal Processing
Steven Friswell	Clover Hill Club Share block
Tanya Botha	Evraz Highveld
Tendani Nditwani	DWS: NWRP
Thabiso Mpahlele	Lepelle Northern Water
Thia Oberholzer	Evraz Highveld
Thomas Napo	LDARD
Timothy Marobane	Steelpoort Business Bridge Chamber
Tintswalo Ndleve	DEA (NRM)
Tony Bowers	Mpumamanzi Group cc
Tshepo Magongwoto	LEDET
Tshidi Mamotja	Department Environmental Affairs
Vinesh Dilsook	Anglo American Platinum
Wilna Wepener	Lonmin Akanani
Zama Ramokgadi	Tubatse Chrome
Zonke Miya	Mpumamanzi Group cc

APPENDIX C: GN 466, Classes and Resource Quality Objectives of Water Resources in the Olifants Catchment, 22 April 2016