water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

Report Number: P WMA 04/B50/00/8310/1

DEVELOPMENT OF A RECONCILIATION STRATEGY FOR THE OLIFANTS RIVER WATER SUPPLY SYSTEM

WP10197

Contact person:
WP Comrie
1040 Burnett Street, Hatfield
Pretoria, South Africa

T: +27 12 643 9000
F: +27 12 663 3257
M: +27 82 808 0435
E:
Werner.Comrie@af.aurecongroup.com

Submitted to:
Department of Water Affairs
ZwaMadaka Building
157 Schoeman Street
Pretoria
0002

aurecon

Leading. Vibrant. Global.
www.aurecongroup.com

In association with:
ILISO Consulting (Pty) Ltd
MBB Consulting Services (Nelspruit) (Pty) Ltd
WFA Aquatic Ecology (Pty) Ltd
Chuma Development Consultants CC
WFA Water Resources (Pty) Ltd

Submission date:
4 June 2010

Original

Inception Report

(Second Revision)

PROJECT NAME	:	**DEVELOPMENT OF A RECONCILIATION STRATEGY FOR THE OLIFANTS RIVER WATER SUPPLY SYSTEM (WP 10197)**
REPORT TITLE	:	Inception Report
AUTHORS	:	J Beumer and Task Leaders
REPORT STATUS	:	Second Revision
REPORT NO.	:	P WMA 04/B50/00/8310/1
DATE	:	4June 2010

Submitted by:

W.P. COMRIE
Water Unit Manager

2010 0606
(Date)

J BEUMER
Study Leader

6/6/2010
(Date)

Approved for the Department of Water Affairs:

T NDITWANI
Chief Water Resource Planner : NWRP (North)

06/06/2010
(Date)

J.A. VAN ROOYEN
Director NWRP

6/6/2010
(Date)

Glossary of Terms

Allocatable Water
Water which is available to allocate for consumptive use.

Database
Accessible and internally consistent sets of data, either electronic or hard copy with spatial attributes wherever possible.

Environmental Water Requirement
The quantity, quality and seasonal patterns of water needed to maintain aquatic ecosystems within a particular ecological condition (management category), excluding operational and management considerations.

IWRM Objectives
The objectives and priorities for water resource management, for a given time frame, which have been agreed by the parties as those which will best support the agreed socio economic development plans for the basin.

IWRM Plans
A set of agreed activities with expected outcomes, time frames, responsibilities and resource requirements that underpin the objectives of IWRM.

Management Information System
Systems such as GIS which provide a user friendly interface between databases and information users.

Resource Classification
A process of determining the management class of resources by achieving a balance between the Reserve needs and the beneficial use of the resources.

Acid Mine Drainage
Decanting water from defunct mines which have become polluted and acidic and that reach the resource.

Level of Assurance
The probability that water will be supplied without any curtailments. The opposite of Level of Assurance is the risk of failure.

Internal Strategic Perspective
A DWA status quo report of the catchment outlining the current situation and how the catchment will be managed in the interim until a Catchment Management Strategy of a CMA is established.

List of Abbreviations & Acronyms

AME	Africa-Middle East
APAC	Asia Pacific incorporating Australia, New Zealand, South-East Asia, India and China
BID	Background Information Document
CESA	Consulting Engineers of South Africa
CMA	Catchment Management Agency
CME	Compliance Monitoring and Enforcement
CMIP	Consolidated Municipal infrastructure Grant Programme
DBSA	Development Bank of South Africa
DPLG	Department of Provincial and Local Government
DWA	Department of Water Affairs
EWR	Ecological Water Requirements
GIS	Geographical information System
IDP	Integrated Development Plan
IAP	Invasive Alien Plants
ISP	Internal Strategic Perspective
MEC	Member of Executive Council
ORASECOM	Orange-Senqu River Basin Commission
PSP	Professional Service Provider
RO	Regional Office
RWQO	Resource Water Quality Objectives
SAICE	South African Institute of Civil Engineering
SALGA	South African Local Government Association
SMC	Study Management Committee
SMT	Study Management Team
ToR	Terms of Reference
TL	Team Leader
URV	Unit Reference Value
VAPS	Vaal Augmentation Planning Study
WAAS	Water Availability Assessment Study
WCDM	Water Conservation Demand Management
WFGD	Water for Growth & Development
WMA	Water Management Area
WQMP	Water Quality Management Plan
WRC	Water Research Commission
WRPM	Water Resources Planning Model
WRYM	Water Resources Yield Model
WSDP	Water Services Development Plan
WWTW	Waste Water Treatment Works

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. The Study Context

1.1 Introduction

The Olifants River catchment is one of South Africa's most stressed catchments in terms of both water quantity and water quality.

The water requirements in the Olifants Water Management Area (WMA) have long exceeded available yield due to diverse activities of agriculture, mining, power generation and the steel industry. These requirements have increased substantially over the last number of years, with the mining sector in particular growing rapidly. This has brought rapid urbanisation and the expansion of manufacturing and industrial development. Further to this has come the recognition of the importance of the ecological needs and the ecological Reserve, i.e. that rivers require, and are entitled to, a certain quantity and quality of flow. These needs are further highlighted by the position of the Kruger National Park at the bottom end of the catchment. The Kruger National Park and other wildlife reserves and recreational facilities are major income generators for the country. The Olifant River ultimately drains into Mozambique and in line with the Protocol of Shared Watercourse Systems in the Southern African Development Community Region, brings about international obligations with regard to the quantity and quality of flow delivered.

As the trustee of the country's water resources, the Department of Water Affairs (DWA) acknowledges the need for a dynamic and interactive planning approach to meet future water requirements for this key area of the country. A reconciliation strategy had to be developed for the study area to alleviate the current water deficits and to ensure a sustainable water supply for the next 20 years and beyond.

1.2 Background to the Olifants WMA

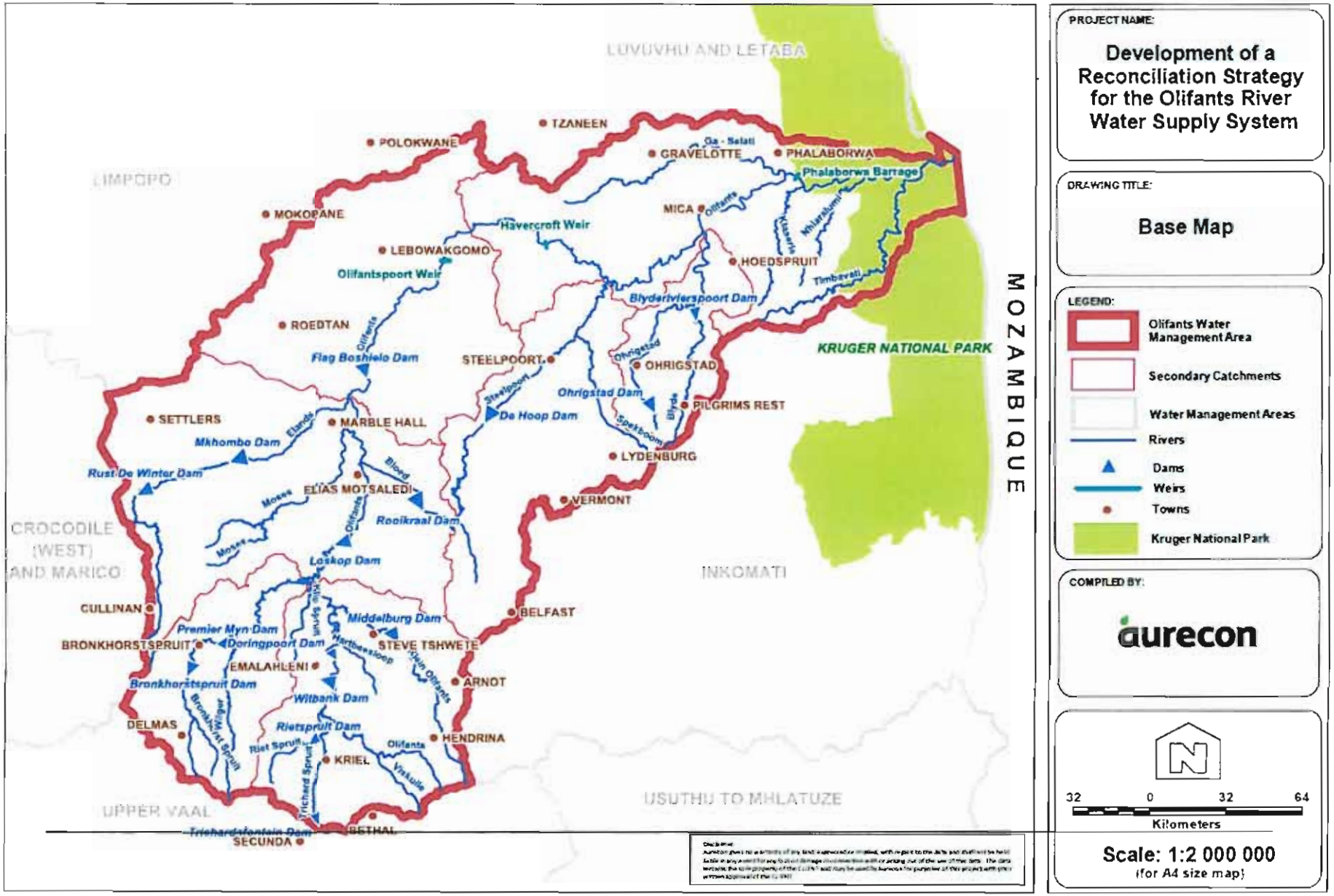
The Olifants River System originates just within and east of Gauteng Province and the main stem flows in a northerly direction, see **Figure 1.1.** Beyond Flag Boshielo Dam it changes direction eastwards, enters the Kruger National Park near Phalaborwa and flows further east to the Moçambican border. Before the Moçambican border the Olifants River is joined by the Letaba River. The Massingir Dam is just across the border. The Olifants River is joined by the Limpopo River further downstream in Mozambique. The size of the whole Olifants WMA, excluding the Letaba Catchment is 54 570 km^2, only representing the RSA portion of the Olifants River Catchment.

Some of the major challenges of the catchment that will be addressed during the development of this reconciliation strategy are the following:

- Water supply to power stations: Seven ESKOM power stations are located in the upper reaches of the catchment, of which one has been decommissioned and the other six are operational. Water is transferred from the Komati, Usuthu and Vaal catchments to augment the water supply to these power stations. ESKOM intends to recommission the one "moth-balled" power, and is building an eighth power station, namely the Kusile Power Station, within the catchment. The assured continuous water supply to these stations for the generation of energy is seen as a matter of strategic importance for the country.
- Growing domestic water requirements: Approximately 20 towns are spread over the catchment area of which Emalahleni (Witbank) and Steve Tshwete (Middelburg) are the largest. Rural settlements are also found widely spread over the whole area. The growing domestic water requirements therefore need urgent attention in this reconciliation strategy.
- Mining operations in the catchment:
    - Coal mining operations in the upper reaches of the catchment: Coal mines mainly supply coal to the ESKOM coal fired power stations. These mining operations pose a serious threat to the natural environment and affect the water quality. Particularly when mine operations are relocated and a mine is abandoned, the decanting water out of such a mine is acidic and polluted.
    - Other mining: A number of new mines have opened over the past number of years and new mining areas are being explored. Major mining activities include inter alia Vanadium and Chrome mines at Steelpoort, Copper and Phosphorus mines at Phalaborwa and Platinum mines at a few places within the catchment. These and other mines bring economic prosperity to the area and whilst their water requirements need to be secured, the water resource and other environmental impacts of each of these mines need to be carefully considered.
- Water transfers out of the catchment: Water is being transferred out of the catchment for supply to Polokwane and Mokopane in Limpopo Province, despite the fact that the catchment is in a water deficit situation. As mentioned before, water is also imported into the catchment to the ESKOM power stations. All imports and exports need to be accounted for when analysing the water balance.
- Sustaining the current irrigation use: There are quite a few irrigation schemes in the catchment, with the Loskop irrigation scheme the largest. The water quality of the Loskop scheme is currently affected by operations upstream and some farmers had to change their farming practices and/or their crops in order to adapt to the deteriorating water quality. This strategy will carefully look into striking a balance between the needs of the

irrigation farmers and the users upstream. Although expansion of irrigation is not a priority, there is a dire need for water allocation reform where previously disadvantaged communities also get an opportunity to enter into the farming business.

- Alien invasive plants: The Olifants catchment also has its quota of infested areas, which use up much of the available water. The possible removal of the alien invasive plants, and the impact this will have on the water balance, needs to be investigated. The water allocation to the forestry sector also needs to be reviewed.
- Ecological Water Requirements: The KNP and other nature reserves are situated at the downstream bottom of the catchment and the ecological water requirements, both in terms of water quantity and quality to these areas in particular, poses a huge challenge.



PROJECT NAME:

Development of a Reconciliation Strategy for the Olifants River Water Supply System

DRAWING TITLE:

Base Map

LEGEND:

- Olifants Water Management Area
- Secondary Catchments
- Water Management Areas
- Rivers
- Dams
- Weirs
- Towns
- Kruger National Park

COMPILED BY:

aurecon

32 0 32 64

Kilometers

Scale: 1:2 000 000

(for A4 size map)

Figure 1.1: The Olifants River Catchment

1.3 Appreciation of the Study Objectives and understanding the Study Context

The objective of the study is to formulate a reconciliation strategy for the entire Olifants River system up to year 2030. The strategy should:

- Address growing water demands as well as serious water quality problems experienced in the catchment,
- Identify resource development options;
- Provide reconciliation interventions - both structural and administrative/regulatory,

The timeframe for the final strategy, containing both the short and long term reconciliation interventions, is approximately two years. The terms of reference, however, asked for an interim short term strategy within one year that will address short term needs. Reconciliation options will therefore be identified as soon as practically possible during the first year of the study, and explained to the Strategy Steering Committee (SSC), as it is imperative that the committee members and other key stakeholders understand the problems and the possible solutions, especially those solutions which are clear cut and can be addressed over the short term. Scenario modelling for options that can possibly offer such solutions will also be undertaken as soon as possible in preparation of the interim strategy.

1.4 Approach to the Assignment

In order to achieve the above objectives, the steps shown in **Figure 1.2** will be followed. Each of these steps is explained in Section 5 of this Inception Report.

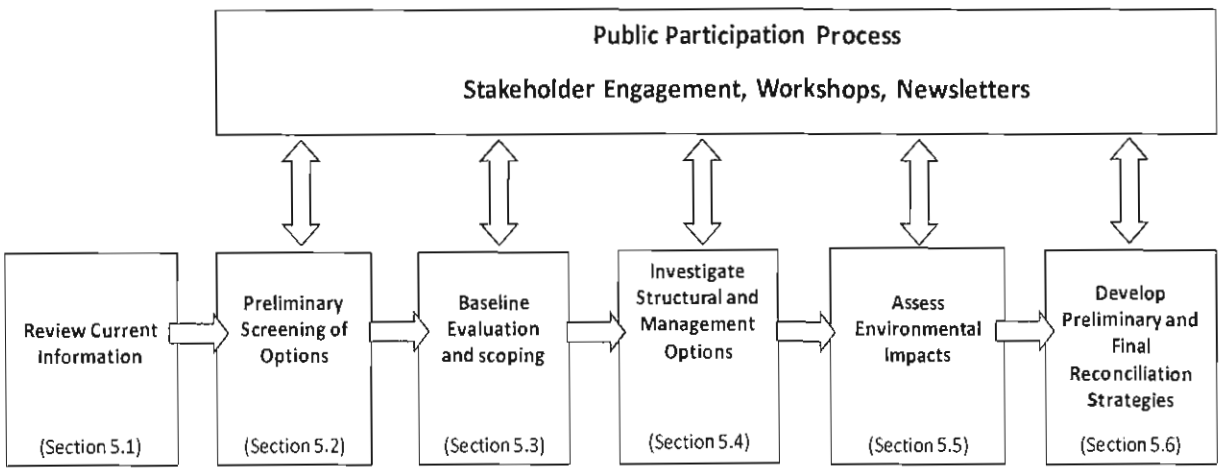


Figure 1.2: Steps to be followed to achieve Objectives

The process starts with a review of the current information. This is where previous and current reports on the Olifants catchment will be reviewed and summarised.

From the summary of studies and the list of options one will be able to identify which of the options are seemingly definite "no go" options because of findings from previous studies, political unacceptability, realities on the ground, etc. A screening workshop with the SSC will be arranged for dividing the options into two groups, i.e. those that deserve further investigation (those with potential and those that are possibilities) and those that can be rejected outright.

The next action will be to look at all the options that need further investigations and decide what further information is necessary. Certain modelling scenarios will also be identified.

Once a clear picture is formed of which options need to be investigated, their feasibility will be determined. The environmental impacts of each promising option will also be assessed.

After having screened the options once again, and after identifying the environmental impacts, the best options will be selected and the strategies will be compiled.

The preliminary strategy will be formulated halfway through the study and will contain obvious and "quick win" interventions. The final strategy will be delivered towards the end of the study after further investigations have been completed.

The process of selecting the options will be done in consultation with the SSC and public meetings will be held to keep the public informed.

1.5 The Study Area

Since water is also transferred to Polokwane and Mokopane, the study area will include the Olifants Catchment as shown in **Figure 1.1**, plus the surrounding areas of Polokwane and Mokopane.

2. Phase 1: Study Planning and Process Initiation

The objective of this phase was to plan the study and to compile an Inception Report containing a study plan.

The client and important stakeholders, such as representatives of Regional Offices and DWA Directorates, were consulted on the following aspects:

- Particular requirements of the assignment,
- Additional requirements not specified in the terms of reference,
- Work processes and programmes,
- Investigative methods,
- Study management and administrative functions and responsibilities.

A study plan has been compiled which contains the above-mentioned aspects. The study plan is incorporated into this Inception Report.

For the purpose of this Inception Report, the following planning work was undertaken:

- The objectives of the study, as described in the terms of reference, were verified and amended as per Paragraph 3.3.
- The methodology as described in the project proposal was reviewed and refined.
- Planning for doing further work related to resource classification as described in the draft Resource Classification Regulation was done on request of the client, but it was eventually decided that this work will not form part of this study. The planning work however, was additional to the work described in the terms of reference and this planning will indeed form part of the study through a variation order.
- On request of the client, a study reconnaissance tour was added as additional work, which will also be formalised through the variation order.
- Scenario modelling was limited in the terms of reference only to updating scheme yields subsequent to the updating of the estimates for the Reserve requirements. During meetings after the submission of the proposal, the requirement for modelling scenarios for possible reconciliation solutions was set. This work also has been included in the planning.
- The study budget was reviewed and refined.
- The timing of tasks was reviewed and an updated work schedule was prepared.

- The composition of the study team was reviewed.
- The management structure for the study was reviewed and the Study Management Team (SMT) was established and held their first meetings. Steps have already been taken to establish the SSC, who held its inaugural meeting on 5 May 2010.

3. Phase 2: Study Implementation

Introduction

The Study Implementation Phase comprises 16 separate tasks of which the first 15 tasks are in accordance with the 15 tasks in the terms of reference, the 16th task represents the Study Management Work as per our proposal.

3.1 Review of Current Information

3.1.1 Task 1: Summary of Previous and Current Studies

Task Objective(s)

The objective of Task 1 is to prepare a document that summarises all the available information on the water resources and water related land use of the Olifants WMA for inter alia the purpose of the screening workshop of Task 2.

Methodology

- Sub-Task 1.1: Information Review

  The first step in achieving the above mentioned objective is to collect all relevant information on the Olifants River System. The four sets of study reports, which are mentioned in the ToR, will be reviewed as well as other reports on the catchment such as the ISP for the Olifants WMA.

  The most up-to-date information will be selected from the reviewed documents and contact will be made with institutions such as the DWA and the WRC etc. to verify which information is the most recent and reliable.

- Sub-Task 1.2: Information Summary

  The next step is to produce a single document summarising all previous reports and data updates. At least the following topics will be covered in the summary report:

  - Historical and projected future water use, its geographical distribution in the WMA and in affected areas of the adjacent WMAs,
  - Water availability,
  - Existing water supply infrastructure,
  - Hydrological information and concerns,
  - Hydrogeological information about the various aquifers,
  - Water quality information and concerns,

- The Reserve requirements,
- System modelling and operational management,
- Potential impacts of climate change on water usage and scheme yields,
- Water conservation and demand management (urban, industrial, mining and irrigation),
- Current and potential water reuse,
- Water utilisation by and removal of invasive alien plants,
- Trading of existing allocations (especially unutilised allocations),
- Potential surface water schemes, both local and transfer,
- Potential groundwater schemes, both local and transfer (including utilising of mine treated water by local municipalities and Eskom),
- Potential desalination schemes,
- Water purification, especially for use of contaminated groundwater,
- Other potential importation schemes and options,
- Existing institutional responsibilities and co-operative governance (including operating rules, infrastructure planning and development, tariff structures and monitoring), and
- Existing public participation in the water sector.

The Summary Report will inter alia emphasise the water quality information as this is regarded as an important aspect for the strategy. In addition, a PowerPoint presentation will also be prepared for the purpose of Task 2.

Deliverables

A Summary Report and PowerPoint presentation as described above.

3.2 Preliminary Screening of Options

3.2.1 Task 2: Preliminary Screening Workshop

Task Objective(s)

The objective of this task is to agree with the SSC on what the main issues and concerns are and to eliminate those options which should not be given further consideration under this study.

Methodology

The task consists of five main components which are described below:

Sub-Task 2.1: Assembling the information required for the workshop

Information that needs to be presented at the workshop will be summarised in a hand-out document. This document will contain the necessary information from the Summary Report of Task 1 and will inter alia cover the following:

- Water balance based on current information

  A water balance will be prepared based on the 1:50 year yields already determined in previous studies and the projected water use up to the year 2030. This will be presented graphically so as to indicate when interventions to restore a negative balance need to come into effect.

- Identification of information gaps

  It is expected that some information gaps will still exist after the literature review associated with Task 1. These gaps will be listed and the manner in which these gaps will be dealt with will be shared with the key stakeholders. Some information may come from the key stakeholders during the screening workshop, and some information might be obtained later in the study through surveys. If it is necessary to make assumptions in terms of gaps that cannot be filled within the scope of this study, this will be shared with the key stakeholders and an approach agreed upon.

- Identify the Main Concerns of the Key Stakeholders

  The main concerns will be identified from knowledge gained during the execution of Task 1 and through interaction with some of the Key Stakeholders. These will be listed in the hand-outs, and it is trusted that the key stakeholders will add to the list during the Workshop.

Sub-Task 2.2: Preparation for the Logistical Arrangements associated with the workshop

- Establish the Stakeholder Data Base

  The Study Steering Committee (SSC), as described in Chapter 4, will be invited to the preliminary screening workshop. This will form the basis of the stakeholder database. Interested and Affected Parties (I&APs) participating in the public meetings will later be added to the database.

- Send out invitations to the workshop

  An email invitation will be sent out to the SSC.

- The venue, catering, equipment and accommodation (where applicable) will be arranged. A facilitator will conduct the proceedings and the workshop will be held at a central and easily accessible venue within the WMA. It is anticipated that the duration of the workshop will be a half day.

Sub-Task 2.3: Conducting the Workshop

At the Preliminary Screening Workshop, the following objectives will be implemented:

- Key stakeholders to advise on the information gaps,
- Key stakeholders to add to the list of main concerns,
- Identify possible reconciliation options,
- Group options in "definite yes", "possible" and "no-go" options.
- Document workshop proceedings

Sub-Task 2.4: Document Workshop Proceedings

The proceedings of the workshop will be accurately recorded together with comments and questions raised. Possible management and infrastructure options to be taken forward will be listed. The workshop proceedings will be summarised in the first newsletter, which will be distributed inter alia to all the stakeholders who attended.

Sub-Task 2.5: Reconnaissance Tour

Provision has been made for the four Team leaders and another two key team members representing specific disciplines to participate in a two day reconnaissance tour immediately before or after the workshop. The purpose of the site visit is for team members to familiarise themselves with parts of the study critical to the study and in some cases (e.g. environmental) to confirm existing information. The reconnaissance tour will focus on areas where new infrastructure development is identified (e.g. large dams) as options.

Deliverables

A document summarising the proceedings of the workshop and defining the schemes to be investigated as well as the shortfalls in information.

3.3 Baseline Evaluation and Scoping

Introduction

The outputs of the Screening Workshop will be additional sources that can be explored in order to fill the information gaps, the concerns of the stakeholders and a list of options that can be considered. With this information, a water balance exercise needs to be done for the current and future situation in order to determine where the surpluses/deficits in the catchment exist or can be anticipated. For this purpose the water requirements need to be assessed and compared to the water availability. Existing information from current and previous studies will be used as far as possible for the water balance, but where necessary, supplementary information will be obtained. Scenarios for possible intervention options, to be modelled as the next step, will be agreed upon.

3.3.1 Task 3: Current and Future Water Requirements and Return Flows

Task Objective(s)

Reconciliation implies balancing the available water resource against the current and future water requirements. Hence, it is imperative to have good information on how much water is currently being used in the catchment and how much users would like to use both now and in the future. Closely linked to this are the assurance of supply that users are currently experiencing and the assurances that they would be willing to accept. Return flows and mine water decant form an especially important part of the water resources in this catchment, and must also be estimated.

The objective of this task is to obtain the latest information on current and future water requirements as well as return flows, and to present this in an easy to understand format to stakeholders.

Methodology

- General

  It is understood that most data needed for the water balance, is available from previous studies and that primary data collection is not part of the task. A synthesis of available information into an easy-to-understand format will therefore be prepared for the development of reconciliation scenarios and for presentation to the SSC. Where data is not available, conservative assumptions will be made.

- Water Use Sectors

There is a wide range of water use sectors within the Olifants River system, all of which must be assessed. In order to focus the study on the most relevant water users, a ranking system will be applied which will combine the volume and assurance of water used by a sector with the economic importance of the sectors. Without prejudging this evaluation, the mining and irrigation sector will probably be targeted as the main focus area of the study. While power generation is a large water user located within the Olifants River catchment, their water is supplied from the Komati and Vaal systems and hence does not significantly alter the balance within the Olifants catchment. Return flows from the power stations are however relevant and will be determined. For socio-political reasons, the water supply to rural water users, currently not receiving adequate water supplies, will also receive high priority:

- Power generation

Due to the presence of vast coal reserves in the Olifants System, six currently operating power stations are located here, one "moth-balled" power station will be recommissioned, and a further power station at Kusile is under construction. The power stations require water at very high levels of assurance. The current and future water requirements of these power stations are well documented and have already been obtained from ESKOM. These are summarised in **Appendix A1**.

The literature review (in progress) suggests the possibility of the moth-balled Wilge Power Station being recommissioned. The water requirement associated with this will need to be investigated further.

- Mining water requirements

The expansion of the mining sector in the Olifants System, driven by *inter alia* the high platinum prices up to mid-2009, is hampered by the lack of water and this is having a serious impact on the economy of the region and country as a whole. The current and future water requirements of the mines therefore need to be well-understood and realistic growth projections made for scenario modelling purposes. Mines are generally hesitant to divulge their development plans and hence scenario analysis will be required to capture likely and possible maximum future water requirements of the mining sector.

Water requirements of the mining sector have already been obtained from previous studies but these might need to be updated due to the changes in commodity prices and demand for platinum and chrome over the last two years. The proposed methodology to update these requirements is to contact the dominant mining groups, present them with the information available, and request an update of their current and future water requirements. This will be closely coordinated with the stakeholder participation process.

The mining water requirements obtained from the BKS study (DWAF, 2003) are summarised in **Appendices A2 and A3** while the water requirements of the coal mines located in the upper Olifants River catchment were obtained from the more recent study by WRP (DWAF, 2009) and are attached as **Appendix A4**. It is understood that BKS are continually updating the mining water requirements to be supplied from the new De Hoop Dam and this information will be obtained from them. This Reconciliation study will need to estimate future water requirements of the coal mining sector. This could be significant given the construction of the new Kusile power station as well as the possible re-commissioning of the Wilge power station.

- Domestic water requirements

A review of existing reports indicates that the domestic water requirements (both Urban and Rural) in the Olifants River catchment are increasing rapidly, especially in the Emalahleni/Steve Tshwete areas. Estimates of domestic water obtained from a review of existing reports are attached as **Appendix A5.** It is noted that previous studies have not explicitly separated industrial and domestic water users but referred rather to 'municipal' water requirements. It is suggested that this reconciliation study should separate out these sectors so that reconciliation strategies applicable to each sector can be developed. It will also be necessary to check whether the water demands of the so-called rural areas have been taken into account, especially in the Sekhukhune area where there are numerous small villages with limited water supply. Much of this area will be supplied from De Hoop Dam in future.

The domestic water requirements will be sourced from the "All Towns" study. For areas where this information is not available in time, it will be based on existing information from other reports and, where not available, conservative assumptions

will be made. Continual liaison between the PSP and the "All Towns" project team will be required.

- Industrial water requirements

  While most of the previous reports reviewed, refer to the industrial water use in and around Emalahleni, this water use seems to have been included in the municipal water supply to Emalahleni and has not been reported on or evaluated as a sector. As part of this reconciliation study these demands will be quantified and the assurance of supply to this sector investigated. Possible new industrial initiatives, for example the proposed ethanol plant near Hoedspruit and industries at Steve Tshwete Local Municipality (Middelburg) will also be investigated. The information already obtained on the proposed ethanol plant is that a portion of the irrigation allocation use will be traded for an industrial licence, and hence there will be no increase in water consumption.

  Appendix A6 tabulates estimates of industrial water use obtained to date from existing reports.

- Irrigation water requirements.

  Information on irrigation water requirements is readily available (see **Appendix A7**).

  A review of existing reports has not identified any major problems associated with the irrigation data. The rapid increase in irrigated area from 1998 to 2004 is however, cause for alarm. Similar trends were also noted in the Inkomati WMA. A key strategy will therefore probably be to assess how much of this irrigation is lawful. The DWA Mpumalanga Regional office have just embarked on a process to verify all water use in the Olifants River catchment and as this information becomes available irrigation requirements will be separated out into lawful and unlawful use.

  Another important factor affecting future irrigation requirements that will need to be investigated is the impact of increased electricity tariffs on irrigation demands. Economists are suggesting the many irrigators will not be able to afford Eskom's proposed tariff increases and hence a drastic decrease in irrigation is predicted in those areas where irrigation has high pumping costs. It is suggested that this aspect be investigated as part of this reconciliation study as it could have a

dramatic influence on the proposed strategies for this catchment. High electricity cost may also lead to an increased utilisation of groundwater, should the pumping of surplus water prove to be more expensive. It is anticipated that data on the sensitivity of irrigation demand to electricity tariffs will be available, but if not, it is recommended that an economist be included in the team to investigate this.

- Level of assurance

  Of great importance in the evaluation of reconciliation options will be the levels of assurance that are economically sustainable within the study area. This should be available from the study setting up the Water Resources Planning Model (DWAF, 2009), but these priority classifications will be reviewed and adjusted (through the stakeholder participation process) if necessary. The reports reviewed to date did not contain this information but the PSP responsible for these studies will be contacted directly if required. The proposed methodology will be to follow an iterative procedure, commencing with desired or acceptable levels of assurance, carrying out water resources analyses to determine what can be achieved, and then suggesting alternative assurances and/or restriction rules relating to various reconciliation options.

- Return flows.

  Current return flows from most sectors are well documented in existing reports. Return flow scenarios will be developed for each user sector based on the water growth scenarios and assuming:

  - Constant proportions of return flow relative to water use,
  - Reduced return flow due to re-use options.

  A complication that has been noted in previous studies is the fact that many mines are processing and re-using (or selling) their effluent, thus resulting in reduced return flows due to increased efficiency of water use, while many coal mines have closed down resulting in mine water decant. Hence return flows are very dynamic and will need to be given careful consideration in this reconciliation study.

Deliverables

The deliverable of this task will be an updated water usage database for the study area. This will be at quaternary scale and will distinguish between the users sectors described

above. This deliverable will include projected water use to the year 2030 for a low, high and most probable growth scenario.

3.3.2 Task 4: Water Conservation and Water Demand Management

Task objective(s)

The objective of the Water Conservation and Demand Management (WCDM) task is to identify opportunities for water savings and to quantify these savings. These water savings will form one of many options to reconcile water demand with the available water resource.

Methodology

A considerable amount of work has already been done on water conservation and demand management in the Olifants system and hence this task will mainly entail reviewing what has been done and determining what economically viable actions can be taken to reduce the water use. The main source of information for this study will be the recently completed WCDM study of the Olifants and Inkomati WMA carried out by Directorate : Water Use Efficiency.

The WCDM reports on the study area will be obtained from the Water Use Efficiency Directorate in DWA. It is suspected that the WCDM reports will highlight the areas of potential, which are believed to be the following:

- Irrigation, and
- Domestic use in the Western Highveld area and Emalahleni (Witbank).

The above needs to be verified when the reports become available.

Aspects of WCDM include most especially optimal operating rules and then supply efficiencies (leakages in pipes and canals).

The following reports have been received and reviewed to date:

- WCDM in the Emalahleni Municipality,
- WCDM in the Lebowakgomo Municipality,

- WCDM relating to Eskom's power stations.

The crucial report on WCDM in the Western Highveld region and the Irrigation sector as a whole have not yet been unearthed and there is growing concern that these reports were either never completed or have been misplaced. As a worst-case scenario, the savings achievable in the irrigation sector will be re-analysed using the data from the Validation study completed in 2006. There could be budgetary implications if this work has to be redone.

It seems unlikely that there will be scope for conventional WCDM measures in the mining, industrial or power generation sector.

Deliverables

The deliverable of this task will be a report on the possible WCDM measures in Olifants systems, and the Unit Reference Value (URV) related to the various options.

3.3.3 Task 5: Opportunities for Water Re-use

Task Objectives

The objective of this task is to collect and review all available information on existing and planned re-use of water in the study area, and to incorporate these existing and planned uses into the modelling scenarios.

Other forms of "marginal water" usage such as rainwater harvesting and desalination of brackish- and seawater, polluted water from mines and saline water left over from power station cooling will also be looked at under this task.

Methodology

Re-used water can supplement intensively exploited conventional sources of water. Re-used water in this context can be seen as water that is used once and then used again in the same process (recycled water) or for another purpose (re-used water) with or without treatment to some acceptable level, or water that is used once and then used again for potable purposes, (reclaimed water) after treatment. The task of looking into the water reuse opportunities will be broken up in the sub-tasks as described below:

Sub-Task 5.1: Obtain information from Municipalities

Information from the "All Towns" study will be used as a starting point. We also intend to visit the Water Services Authorities of the approximately 20 towns in the WMA and some of the bigger municipalities after making telephonic contact. Information on current water re-use practices will be obtained and future opportunities will be discussed. The questionnaire in **Appendix B** will be used for this purpose.

Sub-Task 5.2: Obtain information from Mines and Industries

Similar questionnaires will be used for mines and industries, but in this case only the most prominent ones will be visited. The questionnaires will, however, be sent out to other selected mines and industries with a request to complete and return the forms.

Sub-Task 5.3: Obtain information from the Irrigation Sector

The same questionnaires will be used and sent to the Irrigation Board and WUAs in the WMA.

Sub-Task 5.4: Determine the Status Quo of existing water re-use

The questionnaires will be analysed and the status quo of existing water re-use will be recorded.

Sub-Task 5.5: Identify future possibilities

Future re-use possibilities will be identified in consultation with the visited municipalities, mines, industries and organised agriculture. The review of their feasibilities and selection of possible options will be done as part of Task 11 and the assessment of their impacts on the environment as part of Task 12. As part of this sub-task however, re-use scenarios will be defined in order to incorporate these into the initial modelling.

Possibilities of other forms of "marginal waters" such as importing desalinated sea water and rain water harvesting will also be considered under this sub task.

Deliverables

A report will be produced describing the extent of existing effluent and return flow re-use and the future re-use possibilities and the possible scenarios that need to be incorporated into the modelling. The feasibility of possible re-use schemes will be dealt with under Task 11.

3.3.4 Task 6: Invasive Alien Plants

Task Objective(s)

The objective of this task is to quantify the impact of removing alien vegetation on streamflow. The reason that this is important in the Olifants catchment is that there are large areas of alien vegetation, mostly Black Wattle, in the Olifants River System. Removal of this alien vegetation will result in increased stream flow but there is some dispute as to the magnitude of this increase. The mines are making claims of much greater increases in flow than the accepted norm in attempts to obtain water use licences in exchange for removal of alien vegetation. It is important to comprehensively re-look at alien vegetation and to make realistic estimates of their impact on streamflow. These streamflow reductions (or enhancements if removed) will be incorporated into the yield models in order to model scenarios in which alien vegetation is progressively removed.

Methodology

The recently completed Water Availability Assessment Study (WAAS) study (DWA, in press) used data on alien vegetation obtained from Ninham Shand in 1995 while the IWRM study (DWAF, 2008) does not state the source of their information. However, the Agricultural Research Centre has embarked on a comprehensive nation-wide study to improve estimates of the extent of invasive alien plants. The first of their reports has already been sourced as part of this Reconciliation study and it appears that estimated areas and quaternary resolution will be available by June 2010. The suggested approach is therefore to make use of this latest information and incorporate this into the WRSM2000 hydrology model in order to obtain improved estimates of the streamflow reduction due to alien vegetation.

Realistic IAP removal scenarios will be adopted for the purpose of modelling, in consultation with the managers of the Working for Water Programme.

Deliverables

The deliverable for this task will be a short report documenting the extent of IAPs and scenarios of increasing yield based on a range of removal plans. High, low and most probable scenarios will be assessed. The report will include GIS maps to present the data spatially.

3.3.5 Task 7: Surface Water Hydrology

A comprehensive study to update the surface water hydrology of the Olifants River catchment has recently been completed and no further work on this will be required. The

hydrology report has been reviewed. This latest hydrology is significantly different to the previous hydrology used to determine the ecological Reserve. It may therefore be necessary to review these Reserve estimates.

3.3.6 Task 8: Water Quality

Task Objective(s)

Water quality must not be seen in isolation, but the water quality information, knowledge and experience must be integrated with water quantity aspects. It will be ensured that the strategies are not water quantity biased, but cover the full spectrum of IWRM.

Water quality was analysed at fine resolution in previous studies, and therefore it is anticipated that no significant data collection and analysis will be required for this task. Two previous studies address water quality specifically. They are the study on the Upper and Middle Olifants by Golder/WRP and a study covering the rest of the catchment done by SSI.

The Golder/WRP report, Integrated Water Resource Management Plan for the Upper and Middle Olifants Catchment.- July 2009, covers the Upper and Middle Olifants, i.e. from the headwaters downstream to Flag Boshielo Dam. The study developed resource water quality objectives, and compared these to the prevailing water quality. The Resource Water Quality Objectives (RWQOs) are single values, and do not refer to an ecological category. The setting of RWQOs will have to be redone to conform to what is now DWA policy.

The SSI and Africon (now Aurecon) in association with Knight Piesold, Sigodi Marah Martin and Umfula Wempilo, September 2008 report, Assessment of Water Availability in the Olifants WMA by means of Water Resource Related Models : Water Quality Situation Assessment Analysis, Report No. P WMA 04/B50/00/5607, Department of Water Affairs and Forestry, uses the Golder RWQOs and then investigates the Steelpoort and the Olifants Rivers downstream of Flag Boshielo.

The RWQOs for the whole of the catchment will be redefined, specifying the requirements for ecological categories A, B, C and D. This will also be needed for the resource classification process. If the data files (the Excel spreadsheets) from Golder and SSI can be obtained, it will be possible to complete the water quality task within the current budget.

Methodology

- Water users

  Water quality is always assessed in terms of fitness for use, i.e. there must be a user in order to determine whether the water is usable or not. The first task will therefore be to confirm that all water users (including the aquatic ecology) were taken into account in the previous studies.

- Water quality requirements

  Once all the users have been identified, the associated water quality requirements can be determined. These water quality requirements will depend on an agreed "desired future state". It is proposed to obtain such a statement from the stakeholders that will attend the first screening workshop. A robust and simple methodology has been developed and applied on past studies that the Consultant was involved in (Waterval River, Modder/Riet River).

  As water quality requirements, and therefore the guidelines, can differ for individual user groups, a single set of water quality guidelines for the various parts of the study area will be determined by combining the guidelines for the different users. These will then be used to set water quality management objectives for the different sub-catchments. The outcome of Task 9 (Reserve requirements) will affect the management objectives, as the Reserve classes will determine the instream water quality objectives.

- Kruger National Park,

  It is foreseen that for most of the variables of concern, the requirements for the Kruger National Park will determine the management objectives. Using this as a point of departure, the water quality management objectives for the upstream sub-catchments will be determined. Should the management objectives determined in this way not comply with the objectives for a sub-catchment, the more stringent requirement will be used.

- Comparison – current state with management objectives

  Once the management objectives have been set, they can be compared to the current state, as well as expected changes due to mining, irrigation and urban discharges and runoff.

- Recommended actions

  Where required, actions to overcome existing or potential future water quality problems can then be recommended.

Deliverables

A water quality report that will set water quality management objectives, identify existing and potential future problems, and recommend actions to overcome these problems.

3.3.7 Task 9: Reserve Requirement Scenarios and Scenario Analysis

Task Objective(s)

The task objective is to determine whether the ecological state of the river has changed since the Ecological Water Requirements (EWRs) were set (2001) and to update the EcoClassification process to comply with recent methods. A Level 3 EcoClassification process will be applied to ensure compliance to DWA requirements.

Input into system yields will be minimal as the only information available that can be used is that associated with the Reserve study undertaken 1998 – 2001. Available information will be used to provide as much input as possible in terms of whether the Present State or Recommended Ecological Category are likely to change with a change in operation of the system.

Methodology

- Scope

  The main issue of concern is to determine how the ecological state of the river has changed since the detailed Reserve study (1998 – 2001). No formal monitoring programme was implemented, nor any implementation of the Reserve in terms of adjusting operating rules and supplying the Reserve. The first issue to address would therefore be to determine the Present Ecological State according to the now published EcoClassification methods, Level 3. Only Level 3 will be used as Level 4 would require a large range of specialists to be involved. It is assumed that input from the Mpumalanga Parks Board, Kruger National Park and RQS in DWA will be available, as most of the scientific and local knowledge are seated within these organisations.

The EcoClassification process will be provided for reaches in the river represented by the 17 EWR sites. Photographs will be taken of the sites for comparative purposes. No biological surveys apart from visual observations for vegetation assessments will be undertaken. Only readily available existing information will be used for this assessment.

The output of the EcoClassification process would be a defined Present Ecological State as well as a Recommended Ecological Category based on the existing Ecological Importance and Sensitivity information. Any obvious changes in the Present Ecological State since 1998 will be documented and the reasons provided. These changes will not be just because an Ecological Category has changed, but whether there is visible and other indicators of change. I.e., even if the Ecological Category has changed, one will first have to determine whether this change is due to the updated methods, and or whether a real change has taken place in terms of degradation or improvement.

To assess new flow scenarios, the existing EWR information based on the Building Block Method will be used as set for different river states. New flow scenarios will be compared to the range of EWRs previously set for a range of Ecological Categories, as well as the results of the ecological consequences of different operational scenarios. The following constraints in the process must be acknowledged:

- The hydrology used for the EWR assessment is significantly different to the latest hydrology.
- EWRs were set using old methods that were not designed to deal with various scenarios in a simple manner.
- EWRs might not be relevant now due to changes in the river during the last 10 years.
- A full range of specialists will not be involved in assessing the scenarios.
- Scenarios that fall outside the range of previous assessed scenarios cannot be assessed with high confidence.
- Evaluating scenarios will only be complete if a detailed Goods and Services assessment was undertaken and these consequences also addressed, as well as the relevant socio-economic assessments.

In conclusion, the output of this task will serve as a screening to indicate how much of the previous Reserve results can be used and where the major gaps are. For a system of this overall high ecological and socio-cultural importance, a more detailed Ecological Reserve

study will be required in order for informed decision-making to take place. This will also be required to apply to the Classification system and prepare for compulsory licensing. It is imperative that an Ecological Water Resources Monitoring Programme be implemented as soon as possible so that this situation will not occur in future.

Scenario Analysis

The Classification of the system will require the modelling of various scenarios in order to assess the impact of various EWR and reconciliation options on water users in terms of assurance of supply and/or the volume of water supplied. The impacts will then need to be expressed in economic terms.

The proposed methodology to be used in this study is that used on the recent Crocodile (East) and Sabie River Comprehensive Reserve study. This entailed modelling a range of possible reconciliation options relating to curtailments (across the board reduction of allocations through compulsory licensing) or restrictions (occasional reduction is supply during times of drought) as well as a range of possible Ecological Classes.

The following scenarios are envisaged:

- 3 levels of curtailment and 3 possible restriction rules (= 9 scenarios)
- Three ecological classes (PES, REC and one class lower than PES)

Deliverables

A report on the present ecological state of the river system based on the 17 EWR sites that were used previously, as well as the Recommended Ecological Category for each site will be produced. The flow scenarios set for the various ecological states during the previous Reserve studies will be linked to the newly determined Ecological Categories.

The deliverable from the Scenario Analysis will be as follows:

- Natural flow time series at every EWR site of which there are 17.
- Flow time series at every EWR for each scenario up to a maximum of 15 scenarios (as follows):
    - Curtailment vs restriction options (x 9)
    - EWR classes (x 3)
    - Development options (x 3)

- A water requirement, supply (volume and assurance) matrix for every scenario (for input to the economic model. The matrix will contain water use categorised per water use sector for every hydro-node, assumed to be the same management units used in previous studies.

The current and proposed use of groundwater will be reviewed against availability in Task 10. In this task, priorities will be set for areas in which the groundwater component of the Ecological Reserve should be set, based on the likelihood that the Reserve will impact on the available groundwater yield.

If conjunctive use of groundwater has been built into the Water Resources Yield Model (WRYM) model, then guidelines will be proposed for determining the effect of groundwater Reserve scenarios on the system yield.

3.3.8 Task 10: Groundwater

Task Objective(s)

Knowing that the Olifants River Catchment is stressed in terms of surface water, much hope for further water lies in groundwater. The possible expanded utilisation of this resource will constantly be kept in mind when considering water supply options.

The objective of this task is to investigate and weigh up various groundwater options, and possible conjunctive utilisation with surface water, taking into account the yields, water quality, costs (infrastructure and operating), groundwater: surface water interaction, Reserve requirements, and environmental impacts.

Methodology

The available reports, as reviewed as part of Task 1, as well as information acquired from the "All Towns" study, will be the base for the task requested. The report Volume 4 of 12 of the Assessment of Water Availability in The Olifants WMA, titled "Groundwater and Groundwater Quality Analysis" of SATAC contains much information on groundwater which will be used for this strategy. The most recent geohydrological information on the various aquifers and their possible future sources of supply from previous reports will be summarised. Sustainable volumes of available groundwater, and existing and potential schemes utilising the available groundwater, will also be identified in the summary. The required evaluation and calculations for feasible existing and potential schemes need to be done based on the available

information. During the Screening workshop of Task 2, the potential schemes will be screened and the schemes will be defined to be investigated as well as the shortfalls in information.

Both over- and under-exploitation of groundwater resources will be investigated. Management and control measures for over-exploitation must be considered for implementation. In areas of over-exploitation the Groundwater Reserve should be set and the impact of the Reserve on the available yields evaluated. The potential of under-exploited resources to augment water supplies in areas of over exploitation by transfer can be considered.

Groundwater resources with unacceptable drinking water quality such as high natural fluorides or high nitrates may be usable as such for irrigation or can be used conjunctively with surface water to reduce the parameter levels to acceptable levels. The mining sector plays an important role in the Olifants River Catchment and both dewatering and decanted water sources must be evaluated. Mines should be encouraged to use groundwater as supply to mining operations, thus intercepting mine water inflow, the need to dewater, and acid mine drainage. Treated decant water can be reused by mines or utilized by Eskom and when treated to potable quality, by the municipalities. The treatment or recycling of groundwater contaminated by coal discards or ash dumps must be considered.

Possible increases in the groundwater resource as a result of mining activities (e.g. higher recharge potential) will be briefly evaluated. Mines should be encouraged to use this water rather than drawing on surface water sources and then getting flooded and pumping dirty water back into the system.

The conjunctive use with surface water can reduce the salinity and reduce the cost of treatment for selected uses. The groundwater options will vary for the different sub-catchments and the most favourable option for each sub-catchment will be described in the final report. Cost estimates for the implementation of options will take account of parameters such as yield, storage, water quality. Reserve requirements and environmental impacts by determining the URV for capital and operational costs. Although the final selection of options and the feasibility assessment will be part of Task 11, the scenarios for modelling purposes will be decided on as part of this task.

Deliverables

A report on groundwater options with recommendations for implementation up to the year 2030.

This report will describe how much utilisable groundwater exploitation potential there is in each sub-catchment, possible use scenarios in terms of ground water exploitation and conjunctive use with surface water.

3.4 Investigate Structural and Management Options

Introduction

This step in the process (See **Figure 1.2**), cannot start after the completion of the previous step, but must rather be seen as a continuous iteration between the preceding tasks and this option's selection process. Scenarios will be identified as part of the preceding tasks which will lead to further feasibility investigations under this step in the process. Once the preferred options have been selected, a new set of scenarios need to be defined for the final water balance of the system.

3.4.1 Task 11: Review Schemes and Update of Cost Estimates

Task Objective(s)

The objective of this task is to review the schemes and management options that were identified at the Preliminary Screening Workshop and to prepare updated cost estimates for them.

Methodology

- Sub-Task 11.1: Condition of Existing Infrastructure
  The condition of existing water services infrastructure will be considered only in sufficient detail to assess whether the poor condition or poor management is the reason for water shortages rather than inadequate water resources at source. Where problems of poor condition/management are identified they will be described only in very general terms and no detailed solutions or cost estimates will be provided. A subjective assessment will have to be made on the effect of possible improvements on the extent of future water resource development requirements.

- Task 11.2: Reassess the configurations of identified future schemes.
  This will be done taking account of all recent studies, other developments subsequent to the study, and the implications of the Reserve requirements on the yield of schemes. This is likely to require that most identified schemes need to be re-sized, possibly with alternative sizes to account for different Reserve scenarios.

Re-sizing will be done only to a reconnaissance level of detail.

- Task 11.3: Update Cost Estimates
  Costing will generally be done using the VAPS model, except where previous schedules of quantities can be used unchanged, in which case only rates will be updated to an agreed common base date. Particular attention will be given to the cost of infrastructure required to convey the water to major users as this is often a major portion of the scheme cost.

  Information in the BKS report "Assessment of the Ultimate Potential and Future Marginal Cost of Water Resources in South Africa", which is contemplated to be released in June 2010, will also be used for this purpose.

- Task 11.4: Prepare URVs
  URVs will be calculated using the VAPS model except that the unnecessarily complex spreadsheet will be simplified and modified as necessary to simplify future updating.

Deliverables

A report will be prepared providing a summary of identified schemes, their yields, costs and URVs.

3.5 Assess Environmental Impacts

3.5.1 Task 12: Review or Assess Social and Environmental Impacts

Task Objective(s)

The objective of this task is to undertake an environmental screening exercise for each of the schemes under investigation in order to:

- summarise any key environmental or social issues that should be taken in account when considering and comparing options,
- identify any environmental or social "fatal flaws" or "red flags" associated with any of the projects; and
- identify environmental authorisations that will be required for any of the projects.

A fatal flaw would be an environmental or social negative impact that is not possible to mitigate, and significant enough to prevent implementation. A red flag issue would be a

negative impact that although significant could be mitigated, but warrants special attention in the consideration of scheme alternatives.

Methodology

The screening exercise will be undertaken drawing on the context of the existing Integrated Development Plans (IDPs), Strategic Development Frameworks (SDFs) and any relevant Environmental Management Frameworks (EMFs).

The schemes being investigated can be divided into two categories:

- schemes for which previous environmental assessments are available; and
- schemes for which no environmental assessments have been undertaken.

- Task 12.1: Desktop Review of existing Environmental Assessments
  The Environmental Assessments of schemes that have previously been studied will be obtained and reviewed with the aim of identifying whether any circumstances have changed. Key issues, red flags, fatal flaws and authorisation requirements will be identified and summarised.

- Task 12.2: Undertake a desktop Assessment
  A reconnaissance tour and/or environmental screening will be undertaken for schemes for which no environmental assessments are available. Provision has been made to consider two schemes in this category. Key issues, red flag, fatal flaws and authorisation requirements will be identified and summarised.

Deliverables

The deliverable from this Task will be an Environmental and Social Screening Report that summarises the key environmental issues, any fatal flaws and red flags and the authorisation requirements for each scheme under consideration.

3.6 Develop Reconciliation Strategies

3.6.1 Task 13: Assembly of Information and Formulation of Scenarios

Task Objective(s)

The objective of this task is to synthesize all the information collected and analysed in the previous tasks and to compile two reconciliation strategies, i.e. the Preliminary Reconciliation Strategy and the Final Reconciliation Strategy. The purpose of the Preliminary Reconciliation Strategy is to address immediate shortfalls requiring urgent interventions. This is a short-term strategy which will endeavour to satisfy the water requirements up to the year 2012. The Final Reconciliation Strategy will have a 20 year (until 2030) planning horizon.

Methodology

The task is broken up in the following sub-tasks:

- Sub-Task 13.1: The Preliminary Reconciliation Strategy

  It is foreseen that the Preliminary Reconciliation Strategy will be complete one year after appointment. This estimated duration has taken into account that it has taken four months for Phase 1 Inception Report to complete and the fact that the strategy is dependent on some basic information that will be collected and developed under the other tasks.

  Catchment information will be assembled in the shortest possible time (see Task 1) to enable the stakeholders (see Task 2) to understand the catchment and to participate in option identification.

  A short term water balance will be conducted by developing a number of short term water requirement scenarios and weighing these up against the water availability, (i.e. the surface water and groundwater resources). Assurances of supply required for the different water uses will be taken into account. The strategy will only focus on the interventions that were positively identified at the Preliminary Screening Workshop, which can show results over the short term (e.g. addressing unlawful water use, trading of water entitlements, etc.) and these will be assessed in order to recommend the best appropriate actions. Interventions that require further investigation will be incorporated in the long term Final Reconciliation Strategy.

- Sub-Task 13.2: The Final Reconciliation Strategy

  Future water requirements and return flow scenarios with a 20-year planning horizon (as updated under Task 3), will be developed.

Yield deficits (or surpluses) for the four different sub-catchment management units over time will be determined, taking into account:

- The verified Reserve requirements (Task 9),
- Surface and groundwater resources (Tasks 7 and 10),
- Water quality requirements (Task 8),
- Impacts of IAPs (Task 6),
- Water losses that can be addressed by a WCDM program (Task 4).

Intervention scenarios will then be assessed in order to determine the optimum management and infrastructure interventions and the timing of these, taking into account the feasibility and estimated costs (URVs) of the interventions.

Both strategies will be preceded by a brief report explaining the water situation in the catchment, the assumptions that have to be made, the intervention scenarios analysed, and the conclusions reached, etc. The strategy activities of the Preliminary Strategy will be listed in a table in the format as set out in **Appendix C1.** The recommended interventions to be screened at the Final Screening Workshop (see Task 14) will be listed in a hand-out prepared for the workshop. After the screening has taken place, the selected interventions will also be listed in the same format of **Appendix C2.**

Deliverables

A report integrating the findings of the previous tasks and recommended development/management options for screening under Task 14.

Task 14: Final Screening Workshop

Task Objective(s)

The objective of the Final Screening Workshop is to obtain the views of the Key Stakeholders and their buy-in on the most favourable reconciliation options and their sequence of implementation.

Methodology

The SSC will be invited to the workshop which will again be arranged at a central and easy accessible venue in the Water Management Area.

The information obtained under each of the Tasks as well as the draft Final Reconciliation Strategy will be explained to the SSC and ample opportunity will be given to them to raise their views. These will be carefully recorded and where necessary, the draft Final Reconciliation Strategy will be amended. An effort will be made towards reaching consensus amongst the SSC members on the selected reconciliation options and their timing. Consensus will also be sought regarding future investigations and studies for the purpose of long term reconciliation planning.

Deliverables

A document summarizing the proceedings of the Final Screening Workshop, the recommendations of the experts on the most likely future options and their sequence of implementation as well as their recommendations for future investigations.

3.6.2 Task 15: Public Participation

Task Objective(s)

The objective of this task is to inform an as broad as possible group of interested and affected parties of the findings of the two workshops with the SSC as well as of the strategies.

It needs to be noted that the ToR asked for only one public meeting and a number of information sessions with the CMA Reference Group. At later interactions between the PSP and DWA it came to light that DWA would actually prefer two public meetings – one to introduce the preliminary strategy and the second to present the final strategy. It is therefore suggested to replace the CMA Reference Group sessions with the additional public meeting to ensure that we keep within our budget. The CMA Reference group members will attend both public meetings in any event.

Methodology

- Sub-Task 15.1: Database of interested and affected parties
  A meeting will be held with the DWA Regional Office (RO) officials who are responsible for the establishment of a CMA Reference Group and the interested and affected parties will be identified by means of a brainstorming session. Contact details will be obtained for all identified groups. The final database as product will be handed to the RO.

- Sub-Task 15.2: Presentations to the CMA Reference Group

  The CMA Reference Group members identified above will be invited personally to the two public meetings, which will be held within one month after The Preliminary and Final Screening Workshops with the SSC. (See 15.3 below).

- Sub-Task 15.3: Public Meetings

  Two public meetings will be held – the first one within one month after the completion of the Preliminary Strategy and the second one within one month after the completion of the final strategy.

  Invitation letters will be sent to CMA Reference Group members, all water related institutions and groups such as municipalities, water user associations, farmer associations, etc., for the public meetings. The invitation to the first public meeting will include a brief Background Information Document (BID) to introduce the project. The BID will be printed on both sides of an A4 page and folded into 3 sections, thus ending in six columns of text and pictures.

  The BID will be ready for printing and it has been assumed that the printing of the necessary quantity of colour copies will be undertaken by DWA Communication Services.

  The meetings will further be advertised in at least three local newspapers. The findings of the Preliminary and Final Workshops will be explained to the attendees.

  Public comments will be listened to and valuable suggestions may be taken up, but the level of public participation will basically be to "inform". Higher levels of public participation such as "consult", "involve" and "collaborate" will happen at the SCC meetings and workshops described in Tasks 2 and 14.

- Sub-Task 15.4: Newsletters

  Two newsletters on the findings of the Preliminary and Final workshops have been provided for.

  The newsletters will be printed on both sides of an A4 page and folded into 3 sections, thus ending in six columns of text and pictures.

The newsletter will be ready for printing and it has been assumed that the printing of the necessary quantity of colour copies will be undertaken by DWA Communication Services.

Deliverables

- Database of interested and affected parties,
- Proceedings of the public meetings,
- Two newsletters in electronic format, ready for printing.

3.7 Project Management

3.7.1 Task 16: Project Management

The client for this project will be the Department of Water Affairs. The Chief Water Resource Planner : National Water Resource Planning (North) will be the first point of contact for the Project Team.

From experience, the management and coordination requirements are significant for a multi-disciplinary project of this nature, as is the need for diversity of skills and experience in the generation of innovative options and approaches to the management of identified issues or concerns. This will be supported by the project management structures as explained in Section 6.

Because of the breadth of the technical work it is envisaged that the Team Leader will be fully occupied with the technical leadership, management and integration of the five expert teams and their tasks. He will be supported by an experienced Deputy Team Leader.

The responsibilities of the Team Leader are seen as:

(i) The Team Leader will meet with the Project Manager (The Chief Water Resource Planner : NWRP (North)) on a regular basis.

(ii) Compliance with ongoing administrative requirements of the Client.

(iii) Co-ordination of technical work of the expert teams, to meet the objectives through direct interactions and holding team meetings, to monitor the progress and to provide coordination and guidance;

(iv) Ensuring review of specialist outputs.

(v) Reviewing of draft reports.

(vi) Monitoring the progress against the detailed activity programme. This will be facilitated by defining appropriate milestones and deliverables for each team and task against which to monitor progress.

(vii) Preparation and updating budgets and then regular monitoring of expenditure against budget and progress.

(viii) The distribution of the required numbers of draft reports in hard copy and on CDs to the client's office, for comment by the Study Steering Committee.

We have included a team of Strategic Advisors and issues and ideas will be bounced off to them. Some of the Strategic Advisors will also be requested to edit reports for quality assurance purposes before it is submitted to the client.

4. Study Management Structures

A thorough formalised management structure between the PSP and the client is necessary in order to ensure the smooth functioning of the team. The following structures are envisaged:

- Day-to-day management between the DWA Study Manager and the PSP Study Leader,
- The Study Management Team (SMT),
- The Study Steering Committee (SSC).

Each of these structures is explained in more detail below.

4.1 Day-to-day management between the DWA Study Manager and the PSP Study Leader

Communication for the day-to-day management will mostly be informal of nature, i.e. on a personal one-to-one meeting or telephonic conversation basis, or by means of e-mail correspondence. No formal minutes will be kept, but notes may be prepared as the need arises. The DWA Study Manager may want to call on his assisting staff to attend such discussions and the PSP Study Leader may also wish to call on his Deputy Study Leader and/or some of his task leaders to participate in such discussions.

4.2 The Study Management Team

Communication through the SMT is more formal. The meeting comprises the DWA Study Manager, his study assistants, involved DWA directorate representatives on middle management level, the PSP's Study Leader, Deputy Study Leader, Task Leaders and Study Secretary. The frequency of meetings will be approximately every six weeks and formal minutes will be kept of each meeting. The team set-up is reflected in **Figure 4.1.**

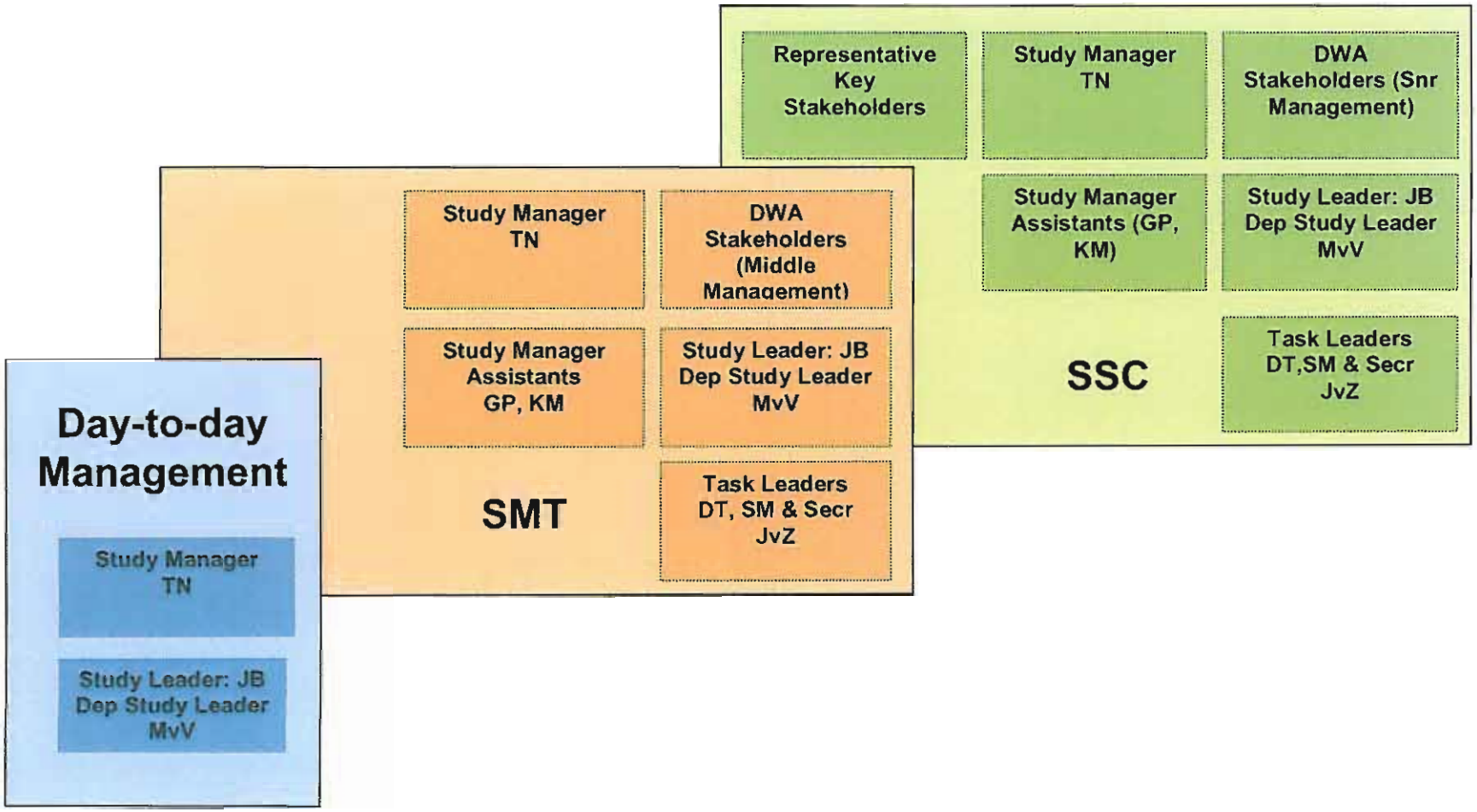


Figure 4.1: Study Management Hierarchy

4.3 Study Steering Committee

The Study Steering Committee (SSC) is a similar communication structure than the SMT, but its membership is extended so that it includes selected key stakeholders and the DWA representatives are on a more senior level than that for the SMT. The main purpose of the SSC is to provide a balanced view in order to guide the study in the right direction. The SSC comprises all members of the SMT plus key stakeholders representing important institutions or water user groups in the catchment. The SSC will consist of approximately 35 to 50 members. This committee will meet bi-annually as the need arises. The SSC set-up as well as the hierarchy of management structures is shown in **Figure 4.1.**

The membership list for the SSC is attached as **Appendix D**.

5. Study Control

5.1 Introduction

The strategy development process entails the integration of several tasks which all lead to the interim and final reconciliation strategies as outputs. The completion of the individual tasks must be carefully orchestrated in order to ensure the timeous delivery of the interim and final strategies. This section explains how control will be exercised.

5.2 Quality Assurance

Aurecon is an accredited ISO 9001 company and will utilise the Quality Management System to ensure that all procedures are correctly adhered to.

5.3 Performance Control

It is our intention to thoroughly monitor the progress of the work and to timeously take corrective action where staff deviates from performance targets.

A breakdown of each task and milestones will be scheduled in MS Projects and the critical path will be determined.

Progress will be reported at each SMT Meeting and unacceptable deviations will immediately be addressed with the necessary corrective action.

5.4 Progress Reporting to the SSC

A rolled-up progress report will be submitted to the SSC at their meetings. As the meetings are expected to take place approximately bi-annually, these reports will reflect a status of the work done in the preceding 6 months.

6. Project Team

The original proposal suggested four task teams namely:

- Water Requirements,
- Water Quality and RDM,
- Water Resource Options, and
- Strategy Development.

The high level organogram for the entire study including resource classification is shown in **Figure 6.1.**

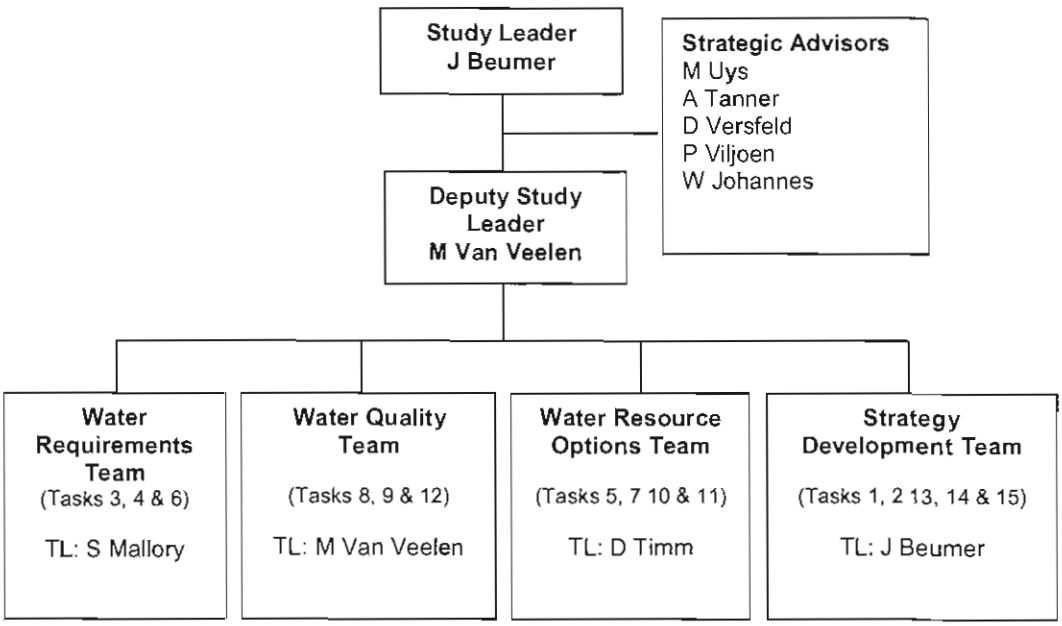


Figure 6.1: High Level Organogram

The first four task teams are the same as in the original proposal. **Figure 6.2** provides the composition of each of these task teams.

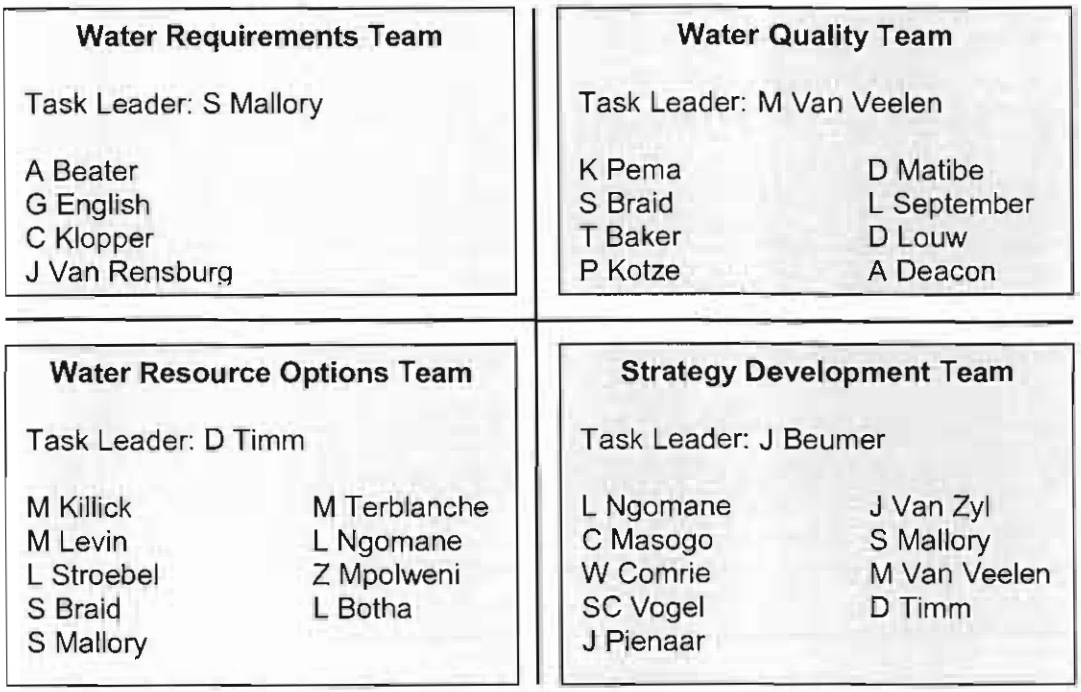


Figure 6.2: Composition of the Water Requirements, Water Quality, Water Resource Options and Strategy Development Teams

7. Activity Work Schedule

The Activity Work Schedule is attached as **Appendix F**. The work can still be done within the 24 months as originally planned, but certain adaptations had to be made within this timeframe. The first three deliverables, i.e. Inception Report, Summary Report and Screening Workshop, had to be moved on due to the considerable amount of time absorbed by the planning of the Resource Classification task which was decided not to pursue as part of this contract.

8. Project Budget

For the purposes of this Inception Report, the budget as per the proposal offer had to be revised. The new budget had to make provision for the requested three additional items, i.e.

i) Planning for the possible inclusion of the Resource Classification task

ii) Scenario modelling of water balances for possible reconciliation options

iii) Inclusion of a reconnaissance tour and site visits through the study area

These additional tasks were not included into the original proposal and are therefore not part of the current contract between the PSP and the client. A Contract Variation Order will subsequently be required in order to make the above listed tasks part of the contract.

8.1 Budget Results

Budget summaries are given in **Appendix E**. The totals including the additional requested work are as follows (VAT Inclusive):

• Original budget proposal	R 6.760 Million
• Planning for the Resource Classification Task	R 0.335 Million
• Scenario modelling for possible reconciliation options (10 runs)	R 0.240 Million
• Reconnaissance tour	R0.185 Million
Total	**R 7.520 Million**

The current contract awarded is for R7.00 Million

A Contract Variation Order for R 520 000 is therefore needed.

8.2 Hourly Staff Rates

Staff rates that have already been approved under the existing contract remain the same. An extract from the contract with the rates are shown in **Appendix E2**.

8.3 Budget Breakdown

The budget breakdown for the two years are given in **Appendices E3** and **E4.**

8.4 Cash Flow

The estimated monthly cash flow for the project is reflected in **Table 8.1.**

Table 8.1: Monthly Cash Flows

Month	Cumulative Amount (Thousands of Rand)	Month	Cumulative Amount (Thousands of Rand)
December 2009	-	December 2010	3 760
January 2010	280.0	January 2011	4 100
February 2010	451.3	February 2011	4 440
March 2010	687.7	March 2011	4 780
April 2010	1 040	April 2011	5 120
May 2010	1 380	May 2011	5 460
June 2010	1 720	June 2011	5 800
July 2010	2 060	July 2011	6 140
August 2010	2 400	August 2011	6 480
September 2010	2 740	September 2011	6 820
October 2010	3 080	October 2011	7 160
November 2010	3 420	November 2011	7 520

9. Risk Management

This study is subject to a number of risks which have to be carefully managed in order to minimise the chances that the study objectives are not achieved.

9.1 Identified Risks & Mitigation Measures

Risk

- **Limited allowance for intervention option modelling:** Without knowing the number of scenario runs that are needed for intervention option modelling, the cost of such modelling (which was not specified in the ToR), can easily exceed the allowed budget. No scenario modelling for strategy options (except for determining the scheme yields with the updated Reserve) was specified in the ToR. It was accepted in our proposal that modelling information would be made available from other studies. However, during later negotiations it became clear that scenario modelling for strategy interventions will be necessary.

Mitigation Measure

- The expenditure on this item must be monitored carefully and if the need arises to do more modelling than budgeted for, the DWA will have to consider a further variation order with increased budget. Provision has now been made for 10 scenario runs in this Inception Report.

Risk

- **Timeous completion of the study:** A multi-disciplinary study such as this one can easily run behind if any one of the many inputs is not delivered timeously. The team has been significantly delayed with the planning of the possible Resource Classification Task.

Mitigation Measure

The PSP will manage its sub-consultants carefully and will do regular reporting in accordance with Section 5.

Risk

- **Stakeholder Deadlocks:** A deadlock situation may develop if all the participating key stakeholders do not adopt a "give-and-take" approach and insist that their needs must at all cost be satisfied.

Mitigation Measure

- Expert staff in conflict resolution will be kept on standby. One of our team members is a legal expert, and should the need arise we may solicit her assistance.