Orange-Senqu River Basin

Orange-Senqu River Commission Secretariat
Governments of Botswana, Lesotho, Namibia and South Africa

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Demonstration Project on Water Management in the Irrigation Sector in Namibia and South Africa

Scoping Paper and Terms of Reference

Technical Report 09
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UNDP-GEF
Orange-Senqu Strategic Action Programme

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Scoping Paper and Terms of Reference

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1. Background

1.1 Orange-Senqu Strategic Action Programme

The Orange-Senqu River riparian States (Botswana, Lesotho, Namibia and South Africa) are committed to jointly addressing threats to the shared water resources. This is reflected in bilateral and basin-wide agreements between the riparian States and led to the formation of the Orange-Senqu River Commission (ORASECOM) in 2000.

The 'Orange-Senqu Strategic Action Programme' Project supports ORASECOM is developing a basin-wide plan for the management and development of water resources, based on integrated water resources management (IWRM) principles. The Project will finalise the preliminary Trans-boundary Diagnostic Analysis (TDA). This final TDA will serve as the scientific basis for developing a set of interventions under the framework of a basin-wide Strategic Action Programme (SAP) and associated National Action Plans (NAPs) in the riparian States. In addition, demonstration projects shall focus on:

- Community based rangeland management, with sites in Botswana and Lesotho;
- Environmental flows for the Fish River in Namibia and the Orange Mouth, shared by Namibia and South Africa; and
- Water resources management in the irrigation sector, with sites in Namibia and South Africa.

1.2 Rationale

The irrigation sector is, by far, the largest user of water in the basin. The total gross irrigation water demand is close to 4,000 Mm^3/annum. Net demand, once return flows are taken into account is likely to be in excess of 3,500 Mm^3/annum.

In addition to being the largest user of water in the basin, the irrigation sector is often accused of being the biggest waster of water. This perception is as a result of the use of old technology in both conveying and distributing water, and in the use of less than desirable management practices. Many of the irrigation areas, especially along the Lower Orange River were developed in or even before the 1950's, 60's and 70's and many with the specific aim of "job creation' during periods of low economic activity. The preferred conveyance and irrigation systems during this time of plentiful water, was open earth canals and flood irrigation. Many of the canals have since been lined and although many farmers are converting to more efficient irrigation systems, flood irrigation still predominates.

Under the recently-completed Phase 2 of GIZ support to the development of the ORASECOM Basin-wide IWRM Plan, the issue of water conservation and water demand management in the irrigation sector was dealt with in some detail. The report "The Promotion of Water Conservation

and Water Demand Management in the Irrigation Sector" looked at current practices in all the basin states and then made some in-depth investigation into best management practices both in theory and on the ground. The study went as far as evaluating best management practices at some schemes but stopped short of looking at measures to promote these practices, such as the setting up of pilot demonstration sites.

The setting up of a pilot demonstration is now to be undertaken under the UNDP-GEF support to ORASECOM, more specifically at the transboundary Noordoewer-Vioolsdrift Joint Irrigation Scheme. This document provides the background and scope of work for this Demonstration Project.

This Demonstration Project in water management in the irrigation sector shall:

- Be consistent with broader Government policies and (ongoing) initiatives in Namibia and South Africa;
- Promote irrigation water conservation and water demand management practices and demonstrate benefits to the stakeholders;
- Put in place measures that ensure the sustainability of the introduced measures beyond the lifetime of the Project;
- Be set within a viable institutional framework and realistically attainable within the timescale and allocated budget; and
- Establish stakeholder-based monitoring methodologies and management approaches that are replicable in other parts of the Basin.

2. Water Management in the Irrigation Sector

2.1 The Irrigation Sector

Context

The Orange-Senqu River rises in cool temperate and alpine regions and flows through progressively more arid terrain and ultimately through hyper-arid desert areas. This extreme range of climatic conditions has resulted in a wide variety of crop types being grown throughout the catchment under irrigation. In the more temperate north-eastern sections of the catchment rain-fed crop production occurs widely and is interspersed with irrigated cropping. Moving westwards, crop production becomes more dependent on irrigation to the point where rainfall is too low or too unreliable and only irrigated crop production takes place. In the more temperate north-western sectors, mixed cropping with field crops and fodder crops predominates. The main field crops are maize, wheat, potato, groundnut, cotton, soybean and dry-bean while the main fodder crops are lucerne, maize-silage and pastures. Limited areas of orchard crops such as cherry, apple and peaches are grown in the high altitude areas with adequate winter chill. In the dryer western areas permanent orchard and vine crops such as table grapes, raisin grapes, wine grapes, citrus and dates predominate. Lucerne is also a common crop in the dryer western areas.

Irrigation in Namibia is mainly vested in either commercial enterprises, or in state owned projects. Very little informal irrigation takes place, mainly because of scarce water resources, combined with either very sandy soils or often high pumping heads. However, state owned projects are designed in such a way that ±50% of each project is allocated to smallholder farmers, while the remaining 50% of the area is cultivated by commercial entities.

The part of the Orange-Senqu Basin which falls within Namibia consists of four catchment areas. The four catchment areas are again grouped into two main areas, namely:

- The Orange-Fish River catchment (4,465ha irrigated); and
- The Nossob-Auob catchment (1,036ha irrigated).

The present irrigation from the two catchment areas therefore comprises about 5,500 ha, while the potential irrigable area is about 8,750 ha.

The majority of irrigation in the Basin takes place in South Africa. Approximately 330,000ha are under irrigation in the South African portion of the basin. In recent years there has been a rapid growth in irrigation on the Namibian side of the river, especially in the growing of high value crops such as table grapes. Although there have been a number of irrigation initiatives in Lesotho, there are today only a few hundred hectares over to irrigation. There is no significant irrigation in the

Botswana part of the basin. In view of the very small amount of irrigation taking place within Botswana and Lesotho, as well as the fact that this project will focus on a transboundary project between Namibia and South Africa, it is only with reference to these two countries that further context on the irrigation sector is provided in this document.

Water use for irrigation in the South African section of the Basin occurs in two main areas, the Vaal River catchment and the middle to Lower Orange River catchment. Irrigation schemes fall under Government Water Schemes (GWS), Irrigation Boards (IB) or Water User Associations (WUA).

Most of this irrigation occurs on commercial farms with freehold tenure. The average size of irrigated areas per farming unit is about 50ha. However, there are many farms with larger irrigated areas where consolidation of irrigation units under one owner has taken place in order to maintain or improve financial viability. A programme to introduce and develop resource poor farmers on smallholder irrigation schemes is intensifying in the South African portion of the catchment but these areas make up only about 10% of total irrigation.

Regulatory and Institutional Setting

The regulatory and institutional settings are different in South Africa and Namibia. Within Namibia the Water Resources Management Act 24 of 2004, which had made allowance for several IWRM-related measures and approaches, including the development of WUAs similar to those in South Africa was rescinded and a revised version is still under preparation. The Water Act currently operating therefore is The Water Act 54 of 1956 which is not only outdated but also inconsistent with the country's hydrologic reality. It predicates the right to water through ownership of riparian land and thus effectively excludes non-landowners, particularly in the rural areas, from having adequate access to water.

The Government of Namibia is currently in the process of drafting the blueprint for a new Water Act for Namibia to replace the Water Act 54 of 1956. The Bill of the new legislation includes:

- The establishment of a Water Advisory Council as the nation's supreme advisory authority in water resources matters;
- The establishment of a Water Regulator and a Water Pricing Policy;
- The establishment of a Water Resources Management Agency;
- The establishment of Basin Management Committees to deal with matters relating to the use, protection, development, conservation, management or control of a water resource in a basin or part of a basin, including irrigation activities;
- The establishment of an International Water Management Institution to be responsible for implementing the international agreement;
- The establishment of Water Point Committees for the management of rural water supply services;
- The formation and periodic review of a National Water Master Plan.

Legislation on irrigation in Namibia has been in draft form since 1993. Two main constraints are impeding progress. Firstly, the legislation should be in line with existing national and neighbouring country legislation, and this was impossible because the Water Act was not finalized, and secondly major investment is needed to upgrade existing irrigation scheme infrastructure to levels that users could be expected to assume responsibility for it.

The National Agricultural Policy and the Green Scheme Policy are the only two pieces of legislation which currently directs irrigation development to a certain extent. The National Agricultural Policy of 1995 includes the following important guidelines relating to irrigation:

- To improve regional irrigation performance through improved economic efficiency.
- To ensure that future irrigation development should be socially and economically viable.
- To minimize direct Government intervention and investment in present and future irrigation development, thereby reducing the Government's financial burden within the sector. This should however not exclude the Government from providing major, general infrastructural investment.
- To create an enabling atmosphere, whereby the non-Government sector is encouraged to invest in irrigation development and manage operations.
- To establish the principle that the water user, rather than the Government, pays for irrigation operation and maintenance.
- To encourage and support development of the informal irrigation sector, bearing in mind the need to limit direct Government financial intervention.

The Green Scheme Policy (Cabinet Decision No. 18th/06.08.02/004) is a programme of investment and promotion of increased food production through irrigation. Through irrigation development, Government aims to bring the private sector to remote and underdeveloped areas, thereby building local capacity in terms of production, marketing management and general development.

South Africa's new National Water Act (Act 36 of 1998) provided for a fundamental reform of water resources law, for the conservation of a scarce resource, and for the equitable allocation of water for beneficial use. Some of the key elements which guide water management in South Africa and which are of some relevance to the irrigation sector are that:

- Only water required to meet basic human needs and maintain environmental sustainability will be guaranteed as a right. This will be known as the Reserve.
- In shared river basins, Government is empowered to give priority over other uses to ensure that the legitimate requirements of neighbouring countries can be met.
- The new system of allocation will be implemented in a phased manner, beginning in water management areas which are already under stress. This system of allocation will use water pricing, limited term allocations and other administrative mechanisms to bring supply and demand into balance in a manner which is beneficial in the public interest.
- The riparian system of allocation, in which the right to use water is tied to the ownership of land along rivers, was effectively abolished. Transitional arrangements will

over time, ensure an orderly, efficient and gradual shift in water use allocations as and when necessary.

- Water use allocations will no longer be permanent, but will be given for a reasonable period, and provision will be made to enable the transfer or trade of these rights between users, with Ministerial consent.
- To promote the efficient use of water, the policy will be to charge users for the full financial costs of providing access to water, including infrastructure development and catchment management activities. This will be done on an equitable basis and according to the realistic reasonable programme which has already been begun.
- All water use, wherever in the water cycle it occurs, will be subject to a catchment management charge which will cover actual costs incurred.
- To promote equitable access to water for disadvantaged groups for productive purposes such as agriculture, some or all of these charges may be waived for a determined period where this is necessary for them to be able to begin to use the resource.
- All major water use sectors must develop a water use, conservation and protection policy, and regulations will be introduced to ensure compliance with the policy in key areas.
- Provision will be made for the phased establishment of Catchment Management Agencies, subject to national authority, to undertake water resource management in these water management areas

Catchment Management Agencies

Catchment Management Agencies (CMAs) are statutory bodies established in South Africa under the Act. A Catchment Management Agency manages water resources within its Water Management Area. South Africa has been divided into 19 Water Management Areas as part of the progressive development of the National Water Resource Strategy. Catchment Management Agencies are obliged to develop and implement a Catchment Management Strategy for the water resources within their Catchment Management Area. The Catchment Management Area for the Lower Orange has not yet been established.

Water User Associations

In South Africa a Water User Association (WUA) is a statutory body established by the Minister under Section 92 of the Act. Water User Associations are, in effect, cooperative associations of water users who wish to undertake water-related activities for their mutual benefit. A Water User Association must accommodate all water sectors within their area of jurisdiction.

The broad role of a Water User Association is to enable people within a community to pool their resources (money, human resources and expertise) to more effectively carry out water-related activities. Members will thus benefit from addressing local needs and priorities.

The Act provides adequately for the implementation of water conservation and water demand management in the irrigation sector and the Department of Water Affairs (DWA) has developed conservation and water demand management (WC/WDM) strategies and guideline documents for agriculture. The Act requires that WC/WDM be driven primarily by Water User Associations. Water User Associations are, in turn, required to submit annual business plans, to a Catchment Management Agency, or the DWA in the absence of a Catchment Management Agency. The business plans are to include a Water Management Plan (WMP).

The development of a Water Management Plan by a Water User Association is central to implementing water conservation and water demand management in the agricultural sector in South Africa. The Water Management Plan sets out benchmarks and best management practices for water conservation and water demand management and a manageable and affordable programme for their implementation by both the Water User Association and their irrigators over time. The Water Management Plan is therefore the primary tool with which the agricultural sector is expected to implement the National Water Conservation and Demand Management Strategy (NWCDMS). In terms of this strategy, the vision of all water conservation and water demand management endeavours is the efficient use of water by water institutions and consumers in South Africa.

Technological Aspects

In Namibia, gravity fed conveyance systems are only found below the large state owned dams such as Hardap and Naute and at the Noordoewer-Vioolsdrift Joint Irrigation Scheme. The bulk water distribution networks are generally in a fair to good condition, since they belong to Government and it is normally also maintained by Government, whether directly or indirectly. The Noordoewer-Vioolsdrift Scheme is an exception, because it is maintained by the farmers, but Government has made substantial contributions towards upgrading and repair of the infrastructure.

The South African portion of the basin is characterised by a highly sophisticated network of water storage and conveyance infrastructure serving a large number of formal irrigation schemes.

In the case of the Vaal River portion of the catchment water is allocated to these schemes from 22 Government controlled schemes (including major dams such as the Vaal Dam and Bloemhof Dam through to minor dams and weirs) and is distributed to irrigators via canals, pipelines, balancing dams and pumping systems. There is a significant amount of diffuse (uncontrolled) irrigation from the Vaal River and its tributaries and from private farm-dams. In the Orange River portion of the catchment, irrigation water distribution is controlled from the Gariep Dam and the Vanderkloof Dam and a number of weir and canal systems along the Orange River. The Vanderkloof Canal which runs for over 100 km from Vanderkloof Dam is a major artery of high-quality Orange River water to the water stressed central region of the catchment near Kimberly, feeding the Riet/Modder irrigation areas.

Distribution to farmers within schemes is mainly by means of calibrated sluice gates while in-line flow meters with telemetry are used in some schemes in the central region of the basin. Although there are some exceptions, the irrigation distribution infrastructure and particularly the lined open canals are aging and the rehabilitation requirement is widespread.

Centre pivot irrigation now makes up about 80% of all irrigation systems in the catchment and micro-jet and drip irrigation systems are dominant in the orchard and vine crops.

A wide variety of irrigation systems are found in Namibia. Many farmers at the Hardap Irrigation Scheme and the Noordoewer-Vioolsdrift Joint Irrigation Scheme still use flood irrigation and do not practice proper irrigation scheduling, which leads to poor water use efficiency. Labour issues (mainly the cost) as well as the introduction of high value crops such as grapes, dates and vegetables have, however, encouraged some farmers to switch to more efficient irrigation systems like centre pivots, micro and drip irrigation.

Flood irrigation is still practiced widely in the basin particularly on the South African Lower Orange areas like Boegoeberg, Upington and Kakamas.

The majority of farmers irrigate on the basis of an allocation of irrigation water per hectare and technical irrigation scheduling is the exception rather than the rule. These are both aspects which are of critical relevance to water conservation and water demand management in the irrigation sector and will be re-visited several times in this report.

Relatively low-value field crops such as maize and wheat and fodder crops like lucerne make up over 85% of irrigated crops in the South African portion of the catchment. Higher value field crops like potato, vegetables and certain annual fruit crops such as sweet melon, make up only about 10%. High value orchard and vine crops, which tend to be more water efficient and provide a significantly higher net financial return per unit of irrigation water, make up less than 5% of irrigated crops. This situation is determined by a number of key factors:

- Climatic risk: Low assurance of irrigation water supply discourages conversion to intensive permanent crops.
- Investment versus operating costs: High capital cost of establishing orchard and vine crops. Low cost of water usually allows farmers to farm profitably using annual field crops, provided they maintain a reasonably high standard of management and intensive rotation of summer and winter crops.
- High level of management: Successful production of permanent orchard crops has become a complex multifaceted agribusiness requiring good management skills, substantial financial resources and technical skills. The high-value orchard and vine crops have to be export-orientated for financial viability and this requires sophisticated operation.
- Water quality issues: The rate of change to orchard/vine crops is being affected by water quality issues, because of the higher sensitivity to water quality of these crops.

Consistent with the above, there are, however, areas where rapid evolution to intensive and water-efficient irrigation is taking place in the Basin. This includes areas in the Lower Orange on both sides of the border, where the world-renowned table-grape and raisin industry has blossomed on the basis of favourable climatic conditions, relatively high assurance of supply of irrigation water and the development of sophisticated agri-business operators. In addition, as the industry expands onto the higher-lying ground away from the River, pumping costs (coupled with ever-increasing electricity costs) have become a significant component of crop production costs. This has lead to an ever-increasing irrigation efficiency through sophisticated irrigation scheduling.

2.2 Water Conservation and Water Demand Management

Water Demand Management can be defined as including influencing and regulating the demand through maximising the participation and defining accountability and responsibility of both political stakeholders and civil society stakeholders.

Water Conservation measures are sometimes seen as the means to bring about the results hoped for under the umbrella of Water Demand Management, and includes:

- The minimization of loss or waste of water;
- Maintenance or improvement of water quality;
- Care and protection of water resources; and
- The efficient and effective use of water.

Wherever possible, water demand management should be used to delay implementing new expensive infrastructure developments to meet existing and future demands. This is particularly relevant for the Orange-Senqu Basin where the expansion of new infrastructure is ongoing and costly.

Within the context of the irrigation sector the combined goal of a combination of water demand management and water conservation is to produce more crops per net drop of water.

Water Conservation and Water Demand Management initiatives in the Orange-Senqu Basin should be aligned to three important global trends in water resource management, namely:

- integrated water resource management within catchment boundaries;
- decentralised management, operation and maintenance of water delivery; and
- Improved management of existing water resources to promote water use efficiency and water conservation.

To a greater or lesser extent all of these trends are evident, in member-state legislation and/or policy on water management which provides a sound foundation for their implementation over time.

It is generally accepted that water conservation and water demand management measures will not be effective unless there is a benefit to the user. The obvious benefits include:

- Improved yield and quality of crop (improved income);
- Cost savings (e.g. pumping costs and user charges);
- Income from sale of saved water (water markets); and
- The possibility of irrigating a larger area with same water allocation.

Perhaps less obvious is the concept of "long-term assuredness of adequate water". Under the legislation in all four riparian States the supply of water for irrigation is assured at lower level than water for other uses such as domestic, industrial, stock-watering etc. In times of shortage, as has already been shown frequently in the past, the supply of water to irrigators has been cut and farmers have had to grow using a reduced amount of water. It is therefore in the interest of all irrigators to play their major role in ensuring that there is sufficient water to go round even in times of drought.

2.3 Best Management Practices

Identified Current Best Management Practices

The concept of best management practices as applied to the irrigation sector is a useful and practical vehicle for the promotion and implementation of water demand management and water conservation. A study entitled "The Promotion of Water Conservation and Water Demand Management in the Irrigation Sector" (2011) was recently completed for ORASECOM and examines the status of water demand management and water conservation in the irrigations sector. In this report, best management practices are examined in detail for each of the basin states and selected irrigations schemes were evaluated at both the "water distributor" and irrigator/farmer level. This report provides important background to this project and is essential preparatory reading.

Best management practices can most easily be examined at three levels:

- Water Management Institutions;
- Irrigation Water Suppliers (Distributors); and
- Irrigators/farmers.

With respect to the need for decentralized management, operation and maintenance of water delivery, effective improvements in water conservation and water demand management primarily depend on strong and active water management institutions at the water-user level. The Water User Associations, which are currently being established in South Africa, are a good example of how devolution of water management responsibility can take place.

The Water User Associations should not have to operate in isolation and require mentorship and monitoring from a Catchment Management Agency. These are in their infancy in the South African portion of the Orange-Senqu Basin and those which would cover the South African portion of the

basin have not yet been established. In the interim the Department of Water Affairs (DWA) fulfils the responsibilities of the Catchment Management Agencies.

In South Africa, Water User Associations are required, in terms of the Water Act, to submit Water Management Plans to their Catchment Management Agencies. The development of a Water Management Plan is central to implementing water conservation and water demand management in the agricultural sector. A Water Management Plan is not an end in itself but is a process with an annual cycle, which can assist Water User Associations and their irrigators in realising the economic and social benefits of improved water use efficiency.

The development of the Plans provides an opportunity to improve agricultural water management by stimulating self-analysis and forward thinking on the part of farmers, their water suppliers, Catchment Management Agencies, officials, Consultants and advisors. The Plans can be used as a management tool for Water User Associations, Developing a Water Management Plan and reviewing it annually is a major stimulus to efficiency, provides input to the business planning process, promotes coordinated action and facilitates negotiations with the Catchment Management Agencies and other stakeholders. The process involves analysing current water use, setting targets for improved efficiency and planning a realistic means of reaching these targets. The Water Management Plans must identify appropriate best practices for a specific water supplier and its irrigators.

In the case of irrigation water suppliers, best practice can be divided into primary and secondary elements. Examples of primary best practice include:

- Appointing a person with responsibility for Water Conservation Coordination (apart from normal Water User Association management roles).
- Ensuring that available information for improved on-farm water management is distributed to farmers.
- The use of acceptable measuring devices or techniques (You can't manage what you can't measure).
- Measurement of the quality and quantity of inflows and outflows, and measuring losses and water supplied to customers,
- Establishment of a GIS type data bases on irrigated lands, crop types and areas, irrigation requirements and actual applications, etc.
- Implementation of a water pricing structure to facilitate water conservation.
- Maintaining and improving infrastructure, according to a long-term maintenance plan, supported by a financial plan.
- Positively promoting good communication between all concerned in water management and
- Preventing unlawful withdrawals of surface and groundwater.

Examples of secondary best practice for irrigation water suppliers include:

- Facilitating support services to enable farmers to use water more efficiently on-farm.
- Coordinating the evaluation of energy and water efficiency of pumps, distribution and irrigation systems belonging to Water User Associations or private irrigators.
- Considering the suitability of irrigation methods and crops to an area.
- Reducing losses by lining canals, balancing dams, etc.
- Promoting better management procedures for water bailiffs and other management staff.
- Training Water User Association personnel.
- Facilitating the financing of capital improvements for on-farm irrigation systems.
- Facilitating voluntary water transfers.
- Eradicating invasive alien plants.
- Practising adequate soil conservation and drainage measures.

While the role of a water management authority is critical for the sustainable improvement in water use efficiency and water demand management, the role of individual irrigators in this initiative is equally important. Examples of best practice for irrigators include:

- Establishing benchmark irrigation water requirements of their selected crops in their climatic zone.
- Establishing benchmarks for the relative efficiency of their different irrigation systems.
- Practicing irrigation scheduling to meet irrigation requirements.
- Installing flow meters or other appropriate measuring devices for accurate measurement of irrigation water. Without the ability to measure application rates it is not possible to manage irrigation efficiently. The lack of good water measurement impacts directly on the ability to:
    - transfer water from one irrigator to another within a WUA (water trading);
    - effectively schedule irrigation;
    - monitor abuse of water allocations to farmers;
    - apply almost any aspect of water management best practice, and

  These are all aspects which can encourage farmers to use water efficiently.
- Maintaining on-farm canals, pipelines and dams to minimise wastage.
- Maintaining irrigation equipment to ensure efficient application of the correct amount of water.
- Installing (where necessary) and maintain irrigation drainage facilities.
- Improving production practices to optimise net returns from crops per unit volume of irrigation water used.

2.4 Current Best Management Practices

Introduction

The ORASECOM 2011 study identified a number of distributers and farmers as practitioners of best management practices, some of these were visited for detailed evaluation. A brief overview is provided in the following sections, further details are contained in the report.

Best Practice at Distributer Level

The Orange-Riet Water User Association, situated within the Upper Orange Catchment Management Area was evaluated in some detail under the ORASECOM study. While the schemes falling under this Water User Association have significant differences compared to the Noordoewer-Vioolsdrift scheme, the management practices employed at the distributor level are arguably second to none within the Basin and such provide an excellent model for study and lesson-learning.

The management area of the Orange-Riet Water User Association includes all the properties entitled to use water from the Orange River via the Scheiding Pumping Station at Vanderkloof Dam, and includes all irrigation along the 113km Orange-Riet Canal, the Riet River Settlement and selected areas along the Riet River and the Modder River. The total area under irrigation is 17,050ha. This area, together with a number of municipalities and other consumers are consolidated to form the Orange Riet Water User Association. The Water User Association took over the maintenance of all infrastructures from DWA in November 2001. The ownership of the infrastructure remains vested in DWA.

The key irrigation best management practices that are demonstrated by the Orange Rite Water User Association are listed below:

- Sense of awareness of all staff members of the importance of efficient irrigation water management and conservation.
- The management team maintains a high level of service to irrigators and good control of overall water distribution by means of a computerised telemetry system, integrated through all levels of water management from bulk flow measurement right to the invoicing of irrigators for water used.
- Water abstraction is measured. Water meters are purchased by the farmer at a subsidized price and belong to him.
- The WUA has a clear but simple set of regulations for each of the Irrigation Schemes within the Association. The main regulations include:
    - Transfer water from one irrigator to another within a WUA (water trading);
    - Water allocations per irrigator, the conditions under which the allocation can be restricted and the allowed abstraction rate;
    - Irrigators are responsible for the setting, opening and closing of sluices;
    - Only the owner or authorised individuals may request water;

  - Water may be transferred from one property to another in a season via a rigorous process which is driven by the WUA;
  - Water allocations may be transferred permanently (sold) from one property to another within the area of the Orange Riet WUA also via a rigorous process which is driven by the WUA;
  - Strict regulations regarding the unlawful abstraction of water including fines and charging for work done by the WUA which otherwise would be done by the irrigators themselves.
  - A year planner that has to be completed by each irrigator
  - Recording of all crops grown under irrigation
  - Control over the submission and payment of water accounts.
- The WUA prepares an annual Water Management Plan. The plan allows for a systematic and practically achievable improvement in water management and water-use efficiency.
- All sluices are measured at the outlet. A record is kept of every irrigator's requests and receipts.
- A water management programme (spreadsheet-type IT application) is used to manage the water measurements and prepare accounts for irrigators.
- The WUA prepares an annual disposal report, an annual water-accounting report and specific performance indicators.
- Unlawful use of water is monitored using a spot-check system, reported shortages in the canal, telemetric measurement and comparison with benchmark crop water use.

Best Practice at Irrigator Level

A number of individual farmers were visited and evaluated as part of the ORASECOM study. The type of irrigation and/or crop grown was different for each of the irrigators visited. Two of them are briefly described here.

Soetmelkvlei Farm, which is a maize, wheat and lucerne producing farm using centre pivots and a solid set sprinkler system filling the spaces between the centre pivots, can best be described as a farm with "state of the art" technology and high-level management. It is interesting to note that this multi-million operation, with 183ha under irrigation, is run by the owner-manager, an assistant manager and three full-time employees.

Centre pivots are the main form of irrigation with a permanent overhead sprinkler system installed for the areas between the Centre Pivots. Some of the best practices can be highlighted:

- Irrigation scheduling is done by means of soil moisture (capacitance) probes and a sophisticated computerised monitoring and management system. The system is supported (technically, financing etc) by a commercial service provider.
- Centre pivots are the main form of irrigation with a permanent overhead sprinkler system for the areas between the Centre Pivots
- Irrigation efficiency is in the order of 85% against a benchmark of 80%.

- Water released onto the farm is measured. Water pumped from the on-farm storage dam into the irrigation system is accurately measured with in-line flow meters
- All irrigation equipment is regularly monitored and maintained
- On-farm drainage canals (which drain back into the Riet River) ensure that water logging and related salinity problems are avoided
- The agronomic practices on the farm include a "fertigation" system using soluble fertilizers applied through the irrigation system.
- Crop yields on Soetmelkvlei are significantly higher than the average on the irrigation scheme.

The Liebenberg Boerdery is a farm of 50ha, of which 30ha is under irrigation (20ha flood irrigation and 10ha micro-jet irrigation pumped directly from Orange River to a farm storage dam). Only grapes are grown, raisin grapes (24ha), wine grapes (3ha) and table grapes (3ha). The irrigation water allocation is 15,000m^3/ha/a.

Some of the best practices can be highlighted:

- Low irrigation demand (15 000 m^3 for flood irrigation and 12 000 m^3/ha micro-jet irrigation)
- Flood irrigation areas have all been laser-levelled.
- The micro-jet irrigated areas have water pumped from the Orange River into a farm dam from which it is booster-pumped to the vineyards.
- All irrigation equipment is well maintained.

3. Demonstration Project

3.1 The Noordoewer-Vioolsdrift Joint Irrigation Scheme

The Noordoewer-Vioolsdrift Joint Irrigation Scheme was built in 1934 and is managed by the Noordoewer-Vioolsdrift Joint Irrigation Authority (JIA) which was established through a bilateral agreement between Namibia and South Africa in 1992. Farmland is situated on both sides of the Orange River and is privately owned. The operation and maintenance of the canal and an inverted siphon (under the Orange River) distribution system is done by the JIA with own funds. The reticulation system is in a fair state and both the Namibian and South African Governments contributed towards upgrading of the infrastructure in the recent past. Some further work is planned. Many farmers still use flood irrigation, but several are beginning to switch over to centre pivot, micro and drip irrigation. Water usage is not measured and incentives for farmers to switch to more efficient irrigation technologies are limited. The number of famers on the scheme has decreased from 58 in 1994 to only 16 in 2010. Resulting from this, the average hectares per farmer have increased from 15 to 55ha. This can mainly be attributed to improving economical viability.

Farmers have moved away from the traditional planting of lucerne because of the poor and remote markets. Sweet corn and vegetables like tomatoes, green peppers, onions, water melons, sweet melons and eggplant (aubergine) are now the primary crops. The vegetables are mostly irrigated through drip irrigation, while centre pivots are used for the sweet corn. Table grapes under micro irrigation are also gaining momentum.

The JIA is managed by a board consisting of three farmers from each side of the border, as well as one official from the Ministry of Agriculture, Water and Forestry (Namibia) and one official from the Department of Water Affairs (South Africa). Meetings are held on a quarterly basis.

The day to day operation and maintenance is managed by a technician and a workforce of five. An additional two workers operate the pumps on both sides of the river which are used to supplement the canal sections when shortages occur during the summer months.

Each farmer is allocated 0.042m³/s/ha for a period of 6 hours per week. The board does not have a water bailiff and control is exercised by the farmers themselves. Due to the small size of the scheme and the limited number of farmers, no problems in this regard are experienced. Farmers quickly take up transgressions with each other.

3.2 Demonstration Project Objectives and Expected Outcomes

Objectives

The objective of the Demonstration Project will be to contribute towards better managed irrigation demand in the basin, more economical use of water and improved pollution control in the irrigation sector.

The Demonstration Project will show selected farmers what water savings and improved yields can be made through the generalisation and implementation of best practices including scheduling, metering, pricing and improved irrigation methods. The project will also show the best practice in application of agro-chemicals and pollution control and monitoring. The project will serve as a model for improved water management in the irrigation sector and as a source of information dissemination to all irrigation farmers in the Orange-Senqu Basin.

At the overall scheme or distributor level, the project will aim to achieve show an overall reduction in the quantity of water abstracted. The project will also show what has to be done to support famers in achieving their goals of improved efficiency, higher yields and the implementation of on-farm best management practices in general.

Expected outcomes

Expected outcomes at the distributor level (JIA):

- Improved and accurate measurement (quantity and quality) of abstraction/diversion of water to the irrigation scheme and the return flows to the river;
- Improved and accurate measurement of plots areas, crops cultivated, yields etc, all captured on GIS database;
- Proven reduced abstraction/diversion of water to the irrigation scheme (GEF IW stress reduction indicator 8);
- Improved water ordering systems and scheduling, water market among farmers established (if practical);
- Water Management Plan established and updated on an annual basis;
- Replicable strategy, highlighting areas which can be considered as universal and how these can be implemented.

Expected outcomes at the irrigator level (farmers):

- Improved and accurate measurement of water supplied to individual farmers/offtakes;
- Reduced water consumption and improved yields on demonstration plots;
- Agreement with and support for introduced best management practices by farmers and JIA.

Indicators/means of verification

Indicators or means of verification are essential both for demonstration to the Client of project progress and results and for the JIA and farmers to monitor progress over the project life and beyond:

- Structured interviews with farmers participating in the demo project gauging at mid-term: (i) their interest in adopting new practices, (ii) their willingness to reduce their overall water consumption/use and at the end (iii) improved productivity and (iv) replicability of piloted approaches in other areas of the Basin.
- Measurement of flows into and return flows out of the scheme (quantity and quality).
- Quantification of stress reduction (% of reduced water use).
- Lessons learnt (documented in report or other publication/media).

3.3 Project Duration and Phasing

The Demonstration Project will run for a minimum of two years. It is anticipated that the Inception Phase will start in August/September 2011 and that all work will be completed by October 2013.

The project will be phased with clear outputs for each of the phases. The following phases are anticipated:

- Kick-off Phase (6 weeks);
- Assessment and Project Design Phase (3 months), and
- Implementation Phase (21 months).

3.4 Proposed Activities

Inception Phase

The main objective of the Inception Phase is to make arrangements and take all necessary actions to ensure that remaining phases of the project will yield the best results possible. The Inception Phase provides the Consultant with the opportunity of meeting with key stakeholders and modifying or fine-tuning their proposed approach and methodology. In view of the complexity of the assignment, six weeks have been allowed for the Inception Phase.

Within the first two weeks of the Inception Phase the Consultant will organise a "kick-off" meeting in Noordoewer or Vioolsdrift. This meeting will be attended by the Client, members of the Joint Irrigation Authority and famers. It will provide the opportunity for a mutual exchange of ideas, opinions and expectations and will include presentations by the Client and the JIA. The Consultant's team will make a presentation of their proposed approach and methodology and take due note of discussions and suggestions.

The Inception Report will be submitted six weeks after project commencement and presented to a workshop in Noordoewer-Vioolsdrift. The Inception Report: shall outline:

- The Consultant's mobilization;
- The work plan;
- A revised methodology and timetable for the services; and
- A progress monitoring and quality assurance plan.

More specifically, it is important that the participants, their roles and their responsibilities on both the side of the Consultant and the Joint Irrigation Authority and selected farmers are clearly defined. The Inception Phase is also the opportunity for the Consultant and the JIA to ensure that as many of the farmers as possible know about the project and are prepared to participate, even if only to share data concerning their individual operations.

Assessment and Project Design Phase

This is the most intense phase of the project and should be completed within three months. The objective of this phase is, through a thorough diagnostic assessment, to come up with a "Water Management Plan for the JIA". This plan will effectively serve as the basis for implementation of the next phase of the project as well as identifying objectives and activities beyond the end of the project. Amongst other things, the Water Management Plan should be based on:

- Situational analysis of the Noordoewer-Vioolsdrift Irrigation Scheme;
- Review of best management practices;
- Analysis of possible measures; and
- Water Management Plan and project design.

Using the available information (maps, databases, aerial photography, and satellite images) as a point of departure, the Consultant will be required to make a thorough analysis of the current situation at the scheme. This will be done at the scheme or distributor level in cooperation with the JIA and at the famer level with the cooperation of both the JIA and the farmers concerned. A GIS should be set up with all the necessary attribute data to describe the scheme. The type of information to be collected and mapped at the scheme level should include:

- Details of all infrastructure including offtake structures, siphons, the canal distribution system and farm offtakes. This should include accurate dimension and capacity data and comments on condition;
- Mapping of all farm and field boundaries together with ownership / management data; and
- The fields/areas served by each offtake should be clearly mapped.

Surveys and interview at the famer level should serve to complete the detail. The mapped fields should be populated using feedback from the individual farmers with accurate information on:

- Crops currently being grown and plans for the immediate future for each of the areas;
- Current irrigation method and application rates;

- Details on the status of each irrigation area; whether the field is laser-levelled, drainage conditions etc.
- Details of scheduling practised (if this is the case); and
- Details on yields etc.

Having obtained a clear picture of operations and management at the Noordoewer-Vioolsdrift Scheme, the next step will be to review current best practices as they may be applicable to the scheme. This review should take the diagnostic analysis of the Noordoewer-Vioolsdrift Scheme as the point of departure and then look at each aspect of best management practices as being practised at some of the sites evaluated in ORASECOM's 2011 study. Clearly not all measures will be (easily) applicable or necessarily relevant to the Noordoewer-Vioolsdrift Scheme.

In order to do this the Consultant should make a visit to the Oranje-Riet and Boegoeberg Schemes as well as selected farmers on these and other schemes. All these visits can take place in a one week period and should be planned well in advance with the cooperation of the Client. It is proposed that selected stakeholders from the Noordoewer-Vioolsdrift Scheme accompany the Consultant on this visit and be involved in this review as far as possible.

Having reviewed examples of best management practices at both the scheme and farmer level the Consultant should carry out an in-depth analysis into which measures could be implemented either at the schemes level or at the pilot demonstration level. Careful consideration should be made of the available budget for measure implementation and the right balance struck between soft and relatively inexpensive measures such as capacity building, improved management systems and tools, and technological improvements whether they be at the distributer level (improved measurement at offtakes, improved water ordering systems etc) or at the farm level.

In the consideration of on-farm measures such as improved cultivars, irrigation scheduling and application of fertilisers, potential support from the commercial sector should be fully exploited.

The previous steps will all contribute to the first Water Management Plan for the Joint Irrigation Authority. This document which will implicitly set up the project design will be the output of the Assessment and Project Design Phase and will be presented to the JIA and the Client at a workshop in Noordoewer-Vioolsdrift.

The development of a Water Management Plan can be considered as central to implementing water conservation and water demand management. The Water Management Plan will set out benchmarks and best management practices for water conservation and water demand management and a manageable and affordable programme for their implementation by both the Water User Association and their irrigators over specified time period and with an associated budget. The Water Management Plan will effectively become the project design and implementation document and will, in line with best practices be updated both at the end of year one and at the end of the project.

The implementation programme set out in the Water Management Plan will include a detailed breakdown of how JIA funds and those made available through this project, are to be spent.

Implementation Phase

The project implementation phase will last for 21 months. Project implementation will be in line with the Water Management Plan as defined in detail for the first two years of operation in the previous phase.

3.5 Project Team

It is envisaged that the Consultant's team will made up from a partnership of a consulting firm and a commercial irrigation equipment/fertilizer supply company that can provide practical on-farm support.

The project team should be such that it combines strong and extensive experience at the leadership level with a maximum level of presence on site by a less-experienced but nonetheless dynamic and independent professional.

3.6 Reporting

The following meetings are envisaged:

- Kick-off Meeting, as specified above.
- Progress Meetings: meetings at site with the UNDP-GEF Project Manager, members of the Joint Irrigation Authority, government line agencies, and others. At appropriate intervals, i.e. quarterly or at milestones in project delivery.
- Presentations: Presentations for ORASECOM Technical Task Team and others, as per requirements.

The Consultant shall provide the following management reports:

- Monthly Progress Notes: Concise reports to the Client, summarising progress and issues at site, providing a rolling detailed work plan and pertinent financial information.
- Inception Report: as specified above, due six weeks after commencement.

The following technical reports are expected:

- Assessment and Water Management Plan.
- Mid-term Report with revised Water Management Plan;
- Final Report.

All reports hall be submitted as two hardcopies as well as softcopy (.doc and .pdf). Submitted reports may be subject to final editing by the Project.

3.7 Implementation Arrangements and Tentative Budget

Implementation arrangements

The Consultant shall provide the following services:

- Implement all Demonstration Project activities at the selected site.
- Conduct applied scientific research related to the Project; draft respective technical reports, papers, etc.
- Undertake other specific assignments relating to the Project, at requested by the Client.

The Consultant must be a legal entity registered in Namibia or South Africa with the right to enter a contractual agreement with UNOPS. It can also be a consortium of legal entities where the lead agency is registered. It must have no history of legal proceedings related to fraud or corruption and an ability to work in English.

Tentative Budget

The below table provides a tentative breakdown of the allocated resources and implementation budget for the Demonstration Project's duration of 25 months:

No	*Description*	*Quantity*	*Costs (USD)*	*Comments*
1	**Project team (fixed price, funds under the Consultant)**			
	Team Leader	25% of time		International/regional Team Leader (> 15 years experience), senior irrigation engineer/ expert. Part-time assignment, 25% or less over 25 months.
	Technician	60-75% of time		Technician (> 5 years experience) based on-site. Part-time assignment, 60 to 75% over 25 months.
	Agronomist / on-farm irrigation expert	25% of time		Locally-based with experience of technical support to irrigation farmers. Part-time assignment, 25% or as per requirements over 25 months.
2	**Expenses of the Project team (fixed price, funds under the Consultant)**			
	Utilities and communication	Lump sum per month		
	Transport	Per km		i.e. 4WD, 1,000km per month
	Subsistence	Daily rate		For project team, as per requirements.
	Field office and accommodation	Lump sum per month		If not provided through JIA.
3	**Goods and services for implementation (reimbursable costs, funds under the Consultant)**			
	Goods and services	Estimate	150,000.-	Goods and services, as specified in Assessment and Water Management Plan
	Total			

References

Burmeister&Partner et al., 2004: Lower Orange River Management Study. Pre-Feasibility Study into measures to improve the management of the Lower Orange River and to provide for future developments along the border between Namibia and South Africa. Vioolsdrft and Noordoever Joint Irrigation Scheme, Assessment of viability with particular reference to JIA request for further investment. Windhoek, Namibia.

Burmeister&Partner et al., 2005: Lower Orange River Management Study. Pre-Feasibility Study into measures to improve the management of the Lower Orange River and to provide for future developments along the border between Namibia and South Africa. Water conservation and demand management. Windhoek, Namibia.

Burmeister&Partner et al., 2005: Lower Orange River Management Study. Pre-Feasibility Study into measures to improve the management of the Lower Orange River and to provide for future developments along the border between Namibia and South Africa. Pilot study of water conservation in the irrigation sector of the Lower Orange River. Windhoek, Namibia.

WRP and Associates. 2011. The Promotion of Water Conservation and Water Deland Management in the Irrigation Sector ; Phase 2 of GIZ Support to the ORASECOM Basin-wide IWRM Plan; Work Package 6; ORASECOM, Document No. 011/2011 and related supporting work and database (available at http://orangesenqu-iwrmplan-phase2.org/)