

Integrated Water Resources Management



Okavango-Omatako River Basin

About this booklet

This booklet is intended for all water users to encourage awareness of the water sources, water use and its values, especially in a dry country as Namibia. There are no perennial rivers within the borders of Namibia and water resources are very unevenly distributed across the country. The water resources challenges in Namibia can only be addressed through efficient water resources management including development of an integrated framework and provision of infrastructure to ensure water security. In this regard, this booklet is compiled for the Ministry of Agriculture, Water and Forestry to introduce the concept of Integrated Water Resources Management (IWRM) and how it can be implemented with emphasis on stakeholder participation and decision making at the lowest appropriate level. The contents of the booklet includes:

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What is IWRM and why is it important?

Integrated Water Resource Management (IWRM) is defined as a process that promotes the coordinated development, management and use of water, land and related natural resources (people, vegetation, animals and eco-systems) for economic, social and environmental sustainability. The IWRM process further involves participatory approaches which include discussions, planning and negotiations between stakeholders of the basin on important issues to achieve social equity, economic efficiency and environmental sustainability.

IWRM is implemented at a basin level in Namibia, linking all aspects of the basin, so that the users can understand the interactions between resource use, economic value and conservation, as well as the impacts of their activities on eco-systems and the goods and services they provide.



The Department of Water Affairs and Forestry (DWAF) in the Ministry of Agriculture, Water and Forestry (MAWF), assisted by a Steering Committee representing various sectors, formulated an IWRM Plan (IWRMP) for Namibia to ensure coordinated and sustainable water use of water resources.

The knowledge gained from the IWRM process, enables the stakeholders to understand the threats, prescribe mitigation measures and predict changes, and then manage them accordingly.

Welcome to the Okavango-Omatako River Basin!

Water and land resources management in Namibia is carried out at the lowest management level, known as the basin level, to broaden the management process.

Hence, Namibia is divided into 11 water management areas referred to as "water basins" according to the common drainage flows of major water sources such as rivers, groundwater systems (aquifers), water supply canals and pipelines.

The **Okavango-Omatako** River Basin is located in the north-eastern part of Namibia, stretching across the entire Kavango Region and parts of Otjozondjupa Region.

The basin area is 20 500 km² and borders with Angola and Botswana in the north and east respectively. It is also known as the northern Kalahari water area.



Map provided by **Uazukuani Uazukuani**, National Planning Commission - *Central Bureau of Statistics, February, 2010*

Where does the water in the basin come from?

The water comes from perennial rivers, ephemeral riv-source: WRMP Joint Venture, Theme Report 2, 2010 ers and aquifiers. The Okavango River is a perennial river (perennial rivers are rivers that flow throughout the year) and forms the northern border of the basin. The main perennial tributaries are the Cubango and the Cuito in Angola, but there is also an ephemeral tributary, the Omuramba-Omatako, that originates in Namibia. Other smaller sandy watercourses (Ephemeral rivers only flows after heavy rain) known as *omiramba*, namely Nhoma and Kaudom, drains towards the Okavango Delta in Botswana.

The **Omatako dam** is built on the Omuramba Omatako. It serves as a water source for the Eastern National Water Carrier (ENWC). The purpose of the ENWC is to transport water by means of pipelines and canals from water sources such

other basins. exceeds 550 mm.

as the Omatako Dam, the Karst Aguifers in the Tsumeb-Otavi-Grootfontein Karstveld area and the Okavango River to the central parts of Namibia. Several excavation/earth dams are found in the basin that collect seasonal surface water, which are primarily used for livestock water supply. Although the dams are expensive to build, the water is free for people and livestock to use. The major disadvantages of earth dams are that it can only recharge water in one place and it is not good for storing water because they loose most of the water through evaporation.

Good Groundwater resources are found all over the basin, but in the Karstveld area, one of the most productive aguifers (aguifers are geological formations in which groundwater is

found) in Namibia is found. Most of the groundwater is abstracted through boreholes.

The Eastern National Water Carrier, including major dams in the basin.



For further information contact: Department of Water Affairs and Forestry, Tel: 061-208 7696

Who supplies and manages the water in the basin?

The institutions responsible for water resources are divided into the following categories for ensuring efficient and effective management thereof:

- Overall water resource inventory, monitoring, contol, regulation and management: Directorate of Resources Management within the Ministry of Agriculture, Water and Forestry (MAWF).
- **Bulkwater supply:** Namibia Water Corporation (NamWater) abstracts water from primary sources (eg. rivers, aquifers or dams) and supplies to some end-users directly.
- Self-providers: These are commercial farmers, tour operators, mines and nature conservation parks), subject to appropriate agreements and licences, supply their own water.
- Water supply to rural areas: Directorate of Water Supply and Sanitation Coordination in the MAWF.
- Water supply to urban areas: Local Authorities and Regional Councils buy water from NamWater or supply their own water from boreholes for delivery to end users.

The Constitution of the Republic of Namibia is the primary law for sustainable resource management and equal distribution of water to the people. Specific documents dealing with water management include the: Water and Sanitation Policy of 1993; Namibia Water Corporation (NamWater) Act of 1997; National Water Policy White Paper of 2000; Water Act 54 of 1956 and Regulations, soon to be replaced by the Water Resources Management Act (2004) [which has not yet entered into force and is currently under revision] and the Water Supply and Sanitation Sector Policy of 2008.

The Water Resources Management Act makes provision for the establishment of basin management committees (BMCs) to make sure that integrated management takes place at the basin level. The role of a BMC is to provide scope for addressing various issues affecting water resources in the basin, ranging from efficient water use to monitoring the health of the basin.

The aim of such a committee is to equip basin communities (ensuring gender equality wherever possible) to take full ownership of their own development (through developing a strategic basin management plan) with strong support from the relevant service providers. The committee is ideal for knowledge and experience sharing to realize a common vision for the basin, through IWRM principles such as stakeholder participation, transparency and information sharing.

Thus the Okavango Basin Management Committee was formed in 2008, with a vision to ensure sustainable integrated resources management within the basin with the focus on:

 * socio-economic benefit-sharing of natural resources and
* sensitisation on sharing natural resources utilisation responsibilities.

Who uses water and how?

The supply of water from surface and groundwater resources to competing demands is prioritised in Namibia. The first is water for domestic purposes (including livestock water for both subsistence and commercial farming) and the second is water for economic activities such as mining, industries and irrigation.

The Karstveld area is the main maize-growing area in Namibia and hence large-scale commercial irrigation projects (including the Green Scheme along the Okavango river) are the biggest water users in the basin. The major crops grown are mahangu, maize, cotton and wheat. Other water-use activities in the basin are:

• **Domestic purposes:** Towns in the basin include Grootfontein (estimated population of 18 200); Okakarara (estimated population of 4 200) and Rundu (estimated 55 600 people). Surrounding settlements supports approximately 17 500 people, while the rural population is estimated at 212 000.



How much water do we require (in terms of 10-litre buckets):

 One person uses on average 15 litres (one and half bucket) per day
One goat/sheep/kudu/zebra/oryx drinks on average 12-45 litres (about one to four buckets) per day
One cow drinks on average 30 litres (three buckets) per day

*An average household of four people thus consumes 60 litres per day (6 buckets)

- Subsistence and small-scale farming: This includes both livestock and crop farming with mahangu, maize and sorghum as the main cereals, supplemented with vegetables.
- Large-scale commercial farming: The basin is a prime farming area, dominated by cattle and goats.
- Mining: In addition to using water for mining operations, water from Kombat mine is also used to supplement water into the ENWC canal and subsequently supplies Okakarara town and some parts of the Eiseb-Epukiro basin. Water can also be supplied from the Berg Aukas Mine or Kombat to places as far south as Windhoek.
- Fishing: There is an abundance of fish resources in the basin, mainly along the Okavango river and floodplains. The flood plains are reported to be rich in nutrients and as a result rich communities of animals and plants survive there. Fish is an important source of protein and is eaten fresh or dried (mainly for subsistence) or is sold locally.
- **Tourism and wildlife conservation:** The Mangetti, Mahango, Khaudum, Popa and Caprivi Game parks are in the basin. The parks have conservation open pans and surface water sources that are used by the wild-life. Tourist facilities are also found along the Okavango river and on many commercial farms.
- Research: Government agricultural research activities are taking place at Kavango Cattle ranch, Mashare

and Mile 46 cattle-breeding farm. There are also several horticultural projects (eg. Salem vegetable garden) taking place in the basin.

The sandy nature of the basin results in limited surface water. Drinking water for people, livestock and other animals is scarce in some places.



Water demand management - how to use water more efficiently

Groundwater in the basin is a scarce and precious resource which needs to be used wisely if plants and trees are to continue providing fodder for livestock and springs and boreholes are to continue supplying water. Water demand management (WDM) is a very important part of IWRM. WDM involves ways that improve water use efficiency by reducing water losses or changing the wasteful way people use water. WDM is an approach to achieve "water use efficiency".

WDM is implemented through various ways such as education and information; training; using economic and finanical principles; water pricing and tariff policies (eg. rising block tariffs) and technical measures.

The price of water supply services are determined by the cost to develop a water source; the distance the water has to be transported by pipeline/canal, the treatment costs, storage of treated water,

pipelines to the consumer and the topography which determines the pumping cost to supply the water.

The consumer base and technology, i.e. household taps or pre-paid meters, that is affordable to various income groups, also have an effect on the cost of water. The ability of Local Authorities to enforce credit control measures also influences water consumption.





Water supply chain, showing the process from source to the tap of a household, is the basis on which water services are charged.

Municipal costs to provide a household with water and sanitation services include charges for water collection from a source; water production (treatment of raw water to drinking water standards); water delivery to the consumer and wastewater treatment and disposal.

Wastewater collection and treatment contribute to hygienic environments and form part of the water chain to prevent pollution in order to ensure that good water quality and sanitation is achieved. Therefore it is essential that water consumers PAY for water services to ensure continued quality and efficient service delivery.

In rural areas, the community based water management programme under the Directorate of Water Supply and Sanitation Coordination, established mechanisms for users to pay for water services. In addition, mechanisms for transparent and targeted subsidies for those who are unable to pay for water services are being considered. Local water point committees manage local aspects of water services, preventing issues such as illegal connections and vandalism to pipelines.

Different ways to save water in urban households:

- Schedule garden watering for early or late in the day (before 10 am and after 4 pm)
- 2. Avoid the use of hosepipes for cleaning pavements, floors or cars; instead use buckets
- 3. Make use of retrofits (replacement with equipment specifically designed to reduce water use) such as:
 - 3.1 Low flush and dual flush cisterns that are being used more and more.



"The price of water should be set so that the price does not prevent consumers from obtaining sufficient quantity and quality to meet fundamental domestic needs". Reducing the volume of existing toilet cisterns can be achieved by:

- *Placing a 1 to 2 litre plastic bottle filled with water, or a brick wrapped in plastic, inside the cistern. This will decrease the volume of water held within it.
- * Bending the swimmer arm inside the cistern downwards so that the inflow valve is shut off when the water reaches a lower level than previously.
- 4. Fix or report to the municipality any moisture or leak problems immediately. Most water leaks occur from toilet cisterns. A single leaking toilet cistern can lose up to 7 000 litres of water per day.
- 5. Explore rain water harvesting (collection and storage of rain from run-off areas such as roofs) options. Remember - the first flush of new rain should be run to waste, before collection starts
- 6. Keep track of water usage by regularly monitoring the water meters. This also gives an indication of the water bill (water tariffs guides are available at the Municipality).



A Word of Caution: It is important to seek good advice from a knowlegeable dealer as not all water-efficient fittings and devices are appropriate for every location. Also consider whether the fittings can withstand rough and frequent use.



Water quality

The quality of water is determined by its aesthetic (colour, smell, turbidity), the chemical and the bacteriological quality. There is a direct link between water quality and health and therefore it is important to be able to differentiate between safe and unsafe water sources. Water quality is determined by both natural and human-induced contaminants (pollutants) that may have found their way into the water supply. Naturally, water contains varying concentrations of dissolved oxygen and other gases, microscopic living organisms, tiny particles of dead decaying organic matter, inorganic salts and sediments. The water is described to be highly saline, when the concentrations of the salts and sediments.

Unused boreholes and wells should never be used as refuse tips. Their surface openings should be sealed when not in use.

salts and sediments. The water is described to be highly saline, when the concentration of salts dissolved in the water is high. This includes nitrates, fluorides, sulphates as well as sodium chloride and carbonates. Water with high salinity tastes salty and is usually called 'brackish' water.

However, some water quality concerns exist due to increasing chemical concentrations in the Okavango river due to increasing farming activities. In a few areas, contaminated water, mainly through animal waste (especially where cattle troughs are close to wells), has been declared as 'unsafe' for both human and livestock consumption.

The quality guidelines for drinking water have been set out by the Department of Water Affairs and Forestry, Water Environment Division.

Groundwater monitoring is considered very important, not only to understand and identify water quality trends and related indicators, but also to determine the availability of acceptable quality water sources. The Geohydrology division in the MAWF is responsible for groundwater investigation and monitoring.

Many people in the basin are exposed to "dirty"unsafe water from open wells and watercourses which contains bacteria and organisms which can cause diseases, such as bilharzia, cholera, typhoid and dysentery. Dirty water can have a colour (yellow, brown or black), but it can also be clear and contain invisible bacteria or chemicals that are harmful to humans and animals. Therefore it is advisable to "clean/cook" water before drinking it.

The following ways are used to clean water:

- Step 1: Remove dirt that you can see, through filtering by using a sieve wire or a dense cloth of material
- Step 2: Boil water or keep water in a clean container in the sun for two days
- Step 3: Store clean water in a clean container with a cover.



Water sanitation and hygiene

Communities have the right to determine which water and sanitation solutions are acceptable and affordable to them

Sanitation is vital for human health, generates economic benefits, contributes to dignity and social development, and protects the environment. Sanitation promotion focuses on stimulating demand for ownership and use of a physical good. Access to basic sanitation refers to access to facilities that hygienically separate human excreta from human, animal, and insect contact. Hygiene promotion focuses on changing personal behavior related t o safe management of excreta, such as washing hands and disposing safely of household wastewater. Both are essential to maximize health benefits. Lack of sanitation facilities and poor hygiene cause water-borne diseases such as diarhoea, cholera, typhoid and several parasitic infections. Provision has been made for both urban and sanitation management objectives and principles in the Water and Sanitation Sector Policy of 2008, to contribute towards improved health and quality of life.

Considering that Namibia is a water-scarce country, in most (rural and urban) instances, the most affordable individual household or community sanitation option are ecological or dry sanitation facilities, however where possible it should be left to the individuals to decide on the most appropriate technological and payment options as well as maintenance responsibility allocation.

The institutions responsible for water sanitation and hygiene are divided into the following categories:

Washing hands with soap at key imes such as after going the toilet can reduce the occurance of diarrhoea

- Public health issues and awareness: Ministry of Health and Social Services; Directorate of Water Supply and Sanitation Coordination within the MAWF; Regional Councils and Local Authorities
- Health policies and legislation: Ministry of Health and Social Services

• Advice and research on alternative sanitation options and development: Habitat Research and Development Centre

Challenges of IWRM in the basin

The IWRM challenges in the basin are linked with climate variability and associated changes. In particular, the basin is highly prone to the following challenges:

- Land degradation and deforestation: The topsoil of land contains valuable nutrients for vegetation to grow. When vegetation cover or trees are destroyed (either through high population growth or overgrazing due to high livestock concentrations in an area) the land becomes vulnerable and results in topsoil being easily blown away by wind; increased run-off (rainwater not infiltrating in the soil) and therefore causes loss of agricultural productivity (soil fertility).
- Bush encroachment: Invader bushes is the highest single consumer of groundwater, with detrimental long-term consequences on the sustainability of groundwater resources and fodder availability.

Due to the arid and highly variable climate in Namibia, water resource managers and users have to focus on improving efficiency of water resource use through improvement of water demand management practices.

Future of water in the basin

In future, the Eastern National Water Carrier (ENWC) is earmarked to transfer surface and groundwater to the central, eastern and western parts of Namibia. This is marked as the largest integrated water supply infrastructure project in the country. The system links different water sources; groundwater, ephemeral and international perennial surface water and reclaimed domestic sewage water. The development of th ENWC is postponed until 2020 based on water availability, artificial recharge and water demand management measures that are in place in central Namibia.



Development of irrigation projects along the Okavango River may result in pressure on the availability of water from the Okavango. Similarly, the plans to build a hydroelectric power station at the Popa Falls are still under investigation, but there may be too many negative impacts to implement the project.

The basin is home to the highest diversity of plants and animals in Namibia due to the presence of the Okavango River. As a result the tourism industry is growing at a high rate, which may impact on water resource use in the basin in the future.

Basin Management Approach Water pollution Caring for SANDANDWATER A Guidebook Basin our water management A profile of the Kavango Region A resource book related for Upper Primary teachers and learners information: ALCOPANIA. atz) er in Namibia More about... a^{ter} in Namibia John Mendelsohn and Selma el Obi OKAVANGO RIVER FileNumber 7/8/78/P DEVELOPMENT OF AN INTEGRATED WATER RESOURCES MANAGEMENT PLAN FOR NAMIBIA Consolidation of National Water Development Strategy and Action Plan REP. IN IT OF MAN THEMATIC REPORT 1 REVIEW AND ASSESMENT OF EXISTING John Mendelsohn & Selma el Obeid SITUATION MINISTRY OF AGRICULTURE, WATER AND FORESTRY Natural Resources Managemen Submitted by: IWRM PLAN JOINT VENTURE NAMIBIA WATER SUPPLY AND SANITATION POLICY May 2009 Ministry of Agriculture, Water and Forestry Private Bag 15/183 WINDHOEK S WATER Nambia July 2008 atz •

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Water is life. We are the people who live by the water. Eat and drink from these waters. To poison the waters is to show disrespect for creation. To honor and protect the waters is our responsibility as people of the land.

-adapted from Winona LaPuke, "Like Tributaries to a River," translated from Anishinaabe by Marlene Stately, The Winona LaPuke Reader, 2002



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Photo credit: John Mendelsohn









Dublin Principles adopted for IWRM in Namibia

I. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment

II. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.

> III. Women play a central part in the provision, management and safeguarding of water.

IV. Water has an economic value in all its competing uses and should be recognized as an economic good.

Source: International Conference on Water and the Environment in Dublin, 1992.