Swedish International Development Cooperation Agency (Sida)

Cap-Net

TRAINING MATERIAL IN INTEGRATED WATER RESOURCES MANAGEMENT FOR RIVER BASIN ORGANISATIONS

CASE STUDY:
PUNGWE RIVER BASIN IN MOZAMBIQUE

Final Report

September 2008

SWECO International

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

The Pungwe River flows from the Eastern Highlands in Zimbabwe into Mozambique and drains into the Indian Ocean. The total catchment area is 31,151 km^2 of which only 4.7% lies within Zimbabwean territory. The river basin, with its abundant water resources, offers considerable potential for economic growth and development provided problems and constraints on water resources management can be solved. For the Mozambican part of the river basin the regional water authority, ARA-Centro, thus is a key for economical growth. Much relies on how well ARA-Centro, together with other governmental authorities, succeeds to implement IWRM in collaboration with the stakeholders of the river basin.

This case study report describes the level of implementation of IWRM in the Pungwe River basin as of 2008 and the lessons learnt so far. The purpose of the report is to provide training material in IWRM for river basin organisations and to test the applicability of IWRM indicators developed by Cap-Net.

Implementation of IWRM in the Pungwe River basin has taken the first important steps since the establishment of ARA-Centro in 1998. The enabling environment through national laws and policies is in place and concrete activities occur, such as licensing of surface water users and participation of stakeholders through an established basin committee. On the other hand, there are many further steps to take. Presently the implementation is not judged to have reached halfway. Essential parts of IWRM are missing, such as water allocation criteria that take into account efficiency and economic benefits and sufficient funding of the IWRM activities through water fees or the polluter-pays-principle.

The experience of implementing IWRM in the Pungwe River basin has shown that the need for central funds is essential when establishing an RBO and starting to implement IWRM. It is not until stakeholders have acknowledged IWRM and functioning water allocation, polluter-pays-principle and collection systems are in place, that revenue from users and polluters will be sufficient for the operational cost of IWRM. Furthermore, even if the financial resources are there, IWRM takes time to implement. The principles of IWRM are not easily adopted by everyone and capacity building takes time to be sustainable. Therefore, implementation of IWRM has to follow the pace that can be adopted by all involved parties, both authorities and stakeholders.

The Pungwe experience has also shown that cross-sectoral coordination between different governmental bodies is fundamental for implementation of IWRM. It is basically impossible for the regional water authority to have responsibility and capacity to deal with all aspects of IWRM. The RBO must therefore act as a strong stakeholder in its relation with other ministries important for IWRM.

Although ARA-Centro is a result of decentralisation of the water management in Mozambique, the lesson learnt in Pungwe is that, even on the river basin scale, a too centralised organisation prevents implementation of IWRM. Frequent presence in the fields is necessary to meet and motivate stakeholders and to cover monitoring of all parts of the river basin.

The indicators developed by Cap-Net were found very useful for judging the level of IWRM implementation in the Pungwe River basin and to identify which areas ARA-Centro should put more emphasis to in the future. The setting of indicators indicated a level of IWRM implementation that corresponds well with the general view of the staff of ARA-Centro. It is concluded that the indicators are a good tool for monitoring progress of the general implementation of IWRM in the Pungwe River basin. Based on the results of the indicators for 2008, concrete recommendations on which areas to focus on were given to ARA-Centro for the continued work of implementing IWRM.

2 INTRODUCTION

2.1 Background

Sustainable management of water resources is an important goal being adopted at international level and by many countries around the world in a bid to address water shortages, inequity, pollution and many other water problems. One of the key changes being adopted follows from the recognition that upstream/downstream effects require management using a basin approach. As a result many countries are introducing new institutional arrangements for water resources management, including organizations to manage water at the basin level – River Basin Organisations (RBOs).

Following from a series of case studies Cap-Net has therefore developed a foundation training programme for the management of water resources aimed for RBOs. The approach has been to focus on the functions that have to be undertaken to manage water resources. These key functions are essential for sustainable management of water resources and represent the core responsibilities of a water management agency. By linking indicators to each of the key functions it also gives the RBO a possibility to monitor progress of implementing IWRM on the river basin scale.

During a first training session in Pretoria in April 2008, the draft training material was tested. This draft material had been developed mainly based on four case studies in Kenya, Malaysia, Sri Lanka and Mexico. One of the conclusions from the course was that the course material would be augmented by introducing more case studies and by testing the developed indicators in reality in river basins where RBOs already exists.

During the course the Pungwe River was identified as a possible case study and that the experience from ARA-Centro would be a good example of an RBO that has started to implement IWRM.

The Swedish International Development Cooperation Agency (Sida), which supports the capacity building of the regional water authorities in the Pungwe River basin, and Cap-Net have therefore requested SWECO International to produce a case study report on the implementation of IWRM in the Pungwe River basin in Mozambique.

2.2 Objectives

The overall objective of this report is

- to summarise and document the experience of ARA-Centro's work to implement IWRM in the Pungwe River basin.

For the development of the Cap-Net training material the specific objectives are

- to provide a case study document, to be distributed in the organisation's global network, for RBOs and others to draw experiences and ideas from for their own implementation of IWRM.
- to test the applicability of the developed indicators for IWRM implementation.

2.3 Acknowledgement

This case study report has been jointly funded by Sida and Cap-Net. The report is the result of inputs from previous studies and direct input from the staff of ARA-Centro at its head office in Beira. Special thanks to Director Manuel Fobra and the participants of the workshop held on 4th August 2008. Thanks also to CONSULTEC for advisory inputs on the Mozambican water law and policy.

2.4 Use of this material

This case study report is mainly produced as a training material for IWRM and will be distributed at Cap-Net's webpage www.cap-net.org. The report is also written with the purpose of giving feedback to ARA-Centro for its work of implementing IWRM in the Pungwe River basin.

3 SETTING

3.1 The Pungwe River Basin

3.1.1 General description

The Pungwe River drains a total catchment area of 31,151 km^2 of which 4.7% lies within Zimbabwean territory and 95.3% in Mozambique (Figure 3.1). The Pungwe River Basin stretches over two climate types. The western part has a humid mountainous climate in which the mean annual rainfall may be above 2,000 mm, and has a temperature that is significantly lower than in the surrounding non-mountainous areas. In the eastern region near Beira, the climate is classified as tropical-humid. In this region, rainfall is distinctly seasonal with a pronounced concentration during the warm season November-April with normally very little precipitation falls between June and October.

In general, settlements in the Pungwe River Basin consist of rural village communities, a few scattered small urban centres, growth points, commercial farms and estates. These are concentrated along the river valleys, in the flood plains, along main roads, and around administrative centres. The City of Beira in Mozambique is the main urban and industrial centre in the basin. In 2003 the Pungwe River Basin had an estimated total population of 1,199,567 persons, of which 8% resided in Zimbabwe. It is estimated that by the year 2023, the total population in the basin will have reached some two million persons.

Economic activities among the basin communities are largely agro-based. They include crop and livestock production, forestry, fisheries, gold mining and eco-tourism. The agricultural practices are a mixture of subsistence dry land and irrigated crop farming.

Poverty is widespread in the river basin. The majority of rural households in the Pungwe River Basin have incomes that fall below the level that satisfies basic needs.

The status of health facilities in the basin is generally poor, particularly in Mozambique. The HIV/AIDS pandemic is exerting considerable pressure on an already stressed health delivery system in the basin. It is estimated that about 20% of the population in the basin are HIV positive, and that by 2010, the projected life expectancy will be reduced to 36.5 years of age.

The education status in the basin is variable. In Mozambique most pupils that complete Level 1 primary school do not proceed to the secondary level. In Zimbabwe the majority of pupils in the education system have proceeded to secondary school. In Mozambique, the few existing secondary schools are all located in the district capitals leaving the remote areas particularly poorly served.

There are no large dams in the Pungwe River Basin. Major water supply schemes located include the Pungwe Mutare Water Supply Transfer, the Mafambisse Sugar Estate and Beira Water Supply System. Other water supply schemes comprise of small piped water supply systems on tributaries of the Pungwe River in Zimbabwe and several small irrigation schemes in both countries. Sanitation facilities in the catchment are largely based on pit latrines for rural villages with the exception of Beira City where water-based systems have been developed.

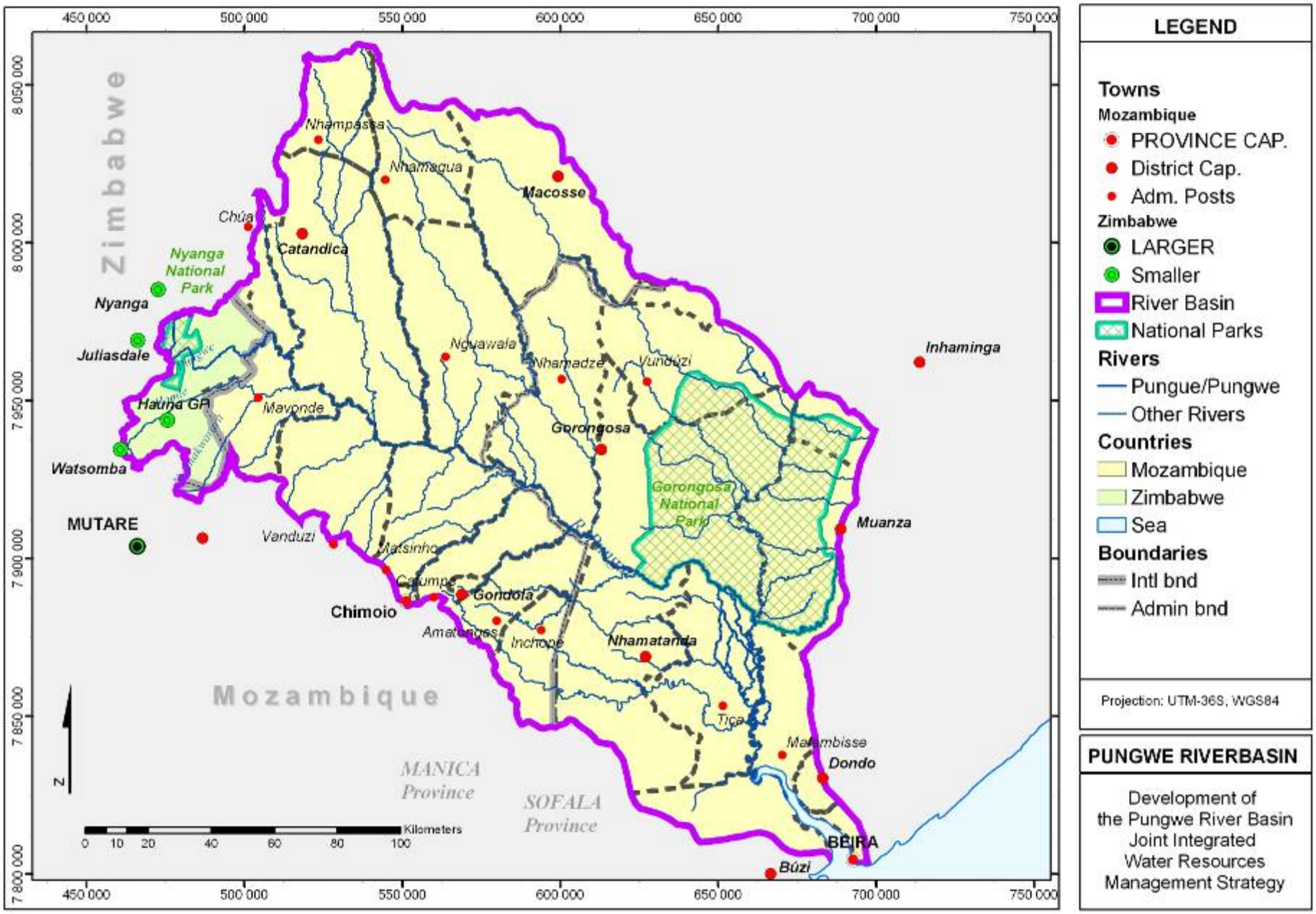

Figure 3.1 The Pungwe River Basin

Water demand is thus dominated by agriculture, mainly because of the large commercial sugar cane estates (Figure 3.2). Urban usage for the two cities of Beira and Mutare make urban supply the second largest user.

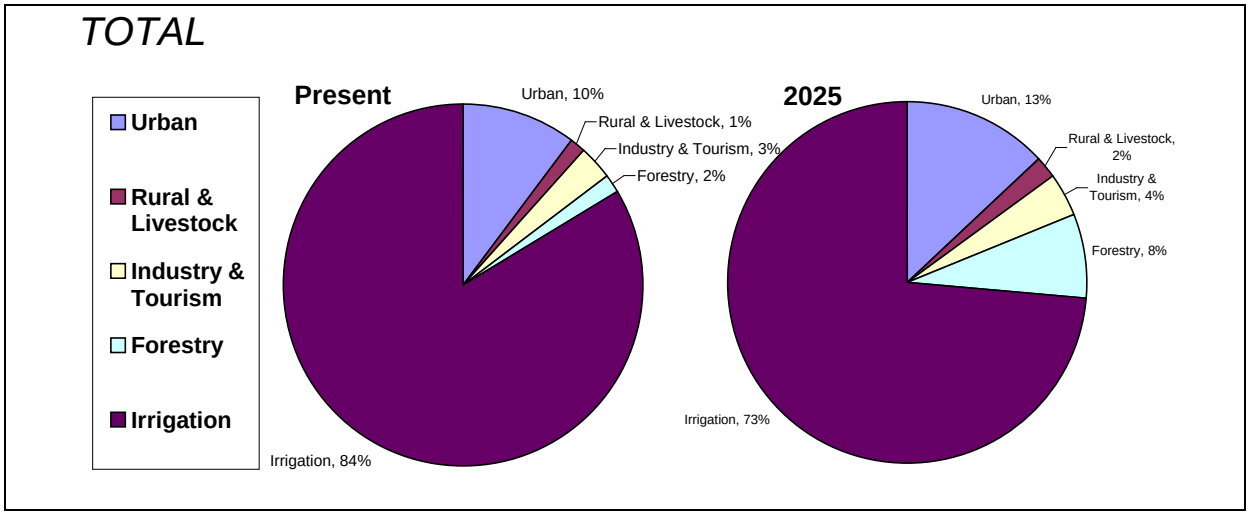

Figure 3.2 Water demand distribution between sectors of the Pungwe River Basin

The Pungwe is a perennial river with a low degree of development with regards to abstractions, diversions and regulation. The large temporal variation in precipitation within the region leads to great inter-annual variations in the Pungwe flows. Both flood and drought periods are experienced. The cyclic pattern of many wet years followed by consecutive dry years is typical for southern Africa. Preliminary results from a study on the impact of climate change indicate that rainfall will decrease slightly in the Pungwe River region and that drought periods will be more persistent in the future.

Conducted water balance analysis shows that measures would need to be taken in order to continue to supply the Mutare urban water, if the sole source remains Pungwe. In 2025 severe water shortages are predicted to occur. It would be possible to meet the Beira water requirements of 2025 without further infrastructure in the Pungwe River. However, in the lower parts of the basin the estimated future requirements from large-scale agriculture cannot be met without major regulating dams.

The potential for groundwater is generally limited and cannot support any large urban or peri-urban demands. However, groundwater plays an important role in supplying water for the rural communities within the basin.

Floods frequently cause problems in the lower parts of the Pungwe River Basin. In the three consecutive years 1999-2001, very high water levels occurred in the Pungwe River causing serious damage to the national road to Beira, among others.

The informal gold mining activities in the basin are responsible for the major effects to the surface water quality of the Pungwe River. These mining activities cause extensive erosion with large amounts of sediment entering into the Pungwe River system. The suspended sediment makes the water unfit for drinking, washing and irrigation. It buries the aquatic fauna, prevents photosynthesis and affects the fish population. The gold mining activities are mainly poverty-driven and the majority of the miners are rural people.

During the spring tide and low river flows saline water extends as far upstream as the intake for the Mafambisse Sugar Estate, creating a threat to the production. The water balance analysis shows that even moderately increased water abstraction upstream the intake would in future significantly increase the problems with saline water intrusion.

3.1.2 Prospects and challenges

The Pungwe River Basin, with its abundant water resources, offers considerable potential for economic growth and development provided the problems and constraints discussed above are resolved. The surface water resources of the Pungwe River Basin can meet the future water requirements, including those of human, health and environmental flow, even in a high economic development scenario, provided that the regulating infrastructure is built. The regulating infrastructure would also reduce the negative impacts of floods and droughts, which would greatly benefit the poor.

However, for successful water resources development Integrated Water Resources Management (IWRM) is key. The development must be balanced to give a fair and equitable allocation of the water to existing and new users. Development must be directed towards poverty alleviation. Environmental threats, such as the artisanal gold mining, need to be solved and the future infrastructure must allow environmental sustainability.

For the Mozambican part of the river basin, which forms the majority of the basin, the regional water authority ARA-Centro, thus is a key for economical growth. Much relies on how well ARA-Centro, together with other governmental authorities, succeeds to implement IWRM in collaboration with the stakeholders of the river basin.

3.2 National Water Laws and Institutions

3.2.1 Water laws and policies

The present institutional and legal set-up is defined by the *Water Law, Law Nr. 16/91*. It is the most important legal document in what concerns water resources management in Mozambique. The national law establishes:

- the water resources that are public domain
- the competences of the Government to manage water resources that are public domain
- principles for water management
- general regime for water use
- rights and obligations of water users, with a distinction established between waters of free use and those whose use is depending on a licence or concession

The law stipulates that the water of public domain comprises all inland waters (lakes and reservoirs), surface waters and the riverbeds; ground water; and the hydraulic works, equipments and dependencies. Regarding the water use and exploitation, the waters are classified into waters of common use and waters of private use. Waters of common use are those consumed by a family, for domestic purposes, cattle and small scale irrigation, with no use of mechanisation. Waters of common use are free – they do not require any licence or concession nor is any payment of tariffs involved. Waters of private use need an authorization that can be given by law, licence or concession, under the following general principles and constraints:

- water supply for domestic use has priority over all the other private uses
- no private uses will be allowed if they conflict with the water requirements for environmental conservation
- conflicts resulting from water scarcity to satisfy different requirements will be solved in function of the socio-economic value of each use.

The Water Law of 1991 provides for a limited role of stakeholders in water resources management. The main institutional format in which stakeholder participation can place is through the Basin Committees. These Basin Committees have a consultative role only.

The *Water Tariff Policy* was adopted in 1998. Through the water tariff policy, the Government intends to improve the provision of services of water supply and sanitation; promote the defence of consumers and user through their participation in the decision-making process; promote the investments required to expand the coverage and the level of services; and improve the management of the national water resources.

In 2007 a new *Water Policy* was adopted in Mozambique. It superseded the first policy from 1995 that focused on rehabilitation of the hydraulic infrastructure, which had suffered during the civil war. The 2007 Water Policy puts large emphasis on Integrated Water Resources Management. Fundamental parts of the policy are:

- Water is an economic good
- Promotion of participatory water management
- Regular updating of knowledge on water resources and water uses
- Preparation and regular updating of river basin plans.

3.2.2 Water management institutions

In Mozambique the main water resources management institutions include the National Water Council, the Ministry of Public Works and Housing, the National Directorate of Water and the Regional Water Administrations. The National Water Council is the consultative body of the Council of Ministers for water-related issues. It is chaired by the Minister of Public Works and Housing and includes other Ministers relevant to water issues.

The Ministry of Public Works and Housing (MOPH) is responsible for all national water issues in terms of policy formulation and the implementation of the management and development of all water resources. This includes the assessment, monitoring and balancing of existing water resources and future demands.

The National Directorate of Water (DNA) is the main national institution responsible for the overall management of the water sector both in terms of surface resources and groundwater, and water for productive and domestic use. Among other things, DNA and its various departments are responsible for water sector policy development, monitoring of water resources, promotion of relevant studies, implementation and management of hydraulic and other water-related investments. DNA is also responsible for the promotion and implementation of relevant water legislation including those related to the protection and quality of water resources and the management of international river systems.

At the basin level, the Water Law of 1991 adopted the principle of decentralised water resources management and established five Regional Water Administrations (ARAs). This included ARA-Centro which is responsible for the water resources of the Pungwe, Buzi and Save River basins - all of which are shared with neighbouring Zimbabwe - as well as minor rivers between the Save and Zambezi River basins. ARA-Centro became operational in 1998, although its statutes were only formally approved in 2004. Its head office is stationed in Beira and Basin Management Units are planned for each of the three river basins.

4 ARA-CENTRO

4.1 Mission and area of jurisdiction

The area of jurisdiction for ARA-Centro covers the three river basins, Save, Buzi and Pungwe, as well as the minor rivers in the coastal areas, in Mozambique (Figure 4.1). The total area of the jurisdiction is 103,071 km^2.

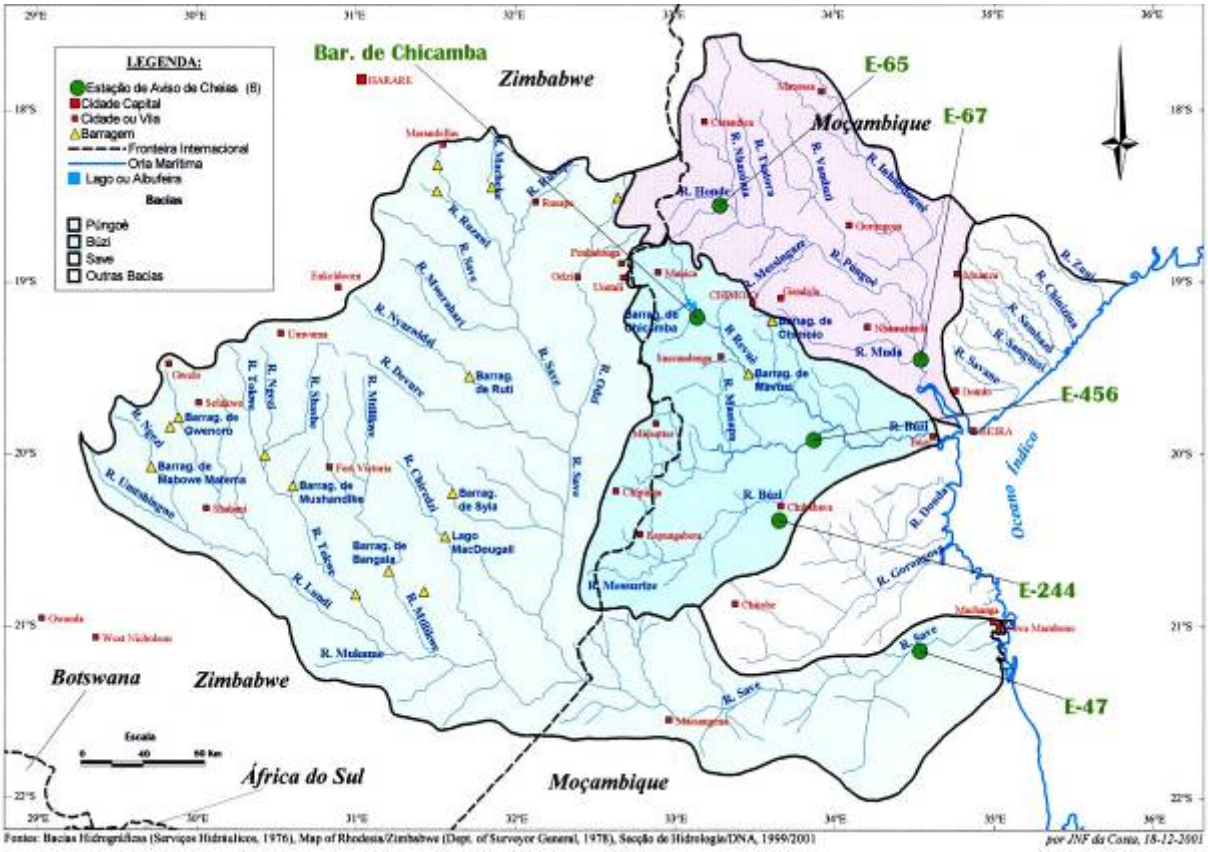

Figure 4.1 River basins for which ARA-Centro has the responsibility for. The area of jurisdiction covers the Mozambican parts of the basins.

The mission of ARA-Centro is given in the statutes that were approved in August 2004. According to the statutes ARA-Centro is responsible for the following functions within its area of jurisdiction:

a. *The formulation, implementation and review of the hydrologic plans of the basins inside its area of jurisdiction.*

b. *The administration and control of public waters within its area of jurisdiction.*

c. *The licensing of water uses, and effluent discharges including monitoring thereof.*

d. *The approval and supervision of new hydraulic infrastructures.*

e. *The declaration of caducity of licenses and concessions and their extinction or repeal.*

f. *The planning, design and construction of hydraulic works, as well as their operation and maintenance.*

g. *To perform consultant services related with the ARA-Centro technicians specialisations, by giving advices to the state local bodies, to the public and to private entities.*

h. To develop the hydrological data required for the river basin administration, and to maintain it updated.

i. To settle conflicts between water users.

j. To apply sanctions, such as elimination or demolition of non-authorized hydraulic works and water usages, as well as closing down contamination sources.

k. The definition of protection areas as declared in the Water Act.

l. To identify and register the traditional uses of common waters.

m. Any other matters associated with the Water Act or the internal regulation.

In addition the statutes give the following general guidelines:

- *ARA-Centro shall provide a public service aiming for a rational and economic water usage, the protection of the environment and the satisfaction of the users.*
- *ARA-Centro shall promote the participation of the water users in the main decisions of the water management and shall promote coordination and exchange of information requested for the integrated water resources management.*
- *ARA-Centro shall be organised to promote an efficient, harmonious and decentralised operation to guarantee a high service quality.*
- *ARA-Centro should be organised in Basin Units for the administration of river basins.*

The mission and guidelines put a strong emphasis towards integrated water management on the basin scale. Through the Basin Units the water resources should be managed in a participatory way for the main river basins under ARA-Centro's jurisdiction. The guidelines give much focus to promoting stakeholder participation as part of the integrated water resources management.

Common to almost all functions of ARA-Centro is the need for monitoring and maintaining data on hydrometeorology and water quality. These data are fundamental for planning, licensing, enforcing authorisations, designing infrastructure and providing services such as e.g. flood warnings. One of the central tasks of ARA-Centro thus is the operation and maintenance of the hydrometeorological network as well as maintaining and updating databases.

According to the statutes ARA-Centro should be both a service provider as well as exercising the authority over water resources issues. Both these functions require interaction with the stakeholders in the river basins. In this aspect the creation and maintenance of a register of water users and other stakeholders are essential for ARA-Centro. The register of stakeholders enables collection of water fees and fines as well as possibilities to disseminate information and receive inputs for planning purposes.

The statutes further put forward missions related to hydraulic infrastructure. Besides approving hydraulic works as an authority, ARA-Centro should also be responsible for the planning, design, construction, operation and maintenance of hydraulic infrastructure.

4.2 External Support

The financial resources of the Government of Mozambique after the civil war were limited. The establishment of the regional water authorities, the ARAs, defined in the water law of 1991 was therefore delayed and to a large degree dependent on external support.

After ARA-Centro was established in 1998 it was supported by the Austrian Government. The focus of the support was institutional capacity building and was mainly through long-term expatriate staffs (three) stationed at the ARA-Centro office in Beira and through funds for vehicles and equipment.

In 2002 to 2007 ARA-Centro was supported through the Pungwe Project funded by the Swedish International Development Cooperation Agency (Sida). Besides base-line studies and development of a Joint IWRM Strategy for the Pungwe River, this project was also focused on institutional capacity building of ARA-Centro and its Zimbabwean counterpart, ZINWA-Save. The Pungwe Project was a combination of long-term institutional support through an expatriate person stationed in Beira and international and local expertise for studies and training. Major capacity building activities for ARA-Centro during the Pungwe project were:

- Advisory support for the establishment of statutes and internal regulations
- Creation of the stakeholder forum in the Pungwe River basin in Mozambique, the Pungwe Basin Committee
- Improved bilateral institutional relations with Zimbabwe
- Initiation of water licences and collected water fees
- Vision/business plan
- Training and delivery of equipment and software for GIS, hydrology and water quality
- Developed software for hydrometeorological database, stakeholder database, website, and accounting system
- Funding of vehicles, computers and auxiliaries and the new office at ARA-Centro

The government of Sweden has in 2008 initiated the continuation of the Pungwe Project (PP2), which aims to implement the joint IWRM strategy for the Pungwe River. This project is more focussed on institutional support with five expatriate staffs stationed in Beira for advisory support and procurement of services.

In addition to the above institutional support programmes, a number of technical studies have been conducted and are planned for the Save, Buzi and Pungwe river basins supported by international donors, e.g.:

- Technical design and construction of new water intake for Beira Water Supply (conducted)
- Rehabilitation of hydrometric network in Buzi for flood forecasting (conducted)
- Training and implementation of flood forecasting in the Save and Buzi rivers via FEWSNET (on-going)
- Development of baseline studies (Monographs) and IWRM strategies for Save and Buzi (planned)
- Technical design and procurement services for three small dams in the Pungwe River basin (planned)
- Rehabilitation of the Chicamba and Mavuzi hydropower schemes on the Buzi River (on-going).

4.3 Capacity Development

ARA-Centro has since its start undergone a considerable institutional development. Ten years ago ARA-Centro had a very small organisation including only five staff of higher technical level. At this time ARA-Centro was in general unknown to the stakeholders and other governmental organisations. Funding was provided only from the central government and was uncertain due to the financial limitations of the country in the late 1990s.

In 2008 ARA-Centro has a full-scale organisation including technical and financial departments (Figure 4.2). The staffs with higher education are 13 and a total number of 31 persons are employed by ARA-Centro at its head office. Revenue is collected from water users parallel to the funding from the central government. ARA-Centro is known by the major stakeholders and other line ministries and is seen as the main institution responsible for water management in the region.

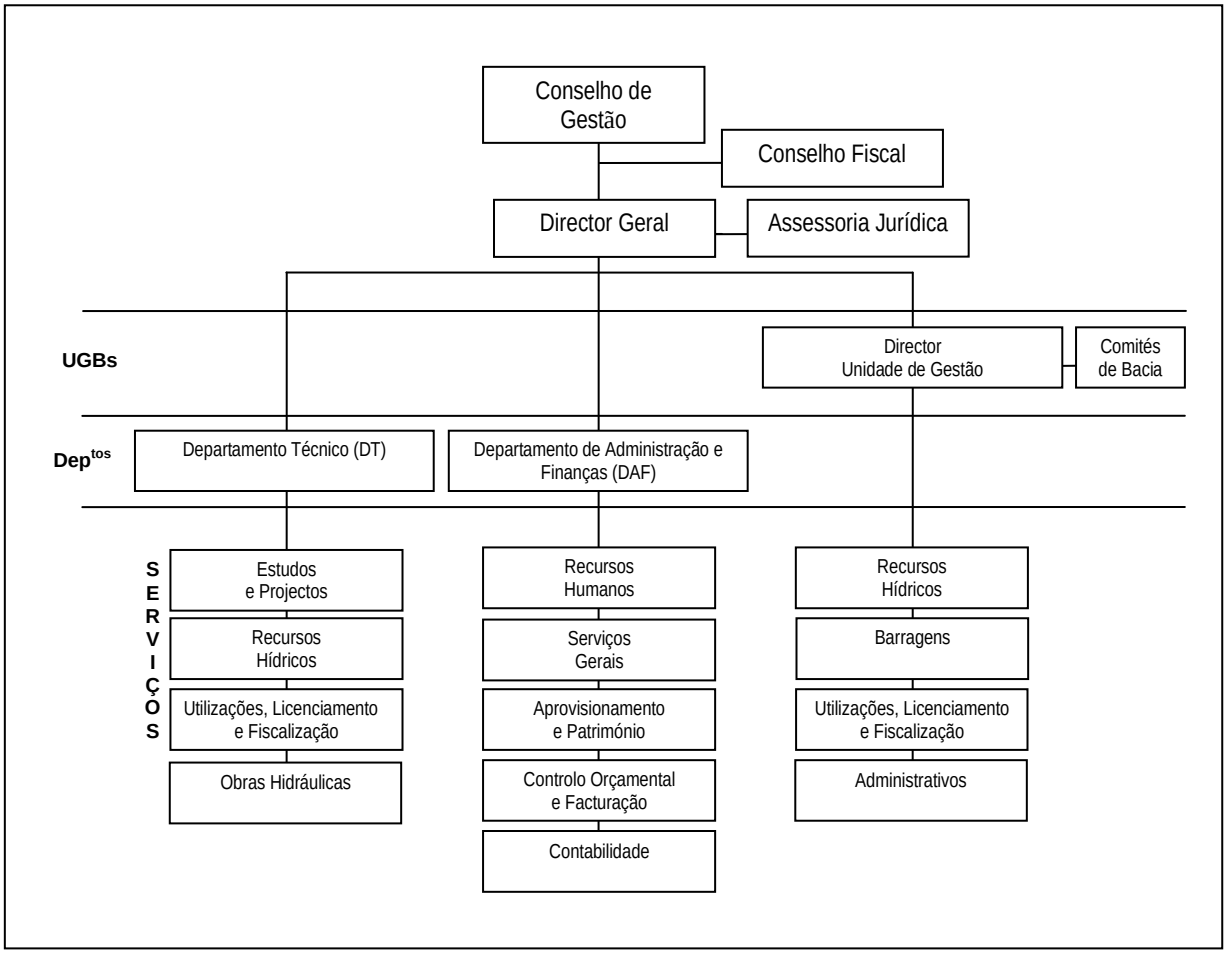

Figure 4.2 Organisation of ARA-Centro in 2008.

The annual funding of ARA-Centro's operations were in 2007 approximately 500,000 USD. 27% of these were generated from water fees. The majority of the large water users are licensed and pay according to the nationally set tariffs. In total 40 users are registered. Payment fulfilment is however not 100% and one of the largest users, the national electrical company, disputes that it needs to pay water fees.

A subjective evaluation of the capacity of ARA-Centro to fulfil its mission was made by the Pungwe Project in 2005 (Figure 4.3). The evaluation is judged valid also for the present situation in 2008.

CAPACITY / *MISSION*	Human Talent Capacity	Organisation and Resources Capacity		Inter-Institutional Capacity
		Technical	Economical & Managerial	
Formulation and upgrading of basin plans for IWRM	3	3	2	4
Develop and maintain a hydrometric database required for IWRM	3	3	2	3
Develop and maintain a water quality database required for environmental management	1	2	2	2
Develop added value to data through GIS and modelling for service provisions	2	4	2	3
Licensing of water uses and effluent discharges including enforcement	2	3	2	2
Develop and maintain an active stakeholder participation process	3	4	2	2
Plan, design, construct, operate ad maintain hydraulic works	1	1	1	3
Develop and maintain a bilateral cooperation	5	3	2	4

Figure 4.3 ICB matrix for ARA-Centro in which present institutional capacity is judged for the main requirements of the statutes. The scale goes from 1 (inadequate capacity) to 3 (sufficient capacity) to 5 (sustainable capacity). Red colour denotes inadequate capacity. Inter-institutional capacity refers to how well ARA-Centro interacts with other institutes and organisations.

Figure 4.3 shows that despite the improved capacity during the last decade, ARA-Centro still lacks sufficient capacity for the basic requirements given in its statutes. The main reason for the insufficient capacity for all missions is the organisational and economical limitations of ARA-Centro. This capacity is mainly low because of insufficient funding, limited number of staff and lack of basic infrastructure such as basin unit offices and vehicles.

5 APPLICATION OF IWRM INDICATORS

5.1 Setting of Indicators

To evaluate to what degree the IWRM is implemented in the Pungwe River basin the proposed IWRM indicators by Cap-Net were applied. The indicators were set in collaboration with the staff of ARA-Centro during a workshop in August 2008.

For qualitative indicators a scale

- Not at all
- Partially
- Mostly
- Completely

was used to describe the fulfilment of the indicators. For each indicator a comment on the source of the information or an explanation was also given to support the understanding.

Since Cap-Net has not proposed any indicators for flood and drought management, which is an essential mission for ARA-Centro, suggestions for indicators were made.

The results are given in Tables 5.2 to 5.9.

5.2 Applicability of Indicators

The setting of IWRM indicators for the Pungwe River basin was also a test of the indicators' applicability.

The staffs of ARA-Centro were in general very positive to working with the indicators and found it straightforward to understand them. All indicators, except the ones relating to pollution control, were found relevant by the staff for the mission of ARA-Centro.

In general the indicators fell into five categories (Table 5.1).

Table 5.1 Categorisation of the indicators in regard to how applicable they are for the Pungwe River basin.

Category	Example	No. of indicators
1) The indicators were very relevant and a value could directly be given	Number of licensed water users	12
2) The indicators were relevant and data exist but a value could not be set since the analysis has never been made.	% of time environmental reserve is maintained	4
3) The indicators were relevant but interpretation of how to qualitatively set the indicator was difficult	Water management driven by basin plans	4
4) The indicators were relevant but no data exist to enable a value to be given	% groundwater stations with declining levels	1
5) The indicators were not considered relevant for ARA-Centro	Number of polluter licensed	4
	Total	25

Table 5.2 Setting of indicators for the Pungwe River basin: Water allocation.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
WATER ALLOCATION Allocating water to major water users and uses, maintaining minimum levels for social and environmental use while addressing equity and development needs of society.	Major water users are known and are managed through a licensing (or permit) system.	**YES!**	Number of surface and groundwater users licensed according to the regulations.	Number. Number of licenses issued. May be further subdivided by use.	**16 for surface water** **0 for groundwater**	**Based on the database on water licenses created by ARA-Centro. No information in this database however shows whether payments are fulfilled. Neither exists a detailed accounting system where this information can be obtained.**
	Water allocation is in line with sustainable use, economic efficiency and social equity principles.	**YES!**	Water allocation criteria include use efficiency, economic benefit and social goals.	Review. Examine allocation criteria for compliance with IWRM principles.	**Not at all!**	**Water licenses are so far given without any criteria, since water resources still considered abundant.**
			% of time environmental and social reserve is maintained in major water courses.	%. Number of records from water resource monitoring stations with flows lower than the reserve divided by the total records x 100. A determination of the reserve is required.	**?**	**Continuous data exist for major surface water resources and for environmental flow at the sub-basin scale. However, a comparison has never been conducted. Data on social reserve is missing.**

Table 5.3 Setting of indicators for the Pungwe River basin: Pollution Control.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
POLLUTION CONTROL Managing pollution using polluter pays principles and appropriate incentives to reduce most important pollution problems and minimise environmental and social impact.	The extent of the pollution problem is known and progress being measured.	**YES!**	% of surface water quality samples complying with water quality objectives.	%. Number of samples below set standard. Simplest approach is to base the determination on measurements of a few key water quality parameters.	**Conductivity 0%** **Suspended Solids 46%** **Nitrite 69%** **Phosphate 46%**	**Key water quality variables are measured at main hydrological stations in connection with hydrometric field work. Standards developed for the Zimbabwean part of the basin (Blue – Normal) are used for comparison.** **Care should be taken since quality assurance of the sampling methods does not exist.**
			% of ground water quality samples complying with water quality objectives.	%. Number of samples below set standard. Simplest approach is to base the determination on measurements of a few key water quality parameters.	**?**	**Conductivity and pH are measured in connection with hydrogeological field work. However, no analysis has been made to compare with domestic water quality standards.**
	Major polluters are known and are managed through a licensing (or permit) system.	**NO!**	Number of polluters licensed according to the regulations.	Number. Number of licenses issued.	**N/A**	**Although the Water Law and ARA-Centro's statutes give the ARA the power to licence effluent discharges, pollution control is considered to be the responsibility of the Ministry of Environment.**

Table 5.4 Setting of indicators for the Pungwe River basin: Basin Planning.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
BASIN PLANNING Prepare and regularly update the Basin Plan incorporating stakeholder views on development and management priorities for the basin, and using it to inform the annual work plans of the RBO.	Basin planning synthesises technical and social priorities for the basin and acts as a basis for action and accountability to the stakeholders.	**YES!**	Water management activities driven by Basin plan.	Review. Examine the link between the basin plan and current water management activities.	**Partially!**	**Three forms of plans exist for water management:** • **A IWRM basin strategy giving an outline of potential development for the next 20 years as well as IWRM principles** • **A 3-year rolling work plan for Pungwe River basin, which however has not been updated since 2006** • **Annual work plans for ARA-Centro** **The annual work plans take to some extent into account the prioritised activities in the IWRM Strategy.**
			Stakeholder priorities reflected in the basin plan.	Review. Examine the basin plan for stakeholder consultation and content.	**Mostly!**	**The potential water resources development and management in the IWRM Strategy was set in liaison with the major stakeholders of the Pungwe River basin.** **The work plans are, however, set without consultations of the stakeholders.**

Table 5.5 Setting of indicators for the Pungwe River basin: Monitoring.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
MONITORING Implement effective monitoring systems that provide essential management information and identify and respond to infringements of laws, regulations and permits.	The water allocation system is effective and permits are being complied with.	**YES!**	Proportion of water allocation permit holders complying with permit conditions.	%. From monitoring visits the number not complying with conditions divided by the total number of visits.	**100%**	**Self-monitoring is a condition for a water license and data are delivered to ARA-Centro on demand. From these records there is 100% compliance.** **No visits are, however, made to check the accuracy of the delivered data.**
	The Pollution control system is effective and permits are being complied with.	**NO!**	Proportion of water pollution permit holders complying with permit conditions.	%. From monitoring visits the number not complying with conditions divided by the total number of visits.	**N/A**	**Although the Water Law and ARA-Centro's statutes give the ARA the power to licence effluent discharges, pollution control is considered to be the responsibility of the Ministry of Environment.**
	Knowledge of water resource availability is a basis for management.	**YES!**	Number of water resource monitoring stations producing reliable data.	Number. Number of stations with reliable data records.	**4**	**Based on number of stations giving continuous river flow data and which have a reliable rating curve.**
			Total water storage capacity.	M^3. The water storage capacity in artificial storage structures above a minimum size (say 5,000 M^3).	**56 million m^3**	**Based on information on the only large dam in the system.**
			% groundwater monitoring stations with declining water levels.	%. Comparison of water levels over a 5 year period.	**?**	**No monitoring made.**

Table 5.6 Setting of indicators for the Pungwe River basin: Economic and Financial Management.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
ECONOMIC AND FINANCIAL MANAGEMENT Applying economic and financial tools for cost recovery and behaviour change to support the goals of equitable access and sustainable benefits to society from water use.	Water use efficiency improving through use of economic and financial instruments.	**YES!**	Charges and fees for water allocation favour the poor and efficient water use.	Review. Examine for the application of economic and financial tools in water allocation.	**Partially!**	**No fees for water outtakes that do not utilise automatic means for abstraction to provide free access for small-scale domestic water supply** **Water tariff cheaper for water supply and agriculture compared to industrial and hydropower use.**
			% revenue received.	%. Total revenue divided by the total amount billed.	**27%**	**Defined as part of total revenue for ARA-Centro that originates from water fees.**
	Pollution reducing through use of economic and financial instruments.	**NO!**	Pollution charges give incentive to reduce pollution.	Review. Examine for the application of economic and financial tools in water pollution.	**N/A**	**The water and environmental law allows for penalties if the limits of effluent discharges are not followed. However, the law does not provide for other fees.** **Pollution control is considered to be the responsibility of the Ministry of Environment.**
			% revenue received.	%. Total revenue divided by the total amount billed.	**N/A**	

Table 5.7 Setting of indicators for the Pungwe River basin: Information Management.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
INFORMATION MANAGEMENT Provide essential data necessary to make informed and transparent decisions for development and sustainable management of water resources in the basin.	Essential information is processed and packaged at the right level for specific managers and stakeholders to support transparent decision making and to gain commitment and political support for the decisions made.	**YES!**	Data base is established in formats compatible with other river basin organisations.	Review. Data base is transferable across basins in the country and for transboundary systems.	**Completely!**	**Databases are deliberately made in standard software, such as EXCEL, to simplify easy access and understanding.**
			Water management information is available to managers and other stakeholders as required.	Review. Examine availability of basin data and reports on water resource management indicators.	**Completely!**	**Data and information are presently available free of charge upon requests from stakeholders.**

Table 5.8 Setting of indicators for the Pungwe River basin: Stakeholder Participation.

Function	Water Management Objectives	ARE THESE WMOs RELEVANT FOR PUNGWE?	Progress indicator	Unit/ definition	VALUE	COMMENT
STAKEHOLDER PARTICIPATION Implement stakeholder participation as a basis for decision making that takes into account the best interests of society and the environment in the development and use of water resources in the basin.	Effective cooperation between government agencies with responsibilities for water management or water use in the basin.	**YES!**	Number of meetings of Government agencies with water interests to consult and collaborate on water management.	Number. Number of formal or ad hoc meetings at interagency level.	**?**	**Government agencies represented in the Pungwe Basin Committee, with regular meetings.** **Direct meetings with government agencies are on an ad hoc basis and are not registered.**
	Stakeholder participation is institutionalised in the management of the river basin.	**YES!**	Formal stakeholder structures established with clear roles and responsibilities in water resources management.	Review. Examine basin water management structure for stakeholder organisations and allocated management roles.	**Mostly!**	**The Pungwe Basin Committee established with statutes and regulations defined.** **However, limited financial resources curb the frequency of meetings and possibility of stakeholders to interact.**
			Basin stakeholders (male and female) represented in decision making bodies at all levels.	Number. Representatives from stakeholders serving in government water management structures.	**0**	**The national law does presently allow only advisory powers for stakeholders**

Table 5.9 Setting of indicators for the Pungwe River basin: Flood and Drought Management.

Function	SUGGESTED WMO	SUGGESTED PROGRESS INDICATOR	SUGGESTED UNIT	VALUE	COMMENT
FLOOD AND DROUGHT MANAGEMENT Operating floods and droughts to mitigate and minimise harm to humans, environment and economic values.	**Knowledge of inundation areas for different flood magnitudes**	**Length of river analysed for flood inundation (flood frequency, hydraulic studies and topographical surveys)**	**Number Kilometres analysed river**	**0**	**Flood analysis conducted for Save. Planned for Buzi and Pungwe.**
	Functioning flood warning system	**Number of forecasts or warnings issued for floods**	**Number Sent bulletins to stakeholders per year**	**74**	**Bulletins including flood warnings sent to stakeholders and media during the rainy season 2007/08**
	Functioning drought warning system	**Number of forecasts or warnings issued for low flows**	**Number Sent bulletins to stakeholders per year**	**0**	**No bulletins presently sent during the dry season.**

6 PROGRESS OF IWRM IN THE PUNGWE RIVER BASIN

6.1 Progress and limitations

In general, for all areas of water resources management, the national water law and policy in Mozambique provide an enabling environment for implementation of IWRM on the basin scale.

The application of indicators shows that considerable steps have been taken towards an implementation of IWRM in the Pungwe River basin. Examples are the licensing of surface water users, existence of a formal stakeholder forum, monitoring and databases initiated and willingness to distribute the information.

On the other hand, the indicators also show that essential parts of IWRM are yet missing. An important example is water allocation criteria that take into account efficiency and economic benefits. Several indicators also indicate the need for improvements. E.g. is groundwater given much less emphasis then surface water (both for licensing and monitoring) and monitoring is still lacking sufficient coverage (both for checking compliance and for estimation of water resources). ARA-Centro's activities are still only partially following the basin plan or strategy. Revenues from water users are still the minor part for financing the operational work of IWRM, which is both because all users are not registered and because the fulfilment of payment is not 100% for the registered users.

The lack of cross-sectoral coordination in the field of pollution control seriously hampers the implementation of IWRM. The national water law and statutes of ARA-Centro give the regional water authority the task to license effluent discharges. However, also the Ministry of Environment (MICOA) has regulatory responsibilities through the right to penalise polluters for non-compliance. There is a grey zone of responsibilities between the ARAs and MICOA, which prevent clear instructions for the staff of ARA-Centro do deal with pollution control.

The limited implementation of water allocation criteria and pollution control is worrying for the Pungwe River basin. The last years records of low flows in the lower river basin and the accelerated water quality problems due to mining activities indicate that clean water resources may be a scarcity in the near future in the basin. This may severely affect the economic development of the region.

On a direct question to the staff of ARA-Centro the degree of IWRM implementation in the Pungwe River basin was judged to 30-45%, which corresponds fairly well to what the setting of indicators shows. The greatest challenges for improved IWRM implementation were listed by the workshop participants in the following priority order:

1. Lack of financial resources for operational costs of ARA-Centro.
2. Lack of financial resources for development of the water resources (e.g. dams)
3. Difficulties to coordinate management with other line ministries, such as Environment, Mining and Local Government.
4. Unwillingness by water users to pay
5. Difficulties in reaching small-scale stakeholders with a centralised organisation
6. Failure to implement polluter-pays-principle and thereby control pollution

The participants all considered that governmental funds will be necessary for the future implementation of IWRM. Although much could be improved to increase the revenue from water users by enforcing all users to pay, the present level of water fees (currently 0.16 cent/m^3) would not allow sufficient cover for the operational costs of ARA-Centro to expand there activities in e.g. monitoring, stakeholder participation and pollution control.

A very rough estimate is that even if all available water was licensed and charged in ARA-Centro's area of jurisdiction, revenue will not be more than about one million USD. This corresponds roughly to the present turn-over including the direct support from external donors for equipment, vehicles and studies. Since ARA-Centro has no right to set the water tariffs it is therefore dependent on that the government of Mozambique either raises the tariffs or supports ARA-Centro financially.

Interviews with major stakeholders confirmed that ARA-Centro is considered the main governmental institution responsible fro IWRM in the Pungwe River basin. However, the stakeholders also emphasised that other governmental bodies, such as Ministry of Agriculture, Ministry of Environment and Ministry of Education, are important for implementation of IWRM.

The stakeholders interact with ARA-Centro either via the Pungwe Basin Committee or through direct personal contacts with the staff at the head office.

The water fees are considered acceptable by the stakeholders but there is a general disappointment that the fees do not give corresponding services or water resources development back to the stakeholders from the regional water authorities.

6.2 Lessons learnt

The staff of ARA-Centro gave the following main recommendation to a newly established RBO based on the experience in the Pungwe River basin:

- Governmental or external support is necessary for starting up the activities
- Emphasise on institutional capacity building, especially to raise the human talents in IWRM
- Put effort to market IWRM among stakeholders
- Essential to coordinate with other government bodies
- Decentralise the organisation and increase the presence of staff in the field.

The need for central money in the initial phase of implementing IWRM has been very clear in the Pungwe River basin. Newly established river basin organisations, such as ARA-Centro, often face a catch-22 situation where revenue is supposed to come from water users and polluters. But to make this happen funds are needed for motivating stakeholders to pay and to build up a fair water allocation and polluter-pay-system for collecting the revenue. In the Pungwe River basin in Mozambique the initiation of a water user licences and the Pungwe Basin Committee would not have been possible without the external support from central government and foreign donors.

When asking the ARA-Centro staff to what degree IWRM had been implemented without the external support the answer was 10-25%, which is considerably lower than their estimation of the present implementation (30-45%).

On the other hand it should be emphasised that implementation of IWRM takes time irrespective of the financial resources. Both the Austrian support and the initial part of the Pungwe Project had very ambitious goals and tried to implement IWRM in a very short time. The results were that ARA-Centro did not have the possibility to absorb all capacity building and that the understanding and acknowledgement of the IWRM principles did not have time to settle in among the staffs of the water authority and the stakeholders of the river basin. It therefore resulted in comprehensive plans and programmes that were found very difficult to implement. The later parts of the Pungwe Project and the planned continued support by Sweden have adopted a larger flexibility to let IWRM implementation follow the pace that can be adopted by all involved, and which has so far been more successful.

Sustainable IWRM is dependent on the stakeholders' willingness to participate. The lessons learnt in the Pungwe river basin are that the stakeholders feel frustrated and loose interest if they do not see that they get anything back. This was forwarded by major stakeholders at large workshops during the Pungwe Project and also by the major stakeholder when recently interviewed. It is therefore essential to provide services to the stakeholders and, if financially possible, to initiate water development projects in parallel with the implementation of IWRM principles to show that things are happening on the ground that directly benefit the stakeholders.

Water resources management in the Pungwe River basin has also clearly shown that the cross-sectoral coordination is essential for the implementation of IWRM. ARA-Centro has not the legal responsibility, or the capacity, to deal with all aspects of IWRM. The problems with artisanal gold mining have shown that the water authorities are toothless without collaborating with Ministry of Environment and the Ministry of Mining. Without clear roles and responsibilities, and regular meetings, between the different governmental bodies the pollution caused by artisanal mining in the Pungwe River cannot be solved.

The area of jurisdiction for ARA-Centro is more than 100,000 km^2 and ARA-Centro's experience shows that it is very difficult to implement IWRM without more presence in the field. Even on the river basin scale it is therefore recommended to avoid a too centralised organisation. The establishment of Basin Units, as given in the statutes, is a necessary step for implementing IWRM in the Pungwe, Buzi and Save river basins.

7 CONCLUSIONS

7.1 On the implementation of IWRM in the Pungwe River basin

Implementation of IWRM in the Pungwe River basin has taken the first important steps. The enabling environment, through national laws and policies, is in place and concrete activities occur, such as licensing of surface water users and participation of stakeholders through a formally established basin committee.

On the other hand, there are many further steps to take. Both the setting of IWRM indicators and a subjective judgement by the staff of ARA-Centro indicated that implementation has not yet reached halfway. Essential parts of IWRM are yet missing, such as water allocation criteria that take into account efficiency and economic benefits and sufficient funding of the IWRM activities through water fees or the polluter-pays-principle.

7.2 On the IWRM indicators

The indicators developed by Cap-Net were found very useful for judging the degree of IWRM implementation in the Pungwe River basin and to identify which areas ARA-Centro should put more emphasis to in the future.

The setting of indicators indicated a level of IWRM implementation that corresponds well with the general view of the staff of ARA-Centro. Most of the indicators were found relevant for the Pungwe River basin and about half of the indicators could be given a value directly by using the existing information at ARA-Centro's head office. It is therefore concluded that the indicators are a good tool for monitoring progress of the general implementation of IWRM in the Pungwe River basin.

7.3 On lessons learnt

The experience of implementing IWRM in the Pungwe River basin has shown that

- The need for central funds is essential when establishing an RBO and starting to implement IWRM. It is not until stakeholders have acknowledged IWRM and functioning water allocation, polluter-pays-principle and collection systems are in place, that revenue from users and polluters will be sufficient for the operational cost of IWRM. In a situation where tariffs are set on a national scale, RBOs in water-scarce river basins with little development may even then have difficulties to be economically independent.
- Even if the financial resources are there, IWRM takes time to implement. The principles of IWRM are not easily adopted by everyone and capacity building takes time to be sustainable. Therefore, implementation of IWRM has to follow the pace that can be adopted by all involved parties, both authorities and stakeholders.
- Cross-sectoral coordination between different governmental bodies is fundamental for implementation of IWRM. It is basically impossible for the regional water authority to have responsibility or to deal with all aspects of IWRM. The RBO must therefore act as a strong stakeholder in its relation with other ministries important for IWRM, e.g. environment, agriculture, mining and industry.
- Even on the river basin scale, a too centralised organisation prevents implementation of IWRM. Frequent presence in the fields is necessary to meet and motivate stakeholders and to cover monitoring of all parts of the river basin.

8 RECOMMENDTATIONS TO ARA-CENTRO

The successful application of general IWRM indicators for the Pungwe River basin indicates that these are a good tool for monitoring the progress of IWRM implementation. It is therefore recommended that the Cap-Net indicators are reviewed on an annual basis as part of the annual work plan of ARA-Centro. The immediate actions to be taken to set the indicators for 2008 should be:

- For the indicators where data exist but no analysis has been made, the analysis should be conducted (e.g. to check the % of compliance of environmental flows at key runoff stations).
- For the indicators regarding pollution control that were not considered relevant for ARA-Centro, contacts with MICOA should be taken to clarify the responsibilities and to get information to enable also these indicators to be given a value.
- Setting of indicators also for the Buzi and Save river basins.

Within the on-going PP2 project indicators are to be developed to monitor the progress of the project activities. It is, however, recommended that these project indicators are not confused with the general IWRM indictors suggested by Cap-Net. It is instead proposed that the general indicators for each of the three river basins, Buzi, Save and Pungwe are used in parallel to the monitoring of the PP2 as an overall judgement of IWRM implementation.

The indicators that were given value in Table 5.2-5.9 indicate areas with a need for improvements in the Pungwe River basin. Following the results of the 2008 indicators ARA-Centro should put emphasis to the following areas to enable the indicator values to be increased next year:

- The rolling 3-year plan should be annually updated for the activities in the Pungwe River, guided by the long-term IWRM strategy.
- Monitoring groundwater and licensing groundwater users should be given more emphasis.
- Monitoring of water resources and quality, both surface and groundwater, should be given larger coverage.
- Visits to the major water users to follow up and control the self-monitoring should be conducted.
- Regular meetings with line ministries should be held and being recorded.
- Further identification of water users and polluters should be made and an accounting system that allows monitoring and enforcement of payment of fees should be developed.
- Water allocation criteria should be developed for licensing of new water users to reduce the risk of future water scarcity.
- Inundation mapping should be initiated for flood-prone areas of the Pungwe River basin.
- Bulletins for drought warnings should be developed and distributed during the dry season.

9 SOURCES OF INFORMATION

Besides direct contacts with the staff of ARA-Centro the following documents have given major inputs to the case study report:

Cap-Net 2008, *Integrated Water Resources Management for River Basin Organisations*, http://www.cap-net.org/node/291.

SWECO and Associates 2006, *Pungwe River Basin Joint IWRM and Development Strategy* http://www.pungweriver.net/.

ARA-Centro 2008, *Relatorio das Actividadas Desenvolvidas pela ARA-Centro Durante o Ano de 2007* (Annual Report of ARA-Centro), February 2008.

CONSULTEC and Associates 2005, *Water Policy (proposal), Building Block 1, Review of the Water Law and the National Water Policy*, prepared for the National Directorate of Water (DNA), January 2005.