Promoting Water Demand Management from Local to Regional Level

Exchange Visit Seminar
for Directors: Proceedings

Edited by
Carmel Lue-Mbizvo

Cresta Bosele, Francistown
Botswana
09 - 11 July

IUCN
The World Conservation Union

Promoting Water Demand Management from Local to Regional Level

Proceedings of the Exchange Visit Seminar for Directors Held at Cresta Boseie, Francistown, Botswana, 9 – 11 July, 2003

Published by: IUCN – The World Conservation Union
(Regional Office for Southern Africa)

IUCN
The World Conservation Union

Sponsored by: German Technical Cooperation (GTZ) and Department of Water Affairs, Botswana

Citation: IUCN – The World Conservation Union, 2003. *Promoting Water Demand Management from Local to Regional Level: Proceedings of the Exchange Visit Seminar for Directors Held at Cresta Bosele, Francistown, Botswana, 9-11 July, 2003*

ISBN: 1-77931-011-0

Design and Layout: Printset

Cover design: Hastings Chikoko (IUCN HQ, Gland, Switzerland)

Cover Photography: IUCN Library

Printers: Printset

Available from: IUCN – Regional Office for Southern Africa, 6 Lanark Rd, Box 745, Harare, Zimbabwe.

TABLE OF CONTENTS

List of Acronyms

AGRITEX - Agricultural, Technical and Extension Services
AFU - Automatic Flushing Urinals
ADD - Average Daily Demand
ALDEP - Arable Land Development Programme
CBO - Community Based Organisation
CWA - Catchments Water Authorities
DGS - Deaprtment of Goelogical Surveys
DWAF - Department of Water Affairs and Forestry
DWD - Department of water Affairs
DWIMP - Dry-land Water management Programme Initiative
EIA - Environmental Impact Assessment
FAO - Food and Agriculture Organisation
GDP - Gross Domestic Product
GWP-SA - Global Water partnership Southern Africa
IUCN-ROSA -World Conservation Union - regional Office for Southern Africa
IRBAs - International River Basin Authority
IWM - Integrated Water Management
IWRM -Integrated Water Resources Mangement
LIM - Less Is More
MLGNH - Ministry of Local Government and national Housing
MoA - Ministry of Agriculture
KOBWA - Komati basin Water supply
NCSA - National Conservation Strategy (Co-cordinating) Agency
NAMPAD - National Master plan for Agricultural Development
NGO - Non-Governmental Organisation
NWCSF - water Copnservation policy and Strategy Franmeowrk
OKACOM - Okavango River Basin Commission
PPP -Purchasing Power Parity
PJTC - permanent Joint Technical; commission
RSA - republic of South Africa
RSAP - Regional Startegic Action Plan
SADC-WSCU - SADC water Sector Coordination Unit
SADC - Southern Africa Development Co-ordination
SEA - Sectoral Environmental Assessment
SRAP - Regional Action Plan
VAT - Value Added tax
WUC - Water Utilities Corporation
WSA - Water Supply Authority
WRMS - Water Resources Mangement Startegy
WDM - Water Demand Mnagment
WASHE - Water, Sanitation and Health Education

Simon Forster (facilitator) welcomed all the participants on behalf of SADC, IUCN and Department of Water Affairs. As the mayor was unable to make it, Masego County Programme Coordinator Madzwamuse of IUCN Botswana office welcomed the participants and thanked them for leaving their busy schedules to be at the seminar. Simon emphasised that water demand management is for the whole region and not just one country. He also gave an overview of what was going to take place for the next two and a half days (i.e overview, outline and objectives) and briefed participants on the field trip to Letsibogo Dam and BCL mine. He pointed out that theme leaders will be elected so that they can report back on various aspects of what would have been observed. The themes to be worked on were:

- Communication
- Community Management
- Overall Planning and Design of Scheme
- Finance and Cost Recovery
- Monitoring and Evaluation

He stated that it was not supposed to be just a talk show. Simon gave a briefing on the objectives of the seminar.

1.1 Official Opening – Dr Akolang Tombale, Permanent Secretary in the Ministry of Minerals, Energy and Water Resources, Botswana

"I am delighted and very pleased to be here officiating at this very important seminar that of promoting water demand management in our individual countries as well as the regional level.

Director of ceremonies, ladies and gentlemen, this seminar could not have come at a better time for the SADC region as well as this country in particular, because we are in the middle of a crippling and devastating drought. We are also, since the development of our Protocol on Shared Water Courses, busy with the establishment of structures for the proper management of shared water resources. In Botswana we launched the National Steering Committee for the Management of the Resources of the Zambezi System in March of this year, 2003. March was also the month during which the Third World Water Forum was held, and most of the directors here participated in that Forum. A month ago the countries of the Okavango River Commission met in Maun, Botswana at ministerial level to discuss matters common to their shared river. These conferences, seminars and workshops were all on managing water resources better.

Since the late 1970s there has been an increasing realisation of water as a basic human need as well as an input to economic development, or may I say what is generally referred to as 'sustainable development'. As a result many management models were developed, we now talk of Integrated Water Resources Management, Watershed Management and all others. This focus on water management is nothing but a reflection that fresh water is finite whereas the world population is rapidly increasing. The tragedy, director of ceremonies, ladies and gentlemen, is that despite this recognition we still manage water from the supply side, as if it is infinite. We have to do everything we tell ourselves to meet water demand. I need not remind all directors of water departments here of discussions that dominate the formations of river commissions which some of you, if not all of you, are involved in one way or the other in the formation of River Basin Commissions. Generally these discussions are dominated by stating each country's water needs and entitlements rather than an emphasis on shared benefits. After all, we claim discussions are on shared waters.

Ironically, ladies and gentlemen, all the poor countries and regions of the world and the undeveloped are those in which water resources are less developed. Water, ladies and gentlemen, or rather lack of it exacerbates poverty and disease. Unfortunately there are not enough resources to reach every little community in all corners of the world unless we learn to pool our resources together for shared development and hence share in the benefits.

I have talked at length about the interest of the world on the management of water resources for sustainable development. Perhaps it is time to briefly turn my attention to the subject of your three days' stay or so in Botswana, the subject of this seminar, Water Demand Management, not I believe meeting water demand but rather managing water demand. Water Demand Management forces us to recognise the limitations and wastefulness of our supply approach policies both in terms of the huge financial resources requirements as well as the irreversible negative impacts on the water environment.

Do we really have to develop a large dam in order to flush 5ml of urine from

each of the individuals of a particular town and as a result be landed with the problem of what to do with the resulting waste water? Can we come up with better irrigation to produce food with less water and less damage to the environment, resulting in the salination of soils? Therefore it is important for you during these few days to focus your energies on finding appropriate and workable technologies and methodologies for managing water demand. Often we are bombarded with new approaches and gadgets that have never worked elsewhere in the world and are passed as tried and tested just because the World Bank, International Monetary Fund or Swedish International Development Agency or some other such agency is funding.

We have to understand we are dealing with the lives of real people who are looking to us to provide for them their basic water needs for poverty reduction and sustainable development.

Director of ceremonies, ladies and gentlemen, it is now my privilege and honour to declare this seminar officially opened, and wish you fruitful discussions and an enjoyable stay in our country (for those of you who are from other countries). May I also express my sincere gratitude to the IUCN and to all of you. We feel honoured to have the seminar here in Botswana and in particular in this important town."

"We have come a long way since the last workshop. Today is a celebration as we bring together a diverse group of people. Water issues in the region are of great importance. I would like to see that we continue this platform for advancing WDM. IUCN South Africa had a meeting with the SADC representative to discuss how we can take forward WDM at regional level for directors and at the political level. It talks about supply side and demand side. We have to recognise that the supply issue will continue and we should therefore strike a balance between the two. It is a pro-active way to dealing with the management of water. Water Demand Management is not punitive, it is an important part of planning for the future. We need to recognise that for planning and implementation, we need to have detailed information, we need to empower people in various spheres and dimensions. Certain institutional culture has to prevail for it to be carried forward. So far Phase II of WDM has focused on:

- Expanding the scope of country studies. Country studies have been completed by IUCN in the SADC countries. Specific analytical work on best practices has been done.
- Sharing of knowledge in various institutions. Universities to include a module on WDM in their various courses.
- Working with Waternet. A training workshop to be held at the end of the year to discuss the way forward.

Saliem expressed his gratitude for the opportunity he was given to give this overview. He hoped that at the end of Phase II there would be an extension to the WDM project."

"From the analysis I will give, it will become evident that there is no single set of policy guidelines that will be universally valid for the entire Southern African situation. The reason for this is that policy initiatives are specific to a given social, cultural, economic and political setting. This explains why despite the best of intentions, and with the valuable material support from NGOs such as the IUCN, no set of guidelines has been developed. It also shows the approach that has been outlined in the document entitled "An Analytical Paper to Support the Development of WDM Guidelines for the Southern African Region" to be flawed, largely because it is based on the key assumption that the South African and Namibian experiences with respect to WDM can be replicated elsewhere in the region. This is unlikely to succeed for the host of reasons that have been presented in this paper. This does not mean to say that the effort is futile however. Quite the contrary. The current IUCN initiative is valuable because it has allowed these complex issues to be analysed, and in particular, it has allowed for the sharing of the ideas presented in the analytical paper to be critically discussed among water professionals from the entire Southern African region.

So, if generating one coherent set of policy guidelines is likely to fail, what can we do to overcome this hurdle?

The analysis of the various concepts, theories and models that have been presented above suggest that there are seven strategic issue areas in which a concerted effort should be made. It is the contention of the author, that by focusing on these key issue-areas, the whole *problematique* of WDM as a concept and a policy can be developed and effectively implemented in Southern Africa.These seven strategic issue areas are as follows:

(1) Accept that Diversity is the Norm

As the result of our deepening understanding of the conceptual difference between first and second-order resources, we can now explain why each country is different and somewhat unique. This is the fundamental reason why policy options that work in one setting, may fail in another. Each country, river basin or catchment area has a different mixture of first and second-order resources at their disposal. This fact should be recognised and accepted as the primary point of departure in any future attempts to develop regional guidelines.

(2) Focus on Institutional Development

It has been shown that the key problem in Southern Africa is the general failure to effectively develop institutions. This does not mean that there are no institutions, but rather that institutions are generally under pressure. The cause of this is the rising level of complexity of management, and in particular the complexity of the need to manage demand. This needs a fundamental change to the so-called 'Paradigm of Perception' that forms the very foundation of institutions as they currently exist. We have seen that each country has a different institutional challenge. Those countries

that can be categorised as SIRWS have primarily a first-order focus, whereas those countries that can be categorised as SIRWA have primarily a second-order focus. Each of these has a fundamentally different logic, rationale and philosophy to it. Those countries that have been categorised as WP have a more complex mix of problems. It is this category that will benefit the most from the involvement of external role-players.

(3) Focus on Data Generation, Flow and Management

It has been shown that complexity is a normal outcome of management intervetions, particularly with respect to ecosystems. This complexity needs to be modeled if it is to be understood. Central to this is the need for data, which needs to be generated. This is particularly true for WDM, where critical data such as water balances, water loss, payment levels, cost-benefit analyses of alternative options and suchlike are of crucial importance. That data then needs to be managed in some way in order to be prcessed and then provided to the relevant decision-maker in a format that can be understood. It is generally known that data management is a weakness in most developing coutries, and Southern Africa is no exception.

(4) Focus on the Broader Socio-Economic Setting

It has been shown that policy decisions do not take place in a vacuum. Similarly, it has been shown that complexity results in feedback loops, some positive and some negative. There is consequently an intimate linkage between the policy-making environment and the broader socio-economic setting in which it is embedded. WDM needs both policy generation and sanction for non-compliance, if it is to succeed. This is unlikely to occur in a setting where socio-economic development does not allow for the generation of sufficient income streams with which to support institutions, let alone to allow them to adapt to changing needs. The linkage between poverty and second-order resource scarcity is a fundamental one that needs to be recognised if WDM policies are to be effective.

(5) Focus on Political Will

Because water brings privilege, its allocation in society will always be politicised. As one commentator has noted, "Water flows (uphill) towards power and money" (Reisner, 1993: 296). Politicians seek power and generally have a short-term focus about getting elected), whereas water resource managers generally have a long-term focus. The political environment constrains the water resource management enviroment. However, there is a difference between what should be done to manage resources sustainably, and what can be done to manage resources sustainably (Allan,2000:184). One therefore needs to get political 'buy-in' before WDM policies can become viable. As long as politicians try to seek re-election by offering free water to potential voters, WDM policies will continue to be undermined.

(6) Focus on Windows of Opportunity

A well-documented factor in hydropolitics is what some have called "emblematic events" (Hajer, 1996) and others have called "windows of opportunity" (Kingdon, 1984; Allan, 2000:190). While this has not been discussed in detail in this paper, it does provide an opportunity for public debate on a given issue, and thus a potential narrowing of opin ions. Windows of opportunity allow for changes to be made in water policy. This is one of the reasons why water policy reform is never uniform, and generally appears as a

series of incremental adjustments and adaptations rather than once-off initiatives. Every effort should be made to concentrate policy reforms at times that coincide with emblematic events. One such opportunity is the Johannesburg Summit (World Summit onSustainable Development) during which issues of sustainability were examined in great
detail.

(7) Focus on Incremental Applications of WDM

It has been shown that institutions are capable of learning, and that this learning results in a redefinition of the core problem being managed (the so-called 'Paradox of Perception'). This incrementalism is expected and is a healthy manifestation as it allows for the fine-tuning of policy modifications and the correction of policy reform errors prior to implementation. For this reason any initiative designed to stimulate best practices and therefore to develop a set of WDM guidelines, should harmonise itself with this natural incrementality rather than seek to make one major effort. In this regard cognisance can be taken of the different factors raised in the other six strategic issue areas, particularly with respect to the differing combinations of first- and second-order resource availabilities within given countries. This will stimulate the development of sustainable WDM policies, and then encourage the cascading and adaptation of these policies to other countries and social settings.

Conclusion

It has been shown that a central component of the *problematique* of WDM as a concept and a policy is what has been called the Paradox of Perception. This in turn is linked to the changing water management paradigm, which is shifting in response to external stimuli that are too strong for any one country to resist, from a highly centralised water supply perspective, to a decentralised demand management perspective based on the principle of subsidiarity. Underlying this transition as a basic driver is the notion of reflexivity. This shift is incremental, which is a healthy condition, as institutions need time to adapt.

An important element of this adaptive response is what has been called Second-Order Resources, where it has been shown that such resources are an independent variable in the majority of cases. A set of hypotheses has been generated in order to test this notion and available evidence supports this conclusion. A central problem is the relative crudeness of our measuring instruments, caused in part by the fact that the concepts relating to second-order resources are under-developed at present. It is hoped that as these are refined, our scientific knowledge about institutional development will increase exponentially.

It has also been shown that as a result of the dynamics of complexity, the Management of water resources actually consists of a series of oscillations between first- and second-order resource focal points, which has been likened to the turning of a screw. The important aspect to note however is the fact that complexity increases over time, and that WDM represents yet another layer of management that is superimposed onto an already overburdened set of water management institutions. While the need to manage demand is a manifestation of increased complexity, a new set of complexities are introduced as well, some of which have unintended consequences.

Emerging from this is the notion of three different phases of water resource management (the supply, demand and adaptive phases); each with a fundamentally different focal point; each representing an increasing level of complexity; and each containing

a progressively greater degree of political risk, thereby introducing the importance of legitimacy into the overall management equation.

In conclusion, a set of seven strategic issue areas has been isolated. It is hoped that third-party role-players such as the IUCN and others can use this emerging knowledge in order to select projects where their impact can be maximised. In this regard the role of such third-party role-players is invaluable because they bring with them a degree of impartiality that increases the chances of success, along with their ability to mobilise the necessary intellectual capital, which improves the prognosis. Such efforts are to be encouraged indeed!

Discussion

- Concerns were raised about why South Africa offers the first six kilolitres of water for free. It was said that it is not a good strategy for WDM (Who takes the esponsibility for the free water? Is it the government?)
- According to some of the participants it is a good WDM tool as water is saved since people would not exceed the limit, thereby saving money. Alsoin one area it was discovered that in most cases it was more expensive to send the water bill than to give a limited amount for free.
- It was also stated that we should not come up with projects which will inconvenience communities, for example the George Compound in Zambia where people ended up getting water for one hour a day, resulting in an outbreak of cholera.

This presenation was based on a study for IUCN-South Africa office and aimed:

To capture all key policies and strategies in WDM for inclusion in the formulation of national and regional water policy and strategy.

This paper focuses on the following areas:

1. IWRM and WDM
2. WDM at the regional level
3. WDM at the national level

Why do we need IWRM?

A 20% water saving in the agricultural water consumption of South Africa amounts to more than the aggregate water consumption of Botswana, Lesotho, Namibia, Swaziland and South Africa together. The savings would be 10 times the expected yields of the Katse and Mahole Dams of the Lesotho Highland Water Scheme (Louw and Kassier, 2002).

"If allocative efficiency is not achieved, it is possible, and even common, to be doing the wrong thing extremely efficiently. It would be much more useful to be doing the right thing, that is with efficiently allocated water, a little bad" Allan (1995, quoted by Lundqvist, 1997)

The discharge of the water treatment plant in Gaborone (well over half of the city's water consumption) is discharged in the Notwane River. The North-South Water Carrier has been built to augment the city's water supply, while the treated effluent is not yet properly used (Arntzen et al., 1999).

IWRM and WDM

- IWRM is a comprehensive approach towards managing and providing water to support sustainable development
- Balancing economic efficiency, social equity and environmental sustainability
- Balancing water demand and supply by:
  - Increasing traditional supplies
  - Increasing non-traditional supplies and/or
  - Demand management

Possible Types of IWRM Instruments

- Physical/ technical measures
- Water and development planning
- Legislative measures
- Economic measures

- Education and consultative instruments

- Countries have to prepare IWRM and water efficiency plans by 2005

IWRM Issues in SADC

- Lack of participation
- Lack of involvement of women
- Inadequate water and sanitation infrastructure

Reasons for WDM

- Economic: cost savings, innovation, technology development
- Environmental: water savings, avoided adverse environmental impacts of more dams and wellfields
- Social: lower water costs, increased access to water
- New opportunities: treated effluent, desalination, technology

Key WDM Themes

- Water user efficiency
- Increasing allocative efficiency
- Demand prioritisation
- Rainwater harvesting
- Desalination
- Re-use and recycling

Why not yet Commonly Applied in Southern Africa?

- Primary reasons: traditional supply bias, lack of expertise and funds, inadequate political commitment
- Secondary reasons: low water prices, inadequate infrastructure and perceived water scarcity
- On the way

Recommendations

1. Prepare IWRM and water efficiency plans
2. Routine evaluation of the options to expand traditional and non-traditional water supplies, and to manage water demand
3. Allocative efficiency should be given much more attention
4. WDM needs to be stimulated and implemented in Southern Africa within the framework of IWRM
5. Focus WDM efforts on areas, which yield highest results that are implementable

National WDM Policy Issues

1. Different stages of WDM preparation and adoption
2. Needs and potential assessment of WDM
3. Few countries have integrated WDM into policies and legislation
4. Few countries have institutions charged with IWRM, WDM and shared water courses
5. Important IWRM components:

- Demand prioritisation
- Decentralisation of water management
- Participatory water management
- Monitoring of self-provider's sector
- Economic analysis of IWRM interventions
- Use of EIA and SEA procedures for IWRM
- Analyse the WDM potential and priorities

6. Overcoming WDM Constraints
   - Identification of main constraints
   - Political commitment: awareness raising, demonstrating economic, social and environmental benefits
   - Capacity: formal education, short courses, cost recovery, WDM budgets etc.
   - Supply bias: broaden disciplines involved in wateplanning,affirmative action
   - Improper understanding of WDM: awareness raising, workshops, media etc.
   - Inadequacies in infrastructure: metering, etc.
   - Water subsidies: design proper water pricing structures

7. Identify WDM Priority Areas
   - End-users: increase user efficiency in irrigation, domestic (water-wise gar dening/exotics), public sector and key industrial and mining sectors
   - Water providers: reduce leakages and unaccounted water; re-using and re-cycling of waste water and water from hydro-electric power stations
   - Water planners: improve allocative efficiency, monitor/regulate self provid ers provide incentives for WDM

8. Review Incentives and Disincentives for WDM
   - Review of subsidies and pricing system (based on marginal opportunity costs)
   - Groundwater charges for self-providers
   - Tax incentives and disincentives
   - Covenants with e.g. service providers, irrigation and public sector
   - Awareness raising
   - Effluent and energy charges
   - Water audits

9. Learn from Existing WDM Cases

10. Consider Linkages between WDM and Water Privatisation

Regional Policy Issues

Key Regional Water Issues

- Implementation of RSAP and Protocol
- Development and implementation of bilateral and multilateral river basin agreements
- Ensure sufficient sustainable water for domestic and productive needs
- Minimise water conflicts
- Ensure benefits to all countries involved; support to national governments

RSAP

The RSAP is entirely based on IWRM and makes explicit reference to WDM: best management practices, water conservation, balancing demand and supply, and promoting allocative and user efficiency. It is recommended that there is need to make sure that the explicit references to WDM in the RSAP are incorporated in the RSAP projects:

- Sectoral WDM guidelines (irrigation, domestic, industry, public sector)
- Norms/standards for UAL and products
- Allocative efficiency through natural resource accounting

SADC Protocol on Shared Water Courses

The Protocol does not mention WDM explicitly, but several provisions can be used to fully incorporate WDM in the implementation of the Protocol. These include:

- Prevention of alien species
- Alternatives to the use of shared water need to be evaluated
- Harmonisation of water uses, guidelines, standards and necessary interventions for sustainable use of all states
- EIA requirement for all projects with an impact on shared water
- WDM can be incorporated into the guidelines and standards that will be developed for the river basins.

The following recommendations were made:

- Evaluate WDM measures as alternatives to use of shared water courses (SEAs, EIAs and economic appraisals)
- Regional alien species prevention programme
- Promote WDM capacity in river basin organisations
- Ensure that WDM is fully incorporated into multi and bilateral agreements
- Incorporate WDM explicitly in future amendments of the Protocol
- Expand the implementation of the Protocol to major shared aquifers .

Other Regional WDM Issues

- Regional review of experiences with water privatisation and the potential of public-private sector partnerships from a WDM perspective
- Analyse the role of comparative water advantages in regional economic integration and trade
- Capacity building: reduce the capabilities in regional negotiation of protocols and multi/ bilateral agreements
- Harmonisation of various standards (minimum-maximum and transition period)

Table 1: IWRM Issues in Twelve SADC Countries

Frequency	Thematic area	Constraint
Widespread (at least in 76% of countries)	Public participation	Inadequate community participation Inadequate women involvement
	Infrastructure	Inadequate access to sanitation Inadequate access to safe drinking water
	Sustainable development	Overgrazing
Widespread (in 51% to 75% of the countries)	Legal aspects	No comprehensive national water law
	Institutional strengthening	No overall water policy/ strategy Weak national water institutions Inadequate manpower
	Sustainable development	Inadequate water conservation measures Pollution from sewage Soil erosion and deforestation
	Information	Inadequate water resource data base Inadequate hydro-meteorological monitoring network
	Infrastructure	Inadequate water resources infrastructure
Less common (in 26-50% of the countries)	Legal	Non-ratification of protocols
	Institutional strengthening	Poor coordination mechanisms Ineffective shared basin institutions
	Sustainable development	Pollution Aquatic weeds Land salination
	Information	Inadequate water user information Inadequate monitoring of sediments and water quality
	Infrastructure	Inadequate flood control
Not common (in 25% or less of the countries)	Sustainable development	Potential water stress Herbicide pollution Cross-border pollution

Source: modified table 4.4, RSAP, p. 92/93.

Table 2: Objectives and Key Issues of the RSAP

Objectives	Priority areas
Improve regulatory and legal framework	Harmonise laws, drinking water standards, water quality standards enforcement of standards, dispute resolution framework and equitable use of shared rivers through river basin commissions
Improve national and transboundary river basin management, planning and coordination	Strengthen national water authorities, improve regional cooperation in river basin management, equitable use of shared rivers through river basin commissions, intersectoral planning and coordination of water sectors in each country and strengthen SADC WSCU
Strengthen linkages among macro-economic, social and environmental policies	**Shift water used to most efficient use, cost recovery, balance demand with supply and conserve water resources**
Improve information acquisition, management and dissemination	Monitoring, assessment, info access and exchange, hydro-meteoreological data banks, research, inter-disciplinary knowledge
Support awareness building, education and training	Share knowledge, **best management practices**, regional and national centres of excellence, education, technical cooperation, IWRM training.
Promote public participation	Stakeholder identification and participation, community-based water resource management groups, special policies for needs of women and disadvantaged groups
Invest in infrastructure	Rehabilitate and expand infrastructure, meet demands of multiple users, **ensure efficient water use**, holistic planning of water works, and balance social and environmental goals with infrastructural goals.

Note: direct WDM areas in **bold**
Source: RSAP, p.100-102.

Table 3: Examples of the Range of WDM Measures

WDM area	Technical measures	Planning	Regulat-ions	Economic	Consultative
WDM in resource manage-ment functions	Removal of invading alien species Wet land rehabilitation Dam storage optimisation (e.g. less evaporation) Artificial recharge	Water catchment management Protection from overutilisation Managing land use Water quality management Drought contingencies Allocative efficiency	BAT water practices as compulsory alternative in EIA/SEA procedure in water stressed areas		Awareness and education, social marketing
WDM in distributio n and supply functions	Infrastructure optimization; Parallel infrastructure for different water classes; Loss minimisation; Reduction of UAW; Metering; Pressure management; Pre-paid meters; Common-property management of standpipes	Town planning services Re-use and reclamation WDM in building standards	Regulations , norms and guidelines	Incentives; Higher energy prices make pumping expensive; Volume-based effluent charges	Education, awareness, training; Covenants for monopolies of WSPs

(continued from p-15)

WDM area	Technical measures	Planning	Regulat-ions	Economic	Consultative
WDM for end-users	Metering; Different service levels; Loss minimization; Retro-fitting existing systems	Irrigation scheduling; Crop choice Agricultural extension; Auditing; Minimising institutional use	Domestic use guidelines and restrictions; Guidelines for private and public sector; Drought restrictions Proper level and structure of tariffs Amendment of water irrigation fees (too low and linked to area; not m^3)	Effective billing and pricing; Product standards; Differential tax rates (e.g. VAT). Higher energy tariffs make pumping expensive Volume-based effluent charges	Education, awareness, training
WC for return flow manage ment	Minimising infrastructure Minimising pollution Minimising losses Minimising infiltration Reclamation	Infrastructure optimisation Minimising pollution	Effluent standards	Effluent charges	Education, awareness, training Covenants for irrigation sector and public sector

Box 1: The Importance of Allocative Efficiency for IWRM

Allocative efficiency may be more important than user efficiency.

According to Allan (1995, quoted by Lundqvist, 1997):

"If allocative efficiency is not achieved, it is possible, and even common, to be doing the wrong thing extremely efficiently. It would be much more useful to be doing the right thing, that is with efficiently allocated water, a little bad"

Allan uses the example of Israel's agriculture, which is extremely water efficient, but the sector accounts for 70% of the country's water consumption and only contributes three to five percent of GDP.

The example also applies to irrigation in Southern Africa. Given the large water consumption by irrigation, two questions need to be asked:

How much water should be allocated to irrigation given the needs of people and other economic sectors?

How can the water efficiency of irrigation be improved?

Both questions need to be addressed to develop efficient, equitable and sustainable water management systems in Southern Africa.

Source: adapted from Lundqvist, 1997.

Box 2: WDM and Irrigation in Southern Africa

Irrigation accounts for around 70% of the region's water consumption.

Efficiency rates of different systems vary widely: surface systems 45-55%; sprinkler 75%; centre pivot mechanical 80%; micro irrigation 85-90%. (Macy, 1999 and Louw and Kassier, 2002).

A switch from surface to drip irrigation could save up to 45% of water. Surface irrigation is still common (38% in South Africa and 25% in Zimbabwe).

In Swaziland a switch from dragline sprinkling to drip irrigation saved 1.5 mega litre/ha, led to increased production (volume and value) and led to cost savings of $192/ha (lower operation and maintenance costs).

Goldblatt et al. (1999) estimate that 10 to 20% of irrigation water can be saved. A 20% water savings in the agricultural water consumption of South Africa amounts to more than the aggregate water consumption of Botswana, Lesotho, Namibia, Swaziland and South Africa together. The savings would be 10 times the expected yields of the Katse and Mahole Dam of the Lesotho Highland Water Scheme (Louw and Kassier, 2002).

Constraints for WDM in irrigation: no meters, low water prices reducing the benefits of water savings, high costs of new technologies, water payments per hectare and not per m^3 and finally strong agricultural lobby groups.

The sector's value added per m^3 is much lower than that of other sectors. This warrants a review of water allocations to irrigation, and possible relocation of irrigation to the northern parts of Southern Africa with less water scarcity.

Sources: Goldblatt et al, 1999; Lange et al, 1999; Macy, 1999; Louw and Kassier, 2002; Mmwendera, 2002; UN-Habitat, not dated.

Box 3: Water Conservation in Hermanus, South Africa

Hermanus is a small coastal town located 120 km east of Cape Town. A dam supplied water, but demand rose beyond the supply capacity of the dam, particularly during the peak tourism season, when the population triples.

In response, the local authorities designed and implemented a water conservation programme in 1996. The programme included the following measures: water loss management, clearing of alien vegetation and water-wise gardening, communication campaigns, education and school water audits, retrofitting and escalating block tariffs and informative billing.

The results: a drop in water consumption of 16.5% one year after the project implementation. A drop of 25.5% during the peak seasons (November-February). The results exceeded expectations. Water audits and water loss management proved very effective. The audits led to a 50% decrease of school water consumption. Water losses decreased from 18 to 11%. Informative billing was appreciated by end-users; retrofitting proved expensive and unpopular.

Source: Goldblatt et al, 2000.

Box 4: Water Conservation in Windhoek, Namibia

Windhoek has low rainfall (360 mm p.a.) and high evaporation (3 400 mm p.a.). Urbanisation, the hidden water demand of low-income groups and economic growth are expected to put significant pressure on water resources.

The city currently relies on surface water (17 M m^3), re-use of water (2.9 M m^3) and groundwater (2.3 M m^3). Plans exist to expand re-use of waster water and the feasibility of artificial recharge is being studied.

The city adopted a wide-ranging Water Demand Management Programme with the following components: policy measures: block tariffs, abolishment of water subsidies, water re-use, smaller plot size, commitment to reduce water consumption by 50%, guidelines for wet industries, new wet industries are required to re-use water. WDM campaigns with information dissemination and WDM-advice. Legislative measures: water Control Officers, product standards, poll covers, and control of groundwater abstractions inside Windhoek. Technical measures: leak detection programme and artificial recharge

Expected savings of N$ 6.8 million per annum excluding. benefits from delayed infrastructural investments.

Source: Goldblatt et al, 2000.

Box 5: Some Lessons from WDM Cases

WDM interventions are feasible, and usually save money;
Commonly used WDM measures: leak detection/ reduction, water pricing, awareness raising campaign;
Most WDM measures concentrate on increasing water use efficiency. Priority areas for WDM include; reduction of water losses, irrigation and luxury domestic use (gardening and pools). Macy (1999) recommends that the limited WDM capacity is directed to areas where the greatest environmental and economic results can be achieved;
WDM is most attractive when decisions about new infrastructure or rehabilitation of existing infrastructure have to be made;
WDM requires collaboration between water planners, water service providers and end-users;
WDM cases have to be based on local needs and conditions. Therefore, it is important that WDM is implemented at the local level (e.g. catchment area, river basin, settlements);
WDM efforts and results have to be weighed. For example, water service providers could aim at reducing water losses to 10%. Further loss reduction would be too expensive;
Droughts may accelerate WDM implementation. It is important that the 'drought momentum' is converted into long-term WDM interventions.

Two areas are rarely addressed, and therefore need government action:

For irrigation, few WDM measures are implemented spontaneously; and
Allocative efficiency is not common.

Sources: based on WDM country reports

4.1 Institutional Requirements for WDM Implementation in SADC - Rees Mwasambili

Introduction

Phases I and II of the IUCN-ROSA Water Demand Management Project have identified inadequacies in the institutional set-ups across the Southern African region as one of the major impediments to a successful implementation of effective Water Demand Management. Indeed the Namibian Country Report (1999) strikes a familiar chord by stating that "institutions dealing with water, or the legal framework within which the sector operates, lack the guidance, legal power and coherence or incentive structure for water to be managed effectively and efficiently" . The same report says that some of the main institutional failures relate to inappropriate budgeting and municipal finance procedures by local level water supply authorities; soft budget constraints on government water-users; insufficient skills and human resources capacity to manage water demand and to maintain infrastructure; and inadequate legal frameworks for WDM. These issues border on policy, legal/regulatory and enforcement frameworks, capacities (financial and human resources), and co-ordination mechanisms.

It appears clear that at the centre of any successful promotion and implementation of WDM in the region will be the right institutional set-up that is completely adaptive to the changing dynamics of both the resource (water) and the competing uses.

What then should be done to promote, establish, and enhance institutions for effective WDM practice in the region? In seeking to answer this question, this paper first presents and examines the case for water demand management in the 'ideal' world. This is by way of stating and analysing the roles, responsibilities, functions and institutional requirements for WDM promotion and implementation. Secondly, the 'real world' (current) institutional structures in the region are presented, and a comparison is made between the institutional dimension of actual WDM efforts and practices in the region (the real world) and the institutional arrangements that would be required to be able to fully embrace WDM practices (as presented in the ideal world).

Discussions in this paper are largely drawn from the preliminary findings of the Analytical Paper 3 (AP3); a current on-going development of an analytical paper on Institutional Requirements for WDM in Southern Africa.[1]

Requirements for WDM in the Ideal World

Setting the Stage

What roles, responsibilities and functions must be clearly defined, unequivocally designated, and fully met for WDM promotion and implementation – and the associated institutional[2] requirements in the ideal world? The ideal world, from a WDM perspective, presupposes equally ideal conditions for a flawless WDM promotion and implementation, encompassing the following:

---

1 AP3 is developed under IUCN-ROSA WDM Phase II Project

2 The paper restricts itself to eight (8) management levels (defined and justified by AP 3) common to the SADC region

(i) An enabling environment (policies, legislative framework, financing, incentive structures);
(ii) Clear institutional roles (an established organisational framework) and institutional capacity building; and
(iii) Management instruments (regulatory, economic, social, information, and water resources).

In such an ideal situation, the elements of the enabling environment (policies, legislative framework and, financing) provide the foundation or the operational framework for the latter two (institutional roles and management instruments).

WDM requires an appropriate policy and legal framework, financing system, organisational framework (institutional) and adequate management instruments. To make these different elements work, different parties involved need to possess sufficient information and expertise as well as incentives to function effectively and efficiently. The combination of skills, resources, instruments and incentives lead to institutional capacity befitting the needs of each institution. In this framework, the tools and systems that are put into place define the institutional capacity The following is a brief discussion of the elements making up an ideal environment.

Ideal Water Policy

> *Without appropriate policies, institutions cannot function, without appropriate institutions, policies cannot work*[3]

A national water policy sets national goals and objectives for the management of water, both resources and services, at the national level and includes policies for regions, catchments, shared or trans-boundary water resources, and inter-basin transfers). It addresses both the quality and quantity aspects of both surface and groundwater resources and also deals with delivery of water services (water supply and sanitation). The ideal water policy recognises and involves all related sectors such as agriculture, land use, forestry, industry, energy, trade, transport, tourism and other key areas of economic development. It also integrates the important relationships between water, health and poverty.

Some key institutional elements required in an ideal water policy include the following:

- Establishment of a national institution specifically responsible for WDM;
- Clear institutional separation of water planning and water supply functions;
- Decentralisation - recognising the importance of subsidiarity – to allow local control of water management in catchments, local authorities and community based institutions;
- A national water sector regulator, with some functions decentralised to lower level organs (local authorities, CWA)
- Provide for licencing of all water services by the water regulator
- Clarified roles of government and other stakeholders in achieving overall goals and especially defines the role of government as regulator, as organiser of the participatory process and indeed as the last resort adjudicator in cases of conflict.

---

3 IWRM Toolbox-GWP 2001

- Mechanism for institutional coordination during policy development

Ideal Water Legislation

The role of water law is to interpret and implement policy, and to provide for effective administrative and regulatory mechanisms at appropriate levels. Thus water laws create an enabling institutional framework, inclusive of the legal roles and responsibilities of institutions and their inter-relationship. Development of WDM supporting legislation should follow on from the development of integrated and coherent water policies.

Institutional characteristics of ideal water laws include:

- Separate legislation for both water resources planning and water services. The two may be in one Act or separate.
- Legislation for water quality.
- Regulatory functions including law enforcement
- Decentralisation where water resources allocation decisions are made at the lowest appropriate level and communities participate in water services management.
- National WDM institution to co-ordinate WDM implementation
- Water services and associated rights and responsibilities, such as: provision of water for basic human needs, and standards of service (quality of water provided, assurance of supply, efficiency levels etc.)
- Tariff and water pricing systems, including principles of fairness, affordability and protection of the poor.
- Clear mechanisms for water rights transfer to minimise conflicts
- Mechanisms for consumer protection, such as quick and appropriate access to information, participation and involvement in water resources management.

Ideal Organisational Framework (institutions)

Different types of institutions can be involved in water demand management, ranging from very large trans-boundary institutions to regional and local authorities, to much smaller community based organisations. The composition in any given country will largely depend on the nation's experience and requirements, and the roles, responsibilities and functions of these institutions vary greatly. This paper concentrates on eight management levels and end-use sectors given below, identified by AP3 common in the region. These are as presented in Box 1 below.

Box 1: WDM Management Levels Considered

International River Basin Authorities (IRBAs)
- Central government ministries/departments
- Catchment water authorities
- Bulk water suppliers
- Local/regional authorities
- Local (public or private) water suppliers or water service providers
- Local informal institutions
- Water end-users : Urban and rural households, industrial, commercial agriculture

(i) **International River Basin Authorities (IRBAs)** provide a framework for the management of water resources across international boundaries, where there are issues about the management of common property resources. IBRAs are

formal and legally constituted institutions governed by international law. At the minimum, key responsibilities of IRBAs include basin planning and management, co-ordination of the harmonisation of national WDM policies of basin countries, and promotion and coordination of joint basin monitoring, research and the development and management of information. Equity and adequate access, usually a source of conflict in international basins, is enforced through the IRBAs by ensuring that the countries sharing the basin have first exhausted all their national WDM opportunities before applying for use of shared waters.

(ii) **Central government ministries/departments** are responsible for national water policy and management; regulation and development of standards. In an ideal situation, different government departments deal with, on one hand, water ownership, planning and allocation, and on the other, supply functions. Due to the cross cutting nature of WDM, there is established an independent central WDM institution. The central WDM institutional organ has the overall/national responsibility of ensuring effective policy implementation and coordination of roles and responsibilities of various actors in WDM. A number of functions are decentralised to lower level management structures. Devolved functions include water management to/at catchment level (water planning and allocation, licensing and licence fees, water quality monitoring etc); bulk water supply to private or parastatal entities; and provision and regulation of water services to the local authorities or, in the case of regulation, even to an independent regulator. In this set-up the central government has no role in direct water supply to household end-users, whether formal or informal. The coordination and linkages from central to lower level structures is ensured through:

a. **Financial routes:** subsidisation (by WDM central institution) of poor catchment and local authorities to ensure access to water by all people; tax-sharing/remittances with/from catchment water authorities, bulk water suppliers, local authorities and water services providers; sharing licence/permit fees with the water services regulators, and local and catchment water authorities.

b. **Reporting/information routes:** this is by way of obligatory annual periodic reporting on institutional performance by lower level management structures. This is a two-way route whereby central government institution also respond to the performance of the sector through necessary instruments aimed at meeting any short-comings.

c. **Supervision of devolved functions:** monitoring implementation of policy and law functions devolved to other institutions such as local authorities, regulators and catchment water authorities.

(iii) **Catchment water authorities** (CWA) are responsible for water management in their respective river and lake catchments, or across an important aquifer. They are made up of a broad section of stakeholders who get involved in all the activities.

Major characteristics of ideal WDM catchment authorities include:

- Catchment-wide planning to balance user needs for water resources and to provide protection from water deterioration,
- Wide public and stakeholder participation in decision making and local empowerment
- Implementation and enforcements of incentives and sanctions against excessive water use
- Promotion of water efficient technologies (e.g. in irrigation)
- Community education and public awareness in water conservation and

efficient water use;

- Financial resources internally generated through application of full cost recovery water rates
- Responsible for developing agreements on commitments within the catchment and mechanisms for monitoring those agreements
- Trained and adequate human capacity.

Catchment water authorities promote WDM practices by ensuring that catchment beneficiaries adhere to the conditions of their water permits/rights/agreements. They draw their legal powers from both the water policies and water laws, which they implement and as such maintain an important link with central government institutions, through compliance to the laws and policies.

(iv) **Bulk water suppliers** — These may be either private or public/parastatal companies, and will supply the water to any sector, such as agriculture and urban areas. Bulk water suppliers strive for efficiency gains and thus both promote and implement WDM. They run efficient infrastructure by reducing water losses; recover full costs of operation, maintenance and replacement of pipes by applying economic tariffs and transfer the cost of supply to the retail suppliers. Additional finance is generated through financial markets. Bulk water suppliers link with water supply retailers (local authorities, private water services etc) and help them run more water efficient and cost effective water operations.

(v) **Local/regional authorities** are both water providers and regulators. Both water provision and regulation are delegated functions from central government and the national regulator respectively. Water provision management is further delegated to lower level structures in water utilities and water end-users. WDM funds in local authorities are generated from internal cost recovery, rate structures, permit fees, special taxes, application of WDM surcharge on the water bill, and central government subsidies to poor authorities. Water activities at this level are ring-fenced and all revenue from water supply is used on water only, and therefore water departments are in charge of water revenue as opposed to finance departments.

This management level is the closest institution to the users. Local governments offer a strong forum for local participation and are instrumental in disseminating information and supporting dialogue among stakeholders and policy makers. It also plays a co-ordinating role as well.

There must also be sufficient staff of adequate capability to enforce regulations and make correct assessments about water management needs. Any changes to municipal policies should be linked to changes in official staff roles and responsibilities

(vi) **Local (public or private) water suppliers or water service providers** are responsible for local or regional (within-country) water distribution, and these may be entities operating under contract (on the basis of service or management contracts) by local authorities, franchised operations, or joint ventures involving different public and/or private partnerships.

Water services providers, like local/regional authorities, are driven by the need

to make efficiency gains in their operations; to do more with less water. They eliminate subsidies, incorporate externalities and minimise impacts to recover all costs of operations, and transfer the cost of supply and treatment from the provider to the consumer (citizens, private companies, government institutions, and other users). Water tariffs (set at full cost) and other charges are a significant source of finances. Thus water service providers both promote and implement WDM. This category has access to private sector finance which may come at a high price.

(vii) **Local informal institutions** provide water supply in areas that suffer from inadequate or missing water supply and precarious or non-existing water distribution infrastructure, and that are usually afflicted by general conditions of poverty, such as the rural and peri-urban areas. These are non-governmental organisations (NGO) or community based organisations (CBO), and are involved in promotion and implementation of WDM. In the ideal the informal institutions are legal entities enjoying legitimacy both from the communities they serve and other sector stakeholders. Informal institutions are involved in WDM through (i) education and awareness creation (promotion), (ii) advocacy on behalf of the poor people, (iii) mobilisation of communities for involvement in water resources management and water delivery, (iv) promotion of cost recovery, water conservation and metering of public taps in peri-urban areas.

(viii) **Water users : Urban and rural households, industrial, commercial, agricutural:**
Urban and Rural Households
This level is closely involved in water services management. Thus they participate, with water provider, in tariff setting and adjustment, water quality monitoring, repair and maintenance of infrastructures (retrofit their plumbing fixtures), and practice water conservation. This is a WDM implementation-only level, meaning the end-user responds to the various WDM instruments imposed by water suppliers. Other features include consumers having access to relevant information on options for using water more efficiently; proactive communications from suppliers to users; quick client response from the supplier to complaints/reports of leakages and timely paying of water bills.

Industrial and Commercial
WDM practice at this level involves total water re-cycling and re-use, use of efficient technologies (e.g. retrofitting), water conservation; and meeting full cost of the water supplied.

A summary of the institutional roles, responsibilities and functions for WDM promotion and implementation in their ideal world - and associated institutions are presented in the matrix below.

Table 1: Roles, Responsibilities and Functions for WDM Promotion and Implementation in Ideal World.

	INSTITUTION	ROLES/RESPONSIBILITIES/FUNCTIONS	INSTITUTIONAL REQUIREMENTS
1.	*International river basin authorities*	provides a framework for water management across international boundaries within common river basins cutting across two or more countries in the region river basin management and planning coordinate harmonisation of national WDM laws of riparian countries promotes WDM through regional policies which are incorporated in national policies	legally /formally constituted between/amongst participating countries adequate financial resources from basin states presence of political will of governments commitment of creating partners adequate human and institutional capacities
2.	*Central government ministries/ departments*	coordination of development of WDM policy strategy and regulations; policy gender sensitive Separation of water resources, regulation and water supply functions in different departments licencing of all water users offer monetary incentives and invoke sanctions delegate functions to lower level structures promote WDM education in schools	central WDM institution independent/autonomous water regulator adequate and secure financial resources unwavering government political will adequate human and institutional capacities create annual budgeting for WDM promotion budget for WDM promotion
3.	*Catchment water authorities*	water resource management issues in a particular (domestic) river or lake basin, or across an aquifer; ensures reflection of land use and needs in water management. water allocation, resources planning, education of basin communities, water quality monitoring focus on serious recurrent problems such as flooding or drought or water shortages; and provision of solutions	effective policy and legal framework clear jurisdictional powers and boundaries broad stakeholder involvement and participation (through appropriate for a) Generates revenue through water rates, fees, grants etc. has core technical competencies
4.	*Bulk water suppliers*	provides bulk water to urban and rural areas for irrigation and water supply promotes WDM in its dealings with its clients through water tariffs, helps retail suppliers run efficient and effective water operations etc;	Efficient infrastructure (through water loss control) Adequate human capacities Recover all costs at full cost of operation

(continued from p-26)

5.	*Local/ regional water authorities*	Provide water supply (may also provide sanitation, treatment and pollution control services) to rural and urban communities, for drinking, industrial use etc. promote WDM through regulations (by-laws), public education, economic instruments (rate structures and charges, permit fees, fines etc. regulates water services and promotes/uses efficient technologies; promotes water conservation and reduction in water loss Applies various economic instrument promotive of WDM	adequate finances (recovers all costs internally) to run functions excellent infrastructure Adequate human resources
6.	*Local (public, private, or PPP) water suppliers or service providers*	finance water resources management through investments in service delivery in WSS, irrigation provides water supply ,sanitation, treatment and pollution control services to rural and urban communities, for drinking, industrial use etc. WDM implementation through use of efficient technologies	adequate human expertise mobilises investment funds Operating under good regulatory framework Full cost recovery from water rates
7.	*Local informal institutions (NGOs, CBOs))*	meets local water supply needs advocate for nature and environment protection promotes community awareness in water loss control, water conservation, education, payment of bills, mobilise local communities for participation in local water resource management and water delivery	recover most costs cross-subsidised by local/central authority ability to meet standards of water use, conservation and health provide corroboration/linkage with service providers
8.	*End-users:* *Urban and rural households as water?*	participation in tariff setting and adjustment water quality monitoring repair and maintenance of infrastructures (retrofit plumbing fixtures), water loss reduction and practice water conservation.	consumers have access to relevant information to options available for using water more efficiently; proactive communications from suppliers to end-users; quick client response from the supplier to complaints/reports of leakages and timely paying of water bills
	Industrial and commercial	*water re-cycling and re-use,* *use of efficient technologies (e.g. re-trofitting),* *water conservation;* *meeting full cost of water consumed* *reduction of water pollution*	efficient water use processes

Current (Real World) Institutional Structures for Water Management (and WDM in Particular) in Southern Africa

WDM regimes in Southern Africa are beginning to emerge within evolving national institutional contexts of water management and use. Each country in the region currently has its own set of institutions engaged one way or another in water resource management, water service delivery, and/or water use. Water sector reform processes currently ongoing in most, if not all countries in the region (of which emerging WDM regimes are an integral part) have been altering the roles and responsibilities of some of the existing water management institutions while creating new institutions at national and local levels where necessary.

At the same time, a regional institutional regime dedicated to the co-ordinated or joint management of water resources that are shared among neighbouring countries (as is the case for all major rivers in the region) has been evolving under the tutelage of SADC. This sub-section briefly introduces and characterises the kinds of regional, national and local institutions involved in water management, service provision and use in Southern Africa.

Inter-governmental level

Southern African Development Co-ordination (SADC)

SADC created a Water Sector Co-ordination Unit (WSCU) in 1996 with a mandate of co-ordinating and harmonising national water legislation, policies and management regimes across its member countries. Based on the SADC Protocol on Shared Water Resources (1995), SADC WSCU developed a Regional Action Plan (SRAP) on Shared Water Resources for the period 1999-2004.

SRAP attempts to offer a regional framework for an integrated approach to water development and management in the region and calls for more human resources and greater institutional capacity to be able to implement such an approach. A comprehensive regional WDM policy for the SADC region is currently being developed under the co-ordination of WSCU.

Inter-governmental Institutions and Organisations with Jurisdiction over or Responsibilities for Specific International River Basins (water catchments)

Various bilateral, multilateral and international agreements have led to the establishment of different inter-governmental institutions and organisations which have been mandated to implement agreed principles and procedures for co-ordinated or joint action regarding the management and use of shared catchments (or basins) and/or new water supply infrastructure within these catchments. These inter-governmental institutions so far have rarely if ever ventured into the realm of WDM, although some of their actions may have been of relevance to WDM. Examples of such inter-governmental entities are:

- Joint Water Commission between South Africa and Swaziland to co-ordi nate the management and use of shared water;
- Komati Basin Water Authority (KOBWA) set up under the Joint South Africa – Swaziland Water Commission to oversee the construction of two dams;[4]
- Permanent Water Commission between South Africa and Namibia, estab lished in 1992 to co-ordinate all matters relating to the management and use of shared water (mainly the Orange River);

- Permanent Joint Technical Commission (PJTC) between Angola and Namibia on the Cunene River, established in 1990, with the priority of developing the Epupa Dam;
- Joint Permanent Water Commission between Botswana and Namibia, established in 1990 to deal with the Okavango River and the Kwando-Linyati-Chobe river system in the Zambezi River Basin;
- Permanent Okavango River Basin Water Commission (OKACOM) between Angola, Botswana, and Namibia, set up in 1994 to oversee development in the Okavango Basin;
- Zambezi River Authority set up to implement the Zambezi Action Plan, involving all eight riparian countries.

Recent SADC policy, as set out in the 1995/97 Protocol on Shared Watercourse Systems and the (1999-2004) Regional Action Plan in Integrated Water Resource Management and Development provides for the establishment of an inter-governmental River Basin Authority in each of the major shared international river basins. The idea is for each River Basin Authority to serve as an institutional mechanism for basin-wide catchment management, co-ordination of water abstraction, use and management practices, and harmonisation of water policies among all riparian neighbours (members of the Authority).

Central Government – Ministries and/or Departments Involved in Water Resources Management

Throughout the region, ultimate water rights and responsibilities are vest within the state.[5] In each country, a country-specific set of central government ministries and departments has been put in overall charge of national water planning, policy implementation, development, and regulation, as well as country-wide service delivery (water supply & distribution).

In Zimbabwe, for example, the Ministry of Rural Resources and Water Development – and under it, the Department of Water Development (DWD) – have the overall mandate of water resources development and management (but no longer water regulation); the Ministry of Local Government and National Housing (MLGNH) is responsible, through local authority structures, for water distribution in (most of) the major local authority areas; and the Ministry of Lands and Agriculture (MLA), through its Department of Agricultural Technical and Extension Services (AGRITEX), is in charge of agricultural water supply and management (mainly small-scale irrigation schemes).

1 Mozambique, another riparian neighbour sharing the Komati Basin, was excluded.
2 Previous individual private ownership of water (particularly by private land owners) in countries like South Africa or Namibia has been abolished in recent water policies and legislation.

In Zambia, the Ministry of Energy and Water Development, through its Department of Water Affairs, is responsible for water resources planning, development and water use regulation; while the Ministry of Local Government and Housing (MLGH) is in charge of water supply and sanitation delivery services in local authority areas. Local authorities have further devolved this function to water utilities. An independent water regulator for water supply and sanitation has been established.

In Botswana, the Ministry of Minerals, Energy and Water Affairs has overall responsibility for water policy and planning, and is also in charge of rural water supply to so-called urban villages (settlements of more than 5000 people); the Ministry of Local Government, Lands and Housing (MLGLH) is responsible for rural water supply, through rural District Councils; and the Ministry of Agriculture (MoA) has responsibility for livestock water provision and small irrigation dams.

Finally, in South Africa, the Department of Water Affairs and Forestry (DWAF) has overall responsibility for water policy and planning; and the Department of Agriculture (DoA) is in charge of on-farm water distribution and use (irrigation schemes).

The potential, if not actual, conflict of interest between the central government's water resource planning, development and service delivery functions, on the one hand, and its water-related regulatory functions on the other has led some countries – e.g. Zimbabwe, South Africa, and (soon) Namibia to institutionally split these two responsibilities (or to propose to do so) by entrusting a separate department or a newly created independent statutory agency with all water-related regulatory functions, as part of ongoing water sector reform processes. The idea is that most if not all water use is to be controlled by means of licenses (to be) issued by these regulatory bodies.

Lower-level Water Authorities

Catchment Water Authorities

Some countries in the region – e.g. South Africa, Zimbabwe, and Namibia — have formalised and (aside from Namibia) legally anchored new institutional frameworks for integrated catchment management and the establishment of multi-stakeholder catchment water authorities mandated to oversee the development and implementation of catchment management strategies and plans. Catchment water authorities (e.g. Catchment Councils in Zimbabwe) are being set up for all major catchments (e.g. Water Management Areas in South Africa), taking on, within their respective catchments, broad water management responsibilities being devolved from the central government.

Local Government Authorities (in urban areas)

Cities, towns and urban villages (above a certain size) have long had or recently evolved their own local authorities who, inter alia, are legally responsible for service provision, including water distribution, within their respective areas of jurisdiction. In larger cities, more developed municipal authorities have set up their own line departments specifically dealing with water service provision.

Community-based Institutions (in rural areas)

In rural areas (and peri-urban areas), the approach to more effective local water resource management and service provision has been to devolve management re-

sponsibilities to local community-based institutions. These institutions differ with respect to the range of service sectors they cover and they come under different names such as rural Water Point Committees (Namibia), rural integrated Water, Sanitation and Health, Education (WASHE) Committees (Zambia), or peri-urban Resident Development (RDC) Committees (Zambia).

Bulk Water Suppliers

These are organisations that are in the business of selling bulk water supplies to local authorities as well as large individual consumers (such as major mining operations and large industrial establishments). Bulk water suppliers own and/or operate extensive water supply infrastructure (such as dams, boreholes, and pipelines) and may be public, private or mixed public-private companies. However, in Southern Africa most bulk suppliers are public agencies (parastatals) linked to respective ministries in charge of water, but they are often run on commercial principles. Some of the public bulk water supply companies have been set up by acts of parliament, as statutory organisations. An example is the Namibian bulk water supplier NamWater and RandWater in South Africa.

Local Water Suppliers/ Service Providers

A variety of organisations are responsible for local water distribution. In urban areas, some local authorities, probably the majority in the region and especially those endowed with better human resources and greater institutional, technical and financial capacity (Windhoek, Harare) supply water by themselves (using their own internal resources). Other local authorities provide water services to their local constituencies in partnership with other public or private organisations (Nelspruit concession), using different forms of contractual arrangements. Yet others have delegated the authorities to public water utilities (Zambia).

In rural areas, some of the water is supplied by the central government through the relevant line ministry, often the ministry in charge of local government (Botswana), while many rural households satisfy their basic water needs informally (by withdrawing water from nearby rivers, springs and lakes or by manually digging shallow wells). Peri-urban households lacking access to water distribution infrastructure (e.g. community standpipes) may also resort to informal water supply.

Local Informal Institutions

In many rural and peri-urban areas in the region, local informal institutions (CBOs and NGOs) assist rural households and communities with water supply, particularly in the poorest areas suffering from inadequate or missing water supply and precarious or non-existing water distribution infrastructure. These informal institutions provide resources and offer expertise that may be critical to meeting basic human water needs in the areas in which they operate. Such institutions are common in Zambia where they enjoy wider support and legitimacy.

End Users

The final destination of water supplies and services are a wide range of water end users:

- households in central urban areas (connected to central piped reticulation systems) and planned settlements in peri-urban areas receiving water at lower service levels (e.g. neighbourhood standpipes);

- rural households and unplanned settlements in peri-urban areas;
- a range of public and private institutions, such as schools, hospitals, municipal gardens, government departments, and military bases;
- a variety of industrial establishments in the primary, secondary, tertiary and quaternary sectors (mining, manufacturing, tourism, services, research and development, and information management sectors)
- agricultural and forestry operations - including large-scale commercial operations as well as small-scale subsistence-level operations, most importantly irrigated crop cultivation, domestic animal husbandry, and commercial forestry plantations.

Role of Communities in Formal and Informal Water Mnanagement Institutions to Promote WDM

The role of communities in promoting and implementing WDM is crucial to the success of any WDM programme. Communities are water users and thus play the following role:

Formal Management Institutions

- Participation in water resources management at catchment level (e.g. Zimbabwe, Namibia)
- Water use reduction through retrofitting of household water and sanitation fixtures (Windhoek);
- Participation in water allocation and quality monitoring (CWA-Zimbabwe),
- Prompt payment of water bills
- Practice water conservation and participation in public awareness

Informal Management Systems

- Increase water through education and awareness creation in water wise use,
- The development and oversight of water delivery and sanitation systems in the rural (WASHE) and peri-urban (RDCs) areas of Zambia;
- Setting water services tariffs (Peri-urban –Lusaka)
- Reducing vandalism through community education and pressure

Mainstreaming WDM in the SADC Region Institutional Reform and WDM Practice

Institutional Gaps between the Ideal and Real World

Discussions from previous chapters can be summarised as follows:

(i) Institutions in the ideal world when compared to those of the realworld have the following strengths:

- They are anchored in WDM promoting and supporting water policies and laws
- Have a national level WDM specific institution to promote, monitor and implement policy
- Adequate finances and elaborate financing arrangements (budgeting, various taxes, fees etc) for implementation
- Possess a diverse and adequately trained human resources base;
- WDM management instruments fully used and enforced
- Elaborate co-ordination structures, both horizontally and vertically.

- Well developed information management and dissemination.

(ii) On the other hand, real world WDM as practised in the region is characterised by the following institutional problems:

- no lead institutions to promote WDM
- few countries (Namibia and South Africa) have WDM integrated water policies/strategies and laws. This lack of operational framework is partly responsible for few WDM institutions in the region.
- most potential WDM functions are centralised
- weak or non-existent institutional linkages and co-ordination
- inadequate financial and human capacity; no WDM specific budgeting
- poor cost recovery
- poor information base and exchanges at inter- and intra-management level
- lack of/weak institutional integration of functions that belong together (water supply and sanitation)

Thus the latter list describes some institutional gaps requiring attention in order to implement WDM effectively in the region.

Institutional Reform - Transcending Current Problems

In order to move from the current state of ad hoc and little WDM practice to full implementation, there is need for deep institutional reform. Institutional reform is intrinsic to water policy and regulatory reform. In other words mere organisational re-arrangements are unlikely to lead to effective WDM unless the water policy and legal framework are reformed.

Due to the different institutional developments across the region, it is very difficult to prescribe a common institutional reform at each management level described in this paper. While recognising individual country needs, some general and common fundamental elements can be identified that should precede institutional reform, and can assist WDM mainstreaming:

- Integration of WDM in water policies, laws, strategies and projects. The aim is to operationalise WDM into specific programmes and interventions.
- Integration of WDM at all levels of management (from international to local)
- Integration of gender issues in WDM policies and strategies.

The institutions should then be reformed and adapted after the principles outlined above. While there is a whole range of reform activities needed to mainstream WDM, the indicative 'wish' list below gives minimal requirements for the region:

(i) **Setting up a central WDM institution (independent or autonomous)**: to be responsible for monitoring the implementation of WDM policy and strategies; budgeting, sourcing and arranging for WDM funds; setting of quality standards

(ii) **Establish annual WDM budgeting**: institutions at all levels of WDM management should budget for WDM activities

(iii) **Establishment of a national water regulator** (for both water services and water use): To enforce water laws; licence water users, approve tariff and monitor service standards. Aspects of this function should further be decen-

tralised to lower level structures, to the catchment and local authorities.

(iv) **Decentralisation** : setting up and strengthening existing catchment authorities;

(v) **Integrating water supply and sanitation** service functions within local authorities;

(vi) **Integrating water supply and revenue** functions within the water department, followed by ring-fencing of water revenues;

(vii) **Development of information management systems** at all management levels. All information should finally be housed and co-ordinated in the national WDM institution

viii) Devolution of WDM enforcement powers to local and catchment authorities

(ix) **Legalising informal institutions** and devolving certain local authority functions such as water quality monitoring and rate setting to them.

(x) Discouraging the following anti-WDM practices:(i) employers from paying their employees' water bills; (ii) central billing within government

(xi) Encourage and enforce participatory approaches between water suppliers and users

(xii) **Improving understanding of WDM** through awareness raising campaigns among water institutions decision makers. Such campaigns should highlight the WDM benefits and give WDM a positive 'flavour'

(xiii) **Human capacities**: Institutions begin to broaden their disciplinary expertise to be able to implement WDM properly through training workshops and recruitment of a wider range of disciplines into water planning institutions to redress the supply bias. There is need for expertise such as policy analysis, economic analysis (Cost Benefit Analysis), socio-cultural analysis, and gender analysis.

(xiv) **Central governments should introduce** WDM training at formal educational institutions (tertiary institutions) as well as short courses.

(xv) **WDM strategies need to integrate gender considerations**

Conclusion

WDM has failed to take off in a significant way in Southern Africa partly because the existing institutions in water resources management are not suited to its promotion and practice. At the same time, there exist WDM practices in all the countries in the region, albeit on an ad hoc basis. Institutional failures are evidenced by inappropriate financing mechanisms that hinder WDM, inadequate human resource capacities and skills for effective WDM implementation, and weak policy, legal/regulatory frameworks for WDM.

In order to understand what is required to move WDM forward, an examination of the current institutional set-up in the region is required. The gaps in the current institutions require institutional reform that is rooted in water policy and law reform. Mainstreaming of the WDM in institutions includes creation of new institutions such as a central WDM-specific institution to be responsible for WDM policy implementation and coordination and a national water regulator (for water services and use). It also includes strengthening existing ones such as local authorities so that they are able to implement WDM and legalising informal institutions where they enjoy legitimacy.

It also means putting in place clear financing mechanisms such as permanent WDM budgets, high collection efficiency of water rates and fees and external funding.

References

Kgathi D.L. and E. Segosebe. 1999. WDM in Botswana. University of Botswana, IUCN Pretoria.

Chavula, G.M.S., 2002. Overcoming constraints to the implementation of WDM in Malawi and proposed measures for overcoming them. IUCN, Pretoria

Department of Water Affairs, 1999. National water conservation policy and strategy framework: rationale, methodology and way forward. Gaborone.

Global Water Partnership IWRM – ToolBox, 2001

Gumbo,B., D.Juizo and P. van der Zaag, 2002. Urban WDM in Southern Africa: information management system for implementation and monitoring. IUCN Pretoria.

Hazelton,D. Nkhuwa and P. Robinson, 2002. Overcoming constraints to the implementation of WDM in Southern Africa: Vol.1 Synthesis report; vol. 4 case studies, advocacy and implementation tools. IUCN Pretoria.

Kampata, J.M., A. Mondoka and S.F. Shisala, 2002. The application of WDM to rural areas in Zambia.

Krugmann, H. and R. Mwasambili, 2003. Institutional Requirements for WDM in Southern Africa (draft Analytical paper)

Mwendera, E., 2002. Overcoming constraints to the implementation of WDM in Southern Africa: Swaziland country report. IUCN, Pretoria

Ndamba,J., J. Sakupwanya, J. Madoko and P. Manamike, 1999. WDM in Southern Africa: the Zimbabwe experience. IWSD and IUCN Pretoria.

Nkhuwa, D.C.W., 2002. Overcoming constraints to the implementation of WDM in Zambia. IUCN, Pretoria.

Nyambe,I., R. Mwasambili, L.Mate, C. Lungu, and C. Maseka, 2002. WDM Country Study for Zambia. IUCN, Pretoria.

SADC-WSCU, 1998. Regional Strategic Action Plan for integrated water resource development and management in SADC countries (1999-2004).

SADC, 2002. Protocol on shared watercourse systems. Gaborone.

Scene-Ries, 2002. WDM Country study Mauritius. IUCN, Pretoria.

Turton, A., 2002. WDM as a concept and policy: Towards the development of a set of guidelines for southern Africa

4.2 Policies Leading to Water Conservation and Water Demand Management in Botswana – Oarabile Serumola

Country Background

Botswana is located in the central, Southern Africa subcontinent landlocked by three countries: Namibia in the west, Zimbabwe in the north and South Africa on the eastern and southern side. It has an area of 581 730 square kilometers (km^2).

Being one of the driest countries in Southern Africa;the mean annual rainfall varies between 250 mm in the south-west and 650 mm in the north. Average evaporation is 2000 mm/annum. The average mean annual rainfall over the whole country is 450 mm with total precipitation estimated at about 230 cubic kilometers per annum (km^3).

Most of the water originates from rainfall that is erratic and unreliable. About 80% of the precipitation is lost due to evaporation. Only 2% ends up as surface runoff, 1% reaches the groundwater table, 17% utilised for biomass generation is ultimately lost through evapo-transpiration.

The development of dams to capture surface water has been hampered by flat topography and high evaporation rates. About 80% of the population and livestock depend on ground water. There is need for a long-term sustainable yield of ~200Mm^3/a of which ~130Mm^3 has already been developed. Major constraints include: low recharge; water quality; great depth and depletion

The water resources in Botswana can be divided into two groups:

- Internal water sources – mostly seasonal in nature
- International shared water sources
  - Okavango (Angola, Botswana, Zimbabwe)
  - Limpopo (Mozambique, RSA, Zimbabwe)
  - Zambezi (Angola, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe)
  - Orange (Lesotho, Namibia, RSA)

Access to utilisation is subject to negotiations.

Most of the internal rivers are ephemeral and only provide sufficient water during a year of good rain. Perennial river systems are the Zambezi (Chobe) and Okavango Rivers.

Total mean annual runoff is ~ 50 000 Mm3/a. Access to large scale utilisation is subject to negotiation. Only 10.0 Mm3/year is utilised for domestic use. Other unconventional water sources are treated effluent discharged into rivers.

Except for servicing industries such as the mines, the Botswana Meat Commission, etc there is no heavy industry that consumes substantial amounts of water. Their water consumption is included in the urban and rural domestic water consumption.Except BCL Mine, Orapa, Letlhakane, Jwaneng diamonds mine utilises underground water.

Six major mining/urban centres, 17 major villages and more than 460 rural village water supply schemes. The National Water Master Plan was commissioned in 1991, to ensure that development of water resources is done in a sustainable way to cater for water requirements for all sectors of the economy over a period of 30 years (1990-2020).

- Close monitoring of ground water wellfields
- Use of alternative technology
- Development and management of water supply by local communities
- Coordination
- WC and DM measures and interventions

Interconnection of Water Supply Schemes as a Measure to Respond to Drought

In the agricultural sector, ~ 20 000 ha of land is suitable for irrigation with only about 2 000 ha under irrigation. Out of these irrigated areas ~ 68.5% utilises ground water, 16.5 % dams in ephemeral streams and 15 % perennial rivers. If further irrigation is developed this will cause a large increase in the water demand.

Development of a National Master Plan for Agricultural Development (NAMPAD).

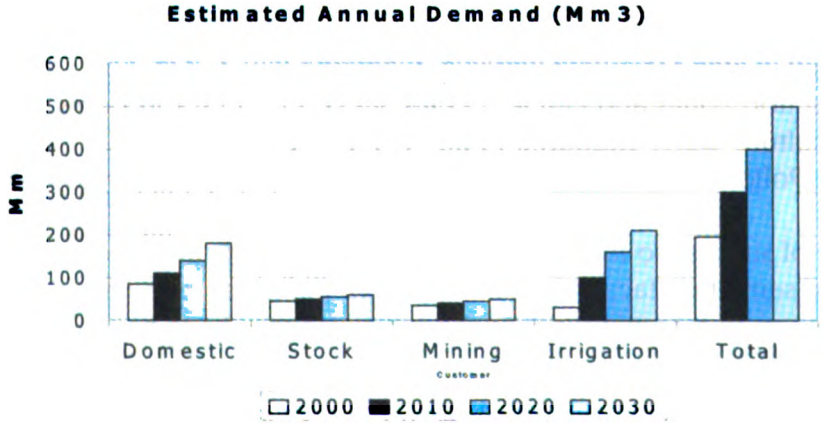
- Identify potential water sources for agricultural activities
- Propose potential sources to be assessed
- Utilisation of urban wastewater and some polluted sources
- Construction of small dams to support agricultural activities in the cattle posts and farmlands

The use of wastewater for agriculture, is an important option to look into since unavailability of water in Botswana makes crop production difficult, especially for horticulture. In addition, rain-fed agriculture has also proved to be difficult. This leaves irrigation as a possible way of increasing crop production and diversifying agricultural production to feed the growing population, create employment and generate income opportunities for local communities.

Given the rate at which development is taking place in Botswana, compounded by the scarcity of reliable water supplies, it is inevitable that uncontrolled demand for water will eventually exceed the capacity of available water resources.

The Water Utilities Corporation, a parastatal body supplying water to the urban centres recorded an average annual increase in the urban centres of 6%, whilst the agricultural sector constitutes 38% of the total water demand in the country.

According to an NWMP study, the capacity of the available water resources in the country which is estimated at 410 Mm^3/annum, already ~ 220Mm^3/annum is committed.



While this has been predicted and is frequently announced at international conferences, WDMS has not yet been fully implemented. The urgent need for reforms in water policy has been highlighted at different forums:

- International agencies (SADC, World Bank, FAO, UNESCO and IUCN, etc).
- Governments

The so-called Dublin Statement (1992) prepared for the Earth Summit in Rio de Janeiro expresses the new principles that are influencing efforts to conserve and protect water in many countries:

- Water is a holistic resource and should be managed in an integrated man ner. To obtain maximum benefit for society, all sources, users and uses of water should be taken into account when planning and managing water.
- Water is a scarce commodity and has an economic as well as social value. Applying the economic value of water is necessary to promote more 'efficient' demand, reduce waste and loss and shift consumption towards higher value uses.
- Water is an environmental asset. The way we exploit, supply, use and dispose of water has drastic impacts on the environment. Water is essential for maintaining the natural environment, with an inherent value which, should be recognised and catered for in the face of many competing uses.

In 1999 a National Water Conservation Policy and Strategy Framework Document was prepared, to provide the rationale,methodology and a recommended "way forward" process to facilitate the introduction of widespread water conservation practice and demand management measures at national and local levels:

- Background information on water conservation and demand management in Botswana
- Overview of Botswana's water sector
- General strategy considerations
- Specific strategies towards water conservation

Other policy issues, acts, guidelines and water management aspects, which are interrelated and have an impact on water conservation are as follows:

- The National Water Master Plan
- Draft policy on wastewater and sanitation management
- National Master Plan for Agricultural Development
- Protocols on shared watercourses
- EIA Bill, Water Act, Water Works Act, Aquatic Weeds Act
- Protection Zones and Guidelines for Major Aquifers and Dams
- Agriculture Water Resource Policy Guidelines
- Draft Policy on National Resources Conservation and Development, etc.

A large measure of success so far has been achieved through the provision of safe water supply and sanitation facilities. About 99% of the urban population has been provided with access to safe water, while the initiatives that have been

taken with regard to rural water supply resulted in 90% coverage.

The Development of National Water Quality Standards

* Hydrological Data collection was carried out in eastern Botswana, Okavango Delta and the Kwando/Linyanti/Chobe region.

Institutional Framework

Water resources belong to and are controlled by the state. Ministry of Minerals, Energy and Water Affairs (MMEWA) is responsible for policy formulation, planning, development and management of water and mineral resources. Its responsibilities relating directly to water are discharged through the Department of Water Affairs (DWA), the Department of Geological Surveys (DGS) and the parastatal Water Utilities Corporation (WUC).

DWA also provides the Secretariat of the Water Apportionment Board.

In addition to MMEWA's key role, other ministries that are involved in water activities include:

- The Ministry of Local Government
- The Ministry of Agriculture
- The National Conservation Strategy (Co-coordinating) Agency (NCSA)
- The Ministry of Health

Legal Framework

The main body of legislation in Botswana directly concerned with water and pollution comprises five Acts, some of which have been amended:

- Water Act (1968),
- Boreholes Act (1956),
- Waterworks Act (1962) and Waterworks Amendment Act (1983),
- Water Utilities Corporation Act (1970) and WUC Amendment Act (1978),
- Waste Management Act (1998).

Besides these principal statutes, there are other Acts which have a bearing on water, though some only marginally:

- The Public Health Act
- The Local Government (District Councils) Act
- The Aquatic Weeds Control Act
- The Mines and Minerals Act.

Botswana also has access to several international river basin organisations such as:

- The Joint Technical Commission between Botswana & RSA on Limpopo, Molopo and Nossob rivers

- Okavango River Basin Water Commission (OKACOM) between Angola, Botswana and Namibia on the Okavango River (1994), etc

Conclusions

It is clear therefore, that demands on water affect many diverse stakeholders and interested groups. There is no formal national water policy document and most of the policies are contained in legislations and feasibility studies. The need to mobilise and harmonise existing Acts, regulations and bye-laws; DDPs, policies etc. to contribute meaningfully to a definitive policy document for water. The current type of institutional setup lends itself to a 'do nothing' syndrome. The success of any water resource development is based on stakeholder involvement and participation at all levels while taking full cognisance of the role of women in the provision and management of water sources. Botswana as a signatory to some commission and agreements on shared water courses needs to harmonise her existing water policies with those of other states in shared river basins.

Discussion

- One participant congratulated Botswana for having a good gender balance in the Water Department.
- WDM cannot be centralised, everybody needs to be involved so that it is integrated into all institutions concerned, for example Finance Ministry (if WDM is going to lead to saving)
- To get recommendations so that institutions can be involved
- On the suggestion that Botswana, South Africa and Namibia's Water Demand Management projects should be used as benchmarks, some participants felt that it might be a problem because situations are different in various countries.
- The following points were raised by the participants:
    - Government cannot be responsible for 100% of their country's requirements
    - It is a race that cannot be finished at the same time (by all the countries involved) we are all going in one direction
    - WDM process must be institutionalised and existing opportunities should be recognised
    - Framework and policy should be developed
    - has been Everyone must take on the responsibility
- We must not get carried away by Integrated Resource Management as institutions do not have the capacity to put laws into force.
- No amount of talking will bring change. The key is for every country to get the right people to do the work from the top man to the last. It's better to implement what we preach instead of just producing a report.

4.3 Practical Implementation of Water Conservation and Water Demand Management in Botswana - Bogadi Mathangwane

Introduction

Water in Botswana is precious. Historically, total rainfall over Botswana is declining quite rapidly. Groundwater sources are constantly being mined and data on the dam levels around the country show a decline. This is worsened by the harsh weather conditions that have prevailed in Botswana over the past number of years. Maun was once described by early travellers as " A Green Oasis Surrounded by Blue Water" - (Laurence G. Green - "The Rivers End"; and Laurence Van der Post - "The Lost City of the Kalahari). Even the mighty Okavango, does not penetrate as far as it did just a few hundred years ago. Many of Botswana's rivers are no longer flowing, many areas are mere dust bowls. All these natural disasters place a greater burden on the limited water resources in the country and we will need to use our limited water resources wisely and efficiently if we have to sustain it for the future. Water conservation is not just for individuals at DWA, it is a job for all of us - a team with each player playing a very important and responsible role.

The National Water Master Plan (BNWMP), prepared in the early 1990s, provides a framework for development and allocation of the nation's scarce water resources in an attempt to match water availability with projected demands in the foreseeable future. The plan also identified wastewater as a potential resource that should be incorporated into the water resources planning process. However, it should be emphasised that the Master Plan to a large extent is concerned with finding ways to develop water resources to increase water supplies in response to an increasing demand i.e. 'supply driven'.

It should be noted that, in a rapidly developing country such as Botswana, the limitations of focusing on demand alone, have been highlighted:

- in many areas demand has surpassed sustainable levels of supply
- new sources are increasingly expensive to develop, driving up prices and therefore the need to keep water affordable
- degradation of the water resource both in quality and quantity has had negative impact on dependent, life supporting ecosystems
- economic development has put pressure on the quality of Botswana's water resources and on the natural environment
- funding is an eternal constraint and many previous investments have proven not to lead to sustainable technical, financial and institutional development
- supply alone does not instill a consciousness of conservation among consumers
- supply alone does not provide incentives to consumers to implement savings measures

The Government of Botswana is now committed to creating the necessary framework to facilitate the principles of water conservation and water demand management as an integral part of future sector planning activities and in the provision of water. In line with government's commitment to promote water conservation, a National Water Conservation Policy and Strategy Framework document (NWCSF) was developed to facilitate the introduction of widespread water conservation and demand control measures at national and local levels. Another important development was the creation of the Water Conservation Unit, a much-needed focal

point within DWAs establishment, to coordinate and facilitate water conservation and initiatives in Botswana.

With due consideration to policy stipulations provided in the National Conservation Strategy, the overall objective of the NWCSF is to set out policy guidelines and strategies which if implemented will assist in managing and developing Botswana's water resources with focus on sustainability of supplies. The document facilitates the introduction of widespread water conservation practices and demand control at national and local levels. It is the intention of DWA to further develop this document into a more binding National Water Conservation Policy and Water Conservation Strategy Action Plan.

The following outlines the measures and interventions proposed to be included in the national water conservation programme for Botswana. The national water conservation initiatives will, among others, look at the following:

- Water pricing and economic measures. This includes tariffs, abolishment of centralised billing, reviewing free water to public standpipes, prepayment-metering systems etc.
- Technical measures. These will include water saving devices, retrofitting, rainwater harvesting and drainage collection, desalination, recycling of wastewater, water efficient irrigation systems, metering and monitoring for water leaks.
- Water efficient practices. These include water wise gardening and landscaping, evaporation loss control, artificial recharge, re-use of grey water and all efficient operational practices of water administration i.e. good housekeeping.
- Public awareness and education for different user groups. This includes educational activities in schools and colleges, promotional material and activities, community participation, customer advisory services and curricula development.

All of the above initiatives will lead to reduced need for expanding traditional water supply resources, thus promoting sustainability of this limited resource. Water will be kept affordable.

Activities Initiated by DWA in an Effort to Influence Water Conservation and Water Demand in the Country

Ramotswa Water Loss Control Project

The availability of freshwater for many villages in Botswana is in the limelight. To ensure sustainable water delivery to rural users depends on a well-maintained distribution system. Ramotswa village, 35 kilometres east of Gaborone was chosen as a pilot project for water loss control. It is estimated that during most months the water loss through leakage and/or wastage can exceed 50% of the water purchased. This means that the Department of Water Affairs is only able to recover a portion of the money that is paid out to Water Utilities Corporation on a monthly basis. With that in mind, Water Affairs implemented the task of examining Ramotswa's water loss by inspecting the distribution system to determine where the losses occur. This project is one of many to be undertaken as part of the Water Conservation and Water Demand Management project. A goal of this Project is to progressively evaluate and

improve the water use efficiency not only in Ramotswa but also in each of the 17 major villages under DWA's jurisdiction throughout Botswana.

Starting in November 2002, the Department of Water Affairs initiated an aggressive leak detection and repair programme to quickly eliminate water loss through leaky pipes and valves within the village of Ramotswa. Initial inspection of the reticulation showed a system that was installed to first world standards using best plumbing practice. However, looking deeper into the village, revealed a system that had been neglected contributing to leaky pipes and dilapidated valve chambers, which has allowed leaks to go undetected for long periods. On the one hand, this was a good benchmark, as a goal of the project is to show the status of the system before and after leak detection and repair. Many leaks were identified in the first few weeks and have been successfully repaired showing that a little observation can go a long way.

High night flows (unaccounted-for water), in excess of around 50%, are still experienced despite a large number of leaks being repaired. One secondary school has a number of three- metre wide automatic flushing urinals, all of which are faulty. It was estimated that between 200 and 500 litres an hour of North South Carrier water is flowing through these ultimate water wasters every hour. This, at P14/ m^3 translates to between P25 000 and P60 000 per month. Most of this water passes through these ultimate waterwasters when there is no-one in the building, or at night when the boarders are asleep. Add to this a blocked drain and the picture is complete. This water still flows over weekends (104 days), public holidays (10 days), during vacation periods (45 days a year) and of course from 5 pm to 7 am when the school learners are at home. The way forward is to finalise the zoning, install a few zone meters (permanent and temporary), refine the nightflows into manageable sizes and isolate and eliminate the causes of the nightflows, aiming to reduce the total water consumption by 50 %.

DWA Headquarters Building Complex

This project aims to establish an accurate water balance for the entire DWA Headquarters campus and to construct a wetland system to collect and treat sewage from all the ablutions on the campus and rainwater from the roofs of the major buildings. Treated effluent will be utilised to replace potable water for irrigating the green areas. At current prices for potable water and the escalations predicted in the NDP 9 for the next six years, indications are that the project will be economically viable.

Sample Survey of Toilet Cisterns and Automatic Flushing Urinals

Efficiency of toilets has improved over the years, resulting in the volume of water used per flush reducing from over 20 litres to as low as 6 litres. To assess the potential for water savings that could be achieved, DWA carried out a sample survey in Broadhurst, a suburb of Gaborone. The survey was randomly carried out in schools, industries and households.

It was found from the sample survey that:

- Automatic flushing urinals were commonly used in schools and some industries. As mentioned before, these water devices run 24 hours a day

irrespective of whether buildings are occupied or not, each wasting about 200 litres per hour.

- Sizes of toilet cisterns ranged from 6 – 13.5 litres. Large volume cisterns were the more prevalent in the survey. It was observed that, 6 litre toilet cisterns gave satisfactory service where they were installed suggesting that large volume cisterns were not necessary particularly in an arid country like Botswana.

Way Forward

Botswana needs to have standards advocating water saving devices and fittings. Other objectives are to have automatic flushing urinals phased out and some retrofitting done where necessary to facilitate water conservation and demand management. Botswana Bureau of Standards (BoBs) will be approached to achieve these objectives.

Arable Land Development Programme (ALDEP) Rainwater Harvesting Structures

Rainwater harvesting is an integrated part of water conservation and offers great potential for investment in water for the future. The Ministry of Agriculture in collaboration with donor agencies undertook the ALDEP programme to assist the rural farming families with water for their livestock watering.

Consequently, a sample survey was undertaken of the now 25-year-old tanks, to evaluate the performance of these rainwater harvesting tanks.
Findings of the survey, which covered approximately 120 (or 35%) of ALDEP schemes, were:

- Initially farmers appreciated the assistance.
- The programme did not adequately meet the farmers' expectations.
- Technology was the major constraint on the performance of the ALDEP tanks.
- Most tanks had difficulty in catching the rainwater and they were relatively small.
- Farmers ended up using the rainwater for drinking and very little for draught power. The reason for this behaviour was that there was no potable water available for the rural subsistence farmers.

Way Forward

- Assist Ministry of Agriculture to develop guidelines for the design and construction of rainwater harvesting tanks in collaboration with Botswana Technology Center.
- The Ministry has to rehabilitate the existing tanks.
- To influence government to carry out more research on rainwater har vesting so that the technology could be further improved and extensively exploited.
- To develop a prototype holding tank with increased capacity.
- Improve the water quality of harvested rainwater. Harvested water could be used safely for domestic purposes as well as for humans , however, must apply treatment such as boiling, or disinfectant prior to use.

Shoshong Senior Secondary School Project

The school has serious periods of drought because of water shortages in the village water supply system. This is exacerbated by wastage through water wasting devices, leakages and intermittent pipe bursts.

A proposal under consideration will utilise the existing harvested rainwater (6 x 40m^3 below ground storage tanks) for flushing toilet blocks around the classrooms, as well as retrofitting the same toilet blocks with water saving devices such as 6-litre toilet cisterns and compatible toilet pans, alternative urinals and washbasin taps.

The Project will also look at the technology and the feasibility of treating the grey water from the laundry, washbasins and showers to be used for flushing hostel toilets. Any excess treated grey water will be used for fruit production in the school garden.

Education and Awareness

Probably the most important cornerstone of any water conservation programme is the education and awareness amongst water users, administrators and politicians. Often, a lack of understanding of the resource, lack of skills in managing water and lack of affordable alternatives makes water use unsustainable. To eliminate such pitfalls, it is of utmost importance that consumers get the right information and impart some knowledge to all water users so that we can sustain the resource. The water authorities, administrators etc. can achieve all this through the full cooperation, understanding and willingness of end users to participate, and most importantly to change their mindset in managing the limited water resources. One of the most important good housekeeping habits that need to be adopted by consumers in Botswana is the efficient use of water. Therefore, a well-coordinated plan of action for public education and awareness needs to be adopted by all.

General aims of public education and awareness programmes:

- To promote awareness of water in daily life; this would develop aware ness in case of crisis situation and would enlighten consumers in their plan of action
- To promote awareness of conservation issues and its links to environ mental issues
- To promote awareness of economic benefits as a result of water saving
- To provide an understanding of the possible need for price escalation or change in tariffs
- To provide an understanding for recycling and re-use of wastewater.

To promote the message of water conservation and water demand management and make consumers aware of the need to save water, the Department of Water Affairs, together with other role players, which include key government stakeholders, parastatals, private sector and NGOs, have jointly embarked on comprehensive water conservation promotional campaigns. A water conservation mascot 'Thothi' was developed and this appears in all our campaign materials/activities. These campaigns come in the form of

different media such as TV advertising, radio, newsletter, posters, to name but a few. This year school children, or the youth and our future leaders - today's school learners, played a prominent role.

As children are the future of any nation, schools offer the best opportunity to achieve the goal of widest coverage at affordable cost. The Department of Water Affairs took this opportunity to promote awareness on the need to conserve water by organising a major awareness campaign held during the week of 17–23 March 2003. The week that straddles World Water Day, 22 March, is National Water Week and is traditionally the time to hold such celebrations. The celebrations started in October 2002 with a promotional tour and concluded with the Grand Gala Closing Event on 11 April 2003. Schools throughout the country were invited to participate in a series of events to celebrate water under the broad theme; "The Precious Nature of Water". World Water Day Celebrations for 2003 have come and gone, and by all accounts it was a most remarkable occasion. This made it undoubtedly the biggest and most successful event of its kind ever held in Botswana.

Other activities and methods of public awareness and education that were implemented apart from educational activities in schools are: use of a theatre group to spread the message of water conservation throughout the country and to stage the group's production, and to make a video recording of the event. The video recording will be circulated to schools across the country and even feature on national TV; use of promotional material and activities. Involvement at community level – by training locals in basic skills needed to operate a water supply system and fitting of water saving devices is another option being considered. This would empower the community and thus build a water conservation oriented society. Use of customer advisory services on the efficient use of water and use of existing materials from other stakeholders e.g. Ministry of Education is also being considered.

Other Initiatives from Stakeholders

Ministry of Agriculture

The Government of Botswana has completed a National Master Plan for Agricultural Development (NAMPAD). The plan has identified existing water resources that could support irrigated agriculture. The plan has also proposed potential water sources, which could be assessed. NAMPAD recommends the utilisation of urban wastewater and polluted sources, as these are readily available. Government also constructs small dams to support agricultural activities in the areas of livestock watering and small-scale horticulture. On a pilot basis, small sand filtration plants are planned to be installed at some of the dams. This will ease the burden or stress on the limited water resources.

Water Utilities Corporation (WUC)

The Water Utilities Corporation (WUC), in addition to supplying water to the urban centres, is also responsible for the operation and maintenance of the five major dams in the country, i.e. Gaborone, Bokaa, Nnywane, Shashe and Letsibogo dams. The Corporation also operates some boreholes in the Dukwi wellfields as an agency for the Department of Water Affairs for the supply of water to Sowa Town. In Jwaneng, a diamond mining town, the Corporation only distributes water but does not operate the boreholes.

Given the scarcity of rains and the recurrence of droughts in Botswana, it is in the interest of the Corporation to manage its water resources and operations in a manner that is environmentally responsible and sustainable. It is therefore the Corporation's policy to promote water conservation through the efficient operation of its resources and processes to ensure efficient water use and maximum water quality standards. WUC currently conforms to the Botswana Bureau of Standards drinking water quality standards for Class 1 type water, which is of ideal water quality.

The Corporation also has programmes in place for the monitoring and prevention of pollution, as well as for drought planning and management, amongst other environmental programmes, which include social and economic aspects.

Local Government (Local Authorities)

In our district councils a variety of wastewater treatment processes are in use. Most of these processes utilise conventional stabilisation ponds. Even though re use of the effluent from some of these systems has not been done, in recent years it has become apparent that this resource can offer some potential, especially in urban landscaping and other options. In Botswana, there are some district councils who are active in the use of treated wastewater in a number of viable options e.g. Gaborone. Maun, Chobe and Central.

Mining and Industrial uses

Mining industries often use large volumes of water and would generally have strong incentives (financial) to re-use water wherever possible in the processing cycle. As a result wastewater treatment and re-use in the mining sector is widespread and advanced in Botswana.

Smaller Institutions

The use of treated wastewater for horticultural purposes in small institutions is a relatively new development. Generally, use of of septic tank and reed bed system (constructed wetland) is used to produce a final effluent of sufficient quality for use with food crops that has to be cooked or fruiting trees. However, most institutions are now embarking on this venture and nowadays we find more of these mush rooming.

The following gives proportions of organisations in Botswana active in water conservation and water demand management practices and measures:

- Government 27%
- Private 26%
- Parastatal 18%
- NGO 21%
- AID 8%

(Aknowledgement: DWA WQMP 1998)

To date, the proportions might have increased slightly.

Conclusions

Management of water in Botswana is currently dispersed between various ministries and parastatal bodies. This has reduced uniform strategies within government in the overall planning process. There is therefore a need to merge the fractured authorities.

"Polluter pays principle" has been put in practice to protect limited water resources from pollution as it directly impacts on conservation.

Collaboration on research activities and information exchange among SADC states and other international organisations on issues related to integrated water resources management is essential.

- We need to conserve water now. Conserving water during times of plenty is banking for the future. Every Motswana needs to take up this initative. We must take charge of our own destiny. The time to save is now.
- Water conservation does not just happen, it has to be planned for. Lets take up this challenge

4.4 Technical Requirements for Water Demand Management Implementation - Charles Chapman

Preamble

Water supplies for mankind are many and varied – from a convenient perennial stream through springs, cave drips and seeps, hand pumps, well-fields and even trying to eke water out by patiently sucking through a reed stuck into the Kalahari sands.

Technologies for managing water demand are equally many and varied. And, as is the case with the supply alternatives, they are neither personality related nor consumer demanded. Appropriate Water Demand Management (WDM) technologies too, depend on the prevailing circumstances.

Certainly, mankind's technological ingenuity can adequately modify any circumstance to suit his needs by either importing water to the Kalahari sands; or by adapting the prevailing supply circumstances to suit one or other preferred WDM approach.

Alternative WDM Approaches

Most purveyors of WDM 'systems' will insist, supported by irrefutable conviction, that the approach they subscribe to is infinitely better than the competition and only someone completely ignorant will not agree. All approaches, from the most sophisticated to the most elementary, have extreme merit, strengths, but unfortunately, also weaknesses.

The trick is to select an approach appropriate to the supply system, the financial resources of the water supply authority (WSA) and be within the capacity and capability of the staff that are going to have to implement, operate and manage the system.

In 'first-world' situations these limitations are usually less onerous as many will not apply. However, in most parts of Africa such luxury is not enjoyed and each limitation has to be carefully evaluated on its own merits.

Where to Apply WDM Measures

There are, in any water supply system, many windows of opportunity for WDM, often completely independent from other sectors of the water supply system. Mountain catchments and dam storage; bulk transport; water treatment plants; distribution networks; on-site losses and wastage; wasteful fittings and appliances and luxury recreation demands, can all be managed to a greater or lesser extent, mostly independent of each other.

The common goal of all WDM approaches, techniques or procedures is, broadly, to manage the outflow of water from the system in such a manner as to render the need for additional supply into the system, redundant.

Supply-side Approach vs Demand-side Approach

The traditional approach of considering rising demand as something that has to be met by increasing supply rather than something that has to be managed, seldom achieves the anticipated result because abundance encourages excesses. Long before the design life has been reached further additional supplies are required. Examples

world-wide are legion. Whenever an expensive new water supply scheme is missioned, the water supply authority immediately embarks on a sales promotion campaign to encourage consumers to use more water and to increase revenues for the authority.

Irrespective of the WDM package the WSA may prefer, the recipe for selection is fairly standard in all cases.

- Analyse the characteristics of the system to be managed.
- Decide whether the system can adequately support the favoured WDM package.
- If so, which is the best of the many similar packages on offer.
- If not, either upgrade the system to levels required by the preferred package or,
- Select an alternative approach.

Seldom are two water supply systems identical, so it is highly unlikely that the optimal system that worked well in, say, Cape Town will also work best in Maputo or Selebi-Phikwe. Even if the systems are identical, the people running the systems may not be similar.

Less is More (LIM)

Most water supply networks are huge spider webs of interlinked pipelines, infinitely criss-crossing each other, ostensibly to ensure that water can reach any consumer from any direction regardless of any pipe closures that might be made to effect repairs anywhere in the system. Such systems can be virtually unmanageable except with the most sophisticated, high technology approaches. These are invariably costly and are seldom within the capability of the WSA.

The approach world-wide is to sub-divide or 'sector' the entire network into one or more Districts, with each District in turn divided into one or more Sub-districts. Third-tier sectoring comprises one or more Zones (usually not exceeding 1000 connections). Each District, Sub-district and Zone is supplied through a strategic bulk water meter, the Zone meter and the consumer meters providing a convenient 'Water Audit' facility. The smaller the area to manage, the easier it is to manage. Hence, Less is More (LIM).

The obvious conclusion is that it is not possible to manage if you do not measure, or, as the adage goes: "To measure is to know."

Appropriate Technologies

Although computers are absolutely essential in today's water management plan, how and the extent to which they are used varies greatly from case to case. The most appropriate technology of all, however, is still 'feet in the street'. There is no computer so powerful that it can substitute for regular visual inspections. At best computers can direct focus to areas of greatest concern.

Computerised management packages can supply useful information through data analyses, but are not magic wands. Often, the 'data-demand' can be quite onerous.

Computer operators must also be very weary of the "Garbage in – Gospel Truth out"

syndrome, i.e. when the results generated have to be correct because the computer said so.

Despite rumours to the contrary, computers do also have shortcomings. They cannot easily differentiate between legitimate, efficient use and inefficient, illegal or wasteful water use. Results can often point in the right direction but usually not with inconclusive conviction.

To analyse an entire network, a District, Sub-district or Zone, requires five basic steps:

- The collection of Data
- The extraction of Information from the data-set
- The distillation of Knowledge about the system from the information
- Getting an Understanding of the dynamics or working of the system
- Confidence to make informed Strategic Decisions.

All too often the above list is truncated at the Information stage and passes straight to the Strategic Decision stage without adequate Knowledge of flow rates and consumption patterns or Understanding of how the system works.

A Case Study

As already referred to by project director Bogadi Mathangwane in her paper, the Department of Water Affairs in Gaborone has identified Ramotswa village, 35 km south of Gaborone, as an area in need of investigation.

Here, monitoring of the village reticulation revealed an average daily flowrate varying around 80 m^3/h, with a minimum night flow (MNF) of around 55 m^3/h. Simply stated, 70 % of the average daily demand (ADD) is still flowing in the middle of the night when consumers are all fast asleep. Even the partygoers could not account for that flow. Surprisingly, no monitoring of the consumption pattern (flow rates) had taken place prior to the commencement of a 42 million Pula augmentation scheme.

Various techniques, technologies and approaches are being applied in Ramotswa including sounding, pressure monitoring and meter logging. Once sufficient understanding of how the system works has been acquired, more strategic water meters will be installed and night flows isolated. Not all of the night flows will be losses from the system, indeed, very little will be as most will be wastage downstream of the consumer water meters. Automatic flushing urinals (AFU's) will doubtless be high on the list of culprits.

Conclusion

Arguably, perhaps, the ultimate aim of water demand management is to keep water affordable.

WDM is not the task of DWA alone. When a country is dying of thirst WDM becomes a national issue and requires the commitment and participation of all ministries.

If the lack of water does not stifle growth in Botswana, then certainly, the price of water will, as more and more hugely expensive bulk water transfer schemes are contemplated in an attempt to keep the leaks filled. And this applies equally to all other nations in the SADC region.

4.5 Social Aspects of Water Demand Management - Geraldine Schoeman

Promoting Resilience and Adaptive Responses

Looking ahead, this means that humanity has to prepare itself for living with unavoidable change and develop methods for adaptive management of the life support systems in such a way that these systems do not lose their integrity but continue to provide essential support for human well-being and economic activities. Adaptive management basically means a science-based management, able to respond quickly to signs of undesirable ecohydrological changes. It has to build on careful monitoring of essential determinants of key ecosystems, the building of knowledge and understanding in society and be supported by flexible organisations able to respond by necessary policy changes.

Botswana Dilemma Regarding the Development of Water Conservation/Demand Issues

Initially, in a development phase, the amount of naturally occurring water is not a constraint. Rather, expansion in demand drives the construction of new infrastructure and expansion of agricultural land. Institutions are primarily engaged in expanding facilities for human use.

Linking Demand Management and Institutional Issues

Different issues tend to arise at different phases of development.
Water Scarcity. Construction of water facilities to provide access to water is often targeted at the relief of water scarcity. But even with facilities to provide access, scarcity can exist. Poor institutional functioning can drive scarcity when laws, traditions, or organisations restrict access or are inadequate to distribute water to all, leaving some people with water scarcity. Physical or absolute scarcity exists when the demand for water outstrips the facilities to tap into resources (IWMI 2000). For example, physical scarcity exists in the North China Plains where there is no more water left for the next user who may wish to develop a new supply. Economic-driven scarcity exists when water is ample in nature, but financial or human resources constraints impede the development of water resources for human use.

Balancing Act a Social Requirement

The overall predicament of balancing between ecosystem protection and human livelihood security and welfare is illustrated in Figure 1 on page 71. The global ecosystem is basically a system of interacting organisms, which produces life support for the social system in terms of ecosystem goods such as food and timber, and ecological services such as for example oxygen production, dentitrification and pollination. The social system is driven by human needs and aspirations to produce increasing welfare, but by mismanagement of the life support system, the latter is continuously being degraded by processes such as pollution, salination and depletion. Both the global ecosystem and the social system are genuinely water dependent.

Food Production Balance

The challenge is in other words to find ways to orchestrate the catchment system for compatibility, i.e. satisfying societal needs, meeting ecological minimum criteria, and securing hydrosolidarity

Food Production Dilemma

As earlier indicated food production represents the dominant water need in the social system, needing 30-60 times more water than what is needed at the household level, depending at what source we are referring to. Moreover, it represents a consumptive water use, by which the water is turned into green water flow after use, i.e. water not available for re-use downstream. While the water consumed in production of the current diets in Sub-Saharan Africa and South Asia represents some 700-800 m3/p yr, an acceptable nutrition in line with FAO's recommended diet amounts to some 1300 m3/p yr (Rockström, in press). Taking both the current under nutrition and the population growth into account, this will correspond by 2025 on the global level correspond to an overall additional need of consumptive use of 3800 km3/yr. This additional water need is of the same order of magnitude as today's overall use of blue water.

Looking at the regional perspectives, the food production needed to feed the growing populations in Sub-Saharan Africa and South Asia will increase the consumptive water need in the former regions by 3.1 times. There are four alternative sources from where this extra green water needs may be found:

- By irrigation, relying on more blue water, transferring it into green water flow
- By reducing current water losses in applying a more-crop-per-drop strategy
- By horizontal expansion by turning the green water flows, currently used by terrestrial ecosystems in forests and grasslands, into water consumed for food production in stead
- By importing food, implying that the water consumed in the produc tion of that food is green water used in some other region, so-called 'virtual water'

Orchestrating for Compatibility

It follows from the above that the overall problematique boils down to finding ways for meeting at the same time both societal needs and ecosystem protection needs. The societal needs can only be met after manipulation of landscape components in terms of water pathways and land cover. Due to water's consequence-producing functions mentioned above, side effects of such manipulations will be unavoidable and involve disturbances of water dependent ecosystems.

Crux of the Paper

The catchment can be seen as a socio-ecohydrological system (Falkenmark & Folke 2002) in which trade offs have to be made. At the same time, social acceptance of the results of those trade-offs has to be secured, implementation be made possible in terms of institutions, regulations and financing needed, and the implementation be realised by securing adequate incentives and education efforts. In these efforts, complications will however emerge, i.e. continuous change in terms of further land use and water use modifications, driven by ongoing population growth, urban migration and increasing expectations. Moreover, response delays will complicate the efforts and have to be accepted: delays in both societal response, hydrological response and ecosystem response. Finally, triggering events will have to be expected in terms of intervening drought events, flood events and pollution episodes.

As a result, three key directions have to characterise the emerging management system (secure-avoid-foresee): securing water related services to the population, avoiding ecosystem degradation, and foreseeing changes and variability.

A cornerstone in any water conservation programme is the creation of awareness among water users, administrators and politicians of the need to conserve water. These aspects are treated in the last sub-chapter under the headings: (a) Educational Activities in Schools and Colleges; (b) Promotional Material and Activities; (c) Involvement at Community Level, and (d) Customer Advisory Services. (National Water Conservation Policy and Strategy Framework p vi).

Water Development

In semi-arid regions, water becomes a critical pre-condition to development. Surface water is often insufficient. There are basically three water sources that society may benefit from for direct uses:

- Groundwater accessible through pumping wells
- Surface water accessible in the water course
- Rainwater harvested on rooftops and impermeable plots and stored in house cisterns or as local groundwater.

When the water courses are non-perennial, groundwater is an essential source in the dry season. But groundwater recharge is often very limited in a dry climate. Over-exploitation is a reality and a serious threat. Documentation from various countries shows a sinking ground water table. Deepening of wells step by step is one way to cope with the challenge, but with time this solution is not feasible.

Demand Management Requirements

Development under conditions of growing water scarcity must be based on a strategy where the best possible use of available resources will be stimulated, probably alongside with a scrutiny of the need for additional withdrawals.

A combination of supply side and demand side management will be natural as countries climb 'the management ladder'. Making water accessible hinges, initially, on a combination of technical skills and financial resources. Gradually, the challenge becomes more complex. Apart from decisions concerning how much water should be developed, policy makers must also ensure that water is reaching those who should have access to it. Incompatible claims for water from various sectors, from

urban and rural areas and from upstream-downstream interests are currently quite common. In addition, the claims for more water to sectors in society clash with interest that promote environmental values. An increased ability to deal with water management from an integrated perspective is thus necessary. In this work co-operation and co-operative arrangements are needed. This report indicates against descriptions of the challenges for the different regions, techniques and practices, regulatory measures at national and international level, strategies and policies that the European Parliament should suggest to the European Union to regard in its work on Water and Development in the regions identified. Such strategic work would enhance possibilities for conflict prevention, thus resulting in increased water security. (Water and development in the developing countries)

In the sanitation sphere the Draft Policy on National Sanitation embraced the following objectives:

- Raise awareness of diseases caused by unhealthy behaviour and practices;
- Support and provide health and hygiene education;
- Increased demand and willingness to pay for appropriate sanitation facili ties. (Strategy to manage water quality effects on settlements, phase ii)

4.6 Education and Training in Water Demand Management in SADC Countries - Gumbo Bekithemba[1]

Introduction

Water demand management (WDM) is relevant in the Southern Africa region, which is characterised by frequent droughts, floods and erratic, unevenly distributed rainfall. However, implementation of WDM in Southern Africa has been dismal since the inception of its promotion and advocacy as part of the broad framework of Integrated Water Resources Management (IWRM) after the Rio Earth Summit in the early 1990s. Meanwhile nearly one third of Southern Africa's 200 million inhabitants do not have access to safe water and sanitation (Table 1). One of the identified major constraints to the adoption of WDM measures in the southern Africa region is the absence of well structured educational and training programmes or courses suitably targeted to all stakeholders in the water management chain.

As one unpacks the pandora's box of education and training certain key questions arise? What form of education and training is required? How does it fit into broader programmes like Integrated Water Resources Management (IWRM)? And who should be educated or trained and what are the target figures? Most importantly, who funds the exercise? Formal education in WDM is only part of the skill creation system. Vocational and on-the-job training are just as important. As much as awareness has been given some due attention in most SADC countries, education and training to move across the barriers of WDM implementation has been lacking.

This paper highlights some education and training programmes and courses in WDM that have been initiated in the region in order to address this important aspect of water management. The paper takes stock of the programmes and courses on offer and being developed and compares this with the manpower requirements for the various water sector institutions in the region. A critical overview is presented of the various efforts by making local and international comparisons, and suggestions for possible co-operation among the educators and trainers on one hand, and contributing public and private institutions, on the other possibly within the framework and mandate of the SADC Water Sector Co-ordinating Unit.

Rethinking of education and training systems in the regional water sector is imperative to meet the new challenges presented by water demand management.

This calls for a rethinking of education and training policies in the water sector in general. In some countries systems need an overhaul. In others, a re-direction of public funds. How much for public education? For science and engineering? For formal education? For vocational training? And are there ways to increase resource flows to education and training, beyond simply expanding public spending? Tough choices indeed.

It is estimated that the total population in SADC countries will surpass the 300 million mark by 2025 (Table 2). At the same time renewable fresh water abstractions are projected to increase, plunging more than half of the SADC countries into the water stress category by 2025. WDM in SADC counties is becoming more important as deliv-

[1] *Department of Civil Engineering, University of Zimbabwe, gumbo@civil.wits.ac.za*

ery of adequate quantities for development is escalating bringing unprecedented challenges in terms of limited endowment of freshwater resources, infrastructure provision and management of return flows. The crisis is potentially manageable, but not without concerted efforts on the part of water resources managers, planners and regulators; multi-sectoral user groups; governments; international aid institutions, communities, and non-governmental institutions.

Table 1 SADC Member States[1], Demography and Access to Water and Sanitation Services

Country	Populati-on in 2000 (millions)	Urban populatio n (as % of total)	Populati-on under 15 (as % of total)	Population-aged 65 and above (as % of total)	Population using adequate sanitation facilities (%)	Population using improved water sources (%)
Angola	12.9	34	48	3	44	38
Botswana	1.6	50	42	3	41	77
DR Congo	52.0	30	49	3	20	45
Lesotho	2.2	27	39	4	92	91
Malawi	10.8	24	46	3	77	57
Mauritius	1.2	41	26	9	99	100
Mozambique	17.9	39	44	3	43	60
Namibia	1.7	30	44	4	70	78
South Africa	43.3	50	31	4	86	86
Swaziland	0.9	26	41	3	60	75
Tanzania	33.7	32	45	2	90	54
Zambia	10.2	40	44	3	78	64
Zimbabwe	12.4	35	45	3	80	85
Total SADC/Ave	200.8	35	41	4	68	70

[1] *Seychelles the fourteenth member of SADC states with a population of about 80 000 is not included.*

Setting the Scene: Important Human Resource Development Indicators in SADC Countries

Needs Assessment for Water Demand Management

The first logical step in WDM human resources development would be to conduct a comprehensive audit of skills provision and needs, not just once but on a regular basis. Within the region a few exercises are recorded in trying to achieve this end. In 2002 IUCN tasked WaterNet[1] to formulate a needs assessment survey for WDM training in the region. The questionnaire was circulated among more than 30 WaterNet member institutions. The response to the questionnaire was disappointing as less than five responses were received (a sample of the questionnaire is provided as Appendix 1). Another WDM survey was carried out in 1997 under the IDRC Dry-land Water Management Programme Initiative (DWIMPI) networking project for Africa and the Middle East (Forster, 1997). The survey although confined in scope and limited to some countries in Southern Africa indicated that a number of institutions were already involved in WDM education and training (Box 1). The survey also identified that usable information and training opportunities in WDM were in considerable demand throughout Southern Africa. One other main observation during the survey was that consumer education was lacking as part of tariff reform; this has resulted in poor payment performances and consumer suspicion that the revenue is being put to other uses.

Box 1: Institutions Involved in WDM Education and Training Identified

Country	Institution
Mozambique	Eduardo Mondlane University
	Institute of Rural Development
Namibia	Windhoek City Engineers Department
	Desert Research Foundation
	UNICEF
	Department of Water Affairs
Malawi	Concern Universal
South Africa	University of Natal Pollution Research Group
	University of Stellenbosch Agricultural Water
	National Water Conservation Campaign
	Land and Agriculture Policy Centre

Forster (1997) indicates that respondents to the survey made several appeals to support initiatives such as training in WDM, and for South Africa (which is seen as a major source of water expertise in the region) to share its knowledge and skills with its neighbours more readily. There was also a repeated request from water managers to be taught how to implement WDM as opposed to requesting overseas consultants to do it for them.

---

[1] *WaterNet is a regional network of university departments and education, research and training institutes specialising in water and environmental issues (URL: http://www.waternetonline.org)*

With regards to education and training identified demand for services and activities included:

- *information* which is highly relevant to WDM, is accessible, browsable, readily digestible, and easy to download;
- *training courses* which are short, concise, and offer practical assistance on specific aspects of WDM;
- *conferences and seminars* to promote interest, expose latest developments, and encourage personal contact among practitioners;
- *mentorship* and the identification of specific skills in the region;
- a *bulletin board* reporting WDM related activities and initiatives in Africa; and
- a *clearing house* function for WDM research and development projects.

Besides the two examples given, there are no other known surveys to date which have been conducted in the region or within SADC member countries to assess the existing capacity in WDM and training needs. In the absence of comprehensive regional data and information on WDM skills provision and needs, international bench-marking can be used to assess skills needs. International comparisons, despite their problems, have two important advantages. First, they move the debate towards an assessment of outcomes rather than inputs, such as education budgets. Second, they force policy-makers to seek more refined measures to capture the quality of skills through establishing national and local standards.

Human Development Indicators and Demographic Profile of SADC Countries

The Human Development Index (HDI) measures the overall achievements in a country in three basic dimensions of human development longevity, knowledge and decent standard of living (Table 3). The HDI ranking for 2001 has Norway at No. 1 and Sierra Leone is No. 162. Other 29 UN member countries are not ranked including two non-members, Switzerland and Hong Kong. It is measured by life expectancy, educational attainment (adult literacy and combined primary, secondary and tertiary enrolment) and adjusted income per capita in purchasing power parity (PPP) US dollars (UNDP, 2001).

Although there are numerous differences between countries, regions and economic zones, a number of *trends* can be discerned in water education and training in recent years (UNESCO, 1995):

- quantitative expansion, which can hardly keep pace with the need for specialists in the water sector;
- diversification in response to the dynamics of society and speed of developments;
- individualisation in response to industrialisation and urbanisation;
- globalisation and internationalisation of water resources and environmental problems and establishment of international networks for research;
- enhanced inter-disciplinarity of problems asking for integrated approaches.

A number of *constraints and threats* have restrained education and training sector in SADC countries to meet these challenges. However, there are large regional and national differences in the extent to which the constraints mentioned in the following list apply to particular situations. But in general the constraints met by educational and training institutions to reform include:

- Insufficient or reduced public funding for higher education;
- Deficient quality of staff and facilities;
- Poor quality of students;
- Limited access to higher education;
- Inferior quality of education and conventionalism;
- Insufficient training and research capacity;
- Institutional factors;
- Cultural factors;
- Insufficient incorporation of appropriate indigenous approaches.

SADC countries only spend (on average) 5% of their Gross National Product (GNP) on education whilst the high income OECD countries[9] spend about 10% (Table 3). Inequality, skewed distribution of income, economic resources and mass unemployment (as exemplified by the Gini index in Table 3) are major causes of poverty in SADC countries. This raises a vital issue in considering who pays for education and training in water in general when the average GDP for SADC countries is about US$3500.00 per capita per year compared to that of OECD countries of US$25000.00. SADC countries also lag far behind High income OECD countries with a gross enrolment (primary, secondary and tertiary levels) ratio of 56% compared to 94%. This reflects uneven progress in building skills. Another threat is the potential loss of key human resources through HIV/AIDS and other notifiable diseases. Education and training may well be blithely unaware of the potential for system disruption and even catastrophe that lies ahead with already about 20% of the adult population living with HIV/AIDS in the region. For example Botswana's 2000 human development report focuses on how HIV/AIDS is reducing economic growth and increasing poverty (UNDP, 2001).

Richer countries abroad and within the region are opening their doors to poorer and developing country professionals at a high cost to the home countries. The brain-drain makes it more difficult for SADC countries to retain the very people critical for WDM. What can supplier countries do to get some 'compensation' for generating skills that have an international market? How can diasporas contribute to their home countries?

The majority of countries in SADC have minimal private funding for education and training., but combining private and public funding at higher levels of education and training with public spending for primary and lower secondary levels is an option - as long as adequate access to higher education is assured for poor children. For example the recently launched WaterNet's Master of Integrated Water Resources Management degree programme at the University of Zimbabwe (http://www.uz.ac.zw/engineering/civil) and University of Dar es Salaam (http://www.wrem.udsm.ac.tz) indicate that to train one student for the 18-month programme requires about US$15000.00 to US$20000.00 inclusive of travel and upkeep for regional students. The cost to attend one three-week-module ranges from US$500.00 for local students to about US$3000.00 for regional students. Comparative costs for education and training in Western Europe or America for similar programmes will probably be of the order of 5 to 10 times as much.

It is unlikely that the full cost of training and education in a field such as water demand management can ever be entirely borne by the beneficiaries themselves. Subsidies in the form of grants and fellowships will continue to be required, reflecting

[9] *Organisation for Economic Cooperation and Development (OECD) comprises of 30 countries and areas predominantly in Europe and North America*

the public good value of investing in human resources development. The value to society of knowledge on water resources is greater than the direct economic benefits accruing from such knowledge; just as the value of water can never be entirely reduced to its economic worth. What is emerging is that more reliance should be on private funding for vocational and on-the-job training. The public sector must retain responsibility for universal primary and secondary education and some parts of tertiary education. But countries should consider allowing greater scope for private supply of some education services and rely more on payments from individuals for advanced professional courses with strong market rewards.

Financing education and training in the water sector in general and WDM in particular calls for a mix of public and private responsibility

---

Greater resources and higher enrolments alone are not enough. The quality and orientation of the education and training at each level, and the link with the demand for skills, are critical for mastering WDM. Orientation and content is thus as important as resources.

Water Demand Management as a Component of Integrated Water Resources Management

Integrated Water Resources Management Training Needs Assessment

Demand management as a policy and strategic option for water resources management seems to have gained prominence at the same time as the paradigm shift from water resources development to Integrated Water Resources Management (IWRM) occurred. It is therefore imperative to locate demand management within the context of IWRM to fully appreciate the contribution demand management can make towards water resources management. A needs assessment study for WDM might as well include the bigger picture and focus on the IWRM capacity within the region.

In July 1997, the first ever attempt to determine the regional education and training needs was initiated (Ndamba and van der Zaag, 1998). About 150 questionnaires were distributed to selected persons and institutions in the Southern Africa region. By September 1997, only 17 filled out forms were received.

Table 2 water availability and used by sectors for SADC states

Country	Total renewable fresh water available (km³/year)	Population in 2000 (millions)	Water per person in 2000 (m³/person/year)	Estimated population in 2015 (millions)	Water per person in 2015 (m³/person/year)	Water use by sector in year 2000 (% of total freshwater withdrawals)		
						Agriculture	Urban	Industry
Angola	184.0	12.9	14260	20.8	8850	76	14	10
Botswana	14.7	1.6	9190	1.7	8650	48	20	32
DR Congo	1019.0	52.0	19600	84.0	12130	23	16	61
Lesotho	5.2	2.2	2360	2.3	2260	56	22	22
Malawi	17.5	10.8	1620	15.7	1110	86	10	3
Mauritius	2.2	1.2	1830	1.3	1690	88	15	7
Mozambique	58.0	17.9	3240	23.5	2470	89	9	2
Namibia	9.0	1.7	5290	2.3	3910	68	29	3
South Africa	52.8	43.3	1220	44.6	1170	62	17	21
Swaziland	4.5	0.9	5000	1.0	4500	71	21	8
Tanzania	80.0	33.7	2370	49.3	1620	89	9	2
Zambia	116.0	10.2	11370	14.8	7840	77	16	2
Zimbabwe	20.0	12.4	1610	14.0	1430	79	14	7
Total SADC/Ave	1582.9	200.8	6070	275.3	4430	70	16	14

[1] This is the surface plus ground water that is generated within the geo-political boundaries of the country each year and excludes water that flows in from neighbouring states. Minor volumes of recycled water are included in the values for water available in South Africa.

[2] Countries with less than 1700 m³/person experience water stress; those with less than 1000 m³/person, water scarcity. The water scarcity benchmark has been accepted as a general indicator of water scarcity by the World Bank and other analysts. It is taken as the approximate minimum for an adequate quality of life in a moderately developed country. It assumed to satisfy the requirements of agriculture, industry, domestic use and energy production.

[1][2] Population growth rates in each country used to estimate the population in 2015 have been adjusted to account for the current prevalence of HIV/AIDS in that country

able 3 Human Development Indicators (1999)

ountry	HDI[1] rankin g	Life expectan cy at birth (years)	GDP per capita (PPP US$)	Adult literacy (% age 15 and above)	Combined primary, secondary, tertiary gross enrolment ratio (%)[2]	Public education expenditure (as % of GNP)	Tertiary students in science, maths and engineering (% of all tertiary students)[3]	Inequality in income or consumptio n (Gini index)[4]	Adults living with HIV/AIDS (% age 15-49)
ngola	146	45	3180	42	23	5	15	49	5
otswana	114	42	6870	76	70	9	27	44	36
R Congo	142	51	800	60	32	2	15	48	8
esotho	120	48	1850	83	61	8	13	56	23
alawi	151	40	590	60	73	4	19	40	16
auritius	63	71	9100	84	63	5	17	35	0.1
ozambique	157	40	860	43	23	7	46	40	14
amibia	111	45	5470	81	78	9	4	50	20
outh Africa	94	54	8900	85	93	8	18	60	20
waziland	113	47	3990	79	72	6	22	61	25
nzania	140	51	500	75	32	4	39	38	10
mbia	143	41	760	77	49	2	20	45	20
mbabwe	117	43	2870	88	65	7	23	57	25

[13] The HDI ranking, ranks 162 UN member countries.
[14] The number of students enrolled, regardless of age, as a percentage of the population of official school age.
[15] Science refers to natural sciences, engineering, mathematics and computer sciences, architecture and town planning, transport and communications, trade,craft and industrial programmes, agriculture, forestry and fisheries.
[16] The Gini index measures inequality over the entire distribution of income or consumption. A value of 0 represents perfect equality, and value of 100 perfect inequality Source: UNDP, 2001

In sum, the questionnaires received and interviews held covered the following countries: Botswana (1), Malawi (1), Mauritius (1), Namibia (1), South Africa (4), Tanzania (1), Zambia (4), and Zimbabwe (4). The returned forms were filled out by the following types of organisations: Government (4, of which one: 'Government, evolving into a corporate body'), Parastatal (2), University/ educational institution (5), Research institutes (3), Private (2), International NGO (1). Despite the disappointing number of respondents, the distribution of those who did respond over the region and the variety of organisations they represented made the exercise worthwhile. The training needs in IWRM identified from the survey are listed in Box 2. However, again no quantitative figures were made available. The need for networking and collaboration in the region was quite clear this included important regional activities, such as the SADC Protocol on Shared Watercourses, the setting up of the SADC Water Sector, the active involvement of the Global Water Partnership in issues of Integrated Water Resources Management in Southern Africa.

Box 2: IWRM Training needs Identified in the 1997 Survey (Ndamba and Van der Zaag, (1998)

Training & education at all levels of society from grass roots up to parliament
Re-orientation from a supply based ethos to a demand management ethos amongst existing government officials and consultants.
Sector driven and accredited training programmes aimed at operator and management levels
Capacity building at local government level. *(South Africa)*
Training at all levels: grass-roots; middle class and top leadership and general public awareness on the intricacies of IWRM, through short applied courses. *(Zambia)*
Stakeholder capacitation for water management at grassroots level
Senior management also need refresher courses
Post-graduate degree programmes in areas of integrated water resources planning and management, including water demand management. *(Zimbabwe)*

The survey demonstrated the importance of a new trans-national community of water sector professionals, constituted by a common class of tools and a common mode of their application. The community should consist of both geographically distributed and functionally linked first - and Third World water sector professionals.

UNESCO Assessment of Human Resources Requirements in DWAF, South Africa

The following is extracted from a UNESCO (1999) report entitled Water –Education-Training which formed part of the preparation of the World Water Vision (World Water Council, 2000) which in effect represented a global platform for tertiary level human resources development for the water sector. The case of the Department of Water Affairs and Forestry in South Africa is given as an indication of the challenges which face the region in terms of capacity building in water resources management in general.

At present DWAF provides water to an estimated 20 million South African residents who differ significantly with regards to level of services demanded and type of needs. In the Directorate: Hydrology of DWAF, severe under-staffing has been reported in 1998. (50% vacancy) and staff tenure is only a few years. In the year 2000, DWAF employed about 22 000 people spread across 16 grades, and about 6000 vacancies existed, with about 4000 of them in water resources management.

According to UNESCO/WMO (1998) the existing training system in DWAF is not satisfactory. In fact, training opportunities were seriously limited during 1998 in relation to needs. As an example, in one of the provinces, the annual budget for training was R12000 for 4000 people employed in the regional office of DWAF. This translated to only R3.00 available for training each employee. The report also stated that the curriculum in South African universities and the background of young incumbents did not fit the needs and expectations of DWAF.

In-house training (preferably one-to-one mentorship) was needed, but the possibilities of in-house training, under the conditions of serious under-staffing, was still not the solution. Senior staff was far too busy to lead such training. Furthermore, experienced people left DWAF, seriously affecting institutional memory, and further reducing the number of potential mentors.

In the year 2000 the South African education system accommodates more than 12.3 million learners (50.5% female), 300 000 students at 21 universities and 15 technikons (54.6% female). The system encompasses 30 000 primary and secondary schools, 375 000 educators, 5 000 inspectors and subject advisers, and 68 000 officials, managers and support personnel (DoE: 2000b). There were 156 technical colleges accommodating 125 000 students in the further education and training sector.

In year 2000 DWAF had at least 1500 vacancies for graduates in different disciplines. With the total production of appropriate graduates from 21 universities standing at approximately 500 per year this meant that at least 3 years was required to meet the needs of DWAF provided every graduate was recruited by DWAF and no resources retired or left DWAF otherwise.

Water Demand Management Educational and Training Programmes in the Region

Overview of some Educational and Training Programmes

The water sector is very broad, not only with regard to the different types of water systems (river basins, coastal areas, urban water systems) but also with regard to issues of scale (local, regional, transboundary and even global water issues). In discerning to the subject of WDM important questions are what aspects of water sector

should be covered so that one understands the dependencies within and between water systems? How much attention should be given to the national and regional situation in comparison with water sector in different climates or countries of different economical development? A number of different approaches and instruments are available for water sector human resources development. Some are listed in Box 3.

Box 3: Education and Training Approaches for WDM Programmes or Courses

Formal programmes: These courses, undergraduate and postgraduate, if focused and custom designed are the fundamental cornerstone of water sector human resources development and can be implemented by any tertiary education institution in South Africa.

Generic short courses. These courses, are an excellent opportunity for professionals who cannot be absent from their work for a long period of time. Although the programme is not made to meet the specific requirements of a particular institution, the content is usually focused on a restricted field of interest, such as Leak detection.

Tailor-made short courses. The tailor-made courses are developed on request to respond to an immediate training need of an organisation (See Appendix 2: Example of a WDM course for City of Bulawayo, Zimbabwe).

Group training in Masters Programmes. This is an intermediate form of the tailor-made and the generic type of education. A module that is specific to the group that is being trained replaces part of the regular Masters Programme. The group of participants has often a multi-disciplinary character, which requires a common training module that allows complex problems to be tackled by a team (See section 4.2 WaterNet/IUCN WDM tertiary training module).

Refresher courses. The objective of these courses is to bring the alumni in a two-week programme held in the region up-to-date on the developments in his/her field of interest.

It is noted that with the embedding of the water sector human resources development programme within the university structures imposes undue bureaucracy upon the programme. Regulations regarding scheduling of lectures, recruitment of participants, financial and student administration, examinations, accreditation by the national authorities and associations, use of facilities, payment of guest lecturers, etc. slow down the implementation of the planned activities

It is widely recognised that knowledge structure is a typical pyramid. In a knowledge pyramid, a large amount of elementary knowledge is located at the base of the pyramid. New knowledge is at the root of the base. Higher-level knowledge grows from lower-level knowledge. Different elements or kinds of knowledge at a same level produce different kinds of higher-level knowledge. The higher the level is, the more academic the knowledge is. Therefore, the knowledge varies from elementary or general knowledge at the bottom to highly academic knowledge or advanced science and technology at the top of the pyramid. Similarly, the knowledge structure of WDM is also a pyramid. It is composed of different levels of water sector knowledge ranging from general knowledge to highly advanced science and technology of the water-sector. Tables 4 and 5 summarises the different levels for WDM education and training and the motive of targeting certain groups for WDM.

Table 4 Educational Programmes

Level/Target group	Comment	Motivation and examples
Public education, primary and secondary schools	Primary and secondary education in WDM for all, is essential. It develops awareness and some of the most basic capabilities in water cycle management. It also creates a base of numeracy and literacy that enables people to be water-wise. Public education can take many forms, but it is usually informal and is achieved through use of public media, pamphlets, programmes in the electronic media and public meetings. The main objective is to raise awareness.	A number of successful schools programme on water awareness have been launched around the region, notably the schools programme in Namibia and South Africa. In Namibia water education which includes WDM aspects has been incorporated into the schools curriculum. The City of Bulawayo has a comprehensive public education and awareness raising campaign on the benefits of water conservation. Similar exercises are also being carried out by a number of cities in the region. ( )
Graduate and diploma	University education in WDM is very crucial for sustainable use of water resources. University education creates highly skilled individuals like catchment managers, city engineers, who reap the benefits through higher salaries. But it is also at the heart of creating national capacity in WDM so as to be able to adapt to the country's changing needs and manage the risk of water availability for different competing sectors. Analytical skills are essential in various disciplines which include, social and natural sciences and engineering and technological fields.	Various aspects of WDM are taught at a number of universities in the region as topics in courses or modules in mostly Civil and Environmental engineering degree programmes. The Universities of Zimbabwe, Witwatersrand, Pretoria, Natal, Western Cape, Cape Town, Stellenbosch and Dar es Salaam already teach such topics at undergraduate level. However none of the universities have dedicated courses or modules on WDM. Commonly, WDM features in courses like Water Supply, Water Resources, Water Treatment, Water Distribution and Irrigation Engineering. Some technical colleges or technikons have some aspects of WDM albeit less material and limited in scope and content than at universities.
Post-graduate		A few universities offer courses in WDM at this level. Generally postgraduate programmes in water are limited with the region churning out probably less than 150 post-graduates in the field of water. The WaterNet module on WDM being developed with the collaboration of IUCN is an innovative module which is designed to act also as a short course for water professionals. The module forms part of the WaterNet's Regional Master Degree Programme in Integrated Water Resources Management (IWRM).

Table 5 Training Programmes and Courses

Level/Target group	Comment	Motivation and examples
Top level management. Councillors, Politicians, Catchment managers,Board members,Decision makers,CEOs, Industrialists and other key players.	The training of decision-makers is required to create the proper environment for the new WDM specialists, generalists and technicians to effectively carry out their duties. Two types of training are envisaged here: the training of decision-makers with a professional background (senior level management), and the training of the elected decision-makers (user representatives), such as the councillors in a catchment or town or city (top level management)	In order to effect sustainable change, this group has to be trained mainly for awareness raising and to win political support. Once this group has been convinced, policy directives and regulations on WDM can then easily follow. Under UNEP and UNHS-Habitat programme on Managing Water for Africa Cities (MAWAC) Programme appropriate programmes have been developed to target this group. Similarly Rand Water (a bulk water supplier in South Africa) has developed such short courses
Senior level management. City Engineers,Heads of Departments, Farm Managers,Industrial Engineers,City Treasury,Legal section heads		This is the critical group to target in order to influence implementation. Benefits of WDM need to be well articulated to this group illustrating mainly economic, social and environmental benefits. The MAWAC project, City of Bulawayo and the Rand Water has also developed training course tailor made for this group.
Middle level management. Engineers, Accountants, Economists, Ecologists, Planners	Any intervention in matters of WDM will increasingly require detailed, up-to-date, state-of-the-art, specialist expertise. This expertise will include the 'conventional' disciplines such as hydraulic engineering, hydrology, geology, chemistry, etc. Advantage should be taken of the rapid developments during recent years with regards to PC-based modelling and to the use of remotely sensed data. However, specialist expertise should be widened to include disciplines that hitherto were not considered relevant to water, such as natural resource economics, ecology, and law	Planning and supervision of WDM implementation is executed by this group. Detailed training is required: this may include technical aspects like pressure management, design of water reticulation networks, leak detection and repair. City of Bulawayo, Rand Water and the MAWAC project have developed courses targeted at this group.
Operatives. Superintendents, Foremen, Plumbers, Irrigators, Extension workers, Water bailiffs	The eyes and ears, and hand and feet, of any water management organisation are the technicians, water bailiffs and other field staff who monitor water use, collect data, and have an intimate knowledge of the local reality. Traditionally the important role these technicians play has not been acknowledged. The skills of technicians should be urgently updated, not only in terms of technical expertise, but also in the (in many countries rapidly changing) legal and institutional context in which they operate.	This group, although falling at the bottom rung of the management hierarchy is crucial as it consists of the hands-on operatives who also maintain and repair the system. WDM is to some extent a bottom-up activity and training of operatives is probably more important than that of politicians and decision makers. City of Bulawayo and Rand Water has developed a short course to address the training requirements of this group.

The IUCN/WaterNet Water Demand Management Tertiary Training Module

In 1999 the IUCN-ROSA[17] (World Conservation Union Southern Africa) identified the need to develop a Post-graduate course module on Water Demand Management. IUCN in collaboration with WaterNet, University of Zimbabwe (Harare), University of the Western Cape (Cape Town) and ZimConsult (Harare) have compiled a draft module targeted at professionals involved in different aspects of water, and at various levels, including:

- water managers in charge of a water network (such as a catchment manager, operations manager of an industrial plant, chief engineer of a public water utility etc.), who supervise and provide guidance to professionals (senior managers);
- professionals working in a water network; who supervise technicians (middle managers).

The long-term objective of the course is that Water Demand Management analysis and measures are implemented on the ground, so that water is used more wisely, i.e. more equitably, more efficiently and in a more sustainable manner. The course objectives are informed by our understanding of why WDM is rarely implemented on the ground. The failure of WDM to be implemented on the ground may be understood from two main reasons:

- Most persons involved in water management: (a) lack appreciation of the merits of WDM; (b) lack understanding of the systems' approach, and (c) lack appropriate skills
- no political will from superiors.

Although the latter reason is very important, it falls outside the scope of the course i.e does not cater for top managers.

The course consists of the following teaching elements:

1. WDM in the context of IWRM; merits and limitations
2. Systems thinking
3. The hydrological system
4. The engineering system
5. The economic/financial sub-system
6. The political sub-system.
7. The information system
8. Linkages and water networks as a holistic system
9. Practical field study

All teaching elements contain many practical examples and exercises. The aim of the practical field study is to apply acquired skills to a real-world situation, and to serve as an integrating device. The course module is founded on a holistic understanding of a water system which takes into account all five sub-systems identified, and how these are intertwined in the system under consideration (Figure 1). The point is that *any* water system can be understood by considering these five sub-systems, establishing balances for these, and analysing the interfaces or linkages between them. It is believed that this approach is the key to understanding WDM at various scales and institutional arrangements.

---

[17] *Water Demand Management Phase II Project for Southern Africa*

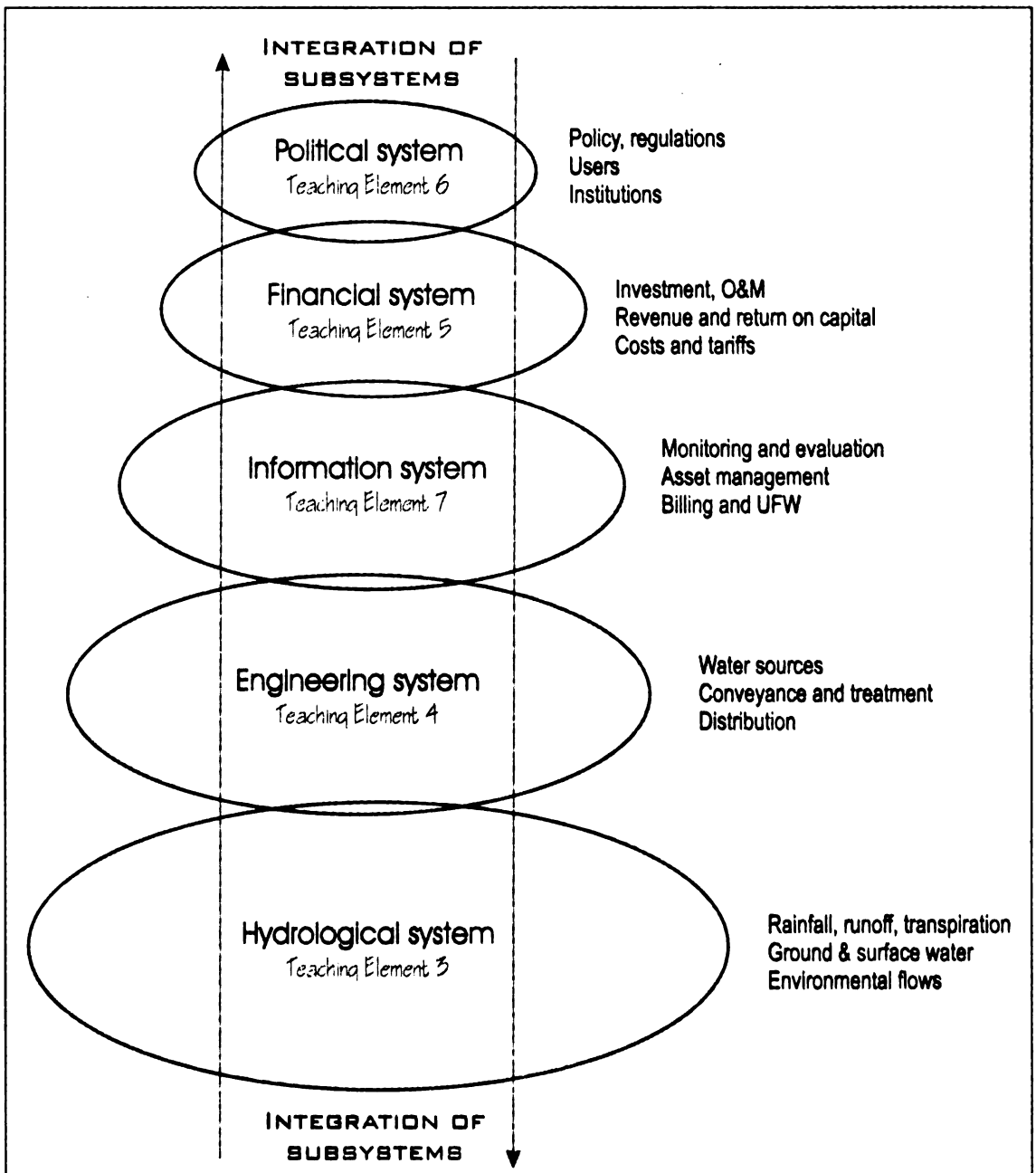


Figure 1 A holistic understanding of a water system

All teaching elements 3-7 have adequate examples of different types of water net works, including:

- Catchment area / river basin;
- Bulk water supplier and public water utility (both urban and rural), and
- Community level / end users (e.g. poor and rich neighbourhoods in an urban environment, as well as industrial users in an urban setting; but also irrigation systems)

Since skills-training has a strong emphasis in this course module, sufficient time should be allocated to practical work. For the post-graduate course module on WDM to fit within the WaterNet format, it should have a duration of 15 days, of which one day is for swot leave and another day for the examination. The remaining 13 days are available for teaching/training/exercises/self-study/field work. These could be filled as follows:

- 55% for conventional class room teaching situations, including exercises etc.
- 45% practical field study, including report writing and presenta tion.

Moreover, at least 50% of the conventional class room situation should be dedi cated to exercises, group assignments, self study etc. All lectures and exercises prior to the practical field study should provide all the tools and skills required, including methodology, to ad equately carry out a comprehensive systems analysis during the field study.

Implementing Institutions and Partners

It is clear from section 2 that almost all SADC countries do not have enough capacity to go it alone to educate and train sufficient manpower to handle the intricacies of WDM.The problems range from funding, insufficient local experts and expertise in relevant institutions and other resource materials. The involvement of the private sector in WDM training in the region is exemplified by consulting com panies like WRP Pty Ltd and Stewart Scott, both based in Pretoria South Africa (www.wrp.co.za and www.stewartscott.com).

Creating innovative partnerships and new incentives for WDM education, training an research is essential. This requires motivating the private sector, government and academia to combine strengths, within member countries, across SADC states and international collaboration.

Innovative learning tools and methodologies like e-learning, tele-education, internet based and distance education need also to be investigated. Knowledge and information exchange (North-South and South-South co-operation), is also crucial and setting up of quality benchmarking systems to ensure academic quality of the WDM training and educational products.

Regionally the SADC Water Sector is tasked to facilitate human resources development,capacity building and institutional strengthening at both national and regional levels (http://www.sadcwscu.org.ls/). The WDM educational and training needs have to fit into the broader IWRM SADC Water Sector / Waternet proposal for an Elabo rated Waternet (PCN 23) (Mudege and Taylor, 2001;

Krugmann and Sim,2002). Other possible key players nclude:

- Global Water Partnership Southern Africa, (GWP-SA) is a unique network that brings together governmental, educational, private and civil groups across various sectors in Southern Africa to support the practice of IWRM in the region, and the achievement of the Regional Vision for Water, Life and theEnvironment in the 21st Century. (http://www.gwpsatac.org.zw)
- WaterNet is a regional (Southern and Eastern Africa) network of university departments and research and training institutes specialising in water (http://www.waternetonline-org)
- Cap-net is an International network for Capacity Building in Inte grated Water Resources Management with its mission being "To enhance human resources development for IWRM by means of establishing or strengthening regional capacity building networks (http://www.cap-net.org)
- UNESCO-IHE Institute for Water Education - conferred with a certain autonomy - to deliver UNESCO's educational and capacity building services in the most efficient manner to all its member states and NGOs operating in the most environment sectors (http://www.ihe.nl)

Conclusion

There is no doubt that delivery of education and training is essential in increas ing awareness and equipping various stakeholders with the necessary skills and tools to implement WDM in the region. However cooperation and co-ordination is essential in order to meet the requirements of the various water using sectors. In the absence of clear data on the manpower requirements in the region's water sector only rough estimates can be made. A proportionate spread of water professionals among the various water users and institutions would also appear reasonable, al- though it is seems WDM in the short to medium-term emphsiwill have to be placed on training and continuos professional learning than formal education. In the long- term investment in education for children and the youth is more important. The education and training programmes or courses have to be flexible in terms of content

References

Forster, S. (1997). A water demand management network for Southern Africa. In Brooks, D.B., Rached E., and Saade, M. (eds). Management of water demand in Africa and the Middle East: Current practices and future needs. International Development Research Centre (IDRC), Ottawa.

Gleick, P.H. (2000). The world's water. The biennial report on freshwater resources, 200- 2001. Island Press: Washington DC.

Hirji,R., Johnson, P., Maro, P and Matiza-Chuita, T. (eds.). (2002). Defining and mainstreaming environmental sustainability in water resources management in Southern Africa. SADC, IUCN, SARDC, World Bank: Maseru/Harare/Washington DC.

Krugmann, H. and Sim, K.L. (2002) Capacity building networks in water: Lessons learned from Waternet. Final report submitted to Cap-net. URL: http://www.cap- net.org

Mudege, N. R. and Taylor, P. (2001). building Capacity for Integrated Water Resources

Management in the SADC Region, Project Proposal (for the elaboration of) Project Concept Note PCN 23: Waternet, Pundit Consultancy (Pvt) Ltd for SADC-WSCU, Final Draft, December 2001, 24 pp. plus one Annex.

Ndamba, J., and van der Zaag P. (1998). Assessment of integrated water resources management activities in the Southern Africa region. Institute of Water and Sanitation Development, Harare: URL: http://www.thewaterpage.com/IWRM_Zimbabwe.htm

SADC. (2000). SADC statistics: facts and figures 2000. SADC secretariat: Gaborone.

Southern African Development Community (SADC) (1999) Round Table Conference on the theme "Integrated Water Resources Development and Management in the Southern African Development Community." http://www.sadcwscu.org.ls/programme/rtc/rtc-II.htm

UNAIDS. (2000). Aids epidemic update. December 2000. Joint United Nations Programme for HIV/AIDS Geneva.

UNDP. (2001). Human development report 2001; making new technologies work for human development. United Nations Development Programme. Oxford University Press, New York.

UNESCO. (2000). World education report 2000: The right to education-Towards education for all thought-out life. United Nations Education, Scientific and Cultural Organisation. Paris.

WHO. (1997). Health and environment in sustainable development. Five years after the Earth Summit. World Health Organisation. Geneva.

Discussion

- Participants wanted to know if there was any training for primary and secondary schools and the presenter advised that that level was not covered by the study.

- On whether there was any proposal for the said training the presenter advised that all the countries have an institution representing Waternet except for Angola, DRC and Tanzania.

- There are a lot of people working on WDM but there is no one who can be called a WDM manager. Existing water professionals should be retrained and re-educated on WDM.

Reflections on the Kgotla Meeting

Participants visited Kgotla village and had a meeting with the Tswana people. The senior villagers at the meeting included the chief, headman, and Board member of the Development Trust.

The village chief welcomed the participants and apologised on behalf of those who could not be at the meeting due to work-related commitments. Masego introduced the group and explained that participants were there to learn from the community.

The chief explained that before the construction of the dam people were drawing water from the river. The village depended on water from the river stand. There were no standpipes. Because of the problem of sippage from latrines, boreholes were drilled in the river and then pipes were put in to take water to the villages. After construction of Shashe dam the village received water from Selebi Phikwe. A few years later Selebi Dam was constructed but the village does not get water from this dam.

Participants wanted to know how the village was involved in deciding what they wanted in order to overcome their water problems (Problem of misuse of water from the stand pipes). Villagers are aware of vandalism of water stand pipes by livestock. When this occurs they go to the council to report these cases. The chief confirmed that livestock should be removed from the village. Fines will be imposed on anyone found to be misusing the water. Management of national assets is everyone's task not just council or Water Utilities.

The community realises that they have a social responsibility for their environment and so they have formed a Development Trust which consists of a board of trustees. The limitation is on capacity building. They have organised workshops and trained board members and community at ward level on leadership. They feel that they are a step or two towards what is required. Walls were built around the stand pipes to protect them from being damaged by livestock. There is a proposal that a Water Committee be formed. The effect of having a dam is to enable sand to go downstream and so no water stays behind for people and livestock. The affluence and also waste from BCL Mine is discharged into the river. The relationship between people and cattle is strong traditionally. Traditionally there are three homes i.e. village home, masimu – where people plough and the cattle post.

Participants wanted to know how the management of water had been before the project and after the project. Before the project water was being drawn from boreholes and rivers but after the project the water is available in one's own yard and paid for at the end of the month. Those who have the money drill their own boreholes and water their cattle. Consultations with DWA on the water issues are good and still continuing. As a community there are no benefits but as a nation the community is proud of the dam. When the dam's water level goes down, cattle get stuck in the mud.

Businessmen are given loans to get access to the shoreline for enterprise development. Concerns were raised on why the community cannot get access to

these opportunities instead of the businessmen only.

The dam also has potential for tourism. A tender was put out and an individual obtained permission to put a camping site. A club was permitted to have sailing facilities and this club charges a membership fee. The club seems to be doing other things to generate income. Because of the pollution of Gaborone Dam the government commissioned a study and put on hold all other proposals for tourism related activities.

The community feels that they belong to the project and the project belongs to them, which means that whatever benefits that Water Authority thinks should be allocated, the community should be given first option (given that the community is closest to the project and have suffered some consequences e.g. having to move cattle posts, [Water Authority has been arrogant]). Whatever they do they will ensure that they take into account conservation of the environment. They are used to dealing with NGOs which are serious when it comes to conservation issues. The community is in the process of developing a wildlife sanctuary and they want to know if it was possible to provide water for animals for the wildlife sanctuary. They were encouraged to put forward a proposal.

There is very little recharge as a result of the project so farmers are being affected. Pollutants are now discharged and government is aware of this and it is taking measures to stop it. The mine has set aside some land that will absorb the waste.

There is a provision to release water periodically but because of climatic conditions of the country this has not been possible. Accidents can also happen when releasing water and designers are not often aware of these accidents. Farmers and livestock do not have enough water and therefore conflict will continue as long as this situation is there. Is there an opportunity for these farmers to get water through off-take from the pipeline? There are competing uses within the Botswana context. There is capacity to solve the problem and a way will be found through consultation. The Water Affairs Department is committed to working with the communities that they serve.

Vote of thanks was given by the headwoman.

PowerPoint Prentation By George Ramatoboro, Environmental Department, BCL Limited

Mr Ramatoboro gave this presentation to stress specific issues before the field visit commenced.

Presentation Outline

- Wastewater Sources
- Wastewater Management Projects
- Water Balance
- Conclusion

Sources of Wastewater

- Fissure water from underground and water from Smelter Cooling and granulation
  - 10 - 12 Ml/d water must be pumped from mine
  - 50% is re-used either for machine cooling or in the milling process
  - leaves an excess of 6 Ml/d for disposal into natural streams
  - not bad quality but not suitable for either re-use in process or for untreated discharge
  - off-spec" in sulphates, dissolved salts, nickel, iron, manganese
- From the concentrator process
  - Cleanings, tailings material (35% solids)
  - Not suitable for disposal into the environment
  - Solids settle on the dam and the water is recycled to the concentrator

Wastewater Management Projects

- Agricultural Utilisation:
  - Irrigation Project by Selebi Phikwe Fruit Estate
- Tailings Dam Seepage Treatment Plant

Wastewater - Agricultural Utilisation

- Feasibility study confirms:
  - soils will not suffer long- term damage
  - salts will be retained in sub-surface soil system
  - movement of salts into sub-surface water is not significant
  - wide range of cropping scenarios is possible
  - all final effluent (6 Ml/d) can be utilised by 120 -300ha land, depending on crops

Wastewater - Agricultural Utilisation

- Benefits of proposed citrus farm:
  - land usage 200 ha
  - 400 full time jobs
  - packing and juice factory
  - fruit for export only
  - use of Phikwe Dry Port and Botswana Railways
- Approvals needed:
  - Land Board
  - Ministry of Agriculture
  - Department of Water Affairs
- Approvals obtained:
  - Land Board - approval obtained provided that:
- WUC agree to supply water after mine closes
- Ministry of Agriculture agrees
  - WUC - agree to supply raw water after mine closure at commercial rates
- Approvals outstanding:
  - Ministry of Agriculture (Department. of CP&F) - approval expected subject to:
- Removal of Ni
  - Dept of Water Affairs (Water Apportionment Board) - approval

expected with following conditions:

- Removal of Ni
- Reduction of NaCl
- Nickel Removal Plant
  - precipitate with lime
- $Ni^{2+} + Ca(OH)_2 = Ni(OH)_2 + Ca^{2+}$
- Reduction of sodium
  - major source is sodium chloride used at Ice Plant
  - replace sodium chloride with potassium chloride
  - KCl has similar properties with respect to freezing point depression but cost is approximately 5 times more
  - farmer must add potassium (K) for plant nutrient and agree to pay for additional cost if added by BCL
  - full-scale test planned

Wastewater Utilisation- Summary

Effluent Problem? An opportunity!

- No damage to environment
- Agricultural crops potential
- Job creation
- Catalyst for further diversification.

Tailing Dam

- Formation of acid mine drainage:
- The culprits
  - Bugs
  - Sulphur
  - Air
  - Water
- $FeS + 2O_2 + 2H_2O = Fe(OH)_2 + H_2SO_4$
- We cannot stop this reaction from happening! Seepage treatment plant offers the solution.

Seepage Treatment Plant

- installed at P2.8 million to neutralise the acid water
- neutralisation using local limestone
  - cheaper than hydrated lime
  - high reaction rates
  - Acid Neutralisation

  $CaCO3 + H_2SO_4 = CaSO_4 + CO_2 + H_2O$
- precipitates gypsum (calcium sulphate) in Tailings Dam (no disposal problem)
- water return to Concentrator directly from main lake
- long-term requirement after mine closes

Water Balance

- relies on mass balance
- identify major water streams
- looks at the flows of water into and out of process units
- look at water quality and develop component balances for critical control parameters e.g. sulphates
- look for opportunities for water saving by either re-use or recycling

Conclusion

- Water conservation programme encourages
  - Re-use
  - Recycle
  - Reduce (consumption)

Problem

Wastewater has been going into the river (sulphates, nickel and iron) and it is impossible to remove sulphates effectively. A plan has been deviced whereby waste water can be used for agriculture.

Two proposed projects :

1. Agriculture utilisation – Selebi Phikwe Fruit Estate Company
2. Trailings Dam Seepage – Agriculture utilisation: Ministry of Agriculture approve subject to remove nichol. Department of Water Affairs approve subject to remove nichol and sodium chloride. Effluent – a problem or opportunity
3. Trailings Dam project – formation of acid mine drainage. Seepage treatment plan to combat pollution.

Reflections on the Field Trip – Simon Forster (seminar facilitator)

It was perhaps typical, and somewhat appropriate, that a field trip focusing on Water Demand Management (WDM) produced little in the way of visual examples. This is part of the problem of WDM. It is not characterised by impressive structures and systems but by almost invisible behavioural responses to water use. However, the day did produce ample evidence of why WDM is so important and why it must be incorporated in every aspect of water supply and Integrated Water Resources Management.

Mindful of the sensitivity surrounding the problems that Botswana faces with regard to water supply in the eastern areas, and of the purpose of this seminar (i.e. to advance the implementation of WDM) and not to criticise water supply systems which we have had the privilege of examining at close quarters, I propose to present my views on the field trip in the form of five key questions which I feel are fundamental to the advancement of WDM in Southern Africa.

Our first stop was a key section of the North-South Carrier Scheme, a large water scheme by anyone's standards. A number of national agencies were involved in its development along with numerous international bodies and plenty of professional expertise. Its development coincided with considerable international debate on the merits of large dams. Yet, at two years old the scheme has already failed, reportedly due to a severe drought. We heard some unhappiness about the design of the scheme, and that operational support tools were not in use. There was also a lack of clarity about the scheme's drought operation policy. However, irony of all this was that the beneficiaries of the scheme all seemed to be coping quite well with its failure. This raises a number of questions around the timing of the scheme, the resources devoted to its operation and whether or not it will contribute to water security whilst it remains disconnected from the Zambezi River. However, we are not here to consider these questions. The question we must be concerned with is:

Question 1
If the scheme were planned today, would it be designed differently and might WDM be accorded greater consideration – not as an alternative to the scheme but as a complimentary initiative designed to render inevitable drought operation easier?

One aspect not considered in the Working Groups was finance. This was largely because there was limited scope for encountering financial issues during the Field Trip. However, when we look at the cost of the North-South Carrier and the fact that it must still be paid for, there are important issues for the implementation of WDM. For example, the repayment of the debt is reportedly being met by revenues from other schemes run by the Water Utilities Corporation as the North South Carrier is not generating revenue due to the non-supply of water. To survive this added financial burden, one option must be to sell more water from other schemes. It is not clear whether this eventuality was anticipated in the financial risk modelling that should have been under taken in the planning phase of the project, but it needs to be pointed out that when a scheme fails, all financial resources are needed to deal with that failure.Current WDM initiatives being implemented in Botswana such as tariff hike investigations, recycling and community education all require funding if droughts are to be survived.

Therefore, if the introduction of WDM is likely to be associated with financial hardship for utilities, then we can expect it to be resisted – either overtly or covertly. Thus my second question is:

Question 2
How do we protect the revenues from water supply schemes as the consumption-reducing consequences of WDM programmes take effect? Those revenues are needed for debt repayment as well as WDM implementation? Obviously, a key issue here are the privatised utilities where revenues are even more sacrosanct.

At a community level, where there were few issues related directly to WDM, the problem of water for livestock was clearly uppermost in many people's minds. This is water that the community has enjoyed for generations but which is no longer available due to the construction of the dam. It is difficult to broach the issue of WDM with a community experiencing water shortages. Moreover, as the domestic needs of the community are met through standpipes, it suggests that a high level of water use efficiency already exists. This begs the question:

Question 3
What is the purpose (if any) of including water-efficient communities in a WDM programme? Does it send the wrong message – i.e. achievement results in more attention. Should we not be holding such communities up as an example to other water users rather than asking them to achieve more?

The mine visit presented a fairly desperate picture of 30 years or more of envi ronmental damage. It serves as an important reminder of the fact that we cannot turn back the clock and impose today's environmental standards retrospectively. Clearly the treatment and recycling of leachate water should have taken place from the first day of mining when the resources and on-site management for recycling were available. Now the mine is faced with closure, it has no revenues and presumably a skeleton on-site staff. Recycling is of course a key WDM option that needs to be encouraged as it delivers a double dividend – reduced water demand and reduced waste discharge. Unfortunately, the requirement to recycle is often beyond there-

sources of many effluent producers. It is expensive and there are not always the economies of scale at a given site. Durban in South Africa has developed a novel solution to this by gathering the waste of several producers and treating it to a level where it is suitable for re-use by industry. In this way the demand for fresh water is significantly reduced, some of the adverse effects of individual effluents cancel each other out in the mixing process, and it is affordable for even a small effluent producer. This raises the question of:

Question 4
Should water agencies promoting WDM not take the lead in forging recycling schemes that treat the waste from several producers rather than placing tough discharge criteria on individual companies?

WDM is not just a multidisciplinary approach to water management. It requires all water managers, regardless of their primary discipline, to adopt a multidisciplinary approach to doing their job. We met many people on the field trip. All of them could be classed as water managers of one form or another, including the community representatives. They are certainly all important in implementing WDM. However, this begs the question:

Question 5
To what degree are established water managers mentally prepared and convinced of the need to acquire the additional skills to implement WDM effectively?

In considering the experiences of the field trip and the five questions I have raised in this review, it should be apparent that water supply systems are not sustainable under any circumstances. But by incorporating WDM in the planning of such schemes from the outset, the sustainablility profile of the systems can be greatly improved. As such it is important not to see the two approaches as competing philosophies but as a necessary complimentary methodology to providing water.

Participants were divided into groups, with each group assigned a specific topic. The first group presented the following topic:

6.1 Engineering and Operations

Is the scheme adequately engineered and operated to respond favourably to WDM aims and objectives?

- No: From the pipeline part of the scheme there were questions about:
  - Pipe material selection
  - Design (engineering) of joints
  - Workmanship

What modifications could be made to assist with implementing WDM?

- There is need for better control of how the water is used including down stream users.
- A policy statement on use of water by WUC as custodians of the water is necessary.

Do the operators have sound understanding of WDM?

- Yes, They do have a good understanding of WDM but are limited by capacity.

Do the operators have a sound understanding of community needs and circumstances?

- Yes. The scheme operators appear to understand community needs and circumstances *but* the depth of that understanding is debateable and there is room for improvement as witnessed by our field visit.

What knowledge existed concerning water use and water demand by the community prior to the development of the scheme?

- Yes, there was some knowledge as indicated by the fact that the community recognises the importance of water for their needs and those of their livestock. Regular drought events have alerted (made aware) communities to the need not to waste water rather than specifically save it.

To what extent is that monitoring continuing now?

- Apart from the regular consultations between council and WUC, there is no apparent formal monitoring of the scheme.

How is the information being used to operate the scheme and meet the needs of the community?

- Given that there is very little relevant WDM information, there is not much (information) being used to operate the scheme in order to meet the needs of the community.The second group presented on the

following:

6.2 Community Management in Water Supply/2nd group

Current extent of Community Management

- Generally minimal
  - (a) Protection of standpipes and water points
  - (b) Reporting of leakages and vandalism
  - (c) Discouragement of livestock watering at standpipes
  - (d) Discouraging children wasting water at standpipes
  - (e) Willingness to have private connections

Weakness/Limitations

- (a) Communication gaps
- (b) Political support and commitment not adequate leading to the following:
  - Lack of ownership due to inappropriate or adequate consultation
  - Lack of policies (adaptive and flexible policies)
  - Complacency and apathy in terms of community participation
  - Misinformation by politicians

How Weakness can be Overcome

Address policy issues:
Promote community based strategies in water supplies management (responsibility and authority). This entails the following:

- Water Committees
- Maintenance fund
- Train communities on O&M
- Provide manuals
- Appropriate legislation and institutions.

What could be Achieved by Communities in WDM and what Support might be Achieved?

- Communities could achieve:
  - Water re-use (brick water for moulding)
  - Reduce water wastage
  - Rationing water during droughts
  - Control vandalism (stiff penalties, flogging and fees)
  - Individual house connection encourages metering
  - Increased revenue collection efficiencies with household connection
  - Fencing of stand posts/ water points from livestock
  - Formation of water committees will promote governance and transparency.

- Support needs:
  - Training and capacity building at national and community levels
  - Provide enabling environment

- Appropriate policies
  - Manuals for O&M users
  - TOR for water committees
  - Role of beneficiary community
  - Incentives for loss of traditional water sources
  - Appropriate technology.

Community Understanding of WDM

- Need to identify traditional practices and build them into the appropriate/adaptive WDM concepts.

Conclusions

- Encourage interdisciplinary approaches to enhance cooperation,collaboration and coordination in operationalising IWRM
- Provide adequate financing
- Identify and effect incentives
- Gender mainstreaming is necessary
- Regular communication and feedback between authorities and communities should be encouraged
- Monitoring, evaluation; and follow up interventions have to be put in place.

6.3 Communication

The third group discussed communication and looked at the following aspects:

Characteristics of Good Communication

- Engaged in timeously.
- Uses a 'bottom-up' approach rather than a 'top-down' one (start with the people at grass-roots level for whom the services are intended/ project will impact on).
- Understands that working through traditional structures (e.g. the chief) does not necessarily mean that one has "spoken to the people".
- Is consultative (speak with people NOT to people).
- Is comprehensive (it addresses all the issues that need to be in cluded).
- Is honest (does not make false promises, tell half-truths or pretend to know everything).
- Is proactive.
- Is transparent to allow the building of trust and effective open on-going communication.
- Ensures active, constructive participation of all role-players who should be involved.
- The role and purpose of the various stakeholders taking part in communications processes need to be clearly spelt out and understood (e.g. what DWA and WUC do).
- Is almost never "too late". If one failed to involve people initially, apologise, involve them and seek their opinions

(incorporate opinions and needs in some or other way on a "win-win" basis to show you are serious about hearing them).

- Understands the cultural context (e.g. Batswana are too polite to question issues) within which communication takes place AND creates a climate where people can exercise their rights, become more self-reliant and allows them to participate effectively.

Impediments/Constraints to Communication

- It is not always true that the 'proxy/sent' communicator has a good relationship with those he/she represents. Sometimes the person speaking on behalf of others has not/will not communi cate 'downline', is not in touch with the needs and wishes of the people, disregards their opinion and/or is not taken seriously by the people.
- Different stakeholders (e.g. DWA, WUC and EIA team) have differ ent sometimes even contradictory 'messages/stories' about the same subject.
- In communicating with communities there is a tendency to provide only 'positive' messages.
- There is, frequently, insufficient clarity about the purpose of the communication. Is it to inform, to obtain consensus, to get 100% 'buy-in', etc? This is not spelt out up-front.
- Communicators do not always do what is needed ("short-cuts").

Recommendations

- There is need for a three-day Communications Training and Strategic Planning Workshop for Local Water Demand Manage ment Teams.

6.4 Planning and Design

The group presenting this topic had the following points:

- To what extent was the scheme planned with the community and WDM in mind?
- What inputs did the community make to the planning and design process?
- If the scheme was planned and designed today with a need to place more emphasis on WDM, what modifications might be considered?

Some Thoughts about the Dam

- The dam is absolutely necessary and justified - the population is dependent on risky and intermittent water supplies
- "We are proud that the dam is located here and serving the rest of Botswana"
- At the strategic level this is a good project
- Strategic level needs to meet with the local level

Community Involvement in Planning

- Inputs by the community in the planning phase of the project

appears to be limited
- Consultation as part of the EIA was with the chief alone - subsequent engagement
- Consideration regarding community appears to be limited:
- plans for dam releases, although not practised
- no involvement in secondary beneficiation

Would We do it Differently Today?

- Need to define the demand drivers: Domestic, Industrial,Commercial and Agricultural Demand.
- Consider other alternatives,i.e re-use of effluent for agriculture and domestic gardening'or for industrial activities .
- Need to put in an infrastructure with a long life span and institute WDM and Water Conservation practices, prevent premature development of unnecessary infrastructure .
- Need to involve the community during the planning and construction stage.

6.5 Discussion after Group Presentations

The following issues were raised by participants after the group presenations:

- Sometimes there is no sense in continuing to communicate about an issue when a decision has already been made e.g. a decision that has been made by government.
- Communication fatigue amoung stakeholders – do not overdo it e.g. an area with a lot of EIAs taking place due to rapid development
- Incompetence can lead to poor communication. Also lack of confidence / empowerment
- There also seemed to be a lack of policies on how to operate the dam i.e during drought periods
- We use consultants and sometimes we question our capacity to supervise. Also when they are gone it's difficult to follow up on things (performance gap)
- Design phase could have factored in a smaller volume pump to run continuously to rescue the electricity load and therefore manage water demand at the electricity power station.
- Having developed infrastructure in order to provide water supplies, it becomes critical that we operate our system effectively and efficiently. The next stage is to focus on the management of demand and usage of water by end consumers.
- We should take into account water requirements prior to considering the development of infrastructure, we should estimate the potential for water conservation and water demand management. If the assessment indicates that WC/WDM can meet the new demand at a lower cost, we should implement WC/WDM first
- WC/WDM makes the same water (hydrological yield/releases etc) go much further in terms of providing services.
- Community managed water supply schemes generally do not work; they are an experiment brought by donor agencies. They work only in the absence of government projects.
- Are we passing on the buck because we have failed? Is this why we are giving the role/responsibility to communities?

- This issue requires a collaborative approach – community, Water Utilities Corporation, Council. It cannot just be a community managed initiative.
- Do we have a handbook on WDM for the community?
- Levels of community participation should be designed
- What were small communities are now large villages with different technology requirements
- Systems that worked 20 years ago no longer apply.
- Technocrats from the relevant departments can play an advisory role and act as ex officio members on the Village Trust Committee

SADC Co-ordination

Integrated Water Resources Management has been identified and accepted both internationally and locally as best practice in water resources management. SADC-WSCU has embraced IWRM, and this is reflected in its approaches, programmes and projects.

WDM is a critical component of IWRM. It facilitates appropriate consideration if WDM is part of "Water supply". It is vital that WDM be coordinated by SADC as part of its IWRM efforts.

WDM Forum

There is a need for greater collaboration amongst institutions on WDM. There is also a need for opportunities for water managers to meet and discuss WDM. It is proposed that IUCN hold a regular forum on WDM where countries can come together and share experiences and make an input into SADC through the process of feeding-up information from local to national level and then to regional level.

SADC- WSCU commented that they would welcome these kinds of initiatives that support their mandate, particularly the link with the grassroots level as they do not operate at this level.

The function of the forum would be to capture achievements and advances in WDM from the region and to build capacity and knowledge within institutions. GWP fora can be used to present WDM study results as well as the outputs of this meeting.

Brief Secondments/Exchange Visits

There are excellent case studies, experiences and expertise on WDM in the region. Given this, it is proposed that knowledge and capacity be developed regarding WC/ WDM. It is recommended that a programme of secondments and exchange visits be developed and implemented by the participating countries. This should be preceded by investigating and identifying areas on which to focus, and secondly what opportunities are available.

Joint Capacity Building

SADC-WSCU has adopted IWRM as the approach to water resources management. Workshops on IWRM have been held at SADC level. It is recommended that appropriate WDM training and capacity building be developed and implemented as part of the SADC IWRM training initiative. This will facilitate a SADC approach on WDM, and will be especially relevant in the context of shared basins.

Sharing of Resources

Significant resources, both financial and human, both local and donor, have been spent on the development of policy, legislation, regulations, strategies, case studies, guidelines, and management tools. We often find repetition and duplication of efforts

in the region. It is important that we share and network our resources related to WDM from the outset. One example is that the Water Resources Commission (WRC) might become a donor. IUCN may also leverage funds from the World Resources Institute (WRI) as well as bring in capacity to the benefit of the region. We would even consider that SADC-WSCU co-ordinate and manage the distribution and use of these resources.

Many good institutions have a lot of resources from which the rest of the region can benefit . There is need to share these resources more widely throughout the region. A good example of an opportunity to share experiences is the WaterNet meeting where IUCN has been given a day to focus on WDM issues.

IUCN should play the role of promoting awareness and co-ordination on WDM. There is also a need for the co-ordination of documentation of national policies, so that poorly resourced countries can get access to them and will not need to duplicate. Partners could benefit from the positive and negative experiences of the various case studies, and also avoid problems and mistakes.

Country reports should be developed and then presented at the next water forum.

SADC-WSCU: WC/WDM Co-ordinator

Recognising that the WDM is a relatively new discipline, and although many elements have historically been implemented, we have to promote WC/WDM as a new practice and an integrated component of IWRM.

It is suggested that a WDM co-ordinator be appointed with the WSCU in order to facilitate and co-ordinate a SADC regional approach. This would also help facilitate the formalisation and institutionalisation of WDM.

Allocative Efficiency

Although most efforts related to WDM are focused on minimising waste and improving water use efficiency by various water management and services institutions, and end consumers, we do not focus on the optimal use of water resources in the context of comparative use.

It is recommended that we consider securing donor funds to conduct a study on this. It is further suggested that we link up with South Africa's Department of Water Affairs and Forestry and the DFID funded project on Water Allocation.

The workshop noted the experience of sectoral water efficiency or allocative efficiency as an important WDM tool, but we have not unpacked this further. This is a strategic policy tool that we need to develop further if we are to truly balance demand with water availability. Allocative efficiency is a core-element of sustainable development, so we need to understand this in greater detail.

Existing SADC Policy and Protocols

It is important to review the above, from the perspective of identifying opportunities for the incorporation of WC/WDM into them. This will in volve a study, and ideally it should be co-ordinated by WSCU, or alternatively we develop this and some of the other ideas as part of SADC-WDM Phase 2 project.

WC/WDM Schools Education

Having recognised that education, especially in schools, is seen to be so important and necessary by SADC countries, it is suggested that we investigate this opportunity with South Africa taking the lead as it has recently developed relations with Project WET International which is an international "water education for teachers" programme. This project has extensive experience and resources, and has indicated an interest in establishing Project WET in Southern Africa.

Monitoring of WDM

There is a need to develop indicators for monitoring progress on WDM in the region.

Promote Community Based Natural Resource Management (CBNRM)

There is a need to promote community based natural resource management approaches. Skills of water authority managers in community communication and mobilisation need to be enhanced.

The value of this Seminar lay not in the originality or innovativeness of the presentations but rather in the way that water practitioners from the region came together in order to exchange experiences, debate new ideas and to find ways of overcoming obstacles relating to WDM. Although the Seminar was convened by the IUCN it might well have been a SADC initiative. While donor funding is no doubt welcome for events such as this, it is vital that regional structures such as SADC take the lead in establishing fora that deal with issues that are critical to the region. In this respect the response of the SADC delegates is very encouraging, but they must not be too quick to transfer the responsibility for WDM co-ordination onto the IUCN. Organisations like IUCN will always be there to help finance and arrange such fora but the primary responsibility rests with the regional structures.

Valuable suggestions pertaining to regional WDM co-ordination were made by the delegates. These included the annual generation of country reports and the regular exchange of information and experiences. Although, these are important first steps towards a regional WDM initiative, it must not be forced onto SADC countries nor be required of them. Some SADC countries may not have given WDM much thought. If countries do decide to report on WDM achievements it will be important for them to contextualise their efforts by quoting both the portion of the population and the percentage of the national water demand affected by WDM programmes. While the entire SADC membership was not represented at the Seminar, those that did attend clearly came from countries where WDM is starting to become a probable option. In listening to these delegates it became clear that while they would be happy to continue developing water resources to meet population and economic growth, the reality is that there is not always the finance nor the water with which to pursue such a strategy. In short, the keen interest in WDM was driven by the critical need to find new ways of meeting present and future water demand. Whether this consideration of WDM is prompted by decaying infrastructure, large-scale population movement, drought or just an unwillingness to accept loans for new water schemes, one thing is certain; more SADC countries are going to come to the WDM party in the next few years to see what is on offer.

In this context it was interesting to note the frustration that several delegates felt with the international aid community who persisted in promoting out moded, and often unaffordable, supply-side solutions to meeting future demand. The secondment of so-called 'international experts' who fail to adequately assess WDM options, the eagerness to provide 'surplus' supply-side materials (pipes, valves and taps) and the structuring of debt repayment arrangements which encourage the maximised use of water in water-scare areas, are clearly starting to be recognised as inappropriate forms of assistance. This suggests the start of a philosophical divergence between developed and developing nations with regard to the provision of water-related aid. If this potential dichotomy is ignored, some of the providers of international aid may one day find that they are out of step with evolving and progressive indigenous knowledge systems in Southern Africa. The Seminar demonstrated that these knowledge systems are already starting to engage with complex issues such as socio-economic allocative efficiency, the integration of WDM with IWRM, the institutional reform needed to accommodate WDM, and the promotion of educational strategies that will ensure the necessary skills with which to implement WDM effectively. Botswana, as it turned out, was an excellent venue for debating these issues as they

clearly had first hand experience of many of these problems and were open to sharing these with their SADC neighbours. The Seminar hosts are deserving of considerable recognition for their preparedness to debate the strengths and weaknesses of their water policies in an open forum. Moreover, the marked policy shift by Botswana from supply-side to demand-side approaches as encapsulated within the recent National Water Conservation Policy and Strategy Framework (NWCPSF) serves as an example to the SADC region of what can be achieved in a short space of time when policymakers, water practitioners and an educated public come to together and enthusiastically decide to do things differently. It is sincerely hoped the momentum and prominence currently enjoyed by this programme can be sustained from the pilot projects through to national rollout. If this occurs then Botswana will become the WDM beacon and pace-setter for the SADC region.

It is important for the delegates and SADC countries to realise that although a country such as South Africa may be comparatively wealthy, the high level of investment it has made in water supply systems and its resultant reduced vulner ability to drought means that the wide scale adoption and integration of WDM is probably many years off. As such other SADC countries that are required by circumstance to expedite the adoption of WDM may prove to be better role models for the region in the short term.

Having devoted justifiable recognition to the successes of the Seminar it is no less important to highlight the weaknesses. These weaknesses are not failures on the part of either the delegates or the nations they represent, but are in essence areas of critical omission. In some instances these omits have simply not yet been contemplated by water managers, in other situations they represent areas of political and economic sensitivity. The role of the Facilitator and Evaluator is to place these difficult, and sometimes painful, issues on the agenda for future attention.

The notion of educating politicians in WDM so that the necessary political will exists to support those tasked with modifying water management systems was raised during the Seminar. It is also recognised in WDM literature as a key imple-mentation bstacle. However, notice is seldom taken of the role played by the international community in influencing politicians of the merits of more visible and sometimes quite grandiose water supply schemes. The promotion of WDM starts at the very top with the belief that, although water supply schemes are, and will always be necessary, they should only be sanctioned once a respectable level of water use efficiency has been achieved and demonstrated with existing water supply systems.

International aid agencies and national politicians have a responsibility to ensure that financial and natural resources are employed to the maximum benefit of each nation. One way to achieve this would be to require the proponents of new water supply schemes to demonstrate that prevailing water use efficiency has been maximised, and that supply augmentation is fully justified. Such a simple requirement would radically alter the way in which water is managed throughout Southern Africa and would lead to an increase the longevity of many supply systems, it would make more water available for economic growth and enable available finance to be targeted at the poorly served – where it is needed most. This WDM forum, if it is to continue, should consider debating such measures and if found to be acceptable then they should lobby SADC, national governments and donors to consider adopting it.However, by issuing this challenge to policymakers it is important to be aware of the shortcomings within the WDM community regarding its ability to confidently quantify the benefits and savings associated with proposed local and national WDM strategies. To a politician, the socio-economic welfare of the nation is paramount. If supply-side proposals seem more convincing and demonstrate greater security, then they will continue to win the

day. Future Seminars need to devote time and effort to quantifying the benefits of proposed WDM programmes. This should not focus on measuring the benefits of implemented WDM programmes, although these do have an important guiding role. Rather it should devise ways and means to realistically quantify the benefits of a proposed WDM programme and to express these in terms of the costs involved. A key issue that was noted but not awarded the attention it deserved by the Seminar was WDM in the commercial irrigation sector. Whilst several presenters made refer-ence to the fact that small, and often easy to achieve efficiency improvements in the commercial irrigation sector had the potential to delay the commissioning of major water supply schemes for many years, no one seemed prepared to offer insights as to how this might be achieved practically and legally within the context of WDM. This issue must be awarded the attention it deserves in future.

Lastly, any future Seminar must take time to debate the conflict between the need to sell water from a scheme and repay debts versus the need to implement sustainable WDM. Perhaps the services of a creative financier may be warranted to lead the search for WDM-friendly financing mechanisms. Alternatively, perhaps the Seminar needs to challenge finance institutions such as the WB and donors active in the water sector to clearly spell out how WDM should be integrated with their current lending policies and their encouragement of Public Private Partnerships - which are premised upon maximising profits derived from the sale of water. This conflict can be ignored no longer.

In closing, it is important to recognise that WDM is a relatively new water management regime to the Southern African region. It will take many years, several conferences and lots of seminars before all the key issues are adequately unpacked, debated and resolved. The important thing to note from this gathering is that the process has begun, it has momentum, and the participants exhibited a high level of enthusiasm and commitment. Such a foundation should neither be ignored nor permitted to lead an unco-ordinated future.

Recommendations and the Way Forward

The sentiment expressed by the delegates on the way forward was quite clear. They wanted a Forum that meets annually to exchange ideas and experiences. They would like it to have strong ties to SADC, or alternatively part of the SADC water management system. IUCN should assist in holding and co-ordinating the Forum, and funding support should come from a wide range of donors. In essence, WDM should be subject to a far greater sharing of resources and expertise throughout the SADC region than exists on other aspects of WRM. In view of this I would like to suggest a way forward for the future of the Forum. These are merely more elaborate proposals based on the preferences of the delegates. They should be subjected to debate within SADC and IUCN. Furthermore:

- The Forum should become an annual Forum conducted under the auspices of SADC WSCU.
- The current format of the first day devoted to paper presentations, a field trip on the second day and a debating and resolution-taking session on the final day should be retained.
- IUCN should consider actively supporting the Forum in an administrative, logistical and content management capacity, but under the guidance of SADC.
- Guest specialists from overseas should be considered if funding for this

can be found from another donor.

- The purpose of the Forum should be to report on, review and exchange experience with regard to the implementation of WDM in Southern Africa. SADC may wish to task the forum with resolving certain WDM related issues or developing draft policy positions.
- Participation in the Forum by SADC countries should be voluntary. Delegates can be drawn from either the NGO sector or from Government, although only the latter would be an official representative of the country. In time, delegates from other sectors involved in WDM may be accommodated.
- Two levels of participation may be considered: active and observer. Active participants would be those countries that are implementing WDM and are willing to share experiences. Observer participants would be those countries who just want to keep abreast of developments/
- Forum venues could rotate around the countries of the active participants.
- A Forum Executive should be formed between the sponsor (IUCN) and SADC to map out the activities of the Forum, to engage the active participants, and to establish and prioritise an issues agenda.
- The Forum should have an elected Chair/Facilitator/Convener which changes every year. Such a person should ideally be drawn from academia and have a comprehensive background in WDM.

Chairperson, ladies and gentlemen, it is my pleasure to be accorded the opportunity of passing a vote of thanks and closing the seminar on behalf of SADC Water Division. It is also important to further remind you that SADC Water Sector Co-ordinating Unit (WSCU) has been relocated from Lesotho to Botswana and that the name WSCU has been phased out and replaced by Water Division. The Water Division is incorporated within the Directorate of Infrastructure and Services together with the Divisions of Energy, Tourism and Transport, Communications and Meteorology.

Indeed, you will all agree with me that the Seminar papers were excellently prepared and that the presentations were erudite. The participation in the discussions was very good and lively; this I believe shows how important the water issues are in our SADC region. The gender balance in the presentations was very encouraging and I am not sure as to whether this was by design or accident. We need to take gender mainstreaming issues very seriously in the Water Sector and go a step further by addressing the related role clarity.

SADC Water Sector continues to collaborate with IUCN-ROSA as one of the key partners in the implementation of the Regional Strategic Action Plan.There are other initiatives carried out by IUCN-ROSA that add value to the integrated water resources management processes in our region. The Water Division sits in the steering committee of the Water Demand Management Project.

Water Demand Management has lots of linkages with the Regional Strategic Action Plan. The Plan comprises of 44 Regional Projects out of which 31 have been prioritised for implementation and are currently at various implementation stages. Water Demand Management is an integral part of the integrated water resources management; therefore, it is vital to identify synergies and policy guidelines and directions through the water demand process that will feed into relevant projects of the Regional Strategic Action Plan.

Chairperson, in my view, the seminar participation level is well chosen. The role of Directors of Water in policy generation is quite clear and decisive. This is the level that translates techno-social issues into policies and beyond. The collective, honest and transparent sharing of experiences would help our region to forge ahead in the endeavour to develop, implement and sustain 'best practices' in the management of our scarce life line resource water. We need also to encourage study tours amongst our countries or exchange visits on specific projects.

We may be at different development levels due to reasons beyond our control, but what is important is that our region has decided to talk with one voice and that has created the opportunity of moving in the right direction. Our region should therefore be proud and supportive of its Regional Strategic Action Plan as it is the key to the regional co-operation, integration and above all poverty reduction.

Chairperson, ladies and gentlemen, the seminar has identified lots of challenges as our region is embarking on an integration route; the challenges need to be strategically and collectively addressed. Some of the identified challenges are:

Sharing of benefits as against sovereign positions

- Sharing of information and best practices
- Harmonisation of guideline standards
- Community focus on water programmes and projects
- Awareness creation
- Appropriate technologies
- Capacity to implement national and regional projects
- Avoidance of talk shops
- Harmonisation and strengthening of policies
- Water Demand Management as a conservation tool
- Changing the mindset of urban consumers (water wastage)
- Integrated Water Resources Management as a multi discipline
- Institutional reforms to deal with recent and future challenges
- Collaboration and co-ordination of the donors/co-operating partners

In conclusion Chairperson, special thanks to:

- The distinguished presenters including the official opening by Permanent Secretary, Ministry of Minerals, Energy and Water Resources (Dr. Tombale) and Ms Madzwamuse's welcoming remarks.
- IUCN
- Thothi the Water Conservation Drama group
- The co-operating partners who support the Water Demand Management Project
- The able facilitator
- Mmadinare community and members of the Village Trust
- The Management of the Hotel and BCL
- The Host in the names of Department of Water Affairs and Water Utilities Corporation
- Last but not least, all of us.

Chairperson, please allow me to officially close this very important seminar.

Bon Voyage

SURNAME	FIRST NAME	ORGANISATION	POSITION	COUNTRY	ADDRESS	TEL	FAX	E-MAIL
ARNTZEN	JAAP	CENTRE FOR APPLIED RESEARCH	DIRECTOR	BOTSWANA	P O BOX 70180, GABORONE	267-3903401 267-72141259	267-3903401	siphoka@botsnet.bw
BALEBETSE	MESHACK	WUC	WATER QUALITY MANAGER	BOTSWANA	P BAG 00276, GABORONE	267-3975179 267-72112216	267-3975187	mbalebetse@wuc.bw
BOCKARIE	JOSEPH S	MINISTRY OF LOCAL GOVT: DEPT OF LOCAL GOVT. & DEVELOPMENT	PRINCIPAL WATER ENGINEER	BOTSWANA	P BAG 00338, GAGORONE	267-3180613	267-3188909	jbockarie@gov.bw
BOITUMELO-MFULA	TUMISANG	DWA	E&A OFFICER	BOTSWANA	P BAG 0029, GABORONE	267-3607187	267-3607160	tmfula@gov.bw
CHAPMAN	CHARLES	DWA/COWI A/S	CTA	BOTSWANA	P. BAG 0029, GABORONE	267-3607160 267-72272236	267-3607160	hchapman@gov.bw
CHOGA	VAVARIRAI H.	DEPARTMENT OF WATER DEVELOPMENT	DIRECTOR	ZIMBABWE	6TH FLOOR, KURIMA HOUSE, P BAG 7767, CAUSEWAYHARARE	263-4-707681/793 263-11-403326	263-4-722752/707865	
CHOLA	PETER	WATER AFFAIRS DEPARTMENT	ASSISSTANT DIRECTOR	ZAMBIA	BOX 50288, LUSAKA	260-1-252589 260-97-873314	260-1-252589	hydro@zamnet.zm
DANQUAH-DARKO	STEPHEN	CENTRAL DISTRICT COUNCIL	HEAD OF WATER AND WASTEWATER DEPARTMENT	BOTSWANA	P BAG 001, SEROWE	267-4631686 267-71564481	267-4631686	sdanquahdarko@yahoo.com
DEEPCHAND	DHARESHWAR	WATER RESOURCES UNIT, MINISTRY OF PUBLIC UTILITIES	DIRECTOR	MAURITIUS	3RD FLOOR, ROYAL COMMERCIAL CENTRE, ST IGNACE STREET, ROSEHILL	230-4657988 230-2567820	230-4657177	wru@intnet.mu; ddeepchand@mail.gov.mu
DEWET	STEPHAN	MINISTRY OF AGRICULTURE, WATER & RURAL DEVELOPMENT	DEPUTY DIRECTOR	NAMIBIA	DEPARTMENT OF WATER AFFAIRS, P. BAG 13193, WINDHOEK	264-61-2087161	264-61-2087227	WetS@mawrd.gov.na
FAKIR	SALIEM	IUCN	COUNTRY PROGRAMME COORDINATOR	SOUTH AFRICA	3RD FLOOR, NORTH WING, HATFIELD FORUM WEST, 1067 ARCADIA STREET, HATFIELD	27-12-3428304/9	27-12-3428289	saliem.fakir@iucn.org
FOSTER	SIMON	DPR MANTEDI	PROJECTS MANAGER	SOUTH AFRICA	P O BOX 484 WITS, 2050	27-11-3391172 27-82-4547814	27-11-3391463	simon@dpr.co.za; dpr@iafrica.com
GABAAKE	GABAAKE	DWA	DIRECTOR	BOTSWANA	P. BAG 0029, GABORONE	267-3951601 267-72305154	267-3930508	ggabaake@gov.bw
GOTLOP	PETER	BOTSWANA DEFENCE FORCE	PRINCIPAL ENGINEER	BOTSWANA	P O BOX 9, THEBEPHATSHWA	267-3665196 267-71783821	267-3665239	
GUMBO	BEKITHEMBA	UNIVERSITY OF ZIMBABWE	LECTURER	ZIMBABWE	P O BOX MP167, MT PLEASANT, HARARE	27-11-7177140 27-83-714779	27-11-8040385	gumbo@civil.wits.ac.za; gumbo@ibe.nl
JAY	BARAEDI	DWA	PRINC. WATER ENG. (HYDRO& WATER RESOURCES)	BOTSWANA	P BAG 0029, GABORONE	267-3905604 267-72111297	267-3903508	bjay@gov.bw
KELAENG	EPHRAIM	DWA	PRINC. WATER ENG. (CIVIL)	BOTSWANA	P BAG 0029, GABORONE	267-3607139 267-		

KHONJE	ABEL THOMSON	DEPARTMENT OF IRRIGATION	DEPUTY CONTROLLER: IRRIGATION SERVICES	MALAWI	P O BOX 30797, LILONGWE 3	265-1-750595/752122/751177/ 757575 265-8872814	265-1-751459	irrigation@sdnp.org.mw; akhonje2002@yahoo.com
LEJOWA	ODUETSE CHRISTOPHER	MMADINARE TRUST BOARD (CBO)	BOARD SECRETARY	BOTSWANA	P O BOX 337, MMADINARE	267-2601440		
MADZWAMUSE	MASEGO	IUCN	COUNTRY PROGRAMME COORDINATOR	BOTSWANA	P. BAG 00300, GABORONE	267-3971584	267-3971584	masego@iucnbot.bw
MAFELA	JAMES	WUC	MAINTENANCE ENGINEER	BOTSWANA	P O BOX 141, SELEBI-PHIKWE	267-2617453 267-72103318	267-2617685	jmafela@wuc.bw
MAGWEREGWEDE	RICHARD	BOCOBONET	PROGRAMMES MANAGER	BOTSWANA	P BAG BO166, GABORONE	267-3185081 267-71563957	267-3185081	bocobonet@mega.bw
MAINALA	SYDNEY M N	MINISTRY OF WATER DEVELOPMENT	DIRECTOR: WATER RESOURCES	MALAWI	P. BAG 390, CAPITAL CITY, LILONGWE 3	265-1-770344/221	265-1-773737	mainalas@malawi.gov.mw
MASEDI	OBONETSE ALFRED	SADC DIRECTORATE FO R INFRASTRUCTURE & SERVICES - WATER DIVISION	INTEGRATED WATER RESOURCES MANAGEMENT EXPERT	BOTSWANA	P. BAG 0095, GABORONE	267-3153000/4 267-72106053	267-3153002	sadcrsap@botsnet.bw
MATAND	GEORGES KAZAD	CNAEA	SECRETARY GENERAL	DRC	65, BD DU 30 JUIN BLDG, REGIDESCO/DG, BP 12599, KINSHASA-GOMBE	243-8845125 243-9903066	243-1398919	gkazadmat@yahoo.fr
MATHANGWANE	BOGADI	DWA	SNR. WATER ENGINEER (CONSERVATION)	BOTSWANA	P BAG 0029, GABORONE	267-3607159 267-72272230	267-3607160/3901981	bmathangwane@gov.bw
MATHANGWANE	BRIXTON	AGRICULTURE, CROPP PRODUCTION & FORESTRY	PRINCIPAL WATER ENGINEER	BOTSWANA	P BAG 003, GABORONE	267-3950671 267-71554056	267-3907057	bmmathangwane@gov.bw
MAUNGE	FRED MVIMI	WUC	CHIEF EXECUTIVE	BOTSWANA	P BAG 00276, GABORONE	267-3604421	267-304676	fmaunge@wuc.bw
MBIZVO	CARMEL	IUCN-ROSA	PROGRAMME COORDINATOR	ZIMBABWE	6 LANARK RD, BELGRAVIA	263-4-728266/7	263-4-720738	carmelm@iucnrosa.org.zw
MMOLAWA	ROBERT K.	DWA	CHIEF WATER ENG. (O&M)	BOTSWANA	P BAG 0029, GABORONE	267-3607166 267-72111239	267-3901981	rmmolawa@gov.bw
MMUTLE	ROACH	WC&DM PROJECT	DISTRICT TECH OFFICER	BOTSWANA	P BAG 0029, GABORONE	267-3607338 267-72272240267	267-3607160	rmmutle@gov.bw
MOALUSI	MOABI. E	GHANZI DISTRICT COUNCIL	STO	BOTSWANA	P. O. BOX 98, CHARLES HILL	267-6592059 267-72238750	267-6592188	
MOGOTSI	MOGOTSI	MMADINARE TRUST BOARD (CBO)	VICE CHAIRPERSON	BOTSWANA	P O BOX 337, MMADINARE	267-2617270 267-72236320	267-2600054	MOGOTS@BOTSNET.BW
MOJAKISANE	MOKAKE	DEPARTMENT OF WA TER AFFAIRS	DIRECTOR	LESOTHO	P O BOX 772, MASERU 100	266-22-317516 266-58883948	266-22-310437/22313602	dwa@ilesotho.com
MOLOTSI	T.	DABS	CE	BOTSWANA	P. BAG 0025, GABORONE	267-3653700	2673974932	
MOREMI	L	BOCOBONET	CHAIRPERSON	BOTSWANA	P BAG 166, BONTLENG, GABORONE	267-3185081 267-72444807	267-3185081	bocobonet@mega.bw
MOSIMANEOTSILE	LILLIAN	WUC	WATER SUPPLY MANAGER	BOTSWANA	P BAG 00276, GABORONE	267-3975179 267-71309741	267-3975187	slmosimaneotsile@wuc.bw
MOZOLA	JUSTICE	WUC	CUSTOMER CARE & SERVICES MANAGER	BOTSWANA	BOX 843, FRANCISTOWN	267-246100 267-72103301	267-2413326	jmozola@wuc.bw
MPHEKE	MOTSHWAEDI	WUC	DISTRIBUTION MANAGER, SOUTH	BOTSWANA	P BAG 00276, GABORONE	267-3952783 267-71309768	267-3973850	mpheke@wuc.bw

MSIBI	KENNETH	SADC DIRECTORATE FOR INFRASTRUCTURE & SERVICES - WATER DIVISION	REGIONAL WATER POLICY EXPERT	BOTSWANA	P. BAG 0095, GABORONE	267-3153000/4 267-72575619	267-3153002	sadcrsap@botsnet.bw
MUDANGA	GODFREY	WATER UTILITIES CORPORATION	DEPUTY CHIEF EXECUTIVE	BOTSWANA	P. BAG 00276, GABORONE	267-3604485 267-71305728	267--3904676	gmudanga@wuc.bw
MWALE	L. J.	MINISTRY OF AGRICULTURE, FOOD & FISHERIES	DIRECTOR: DEPT. OF AGRICULTURE	ZAMBIA	3RD FLOOR, MULUNGUSHI HOUSE, BOX 50291, LUSAKA	260-1-251871	260-1-254661	chibambanyirenda@yahoo.com.uk
MWASAMBILI	REES	NATIONAL WATER & SANITATION COUNCIL	TECHNICAL INSPECTOR	ZAMBIA	P O BOX 34358, LUSAKA	260-1-226941/2 260-9-749210	260-1-226904	reesm@zamtel; reesm@zamnet.zm
NJAGGAH	PETER M.	CENTRAL DISTRICT COUNCIL - BORORWA SUB DISTRICT	WATER ENGINEER	BOTSWANA	P O BOX 334, BOBONONG	267-2629222 267-71835585	267-2629465	BOBIRWAWATER@BOTSNET.BW
OOKEDITSE	SEELE	WUC	DIRECTOR, CUSTOMER CARE, SERVICES AND DISTRIBUTION	BOTSWANA	P BAG 00276, GABORONE	267-3604417 267-72108802	267-3904676	sookeditse@wuc.bw
OPELO	JIMMY	DEPARTMENT OF SANITATION & WASTE MANAGEMENT	PRINCIPAL SANITATION ENGINEER	BOTSWANA	P BAG BO 323, GABORONE	267-3911802	267-3909953	jopelo@gov.bw
RAMATOBORO	GEORGE	BCL LIMITED	ASSISTANT ENVIRONMENTAL ENGINEER	BOTSWANA	ENVIRONMENTAL DEPT. P O BOX 3, SELEBI PHIKWE	267-2621387	267-2610441	gramatoboro@bcl.bw
RAMOLELE	FREDERICK	KGATLENG DISTRICT COUNCIL	SENIOR TECHNICAL OFFICER	BOTSWANA	P. BAG 11 MOCHUDI	267-5729433 267-71508840	267-5729433	
REVAKA	CHARMAINE	WUC	PUBLIC RELATIONS MANAGER	BOTSWANA	P BAG 276, GABORONE	267-3604484 267-71838975	267-3973852	crevaka@wuc.bw
SANGWENI	RAPHAEL SANELE	MINISTRY OF NATURAL RESOURCES & ENERGY	SENIOR WATER ENGINEER	SWAZILAND	WATER RESOURCES BRANCH, P O BOX 6201, MBABANE H100	268-4048031/2 268-6054223	268-4042019	wrb-wcon@Realnet.co.sz
SCHAAN	CHRIS	DWA COWI	TECH. SUPERVISOR	BOTSWANA	DWA HQ, GABORONE	267-3607338 267-71888062		cmschaan@yahoo.com
SCHOEMAN	GERALDINE	AFROSEARCH	MANAGING DIRECTOR	SOUTH AFRICA	BOX 13540, HATFIELD 0028	27-12-3622461	27-12-3622463	gera@afrosearch.co.za
SEBINA	MATHEWS	SOUTHERN DISTRICT COUNCIL	PRINCIPAL WATER ENGINEER	BOTSWANA	P BAG 002, KANYE	267-5403306 267-7163836	267-5403307	sdcworks@botsnet.bw
SENAI	GASELEMOGWE	WUC	SAFETY AND ENVIRONMENTAL MANAGER	BOTSWANA	P BAG 00276, GABORONE	267-3975179	267--3975157	gsenai@wuc.bw
SERUMOLA	OARABILE	DWA	PRINC. WATER ENG. (WQ&C)	BOTSWANA	P BAG 0029, GABORONE	267-3607173 267-72272242	267-3901981	oserumola@gov.bw
SERUNYA	PONTSHO	POLICE	PPROJECT COORDINATOR (DEVELOPMENT)	BOTSWANA	P BAG 0012, GABORONE	267-3951161 267-71630730	267-3973723	pserunya@gov.bw
SINGH	MICHAEL LUTCHMAN	DEPARTMENT OF WATER AFFAIRS AND FORESTRY	DIRECTOR: WATER CONSERVATION	SOUTH AFRICA	PRIVATE BAG X313, PRETORIA, 0001	27-12-3368819 27-82-8086382	27-12-3368086	SinghM@dwaf.gov.za
TLHABOLOGANG	TAITA	WUC (F/TOWN)	SUPPLY ENGINEER	BOTSWANA	P. O. BOX 843, FRANCISTOWN	267-2412366 267-72103309	267-2415511	ttlhabologang@wuc.bw
TOMBALE	AKOLANG	MINISTRY OF MINERALS, ENERGY & WATER RESOURCES	PERMANENT SECRETARY	BOTSWANA	P BAG 0018, GABORONE	267-3656602 267-72106051	267-3909368	atombale@gov.bw
					ROOM AB 28, BUILDING			

IUCN - THE WORLD CONSERVATION UNION

IUCN - The World Conservation Union was founded in 1948 and brings together 79 states, 112 government agencies, 760 NGOs, 37 affiliates, and some 10,000 scientists and experts from 141 countries in a unique worldwide partnership. Its mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. Within the framework of global conventions IUCN has helped over 75 countries to prepare and implement national conservation and biodiversity strategies. IUCN has approximately 1000 staff, most of whom are located in its 42 regional and country offices while 100 work at its Headquarters in Gland, Switzerland.

IUCN REGIONAL OFFICE FOR SOUTHERN AFRICA

The IUCN Regional Office for Southern Africa was established in Zimbabwe in 1987 to serve the Southern African Region and the Southern African Development Community (SADC) in the development of modern skills in conservation and natural resource management. IUCN-ROSA coordinates such regional services to over 70 members in 11 countries through its regional support programmes, regional networks, and its country offices in Botswana, Mozambique, South Africa and Zambia.

IUCN-ROSA's operational vision is to be a Development Partner of First Choice but the vision for IUCN's environmental and natural resource management work in the region is Greater Environmental and Human Security in Southern Africa. Its mission for southern Africa is to facilitate and strengthen an integrated approach for the sustainable and equitable use of natural resources and the conservation of biological diversity

The underlying objective in all IUCN-ROSA's activities and programmes is capacity building and catalysing action. Developing, coordinating and supporting programmatic partnerships is the preferred operational mechanism supporting this objective. Additional services include the provision of objective and scientifically based advisory services and technical assistance, training inputs and programmes, and fora for national and inter-regional dialogue, networking, debate and conflict resolution.

At the regional level, IUCN-ROSA spearheads the World Conservation Union's efforts to integrate the Union's secretariat, membership and commissions in common purpose within the framework of the Union's mission.

For a copy of the IUCN ROSA Publications write to:

IUCN-ROSA, Information and Marketing Unit, 6 Lanark Road, Belgravia, P.O. Box 745, Harare, Zimbabwe.
Postmaster@iucnrosa.org.zw

Or

IUCN Publications Services Unit, 219c Huntingdon Road, Cambridge, CB3 ODL, UK.
Tel: + 44 1223 277894; Fax: + 44 1223 277175; E-mail: info@books.iucn.org; http://www.iucn.org

WATER AFFAIRS

IUCN
The World Conservation Union