

**Final report**

**National scoping study for the Botswana  
IWRM WE programme**

**31<sup>st</sup> of May 2010**



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## Acronyms

AFU	Automatic Flush Urinal
BORHUA	Botswana Rainwater Harvesting and Utilisation Association
CAR	Centre for Applied Research
CBO	Community Based Organisation
DEA	Department of Environmental Affairs
DGS	Department of Geological Surveys
DWA	Department of Water Affairs
EFR	Environmental Flow Requirements
EIA	Environmental Impact Assessment
GEF	Global Environmental Facility
GoB	Government of Botswana
GWP (SA)	Global water Partnership (Southern Africa)
IWRM	Integrated Water Resources Management
KCS	Kalahari Conservation Society
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
MMEWR	Ministry of Mineral, Energy and Water Resources
MoA	Ministry of Agriculture
NDP	National Development Plan
NGO	Non-Government Organisation
NMPSWW	National Master Plan for Sanitation and Wastewater
NWMP	National Water Master Plan
NSWC	North South Water Carrier
RBO	River Basin Organisation
RSAP	Regional Strategic Action Plan
SADC	Southern African Development Community
SEA	Strategic Environmental Assessment
ST	Somarelang Tikologo
ToR	Terms of Reference
UAfW	UnAccounted for Water
UN	United Nations
UNDP	United Nations Development Programme
WA	Water Authority
WDM	Water Demand Management
WE	Water Efficiency
WSRP	Water Sector Reform Project
WUC	Water Utilities Corporation
WWTW	Wastewater Treatment Works

## 1 Introduction

### 1.1 The project

The Government of Botswana (GoB) and the United Nations Development Programme (UNDP) have commissioned the development of the IWRM-WE programme in Botswana (funded through the Global Environmental Facility GEF, Global Water Partnership Southern Africa GWP-SA and GoB). The project is carried out in the period 2009-2012 and the project management unit is based at the Kalahari Conservation Society (KCS). Botswana has joined many other countries in preparing and implementing IWRM-WE plans, which were initially due in 2005. This report documents the findings of the scoping study for the IWRM-WE strategy. The Centre for Applied Research (CAR; [www.car.org.bw](http://www.car.org.bw)) has been commissioned to carry out the national scoping study for the project during the period Mid-March until the end of April. The following are specific tasks of the study as outlined in the ToR:

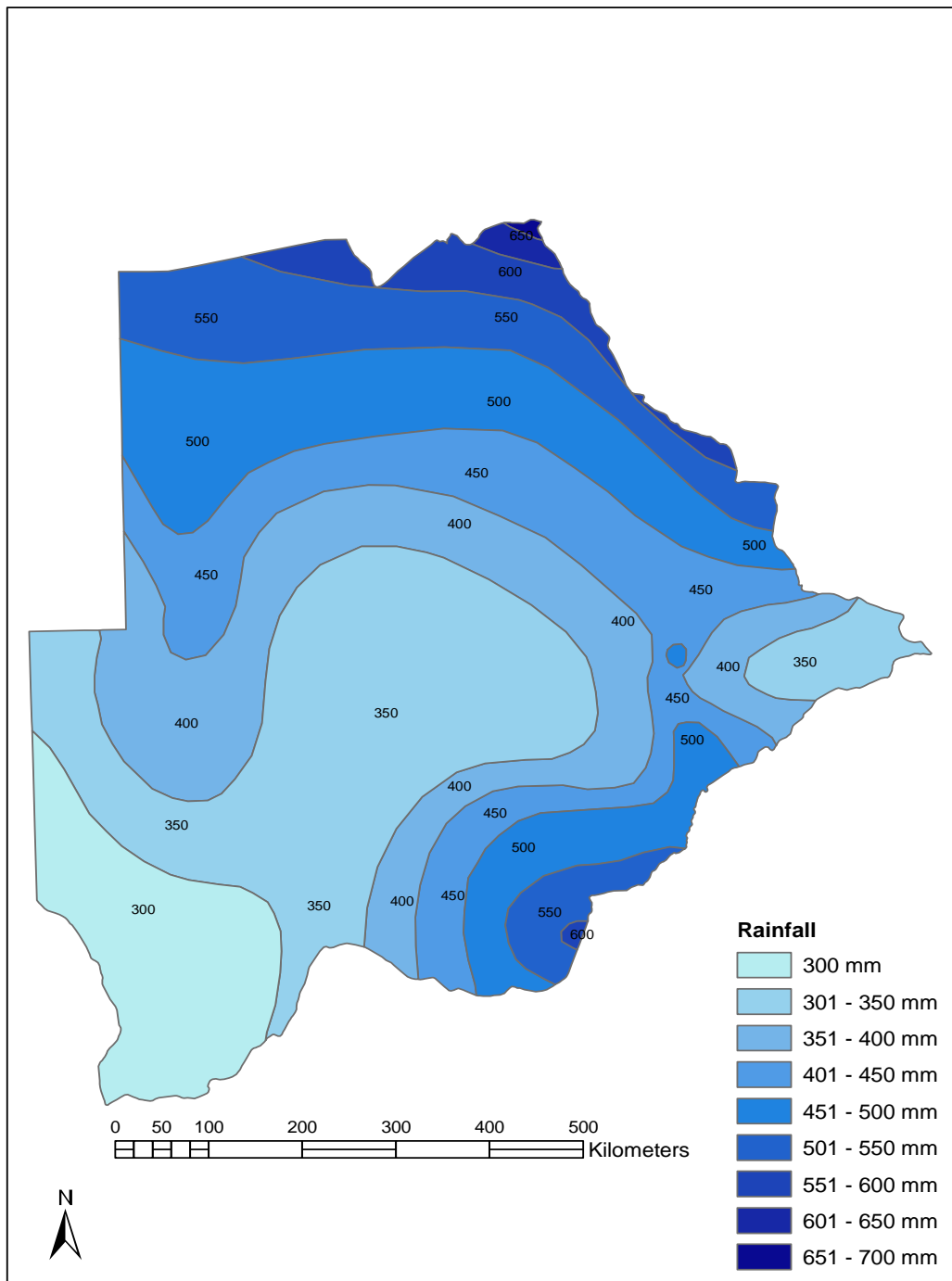
1. To develop the relevant background information on the country's water policies, strategies and programmes to guide the first preparatory workshop on awareness in IWRM/WE planning and implementation
2. To conduct the country scoping studies to assess the current status of the water resources IWRM planning and implementation, and produce a situation analysis report identifying good practices and challenges pertaining to formulation and implementation of national IWRM/WE plans in the country.
3. To undertake a national workshop. This workshop will be attended by policy makers, technical experts and stakeholders in the various districts across the country including representatives of GWP/SA, CapNet, and WaterNet, who will play a pivotal role in regional knowledge management. It will be aimed at providing a platform among for exchange of experiences on lessons learned and good practices on key water resources management and planning and implementation issues
4. Based on the outcomes of the study, develop a summary report on options for assisting in accelerating the development and implementation of IWRM plans, outlining country national and transboundary water resources priorities, challenges and gaps for the effective management of water resources in the country.
5. Identify modalities and mechanisms for ensuring regional knowledge management component by GWPSA and other partners.

The following activities should be undertaken:

- Review of the NWMP review report of 2006;
- Review of the water sector policies, strategies and legislation;
- Undertake a situational analysis water sector;
- Assess national and transboundary water resources priorities and link them to IWRM plan development and implementation as well as associated financial needs;
- Produce a draft report;
- Facilitate a national workshop;
- Incorporate the workshop comments; and
- Produce the final report.

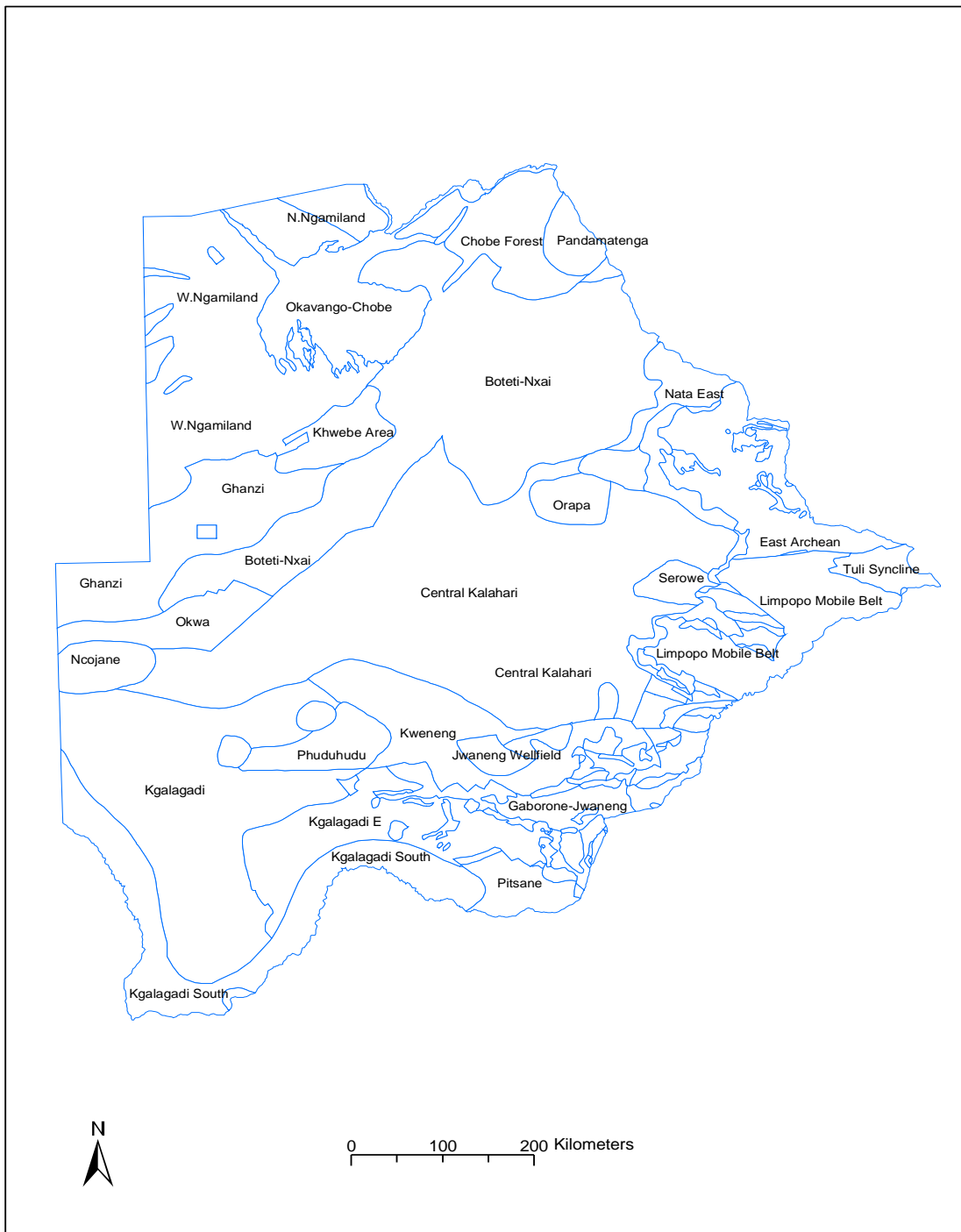
Rainfall patterns are shown in Figure 1. The country's major water resources are shown in figures 2 and 3.

Figure 1: Average annual rainfall distribution (in mm.)

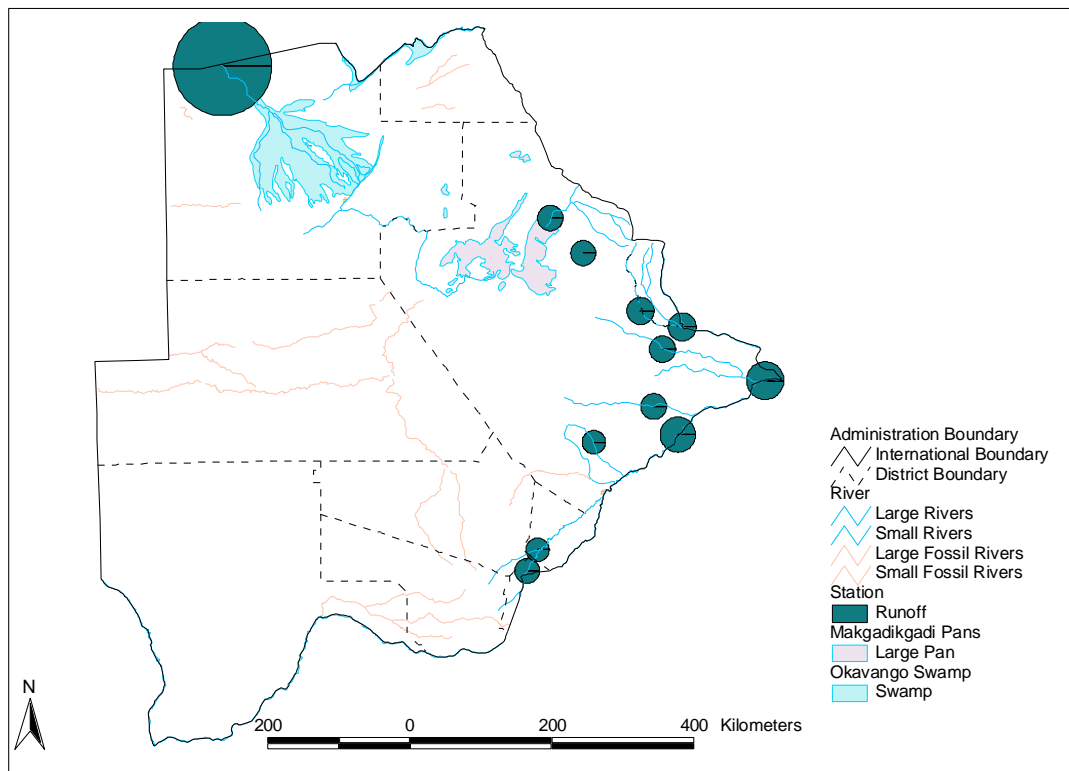


Source: Department of Surveys and Mapping, 2001.

Figure 2: Major well fields



Source: Department of Surveys and Mapping, 2001.

**Figure 3: Estimated annual run-off shared rivers (Mm<sup>3</sup>).**

Source: Department of Surveys and Mapping, 2001.

## 1.2 Global and regional assessments of progress with IWRM-WE plans

A global survey (UN-Water, 2008) showed that 38% of the developing countries now have an IWRM-WE plan. The survey also found that implementation of such plans is much less advanced and that there is need to prioritise water efficiency interventions and to develop a set of indicators to monitor progress with implementation. The survey demonstrates benefits of the IWRM approach over the traditional sectoral and fragmented approach. Findings with respect to African countries are:

- Poverty reduction strategies are less advanced than in Asia and South America;
- Water use and efficiency issues are less covered than elsewhere;
- Stakeholder participation is more advanced in Africa than in Asia or South America (except that Asia is more advanced with respect to transboundary water management).

The SADC IWRM assessment identified four key messages (Pegasys, 2009):

1. IWRM is not a goal but a means to environmentally sustainable water management that supports socio-economic development. IWRM is the water sector tool towards sustainable development;
2. IWRM programmes need to be aligned to the available capacity and prioritise activities *within* the implementation capacity;
3. There is no blue print for IWRM and each country needs to identify the main challenges and actions required to overcome these challenges; and



4. Stakeholder consultation and participation is essential but needs to be purpose driven: there is no need to involve *all* stakeholders in *all* processes.

For Botswana, the assessment observed that the legislation is dated and that there are no legal requirements to meet environmental flow requirements. It further states that the "country places more emphasis on WDM than development" (Pegasys, 2009, p. 62; a debatable statement) and refers to the water sector reform project.

Progress has been made with IWRM and water efficiency but it has been much slower than originally planned. Recognising that each country's IWRM issues are unique, countries need to design their own *roadmap* for improving water management (UN & GWP, not dated). Three stages can be distinguished, each requiring indicators for performance monitoring:

1. Changing the enabling environment (policy, institutions & instruments);
2. Actual IWRM changes; and
3. Impact assessment of IWRM changes on MDGs.

UN-Water and GWP suggest possible indicators for M & E of each stage, to be achieved in 2009, 2012 and 2015 respectively.

### 1.3 Methodology

The study has been based on a review of the literature, on interviews with key persons and on consultations with stakeholders.

The following descriptions of key concepts have been used (Figure 4).

**Figure 4: Description of key concepts**

**IWRM:** 'process, which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'. The overall IWRM goal is to ensure an efficient, equitable and environmentally sustainable water provision in the short and long term.

**Efficiency:** doing as much possible with an amount of water resources in terms of servicing more people with potable water, creating more jobs or increasing value added and economic growth. Efficiency has different aspects such as technical efficiency, allocative efficiency and user efficiency.

**'Road map':** schedule of implementation of IWRM plan with timelines and milestones. The road map is also linked to MDGs and in Botswana's case to Vision 2016.

## 2 Literature review of the water issues in Botswana

### 2.1 Vision 2016

The Vision 2016 (Vision Council, 1996) guides long-term development planning, including NDP 10 and it is in line with the UN Millennium Development Goals (MDGs). The Vision has seven pillars, covering key aspects of society and development (e.g. education, innovation, efficiency and a caring, secure,

democratic and accountable nation). The Vision has several ambitious targets most of which are also part of the Millennium Development Goals developed by the UN:

- Trebling of per capita income (to US\$ 8 500 in 2016);
- Average annual economic growth rate of 8%;
- Full employment by 2016;
- Halving of poverty by 2006 and poverty eradication by 2016;
- Access to good health and education facilities;
- Access to safe drinking water and adequate sanitation facilities
- No new HIV/AIDS infections by 2016.

Achieving these goals will require wise use and management of water resources. Poverty reduction is considered to be the largest challenge (GoB & UNDP, 2004) and therefore pro-poor conservation and development strategies are important. The Vision adopts sustainable development (and hence IWRM) as the guiding principle for long term development. By 2016, sustainable development will be achieved and renewable resources will be used at a rate that is in balance with their regeneration capacity and non-renewable resources will be used efficiently.

Botswana is among the few African countries that are on track for meeting the MDG goals on sanitation and access to drinking water (WHO/UNICEF, 2010); however, rural sanitation is lagging behind. In brief: the Vision 2016 aims at economic growth and development and this will lead to growing water scarcity unless water efficiency is improved and water demand management is given priority. If such adjustments are not made, development will be slowed down by water constraints and excessive water costs. Clearly, water resource management and development planning need to be fully integrated.

## **2.2 Review of the 1991 NWMP (2006) or NWMP2**

The Ministry of Mineral, Energy and Water Resources (MMEWR) through DWA conducted a comprehensive review of the first BNWMP of 1991. The NWMP Review report identifies several outstanding recommendations from the first master plan. Some examples: infrastructure: postponement of Palla Road Wellfield (planned for 1996) and delay in construction Dikgatlong dam and NSWC Phase 2. Regarding institutional recommendations, the Water Act was not reviewed, there is no water pricing policy and the National Water Council has not yet been established.

The NWMP2 argues that a shift towards IWRM and greater attention for water demand management (WDM) are inevitable to keep water affordable for users and government. NWMP 1 and 2 have de-facto guided the country's water resource management over the last two decades and NWMP2 can be viewed as its (general) IWRM strategy.

The main recommendations of the NWMP2 are discussed below by topic.

### Surface and ground water resources

Surface and ground water resources are limited and available resources are under pressure. There is need to promote WDM and use non-conventional water sources such as rainwater. A National Policy on Rainwater Harvesting should be formulated. Relevant amendments to building control regulations are important to incorporate measures for harvesting rainwater.

### Water demand management

The NWMP2 advocates for WDM because about 46% of the developed water resources are wasted through losses and inefficient water use. Water losses in the distribution system (reported to be between 18% and as high as 90% in DWA and WUC) need to be reduced and the water use efficiency in industrial and institutional sectors needs to be increased. In order to reduce the cost of water delivery government should encourage development in central Botswana. Improved water demand

management could defer capital investments such as transferring water from Zambezi River to north-south water carrier (NSWC). The WDM recommendations are presented in Figure 5.

**Figure 5: WDM recommendations from the NWMP2**

- Urgent review of the draft National Water Conservation Policy
- Water monitoring i.e. of the water system operation
- Water conservation and demand management plans for all suppliers and for villages + towns with piped water.
- The policy of removing all public standpipes from people below the poverty line be reviewed, rationalised and abandoned.
- A major water user forum
- The water conservation unit should be properly resourced and funded to enable it fulfil its essential role of future management of water resources
- The building codes and standards be reviewed in line with water efficiency and national products and services
- Building standards be policed by appropriate authorities
- Comprehensive review of the future of NSWC to determine and correct major leaks
- A comprehensive review of the status of all water supply systems to indicate need for capital expenditure and major maintenance stock
- A comprehensive review of the status of national metering
- DWA investigate institutional consumption to ascertain appropriate conservation measures that can be introduced
- DWA & WUC undertake a detailed assessment of the industry and commercial sectors to evaluate their water usage, and to establish appropriate incentives to reduce water consumption in these sectors.
- DWA & WUC survey domestic consumers to establish the various price elasticities and ability to pay criteria
- DWA & WUC undertake a detailed assessment of the industry and commercial sectors to evaluate their water usage, and to establish appropriate incentives to reduce water consumption in these

Source: SMEC and EHES, 2006.

Water accounting is useful for monitoring and evaluating Botswana's water resources state and use and for assessing water efficiency of economic sectors (DEA and CAR, 2007). Water accounting is also important to identify the costs and subsidies on water resource use and management and it could assist with improving allocative efficiency.

### Environment

IWRM recognises that water needs to be reserved for the environment. This amount is often referred to as environmental flow requirement (EFR). Environmental flow is the amount required to sustain the integrity of the river ecosystem such as maintaining nutrient structure, water for recharge of aquifers, water for plants and animals. The Environmental Impact Assessment (EIA) is an important tool to ensuring that EFRs are maintained. The water authority, in association with DEA, should arrange for training of DWA staff on EIA. The NWMP2 promotes subjecting development plans to a strategic environmental assessment to determine their impact on water demand.

### Institutional and legal reform

The NWMP2 identifies two main issues required to meet Botswana's water demand: 1. water resources stewardship and 2. water demand management. The prioritisation of WDM signals a move away from the focus on supply and large water development schemes. The first NWMP (1991) mainly focused on the latter. Water resources challenges facing Botswana include unreliable low rainfall, high evaporation rates, lack of suitable dam sites and under-utilisation of water demand management measures. In order to meet the identified requirements, the policy and institutional environment need to be adjusted to

provide an enabling environment for recommended changes. The current water sector reform project is implementing the 'preferred option', identified from the NWMP2.

It is also important to curb pollution of the limited surface and groundwater resources. Treated effluent is available but it is currently used in limited quantities. There is need to strengthen institutional and legislative environments to achieve useful utilisation of wastewater. Botswana's development planning framework should take cognisance of limitations of water resources and incorporate these limitations in its planning. For example, location of water dependent industries close to water sources, incorporate water saving measure into building regulations and encourage water saving technologies.

Transboundary rivers are sources of water for Botswana; however, their use is subject to international agreements and protocols and most important they require protracted negotiations with neighbouring states. It would be prudent to request use of shared water resources after reaching efficient use of local resources. In addition, Botswana needs to manage water based on international best practice and adoption of the IWRM approach:

- Preparation of a national water resources strategy utilising the NWMP2 as a 'living' document with regular updating as new data, new policies and new priorities are incorporated, coordinating the water needs of various sectors and taking account of relevant international agreements relating to the use or sharing water resources;
- Providing assurance of supply to licensed users and simultaneously enforce compliance with licence conditions for construction of hydraulic works and in waste discharge permits;
- Maintaining a national water resources information system to enable knowledge-based assessment and monitoring of surface and groundwater, and for evaluation and revocation of existing licenses;
- Develop regulations to implement the provisions of the draft Water Bill; and
- Undertaking human resources development and training.

#### Wastewater reuse

The main objective for use of treated effluent is to supply activities that do not require potable water quality, for example, irrigation, watering parks and gardens, dust suppression, road construction and water for mining. The advantage of treated effluent is that as the national demand for water increases, the production of effluent also increases.

The table below shows recommendations from NWMP2 of 2006 and their relationship to the key IWRM and WE issues derived from the GWP Toolbox.

BNWMP Review 2006 Recommendations:	IWRM principles + water efficiency								
	Social good	WE + reduce losses	Ecol good	Economic good	Stakeholder participation	Institutional sustainability	Legislative reform	Technology	Monitoring
<b>Water demand management</b>									
Urgent review of the draft National Water Conservation Policy							√		
Water monitoring i.e. of the water system operation						√			√
Water conservation and demand management plans for all suppliers and for villages + towns with piped water.						√			
The policy of removing all public standpipes from people below the poverty line be reviewed, rationalised and abandoned.	√								
A major water user forum					√				
The WCU be properly resourced and funded to enable it fulfil its essential role of future management of water resources						√			
The building codes and standards be reviewed in line with water efficiency and national products and services		√					√	√	
Building standards be policed by appropriate authorities					√				√
Comprehensive review of the future of NCS to determine and correct major leaks		√							
A comprehensive review of the status of all water supply systems to indicate need for capital expenditure and major maintenance stock		√							√
A comprehensive review of the status of national metering								√	
DWA investigate institutional consumption to ascertain appropriate conservation measures that can be introduced		√						√	
DWA & WUC undertake a detailed assessment of the industry and commercial sectors to evaluate their water usage, and to		√			√			√	

establish appropriate incentives to reduce water consumption in these sectors.									
DWA & WUC survey domestic consumers to establish the various price elasticities and ability to pay criteria	√			√	√				
<b>Environment</b>									
DWA, in association with DEA, should arrange for calculation of EFR by the Building Block Method (BBM)			√						
DWA through DEA teach its staff on requirements of EIA			√			√			
Local community participation in decision making regarding routing of pipelines be sought.					√				
<b>Institutions</b>									
Preparation of a national water resources strategy utilizing the NWMP as living document with continual updating as new data, new policies and new priorities are incorporated, coordinating the water needs of various sectors and taking account of relevant international agreements relating to the use or sharing water resources.							√		√
Providing assurance of supply to licensed users and simultaneously enforce compliance with licence conditions for construction of hydraulic works and in waste discharge permits.							√		√
Maintaining a national water resources information system to enable knowledge-based assessment and monitoring of surface and groundwater, and for evaluation and revocation of existing licenses.									√
Develop regulations to implement the provisions of the draft Water Bill.							√		
Undertaking human resources development and training						√			

## 2.3 Review of the water sector policies, strategies and legislation

The water policy framework contains several laws and a draft Water Conservation Act. The framework is incomplete, fragmented and out-dated. The Acts are over forty years old and obviously they do not incorporate recent IWRM concerns. It appears that the NWMP2 and the tariff assessment, explained in subsequent National Development Plans, are currently the cornerstones of water management framework.

Given the inadequacies in the policy framework it is amazing that water resources are flowing and generally well managed. However, the costs are high and efficiency improvements can and should be made. Therefore, water sector reforms are critically important to meet the growing water challenges that Botswana will face in future. The on-going water sector reform project will implement far reaching institutional reforms, and prepare new water legislation and tariffs.

### 2.3.1 Water Act 1968

The 1968 Water Act controls the use of water in the country and provides an institutional framework for water allocation and control. The State owns public water and users need to apply for user rights to the Water Apportionment Board and Water Registrar. The Water Registrar will keep a record of all water rights (art.32).

Everyone has access to water for stock, drinking, washing and cooking and use in a vehicle without a water right. Land owner/occupier may without a water right (art 6):

- Sink a well or borehole for domestic use not exceeding a specified amount as prescribed for the area by the Minister; the distance between boreholes should be at least 236 mt;
- Construct water for public water conservation and abstract water for domestic purposes as long as the works are not within a prescribed distance from a catchment area or at least 4 km. away from another works.

Holders of mineral rights are entitled to extract any public water from the prospecting area and/or to construct a borehole not extracting more than 22.75 m<sup>3</sup> per day. Holders of forest act rights may abstract any public water not exceeding 22.75 m<sup>3</sup> per day or such other quantity for logging, saw milling as may be prescribed. They may also construct a borehole not extracting more than 22.75 m<sup>3</sup> per day.

Otherwise, everyone needs a water right to extract water. Water rights are needed to: divert water, construct a dam, store, abstract, use, or discharge effluent into public water. Water rights specify the amount of abstraction, the period of abstraction as well as the purpose.

The possession of water right does not mean that the amount of water is always actually available. There is provision to revise or even cancel the water quota if existing water resources become insufficient to meet the demand (art. 19). Water rights can also be cancelled if they are not used within three years (art. 24). The Act gives priority to use of public water for public purpose subject to compensation of individuals.

The Act specifies conditions to water rights for industrial, mining, power generation, and forestry use. Water shall be:

- Returned if reasonably practicable, to the body from which it was abstracted;
- Substantially undiminished as much as possible; and shall
- Not be polluted with any matter that is likely to cause a health risk to people, animals, fish crops or gardens that are irrigated. (art. 17).

As the Act is dated, there are many inadequacies, including the following. There is very little legislation on water quality (e.g. standards) and water pollution control. The penalties have never been adjusted and no longer form an effective deterrent against water abuse. The Act mostly deals with individual water rights rather than with basin wide rights and allocations. There is no reference to IWRM approach and transboundary water management is not catered for.

### **2.3.2 Water Works Act 1962**

This Act provides for water works areas, where a public water supply system should be established. These areas need to be gazetted and have a designated Water Authority (WA) such as WUC. Other water supply is only permitted for use or consumption on the same premises, for fire extinguishing; it requires special permission of the WA. The WA has the following responsibilities:

- Take water, construct, make, purchase, expropriate or take over all water works within or beyond the boundaries of the waterworks area; and
- Supply water (no reasonable request to be refused). If the supply costs are excessive in relation to the revenues, the applicant must pay the extra costs.

The Minister has the right to suspend any water supply and to prevent waste. The water charges should relate to the quantity used and metered readings. Charges need to be approved by the Minister and outside waterworks supply areas should be at no lesser charge than in the waterworks area.

The Act thus identifies a single water supplier for identified water works areas and creates a supply duty and monopoly.

### **2.3.3 WUC Act (1970)**

The Act specifies the following roles for WUC:

- Supply water in bulk or otherwise in areas where it has been appointed the WA;
- Take all measures necessary to secure adequate water supplies in such areas; and
- Apply for rights etc necessary under Botswana law.

WUC has the power to engage in research beneficial to its mandate and is required to keep accurate records. WUC needs to operate commercially and generate a reasonable return on capital (art 19).

### **2.3.4 Boreholes Act (1956)**

A borehole is 'a well sunk by means of a rig or machinery'. Anyone who intends to abstract water, or sink a borehole needs permissions from the Director of the Department of Geological Surveys (DGS), who keeps a country registry of all boreholes. The individual shall keep a record of the progress of the exploration work done. The DGS has the responsibility to access any borehole for the purpose of inspection, taking specimens, water samples, making pump tests and keep records of such. It is expected that the person developing the borehole should inform the Director in writing of any tests made on the borehole.

Thus: the DGS has a complete registry of boreholes in the country.



### 2.3.5 Water pricing

Elements of water pricing are provided for in the Acts, but the Acts do not provide detailed pricing principles. Currently, DWA and WUC use progressive block tariffs, which distinguish government and domestic/ business uses. The DWA tariffs apply country wide; the WUC tariffs differ by region. No pricing principles apply to wastewater.

#### Cost recovery-efficiency

Full cost recovery is pursued in urban areas. In rural areas, operations and maintenance costs should be recovered and part of the capital costs.

#### Affordability

Higher user blocks subsidise the consumers in the basic needs band. Government subsidises the domestic users and the private sector by paying a premium tariff.

#### Tariff adjustments

New tariffs have to be approved by the Minister. During the 1990s, tariffs were annually adjusted to finance the NSWC. Tariff adjustments have been haphazard in the past and consequently the real water tariffs have not increased in time.

The progressive block tariff pricing system encourages water conservation. The 'super' tariff paid by government has not led to increased water efficiency in the public sector and has most likely discouraged water conservation in the domestic and business sectors. The on-going water sector reform project has carried out a review of water tariffs and will recommend a new tariff structure.

### 2.3.6 Draft Botswana National Water Conservation Policy 2004

The draft Water Conservation (WC) policy aims "to identify principles and strategies which if implemented, will promote efficient and sustainable planning, management and protection of Botswana's water resources". Some of the objectives through which the goal will be achieved are as follows:

- Protection, conservation and restoration of water resources;
- Promote efficiency in and productive water use and enhance effective management;
- Reduce water supply costs and related subsidies;
- Protection of the environment; and
- Promote affordability of water and ensure equitable access.

The guiding principles of the WC policy are:

- Water belongs to the state but should be taken care of by its people and the government;
- Water conservation is a shared responsibility of all people in Botswana;
- Water conservation and management and IWRM is to be adopted;
- Water has an economic value;
- Water use and management needs to be based on social equity;
- Polluter-pays and user-pays principles need to be implemented; and
- Cost recovery needs to improve.

The policy stresses that the water sector is comprised of various stakeholders who all have a role to play in ensuring planning, distribution, sustainable utilisation and management of the resource. The WC policy targets are:

- Reduce water use in all sectors and increase efficiency;
- Reduce or delay investment in new water infrastructure projects;
- Savings in investment in water exploration and exploitation; and
- Reduce water losses in all public water supply systems.

The WC policy prioritises different water uses as follows. Water for human consumption, urban and domestic use has top priority followed by water for production, environment, agriculture and livestock. Other uses will be met based on availability of water of a suitable quality after all the above uses have been met. The needs of the environment will be given a high priority; water quality will be ensured, maintained and protected. These uses will be based on cost recovery, efficiency, pollution risk, water requirement, IWRM, cost-benefit ratio and the impact on social equity.

Non-potable water will be allocated to arable farming and dairy activities. For livestock, MoA would develop and implement a strategy to supply water to livestock from other sources on a full cost recovery basis and the mining sector will maximise re-use and recycling.

A summary of the main proposed WDM measures is given in Table 1.

**Table 1: Proposed WDM measures in draft Water Conservation Policy**

Type of measure	Proposed measure
Economic and financial measures	<ul style="list-style-type: none"> <li>• Tariffs will rise by a fixed % annually (marginal cost pricing)</li> <li>• Decommissioning of stand pipes or the use of prepaid meters so as to control misuse and wastage</li> <li>• Fees for water abstraction use of wastewater, water from decommissioned boreholes, effluent discharges charges, polluter charges. The money will be put into a water conservation fund.</li> <li>• Decentralised budgeting and payment of water bills for all government agencies, departments and parastatals.</li> <li>• Promotional incentives and disincentives</li> </ul>
Technical measures	<ul style="list-style-type: none"> <li>• Water efficient devices in new buildings</li> <li>• Water wise landscaping</li> <li>• Reduce evaporation losses</li> <li>• Rainwater harvesting, water saving devices</li> <li>• Grey water and wastewater re-use and recycling</li> <li>• Desalination</li> </ul>
Agricultural water use	<ul style="list-style-type: none"> <li>• Promote high value horticulture crops</li> <li>• Promote non-potable water use for livestock production</li> <li>• Allocate land near WWTW</li> <li>• Construct small dams</li> <li>• Reduce areas used for irrigation</li> <li>• Promote rain fed farming</li> </ul>
Institutional management improvements	<ul style="list-style-type: none"> <li>• Informed water managers</li> <li>• Norms and benchmarks</li> <li>• Performance monitoring</li> </ul>
Public awareness and education	<ul style="list-style-type: none"> <li>• Workshop, training, use of media, Thoti campaign etc</li> </ul>

While the above measures are highly relevant for IWRM and WDM, they have been drafts since 2004 and they do not set priorities among the many recommended measures.

### **2.3.7 National Master Plan for WasteWater and Sanitation NMPWWS (2003)**

The NMPWWS was preceded by the Policy for WasteWater and Sanitation Management (2001). The policy aims to 1. promote the health and well being of Batswana through the provision of appropriate and sustainable wastewater/ sanitation management; and 2. to introduce mechanisms for the protection and conservation of water resources (GoB, 2001, p.10). Both policy documents need to be fully incorporated into the IWRM-WE Strategy.

The NMPWWS concluded that in 2003 the emphasis of waste water management lies with its discharge and that wastewater is not considered as an economic good. The NMPWWS aims to change this attitude adopting an IWRM approach. This is important as a rapidly growing amount of wastewater will become available due to improved sanitation, growing water consumption and living standards and expansion of the WW treatment facilities. The NMPWWS is the foundation for sanitation and wastewater management until 2030. Therefore, it made major recommendations related to wastewater management, which are briefly outlined below.

#### Legislation, regulations and instruments

Legislation for the wastewater and sanitation sector needs to be enacted, including the right to a clean and healthy environment; empowerment of regulators and stakeholders to protect the environment from pollution; an institutional framework aimed at providing the best service with the available resources; and institutional/stakeholder participation in the planning, design and implementation of strategies of wastewater and sanitation management; and finally efficient and equitable administration of the legislation by appropriate processes, practices and economic instruments. Proposed additional legislative instruments include:

- Licences for the operation of sewerage and wastewater facilities;
- Establishment of a National Asset Register, which records the performance of individual WWTW;
- Permits for commercial discharges of effluents. Holders of these licences are bound to comply with certain conditions associated with prevention of pollution of the environment. Trade Effluent Agreements between industries and local authorities would be monitored.

#### Wastewater plans and facilities

The NMPWWS identified settlements where wastewater services are required during the next twenty years and developed a set of strategic plans for these settlements. The NMPWWS proposes that the planning and management of wastewater be extended to large villages, where most of the existing wastewater works are institutional, for example linked to prisons and hospitals.

#### Promotion of re-use of wastewater

The target for 2030 is to increase re-use from 20% to 96% of the outflow (or 48% of the inflow) through agricultural re-use and reduction of losses in the treatment systems. Agricultural re-use is judged economically viable in ten of the country's settlements with the largest population. The anticipated situation in 2030 will be: 48% of the inflows is re-used; 42% is lost through evaporation and treatment and 10% is discharged into the environment.

#### Cost recovery and affordability

P 3.2 billion (2003 estimate!) is needed for implementation of the NMPWWS in the NDPs. Full cost recovery is considered not affordable for households, and the NMPWWS proposes recovery of the operational costs for households.

## 2.4 Transboundary water management in southern Africa

Water has been a focal area of SADC since the early 1990s. This is in recognition of the strategic importance of water for regional economic integration and the dominance of shared water resources. It is also in pursuit of the SADC objective of achieving 'sustainable utilisation of natural resources and effective protection of the environment' (art. 5 of the SADC Treaty). The core of the SADC water efforts is formed by the RSAP (1&2), the Protocol on Shared Watercourses, the Regional Water Policy and the Regional Water Strategy.

### Regional Strategic Action Plan for Integrated Water Resource Development and Management in SADC countries (1999-2004)

The RSAP (SADC, 2001) has adopted a holistic approach towards water development and management. Seven strategic objectives are distinguished:

1. Improve legal and regulatory framework at the national and regional level;
2. Improve national and trans-boundary river basin management and planning;
3. Strengthen linkages among macro-economic, social and environmental policies;
4. Improve information acquisition, management and dissemination;
5. Support awareness building, education and training;
6. Promote public participation; and
7. Invest in infrastructure.

The plan has separate sections on water demand management, water conservation and sustainable development.

Delayed investment costs and reduced environmental costs associated with supply expansion are mentioned as the major reasons for WDM. WDM requires action at three levels:

- Establishment and implementation of progressive government policies;
- Special incentives for water users; and
- Implementation of efficiency measures.

A wide range of instruments is mentioned to support WDM, including water tariffs, pollution charges, water quota, water banking, auctions, licenses, water quality and product norms, and WDM-demonstration projects. The RSAP recommends block tariff water pricing for water conservation. It is recommended that water authorities in SADC countries systematically analyse demand side options to increase allocative and user efficiency (SADC, 2001, p. 75).

The RSAP identified thirty-one priority areas for the seven objectives (Table 2). All objectives and priority areas fit into IWRM. Four priority areas are directly linked to WDM, i.e. balancing demand and supply, water conservation, best management practices and shift towards most efficient use of water resources. Several other priority areas are indirectly linked to WDM.

In conclusion, 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.

**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 WSU
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-meteorological 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.

Source: SADC, 2001, p. 100-102.

#### SADC Protocol on Shared Water Course Systems

The Protocol seeks to facilitate the establishment of shared watercourse agreements through river basin commissions, advance sustainable, equitable and reasonable use of shared water, promote integrated, coordinated and environmentally sound development and management of shared watercourses, harmonise legislation and policies for management of shared watercourses, promote research, technology development, and information exchange on shared water courses. The use of shared water should balance water development and conservation of the environment, and cooperation should be established for all projects with an impact on shared watercourses. Moreover, the use should be equitable and reasonable, and international laws should be respected. Environmental water needs have been explicitly recognised. Use entitlement depend on biophysical and environmental factors, the social, economic and environmental needs of states, the population size dependent on the share watercourse, existing and potential uses, conservation and economic use of water and finally the availability of alternative of comparable value to a particular planned or existing use (art. 3.8).

The use of shared water resources is conditional (both ground and surface water) and based on explicit criteria, including prioritisation of environmental and basic human needs. There is a notification duty of countries for abstraction and response required within 60 days. A country can be asked to demonstrate that no alternative feasible water resources are available and that it already uses its domestic water resources efficiently. Importantly, it adopts a river basin approach and looks at the cumulative impact of abstractions, and not at the impacts of individual projects.

#### Regional Water Policy (2006) and Regional Water Strategy (2007)

The Regional Water policy (RWP) is based on the SADC declaration and treaty, the southern African vision for water, life and environment, the revised SADC Protocol on Shared water courses and the

Dublin principles of IWRM. The main policy areas include the following that are most relevant to shared water courses (Table 3).

**Table 3: Scope and themes of Regional water Strategy and Policy**

Policy area	Policy statement	RWP 2006	RWS 2007
Regional cooperation in water resources management	Water for economic integration & water for peace	Integrated WRD and M based on balance, equity and mutual benefits Southern African vision as point of departure Implementation of SADC protocol Intersectoral cooperation Harmonisation of national policies and legislation Conflict management Water for international cooperation	Promote integrated development of shared water courses based on IWRM for economic integration Effective RBOs Implementation of Shared Water Courses Protocol Develop common data base and experience sharing for shared water courses Promote harmonisation of national laws Capacity building in dispute resolution
Water for development and poverty reduction	Water for socio-economic development, sanitation and hygiene, food security, energy development, industrial development and sports and leisure		Water accounting, equitable and sustainable allocation of shared water Promote sharing of benefits rather than resource allocations Promote water use efficiency in Collin towers of thermal power stations  Regional guidelines for water sports and recreation Promote multi-purpose uses (e.g. tourism and abstractive use0
Water for environmental sustainability	Water and environment & water quality management	Water requirements of environment recognised Sufficient water allocations for environment Minimum standards for shared water courses Pollution prevention Import restrictions EIA requirements Control of alien species to reduce water consumption	Environmental flow requirement guidelines Use of EIAs and SEAs Harmonisation of min. Water quality standards Dealing with non-economical alien invasive species
Security from water related disasters	People's protection from floods and droughts Disaster prediction, planning and mitigation	Commitment to human life protection SADC to coordinate disaster management at shared waters and regional level Capacity building disaster predictions Integrated and coordinated RBO plans and procedures Notification duty of impending disasters	Joint efforts to minimise disasters Coordinate optimal resource allocation and use Coordinated strategic infrastructure development Coordinated early warning systems Sharing of information
Water resources information and management	Information sharing	Water resource data management systems Compatible systems Sharing Public access Regular dissemination	Hydro meteorological data systems and networks Guidelines for water resources assessment Awareness programmes Harmonisation of national data bases Prioritise water resources research
Water resources development and management	RBO	RBO approach and plans Water allocation and utilisation based on equitable and reasonable mechanisms through negotiations	Facilitate river basin approaches based on IWRM Develop allocative and regulatory guidelines for use of water resources Develop & promote WDM guidelines & promote WDM

			Improve info on alternative water sources Research into new technologies Stakeholder participation and empowerment in dam planning.
	Integrated planning	IWRM based Joint implementation	
	WDM	Utilise shared water more efficiently WDM is a fundamental requirement of IWRM	
	Alternative sources of water	Rainwater harvesting, desalination, treated effluent	
	Dam development and management	Integrated planning, development and management Participatory process Negotiations of operating rules Affected communities	
Reg. water resources institutional framework	Shared water course institutions	Establishment of SWCI and Water course commission Consensus decision making Cooperation with NGOs and civil society groups	Strengthen SADC Water division
In	Institutional arrangements at national level	National enabling environments Decentralisation of water management Increased participation of NGOs	
	SADC secretariat	Support for SWC institutions Implementation of RSAP, RWP and Protocol	
	Monitoring and evaluation		
Stakeholder participation and capacity building	Participation and capacity development	Participatory water management including NGOs	Stakeholder participation mechanisms Information sharing
	Gender mainstreaming	Implementation of principles of gender mainstreaming	
	Capacity building and training	Capacity development and sharing Water education and training	
	Research, technology development and transfer	Demand driven water sector research with a regional perspective Sharing of water technologies and info	
	Financial sustainability	National financial resources Cost recovery	
Financing IWRM	Cost reduction	Cost reduction measures	Sufficient national contributions Efficiency Sustainable financial partnerships between stakeholders
	Public-private sector partnerships		

Sources: SADC, 2006 and 2007.

## 2.5 Botswana evidence of the feasibility of WDM measures

During the Danida funded Water Conservation and Water Demand Management Project (carried out by DWA) a number of interventions were investigated and implemented, which show that:

- Several interventions could save water; and
- Some were financially viable with a short pay-back period.

Based on the empirical evidence, retrofitting of automatic flushing urinal systems and reduction of water reticulation losses should be pursued immediately because of the associated water and financial savings. Improved water metering and rainwater harvesting are beneficial but require incentives (rainwater harvesting) or a comprehensive efficient metering maintenance and replacement strategy.

Water conservation and water demand management have long been known to be cost effective options. WDM measures can cost as little as 20% of the new infrastructure investment. The water "saved" in this scenario can now be used to expand to new customers for a number of uses. Another benefit of WDM is that it allows one to "bank" money that would otherwise have been spent on new water related infrastructure. The best documented ones are discussed below.

### 2.5.1 Retrofitting of automatic flushing urinals

The DWA-DANIDA project investigated the merits of retrofitting of automatic flushing urinals (AFU) within Government Institutions. It was determined that these devices could waste as much as a 1 m<sup>3</sup> of water per hour. It was also calculated that 85% of the water that flowed through these devices did so when no one was using them. The project also showed that a simple retrofitting with a push button Junior Flushmaster could pay for itself within days.

A retrofit was under taken during 2004 in Shoshong Senior Secondary School. The initial average flow into the toilet block was approximately 500 litres/hour. After the retrofit the flow into the toilet block was approximately 50 litres/hour, i.e. a savings of 450 litres/hour. In monetary terms this would equate to savings of almost P4 500/month for one AFU! As the costs of retrofitting were estimated to be around P5 000, the payback period would be less than two months! The question arises why we still have AFUs in the country while the resource and economic costs are so high?

An estimate has been made of the possible benefits of phasing out of AFUs country-wide. The results are summarised in Table 4. Three scenarios have been reviewed: one AFU in 20%, 60% and 100% of the institutions listed. The 100% scenario is considered to be most realistic and in this case retrofitting would save 4 Mm<sup>3</sup> per annum.

While table 4 assumes a moderate flow of 200 litres/hour/day for 30 days, most schools, other Government institutions and private sector businesses in the country lose more than 0.2m<sup>3</sup>/hour. These losses are not only through the AFUs but through leaking toilet cisterns, hand basin taps and leaks; so, the potential water being wasted could be even greater than what is portrayed here. Apart from the obvious financial gains to users, it is the country's interest to use water efficiently to serve more customers, including future generations.



**Table 4: Water and financial savings associated with retrofitting of AFUs in Botswana**

Consumer Group	# of AFUs	# of AFUs (in 20% of the institutions)	Wastage per month in m <sup>3</sup>	# of AFUs (in 60%)	Wastage per month in m <sup>3</sup>	# of AFUs (in 100%)	Wastage per month in m <sup>3</sup>
<b>Government (Public sector)</b>							
Schools <sup>i</sup>	1 023	204	29 376	614	88 560	1023	147 600
Clinics	263	53	7 920	158	22 320	263	38 160
Hospitals	17	3	720	10	1 440	17	2 160
District and Sub district Councils	20	4	720	12	1 728	20	2 880
<i>Sub-total</i>		264	38 736	794	114 048	1 323	190 800
Costs of wastage							
Est. payback period							
<b>Private</b>							
Schools <sup>i</sup>	100	20	2 880	60	8 640	100	14 400
Hotels and Restaurants <sup>ii</sup>	887	177	25 200	532	76 320	887	127 440
<i>Sub total</i>		197	28 080	592	84 960	987	141 840
Costs of wastage							
Est. payback period							
Total (m <sup>3</sup> )			66 816		199 008		332 640
<b>Costs of was</b>							
<b>Total (Pula)</b>			<b>482 411</b>		<b>1 436 837</b>		<b>2 401 661</b>
<b>Payback<sup>iv</sup></b>		<b>461</b>	<b>2.4 mo</b>	<b>1386</b>	<b>2.4 mo</b>	<b>2310</b>	<b>2.4 mo</b>

i) Education Statistics Brief 2009 and Education Statistics Report (January 2009)

ii) 2006/7 Census of Entities and Establishments (April 2008)

iii) Assumes average flow of 200 litres/hour/day for 30 days

iv) Assumes an average retrofit cost of P2500

## 2.5.2 Improved water meters

The DWA-DANIDA project also looked at the accuracy of water meters and assessed their function at low, moderate and high flows. While improved water meters do not change the amount of water used, the intervention has important financial implications for consumers and service providers. Inaccurate meters can be a source of lost revenue for the water authority and can be misleading to the consumer as the amount of water that they are using is not a true reflection of the recorded consumption.

During this small investigation it was found that of the 50 meters tested, 30% of meters were under recording at the low flows (<10L/min). The corresponding percentages for moderate and high flows were 20% and 15% respectively. It was also discovered that a number of meters were not recording at all.

If we assume that out of 1000 connections 20% of water meters are under recording by 20% notwithstanding the flow and look at the cost of replacement the calculations would be as follows: based on 50 m<sup>3</sup>/month for 1000 connections, 200 meters x 10m<sup>3</sup> x P10/m<sup>3</sup> = P20 000/month. The cost of a new 15mm water meter is P373 + P300 for installation x 200 meters = P134 600 giving a

payback time of 6 to 7 months and increased revenues for the rest of the years. It is assumed here that the faulty meters are identified and only those are replaced. If all meters would be replaced, the payback period increases significantly (Table 5).

This is a simplified example but sheds light on the technical feasibility and the associated financial gains that water authorities can realise through strategic planning and meter replacement. Obviously, the consumers have to pay more but this reflects their actual consumption and can thus be justified.

Up-scaling of this example to all metered connections of WUC, the pay-back periods for the private and public sectors have been calculated (Table 5). The payback period for the public sector is lower because of the higher tariffs that it pays. Generally, the payback period is longer if: fewer meters are at fault and when the under recording is lower. In the private sector, the payback time varies from two to ten years; in the public sector from one to six years. The results show that accurate metering is important for the service provider, but that it needs to put in place an efficient metering maintenance and replacement strategy.

**Table 5: Different pay-back times for changing all meters based on different % of inaccurate meters and level of inaccurate recording (in months)**

<b>Private sector (months payback)</b>			
	<b>15% under</b>	<b>20% under</b>	<b>25% under</b>
<b>10% of meters</b>	125	94	75
<b>20% of meters</b>	63	47	38
<b>30% of meters</b>	42	31	25
<b>Public sector (months payback)</b>			
	<b>15% under</b>	<b>20% under</b>	<b>25% under</b>
<b>10% of meters</b>	71	53	43
<b>20% of meters</b>	35	27	21
<b>30% of meters</b>	24	18	14

Note: Based on 2008/9 Water Pricing, 15mm water meter cost of P373, installation average cost of P300.

### 2.5.3 Rainwater harvesting

The DWA-DANIDA project further looked at benefits of rainwater harvesting. While the infrastructure investment to maximize rainwater collection is a hindrance the amount of water that can be collected during the rainy season is substantial and can go a long way to augment water supply. Entities such as the Botswana Rainwater Harvesting and Utilization Association (BORHUA) of Botswana and Somarelang Tikologo (ST) are good places to start with regards to awareness creation and dissemination of best practices. Other stakeholders could include the manufacturers of infrastructure needed for harvesting and water authorities.

Harvesting of rainwater could save the consumers and the country at large potable water that can then be used to serve more business and domestic consumers. Harvested rainwater could most easily be used for gardening and (car) washing. However, subsidies or tax incentives are required to ensure large scale adoption of rainwater harvesting (under current conditions).

A simple example of the economics of rainwater harvesting is show in figure 6 below.

**Figure 6: Two examples of financial implications of rainwater harvesting***Example 1: rainwater harvesting by WUC clients*

The average water consumption per WUC meter was 379 m<sup>3</sup> p.a. in 2008/9. The WUC average supply cost is P 7.22/m<sup>3</sup> with an average revenue per cubic metre sold of P 10.17/m<sup>3</sup> (WUC Annual Report 2008/09). In 2008/9 there were 78 018 individually metered connections.

A ten percent reduction in water consumption through rainwater harvesting would lead to water savings of 5.1 Mm<sup>3</sup> p.a. and a net revenue decrease of P 15.1 million for WUC country-wide (assuming unit production costs would not change). The water savings in terms of cubic metres could be used by WUC to serve other users and to postpone new infrastructure investments (leading to capital costs savings).

At the individual user level (government, business and domestic use), savings would be 37.9 m<sup>3</sup> p.a. equalling P 385. A 5 m<sup>3</sup> (5000 litre) rainwater catchment tank costs around P 2,500 giving a payback time of almost 6.5 years. This is dependent on water pricing, water use habits and number of rain events; so the potential for savings could be greater thereby decreasing the payback time. Nonetheless, it is clear that rainwater harvesting is not financially attractive for most water consumers at present. As there are major benefits to the country at large, targeted subsidies or tax incentives would be justified to stimulate rainwater harvesting.

*Example 2: storm water harvesting in Orapa*

In 2009, Orapa and Letlhakane Mines commissioned the construction of a million cubic metre storm water dam whose primary objective is to harvest rainwater. Much of Orapa's surface area is paved, and because the water is being collected from running water and rooftops, it is an advantage to the project. The project has the potential to recover the total project cost in about two years. The project cost is P58 million. So far in the first year, the total cost benefit is P38.9 million. The project is likely to recover the investment in less than two years.

**2.5.4 Cutting production losses**

The stated average WUC water loss rate is 22% or 6.5 Mm<sup>3</sup> in 2008/9. Loss reduction to 15% would lead to an extra sales capacity of 2 Mm<sup>3</sup> and a permanent increase in revenue capacity of P 22.3 million p.a. This could be the average annual budget for improved maintenance focused on loss reduction. The benefits could be passed on to consumers through the delay of new infrastructure investments thereby delaying future tariff increases.

**2.5.5 Water accounting**

The DEA has prepared water accounts in partnership with the Centre for Applied Research. The report is available on the websites.

The complete Natural Resource Accounting framework comprises stock and use accounts as well as water quality accounts. These accounts occur in physical (m<sup>3</sup>) and monetary (e.g. Pula) terms. Few

countries have comprehensive accounts<sup>1</sup>. Botswana currently has limited stock accounts (for dams and partial accounts for groundwater), three use accounts (by institution, economic sector and source). In addition, three wastewater accounts exist for stock, supply and use respectively. Most accounts cover the period 1990-2003. Some are shorter due to data limitations (1992-2003 and 2001-2003). The longer the time period of the accounts is the more meaningful they become for analysis and policy. All accounts are physical; monetary accounts do not exist due to data limitations. Water accounts were piloted by the Department of Environmental Affairs and the Centre for Applied Research but should be housed and regularly up-dated by DWA.

The stock accounts show that the stock of surface water has increased in time due to the construction of new dams, but that there are significant inter annual and spatial fluctuations (Table 6).

**Table 6: Surface water reservoir stock account (Mm<sup>3</sup>)**

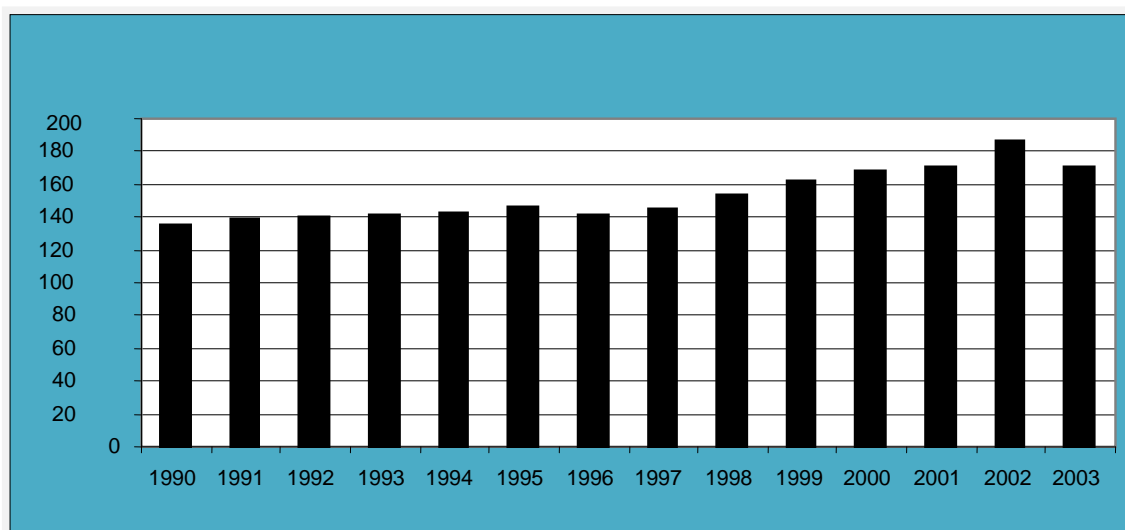
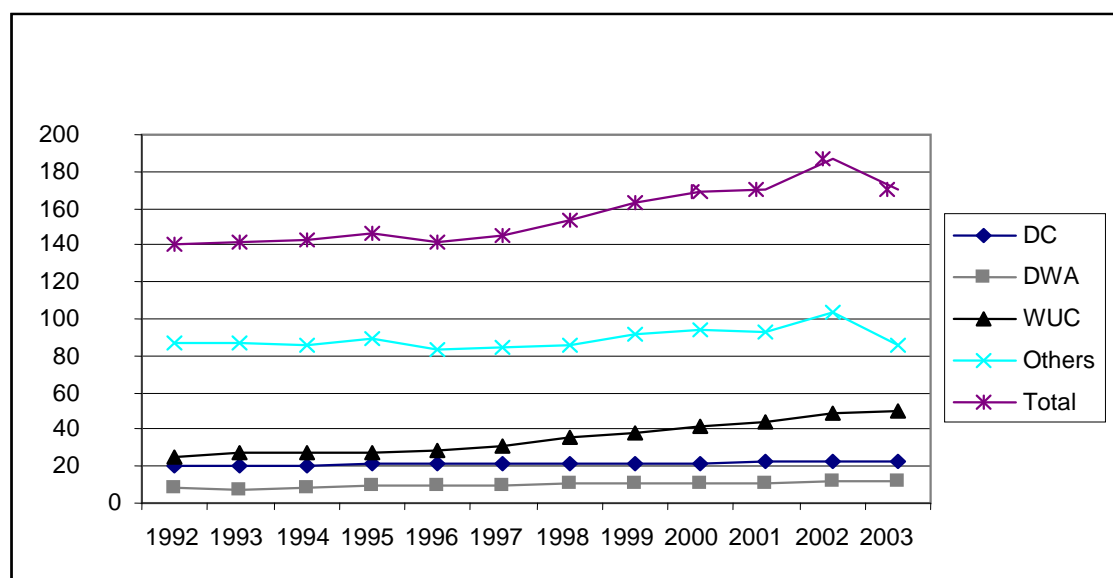
All WUC dams	2001	2002	2003
Opening volume	289	319	235
Inflows	277	142	149
Abstraction	174	159	79
Evaporation	72	66	60
Closing volume	319	235	246

Source: DEA & CAR, 2006.

Groundwater stock accounts are incomplete, but the available figures suggest that abstraction from well fields is much higher than the recharge. Further investigation is necessary regarding the recharge of well fields and regarding the abstractable stock of groundwater.

The use accounts show an increase in water use from 140 Mm<sup>3</sup> in 1990 to 170 Mm<sup>3</sup> in 2003 (Figure 7). Self providers (86 Mm<sup>3</sup>) are the main institutions supplying water followed by WUC (50 Mm<sup>3</sup>), District Councils (22 Mm<sup>3</sup>) and DWA (12 Mm<sup>3</sup>). WUC water supply has grown significantly due to its management of the NSWC and growing urban use (Figure 8). The use account by source shows that the use of surface water is growing faster than that of groundwater, but groundwater continues to provide 56% of the total water use. The use account by sector shows that the agricultural sector is the largest water consumer (63 Mm<sup>3</sup>), followed by households (57 Mm<sup>3</sup>), mining (27 Mm<sup>3</sup>) and government (12 Mm<sup>3</sup>). The trend in water use by sector is, however, quite distinct. Water use of the mining sector, government and households is growing rapidly while that of agriculture is fairly stagnant (though volatile).

<sup>1</sup> SADC is currently developing a standard method for water accounting for the member states and for river basins in the region. The project will be completed by September 2010. Country pilot studies are carried out in Malawi, Namibia, Mauritius and Zambia. The Maputo and the Orange Senque Rivers are the selected pilot river basins.

Figure 7: Total water consumption (in Mm<sup>3</sup>)Figure 8: Water use account by institution (in Mm<sup>3</sup>)

The wastewater supply accounts show that the supply of wastewater to treatment works more than doubled during the same period from 14 Mm<sup>3</sup> in 1992 to 29 Mm<sup>3</sup> in 2003. Urban areas generate the bulk of the wastewater (25 Mm<sup>3</sup> in 2003) but some 4 Mm<sup>3</sup> of wastewater are now available in rural areas. The supply of wastewater will further increase in future due to the construction of treatment works in large rural villages and improved living standards. The wastewater use account shows that nothing is recycled and only a fraction is re-used (3 Mm<sup>3</sup>). Most wastewater is lost during treatment or discharged into the environment.

Although no monetary accounts were prepared, the physical accounts have been used to estimate water use efficiency. Water consumption by sector is shown in Table 7 while the value added per unit of water is given in Table 8. The tables indicate that agriculture is the largest water user and yet it has the lowest value added/m<sup>3</sup>. The estimates show that the service sector and the construction industry have the highest efficiency in terms of value added/ m<sup>3</sup> (over P1 000/m<sup>3</sup>). Government and

the mining sector have a considerably lower value added (P 200-300/m<sup>3</sup>), and agriculture has the lowest value added around P 5/m<sup>3</sup>). The picture is slightly more favourable for agriculture if efficiency is measured as employment/m<sup>3</sup>, but does not alter fundamentally. The agricultural sector is a large water user with relatively limited production outputs. From a production perspective, the rapid increase in water use by households also poses problems, as it leaves less water for productive uses. Re-use of wastewater in these sectors would benefit production and economic growth.

**Table 7: Water use by economic sector (Mm<sup>3</sup>)**

User category	1992	1996	2000	2003
Agriculture	72.9	70.6	76.0	63.4
Mining	12.8	14.4	24.1	26.8
Manufacturing	3.9	2.1	4.0	5.1
Water + electricity	0.0	0.8	0.5	0.7
Construction	0.0	0.4	0.4	0.4
Trade	0.2	0.7	1.0	1.2
Hotels and restaurants	0.2	0.5	0.8	0.8
Transport + communication	0.0	0.2	0.2	0.3
Insurance, banking, business	0.0	0.5	0.7	0.8
Social and personal services	0	1.2	1.7	2.4
Government	8.7	8.8	11.1	11.5
Household use	36.1	41.1	48.1	56.9
WUC private sector	7.7	0.0	0.0	0.0
<b>Grand total</b>	<b>140.3</b>	<b>141.3</b>	<b>168.6</b>	<b>170.3</b>

Source: DEA and CAR, 2006.

**Table 8: Water productivity (value added per m<sup>3</sup> by sector; 1993/94 Pula).**

User category	1993	1998	2002	2003
Agriculture	6	6	5	4
Mining	274	257	257	260
Manufacturing	194	219	144	138
Water + electricity	190	357	942	654
Construction	2,294	4,890	2,395	2,468
Trade	1,116	1,800	1,543	1,445
Hotels and restaurants	276	373	334	321
Transport + communication	2,448	3,221	2,441	2,428
Insurance, banking, business	2,421	2,884	2,577	2,666
Social and personal services	382	494	1,247	1,282
Government	236	237	270	271
<b>Grand total</b>	<b>76</b>	<b>91</b>	<b>93</b>	<b>106</b>

Sources: DEA & CAR, 2006.

Water accounts are useful for policy makers in several respects. The accounts show:

- The trend in water production and consumption that can be used to validate (and when needed improve) water demand scenarios of the NWMP;
- The most important users and their trends in water consumption. These should be priorities of water management and planning. The fast growth in wastewater supply, particularly in south-eastern Botswana. They further show the absence of recycling and very limited re-use. Both need to increase drastically to achieve the policy targets of the National Master Plan for Sanitation and Wastewater;

- The continued high loss rates (or unaccounted water) of water supply institutions, particularly at DWA. This is a waste of scarce resources, and loss reduction need to become a policy priority. Progress can be monitored through the water accounts;
- The different costs of water supply and wastewater treatment;
- The efficiency in water use by economic sector (in terms of value added and employment).

Water accounts need to be regularly up-dated. This can be easily done once DWA has assumed full responsibility for the accounts. The accounts can also be further improved and brought in line with the framework for water accounting that SADC is currently developing.

### **3 Views and suggestions emerging from consultations**

#### **3.1 Consultations during scoping**

Discussions were held with a range of stakeholders (WUC, DWA, water sector reform project, World Bank and Debswana) and with three districts (South-East - Ramotswa, Central-Serowe and Ngamiland- Maun). The purpose of the consultations was to gain insight in the perceptions about IWRM and suggestion regarding the scope of the IWRM-WE programme. The consultations during the scoping phase were not meant to be representative.

##### *IWRM and WDM*

Most stakeholders are moving towards the adoption and implementation of IWRM and some have policy documents. For example, DWA is guided by the NWMP2 and the draft water Conservation Policy; WUC has a revised IWRM & WDM strategy and Debswana has a water conservation strategy with clear targets. The Water sector reform project will be of strategic importance for IWRM as it deals with institutional, tariff and policy reforms. It is critically important that IWRM and WDM concerns are fully integrated into these reforms. The risk exists that both concepts are neglected given the daunting implementation challenges of water delivery and costs. The IWRM-WE project could assist in this respect.

Awareness about IWRM and WDM has not spread to all departments and staff of key players such as WUC and DWA. Moreover, the understanding of these concepts is very limited at the district level. Clearly, there is need for further awareness raising, training and capacity building in IWRM.

Water losses in reticulation, re-use of treated effluent and bills/non payment/ standpipes appear priority areas in districts.

##### *Good and bad examples*

Consultations revealed that IWRM is being implemented on the ground through projects such as growing re-use of treated effluent by farmers, rainwater harvesting and desalination in Orapa (Debswana), investigation of use of brackish ground water for mining (Orapa) and regular monitoring of meters in water reticulation system (Maun).

However, there are also examples of unnecessary water losses, particularly at the district level because of practical constraints (e.g. Ramotswa). Re-use of treated effluent for agriculture is in principle good, but the production and product quality are unclear. There is an obvious need to ensure that the water quality is suitable for the products grown and that farmers are producing good crops.

The analysis of the huge differences in water losses between villages can be used to improve the performance in high loss settlements.

Several examples emerged from abuse of water in settlements for livestock, from vandalism (e.g. pre-paid standpipes) and political interference (e.g. with disconnections for non-payment).

#### *Suggestions for the IWRM- WE project*

- IWRM monitoring and evaluation, including research. This is currently not done;
- Capacity building to support the implementation of IWRM. The capacity has improved in recent years, but it is still inadequate, particularly in districts.
- Encourage accelerated implementation of IWRM and WDM technical measures that have proven to be feasible.
- Establishment of a genuine stakeholder involvement and participation mechanism. This does not exist at present.
- Policy development in areas such as water & agriculture, water & environment, water supply at lands areas, water & poverty reduction, water quality & standards, harmonisation of policies across SADC;
- Greater focus on allocative efficiency of water resources (e.g. using water accounting). This is currently hardly addressed.
- Benchmarking and documentation of international best practices.
- Combine and balance policy development activities with actual implementation of measures that have shown their benefits.

### **3.2 National workshop**

A national stakeholder workshop about the draft national scoping study was held on the 20<sup>th</sup> of May 2010 in Gaborone. Some thirty-two participants attended from different sectors, including agriculture, wastewater and sanitation, water sector, media, district and town councils, natural resource management, parastatals and Central Statistics Office. The main aim of the workshop was to review and validate the findings of the IWRM-WE Scoping Study. The specific objectives of the workshop were to:

- Review and validate the findings of the Scoping Study
- Review and amend IWRM identified activities
- Formulate the (draft) vision for the IWRM in Botswana
- Review the Report's situation of the water sector

The participants were divided into groups and reviewed the Scoping Study based on the workshop objectives. The detailed views and observations have been directly incorporated in the situation analysis (section 4) and proposed scope of the IWRM-WE strategy (see section 55). Here some of the more general views are summarised.

One of the major points of discussion was the limited use of non-conventional sources of water such as rainwater harvesting and re-use/recycling of treated wastewater. Participants emphasised that water management should encompass *all* water. Participants further argued that there is need for public education and provision of incentives to utilise these sources of water and increase water use efficiency. Training of stakeholders in the public sector and among end-users was considered very important. IWRM is a new concept to many stakeholders in Botswana, therefore, it is important to share IWRM information and build capacity of stakeholders including those outside the water sector. The quality of effluent from the WWTP is not sufficiently monitored and the information is not well disseminated hence the quality of outflow is unknown. The workshop highlighted the importance of



regular monitoring in general (e.g. as self providers such as mines and livestock owners), loss rates of water service providers and the effluent quality and development of water quality standards for different uses. Moreover, water management and planning needs to be carefully coordinated with land use planning. The role of water access and provision for rural livelihoods and poverty reduction needs to be recognised and addressed. Clear targets should be set for integrated water resources management in order to assess progress and measure results.

The government subsidises water for domestic users and private sector for up to 40% of the cost of water and this distorts the real cost of water. The discussion was centred around the need for targeted subsidise to assist the poor section of society to access because the current 'blanket' subsidy is not sustainable in the long term. The current system benefits all including those who do not need subsidies.

Some of the recommendations emerging from the workshop include:

- The need for IWRM/WE project facilitators to reach out to many sectors that were not represented at the workshop and the public for capacity building and to raise awareness about the IWRM approach.
- The road map should indicate responsible institutions or individuals to implement the proposed tasks.
- The IWRM vision should embrace the concepts of sustainable utilisation, affordability to all sectors of society, minimise water wastage, efficient use and access to sufficient and good quality water.

The workshop proceedings are presented in a separate report.

#### **4 Situation analysis of the water sector**

Due to its semi-arid conditions, Botswana has limited surface and groundwater resources. Despite these resource limitations and facilitated by rapid economic growth and growing government budgets, Botswana has done relatively well in providing drinking water to urban and rural settlements. Moreover, the mining and livestock sectors have managed to develop their own water resources, having been allocated water rights by the Water Apportionment Board. Supply augmentation measures have driven (and continue to drive) the water development sector: more dams, well fields and water transfer schemes. Institutionally, DWA and WUC have been the main players together with the mining corporations and the Councils. Developments have been largely driven by the NWMP1 (1991) and currently by NWMP2 (2006). Policy and legislative development have remained behind.

As a result of the above, water constraints have been greatly reduced and the water sector has managed to support economic growth and development. Looking forwards however, the current situation is unsustainable for economic, social and environmental reasons. In economic terms, the water supply has been achieved at great costs and least costs options (e.g. re-use of treated wastewater and loss reduction) have not been fully utilised. Government subsidies have long hidden the true high costs for stakeholders such as domestic users and the private sector. Moreover, it is uncertain whether (and unlikely that) government will be able to afford the 40% subsidy level in future. From a social perspective, the pursuit of supply measures will lead to unaffordable water tariffs or require permanent large government subsidies. Remaining subsidies need to be better targeted. In environmental terms, the options for more large dams have run out, groundwater is frequently mined (i.e. abstraction exceeds the recharge) and access to shared water will depend on the efficiency of use of 'domestic' water resources. Whichever, way the associated water transfers schemes are very costly. Re-use and recycling of treated wastewater need to be fast tracked. Current levels of groundwater abstraction are unsustainable as they often exceed recharge.

**Figure 9: Some quotations from the NWMP2**

According to the 2006 review of the NWMP (vol 12, p 41):

*'Continuation of current practices is the most costly course of action to follow. It will require more government subsidies and large capital works.*

*'Duplication of the NSWC is a very expensive option to pursue. Despite it being uneconomic, it may still proceed for political and strategic reasons, which could be equally valid. However, these reasons should be transparent, as all consumers will eventually pay for these decisions'* (Review NWMP, vol. 12, p.9).

In other words, there is an urgent need to switch and implement integrated water resources management, with much more emphasis and efforts spent on water demand management measures. WDM must no longer be seen as a temporary 'drought relief' programme but it is a vital part of the IWRM strategy. Moreover, water for productive use needs to be based on allocative efficiency, i.e. a virtually neglected area to-date. Other priority components of the IWRM strategy should be:

- Mainstreaming water resources management in development planning and poverty reduction efforts;
- Institutional reform and effectiveness;
- Financing needs, water tariffs and subsidies;
- Speedy finalisation of quality water policy documents and laws;
- Implementation: several WDM measures can immediately be implemented, but remain 'pilots', leading to unnecessary water wastage.

Botswana has several advantages in the pursuit of IWRM-WE project. Firstly, government has embarked on an ambitious water sector reform project (2008 – 2013), which changes and defines the roles of major stakeholders, reviews the finances, tariffs and subsidies of the sector, and develops the water policy and water act. The approved institutional framework and mandates are summarised in Figure 10. The water sector will have a new regulator and the roles of DWA and WUC change considerably. An expanded WUC becomes the service provider for water and sanitation for the entire country while a smaller DWA assumes responsibility for water resource management.

In addition, the WSR-project has a communication and participation strategy, covering relevant Ministries, unions, NGOs and staff of affected institutions. These are vital components of the country's IWRM plan, which need not be addressed by the IWRM-WE project. However, it is important that the IWRM-WE project contributes IWRM and WDM concerns and issues towards the implementation of the water sector reforms, especially at WUC and DWA. GIWRM and WDM should not receive low priority as compared to the huge challenges associated with the reforms.

Secondly, the DEA has piloted natural resources accounting in the country, and among others, prepared Water Accounts in association with the Centre for Applied Research. This tool can be used to monitor resource use trends, integrate water resource management into development planning and to improve water allocative and technical efficiencies if it is adopted by DWA (as planned).

**Figure 10: Institutions and mandates after the water sector reforms**Water Utilities Corporation (WUC)

WUC will be responsible for the delivery of water and wastewater services country wide. WUC must be financially viable and use cross subsidisation to keep water affordable.

The Regulator

The regulator regulates more than one sector, e.g., water and electricity, or water, electricity and telecoms. The regulatory Commission should become financially sustainable.

Department of Water Affairs

The DWA's mandate post reform effort could be described as: "To serve the nation through protecting and developing the country's water resources, such that the growth of the economy is not vulnerable to inherent climate variability or constrained due to inadequate availability of sustainable water sources of required quality." DWA would continue to be completely financed from central government resources. Water Resources Management will be the prime function of the Department of Water Affairs with the focus on:

- *The strategic role of water in the economy:* Water may become a key constraint on future economic growth. Planning for investments in water storage and conveyance needs to be integrated with national strategic planning as water infrastructure is expensive and requires long lead time to develop.
- *Demand management and conservation:* Where there are limited new sources available for development, as is the case in Botswana, efficient utilization of existing resources is required to meet growing demands including conservation and demand management. This includes recycling; identifying and employing appropriate technologies for conservation, reuse, control of losses etc.; water pricing strategies including volumetric abstraction tariffs; regulation and enforcement.
- *Protection of water as a scarce resource:* The country's water resources need to be protected from misuse, overuse, waste and pollution. This applies to surface and groundwater resources. Natural resources such as the Okavango need to be preserved and protected. Adequate legislation and regulation is required, together with enforcement capability.
- *Monitoring of water resources and water utilization:* Water resources need to be scientifically quantified and monitored on an ongoing basis. Without the ongoing monitoring of both surface and groundwater, investment and utilization cannot be optimized and the impacts of current usage on present and future requirements cannot be determined.
- *International water use:* Most of the water resources available to the country are shared with other countries which are riparian to the same international river basins. Botswana needs to be able to protect and exploit its rights, in the spirit of a good neighbour, in order to optimize the benefits of shared resources.

Water Resources Council

WRC is as an advisory body to the Minister of Minerals, Energy and Water Resources on water matters. It will allocate water resources among users, monitor water resources, and develop water resources management policy. The WRC will replace the WAB. Initially, the WRC will need to be 100 percent financed by the federal budget. As licensing and water abstraction fees are levied and collected, then the WRC can reduce its reliance on the federal budget. However, it is envisaged that the federal budget will remain the principle source of WRC's support.

Source: World Bank, 2009.

Thirdly, the IWRM-WE project can benefit from earlier projects and policy initiatives such as the DWA Water Demand Management Project and the draft Water Conservation Policy. Moreover, several water quality standards are in place (e.g. drinking water, bottled water BOS 143:2007), treated effluent discharge standards BOS 93:2004), under revision (potable water) or in preparation (e.g. livestock water quality and irrigation water quality standards). Finally, the results BNWMP2 and the subsequent water cluster study carried out by DWA and Water Surveys Botswana need to be used in the development of the IWRM-WE strategy.

Several good practices have been identified during the study:

1. Clear verifiable target for 96% re-use/ recycling of wastewater by 2030. This target sets a clear agenda for the wastewater sector; the extended WUC mandate should make it easier to reach that target. The IWRM-WE strategy should ensure that progress with achieving the target is monitored;
2. Re-use of treated wastewater is increasing, particularly for agriculture (e.g. Ramotswa, Glenn Valley), but there is need to ensure that the use is productive and yields safe products;
3. Pilots conducted by the WCU-DWA have shown that certain interventions (e.g. replacement of AUF and meters) have major resource savings and/or economic benefits;
4. In the absence of a water policy and up-to-date water law, the NWMP 1 and 2 have successfully guided water management in the country (aided by government subsidies). While NWMP 1 was essentially a water supply strategy, NWMP 2 balances supply and demand measures. It must be noted that NWMPs do not require approval by Parliament;
5. All new institutional government houses are fitted with rain water harvesting facilities, water tanks, to encourage tenants to utilise rain water. The important step is to ensure use of the stored water and extend the initiative to the general public.

The following gaps and challenges have been identified:

- An outdated and incomplete policy and legislative environment (e.g. water conservation, water quality, irrigation);
- Allocative efficiency is not addressed as a challenge;
- Demand is not prioritised; basic needs and environmental requirements need to be assessed and given priority before productive demand and –last- luxury domestic use.
- Water quality does not receive the attention that it deserves. Economic growth and increased welfare levels will increase water quality concerns. The quality of water, especially wastewater and groundwater, is not regularly monitored.
- Lack of water and effluent quality monitoring may lead to pollution of the environment or other sources of water;
- Lack of implementation of interventions, which can yield immediate results as pilots have shown (e.g. automatic urinal flush systems, reduction of unaccounted for water (UAfW). There is a need to up-scale viable interventions and to ensure that pilot project do not collapse after the initial support period;
- Land use and water planning are not sufficiently harmonised;
- Rainwater harvesting opportunities are hardly used and yet there is considerable potential. Awareness about the potential of rainwater harvesting needs to be raised
- No or limited monitoring and evaluation of water use of self providers (e.g. mines and borehole owners);
- Little IWRM and WDM research;
- Inadequate IWRM and WDM trained human resources;
- A large gap in water management and capacity between Central government and Districts;
- The level of awareness amongst water stakeholders on IWRM and water-related issues is low.
- The impacts of the abolishment of standpipes have not been investigated/monitored;
- Water resource management needs to be closer alignment with development planning (i.e. mainstreaming);
- Political interference with water supply and tariffs.
- Illegal tapping of potable water in settlements mainly to water livestock;
- Dam maintenance and management such as addressing siltation of dams through dredging.

## **5 Priorities & recommendations for IWRM plan development and implementation**

The IWRM strategy needs to cover the following aspects:

- Goals, targets

- Activities & priorities for IWRM-ME project
- Road map for IWRM-WE programme, including options to accelerate IWRM plans
- Accessing regional knowledge and resources
- M & E process and indicators

The IWRM plan needs to be *dynamic* and respond to changes in the socio-economic and resource cont/ext. Key factors include government finances, economic growth and diversification, climate change and SADC developments and commitments. The latter also refer to use of shared water courses. A dynamic plan requires careful monitoring and evaluation as well as frequent reviews. We suggest that the IWRM plan will be coordinated with the development planning cycle, i.e. adjustment during the Mid Term Review of NDP10 and the preparation of the next NDP. NWMP2 can be used as the basis for the IWRM-WE plan.

The following *cross cutting issues* have been identified for the project:

- A target and efficient approach towards stakeholder participation;
- Gender sensitive and participatory approach;
- Pro-poor strategies in order to ensure that water management contributes to poverty reduction;
- Full integration of climate change impacts and adaptive measures;
- Full integration of SADC water and economic integration commitments; and
- Finances and distributional impacts of water management.

***Are there any other cross cutting issues to be considered in the IWRM programme?***

### 5.1 Vision, goals and targets

***WHAT DO WE WANT TO ACHIEVE??***

***The IWRM – WE needs to develop a shared vision for IWRM, clear goals and targets in a participatory process involving all stakeholders (public sector, private sector, population, NGOs and academia).***

A clear Vision needs to be developed as part of the IWRM-WE Strategy. Table 8 provides current thinking as expressed during the May 2010 stakeholder workshop.

**Table 9: Possible elements of the Botswana IWRM Vision, goals and targets**

	<b>Possible elements</b>	<b>Comment</b>
Vision	No water (grey or fresh) is wasted OR water wastage should be minimised. All people have access to sufficient and good quality water Water should be affordable Economic production is not curtailed by water constraints (amount and quality) and shortages	Has to be in line with Vision 2016 and MDGs
Goals	Achieving greater welfare levels and water efficiency through improved allocative efficiency and improved water user efficiency. Development of an innovative & viable water saving technology sector	Requires two new elements: demand prioritisation and focus on allocative efficiency
Targets	Reuse and/or recycling of 96% of treated wastewater by 2030. Intermediate targets should be set for 2015, 2020 and 2025 and	Part of NMPWWS 2003 Not yet articulated

	progress should be monitored Reduction of water reticulation losses to in phase to 20% and ultimately 15%. Comprehensive wastewater standards by 2015 Appliances: <ul style="list-style-type: none"> <li>• All toilets have dual flush system by 2015.</li> <li>• No automatic flush urinal systems by the end of 2011</li> <li>• All households have and use rainwater catchment tanks</li> <li>• For house construction, shower has priority over bath</li> </ul> Develop, test and implement new water saving technologies	Not yet done  Could be linked to innovation hub activities
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## 5.2 Enabling environment & instruments

***The IWRM programme should provide additional impetus to strengthening the enabling environment in close association with the WSRP. Below are some suggestions for instruments to be strengthened or developed. Which other instruments should be explored by the IWRM-WE project??***

**Table 10: Proposed key IWRM instruments**

Type of instruments	Key instruments	
Policies	Water Policy, based on IWRM with section on water supply, water demand management, shared water courses/SADC, wastewater, water quality and pollution	Will be done by WSRP. Need to harmonise standards and policies with those of other SADC countries
Laws	Water Act with similar section as above Bye-laws	Will be done by WSRP Some exist but generally under-utilised
Legislative instruments	Building regulations and water conservation BOBS WDWDM product and water savings standards (e.g. Australian experience) Ban on water wasting products Drought regulations and restrictions  Drinking water standards and standards for re-use and recycling of wastewater	Urgently needed Not yet done Do not exist as yet. May conflicts with WTA and SACU Used by WUC BOBS under review; DWA irrigation WW standards to be reviewed.
Economic instruments	Water tariffs Cross subsidisation Government subsidies (currently around 40 %)	Covered by WSRS
Consultative instruments	Trade effluent agreements  Water covenants: these would be agreements between water suppliers and water users/ sectors on water use efficiency WDM campaign and informative billing	Existing for wastewater  Not used  Existing but need to be targeted
IWRM support tools	Water accounts to be adopted and regularly up-dated by DWA IWRM & WDM performance indicators and M & E	At initial stage  Require development

***The current WSRP lead to centralisation (and a monopoly) of water supply services through WUC. This is against one of the IWRM principles of decentralisation of water management to the lowest feasible level (e.g. river basins).***

**Questions:**

- ***What can be done to ensure that this does not adversely affect IWRM advancement in Botswana?***
- ***Do we need a catchment area/ river basin approach towards water management in Botswana?***

### 5.3 Activities & priorities

***What activities should be addressed by the IWRM-WE project and what are the priorities?***

***Activities to be addressed should be gaps in IWRM coverage in Botswana and priority should be given to those activities that are ready for action and can make a significant distribution***

Below, activities are listed that emerged from the NWMP2 and from further analysis/ consultations. Seven themes emerged:

1. Improving allocative efficiency & establishing water accounts
2. IWRM and WDM implementation
3. IWRM mainstreaming
4. Transboundary water resources
5. Capacity building in IWRM and WDM among planners, managers and technical staff
6. Communication & participation (jointly with WSRP)
7. M & E, including research

*Activities to promote greater allocative efficiency*

1. Establishment of Water Accounts capacity (WA) at DWA: WA are available.
2. Up-date and improve WA; they also need to be harmonised with the SADC approach towards WA (on-going project);
3. Develop guidelines for increasing allocative efficiency and associated economic development; for example: Botswana could aim to attract industries and sectors with low to modest water consumption;
4. Use of WA for evaluation of development scenarios (linked to mainstreaming of IWRM in development planning).

*Activities re IWRM & WDM implementation (improving end user efficiency and service provider efficiency)*

1. Immediate implementation of water savings measures that have proven to be viable: retrofitting of automatic flush urinals
2. Identification and subsequent implementation of one additional feasible water saving measures each year;
3. Identification of the main water users in the public and private sector and selection of one per annum in each sector for in-depth consultations on water saving opportunities; goal is to conclude *a water saving covenant* with the user/ sector.
4. Design (with WUC) a strategy to reduce of water losses in urban areas (WUC), large rural villages (previously DWA) and small rural settlements (previously DCs);

5. Ensure the design and implementation of a monitoring system for water suppliers with verifiable loss figures

#### *Activities re IWRM mainstreaming*

1. Development of IWRM guidelines and benchmarks for water service providers, end users and water resource managers;
2. Close liaison with the Water Sector Reform Project to ensure that IWRM and WDM are fully integrated into the reforms and their implementation;
3. Development of guidelines for:
  - a. Design specifications of water reticulation systems to ensure that water losses can easily be detected and rectified and require less maintenance;
  - b. Full integration of treated wastewater re-use or recycling and the construction of new wastewater treatment works;
  - c. Water efficient building (DBES & BOBS), including on-site wastewater treatment, dual water systems and re-use/ recycling;
  - d. Irrigation & water wise gardening.
4. Develop with DWA and MoA a strategy for the provision and management of water at the lands areas. This is important for poverty reduction and for arable growth.
5. Review of the poverty impacts of water (supply) management in the past and identification of opportunities to reduce poverty through water management and supply. Areas of concern include: cross subsidisation, abolishment of free water at standpipes and water at the lands.
6. Review poverty and resource impacts of the abolishment of standpipes and recommend amendments or alternatives (e.g coupons).

#### *Activities towards transboundary water*

1. Review and harmonisation of Botswana Water Policy and Act with those of other SADC countries (part of WSRP);
2. Demonstrating of efficiency of alternative domestic water resources use prior to applications for shared water;
3. Contribute to and implement SADC guidelines for water allocation and benefit sharing (based on equitable sharing, fairness and sustainability).

#### *IWRM & WDM capacity building*

1. Awareness raising about the need for and benefits of water saving. Informative water billing
2. Training of key staff at WUC, DWA and WRC and of (major) end-users. The knowledge and capacity gap between Gaborone and the Districts needs to be closed. End users need to become more aware of the benefits of IWRM and WDM;
3. Establishment of IWRM & WDM units in WUC, DWA, DBES and in major end-user institutions.

#### *Communication & participation*

1. Stakeholder participation campaign throughout the IWRM-WE project in coordination with WUC and the WSRP.
2. Creation of a water user forum to discuss IWRM and WDM plans and implementation. The form and role of the Water Use Forum needs to be determined during the IWRM-WE strategy preparation by the major stakeholders.
3. Awareness raising about the importance and potential of rainwater harvesting

#### *Activities regarding Monitoring & Evaluation and research*

1. Development of M & E indicators for IWRM implementation and data collection (in conjunction with DWA, WUC and WRC); need dedicated M & E & research staff;
2. Monitor the progress towards meeting the IWRM-WDM targets;
3. Assessment of the most viable water saving technologies (e.g. small scale irrigation) and recommend for implementation
4. Assessment about the best use of treated effluent (re-use, recycling etc.)



5. Review best practices in terms of water losses/ UAfW, re-use & recycling of wastewater

#### 5.4 Road map and fast tracking options

While Botswana has made some progress with IWRM, it has been slow and opportunities exist for accelerating the process. The aim should be to use water as efficiently as possible and to become an IWRM front runner in southern Africa. This can be done by adhering to the ambitious water sector reform process time lines, by making better use of the water accounts and by rapid implementation of demonstrated successful WDM interventions. This requires an IWRM plan that combines resource management planning with implementation of physical measures.

A proposed road map for IWRM-WE activities is suggested in Table 10. It will be finalised after comments have been received from the key stakeholders and the national stakeholder workshop.

#### 5.5 Benefiting from regional and global knowledge & experience

The country can learn from experiences from other countries and share its lessons with other countries too. Good opportunities exist but there is need to seek active benefits from networks. Workshops are not sufficient. There is need for active networking, exchanges with other IWRM experts and follow ups. Table 11 summarises the main support programmes currently available.

#### 5.6 Financing options

Implementation of the IWRM-WE activities and their follow ups will require financial resources. It is important to note that many activities can be absorbed under existing government programmes and budgets. Examples include: the already developed water accounts can be handled by DWA staff at no or little extra costs (perhaps a temporary technical advisor is necessary); the water sector reform project is on-going and already addresses some of the activities discussed here (the IWRM-WE project staff can advise the WSRP); loss reduction and other activities are already in the IWRM-WDM plan of WUC and budgeted for.

Moreover, some IWRM measures lead to costs savings and have a short payback period. This should be a strong incentive for water users and commercial banks (if loans are needed). Subsidies or tax incentives are required for small scale rainwater harvesting.

Additional financial resources can be accessed such as grants and loans from the SADC WDM project administered by the DBSA. Moreover, a small water surcharge/m<sup>3</sup> can be levied to finance additional IWRM activities.

Finally, in kind support is available from a wide range of international projects. It is important that Botswana uses this support better to quickly advance in IWRM and WDM.

**Table 11: Suggested activities and time schedule for the project (and 1 year beyond)**

I	Improving allocative efficiency	2010		2011				2012				
		3	4	1	2	3	4	1	2	3	4	
	water accounts at DWA	X	X									
	Up-dating of water accounts (DWA)		X	X								
	Guidelines for increasing allocative efficiency (DWA)				X							



	modules. GWP Toolbox partners: Groundwater Management Advisory Team (GW-MATE) produces briefing notes series on groundwater resource management. International Network of Basin Organisations (INBO) aims to upgrade and support the development of organisational initiatives for IWRM in river basins.
GWP – other benefits ( <a href="http://www.gwpsa.org">www.gwpsa.org</a> )	Training course (often jointly with Waternet & Cap-net)
Waternet ( <a href="http://www.waternetonline.org">www.waternetonline.org</a> )	M.Sc course in IWRM Short term professional courses Annual conference (with GWP and Cap-Net) Research opportunities Net work of alumni and other Waternet members
Cap-Net ( <a href="http://www.cap-net.org">www.cap-net.org</a> )	A network for capacity building in the water sector. Focuses on education and training in the field of water resource management. Cap-Net also encourages partnerships and networking at national, regional and global levels. Provides courses, instruments for decision making and training materials.
WDM-DBSA	Grants, loans, technical assistance for water demand management, particularly to service providers
SADC groundwater & drought management programme ( <a href="http://www.sadc-groundwater.org">www.sadc-groundwater.org</a> )	Provision of tools for integration of groundwater in overall management of water resources and ecosystems. For example, tools for groundwater valuation and assessment of groundwater resources and recharge, guidelines for groundwater management.
LoGo Water	Provides information, guidance and research on IWRM and local government in SADC region. Set of materials tailored for SADC region for decision makers, practitioners and other stakeholders. Training material and guidelines for local authorities Case studies from other parts of the world.

## 5.7 Monitoring and evaluation

Progress with the implementation of IWRM needs to be monitored by all parties (WUC, major end-users and DWA) and ultimately by the water regulator. The IWRM project and strategy need to develop M & E indicators, for example by adjustment of the road map indicators (Table 12).

**Table 13: Possible roadmap performance indicators**

Enabling environment	<p>I.1 <b>Changes in enabling environment</b></p> <p>I.1.1 revision of policies &amp; acts</p> <p>I.1.2 water mainstreaming in NDP, DDPs etc.</p> <p>I.1.3 Appropriate &amp; sustainable funding in national budgets</p> <p>I.2 <b>Changes in institutional framework</b></p> <p>I.2.1 cross sectoral coordination framework in place</p> <p>I.2.2 Change Ministerial &amp; departmental mandates</p> <p>I.2.3 Formal involvement of stakeholders</p> <p>I.2.4 Launch of awareness &amp; mobilisation campaigns</p> <p>I.2.5 decentralisation &amp; delegation of decision making</p> <p>I.2.6 capacity development in government &amp; among stakeholders</p>
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	<p>I.3 <b>Changes in Management instruments</b></p> <p>I.3.1 Improved info management</p> <p>I.3.2 water resources issue assessment</p> <p>I.3.3 IWRM strategy &amp; plan development</p> <p>I.3.4 WR dev. &amp; Man Plans to support MDGs</p> <p>I.3.5 WDM &amp; water use efficiency</p> <p>I.3.6 social change instruments e.g. Awareness, conflict resolution</p> <p>I.3.7 Regulatory instruments</p> <p>I.3.8 Economic instrument to induce behavioural change</p>
IWRM change	<p><b>II.1 Enabling environment</b></p> <p>II.1.1 New legislation &amp; standards applied</p> <p>II.1.2 Water resource agencies operations based on IWRM</p> <p><b>II.2 Institutional framework</b></p> <p>II.2.1 sector ministries implement IWRM</p> <p>II.2.2 Coordinated water use between private sector &amp; government</p> <p>II.2.3 increased awareness &amp; IWRM management capacity</p> <p><b>II.3 Management instruments</b></p> <p>II.3.1 M &amp; E and research programmes for key water issues</p> <p>II.3.2 Transparent, coherent &amp; consensus based planning in all sectors</p> <p>II.3.3 Instruments change inappropriate water allocations &amp; use</p> <p>II.3.4 Participatory, conflict mediation</p>
Performance	<p>III.1 Development of water infrastructure</p> <p>III.2 Water management results</p> <p>III.3 Impacts on MDGs and Vision 2016.</p>

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