

## CHAPTER 12

### WATER RESOURCES

#### INTRODUCTION

12.1 Botswana is a country with scarce water resources, both surface and groundwater. Vision 2016 recognizes this problem and states that by the year 2016, Botswana must have a national water development and distribution strategy that will make water affordable and accessible to all, including those who live in small and remote settlements. It goes on further to state that Botswana must use water as efficiently as possible by using water efficient technology and various water conservation techniques such as water harvesting from rooftops, and that it must play a full part in negotiating and promoting international agreements concerning water usage and storage at a regional level, to provide a buffer against localised drought, which is not an uncommon phenomenon in Botswana. This vision is consistent with the SADC vision for water, which envisions the utilisation of the regions water resources in an equitable and reasonable manner.

12.2 In the past, because of the level of infrastructural development, Botswana's water resources management approach was based on what is called the 'water supply management paradigm'. This paradigm is based primarily on the tenet that water needs are requirements which must be met and consequently it is focused on development of new sources and structures in an attempt to manipulate the world's water resources to meet perceived water needs. The reality is that water is a finite resource and no amount of manipulation can change that fact. In NDP 9, there will be need for a shift towards a paradigm, which considers water needs as demands that are variable

and changeable. More investment will need to be put on water demand management and conservation in order to reduce overuse, resource wastage which can include water losses of more than 30% in some water supply schemes.

12.3 This chapter sets out the path towards meeting Botswana's aspirations on water in 2016. It outlines the policy changes, strategies and projects necessary in NDP 9 in order to make vision 2016 a reality.

#### Institutional Framework

12.4 Water resources management, which in this context includes all activities from planning and development up to water delivery at the customer end, is the responsibility of a number of institutions, which include but are not limited to the following key players; Department of Water Affairs (DWA), Water Utilities Corporation (WUC), Department of Geological Survey (DGS), Ministry of Local Government (MLG), District Councils, National Conservation Strategy (Coordinating) Agency (NCSA) and the new Department of Sanitation and Waste Management (DSWM) established in NDP 8.

12.5 The Ministry of Minerals, Energy and Water Resources (MMEWR) has overall responsibility for policy in the water sector. Within MMEWR, the Department of Water Affairs has the responsibility for national planning and/or water allocation. This task involves making decisions about which next major source of water should be brought on line and to supply which part of the country. Through a bilateral cooperation project between the Government of Botswana and

the Danish Government carried out in NDP 8, DWA has also now been designated the national focal point for water conservation in Botswana.

12.6 In the area of water resources development (i.e. construction of dams and wellfields, water transfer from source to user point, and water reticulation at the end user point) the Water Utilities Corporation is responsible for development of infrastructure and water supply to urban centres and other areas as may be designated by the Minister, while development work aimed at rural villages is mainly shared between DWA and MLG. The Ministry of Agriculture is responsible for constructing small dams targeted mainly for agricultural use.

12.7 In NDP 8, whereas DWA was responsible for development of sources of supply (dams and wellfields), supported by DGS in the case of wellfield development, and the construction of water reticulation schemes for almost all rural villages, MLG's main responsibility remained concentrated on operating and maintaining small to medium rural village water supply schemes through Water Units located in the District Councils. While the gradual take-over of the operation and maintenance responsibilities for the 17 major village water supplies by the District Councils was proposed in NDP 8, this responsibility remained with DWA. This situation is likely to continue throughout NDP 9 as the District Councils could hardly cope with the operation and maintenance of schemes already under their responsibility and called on DWA for assistance on numerous occasions and thus also putting a significant strain on DWA's limited manpower resources.

12.8 The design and construction of new village water supply schemes including major rehabilitation works on existing schemes will continue to be done by DWA in NDP 9, with Ministry of Local

Government focusing on smaller upgrading works in between the major rehabilitation works, pending a decision on rearrangement of the water sector based on the results of the National Water Master Plan (NWMP) review.

12.9 In order to facilitate efficiency and effectiveness, the whole arrangement of water supply authorities in Botswana will be reviewed in early NDP 9. The current arrangement in which there can be up to four water supply authorities in a relatively small area from a water distribution point of view, e.g. Gaborone (WUC), Tlokweng and Mogoditshane (DWA), and Gabane, Mmopane and Metsimotlhabe (Kweneng District Council), Oodi, Morwa and etc., (Kgatleng District Council), amounts to promotion of inefficient use of resources and is not focused on delivering good quality service to the customer but respect for historical institutional mandates and district boundaries. In order to realise Vision 2016, this situation will need urgent attention in early NDP 9.

12.10 The decision to transfer wastewater responsibilities to the Ministry of Local Government (MLG) was partially effected in NDP 8 with the establishment of the Department of Sanitation and Waste Management (DSWM). Complete transfer of all wastewater responsibilities including planning and construction of wastewater facilities will be achieved in early NDP 9. DWA will only focus on completing ongoing projects in NDP 9.

## **REVIEW OF THE WATER SECTOR PERFORMANCE DURING NDP 8**

12.11 During NDP 8, Government had two aims in the water sector:

- a. To meet the water requirements of the population through provision of a clean, reliable and affordable water supply, which is available to all, and

- b. To meet water requirements for industrial, mining, agricultural, wildlife, commercial and institutional users in order to achieve the major aims of rapid economic growth and sustained development.

These aims will continue to be valid throughout NDP 9 as they are in perfect alignment with Vision 2016.

## **Urban Water Supply and Demand**

12.12 Water Utilities Corporation (WUC) supplies water to six urban/mining centres in Botswana. WUC took over Phase 1 assets of the North South Carrier Water Project (NSCWP), for operation and maintenance during NDP 8, and this tripled the asset base of the Corporation leading to significant increases in urban water supply tariffs in order to recover investment costs.

12.13 Despite the intermittent drought during NDP 8, WUC was able to supply all its customers without any need for water supply restrictions throughout NDP 8. The transfer of water from Letsibogo Dam under the NSCWP improved the water resources situation significantly for the Greater Gaborone Area, surrounding villages and villages along the Gaborone/Lobatse corridor.

12.14 WUC experienced a further increase in demand during NDP 8 from peri-urban villages and some villages along the NSCWP. These are areas, which fall outside WUC statutory area of supply and were connected to the urban water supply infrastructure following upgrades of the urban water supply infrastructure that did not include them. Thus the existing WUC infrastructure was

overstretched in some areas to accommodate these cases.

12.15 In accordance with WUC Act, the Corporation provides primary infrastructure and requires developers to provide secondary infrastructure. Whilst this may appear to be very clear, major problems were experienced in NDP 8, with the servicing of land in WUC statutory areas, which is a responsibility of either Government or private land owners. The problems were mainly due to lack of standard procedures guiding developers in both State land and private-owned land. Plots were allocated in areas that are not serviced and as a result plot owners had to endure the frustration of not getting water supply connections.

12.16 This situation will need to be addressed in NDP 9, as quite clearly, it is the customers in the end, who suffer, and not WUC or the other government agencies involved. Such an approach to land allocation is also not consistent with other broader national goals such as attracting foreign investment into Botswana, as investors get very discouraged by delays in obtaining basic services such as water after being allocated land. This could easily be avoided by ensuring that land is properly serviced before allocation.

12.17 An average increase in water demand of 16% was recorded by the Water Utilities Corporation (WUC) between 1998 and 1999, dropping to 4% between 2000 and 2001. This trend was caused by the tariff increase and standpipe disconnection. Table 12.1 summarise the Corporation's performance during the first half of NDP 8.

**Table 12.1 Performance Indicators for Water Utilities Corporation 1996/97 – 2000/01**

	1996/97	1997/98	1998/99	1999/00	2000/01
Total water sales 10 <sup>6</sup> m <sup>3</sup>	25,5	27,7	23,3	35,6	37,2
New connections made (No.)	4,187	2,137	4,215	1,865	4,928
Total connections in service	40,532	42,669	46,884	48,749	53, 677
Total assets in millions of Pula	431.5	1,091.1	1,616.1	1,807.0	1,991.4
Average tariff (constant) Pula/K1	3.50	4.06	4.74	5.31	6.22

**Source: Water Utilities Corporation**

12.18 In anticipation of further growth in demand, particularly in Francistown, Gerald Estates, WUC decided in 2000 to update the Greater Francistown Water Supply Master Plan last reviewed in 1987. The reviewed plan recommended the implementation of some major capital works in the form of treatment works, pump stations, pipelines and storage to enable transfer of water from Shashe works to Greater Francistown Area. Implementation of the recommendations of the reviewed plan reached detailed design stage towards the end of NDP 8 and construction will be done during NDP 9.

### Major Village Water Supply

12.19 The upgrading of Kanye, Molepolole and Ghanzi water supply; Mochudi, Tlokweng and Mogoditshane water and sanitation schemes were completed in NDP 8. Detailed design for water sanitation schemes for Mahalapye, Palapye, Serowe, Tonota/Shashe and Ghanzi were completed during NDP 8. Construction started towards the end of NDP 8 and will continue into the middle of NDP 9.

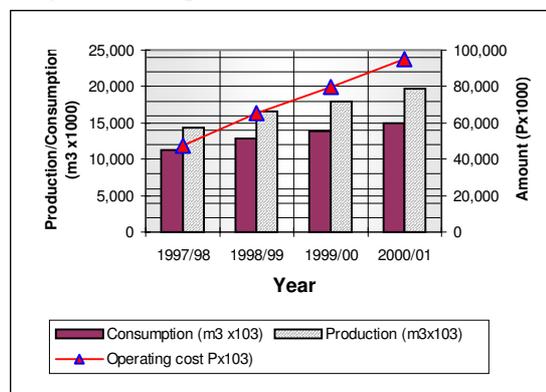
12.20 Ministry of Local Government completed Ramotswa sanitation under NDP 8. Kanye, and Molepolole water borne sanitation and, Letlhakane, Thamaga, Moshupa and Tsabong water supply and water borne sanitation design and construction were deferred to NDP 9

due to shortage of staff and financial constraints.

12.21 All water borne sanitation projects in NDP 9 will be carried out by Department of Sanitation and Waste Management. Upgrading of Maun water supply and water borne sanitation schemes was delayed due to the unavailability of a longer-term water supply source. Both the water supply and sanitation components of this project were at the design stage at the time of preparation of NDP 9, and construction was planned to take place in NDP 9.

12.22 Tsabong reverse osmosis water treatment (desalination) plant was completed during NDP 8. The plant produces 30 m<sup>3</sup>/hr of fresh water with a TDS (Total Dissolved Solids) not more than 400 mg/l.

**Chart 12.1 numbers of private water connections & metered consumption in major villages DWA Reports 2001**

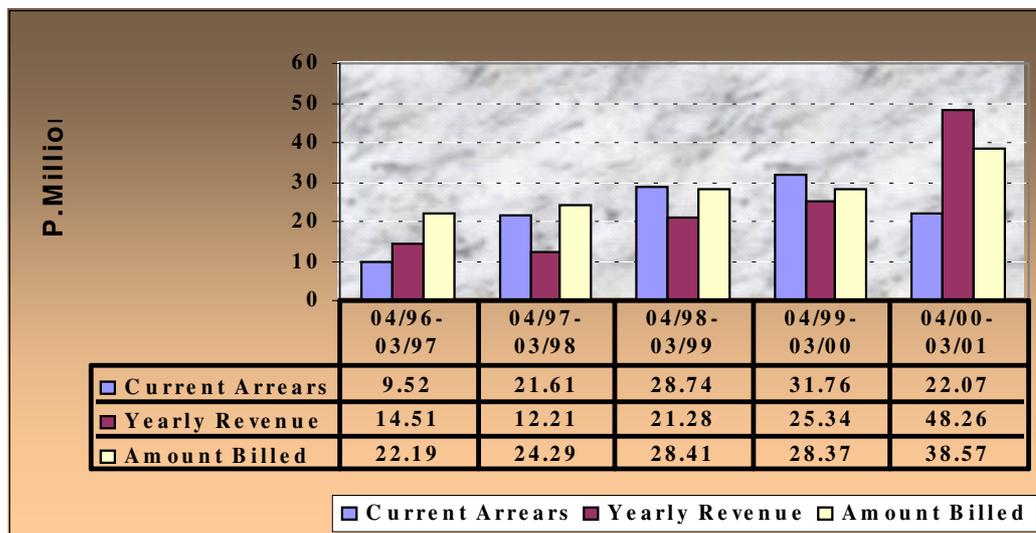


**Source: Major Village Water Supply Database**

12.23 As can be observed from Table 12.2 below, the demand for private connections increased significantly towards the end of the NDP 8 period. This in turn increased total water consumed by 32.7% (see Chart 12.1). The increases reflect changes in economic activities, improved standard of living and level of developments in the major villages. A similar trend in increase of private connections and water consumption is expected in NDP 9. The rate of private water connection did not meet demand fully, and resulting in a total of 2,358 outstanding connections to be made as at June 2002.

12.24 Cost recovery performance in the major villages during NDP 8 was not significant as efforts were concentrated on setting up an effective computerized billing system to facilitate effective billing and revenue collection. Tariffs were only reviewed towards the end of NDP 8. The costs of supply rose significantly as a result of the purchase of bulk water from WUC for a number of major villages, in which the cost at which the water is bought from WUC is significantly higher than the cost at which it is sold to the customer. Increase in the billing rate and revenue collection in major villages was achieved in NDP 8. At the time of preparation of NDP 9, billing rate was over 90% and arrears of revenue were on the way down, whilst revenue collected was on the way up (see Chart 12.2).

**Chart 12.2 Water Sales & Arrears of Revenue in Major Villages 1996/97 - 2000/01**



Source: Major Village Water Supply Database

## Regional Buildings

12.25 During NDP 8, construction of DWA regional buildings was completed in the following areas; Francistown, Gumare, Molepolole, Mochudi, Palapye, Maun and Tsabong. Ramotswa regional building will be completed in NDP 9.

**Table 12.2 Increase in the Number of Private Connections Over NDP 8 in the 17 Major Villages (Data from Major Village Water Supply Database in DWA)**

Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
<b>Total No. of Connections</b>	46,608	52,099	57,654	64,248	70,769	78,866
<b>Difference From Year Before</b>		5,491	5,555	6,594	6,521	8,097

**Source: Department of Water Affairs**

## **Rural Village Water Supply**

12.26 Rehabilitation and upgrading of existing rural village water supply schemes continued in NDP 8. A total of 254 projects for rehabilitation and upgrading were completed, 45 of these being major rehabilitation and upgrading projects, which were contracted out to private consultants and contractors, while the rest were done in-house mainly by DWA. This is 21% above the NDP 8 planned target of 210 projects for rehabilitation and upgrading.

12.27 Groundwater investigations were successfully completed in 211 villages, thus leading to provision of additional supply and standby boreholes. This was 18% above the NDP 8 planned target of 179 villages in which additional boreholes were to be drilled.

12.28 In line with the policy of decentralisation, the District Councils were also able to undertake some of the development projects in rehabilitation and upgrading of rural village water supply schemes. The Council's share of the water development budget has steadily increased from 10% in NDP 7 to 40 % in NDP 8. This clearly shows that there was progress achieved during NDP 8 in building of District Council capacity to do some of the water development projects.

12.29 The main problem encountered during NDP 8 in the operation of rural village water supply schemes was watering of livestock through standpipes. Since there is no provision for animal watering in the design of water supply schemes, this exerted serious stress on some of the schemes. The Ministry of Local Government will address this problem in NDP 9. There was also a noticeable increase in the number of villages experiencing sudden water shortages. This meant that emergency projects had to be put in place to solve these crises, leading to increased unplanned workload for both the DWA and MLG. Improved monitoring of daily production and water level monitoring will need to be established in NDP 9 within District Council Water Units/Departments in order to deal with this problem.

12.30 The other major problem encountered with the rural village water supply schemes was the rapid growth in demand in some of these villages. Some villages underwent a change in character and became small towns with related commercial, industrial and institutional functions e.g. Masunga, Bobonong, Gumare, Tutume and etc. Demand for water increased not only through increase in number of standpipes, but also through growing number of private connections; for instance in Bobonong, the connections increased from 970 in 1997 to 5,000 in 2001.

12.31 As during NDP 7, problems were again encountered during NDP 8 due to lack of effective coordination between ministries with respect to development of institutions in villages, which require huge water supplies. When no plans are put in place in advance by the water supply authorities to cater for these institutions, they put a significant strain on the existing water supply scheme for a village. The Department of Water Affairs and the Department of Local Government and Development in MLG will in NDP 9 try to take a proactive role and ensure that development plans specifically for ministries such as Education, Health and other agencies likely to build new large institutions in villages are taken into account in design of the rehabilitation work for rural village water supply schemes.

### **Agricultural Water Use**

12.32 Small dams have been built by the Water Development Section of the Ministry of Agriculture on appropriate catchments since the early 1980's for purposes of watering livestock. In addition, large multi-purpose dams are planned in NDP 9 to cater for both domestic and agricultural use.

12.33 At the time of preparation of NDP 9, plans were under way to use treated effluent from Gaborone for irrigation upstream of the Gaborone Treatment Works. The Department of Water Affairs was also in the process of developing a plan to make water from polluted wellfields such as Ramotswa available for small-scale irrigation. The complete handover of these wellfields or boreholes within these wellfields to private operators would not be desirable as these wellfields can still be used in the event

of a severe drought, which is common in Botswana.

12.34 MMEWR also recognizes the link between poverty and water availability, and that the worst affected people in terms of poverty in Botswana are women. Not much was done during NDP 8 to address this issue. This will be addressed in NDP 9 as part of the National Water Master Plan Review. Support in dealing with this issue will be required from the Ministry of Labour and Home Affairs.

### **Miscellaneous Water Supplies**

12.35 During NDP 8, DWA continued to receive requests for additional water supplies from other Ministries and Departments. Most of these requests were spontaneous and not adequately planned for, particularly in terms of availability of adequate funding. As a result, most of these projects were half completed at the end of NDP 8 and deferred to NDP 9.

### **Water Tariffs**

12.36 The last but one rural water tariff review was carried out in 1993, when authority was given to increase rural tariffs by margin not exceeding 45% per annum for four consecutive years commencing in 1993/94 to 1996/97. These increases were affected at 45% in July 1993, March 1995 and August 1996. The pricing policy during NDP 8 was aimed at first achieving 100% recovery of the operation & maintenance costs for the 17 major villages and thereafter move on to partial capital costs recovery.

12.37 Overall the level of cost recovery in the 17 major villages went down in NDP 8 mainly due to the bulk water supply rate imposed by WUC

which led to an increase in operational costs of about 20% per annum.

12.38 The revised tariffs effected in December 2001 were set out such that;

- Rate for consumers supplied from DWA sources increased by 18% per annum for the next six years.
- Rate for the domestic, commercial and industrial users in villages supplied through bulk supply from WUC increased by 27% per annum for the next six years.
- Rate for Government and Council institutions in WUC supplied villages increased by 72% per annum for the next six years.

12.39 During NDP 8 water continued to be free at public standpipes. However, the budgetary provision for standpipes declined in major villages as more households chose private connections. Demand for private connections continued to increase during the NDP 8 plan period. Towards the end of the review period, 92% of water consumed in the major villages was through private connections.

12.40 The annual tariff increase for urban areas rose from 12.66% in 1996/97 to 17.14% in 2000/01. The effect of the tariff increases on water consumption was more significant in the domestic consumption category than for public institutions. The result was a drop in consumption in the domestic consumption category. Standpipes were phased out and this reduced the losses dramatically.

12.41 The main objective behind the urban water tariff increases in NDP 8 was to be in line with the Corporation's mandate of full cost recovery. The WUC Act stipulates

that the utility has to be commercially viable and therefore has to fund the costs of expansion of future supply systems. Although the Corporation increased efficiency and kept the cost increases far below the rate of inflation, these adjustments were to meet the requirements of the North South Carrier Water Project, which is owned and operated by the Corporation.

## **Information Technology (IT)**

12.42 During NDP 8, a number of communication infrastructure development projects were completed within MMEWR. The Department of Water Affairs initiated a project to provide its outstation offices with improved network infrastructure. This resulted in great improvement in data management and transmission within the various stations.

12.43 Due to rapid changes in the IT field, this improvement was short lived as by the beginning of 2001 the departmental billing system was drastically changed to an improved database management system that rendered the existing hardware including the servers inadequate. The improved billing system was a necessary change whose new components include assets management modules to assist the operators to better manage the water supply schemes and thereby in the long term reduce breakdowns and water losses. The Departments of Mines, Geological Survey, Ministry Headquarters and Energy Affairs Division also installed Local Area Networks, which composed of cabling and provision of servers.

12.44 A number of business systems and applications projects were also completed in NDP 8. In the financial

year 1999/2000 the Department of Water Affairs implemented the Computer Aided Design (CAD) to assist in the production of village water reticulation maps. This project also involved training of 5 draftsmen and 3 technicians in the operation of the system. The introduction of CAD system tremendously improved the production level in the DWA design office. The quality and accuracy of the drawings also improved significantly compared to the hand drawn ones.

12.45 The Department of Water Affairs also started the implementation of the Water Resources Information System in October 2000. The first phase of the project involved purchasing of hardware and software. The second phase of the project started in May 2001 and involved the actual development and integration of systems and a number of databases.

12.46 The Water Resources Information System Project was a major step forward in information management in the Ministry. It provides links to management databases such as accounts and this facilitates the checking of up-to-date balances on each vote in DWA on line and should eliminate the problem of over expenditure on votes and the consequent audit queries, which take up a lot of productive work time to resolve.

12.47 During NDP 8, WUC implemented Master Information Systems Plan (MISP) whose objective covered the areas of business system, technology and information technology support. In the undertaking of this project, urgent attention and priority was given to the core business applications. The risks in this project have been the short

supply and high mobility of IT specialists.

## **Water Resources Investigation and Development**

12.48 As a follow-up to the recommendations of the National Water Master Plan (NWMP), the Palla Road and Khurutshe Groundwater Investigation and Resource Assessment Project - Phase 2 was successfully completed during NDP 8. The main objective of this project was to develop groundwater resources in the area to act as a strategic back-up supply for the North South Carrier Pipeline.

12.49 The Kanye, Ramonnedi and Moshaneng Areas Groundwater Resource Evaluation Project was also completed in NDP 8. The other major groundwater resources investigation projects successfully completed during NDP 8 were:

- (i). Maun Groundwater Development Project – Phase 1 aimed at identifying potential wellfield areas, which could supply Maun, and surrounding areas. Phase II of this project aimed at developing wellfields in the identified good groundwater potential areas commenced during NDP 8 and will be completed in early NDP 9,
- (ii). Serowe Wellfield II Extension Project aimed at extending the wellfields supplying Serowe. A number of production boreholes were drilled in the project and the resources in the developed area quantified. An emergency project aimed in part to connect these boreholes to the Serowe water supply system commenced towards the end of NDP 8,
- (iii). Tsabong Groundwater Investigation and Resources

- Assessment aimed at identifying resources adequate to meet the demand for Tsabong, Omaweneno, Khisa and the surrounding settlements,
- (iv). North East Regional Groundwater Investigation Project aimed at identifying and securing a permanent water source for villages in the North East District and parts of the Central District. This project was successfully completed during the plan period and identified the Ntane sandstone aquifer in the Maitengwe area as capable of sustainably supplying the northeast region,
  - (v). Maitengwe Wellfield Development and Resources Assessment Project which occurred as a result of the Northeast Groundwater Investigation Project, aimed at developing a wellfield with adequate water resources to meet water demands of villages in the northern region. A wellfield was developed 40 km northwest of Maitengwe village. Adequate resources were identified. Recharge rates in this area are low therefore the supply will be sustained if used in conjunction with the Ntimbale Dam to be developed in the early stages of NDP 9,
  - (vi). The Boteti Groundwater Resources Investigation Project, scheduled for completion in early NDP 9. The project is aimed at securing adequate water supply for 11 villages within the Boteti Sub-District.

12.50 Regional groundwater investigation and assessment projects were also planned for implementation during NDP 8 in the following areas, Ghanzi, Matsheng, Goodhope, and Mabutsane. All these projects

including the Water Well Rehabilitation Project were deferred to NDP 9 due to lack of resources. The planned hydrogeological reconnaissance survey over the entire Okavango Delta could also not be undertaken during NDP 8 due to manpower and financial constraints.

12.51 Parallel to the activities of DWA, the DGS also carried out several groundwater investigation and resource assessment projects during NDP 8. These projects were mainly TGLP projects carried out on behalf of the Ministry of Agriculture and the Ministry of Local Government. The following projects were planned for NDP 8: Werda and Bokspits TGLP areas in the Kgalagadi District, Sekoma and Mabutsane TGLP areas in Southern and Kweneng Districts and Northwestern Ngamiland project in the Ngamiland District.

12.52 The Bokspits Area project was completed in NDP 8. The Werda, Sekoma and Mabutsane areas were combined into one project and at the time of preparation of this plan, the project was due for completion at the end of NDP 8. The North- Western Ngamiland project was also due for completion at end of NDP 8.

12.53 The planned project to drill deep boreholes in the Kgalagadi and other areas where the possibility of deep aquifers were suspected was not carried out due to a change in scope of the project. However, a new project called the Kalahari Research Project conceived and started during NDP 8 under Groundwater Studies and Protection will be completed in NDP 9.

12.54 The Hunhukwe / Lokalane Groundwater Investigation Project was also successfully completed

during NDP 8. The results of the project were positive, good quality and quantity of water was found in some areas of the project. A follow-up study will be carried out in NDP 9 aimed at supplying the Matsheng Villages.

12.55 On surface water resources assessment and development, following the feasibility and preliminary design of the Lotsane Dam during NDP 7, DWA completed the detailed design of the Lotsane Dam in NDP 8. The dam has sufficient yield to supply several villages in the Tswapong Area, with the possibility of small-scale irrigation. The detailed design of Ntimbale Dam and the designs of Lower Shashe Dam (Dikgatlhong Dam) were also completed in NDP 8. These will be followed by construction in NDP 9.

12.56 A feasibility/ preliminary design of a dam on the Thune River was carried out during NDP 8. The study showed that the dam could yield sufficient water to supply several villages in the Bobirwa Area. The study also identified several patches of land in the vicinity of the dam, which could be irrigated using water from the dam.

12.57 During the review period, DWA also carried out a study to investigate the feasibility of several small to medium dams for possible conjunctive use with ground water. The feasibility of the dams was determined using several criteria such as geotechnical conditions, yield, proximity to possible demand centres and environmental implications. The study was completed during NDP 8 with 12 sites identified for possible future development.

## **Water Quality, Protection, and Conservation**

12.58 The project aimed at assessment of the social acceptability, economic and technical viability of wastewater reuse was deferred following the establishment of the new Department of Sanitation and Waste Management (DSWM). Following clarity on the functions of this department, it is still considered necessary for the Department of Water Affairs (DWA) to consider utilisation of treated wastewater effluent as a potential water resource in the process of national planning. This view was also emphasised by the first NWMP study completed in 1992.

12.59 The first phase of the Water Quality Management Project was completed in NDP 8. This project addressed two main components namely, improvement in the water quality monitoring functions of the DWA and water conservation activities.

12.60 As a follow up to the Water Quality Management Project, a water conservation and water demand management project was also developed and commenced towards the end NDP 8. This project is aimed at addressing issues of public awareness and education as well as improved availability of water-saving technologies, techniques and measures.

12.61 The results emanating from the Water Quality Project were the successful piloting of the prepaid meter system in Tlokweng Village and retrofitting fixtures at Botswana Police College. During NDP 9, it is planned to phase out the old public standpipes in all the 17 major villages and to replace them with the prepaid ones.

The picture below shows the prepaid meter installed at Tlokweg.



**An installed prepaid meter system in operation.**

12.62 In an effort to improve water quality monitoring and pollution control over the whole country, construction of 3 additional water quality laboratories was planned in NDP 8. One out of the three planned laboratories was completed in NDP 8 because of budgetary constraints. The planned purchasing of some laboratory equipment did not take place because of the postponed construction of the other two regional labs. New equipment will however need to be purchased during NDP 9 for the existing labs.

12.63 The DWA mobile laboratory was decommissioned in NDP 8, following the successful transfer of drinking water quality monitoring in rural villages to the District Councils.

12.64 During NDP 8 the Botswana Bureau of Standards (BOBS) developed the national drinking water quality standards (BOS 32:2000), which were launched towards the end of NDP 8. These standards replace the old DWA drinking water quality guidelines and are more stringent compared to DWA' old guidelines.

12.65 The aquifer vulnerability-mapping project, which started in NDP 7 with the help of the German Government, continued in NDP 8. The overall objective of the project is to establish an Environmental Geology Division within the Department of Geological Survey. However, the implementation of the project has faced severe manpower problems. The German Government has agreed to extend their technical cooperation into a second phase to facilitate successful implementation of the project. This project will continue into NDP 9.

## **Data Collection and Management**

12.66 As water demands and water pollution problems keep growing in Botswana, both in terms of volume and complexity, the management of water resources in Botswana is increasingly becoming a more complex task, which needs more accurate water resources data and information. In response to the above challenge, DWA continued with its hydrological data collection programme during NDP 8. The hydrological database (HYDATA) continued to be the main archiving and data management system for surface water data.

12.67 During NDP 8 three satellite data collection platforms (DCP's) were installed under the SADC HYCOS program. They were fully operational at the end of NDP 8, and provided very useful real time flow information.

12.68 The Groundwater Monitoring Project to review the country's monitoring network and procedures was successfully completed during NDP 8. The project recommended the use of data loggers instead of

mechanical recorders for monitoring purposes. As a follow-up to the Groundwater Monitoring Project, Serowe and Dukwi wellfields were fully automated with data loggers in NDP 8 and other wellfields will be covered during NDP 9. Other recommendations from the project such as auditing of wellfields' models will be done during NDP 9.

### **Research and New Technologies**

12.69 During NDP 8, a National Water Well Maintenance and Rehabilitation Program was initiated. The main purpose of the project was to develop new borehole rehabilitation and cleaning methods, which could prolong the lifespan of existing boreholes. Small-scale experiments with some encouraging results were completed in Ramonnedi and Gaothobogwe Wellfields towards the end of NDP 8. This project will be implemented at a much larger scale during NDP 9.

12.70 The investigation of the applicability of hydro fracturing to increase borehole yields was completed in NDP 8. The objective of the project was to investigate whether yields of low yielding boreholes could be increased through sealing of sections of a borehole and applying high artificial water pressures in the sealed sections thereby increasing the yields by creating fractures and cleaning existing ones. The results of the project were that yields could be increased by up to 50%. The project is now complete and the application of the technique will be promoted in low yielding boreholes where water demands are not very high.

### **Contracting Services**

12.71 In the area of water supply in major villages, DWA engaged small citizen contractors from time to time to carry out the construction of private water connections in order to cope with the increasing demand. This arrangement proved to be effective and will be used more in NDP 9 with the gradual phasing out of DWA's construction crews in this area.

12.72 Faced with the problem of high mobility of IT staff and ever-changing IT specialist skills, the Water Utilities Corporation attempted to outsource its internal Information Services Section but could not succeed because of numerous legal and logistic constraints. The Corporation still intends to outsource these services including Telemetry Support Services and other areas after addressing the constraints.

### **National Water Master Plan**

12.73 The National Water Master Plan continued to provide the basis for water development during NDP 8. Following the successful completion of the Letsibogo Dam and Phase 1 of the North South Carrier (NSC), the next major resource to be developed should be the Lower Shashe Dam, and the second phase of the NSC (NSC II), to be in place by 2009. Detailed design of the Lower Shashe Dam and NSC II were completed in NDP 8.

12.74 The review of the National Water Master Plan commenced towards the end of NDP 8 and will be completed in the first half of NDP 9. One of the major expected outcomes of the review is a revised institutional framework for the water sector in Botswana, which can respond and

adequately deliver Vision 2016 goals and aspirations on water.

### **International Cooperation**

12.75 During NDP 8, Botswana continued to actively participate in trans-boundary water resources issues jointly with other SADC member states. A SADC Regional Strategic Action Plan comprising of 31 priority projects was finalised during NDP 8 and its implementation commenced. Botswana also signed and ratified the Revised Protocol on Shared Water Courses. The River Basins that Botswana shares are the Limpopo, Okavango, Orange and Zambezi. In addition to the establishment of the Okavango River Basin Commission (OKACOM) in NDP 7, the Orange-Senqu River Commission (ORASECOM) was established during NDP 8. At the time of preparation of this plan, negotiations on the establishment of the Limpopo River Basin Commission (LIMCOM) and Zambezi River Basin Commission (ZAMCOM) were in progress.

12.76 Terms of reference for the Limpopo basin integrated water development study were completed and approved by the Limpopo Basin Permanent Technical Committee (LBPTC) which is made up of the four co-basin states namely Botswana, Mozambique, South Africa and Zimbabwe.

12.77 Work also continued under the Zambezi Action Plan (ZACPLAN). The co-basin states for the Zambezi are Angola, Botswana, Democratic Republic of Congo, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe.

### **Human Resources Development**

12.78 Both the Department of Water Affairs and Water Utilities Corporation continued to experience problems associated with retention of skilled manpower during NDP 8. This worsened the manpower situation due to the impact of HIV/AIDS and resignations by experienced professionals mainly for better salaries in the private sector. The lack of adequate manpower resources particularly at professional level was one of the major constraints in project implementation.

12.79 In 2002, MMEWR developed a human resource development strategy for all its departments starting with DWA. It is expected that these strategies will assist the Ministry to address the prevailing human resource problems in a more holistic manner during NDP 9. The strategies are also expected to mitigate against the impact of HIV/AIDS in MMEWR, which in DWA was responsible for most of the 167 deaths recorded between August 1997 and June 2002. The Ministry's policy on HIV/AIDS is currently being developed, the work place programmes are being enhanced to ensure that HIV/AIDS activities are mainstreamed into the routine functions of the Ministry.

12.80 In the Water Utilities Corporation, the Corporation implemented the Hay job grading and pay system at the beginning of NDP 8. Whilst the system was generally objective, it did not completely address the problems identified, particularly with regard to the conversion from the old Patterson to the new Hay points system. It will be necessary to review this system in due course.

12.81 A survey by Tsa Badiri Human Resources Management Consultants showed that the Corporation's remuneration structure was not competitive from middle management to the top when compared to other parastatals and the private sector. As a result, the Corporation was losing qualified and experienced personnel and could not recruit and retain the same. The Corporation undertook a salary review upgrade with the view to addressing these problems and this was approved by the WUC Board and implemented at the beginning of 2001.

12.82 Still in NDP 8, the Corporation undertook a labour adjustment exercise whose intention was to optimise the organisation structure by realigning employees to their job functions. As a result of technological advancement undertaken at the Corporation, some jobs became redundant and the affected staff had their contracts terminated and were given exit packages. Regular consultation with the Union was maintained throughout the implementation of the labour adjustment exercise.

### **Lessons Learnt in NDP 8**

12.83 Many lessons were learnt during NDP 8 the principal amongst these was the realisation that improvements in management capacity mainly in terms of skills and not numbers of people could significantly improve implementation of projects and achievement of planned results. Technical skills were fairly well developed; the main problem and challenge lay in developing managerial and leadership skills.

12.84 The other important lesson learnt was the need for a proactive approach in dealing with problems, instead of waiting for the problems to develop into a crisis. One example is the allocation of land without services, a problem that affected all water authorities. The water authorities will have to redouble their efforts and/or find innovative ways to deal with this problem in NDP 9.

### **WATER SECTOR POLICY FOR NDP 9**

12.85 During the strategic planning process for the Ministry of Minerals, Energy and Water Resources and the Department of Water Affairs, the Ministry extensively consulted Batswana throughout the country. A view expressed by most customers in the rural villages was that DWA should take over the running of rural village water supply schemes from the District Council Water Units in order to improve quality of service delivery. This view has also been supported by some District Councils, who initiated the handover of some of their schemes to DWA towards the end of NDP 8 in order to improve service delivery and revenue collection.

12.86 The above clearly points to a different direction to the policy direction articulated in NDP 8, that DWA should gradually handover the operation and maintenance of major village water supply schemes to District Councils. However, MMEWR does not believe that the solution to Batswana's aspirations for a more reliable water service lies in transferring rural village water supply schemes to DWA.

12.87 A desk study carried out by MMEWR through a short consultancy looked mainly at the available

opportunities in improvement of the operation of the major villages water supply schemes and did not look in detail at the operations of the District Councils and WUC. It will be necessary for this study to be extended to cover the operations of all water supply authorities in early NDP 9. Options which need to be investigated and modelled from a financial point of view include but not limited to the following;

- (i). Placing all water distribution in the country under WUC,
- (ii). Establishment of a number of regional water distribution agencies or companies,
- (iii). Grouping the 17 major villages and nearby smaller villages with other big villages operated by the District Councils and establishing an agency or company to run these, while the smaller and isolated villages continue to be operated by District Councils,
- (iv). Separating bulk water supply from water distribution and leaving everything else the same,
- (v). Doing nothing and continuing business as usual.

12.88 A new Water Act was expected to be finalised before the end of the NDP 8 period, but it is not yet developed. This will therefore be given top priority in NDP 9.

12.89 Water in Botswana is already a major constraint to development, e.g. irrigation is made unviable in certain places not because of the soils but because of the unavailability of water. Establishment of the national water resources inventory, both surface water and groundwater, through resources investigations and assessments will therefore continue to be a focus for activity in NDP 9, to ensure that water does not become a

constraint to other sectors of the country's economy.

12.90 A number of villages supplied from groundwater in NDP 7 were connected to the NSC in NDP 8. These include Palapye, Mahalapye, Shoshong, Mochudi, and Ramotswa. It will be important in NDP 9 to continue operating the wellfields, which supplied these villages and carry out extensive monitoring during pumping and improve estimations of the sustainable yields of these aquifers to ensure that in case of need during drought years the country knows how much water it can take from these wellfields and for how long. Because of the scarcity of water in Botswana, the long-term strategy to meet the country's water needs must be conjunctive use of both surface water and groundwater and not the use of one or the other.

12.91 Towards the end of NDP 8, MMEWR established an International Waters Unit (IWU). The Department of Water Affairs together with the International Water Unit will intensify efforts in NDP 9 to ensure that Botswana plays a full part in negotiating and promoting international agreements related to water resources development and usage at regional level, to provide a buffer against localised drought and increased security of supply as envisioned in Vision 2016.

12.92 Parallel to the development of new sources of supply, water conservation and demand management will be given more prominence in NDP 9. A Water Quality and Conservation Division was established in DWA towards the end of NDP 8 through a project co-funded by the Botswana Government and Danish Government. This division will be the

national focal point for all water conservation activities in the country. Public education on water conservation, investigation and introduction of technologies, which conserve water, will have high priority amongst its list of activities for NDP 9. DWA will also seek to develop effective networks and partnerships with NGO's, NCSA, Local Authorities and other key stakeholders in order to create a water efficient society in Botswana.

12.93 The development of water resources in Botswana is a highly costly business. It is therefore prudent that those who can afford to pay for water in Botswana should continue to do so. This is necessary not only to assist government in development of future infrastructure and sustenance of effective operation and maintenance of the country's water supply schemes, but also to ensure the development of a water conservation mindset in all Botswana.

12.94 The policy of contracting out some services to the private sector will be maintained in NDP 9. In the area of design and construction of water supply schemes the intention is to reduce in-house construction capacity and increase in-house inspection of projects carried out by contractors.

12.95 Experience has shown that hardly any work on assessment of the effectiveness of the operation of these schemes is done in between major rehabilitation works. With assets running into billions in terms of cost, hardly any time is put on asset management and this situation will need to be addressed in NDP 9.

12.96 MMEWR will strive to identify an effective and sustainable programme to ensure complete

awareness of HIV/AIDS scourge by staff and hopefully reduce the negative impact of the epidemic on the ministry's business. A thorough research on lessons learnt and action taken by other organisations in Botswana and internationally will be conducted in addition to existing programmes. An attempt will be made to encourage private companies working with the ministry on various projects to sensitise their staff on HIV/AIDS and ensure the availability of HIV/AIDS information and condoms on site.

### **Planning and Institutional Development**

12.97 The National Water Master Plan will continue throughout NDP 9 to be the guiding plan for all large water development projects in Botswana. The review of the plan will be carried out in early NDP 9. Parallel to the review of the NWMP, a detailed study looking at the operations of all the water supply authorities in Botswana will also be conducted in early NDP 9 to develop alternatives of the best arrangement for Botswana.

12.98 The possibility of establishing the office of a Water Regulator to ensure that the interests of water consumers are well looked after, and that the cost of water charged to customers by the water supply authorities reflects the true cost of providing the service will also be investigated. The price of water has an influence on the competitiveness of the country's products and services because it is a basic commodity. Efforts must therefore be made to ensure that cost recovery includes very little costs of inefficiency. In a monopoly type of business, it is very easy to pass on the cost on

inefficiency to the customer, because the consumer has no other alternative.

### **Water Resources Investigation and Development**

12.99 A total of eight groundwater investigation projects are planned for completion in NDP 9. These projects are concentrated mainly in the western part of the country where the possibility of surface water sources is non-existent.

12.100 Four surface water dam construction projects have been planned for NDP 9. These dams will include the Dikgatlong Dam, which according to the NWMP will be required around 2009. The detailed design of this dam commenced in NDP 8 and will be finalized in early NDP 9 followed by construction. The other three dams will be Lotsane, Thune, and Ntimbale. The detailed design for Lotsane and Ntimbale Dams were completed in NDP 8, while that of Thune Dam will be done in NDP 9.

### **Water Tariffs**

12.101 MMEWR through the Department of Water Affairs will undertake a water affordability and tariff study over the whole country with a view of ensuring that those who can afford to pay for water in Botswana should do so and at the right level of cost recovery. The study should come up with a water tariff policy and model, which ensures that the price that a customer pays for water is based on sound economic analysis and not the name or label of where one resides, e.g. urban centre vs. rural village. This study should be commenced and completed in early NDP 9, and thereafter updated on

regular basis to ensure that it remained relevant in all areas.

12.102 During NDP 9, water tariffs for major villages will increase annually for a period of six years, that is, up to 2006 at the following percentage rates:

- Consumers supplied from Department of Water Affairs sources: 18%
- Domestic, Commercial and Industrial users in villages supplied through bulk supply from WUC: 27%
- Government and Council Institutions in WUC supplied villages: 72%.

These tariff increases are anticipated to recover about 70% of the operating costs.

12.103 WUC has adopted the Long Run Marginal Cost (LRMC) of supply of water as the basis for tariff calculations. The adoption of this principle means that full cost recovery for water supply will be achieved at all times. To take cognisance of the social circumstances, a graduated tariff has been introduced and will be maintained. The lower tariff band caters for basic need at very affordable prices, whilst those who consume water for luxury purposes have to pay a price exceeding the LRMC and subsidise consumers with low water demand. The on-going Francistown Water Supply Master Plan Review is worked on the Long Run Average Cost (LRAC) principle. The LRAC will however not change the stepped up tariff policy adopted by the Corporation.

## Data Collection and Management

12.104 A major groundwater-monitoring network upgrading project is now planned for completion in NDP 9. This project will ensure improvement in reliability of groundwater monitoring data. DGS will also continue with groundwater monitoring as agreed between itself and DWA. A nation wide hydrogeological monitoring and archiving development project in the exploration wellfields will be carried out during NDP 9 to improve the department's methods of data collection and quality control.

## Information Technology

12.105 With globalisation increasingly becoming a reality, easy access to basic information on a country such as water availability, can have a significant impact on a country's international competitiveness. MMEWR as the government agency responsible for overall policy in the water sector and national water resources planning will introduce new information systems and enhance the existing ones in order to make information on water, minerals and energy easily accessible.

12.106 Several projects planned for implementation during NDP 9 are indicated in the Thumb Nail Sketches.

## Water Quality, Protection and Conservation



**Extensive and prolific oil pollution in one of the Industrial sites in the country**

12.107 The alarming rate, at which water resources are being depleted, and the risk of water pollution from various industrial developments and individual households, added to the increasing demand for water, indicates the crucial need to protect and conserve it. Introduction of enforceable policies and tight control systems are also crucial for efficient water management practices. During NDP 9, several projects to be carried out to address this problem are indicated in the Thumb Nail Sketches.

## Contracting Services

12.108 During NDP 9, DWA will review borehole cleaning and fishing services provided to customers with an intention of phasing it out and allowing the private sector to venture in. This privatisation drive will create employment and increase productivity in the service rendered. The siting section will also be scaled down to remain with one crew for the same reasons stated above.

### **Land Areas Water Supply**

12.109 The portfolio responsibility for water supply to the lands areas will be determined as part of the proposed study to develop options for the best water supply arrangement in Botswana. This issue remained unresolved in NDP 8, and will be tackled again during NDP 9, so that the goal of making water accessible to all Batswana is achieved by 2016.

### **Implementation Capacity**

12.110 Considering the constraints on posts in government at a senior level, a possible solution is to employ project managers or supervisors with the right level of experience on contract for a specified period of time.

### **Irrigation and Water Development**

12.111 A project aimed at developing infrastructure to supply bulk water to farmers from decommissioned well fields such as Ramotswa and Palapye will be commenced in early NDP 9. This project will be carried out using DWA's in-house capacity.

### **Productivity Improvement**

12.112 At the time of preparation of this plan it was envisaged that by the beginning of NDP 9, all MMEWR departments would have annual performance plans in place. These plans would outline the activities the ministry is going to do in each year and would be linked to specific and quantifiable results through charts indicating progress achieved in each priority result area from one year to the next.

12.113 Regular performance reviews will be conducted in MMEWR both at Ministry and departmental level to determine whether progress is being made towards the achievement of the ministry's goals. WITS, which are a major component of PMS will also continue to be a major driving force behind the development of a continuous improvement culture in the ministry. It is intended that by the middle of NDP 9, the Performance Management System must be fully functional in MMEWR and cover all business areas of the ministry.