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WATER RESOURCE MANAGEMENT IN BOTSWANA: BALANCING SUSTAINABILITY AND ECONOMIC DEVELOPMENT★

DIANNE RAHM[1,*], LARRY SWATUK[2] and ERICA MATHENY[3]
[1]*Center for Policy Studies, University of Texas at San Antonio501, W. Durango Blvd., San Antonio, TX, 78259, USA*
[2]*University of Botswana*
[3]*Cleveland State University,*
*(*author for correspondence, e-mail: drahm@utsa.edu; fax: +1-210-458-2536; tel.: +1-210-458-2505)*

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Abstract. Botswana is a rapidly developing country in southern Africa. Over the last three decades, diamond mining and tourism have provided double-digit rates of economic growth. Yet most of Botswana's land is in the Kalahari desert where the climate is subject to sustained periods of severe drought. In this environment, water resources are the most crucial of all environmental resources. Water use directly affects economic development because water utilization impacts all the major national economic sectors. A sustainable water use resource management plan must stretch several decades into the future to assure the availability of adequate supplies of water to future generations while not compromising the ability of the current generation to reasonable rates of economic development. Yet thinking about sustainability is present in Botswana water policy mostly only in rhetoric. A series of cultural traditions and political constraints, coupled with bureaucratic managerial weaknesses, serve to maintain a system of water allocation that is unsustainable in the long run and inefficient in the short-term. Unless sustainable water use patterns are adopted, the results for the short-term, as well as the long-term, will be devastating. Drawing on data obtained through a series of interviews with government officials, leaders of non-governmental organizations (NGOs), and water resource researchers, this paper explores water policy in Botswana within the larger context of sustainable natural resource management practice and the pressures of economic development.

Key words: agriculture, economic development, mining, natural resource management, tourism, sustainability, sustainable development, water policy, wildlife.

1. Introduction

In the long term, in order to meet increases in demand, Botswana needs a water efficient society, conscious of whether it can afford to pay for its water, and of water being a finite and very scarce resource. Thus focus should not only be put on working out demand figures for the future as was the case in National Development

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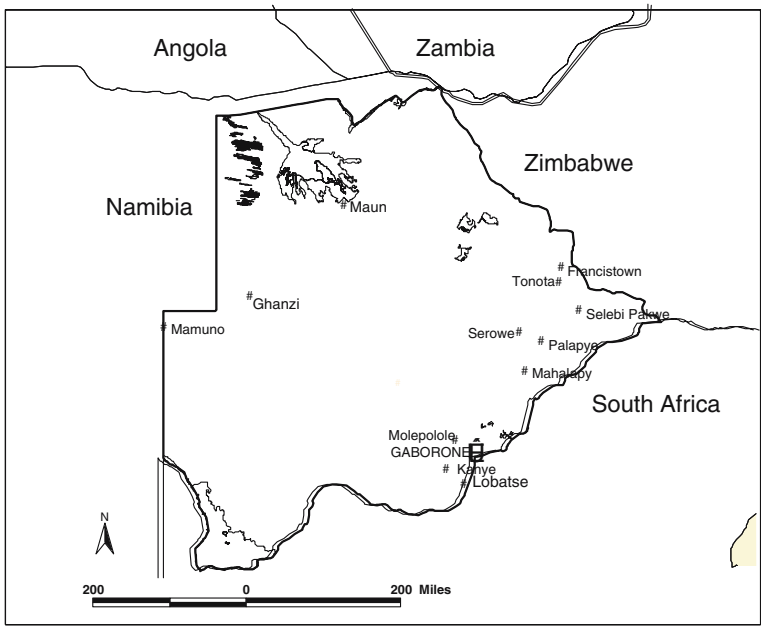

Figure 1.

Plan 7 through the National Water Master Plan (NWMP), but also on how this demand can be kept as low as possible in the long term. (Government of Botswana, *National Development Plan 8*: 281).

Water resources are the most crucial of all environmental resources in Botswana (Figure 1). This is so because water use directly affects the utilization of all other major natural and economic resources. Botswana is a semi-arid country with distinct wet and dry seasons. Drought is endemic and rainfall varies widely throughout the country, averaging less than 450 mm/year (250 mm/year in the southwest up to about 600 mm/year in the northeast).[1] Surface water resources are limited in the country, with most rivers flowing for only a few days every year. Perennial rivers are found in the north. These include the Okavango and the Kwando/Linyanti/Chobe system, which is part of the Zambezi river basin. Large ephemeral sand rivers form much of Botswana's southern border with neighboring states. The Molopo in the southwest is part of the Orange River basin, but its flow to the Orange is blocked by sand dunes. The Limpopo in the southeast is a seasonal stream whose flow increases as it snakes eastward from Botswana, through South Africa, Zimbabwe and Mozambique to the Indian Ocean. Nevertheless, these sand rivers have significant stores of groundwater in their beds. It is estimated that approximately 80% of humans and animals are dependent on groundwater (Moyo et al., 1993: 32).

Water scarcity is compounded by a relatively flat landscape that acts to limit artificial storage capacity and rates of potential evaporation that can exceed 2000 mm/year in parts of the country where temperatures regularly reach 40 degrees Celsius (105 degrees Fahrenheit) in the summer months. While the Okavango Delta

region provides substantial amounts of water seasonally, the river runs through harsh terrain whose poor Kalahari-sand soil structures limit possibilities for large-scale human developments. Two-thirds of the country is dominated by Kalahari Group soils that are mostly sand and commonly termed the sandveld. More than 80% of the population resides along a 50-km wide strip of mixed and dry woodland that runs along Botswana's eastern border. Soils there are poor but workable. Land for arable agriculture is estimated at only 3% of the country.

Overall, the picture is of a harsh and unforgiving climate whose potential for extensive human habitation and sustained economic development is limited. Indeed, at independence from Britain in 1966 there were approximately half a million people in the entire country. Yet, today, the population exceeds 2 million, more than 10% of which is concentrated in the capital city of Gaborone. The national cattle herd is estimated at more than 3 million animals. With a per capita GDP of US$ 3300[2] in the year 2000, Botswana is considered an upper middle-income country by the World Bank (2002). Rapid economic growth fuelled by mineral extraction primarily gem quality diamonds has facilitated this demographic revolution. Clearly, livelihoods for the majority have improved dramatically since the discovery of diamonds in the 1960s. However, there have been many unintended and unanticipated negative consequences of this rapid economic development. Perhaps the most important is the strain being placed on the natural resources base, in particular land and water resources.

The government of Botswana estimates that water demand will increase from 193.4 Mm^3/year in 2000 to 335.2 Mm^3/year by 2020 (Government of Botswana, 1992). Highly placed government officials are also concerned that as demand for water is expected to increase, the available supply will simultaneously decrease. Groundwater resources, for example, are being depleted by a combination of over-utilization and low recharge rates. The Department of Water Affairs is proceeding to make policy under the assumption of likely groundwater exhaustion by 2020 (Personal Interview, Gabaake, 2002). Dam construction, intra- and inter-basin transfer schemes, and technological interventions to better detect and utilize groundwater sources are the government's preferred means to achieve water security (Government of Botswana, 1992).

Given these difficult circumstances, achieving sustainable use of water resources should be paramount. Yet thinking about sustainability is present in Botswana water policy mostly only in rhetoric. A series of cultural traditions and political constraints, coupled with bureaucratic managerial weaknesses, serve to maintain a system of water allocation that is unsustainable in the long run and inefficient in the short-term. Unless sustainable water use patterns are adopted, the results for the short-term, as well as the long-term, will be devastating.

Drawing primarily on data obtained through a series of interviews with government officials, leaders of non-governmental organizations (NGOs), and water resource researchers, this paper explores water policy in Botswana within the larger context of overall natural resource management and the pressures of economic development. The first part of the paper focuses on water resources and the demands

placed on water resources by economic development pressures coming from cattle ranching, mining, tourism, and human use. The paper then discusses the structure of water policy as it currently exists. The paper concludes with a discussion of the challenges to managing water resources in a sustainable fashion including fractured bureaucratic decision making, over dependence on diamonds for GDP growth, the enormous problems posed by the HIV/AIDS pandemic, and the need for regional cooperation in water resources management.

2. Water resources and demands

Botswana, a landlocked country located in the center of southern Africa, is dominated by the Kalahari Desert, which covers more than two-thirds of the country. With the exceptions of the rivers and wetlands of the north, the country has little permanent, naturally occurring surface water. There are four major dams in the country, all lying within the Limpopo River Basin: the Gaborone Dam (144 Mm^3 capacity) on the Notwane River; the Letsibogo Dam (100 Mm^3) on the Motloutse River, the Shashe Dam (87 Mm^3) on the Shashe River, and the Bokaa Dam (18 Mm^3) on the Metsemotlhaba River.[3] There are more than 700 small dams serving a wide variety of user groups. The Government of Botswana considers dam-building as a necessary component of national water and food security (Government of Botswana, 1992; Government of Botswana, n.d.).

Groundwater accessed through drilled wells or boreholes provides the most stable source of water. At the beginning of the National Development Plan (NDP) 8 planning period (1998–2003),[4] roughly 25 wellfields 'were being operated at varying degrees of abstraction' (Government of Botswana, n.d.: 289). Also at that time, the national borehole registry had more than 16,000 listings of government and private boreholes. As part of its stated commitment to Integrated Water Resources Management (IWRM), central government is increasingly turning toward multiple use strategies combining surface water, groundwater, waste water, and a variety of harvesting and delivery techniques.

The Okavango is the only river that flows into Botswana. It rises as the Cubango River in the Bie Plateau of Angola and is joined by the Cuito River before it crosses Namibia's Caprivi Strip and, rather than flowing to the sea, forms an inland delta of channels and streams in northwestern Botswana. Although part of the drainage basin, the Omatako River in Namibia, and the Nata River that runs from Zimbabwe into the Makgadikgadi Pans of Botswana are both ephemeral river systems contributing nothing to the flow of the Okavango. The size of the Delta varies seasonally (based primarily on the amount of precipitation in Angola) from 4,000 to 12,000 km^2 and the shape changes annually as sediments are deposited, new channels are created and old ones are left dry. This is a huge natural variation that makes planning or managing the resource extremely difficult (Personal Interview, Wolski, 2002). The Okavango Delta region and the Kwando/Linyanti/Chobe wetlands system provide habitat for much of the country's rich wildlife. Botswana is home to

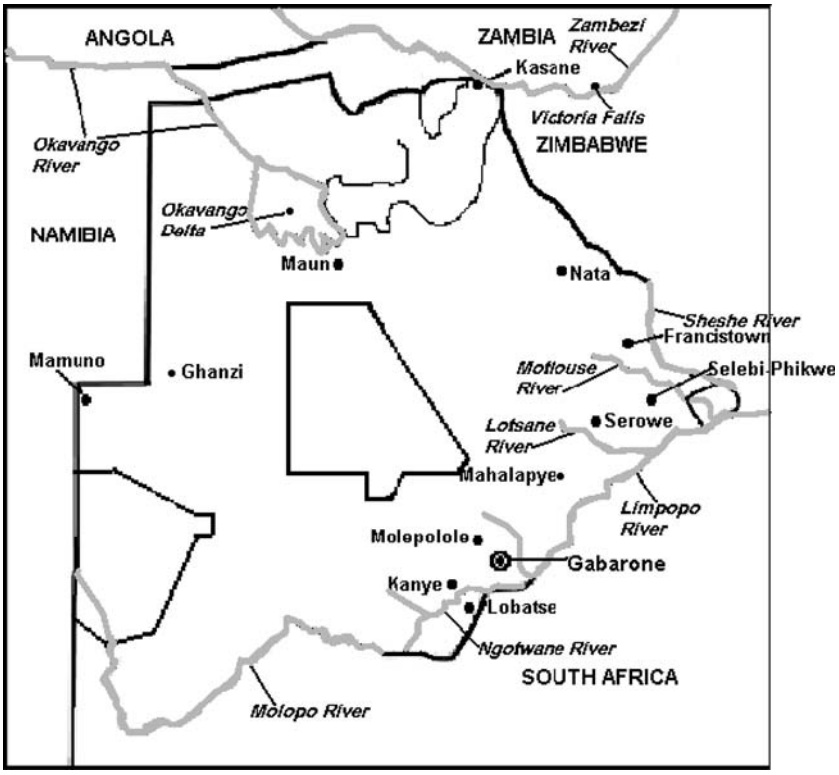

Figure 2.

lions, hippos, crocodiles, hyenas, giraffes, zebras, antelopes, and immense herds of elephants and buffaloes (Figure 2).

Botswana's roughly 2 million people (World Bank, 2002)[5] are concentrated along a narrow 'transportation corridor' connecting South Africa to Zimbabwe in the eastern part of the country. While more than 200,000 people reside in the capital city, the character of other towns, villages and cities is rapidly changing. For example, there are now 17 human settlements defined by the government as 'major villages', i.e. villages either with populations in excess of 5000 people or/and headquarters of Districts (Government of Botswana, n.d.). Demand for water is increasing not only because of increased population but also because of rising standards of living (resulting primarily from the growth in GDP through the diamond trade). Water use is increasing at a higher rate than might be expected through a linear projection because more and more households are demanding private connections. The ease of access afforded by these private connections results in higher per capita resource use (Goldblatt et al., 1999).

The demand for water coming from human use, agriculture, livestock, mining, and wildlife (tourism) is increasing due to the nation's continuing urbanization, economic development, and population growth. According to National Development Plan 8 (Government of Botswana, n.d.: 280), during the 1992–1997 planning period, there were two primary aims in the water sector:

- To meet the basic needs of the population through the provision of a safe, reliable and affordable water supply, which is available to all; and
- To meet water requirements of industrial, mining, agricultural, commercial and institutional users in order to achieve the major objectives of rapid economic growth and sustainable development.

Use can be divided into consumptive and non-consumptive categories. The most obvious consumptive use of water is for human use including drinking, sanitation, and hygiene. Per capita use is low by international standards, but demand is increasing while availability remains limited. In 2000 it was estimated that the country used about 193.4 Mm^3 of water. Of this about 24% went to the urban centers, 11% went to major villages, 6% to rural villages or other settlements, 18% to mining and energy, 23% to livestock, 15% to irrigation and forestry, and 3% to wildlife (Government of Botswana, n.d.: 280). Demand is forecasted to increase to 336 Mm^3/year by 2020 (Lado, 1997).

An important feature of human water use is that it increases greatly with urbanization and standard of living (Sullivan, 2002). According to the Botswana National Water Master Plan (Government of Botswana, 1992), urban populations in 1990 used on average three times as much water as rural populations. The NWMP projects that by 2020 the ratio of urban to rural water use will be 5:1 even as rural consumption of water is estimated to increase by nearly 6% over 1990 levels. Just to meet increasing demand in rural villages, more than 60 additional boreholes are drilled each year (Carlsson and Ntsatsi, 2000). Meeting major village and urban needs requires far more extensive increases in supply. In 1998 there were 460 rural village water supply schemes operated and maintained by the various district councils (Government of Botswana, n.d.: 280).

Tourism, which brings more than US$100 million into the economy each year and represents about 5% of the GDP (Greenway, 2001; Pallett, 1997), places both consumptive and non-consumptive use demands on water. Tourist revenues are largely dependent upon the presence of wildlife, which require access to appropriate habitat to survive. Tourists themselves also consume water thus adding consumptive pressures. While generating needed revenue and many jobs, tourism is highly dependent on intact ecosystems, particularly the linked wetlands ecosystems of the north (Chobe National Park) and northwest (Moremi, Nxai Pan, and Makgadikgadi Pans Game Reserves). Photographic and hunting safaris are the key form of non-consumptive use of water resources. Foreign tourists pay hard currency to photograph and even larger sums to kill particular animals buffalo, lion, elephant, for example.

Historically, wildlife was found throughout the country, with migration routes reflected in the fragmented south-west to north-central pattern of national parks, game reserves and wildlife management areas (WMAs; in effect, buffer zones between humans and wildlife).[6] Approximately 35% of Botswana's land is denoted as one of these protected areas a land area larger than Belgium, but one that is criss-crossed by private farms and ranches, communal lands, and whose boundaries are

Figure 3.

under constant pressure from humans and livestock. The continuing encroachment on wildlife habitat threatens the sector (Figure 3).

The needs of cattle and wildlife are often in conflict (Personal Interview, Muimi, 2002). Livestock increasingly competes with wildlife for limited water resources. The wildlife/livestock conflict in Botswana is an important political issue. The conflict, first and foremost, is over land. As personal wealth has increased in Botswana, there has been a corresponding demand for land for cattle. The relatively well-watered east is grossly over-stocked and badly over-grazed. As a result, the national herd has been pressing westward into marginal lands. Cattle are important to Batswana culture insofar as cattle represent wealth. The desire to own large numbers of cattle places pressure on natural resources especially water. The growth in the national heard has resulted in the drilling of more boreholes and opening up more land for cattle.

The wildlife/livestock conflict has been exacerbated by frequent outbreaks of foot and mouth disease. This disease is spread from wild buffalo to free ranging cattle. To prevent the spread the government built a series of fences across the country. These Veterinary Cordon Fences, the first of which were constructed in 1954, run across the country and prevent wildlife from migrating along traditional routes to gain access to water supplies in the dry season. Despite the allocation of much of the country's land to wildlife preservation, failure to take into account the needs of the

wildlife to seasonally migrate to water supplies has been very destructive (Darkoh and Mbaiwa, 2002). In the last several decades alone, nearly 99% of the wildebeest population has died. What remains of the wild zebras, buffaloes, and much of the country's other game is retained north of the fences. Fencing has opened a wide expanse of land to free-range cattle including 20% of the Okavango Delta region (Greenway, 2001). Somewhat ironically, despite the negative consequences for biodiversity of islandization, many conservationists, who in the past have vehemently opposed the construction of these fences, now view them as useful barriers to further cattle/farm expansion (Personal Interview, Mbaiwa, 2002).

There is a continuing and enormous political pressure to make new land available for cattle grazing and watering. This pressure is particularly acute around the Okavango Delta where tourism-based economic growth has led to increased human settlement and cattle holding. In the Delta groundwater resources are found at lower depths and have much higher concentrations of minerals, including salt. Cattle, unlike wildlife, have a low tolerance of saline water. The result is that there is a mismatch of resources available for use and the animals most likely to be able to use them (Personal Interview, Monagen, 2002).

The rearing of cattle is deeply rooted in tradition whereby a man's prestige and power is determined by the number of cattle he owns.[7] Cattle provide the point of intersection for numerous groups normally antagonistic toward one another, from migrant laborers who purchase cattle on the basis of their 'stored value', to presidents, chiefs, and freehold ranchers. These are groups whose only other unifying characteristic is gender, as the vast majority of cattle owners are men. So, continued access to cattle no matter how varied one's purchasing power is a powerful drive toward status quo-oriented policies in Botswana (Swatuk, 1994). As national wealth increases, consequences for land and water resources have been predictable. Most of these cattle are controlled by a small number of elites who continue to expand their private holdings, through the Tribal Grazing Lands Policy (TGLP), and push their herds further and further into lands better left to wildlife. Over-pumping of boreholes to support the cattle has resulted in many of the wells becoming unreliable or saline, which in turn, has led to cattle congestion and environmental deterioration in areas near still productive boreholes.

Agriculture is a primary consumer of water in the country. Because Botswana is largely arid, commercial agriculture is practiced on a limited scale. However, the new National Policy on Agricultural Development emphasizes food security at household and national levels, and diversification of agricultural production, particularly into high value horticultural crops for local and regional markets. To this end, provision of infrastructure small dams and borehole development in rural areas will continue to place new demands on existing water resources (Government of Botswana, n.d.: 285).

An estimated 20,000 ha of land are available for irrigation in the country (Government of Botswana, 1992). In 1998 only 1380 ha was under irrigation, mostly in the Tuli Block freehold area of the northeast. Smallholders also irrigate their crops using water from small dams. It is government policy to assist in the construction of

small dams and in well and borehole construction/rehabilitation. According to NDP 8 (Government of Botswana, n.d.: 284), the construction of more than 200 small dams in the Gaborone catchment area has reduced runoff by about 25%, and in the Bokaa catchment, just a few kilometres north of the city, 'the reduction is more than 13% for about 100 existing small dams'. Despite this increased water availability, use is inefficient and economic returns are marginal. According to the Director of the Department of Crop Production and Forestry, Israel is being looked at as a model for improvements to irrigation. In addition, government is actively pursuing a number of approaches to improved efficiency of water use: for example, rainwater harvesting; storm water capture and diversion; solar-powered desalinzation plants; waste water reuse (Personal Interview, Mmopi, 2002).

It is no accident that the water sector is located within a ministry primarily focused on mineral production. Recovering diamonds from the soil requires vast amounts of water to 'wash' the rock. Considered together, mining and energy production (primarily coal) are heavy users of water, though, unlike agriculture, the economic returns in the mineral sector are significant. In 2000, 18% of water used in the country was consumed by the mining and energy sectors, though comprising only one coal-fired power plant and about half a dozen mines. By 2010 that percentage is expected to increase to nearly 22% (Lado, 1997).

Water resource use for mines and mining towns has raised many controversies in the country. The major mines (Orapa, Jwaneng, Selebi-Pikwe) have been responsible for providing their own supply of water. As a result, there has been significant overuse of this resource by mining town residents who, in Selebi-Pikwe for example, do not pay for the water pumped into their homes. Available groundwater has been further depleted through pollution of aquifers. Wastewater produced in mining contains high levels of salt and other minerals, which typically render the water unsuitable for discharge directly into river systems. If discharged onto the ground, mineral content may cause both point-source and more dispersed pollution problems. In any event, in a semi-arid climate reuse of wastewater should be a basic policy consideration. Studies have been done to consider the effects of the use of mine wastewater for irrigation (Jovanovic et al., 2001). All mines, and the Moropule coal-fired power station, reuse their water today. In the past, however, Orapa mine envisioned augmenting supply via a 250 km pipeline from the Okavango Delta. This was to be one part of the proposed Southern Okavango Integrated Water Supply Project a controversial project put forward in the early 1990s that was subsequently shelved following an environmental impact assessment conducted by the International Union for the Conservation of Nature (IUCN). Nevertheless, government has reserved the right to implement this plan in future (Government of Botswana, n.d.).[8]

International demands also pose a concern for water in Botswana. All perennial surface water resources in Botswana are shared international watercourses. As such, off-takes made by one state unavoidably affect neighboring states. For example, Botswana's North South Carrier Water Project (NSCWP) is an intra-basin water transfer scheme that pumps water via a series of dams and pipelines from the Shashe River in the northeast to all major villages and towns along the eastern corridor. In

this case, Botswana is upstream and its off-take reduces water available to other states (Zimbabwe, South Africa, Mozambique) in the Limpopo River Basin. In contrast, Botswana is downstream in the Okavango River Basin. As noted above, the Okavango rises in Angola and passes through Namibia before emptying into the Delta. International law e.g. SADC[9] Protocol on Shared International Watercourses permits Angola and Namibia reasonable use of this water. Namibia has long considered use of this water through its proposed Namibian National Eastern Water Carrier (NNEWC) project (Swatuk, 2002b: 143–52). The NNEWC proposes to 'extract a limited 3 cubic meters per second from the Okavango River early in the [21st] century, which is less than 1 of the present inflow (Van der Heiden in Swatuk, 2000: 232). Botswana diverts a small amount of the flow upstream of the Delta for human consumption in villages in the far north (Personal Interview, Ashton, 2002). A drought in the mid-1990s promoted Namibia to fast track the NNEWC in an effort to guarantee water supply for its capital city, Windhoek. There was a great public outcry over this plan, exacerbated by alarmist media reports (Swatuk, 2002b). At the 11th hour, however, the coming of late but heavy rains depressurized the situation. Nevertheless, plans for developments in the middle Okavango persist and, with peace in Angola, the prospects of further developments in the upper catchment cannot be dismissed. One positive development to come from this difficult situation was the establishment, first, of the Joint Permanent Technical Committee, and second, of the currently operative Okavango River Basin Commission (OKACOM). More will be said about this and related commissions below.

3. Water policy

With independence from Britain came planning for national 'development', defined then as now as a combination of satisfying basic human needs and modernization through industrial development. Water has been a central part of this planning effort. The centrality of water to development is obvious. This is more so in a country where drought is endemic. Indeed, for several years prior to independence, Botswana had been experiencing serious drought. The drought killed or forced to market 400,000 head of cattle (nearly one-third of the cattle in the country) and more than 100,000 people were on famine relief (Sillery, 1974). With the establishment of the new country came the creation of a new city to serve as the capital. Gaborone was established on the Notwane River and a dam was built to provide for the its various water needs. Water was also piped to Lobatse, approximately 50 km south of Gaborone. Despite the adequacy of water in these towns, the principal concern of most people in the newly formed nation was the incidence of rain and access to water (Sillery, 1974).[10]

The first regulation of water use came the year after independence with the passage of the Water Act of 1967 and the Establishment of the Department of Water Affairs in the same year (Sillery, 1974) (Figure 4). The Department was subsequently placed in the Ministry of Mineral Resources and Water Affairs, now renamed the Ministry

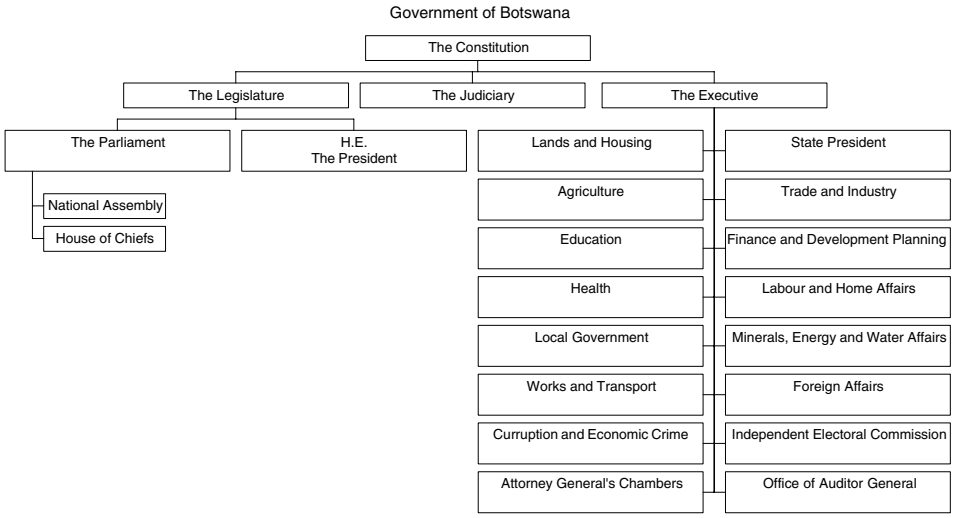

Figure 4.

of Minerals, Energy and Water Affairs (MMEWA). The lack of water was considered the largest limiting factor for national development (Smit, 1970) and so securing adequate supply became the central feature of evolving water policy. According to Goldblatt et al. (1999: 101),

> Water resources belong to, and are controlled by, the state, but it has delegated power to issue water rights ... to the Department of Water Affairs and the Water Apportionment Board while land boards are responsible for issuing certificates of land rights... The Water Act allows for existing water rights to be suspended in the event of a water shortage due to drought or where water is required for public purposes. The act sets borehole abstraction limits of 22.75 m^3/day for mining, forestry, and industry. It provides penalties for pollution and for altering and interfering with water flow, as well as requirement to dispose of wastewater with minimal pollutants.

The MMEWA has overall responsibility for water policy. It is assisted in implementation by the Departments of Water Affairs (DWA) and Geological Surveys (DGS), and the Water Utilities Corporation (WUC), a for-profit parastatal responsible for the supply of water to the six urban/mining centers and other designated areas, Orapa mine excepted. DWA (with DGS) is responsible for groundwater investigations, protection and monitoring of resources. It is also responsible for the protection of surface water, for administering water legislation, and for the provision of water supply to all villages. Operation and maintenance of these village water supplies is the responsibility of the District Councils through the Ministry of Local Government, Lands and Housing (MLGLH) (Government of Botswana, n.d.: 279-80). In all, this means that WUC supplies 21.5% of the population with water, DWA provides for the 22.5% of the population living in the 17 major villages. While District Councils (through the MLGLH) are theoretically responsible for supplying water to the 22% of the population living in rural villages, DWA, in practice,

constructs most of these through its in-house facility. Devolution of responsibility to District Council Water Departments proceeds slowly (Government of Bostwana,. n.d: 284). The remaining 34% of the population relies on boreholes, wells, or water transported from villages (Atlhopheng, 1998). While most of these are private sources, DWA is often called upon for the rehabilitation and maintenance of small dams, boreholes and wells.

In terms of meeting the costs of delivery in urban areas, the WUC has established a graduated step tariff structure. Most consumers fall within the lowest band (0–5 m^3/ month) where charges are nominal, so contributing very little to cost recovery. In addition, the largest users tend to be public institutions (e.g. schools, hospitals), so costs are met by Government. In cities and major villages, people pay a connection fee for private water, be it an on-property standpipe or in-house facility. Those with access to a communal standpipe pay nothing for the water. Costs for the provision of water by the District Councils to rural users is assumed by the DCs. It is government policy to try and recover the 'full recurrent costs of all the major village water supply schemes' (Government of Botswana, n.d.: 286). As wealth increases in the rural areas, demand for private connections is increasing. According to Goldblatt et al. (1999: 101), 83% of households have access to piped water in Botswana.[11] Cattle herders may be required to pay a small sum per head each year to cover the costs of water pumping and maintenance (Atlhopheng, 1998).

Guiding present day policy is the National Water Master Plan (NWMP) of 1991. The NWMP focused neither on conservation nor demand management. Rather, it concentrated on supply-side interventions in response to increasing demand. The NWMP projected major shifts in increasing water demand in the three decades between 1990 and 2020. Urban areas are projected to increase their demand for water by a factor of five. Mining, rural consumption, and energy are projected to increase water use by a factor of three while irrigation will double (Atlhopheng, 1998).

Countrywide, the main issue is security of supply. Following closely behind is containing and managing burgeoning demand. In Government's own words, 'In order to ensure that water does not become a constraint on national development or economic growth, it will be necessary to maintain water demand projections in line with other expected growth rates in the economy, especially population, urbanization and industrial development' (Government of Botswana, n.d.: 291).

3.1. Supply

Augmenting supply is a key policy recommendation of the NWMP and continuing focus of government activity (Government of Botswana, 1992; Government of Botswana, n.d.; Gaolathe, 2001 and 2002; Mogae, 2002). To this end, the Government has developed significant human and technical capacity in making use of both surface and groundwater resources. As part of Government's commitment to integrated water resources management, current policy focuses on dual use of surface and groundwater supplies (Government of Bostwana, n.d.). This is best illustrated in

the NSCWP, of which the now completed Phase I saw construction of the Letsibogo Dam and a 360 km pipeline to bring water to villages, towns and cities all along the eastern border region. This water transfer scheme is connected to the wellfields of Palla Road and Mmamabula. The cost of Phase I was an estimated US$ 1.5 billion. Phase II, which will see construction of the Lower Shashe Dam and a parallel pipeline is estimated to cost in the range of US$ 2–2.5 billion.

On a significantly smaller scale, DWA continues to assist in the development of rural water supply and water-borne sanitation systems (Mogae, 2002). It is also involved in the construction of water systems for major villages. This includes investigation of possible dam sites and potential groundwater resources. Having assumed responsibility for managing the NSCWP, and having taken control of all of its assets, the WUC now assumes responsibility for bulk potable water supplies to major villages along the NSCWP including all those in the greater metropolitan Gaborone area (Government of Botswana, n.d.).

The preference for technological interventions to augment supply reflects a complex web of power relations and developmental philosophy in the country (Swatuk, 2003a). In addition, the monetary rewards from mining activity are substantial, enabling the Government of Botswana to afford the cost of projects like those described above.[12] Although mining creates little direct employment (roughly 13,500 jobs), the vast revenues generated make all other national developmental activities possible. They also enrich a narrow strata of the population (in government and industry) whose conception of wealth is a complex mix of modern Western perspective and traditional Tswana conservatism (that is, seeing cattle as wealth). These interests view access to inexpensive and plentiful sources of water as their right. This viewpoint makes political action to restrict access to water, either through conservation efforts or by increasing its cost, politically difficult to accomplish. At the same time, political support for large engineering projects that promise to deliver unrestricted quantities of water is generally easily sustained.

An example of this is the rise and (possibly temporary) demise of the Southern Okavango Integrated Water Development Project (SOIWDP). Ways and means of utilizing the waters of the southern Okavango share a similarity with the NNEWC project and the Kariba Dam hydroelectric project on the middle Zambezi River: all large-scale projects hoping to solve water shortages through advanced engineering. The specific character of the SOIWDP integrated surface water development through channelization and dam building is a large scale engineering approach (Swatuk, 2001). In the early 1980s, DWA initiated the creation of the inter-ministerial Okavango Water Development Committee. While the SOIWDP was developed for the government by an Australian company, the Snowy Mountain Engineering Corporation (SMEC), the project's vision was clearly local. It called for the improved outflow from the lower Okavango by a 42-km long channel whose water would be stored in three reservoirs. These reservoirs were intended to meet four specific demands: Maun village and Orapa mine water supply, commercial irrigation and floodplain agriculture. Claimed benefits were to be huge: some 10,000 ha of commercial irrigation, 5000 ha of floodplain irrigation for the village

sector, improved fisheries, improved water supply for river communities and livestock, to name several.

The plan was approved at the national level without much opposition but when SMEC moved in machinery in November 1990 there was immediate local reaction. The kgotla system of village democracy helped articulate local fears and communicate them to central government. In response, central government asked the IUCN to conduct an independent review. The review challenged the validity of every one of the hypothesized benefits, going so far as to illustrate how the creation of reservoirs would, in fact, increase household insecurity at village level by inundating fertile land. The review put forward a number of alternatives to the SMEC plan, for example, suggesting that existing groundwater sources should be exploited before rushing into expensive physical infrastructure development of dubious benefit to local people and ecosystems. The report was received coolly by the Government. Indeed, it has taken about a decade of careful diplomacy on the part of the IUCN to re-establish the trust it had never intended to break (Personal Interview, Jensson, 2003). In any event, the plan was shelved and no serious efforts have been undertaken to exploit the Delta's water on a large-scale (Personal Interview, Ramberg, 2002).

The IUCN review also called for further studies regarding possibilities for integrated natural resources management. To this end, the government through the MLGLH Department of Town and Regional Planning commissioned Swedeplan to develop a program for the planning of resource utilization in the Delta region (Swedeplan, 1994).

To oversee developments throughout the country, including the Delta region, the National Conservation Strategy was put in place in 1990. At this time there were three groups created: the National Conservation Strategy Advisory Board, the National Conservation Strategy Coordinating Agency (NCSCA), and an environmental liaison committee. The NCSCA was set up to deal with conservation but also to become the lead agency when two or more other agencies shared jurisdiction. In cases of matters such as wetlands, for instance, the NCSCA is the agency in charge of coordinating policy (Personal Interview, Nchunga, 2002). The NCSCA is the main agency in charge of compliance with the Ramsar Convention on wetlands. The DWA maintains overall planning authority but coordinates with the NCSCA. In some areas, such as groundwater, the NCSCA has no authority.

There are two further elements to augmenting supply worth noting. One is government's commitment to exploring the utility of new technologies and/or approaches to increasing existing supply. The most significant new development is wastewater recycling and reuse technologies. Porter et al. (1997: 86) estimate that 50–65% of water sales in Gaborone end up discharged into the municipal sewerage system. The government estimates that out of Gaborone's total demand of 30 Mm^3/year, return flows are in the neighborhood of 20 Mm^3/year (Government of Botswana, n.d.). Investigations are on-going regarding the feasibility of wastewater use in agriculture, and of the social acceptability of using wastewater if treated to potable standards. Changes to government policy e.g. an end to special water tariff rates have encouraged the mines at Orapa and Selebi-Phikwe to install recycling and other water-saving

technology.[13] Government is also actively supporting other innovative technologies such as portable desalinization plants in remote locations like Tshabong, rainwater harvesting, storm water diversion, and impoundment approaches to increasing water supply (Government of Botswana, n.d.; Goldblatt et al., 1999: 102–l04).

Water quality is also an issue. A polluted water source is an unusable water source. The main quality issues confronting Botswana water are salinity, high fluoride levels, and nitrate pollution. While legislation exists to control pollution levels (through, for example, polluter-pays principles), the government is often reluctant to penalize key employers in the country. Goldblatt et al. (1999: 108) highlight the case of the Botswana Meat Commission (BMC) in Lobatse. In 1997–1998, the BMC accounted for 30% of all water consumption in Lobatse. Water is used in processing livestock into meat product. Almost all of the BMC's final effluent parameters exceed the maximum allowable limits set by the Department of Water Affairs for ephemeral stream discharge.

Supply is complicated by problems of distribution. System water losses average 15–25% but may run as high as 35% when older pipes are used (Atlhopheng, 1998). According to Lado (1997: 48), 'average total water losses per year for 450 villages is estimated to be 3.5 Mm^3 of water. In monetary terms, this means that it costs about P10.5 million'. Despite such inefficiencies, government policy requires that all new housing be fitted with in-house water and sanitation systems (Mogae, 2002). Moreover, as scattered settlements become villages and as villages become major villages, legislation requires that a particular standard of service be provided. This has put a great deal of pressure on human resource capacity in the country. Trends toward privatization of borehole drilling, among other things, have not helped with the developmental backlog. System upgrades e.g. from pit latrines to water-borne sewerage also place a great deal of stress on the natural resource base (in terms of water availability) and existing infrastructure (e.g. sewerage capacity) (Porter et al., 1997).

As should be clear by now, a common feature of water policy and the various issues that arise from it, is the way in which water is tied to the land. A brief look at land tenure lends insight into the politics behind the allocation and use of water. Land is denoted as state land (47%), tribal (or communal) land (49%), and freehold (less than 5%). In 1968 (amended in 1969) the Tribal Land Act changed the system of land tenure in Botswana by denying Chiefs the right to apportion tribal lands and placing the allocation of these lands under the authority of Land Boards. The Land Boards were authorized to manage and distribute lands for the benefit of the tribe in the area and for the purpose of promoting economic growth and development. The law further allowed the President of the country to step in using a form of eminent domain power to acquire tribal lands for the state if the central government felt the Land Board was distributing or managing tribal lands incorrectly. In addition to the above practices, the government also leases for long terms (20 years or more) state lands in the hope that tenants will find the term of the lease long enough to effect improvements, in particular provision of water facilities (Smit, 1978).

Other changes in the late 1960s and early 1970s created problems for equitable water allocation. During this period of time, those who applied could receive

individual rights to private bore holes located on communal lands without having individual rights to the land itself. The only restriction was that boreholes must be 8 km apart (a regulation regularly abused). The effect was to make those who held the rights to water the de facto 'owners' of the land's grazing rights as smaller and poorer herders would have to move their cattle to a location with access to public water supplies or pay for the right to use private water. The confusion caused by individual water rights on communal property led to the passage in 1975 of the Tribal Grazing Lands Policy. This was a World Bank-sponsored program designed to enhance the commercial cattle industry (Darkoh and Mbaiwa, 2002) and reduce pressure on land and water resources in communal areas. By this law, Land Boards were encouraged to divide tribal lands into three zones commercial farming areas, communal grazing areas, and reserved areas. Existing occupation of lands by individuals and groups were largely automatically classified as commercial. In these commercial areas inheritable 50-year leases were signed giving the holder private rights to the land (and the water) while formally the Land Board held title (Parson, 1984). TGLP has largely failed in its mandate due to the power of large-scale cattle owners who continue to use communal grazing areas while maintaining exclusive access to their ranches. As herds continue to grow in size, communal areas suffer a kind of 'tragedy of the commons'.[14]

3.2. Demand

We have already highlighted the rapidly changing nature of Botswana's economy and society. We have also highlighted its impact on demand for water: expansion in the mining sector; increasing urbanization and the related desire for private in-house connections, government policy in support of water-borne sewerage; growing livestock herds; agricultural policies in support of food self-sufficiency through small scale irrigation and horticulture; and large-scale irrigated agricultural expansion. To meet this demand, government has overwhelmingly focused on new supply. However, there are indications that controlling demand and improving both current use practices and forms of delivery are being considered in policy circles as important ways to increase supply. In other words: to increase supply by decreasing losses through waste and misuse.

Water demand management (WDM) is a relatively new management philosophy in the southern African region (see the papers under the Water Demand Management sub-theme in WATERNET, 2003). According to Goldblatt et al. (1999: 104), 'although the policy of WDM is not fully developed in Botswana, attempts are being made to move away from the traditional supply-oriented approach of developing new water supplies to meet the future water demand'. The authors highlight a number of possible WDM measures that might be taken: rainwater collection; storm water run-off diversion and collection; re-use especially for irrigation of fodder; progressive pricing policy; water-efficient appliances in households, industries and agriculture; farm gardens using minimum tillage and grey-water irrigation; reduction of leaks from distribution systems; use of lower pressures; and consumer education.

However, the government's approach to the actual implementation of these measures is haphazard at best, tending to surface only in the face of severe drought. A primary reason is that controlling demand particularly through punitive measures stands to upset the political status quo. While the government may reprimand on occasion, it clearly prefers to manufacture consent. This results in water prices that remain far below operating and maintenance costs a policy that runs against both regional and global trends and stated government policy in support of full cost recovery.

4. Challenges to managing water resources in a sustainable fashion

There are many challenges to sustainable water management in Botswana. Five will be highlighted here: the character and pace of development; institutional overlap; human resource capacity; cultural impediments; and power relations.

4.1. The Character and Pace of Development

There is little doubt that in policy making circles, development is of higher importance than the environment (Personal Interview, Monagen, 2002; Personal Interview, Gabaake, 2002; Personal Interview, Ramberg, 2002). As an economy based on the extraction of raw materials, Botswana is subject to cycles of boom-bust.[15] This is reflected primarily in the construction industry as government has placed most emphasis on the provision of public goods roads, schools, hospitals, sporting facilities, water and power in the effort to spread economic activity, wealth and employment beyond the capital-intensive mining sector. The focus on infrastructure development in support of jobs has a huge impact on local environments, from hardening of the soils to the depletion of aquifers. Since water is available for the current period, and is estimated to last through the end of the next 6-year planning cycle, sustainable water policies are talked about but not implemented (Personal Interview, Mmopi, 2002). Moreover, surplus capital reinforces the belief that water can be acquired either by direct purchase or by implementation of innovative technologies.

A bright light in this scenario is the recent movement of safari operations toward both sustainable ecosystems management and rural development through the implementation of community based natural resources management (CBNRM) programs (Van der Jagt and Rozemejier, 2002). The realization on the part of this industry that their future is intimately linked to the implementation of sustainable practices is an important change of consciousness. This type of awareness must spread to each of the other economic sectors.

4.2. Institutional Overlap

A second critical challenge is presented by the overlapping structure of the government and parastatal organizations involved with policy making for water

(Personal Interview, Ramberg, 2002). In many ways this is the cumulative result of piecemeal, often reactive policy making over time. The WUC has authority only in cities while DWA only has control of state lands and communal lands are controlled by the District Councils. In addition to this fractured structure, other ministries such as Agriculture, Minerals, Lands, Wildlife and Tourism compete for the water they need to make their missions a success. A central problem is that the Department of Lands has authority to allocate and manage land but generally does so without consideration of water, sanitation, agriculture or waste management. Once land is allocated, other agencies frequently raise these issues. For instance, land might be allocated for industry without full consideration of the pollution effects on water resources. Groundwater, while logically associated with land, is separated from land for government purposes (Personal Interview, Monagen, 2002).

To add to the complexity, each district manages its own multifaceted system of intergovernmental affairs to ensure that water is provided within the district (Personal Interview, Gabaake, 2002). At the local level, concern for water when land is being allocated is extremely restricted. The main concerns are for potential range deterioration if the landholder increases the number of cattle around existing boreholes. The other concern is for the increase of saline boreholes. New occupants of lands will almost certainly increase water use and are likely to drill additional boreholes. This multiplies the potential for saline boreholes as the water table drops (Personal Interview, Maswibilili, 2002). While decision making at the local level is less contentious than it is at the national level, the problem of limited and overlapping jurisdictions among concerned agencies still plays a role in preventing smooth and rational policy implementation.

The government is not unaware of this problem. To address it, the National Conservation Strategy Coordinating Agency (NCSCA) was formed. The NCSCA was to be an umbrella organization to unify water policy across the other ministries. NCSCA, however, is not powerful enough to fulfill this mission. The water needs of livestock, wildlife, mines, and agriculture are often in conflict. The more powerful ministries that exercise control over these issues weigh heavily on decisions regarding water access (Personal Interview, Monagen, 2002). The people in these ministries are often the same people who lobby in support of, say, industry or ranching or mining over less powerful ministries and lobby groups, such as Tourism and the Environment and international environmental NGOs. The failure of NCSCA to be effective has another important consequence. Many issues related to water are simply ignored because the major agencies (including water agencies) do not see them as central to their individual missions (Personal Interview, Mbaiwa, 2002).

NCSCA has a history of organizational shortcomings. The formation of NCSCA did not include any specific structure from which the NCSCA was to accomplish its mission of coordination. There is no formal notification of NCSCA required when other agencies make policy. The NCSCA, therefore, relies on informal contacts to determine what other agencies are doing. When NCSCA was established it was geographically separate from its ministry, making for difficult communication. It remains an agency and as such has limited authority and no budget autonomy

(Personal Interview, Nchunga, 2002). NCSCA also has legal authority to deal with Environmental Impact Assessment (EIA) statements. Under the Monument and Relics Act, environmental and archeological assessments are required. While EIAs are now mandatory, the NCSCA lacks any internal capacity to do anything with the assessments it receives (Personal Interview, Fritz, 2002). In addition, the government often makes decisions prior to undertaking an EIA. It then informs consultants awarded EIA contracts of its intentions and suggests that the EIA simply make the best of the situation, not challenge its validity (Personal Interview, EIA consultant, name withheld, 2002). While the government continues to state that it will streamline and coordinate decision making among all those active in the exploitation of water resources (Government of Botswana, n.d.), coordination tends to take the form of consultations *ex post facto*.

4.3. Cultural Impediments

Underpinning many of these problems is the fact that there is no general belief that water will run out. This combines with an abiding belief that 'government will provide', an attitude that the ruling BDP has consciously cultivated during its long years of careful and conservative rule.[16] Because the issue is taken lightly, no serious solutions are being debated. There is much rhetorical support for the concepts of sustainability, especially using the language of the United Nations, which typically links sustainability to development, but serious policy efforts go wanting. The need exists for an intensive education campaign to convince the public as well as government officials of the water scarcity situation and the timeline for exhaustion of domestic supplies (Personal Interview, Gabaake, 2002). The education of government officials might prove challenging in itself as most of those working in the water sector are trained as engineers. Their professional culture has oriented them to provide a product rather than to think about water as a central component in the sustainable management of an overall ecosystem (Persoanl Interview, Kgathi, 2002; Swatuk, 2003). Reorienting these professionals will require re-education. Donor supported professional regional forums like WATERNET help in this regard.[17]

NGOs are making a contribution in the effort to educate the general population regarding water issues. Local NGOs like the Kalahari Conservation Society and Somareleng Tikologo (Environment Watch Botswana) run programs aimed at community education and empowerment. These NGOs can provide valuable assistance to fill gaps in national and local government lack of capacity. They are frequently asked to partner with government agencies or local governments and serve on committees, give workshops, run pilot programs, assess popular sentiment, and provide feedback to the appropriate agencies and departments (Personal Interview, Fritz, 2002). NGOs such as Conservation International and IUCN often work directly with government on various aspects of conservation, the environment and community empowerment. Unfortunately, the relationship is not always cordial. The actions of NGOs are sometimes treated as suspect by agencies, as they are occasionally seen as having their own agenda and one that can run into conflict with

government plans (Personal Interview, Sekhute-Batungamile, 2002). When this happens, NGOs are less than successful in providing any assistance to government agencies in educating the public.

4.4. Human Resource Capacity

There is a great deal of ignorance about the state of water resources in the country. Where there is knowledge it often reflects popular but inaccurate stereotypes.[18] These views are compounded by shortages of scientific data and ineffective monitoring. There is little known among government decision makers regarding how much groundwater or surface water exists. Outside consultative services are hired to provide this information to government decision makers but because there is no internal capacity to do the studies, the reports of the consultants are not trusted. When internal capacity to generate and understand such reports is developed, it is rapidly lost to the private sector (due to higher pay scales). Consultants may also distort information by tailoring their reports to curry favor with the government so as to earn new contracts. Thus, expertise needed for government decision making is lacking (Personal Interview, Monagen, 2002). Concepts like 'sustainability', therefore, remain merely words and rarely get translated into implemented policy programs with measurable outputs and outcomes. Policies that monitor water use and purpose for use do not exit (Personal Interview, Gabaake, 2002).

While most of Botswana's water policy is supply oriented, one of the main policy mechanisms to create sustainable use might well be demand management. The problem with implementing demand-side policy mechanisms, however, is that there is currently no accurate measure of demand (Personal Interview, Kgathi, 2002). Neither is there an accurate measurement in place to determine water use or need within segments of the population. Even if such measures existed, for an effective pricing policy to be put in place there would have to be additional studies to determine what segments of the population can afford to pay taxes for water use and how much tax they might reasonably afford (Personal Interview, Gabaake, 2002).

Information scarcity makes the rational implementation of these even very basic policies almost impossible. Lacking adequate information, government officials resort to making policy blindly. While there are efforts in place to create a centralized government statistics office to handle these matters, whatever policy currently exists has been created without the benefit of such statistics. The problem of accurate measurement affects the ability of the government and NGOs to attract external monies for projects as donors frequently require some measurement of project outcomes before approving a project (Personal Interview, Kgathi, 2002).

The cumulative impact of data shortage and human resource and policy monitoring incapacity are reflected in emerging problems of pollution. Pollution is a growing threat to all water supplies and, by extension, health. This situation is worsened by the lack of adequate environmental enforcement. As people see others profiting from environmental pollution and misuse without consequence, they are encouraged to join in the activity (Personal Interview, Monagen, 2002). On the

national level this phenomenon plays out as well. While the Water Act empowers the Water Apportion Board to levy fines and withdraw water rights from polluters, such action rarely takes place when jobs are involved (Personal Interview, Gabaake, 2002).

The effects of pollution on tourism are beginning to be felt. In many tourist areas human waste and other effluent is dumped near waterways without control. Open pit burning of other wastes affects air and water quality and presents a threat of veld fire. Invasive species such as *salvinia molesta* also pose a problem for water management in Botswana. Long a problem in the Zambezi River Basin, water hyacinth has spread to the lower Okavango through the uncontrolled movement and proliferation of personal water craft. While there is legislation in place to deal with all of these issues, enforcement is lacking (Personal Interview, Mbaiwa, 2002).

Widespread poverty, particularly within the context of the HIV/AIDS pandemic, makes concern for the environment look rather parochial. The enormous problems posed by the HIV/AIDS pandemic have great impact on other issues. The ability of the country to maintain a stable and able workforce is called into question by the pandemic. As AIDS kills more and more of the country's prime workforce, it leaves behind orphaned children and the elderly. Maintaining a stable economy and stable economic growth in such an environment is difficult in the extreme. Planning becomes contingent, the costs of training new staff to replace those who have died from AIDS are exorbitant. As government units confront the HIV/AIDS problem, their attention to other issues, like water, dissipates. At best, the issue is left to those already active in the sector. Rather than creative thinking to address new and abiding problems, then, pressures from the pandemic encourage status quo-oriented planning and implementation. This is not to downplay the social impact, which is acute. Rather, it is to highlight the myriad ways in which HIV/AIDS reinforces existing problems, rather than alleviates them. Until the problem of AIDS is solved there is little local communities can do about other issues (Personal Interview, Monagen, 2002).

The pandemic also directly affects ways in which water is treated. There is concern about spreading disease and a misunderstanding, especially in the villages, that AIDS is a waterborne illness. Largely because of this concern, but also because of traditional approaches, the idea of recycling water for reuse is soundly rejected by the public. Dam construction has also come under public scrutiny when the water has flown from an area known to have AIDS. People in the countryside fear that when the water sits in a dam near their home it will somehow bring the disease to them (Personal Interview, Monagen, 2002).

4.5. Power Relations

Implementation remains a major barrier to sustainable water policy. While there are many good laws on the books, they are written in large part to address issues raised by donors, international financial institutions (IFIs) and NGOs, whose own interests vary over time. Placed in this context, policy is very much reactive and reflects in its

current language e.g. good governance, democratization, privatization, ecosystem sustainability, integrated water resources management, smart partnerships the interests not of the Tswana elite, but powerful international actors, forces and factors.

In the meantime, the confluence of political and economic power of decision making power in the service of diamond and cattle wealth ensures that resource use and policy reflects these narrow interests and tends therefore toward preservation of the status quo.[19] Failure to fully implement the legal structure and low enforcement rates allows powerful forces within the country to use the system to their own, often short-term, advantage while the needs of the natural environment are ignored (Personal Interview, Maswabilili, 2002).

5. The future conclusion

Water must be seen in the context of other concerns that currently confront or are likely to confront Botswana. For Botswana to turn its attention more carefully to sustainable water use, other more pressing needs must not intervene. At the same time, there must be a willingness on the part of the empowered minority to look beyond their narrow interests toward the long-term sustainability of the natural resource base. Yet there is little in this paper to suggest such a positive context. Botswana's success story is very fragile. Changes in one on several situations could radically alter the country's current direction.

Botswana's development and economic vitality has been fueled by diamonds. Over-dependence on diamonds for GDP growth has been recognized in NDP 9 with its focus on diversification. However, the turn away from diamonds has proven to be extremely difficult. Over-dependence poses several threats. There is a growing world movement against "blood diamonds" diamonds mined in harsh conditions and sold to fund wars or dictators. The government of Botswana, through its partnership with DeBeers, has undertaken an active campaign to market its product as diamonds for development. At the same time, DeBeers is pressing for ways and means to differentiate its diamonds from blood diamonds through the Kimberley Process. Despite these efforts, because diamonds are such an elastic commodity, even minor shifts in global demand could have huge impacts on the economy. If the economy were to falter, hopes of finding ways to develop in a sustainable fashion would grow dim. Botswana must devote extensive economic resources to building a water infrastructure and use program that is sustainable. If the economy were to lose the revenues raised by diamond sales, doing so will be difficult, if not impossible.

The growing need for water throughout southern Africa poses another challenge to sustainable water policy in Botswana. There has been a great deal of writing and research on potential 'water wars' in the region (see Swatuk and Vale, 2000; Swatuk, 2002a; Turton and Henwood, 2002; and Nakayama 2003 for different perspectives). Government fully acknowledges its need to exploit international watercourses. Principle 21 of the UN Declaration on the Human Environment, for instance,

affirms the rights of states to exploit their own natural resources. While international law dictates that each state is entitled to equitable use of an international waterway, the matter of what constitutes equitable use is not settled (Lebotse, 1999).

The government of Botswana is an active supporter of international water sharing agreements and equitable practices. Currently, it is a member of a variety of river basin commissions in the Okavango, the Orange and the Limpopo. As noted earlier in the paper, it is both an upstream and downstream riparian in the region. As such, any development decisions it takes (e.g. the NSCWP) have the potential to negatively impact on its downstream neighbors, while similar decisions taken by neighbors (in Angola and Namibia, for example) have the potential to negatively impact it. In other words, there are very real international political limits to water resource use in Botswana. So, sourcing new supplies is never guaranteed. While these institutions are new and fraught with difficulties, they mark, in the view of government stakeholders, an important development in regional resources management (Personal Interview, Gabaake, 2002; Personal Interview, Pinheiro, 2002).

Finally, if models of Global Climate Change are taken into account, it is anticipated that water shortages in southern Africa will increase due to the occurrence of persistent and severe droughts. The southern African projections predict either dramatically hotter and dryer or dramatically hotter and wetter. Either way, these changes will impact policy and planning in yet undetermined ways (Personal Interview, Ramberg, 2002). This situation will undoubtedly complicate water resources needs throughout the region (Mutembwa, 1998).

Many of the problems of water in Botswana cannot be addressed by merely shifting emphasis to sustainable water use without changing the way policy is made in other areas. Until tourism, agriculture, cattle, and mining are viewed as long-term sustainable industries that need water to survive rather than short-term efforts for development, it is not likely that water will be so treated. The key to the future of water management in Botswana is to embrace the concept of long-term managed growth and sustainability across all major activities. Such policy would involve integrating water use with tourism, agriculture, cattle, mining and human needs not just for the next several years of national planning but for the next several decades (at least). Seeing sustainable water management as a partner with tourism, agriculture, cattle, mining, and human needs to create future decades of steady and sustained economic growth is the only hope for Botswana to avoid a water disaster in the near future.

Notes

[1] Compared to 752 mm/year in London, England; 612 mm/year in Capetown, South Africa; 1128 mm/year in New York, USA; and 1523 mm/year in Tokyo, Japan.

[2] The Botswana currency is Pula (or P). One Pula = 0.17 Euro or 0.21 US Dollar. One Euro = P5.87. One US Dollar = P4.78.

[3] The Gaborone and Bokaa dams serve the greater Gaborone metropolitan area; the Letsibogo dam services the mining town of Selebi Phikwe; and the Shashe Dam services the northern city of Francistown. All of these dams are now part of a reticulated national system called the North South Carrier

Water Project (see below). For a short while the Mopipi Dam operated to service the diamond mine at Orapa. The mine now depends entirely on groundwater.

[4] Since independence, the government has engaged in national planning exercises to manage the economy and development. These are embodied in and guided by five-year National Development Plans (NDP), the first of which focused on the period 1968–73 (NDP 1). NDP 9 will be the first development plan that will be built upon the long-term planning encapsulated in Vision 2016. Beginning in 1996, Botswana engaged in its first effort at long-term planning. Vision 2016, the result of that effort, states the major goals the country seeks to achieve by 2016. These include 'an educated and informed nation; a prosperous, productive and innovative nation; a compassionate, just and caring nation; a safe and secure nation; an open, democratic and accountable nation; a moral and tolerant nation; and a united and proud nation' (Gaolathe, 2002: 7). The theme of NDP 9 is 'Towards Realisation of Vision 2016: Sustainable and Diversified Development through Competitiveness in Global Markets'. NDP 9 calls for a shift away from past strategies that rely almost solely on the production of diamonds as the mainstay of the economy and develop a diversified and globally competitive economy as have all previous national development plans.

[5] The Government of Botswana's 2001 Population and Housing census put the number at 1,678,891 as compared to 1,326,796 in 1991 (Gaolathe, 2002: 10).

[6] Vast herds of wildebeest and hartebeest historically followed a transmigratory route extending from Gemsbok National Park and Mabuasehube Game Reserve in the southwest (and further south and west into South Africa and Namibia) through the Central Kalahari Game Reserve in the center of the country, through the Makgadikgadi and Nxai Pans, into the Okavango Delta and further north, across the Zambezi River into Zambia. These migrations were seasonal, reflecting changing climates impacted by the movement of the Inter-Tropical Convergence Zone over the continent.

[7] Meat exports are no longer a large part of the economy. Recurrent outbreaks of foot and mouth disease have decimated large sections of the national herd over the last decade and restricted access to foreign markets. Nevertheless, the national herd continues to grow and the cultural power of cattle is undeniable.

[8] According to the hydrologist Piotr Wolski (Personal Interview, 2002), 'We have a strange situation here [in the Delta]. We have more water than we need but the IUCN study crushed all attempts to touch the water. Ten years later, it is the same issue'.

[9] Southern African Development Community: current members are Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[10] 'Adequacy', of course, is a relative term. What was adequate for the 40,000 residents of Gaborone in the 1970s is no longer adequate for the 246,000 today. In response to rising demand, various supply-augmentation activities have been undertaken. For example, the Gaborone Dam wall was raised by 8 m during NDP 7. Botswana also buys bulk water from South Africa via the Groot Marico Dam in the Limpopo River Basin system. And the NSCWP brings water to the city from the Shashe River in the northeast.

[11] In contrast to 77% in 1991 and 56% in 1981 (Lado, 1997: 44).

[12] In 2000 and 2001, Botswana's current account surpluses were P2.8 billion and P2.6 billion, respectively. Foreign exchange reserve holdings had increased from P33.9 billion in 2000 to P41.2 billion in 2001, representing 39 months of import cover for goods and services (Gaolathe, 2002: 10).

[13] According to Goldblatt et al. (1999: 107), BCL copper–nickel mine installed a water treatment filtering technology that resulted in the reuse of 300 m^3/h of water 'representing a financial saving of P5.7 million per annum'.

[14] Livestock are also often watered around rural drinking water supply schemes, so leading to point source pollution, hardening of the soils around the water source, and rapid depletion of the resource (Government of Botswana, n.d.).

[15] These cycles are somewhat muted by the presence of the Central Selling Organisation (CSO) which still manages to control the supply of most of the world's diamonds so stabilizing price. Botswana provides roughly 30% of the CSO's diamonds (Gaolathe, 2002).

[16] While some scholars regard Botswana as a mature multi-party democracy with aspects of traditional African democracy, others consider it as being ruled by an authoritarian liberal regime (Molomo, 1991; Good, 1997). In the estimation of one of us, however, it seems clear that vast mineral wealth has facilitated the extension of a typically patrimonial African system of rule.

[17] WATERNET is funded by SIDA. It has four components. One is the Water Research Fund of Southern Africa (Warfsa) which supports local scholars with grants of up to US$ 50,000 per funding cycle. The second is the hosting of the annual WATERNET symposium. Thus far there have been three of these meetings: in Maputo, Cape Town and Dar es Salaam. Gaborone is host city for the 4th meeting. The third component is creation of a network of institutions and scholars working on water issues in the region. This network is deliberately multidisciplinary. Fourth, WATERNET is developing a regional M.Sc. degree in water resources management.

[18] For example, that Namibia is planning to drain the Okavango, or that the solution to water shortage is inter-basin pipelines.

[19] See Peters (1994) for a trenchant historical background, particularly regarding the emergence of powerful Borehole Syndicates.

References

Atlhopheng, J.R.: 1998, 'Water Resources in Botswana', in J.R. Atlhopheng O. Totolo (eds.) *Environmental Issues in Botswana*, (Gaborone, Botswana, Lightbooks), pp. 11–36.

Carlsson, L. and Ntsatsi, J.: 2000, 'Village Water Supply in Botswana: Assessment of Recommended Yield for Production Boreholes in a Semi-arid Environment', *Journal of African Earth Sciences* **30**(3), 475–487.

Darkoh, M.B.K. and Mbaiwa, J.E.: 2002, 'Globalisation and the Livestock Industry in Botswana', *Singapore Journal of Tropical Geography* **23**(2), 149–166.

Gaolathe, B.: 2002, *Minister of Finance and Development Planning, Budget Speech 2002*, (Gaborone, Government Printer).

Gaolathe, B.: 2001, *Minister of Finance and Development Planning, Budget Speech, 2001*, (Gaborone, Government Printer).

Goldblatt, M., Ndamba, J., Merwe, B.van der, Gomes, F., Haasbroek, B. and Arntzen, J.: 1999, *Water Demand Management: Towards Developing Effective Strategies for Southern Africa*, (Gland, Switzerland, IUCN).

Good, K.: 1997, *Realizing Democracy in Botswana, Namibia and South Africa*, (Pretoria, Africa Institute).

Government of Botswana: 1992, *National Water Master Plan (NWMP)*, (Gaborone, Government Printers).

Government of Botswana, 2002, *Economic Snapshot*, http://www.gov.bw/economy/index.html.

Government of Botswana, n.d., *National Development Plan 8*, (Gaborone: Government Printers).

Greenway, P.: 2001, *Botswana*, (Melbourne, Oakland, London, and Paris, Lonely Planet Publications).

Jovanovic, N.Z., Annandale, J.G., Claassens, A.S., Lorentz, S.A. and Tanner, P.D.: 2001, 'Modeling Irrigation with Gypsiferous Mine Water: A Case Study in Botswana', *Mine Water and the Environment* **20,** 65–72.

Lado, C.: 1997, 'Socio-economic Factors Influencing Sustainable Water Supply in Botswana', *GeoJournal* **41**(1 January), 43–53.

Lebotse, K.K., 1999, 'Southern African Devleopment Community Protocol on Shared Watercourses: Challenges of Implementation', *Leiden Journal of International Law*, pp. 173–181.

Mogae, F., 2002, 'State of the Nation Address', delivered to the first meeting of the Fourth Session of the Eight Parliament, Monday, 28 October.

Molomo, M., 1991, 'Botswana's Political Process', in Mpho Molomo and Brian T. Mokopakgosi (eds.), *Multi-Party Democracy in Botswana*, (Harare: Sapes Trust).

Moyo, S., O'Keefe, P. and Sill, M.: 1993, *The Southern African Environment*, (London, Earthscan).

Mutembwa, A., 1998, 'Water and the Potential for Resource Conflicts in Southern Africa', Global Securities Fellows Initiative, Occasional Paper No. 3., University of Cambridge.

Nakayama, M. (ed.): 2003, *International Waters in Southern Africa*, (Tokyo, United Nations University Press).

Pallett, J. (ed.): 1997, *Sharing Water in Southern Africa*, (Windhoek, Desert Research Foundation of Namibia).

Parson, J.: 1984, *Botswana: Liberal Democracy and the Labor Reserve in South Africa*, (Boulder, Co., Westview Press).

Peters, P.E.: 1994, *Dividing the Commons: Politics, Policy and Culture in Botswana*, (Charlottesville and London, University of Virginia Press).
Porter, R.C., Boakye-Yiadon, L. Jr., Mafusire, A. and Tsheko, B.O.: 1997, *The Economics of Water and Waste in Three African Capitals*, (Ashgate, Aldershot, Brookfield, Singapore, and Sydney).
Sillery, A.: 1974, *Botswana: A Short Political History*, (London, Methuen & Co, Ltd).
Smit, P.: 1970, *Botswana: Resources and Development*, (Pretoria, South Africa, Africa Institute).
Sullivan, C.: 2002, 'Calculating a Water Poverty Index', *World Development* **30**(7), 1195–1210.
Swatuk, L.A., 2003a, 'Kant and Should: Thinking Strategically About Achieving 'Wise Use' of the Okavango Delta System', in Anthony Turton and Anton Earle (eds.), *Water for Peace in the Okavango River Basin*, (Gland: Green Cross International).
Swatuk, L.A.: 2003b, *Water Reforms and Privatisation Processes in Southern Africa, Yearbook of African Affairs 2002*, (Bremen, University of Bremen).
Swatuk, L.A.: 2002a, 'The New Water Architecture in Southern Africa: Reflections on Current Trends in the Light of Rio + 10', *International Affairs* **78**(3), 507–30.
Swatuk, L.A.: 2002b, 'Environmental cooperation for regional peace and security in Southern Africa', in Conca Ken Dabelko Geoffrey D. (eds.) *Environmental Peacemaking*, (Washington, Woodrow Wilson Center and Johns Hopkins University Press), pp. 120–160.
Swatuk, L.A.: 2001, 'The Brothers Grim: Modernity and "International Relations" in Southern Africa', in Dunn Kevin Shaw Timothy M. (eds.) *Africa's Challenge to International Relations Theory*, (London, Palgrave Publishers), pp. 163–182.
Swatuk, L.A.: 2000, 'Power and Water: the coming order in Southern Africa', in Hettne Bjorn Inotai Adras Sunkel Osvaldo (eds.) *The New Regionalism and the Future of Security and Development*, (London, Macmillan), pp. 210–247.
Swatuk, L.A., 1994, 'The End of History or the Beginning of the End?: prospects for Botswana in the Twenty-First Century', in Rukhsana Siddiqui, ed.
Swatuk, L.A. and Vale, P.: 2000, *Swimming Upstream: Water and Discourses of Security*. *Security, Ecology, Community: a Working Paper Series no. 2*, (Bellville, University of the Western Cape).
Swedeplan: 1994, *Programme for the Planning of Resource Utilization in the Okavango Delta Region*, (Gaborone, Government of Botswana).
Turton, A. and Henwood, R. (eds.): 2002, *Hydropolitics in the Developing World: A Southern African Perspective*, (Pretoria, African Water Issues Research Unit).
Van der Jagt, C. and Rozemeijer, N.: 2002, *Practical Guide for Facilitating CBNRM in Botswana*. CBNRM Support Programme Occasional Paper No. 8 ICUN and SNV, Botswana.
WATERNET, 2003, *Integrating Water Supply and Water Demand for Sustainable Use of Water Resources*, 3rd) WATERNET/Warfsa Symposium papers, (Dar es Salaam).
World Bank: 2002, *World Development Report 2002: Building Institutions for Market*, (Oxford, New York).

Interviews

Ashton, P., Environmental Scientist, CSIR Pretoria. Personal Interview conducted in Maun, Botswana, 10 September 2002.
Fritz, A., Environmental Officer, Somaraleng Tiklologo. Personal Interview conducted at the offices of Somaraleng Tikologo in Gaborone, Botswana, April 16, 2002.
Gabaake, G., Director, Department of Water Affairs, and Commission Member, Okavango River Basin Commission. Personal Interview conducted at the Department of Water Affairs in Gaborone, Botswana, April 18 and 10–11 September 2002.
Heyns, P., Namibia's Commission Member, Okavango River Basin Commission. Personal Interview conducted in Maun, Botswana, 10 September 2002.
Kgathi, D., Development Economist, Harry Oppenheimer Okavango Research Centre, University of Botswana. Personal Interview conducted at the Harry Oppenheimer Okavango Research Centre, University of Botswana in Maun, Botswana, April 25, 2002.
Jensson, R., Environmental Scientist, UCN-Botswana. Personal Interview conducted in Gaborone, Botswana, May 5, 2003.

Maswibilili, M., District Land Use Planner. Personal Interview conducted at the Department of Towns and Regional Planning; Ministry of Lands, Housing, and Environment, Maun, Botswana, April 19, 2002.

Mbaiwa, J., Research Fellow for Tourism, Harry Oppenheimer Okavango Research Centre, University of Botswana. Personal interview conducted at the Harry Oppenheimer Okavango Research Centre, University of Botswana in Maun, Botswana, April 25, 2002.

Mmopi, K.K. Director, Department of Crop Production and Forestry. Personal Interview conducted at the Department of Crop Production and Forestry, Gaborone, Botswana, April 24, 2002.

Monagen, N., Director, Department of Lands. Personal Interview conducted at the Department of Lands, Gaborone, Botswana, April 25, 2002. Also interviewed at the same meeting were Tshebetso Teekay Kgatlwane, Principal Lands Officer and Sarah George, Principal Lands Officer.

Muimi, E., Head, Department of Wildlife and National Parks, Maun Office. Personal Interview conducted in the Department of Wildlife and National Parks, Maun Office, Maun, Botswana, April 19, 2002.

Nchunga, M., Executive Secretary, National Conservation Strategy Coordinating Agency. Personal Interview conducted at the National Conservation Strategy Coordinating Agency, Gaborone, Botswana, April 24, 2002.

Pinheiro, M., Angola's Commission Member to the Okavango River Basin Commission. Personal Interview conducted in Maun, Botswana, 10 September 2002.

Ramberg, L., Director, Harry Oppenheimer Okavango Research Centre, University of Botswana. Personal interview conducted at the Harry Oppenheimer Okavango Research Centre, University of Botswana in Maun, Botswana, April 25, 2002.

Sekhute-Batungamile, B., Project Coordinator, Kalahari Conservation Society. Personal Interview conducted at the Kalahari Conservation Society Office, Maun, Botswana, April 22, 2002.

Wolski, P., Hydrologist, Harry Oppenheimer Okavango Research Centre, University of Botswana. Personal interview conducted at the Harry Oppenheimer Okavango Research Centre, University of Botswana in Maun, Botswana, April 25, 2002.