Water Demand Management in Malawi: Problems and Prospects for its Promotion[1]

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Abstracts: This paper examines the status of water demand management in Malawi in general and in the Lake Chilwa Catchment in particular. Against the background of both the urban and rural nexus and the various productive activities, the Lake Chilwa Catchment provides a unique opportunity for studying ways in which social, economic and technological measures have been used to promote the sustainable use of water resources. Findings from the case study indicate that, while WDM is highly advocated in the urban and peri-urban areas, very few aspects of WDM are practiced in the rural areas. The water pricing structure that the supplying institutions established serve as a disincentive for water wastages in the urban areas. Both private firms and individuals use various measures to conserve water as a way of minimizing water consumption. The motives for water conservation range from profit maximization to inadequate financial resources to meet the costs of water respectively. In the rural areas where water is supplied at no cost, the people tend to pay less attention to water conservation. In cases where water providers attempted to institute factors of cost sharing, the rural inhabitants tended to be reluctant to contribute. This is so because people view water as a social good that should be supplied to them free of charge. The paper demonstrates that although some aspects of WDM are being practiced in the country, the existing conditions on the ground militate against its increased expansion as a strategy for promoting an efficient and equitable use of existing water resources. A large section of the population still lack access to potable water and the Malawi government is committed to the provision of basic water services. Yet WDM will become even more critical in future because of the growing competition for water resources. In particular, the growing population and the increasing economic activities such as farming, industrialization and urbanization. The argument here is that despite the promising benefits WDM has, its promotion must necessarily be infused with ideas of water supply, considering that the largest population still lacks access to potable water. Coupled with this will be the need for a proper policy framework that promotes public awareness for people to start appreciating the economic value of water especially in the rural areas.

1. INTRODUCTION

This paper examines the status of water demand management in Malawi in general and in the Lake Chilwa Catchment in particular. It demonstrates that although some aspects of WDM are being practiced in the country, the existing conditions on the ground militate against its increased expansion as a strategy for promoting an efficient and equitable use of existing water resources. A large section of the population still lack access to potable water and the Malawi government is committed to the provision of basic water services. Yet WDM will become even more critical in future because of the growing competition for water resources. In particular, the growing population and the increasing economic activities such as farming, industrialization and urbanization.

The paper argues that despite the promising benefits WDM has, its promotion must necessarily be infused with ideas of water supply, considering that the largest population still lacks access to potable water. Coupled with this will be the need for a proper policy framework that promotes public awareness for people to start appreciating the economic value of water especially in the rural areas.

In order to carry out this study, we were interested in collecting data and information on water supply, current demand for water resources, future demand for water resources, policies, strategies and key institutions involved in water resources management. The basic method of conducting this research was an extensive and critical review of policy documents and relevant literature on water resources in Malawi, field surveys, and key informant interviews. A semi-structured questionnaire was administered to twenty four stakeholders,

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four policy makers, six consumers and fourteen supplying institutions), and key informant interviews. The sampling was purposely done in order to collect data from key institutions.
This paper is divided into three sections. The first section provides background information on Lake Chilwa and Malawi in general. Section two reviews the current status of WDM in Malawi. The last section provides some strategies and recommendations for promoting WDM in the country.

2. GENERAL CONTEXT OF WATER RESOURCES IN MALAWI

Malawi has a tropical continental climate with two distinct seasons: the dry and wet seasons. The dry season generally runs from May to October, and the wet season runs from November to April.

Surface water resources consist of a network of river systems (such as the Shire, Ruo, South Rukuru, Songwe etc) and lakes (e.g. Lake Malawi, Lake Chilwa, Lake Malombe and Lake Chiuta) that cover more than 20% of the country's territorial area. Large quantities of surface water resources are stocked in Lake Malawi. The drainage system of Malawi can be conveniently categorized into three separate units namely Lake Malawi System, Shire River System and Lake Chilwa System (National Water Resources Master Plan, 1986).

Lake Malawi, which is the third largest lake in Africa with a surface area of about 28,760 km^2, has great influence on the water balance of the country. The mean annual rainfall over the Lake is estimated to be 1549 mm. The total inflow into the Lake is calculated to be 920 m^3/s, out of which 400 m^3/s is from Malawi, 486 m^3/s from Tanzania and 41 m^3/s from Mozambique. The only outlet of the Lake is the Shire, with an average annual outflow of 395 m^3/s. The highest annual outflow of 825 m^3/s occurred during the 1979/80 rainfall season. The mean lake level is 474.4 m above sea level (Kaluwa et al., 1997; Chavula, 2001).

Lake Chilwa basin is located to the eastern part of the district of Zomba in Malawi. It forms a catchment area of Lake Chilwa, an inland drainage lake without outlet, situated to the south-eastern part of Malawi. This basin covers some parts of Zomba, Machinga and Phalombe districts boasting a network of river systems such as Domasi, Songani, Phalombe, Naisi, Likangala, Thondwe, and Namadzi, which drain water into the Lake. The existence of the lake and a network of rivers together with the low lying nature of the land resulted in the creation of a long wetland whose significance has largely to do with the cultivation of rice through both formal and informal irrigation. The low-lying topography makes the basin vulnerable to water logging and flooding especially during the rainy season. Since most of the rivers spring from Zomba mountain, the second largest mountain in the country, and snake through the urban areas of the Municipality of Zomba, the waters from the rivers are heavily competed for domestic and productive purposes. The rivers are also polluted with sewage wastes and other rubbish which are deposited into the river, particularly as they pass through the urban settlements. Consequently, the inhabitants of the basin largely depend on man-made water sources like boreholes, water taps, hand dug protected and unprotected shallow wells, etc for potable water uses. Not all these sources provide water throughout the year; most of them dry up during the dry months of the year. In addition to poor standards in the construction of the sources, the high temperatures of the basin invariably exacerbate the drying up of water sources. (Lake Chilwa State of Environment, 2000; Mulwafu and Khaila, 2001)

The major socio-economic activities of the area are rice irrigation farming and fishing. The promotion of formal irrigation is being done through two smallholder irrigation schemes established in the area in the late 60s, namely, Likangala and Domasi. Besides, the inhabitants interact frequently with the people of Mozambique who cross the Lake to sell farm produce such as maize at Kachulu harbour. But the source of pride for the basin is the existence of the Municipality of Zomba, which until 1975, was the capital of Malawi. The Municipality is a center of various public institutions (secondary schools, a nursing college, police college, Chancellor College, a major constituent college of the University of Malawi, Zomba General Hospital, Zomba Mental Hospital, Cobbe Barracks, Police Headquarters etc), which constitute the largest users of water in the basin.

Water in the catchment is supplied through taps, protected and unprotected wells, and boreholes. While in the urban and peri-urban areas water is supplied by the Southern Region Water Board, in rural areas it is supplied by various NGOs, church organizations, and the rural water supply department. Mainly tap water is supplied in the urban areas. In the rural areas, water is supplied through boreholes and wells. Those living in the urban areas pay for the water they use either as an institution or as individuals. In the rural areas, the communities are often asked to contribute a small fraction of money to indicate willingness to assume the responsibility of management of the water sources and the purchase of spare parts (CBM Manual, 1998).

3. STATUS OF WATER DEMAND MANAGEMENT IN MALAWI

3. 1 Institutions Responsible for WDM

The management of water resources in Malawi is done by the Ministry of Water Development, the National Water Resources Board, the rural water supply, water boards, NGOs, and the consumers. The Ministry of Water Development and the National Water Resources Board are the lead agencies. The two are not directly involved in the management of water; rather they take part in the monitoring and the formulation of policy to guide the management of water in the country. The following is the water management chain for Malawi. (Malawi Government, Water Policy, 1999)

Representatives of the Ministry of Water Development and the Department of Environmental Affairs stated that their enabling legislation included water demand management (WDM). But as in their policies and strategies, WDM is not given prominence in their legislation. The little WDM that there is often involves duplication of functions between the two institutions, especially in regard to issuance of water licenses and control of water pollution. Often, clients are not sure which of the two institutions they should approach. The institutions themselves attempt to minimise these problems by liaising in the implementation of the legislation. Duplication extends to policies and strategies as well, where common representation on committees is used to minimize conflict.

The Ministry of Water Development uses the World Water Day while the Department of Environmental Affairs uses the World Environment Day as instruments for promoting WDM awareness. On these days, the institutions concerned display messages on placards. They also organize meetings. The effectiveness of these instruments is limited as few people show up and pay attention to them. Other instruments used by the Department of Environmental Affairs are the National Environmental Action Plan and the State of the Environment Report. This is ineffective too because these documents are not read by many people outside government circles. Radio programmes, used by both the Ministry of Water Development and the Department of Environmental Affairs, are more effective as many people listen to them.

There is insufficient WDM in rural areas. Some NGOs blamed lack of policy for this. In rural areas served by the Water Supply Department, WDM is in the hands of the tap, branch and main committees of each scheme, which rely on regulations to control the use of water. For example, normally consumers are not allowed to use water for irrigating crops or watering animals. But these are not easy to enforce.

The five statutory boards pay more attention to WDM. In the urban areas served by these Water Boards, the average amount of water lost or not accounted for ranges from 20 percent to about 30 percent of the total amount supplied. But in some of the urban areas served by Regional Water Boards losses of up to 51 percent have been reported. Discussions with officials of all statutory water boards focused on the causes of these high losses and the measures that they have taken to address these problems.

The lack of funds reflects the generally unsatisfactory financial performance of all Water Boards. Their annual reports and financial statements are difficult to come by. What was made available indicates that the Northern Region Water Board made a loss of K6.5 million in 1998 and K10.6 million in 1999, but realised a net profit of K7.2 million in 2000. The net profit and loss position of the major urban water boards for the years 1994 to 2000 is shown in Table 4.1. Whereas the Blantyre Water Board made a loss only in 1994, the Lilongwe Water Board made losses in all years except 1996 and 2000. The increase in the net profit of the Blantyre Water Board did not offer much relief as most of it was eroded by high urban inflation rates that averaged 40.6 percent on an annual basis between 1995 and 2000. Furthermore, all Water Boards suffer from cash flow problems caused by late payments of water bills by public sector institutions. As a result of financial constraints, technology development leaves a lot to be desired. For example, the Water Boards still rely on the step tests for leak detection when more advanced techniques are available in the field e.g. computer models of water supply schemes.

Whereas Water Boards generate own funds to finance their operations, and whereas NGOs also rely on their own funds, as a government department, the Water Supply Department relies on the government budget, part of which is financed by donors. For the Water Boards for which financial data are available, their operating expenditures in 1999 were: Blantyre Water Board, K296.0 million; Lilongwe Water Board, K111.9 million; and Northern Region Water Board, K45.1 million.

Chart 3.1. WATER MANAGEMENT CHAIN FOR MALAWI

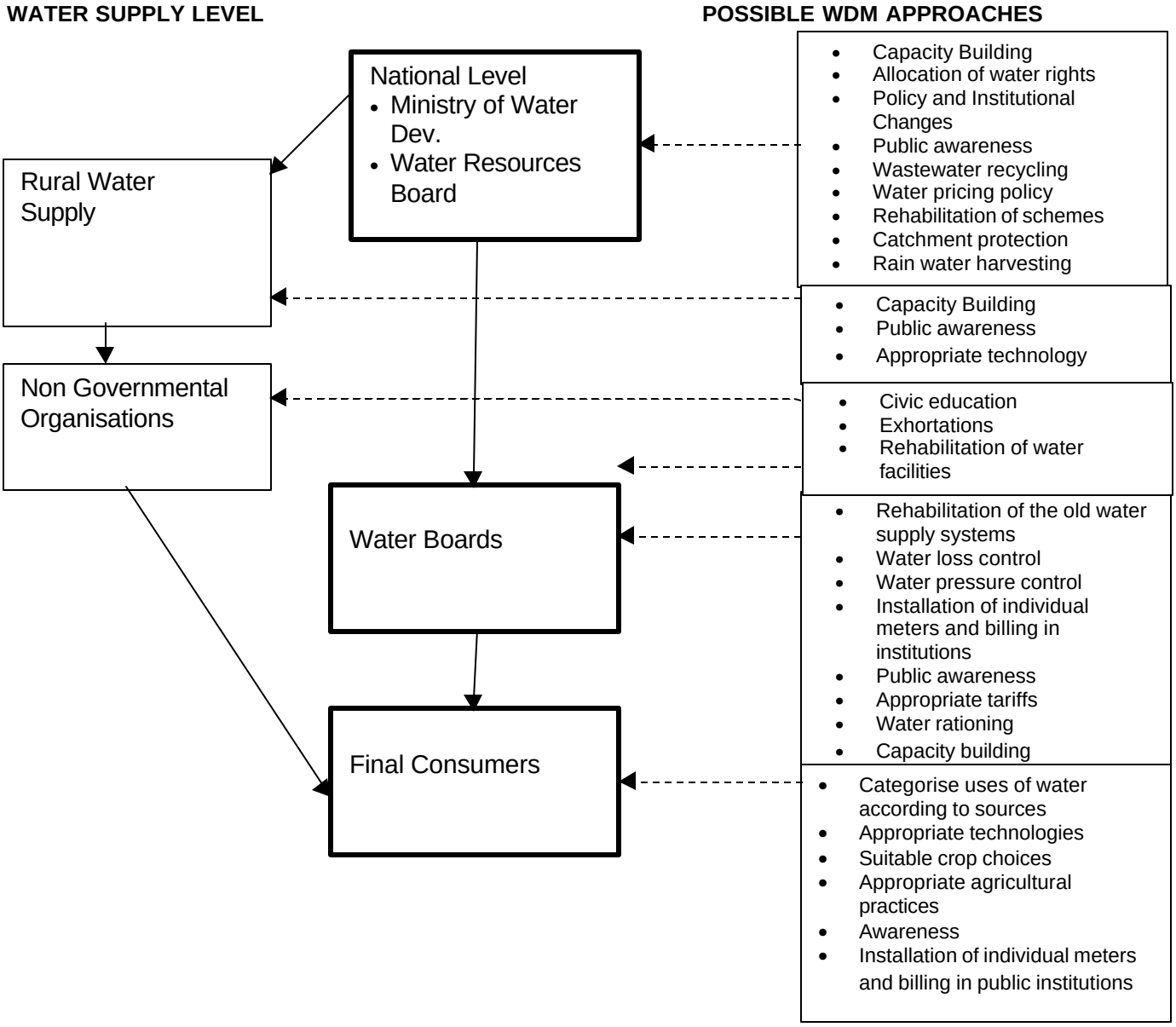

Table 3.1. Net Profit and Loss of Major Urban Water Boards 1994- 2000 (K' 000)

Year	Blantyre Water Board	Lilongwe Water Board
1994	- 27,625	- 102,549
1995	177	-19,784
1996	18,461	6,426
1997	19,431	- 26,138
1998	18,213	- 65,590
1999	32,345	- 147,730
2000	50,000	26,138

Sources: Malawi Government, *Economic Report* (various issues); Blantyre Water Board, *Annual Report and Accounts for the Year Ended 31st March 1999;* and Lilongwe Water Board, *Annual Report and Accounts for the Year Ended 31st March 1999*.

3.2. Water Consumers

Most of the major consumers in Malawi practice WDM. But the extent of WDM varied between the two types of consumers. Among private sector enterprises, WDM was motivated by the desire to minimize water bills. This is consistent with rational behaviour of firms whose objective is to maximize profit by minimizing the cost of production. Naturally, it is among these enterprises that some recycle water, in the process making significant savings on water bills. It is also only among these enterprises that some pay bonuses to their employees if the use of water is within the amount budgeted for the period and some dig boreholes to supply water for cleaning or watering plants.

Lacking the profit motive, public sector institutions are not under pressure to institute such measures. In fact even their commitment to WDM is probably short-lived, being confined to those times when there is a shortage of supply of water or when the water delivery system has broken down. Compared to public sector institutions, private sector enterprises pay more attention to the promotion of WDM awareness among their staff. In these enterprises promotion of WDM awareness is institutionalized through regular staff meetings, through international workshops (if the enterprises have links with multinational corporations) and through instructions to their staff. The former are content with notices.

The sectoral distribution of water in Malawi has been estimated to be 34 percent domestic, 17 percent industry and 49 percent agriculture and natural resources. Thus, agriculture and natural resources use about one-half of the country's water resources, mainly in the form of rainfall. Agriculture and natural resources deserve consideration not only because they are the largest user of water, but also because they are the largest sector of the economy generating about one-third of Malawi's gross domestic product. Moreover, for the foreseeable future, they are likely to remain a significant sector of the economy.

Domestic consumers consist of two categories. These categories are private sector consumers who pay for potable water individually; and public sector consumers whose bills are paid for by public institutions, either because they are employees of these institutions or because they are students or inmates or hospital patients. The latter lack the incentive to conserve water because they are not responsible for the water bills.

Industry consists of manufacturing, construction, mining and utilities. The consumption of 17 percent of the country's water resources by industry compares favourably with its contribution to gross domestic product of 19 percent. This study will focus on manufacturing because it is the largest sub-sector of industry and because it is a dynamic sector, which is bound to grow with the economy in future.

Malawi's agriculture consists of two sub-sectors, a smallholder sub-sector and an estate sub-sector. The former is three times the size of the latter in terms of contribution to gross domestic product. Whether smallholder or estate, agriculture in Malawi is largely rain-fed and covers over two million hectares of land. Water-harvesting techniques are rarely used, especially in the smallholder sub-sector. For this reason, most of the rainwater is lost through surface run-off. Smallholder farmers are encouraged to prepare boxed ridges and to use mulching, but there are no penalties for non-compliance. So smallholder farmers need not follow these farming practices. The technology used on most of the estates is probably not much better.

Discussions with stakeholders revealed that water is wasted through inappropriate methods of irrigating smallholder agricultural land. Often over- irrigating occurs, with furrows being filled with water until the ridges are submerged. Where irrigation is by flooding, as in rice fields, more than enough water is let in and the recommended depth at different stages of the crop are not observed. The absence of water pricing means that smallholder farmers have no incentive to conserve water or to change to alternative techniques, such as improved scheduling of irrigation. Smallholder farmers are also prevented from adopting more efficient technology by lack of funds and extension services.

Estate land under irrigation totals 18,000 hectares, with Dwangwa and Nchalo sugar estates accounting for 15,000 hectares. Tea, coffee, tobacco and wheat estates cover an area of 3,000 hectares. In the smallholder sector, there are 16 major irrigation schemes run by the government covering 3,500 hectares and 17 small self-help community irrigation schemes (Malawi Government, 1998). Most of the smallholder irrigation schemes are very old, having been established between 1968 and 1980. They require major rehabilitation works, including lining to prevent seepage of water. Estates must be inspected regularly to ensure that they are not violating their water abstraction rights.

The irrigation policy makes it very clear about the need to use water efficiently. But the reality on the ground is very different. Much depends on the level of education of the users as well as the amount of water

available. For example, Nchalo, a major sugar irrigation scheme in the country, hardly practices any WDM. The Company has abstraction rights for the two schemes in Nchalo in the southern region and Dwangwa in the central part of the country. At Dwangwa, most of the water is abstracted through gravity and, as such, the energy costs are reasonably lower than at Nchalo where water is pumped from the Shire River at an enormous cost.

Most of the irrigation system used in Malawi is the furrow where water is applied to the crop through open channel flow. Sprinkler irrigation is only done on estates such as the two sugar estates owned by Illovo, and the tea and coffee estates. Drip irrigation is mainly confined to agricultural research centers. It is also applied on a small scale at Wallace coffee estate in Namadzi. Technologies such as drip and sprinkler are very expensive, but farmers also need civic education to appreciate the necessity of WDM. Firstly, there is need for farmer training in water resources management so that they are able to apply sufficient amounts of water to the crop thereby avoiding wastage. This training should be mandatory, and mentioned in both the Irrigation Policy and the Water Policy. Application of water for irrigation should be done under close monitoring of extension workers or farmer group organizations.

4. CONSTRAINTS TO WDM IN MALAWI

Managing demand for water entails taking into account the value of water in relation to its cost of provision, and instituting measures which require consumers to relate their consumption more closely to that cost. It means that water must be treated more like a private good as opposed to a public good. From the field survey and literature review, the main constraints to WDM application in Malawi have so far been identified as:

- *Attitudinal*. Water is to a large extent considered to be a public good to which all people must have adequate access whether they can afford it or not. For this reason, water is supplied free of charge in rural areas and at subsidized prices to low-income households in urban areas. The source of this is the common belief that water is a gift, which God has given for the free benefit of human beings and thus no person should deny others access to water. However, it is important to note that this is common in the rural areas where cultural ideas are strong.
- *Social equity.* About 35 percent of the urban cannot afford to pay for water and is not willing to do so since it is poor. The corresponding percentage in rural areas is about 68 percent. A minimum quantity of water must be provided to them free of charge or at a low price.
- *Organizational*. The main suppliers of water in urban areas are parastatals. Economic efficiency is their objective. However, pricing for their water is subject to control by the government. So they are not free to use price as an instrument for controlling demand. Rural water is supplied through boreholes and piped water schemes by NGOs and the Water Supply Department. Financial gain or economic efficiency is not the objective of these organizations.
- *Environmental*. That charging for water would encourage people to use river or lake water which is not safe from the health standpoint and which leads to water and environmental degradation and pollution.
- *Institutional*. Include weak boards of directors, and institutional rather than individual metering and billing which reduces the incentive to conserve water.
- *Financial*. Cash flow problems of water boards caused by high levels of trade debtors, inability to obtain loans and limited eligibility for donor aid, all of which prevent them from modernizing their water distribution systems and water meters; and budgetary constraints in regulatory institutions.
- *Technological*. Use of water appliances which are inappropriate in a relatively water scarce country. Lack of spare parts for replacing worn out parts. The Regional Water Boards inherited very old and inefficient facilities from the District Water Supply Fund which was formerly responsible for supplying water in small urban areas in Malawi. These old facilities are responsible for loss of water through leakage. Then there is the attendant problem of uneven pressure in the water supply systems, which often causes pipe bursts, and faulty metres. As well, there are illegal water connections, but these are not a major problem.
- *Capacity*. Representatives of all ministries stated that staffing was inadequate at all levels and that this was adversely affecting the implementation of WDM legislation, policies and strategies. Responsible officers in the relevant ministries have had requisite university training in engineering or in chemistry or in environmental sciences. However, social scientists are virtually absent in the professional cadres of these ministries. A related institutional weakness appears to be the absence of a planning unit in the Ministry of Water Development. Once re-established, it would be desirable to have this unit manned not

only by engineers and scientists, but by social scientists as well. The internal capacity for WDM at the Water Supply Department is inadequate. But the water boards generally have adequate capacity for WDM.

- *Awareness*. In Malawi there is a general lack of awareness concerning the economic value of water, pricing, inefficient water use, water scarcity, as well as systems and procedures relating to water allocation and use rights.
- *Policy and Legal Environment*. To the extent that laws, policies and strategies do not explicitly provide for WDM, the policy and legal environment is constraining WDM in the country.
- *Political Will*. The ultimate policy-makers are politicians. So, unless, WDM has their blessing, it cannot succeed.

5. EFFECTIVE STRATEGIES FOR PROMOTING WDM

5.1 Public Awareness

In Malawi, the radio with its countrywide coverage has the largest audience; hence it can be put to effective use in the dissemination of information about WDM. Two of the current radio programmes aired by the Malawi Broadcasting Corporation (MBC) that could be utilized in this respect are: "You and the Environment" and "Madzi ndi Moyo". The former deals with environmental issues in general whereas the latter is specific to water. The Department of Environmental Affairs and the Ministry of Water Development sponsor the programmes respectively. Privately owned radio stations such as FM 101 and Capital FM could also be used in the dissemination of WDM messages. In addition to the radio, TV Malawi (the country's only TV station) could also be used in promoting WDM. Both radio and TV programmes could either take the form of panel discussions, documentaries, and presentation of specifics topics on WDM. For example, on the last approach, the presenter could talk about water rationing, explaining what it is, why it is sometimes necessary to implement it and pointing out benefits of effecting water rationing. After the presentation, listeners would then be invited to ask questions or make comments on the subject through a phone-in slot.

5.2 Capacity Building

One of the major hindrances to the promotion of WDM in Malawi by the Water Boards and the Ministry of Water Development is inadequate financial and human capacity to implement WDM strategies. The country does not have enough trained personnel to carry out tasks pertaining to WDM, both at the technical and professional levels. The lack of financial resources has only helped to exacerbate the situation. Therefore there is a need to recruit and train personnel in WDM, and to source funding for the implementation of WDM activities.

5.3 Technological Development

The technical aspects of WDM entail retrofitting (i.e. the installation of low water use appliances, for example, using push-taps instead of ordinary taps) and the implementation of water saving measures (e.g. leakage control and monitoring, water rationing, etc). Another example of retrofitting would be the replacement of sprinklers used in irrigated agriculture by drip irrigation facilities. However, the initial investment costs for retrofitting are generally prohibitively high. Hence, it is not surprising that the levels of adoption are very low. As pointed out in Goldblatt, *et al* (2000) technology change is important in improving water use efficiency, but it needs to be driven by appropriate incentives; and cannot easily be imposed on consumers. Therefore this change calls for a thorough assessment of the level of adoption of the technology and its cost implications before it is installed. This must be promoted through civic education and making selling the technology at affordable prices without necessarily encouraging subsidies.

At the household level, large amounts of treated water are lost through toilet flushing. This water wastage can be minimized with the introduction of flush toilet units that use water sparingly without compromising the efficiency of the system. Even water supply utilities in Malawi, such as the Blantyre Water Board, realize that the water currently being used for toilet flushing is more than adequate for the purpose. For example, during periods of water scarcity (e.g. during the 1991/92 drought period), consumers were advised to put two standard bricks in the tanks of the flush toilet units in a bid to conserve water. It may be necessary to consult the Malawi Industrial Research and Technology Development Center (MIRTDC) for an appropriate design for flush toilet units. All these technological approaches to reducing water wastage should be complemented with cleaner production strategies whereby efficient utilization of water resources is promoted.

Hosepipe ban is another standard approach instituted even in developed countries for conserving water resources. Although hosepipe bans may be implemented once in a while e.g. once in 100 years, the frequency with which they are effected is dependent on the recurrence of water shortages. These bans include stopping consumers from using water for irrigating lawns and gardens, washing cars, and operating swimming pools during periods of acute water shortage. Experience in Malawi has shown that hosepipe bans are more often violated than not. The country's legal framework is generally weak when it comes to effecting hosepipe bans as evidenced by several violations that go unpunished.

Rainwater harvesting is one of the technologies that can go a long way in sustaining the availability of water for domestic consumption. Rainfall harvesting involves the collection and storage of rainwater before it is lost through evaporation and surface runoff. This can be achieved in a number of ways, for example the collection of rainwater into bamboo cement rainwater tanks as commonly done in Asia or rainwater collection directly from roofs in drums. Although rainfall harvesting is a common practice in many developing countries, Malawi has not extensively exploited this practice of water conservation. Therefore the rainwater-harvesting project that was initiated by the Meteorological Department in the 1980s and handed over to the Ministry of Agriculture for implementation should be revived as a matter of urgency. This project was specifically initiated to assess the feasibility of using rainwater-harvesting technologies for irrigated agriculture.

Consumer care is another technological aspect that can help in reducing water wastage. For example, it is common in Malawi for the Water Boards to advise consumers to use the shower during periods of water scarcity as opposed to the bathtub. Normally, a person uses less water for bathing by using a shower than a bathtub. In addition, a consumer is bound to use more water for brushing teeth when using a running tap than when he / she uses a cup filled with water. These are some of the technical measures that should be put in place by consumers in order to efficiently use the available water for personal hygiene.

5.4 Water Recycling

Wastewater recycling is another water conservation measure that is worth exploring in Malawi. Recycling wastewater is one of the practices commonly adopted in order to boost domestic water supplies. The Malawi Government should therefore explore the potential for wastewater recycling. It was pleasing to note during the interviews that Southern Bottlers is using water recycling in its production process.

5.5 Leakage Monitoring and Control

Leakage monitoring and control in pipe reticulation systems is critical in ensuring the efficient performance of the system. Pipe systems are commonly used for distributing water to areas of consumption. If pipes are worn out, large volumes of treated water may be lost through leakage as a result of high pressures of flow. Leakage control is possibly one of the most difficult tasks for water engineers. Even in developed countries, about 15-20% of the distributed water is lost through pipe leakage. It is therefore important to ensure that leakage monitoring and control is given the attention it deserves by all water supply authorities and consumers. It was interesting to note through the interviews that Blantyre Water Board regularly conducts leak-detection inspections in its pipe networks. In addition, visits are also made to establishments such as industries to check leaking pipes and taps. When leaks are detected, corrective measures are immediately taken by the technical teams to redress the situation. Another form of leakage that is proving illusive to control in the areas being serviced by the Water Boards is the illegal connection to houses, which results in large losses of water supply. Intensive inspection campaigns of pipe networks and civic education are some of the practical solutions to this problem.

The performance of water supply facilities such as boreholes and hand-dug wells may be greatly impaired by corroded pipes and by gravel filter clogging (due to bacterial activity and the accumulation of silts in these water points). These water supply facilities therefore need rehabilitation if they are to perform efficiently in water delivery services. It is therefore encouraging to note that the Ministry of Water Development is carrying out a nationwide borehole rehabilitation programme. This campaign will go a long way towards sustaining the performance of several water points, which are now not being utilized. Not only is this rehabilitation programme confined to boreholes and hand dug wells, but also to some gravity fed rural piped water supply schemes as well. Some of the water supply schemes being operated by the Water Boards are also being considered for extension and rehabilitation.

5.6 Policy and Institutional Changes

The current Water Policy and Strategies (1999) does not explicitly address issues of water demand management. It is therefore advisable that future polices should take WDM into account, spelling out its significance as a water resources management tool. Even where WDM principles are implied, their

implementation leaves a lot to be desired, as there is very little adherence to the regulations by the clients or consumers. For example, the Water Resources Board is responsible for the granting of water rights and the discharge of effluents to clients. Yet the organization has inadequate capacity to monitor and enforce the regulations. This weakness has encouraged many unscrupulous industries to illegally discharge effluents in rivers, especially those flowing through the cities, leading to serious pollution. The Mudi River in the City of Blantyre bears testimony to this scenario. It may even be possible that more water is in some cases being abstracted than what is certified by the water right issued by the Water Resources Board.

6. CONCLUSION AND RECOMMENDATIONS

The foregoing paper has examined the status of water demand management in Malawi. Three conclusions can be made from this. First, although Malawi boasts adequate water resources, the growing population, recurrence of drought, expanding industrial demands, the existence of contested shared water resources and degree of poverty makes the adoption of water demand management strategies is imperative. Second, water demand management principles are highly appreciated among the private stakeholders than the public institutions. Third, the promotion of water demand management in Malawi is mitigated by social factors. The background of poverty, traditional values of water, and centralized management of water resources mitigates heavily on water demand management measures. The following recommendations have been suggested for the success of WDM in Malawi.

- **Policy Review:** The Ministry of Water Development should consider revising the water policy so that it incorporates principles of WDM. The policy must also state the strategies for achieving and monitoring the implementation of WDM.

- **Capacity Building**: Efforts must be made to train staff in the Ministry of Water Development as well as in water supplying institutions in WDM. Such education must emphasize the significance of WDM in sustainable water resource management and must also promote a change in peoples' cultural attitudes towards water resources.

- **Public Awareness**: Public awareness campaigns on water conservation must be encouraged. Both the print and electronic media in Malawi should be utilized to accomplish this task. There is also need to encourage water suppliers to prevent water losses through leakages and unaccounted losses. Awareness must particularly be targeted at consumers at the household level and at public institutions.

- **Economic Measures:** Appropriate pricing of water should be used as economic means of controlling demand for water. Such pricing mechanism must reflect the economic value of the commodity and the full cost of providing it. It must also cover water supplied by all types of providers: water board, water supply department, NGO and private. A change in attitude is also required among some public institutions that provide essential services but do not give priority to water bills. Appropriate economic measures must be enforced for non-payment of water bills in order to avoid water wastage.

- **Technology**: Malawi must seriously consider introducing appropriate technology that does not use more water than required, such as automatic or push taps, automatic urinals and the compartmentalization of tanks for toilet units. This must meet the needs of both individual and institutional water consumers. Another important technology for Malawi is rainwater harvesting: Although it is a common practice in many developing countries, Malawi has not extensively exploited this practice of water conservation. Appropriate rainfall-harvesting technology must be developed and adopted in rural areas in order to collect and store rainwater before it gets lost through evaporation and surface runoff.

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