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WATER DEVELOPMENT****Malawi Water Sector  
Investment Plan****Volume II****31 May 2012**

# **Malawi Water Sector Investment Plan**

## **Volume II**

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## Acronyms, Abbreviations, and Definitions

AfDB	African Development Bank
AWM	Agricultural Water Management
BWB	Blantyre Water Board
CRWB	Central Region Water Board
Development Partners	Bilateral or multilateral entities that provide external funding and support to the WSSI sector
EIB	European Investment Bank
EU	European Union
FAO	Food and Agriculture Organization
FY	Financial Year
GBI	Green Belt Initiative
Government	Government of Malawi
IBRD	International Bank for Reconstruction and Development
IFAD	International Fund for Agricultural Development
IHS	Integrated Household Survey
IRD	Integrated Rural Development
IRLAD	Irrigation, Rural Livelihoods, and Agriculture Development Project
JICA	Japan International Cooperation Agency
LWB	Lilongwe Water Board
MBS	Malawi Bureau of Standards
MDGs	Millennium Development Goals
MDHS	Malawi Demographic and Health Survey
MGDS I	Malawi Growth and Development Strategy (2006-2011)
MGDS II	Malawi Growth and Development Strategy (2011-2016)
Ministry of Finance	Ministry of Finance and Development Planning
MK	Malawi Kwacha
MoAIWD	Ministry of Agriculture, Irrigation, and Water Development
MoIWD	Ministry of Irrigation and Water Development
NGO	Non-Governmental Organization
NIF	National Irrigation Fund
NRW	Non-Revenue Water

NRWB	Northern Region Water Board
NWDP	National Water Development Programme
NWDP I	First National Water Development Project (1996-2003)
NWDP II	Second National Water Development Project (2007-2015)
O&M	Operation and Maintenance
PER	Public Expenditure Review
PSIP	Public Sector Investment Programme
Rural	Areas in which inhabitants are <i>not</i> supplied water services by one of the five Water Boards
SHIP	Smallholder Irrigation Project
SPR	Sector Performance Report
SRWB	Southern Region Water Board
SWAp	Sector Wide Approach
UNICEF	United Nations Children's Fund
Urban	Areas in which inhabitants are supplied water services by one of the five Water Boards
WASH	Water, Sanitation, and Hygiene
WFP	World Food Programme
WHO	World Health Organization
WMS	Welfare Monitoring Survey
WRIS	Water Resources Investment Strategy
WSIP	Water Sector Investment Plan
WSS	Water Supply and Sanitation
WSSI	Water Supply, Sanitation, and Irrigation
WUA	Water User Association

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This Report was created through a collaborative process. This included a number of workshops in Lilongwe and a workshop in Liwonde. Participants at these workshops made comments that greatly contributed to the final version of the report. Inputs were received from staff in the Ministry of Agriculture, Irrigation and Water Development, staff from the Water Boards, representatives of the donor community, and NGOs.

Castalia Advisors assisted with the preparation of this report. Castalia is an international consulting firm specializing in the development and financing of infrastructure. Castalia has offices in Washington, DC (United States), Paris (France), Sydney (Australia) and Wellington (New Zealand) and has undertaken assignments in over 60 countries. Our multi-disciplinary staff brings together skills in economics, finance, law, policy, and project management. Castalia specializes in developing strong institutional frameworks for the provision of infrastructure, including investment appraisal, design, implementation and support for effective PPP arrangements. For over a quarter of a century we have remained true to our commitment to building strong institutions that combine the strengths of the public and private sectors to deliver basic services to people who need them. For more information see <http://www.castalia-advisors.com/>

## Introduction to Volume II

This Volume of the Water Sector Investment Plan (WSIP) includes supplemental information that should be taken into consideration as part of future work in the sector. This Volume is structured as follows:

**Public Expenditure Review: Water Supply, Sanitation, and Irrigation Sector**

(page 2)—Assesses the size, distribution, and effectiveness of public spending in the WSSI sector between 2006 and 2010

**Monitoring and Evaluation in the Water Sector** (page 51)—Gives an introduction to monitoring and evaluation in the water sector, and outlines a way to develop an M&E system for the water sector in Malawi

**A Summary of Work in Water Resources Management** (page 78)—Summarizes and comments on the key findings of the Water Resources Investment Strategy (WRIS), the most recent work in Water Resources Management in the sector

**Terms of Reference: Preparation of an Irrigation Investment and Financing Plan** (page 98)—Details the terms for subsequent work in irrigation and agricultural water management.

# Public Expenditure Review: Water Supply, Sanitation, and Irrigation Sector

## Executive Summary

Public Expenditure Reviews are core diagnostic studies intended to show how public resources are allocated and used, thereby promoting a more efficient, effective, and transparent allocation and use of resources. This is a Public Expenditure Review (PER) of the Water Supply, Sanitation, and Irrigation (WSSI) sector of Malawi **from 2006 to 2010**. The review includes an explanation of the sources of funds for covering recurrent costs and capital investments, for each of the main entities that have a role in sector expenditures. In addition to explaining the nature of expenditures over the review period, the report assesses how efficiently and effectively funds have been applied in the context of the stated growth objectives of the Government of Malawi. It identifies scope for improvement and gives recommendations for its achievement.

Funding in the WSSI sector of Malawi comes from: the Government of Malawi; Development Partners; community members; capital contributions by customers of the Water Boards; cash generated through the operations of the Water Boards; and loans to the Water Boards from commercial banks. This PER categorizes sector expenditure as follows:

- **Government**—this category includes expenditure that is reflected in the records of the Ministry of Finance. Although the Government receives some budgetary support from Development Partners for the sector, those amounts are categorized here as ‘Government’ spending
- **Development Partners**—this category captures the amount of external funding that was disbursed in the sector as support to specific projects, rather than to the Government’s budget. Development Partners may disburse funds to a variety of entities that are responsible for the final execution of a project. Regardless of which entity was this “end-spender,” these funds are categorized according to their source. This category does *not* include grants and loans made to the Water Boards by Development Partners, which are captured in the ‘Water Boards’ category. Finally, this category includes contributions from community members to Water, Sanitation and Hygiene (WASH) activities, which accounted for one percent of total expenditure in Water Supply and Sanitation (WSS). All of the funds from this category went towards capital investments.<sup>1</sup>
- **Water Boards**—this category includes the amounts spent by the five Water Boards to cover recurrent costs and to make capital investments. The sources of funds for this spending include capital contributions from customers, cash from operations, commercial loans, and loans and grants from the Government or Development Partners (see Section 3.2 for a discussion of funding to the Water Boards from the Government and Development Partners).

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<sup>1</sup> Although it is possible that funding disbursed to an entity to execute a project may have been put towards the coverage of recurrent costs, data was not available to analyze at this level of detail.

Between 2006 and 2010, Government expenditure in the sector more than tripled; total expenditures by the five Water Boards nearly doubled; and capital investments funded by Development Partners tripled. This led to an increase in annual spending in the sector from US\$50 million in 2006 to US\$126 million in 2010. Total expenditure—the sum of funds spent to cover recurrent costs and to make capital investments—between 2006 and 2010 amounted to US\$388 million. Of this total, 75 percent (or US\$292 million) was spent in the WSS sub-sector and 25 percent, or US\$96 million, was spent in the irrigation sub-sector. As seen in the table below, the analysis of this PER is separated for the two sub-sectors, and a distinction is made in the WSS sub-sector for investments made in Urban areas, and those made in Rural areas.

**Total Expenditure in Water Supply, Sanitation, and Irrigation in Malawi from 2006 to 2010, in millions of US dollars**

	Urban	Rural	Total	% Sector Total
<b>Water Supply and Sanitation</b>	181	111	292	75
<b>Irrigation</b>	0	96	96	25
<b>Total</b>	181	207	388	

Source: Analysis by Castalia, based on data provided by the Ministry of Finance

Urban in this PER refers to those populations that are within a service area of a Water Board. Urban expenditure thus includes the category of Water Boards, and Government spending that was classified as ‘urban’ in the expenditure records of the Government. Rural thus refers to the categories of Development Partners, and Government spending that was classified as ‘rural.’

**Expenditures in Urban Water Supply and Sanitation**

Out of the total expenditure on water supply and sanitation, US\$181 million, or 62 percent, was spent in Urban areas. The Government accounted for one percent of this US\$181 million, and the Water Boards for the remaining 99 percent.

The general increase in funds available over the review period allowed for an increase in capital investments by the Water Boards. Capital investments by the Water Boards increased from US\$4 million in 2006 to US\$10 million in 2010. This investment allowed the Water Boards to increase the number of connections, in order to keep up with the growing urban population over the period. Almost all of this investment was directed towards water supply, with little going into sanitation.<sup>2</sup> The proportion of the urban population with access to improved sanitation did not change over the period.<sup>3</sup> Unfortunately, despite increases in

<sup>2</sup> Blantyre and Northern Region Water Board Annual Reports; Lilongwe Water Board Corporate Plan 2008-2013.

<sup>3</sup> UN Statistics Division, Department of Social and Economic Affairs, MDG Indicators 7.8 and 7.9 under Target 7.C of Goal 7 for Malawi (results grouped by indicator). Available at: <http://mdgs.un.org/unsd/mdg/Data.aspx>.

spending, the rate of waterborne diseases appears to have increased in urban areas over the period.<sup>4</sup>

### **Rural Water Supply and Sanitation**

Out of the total expenditure on water supply and sanitation between 2006 and 2010, approximately 38 percent was in rural areas, where 84 percent of Malawi's population lives.<sup>5</sup> Rural spending on water supply and sanitation totaled US\$111 million, 25 percent of which was funding from the Government, and 75 percent funding from Development Partners. Development Partners contributed US\$83 million to rural WSS between 2006 and 2010.

Government expenditure in rural water supply and sanitation was more than six times greater than in urban areas. From 1990 to 2009, access to improved water in rural areas increased from 33 to 77 percent.<sup>6</sup> Over the same 18 year period, access to improved sanitation increased at a slower rate (from 41 to 50 percent). The proportion of the population suffering from diarrhea, another indicator of access to either improved water or sanitation, remained nearly unchanged over the period.<sup>7</sup>

### **Irrigation**

Between 2006 and 2010, expenditure on irrigation in Malawi totaled US\$96 million. Of this, 87 percent was possible because of funding from Development Partners. The rest of the expenditure was from Government funds. These expenditures in irrigation contributed to increasing the land under irrigation by approximately 38 percent over the period, from 65,000 to 90,000 hectares, or 56 percent of total irrigable land.<sup>8</sup> This means that capital investment per added hectare over the review period was approximately US\$3,700. This number seems high—according to a recent World Bank study on irrigation investment in Sub-Saharan Africa, investment costs per hectare should be about US\$1,000.<sup>9</sup> Despite these apparently high costs, it is reported that investment has been more effective in the last five years. Before 2006, investments in irrigation had failed due to a lack of Government capacity

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<sup>4</sup> The National Statistics Office, Welfare Monitoring Survey 2006 and 2009. The percentage of the urban population with diarrhea in the previous two weeks increased from 0.7% in 2007 to 0.99% in 2009.

<sup>5</sup> According to most recent household data, from the 2010 Malawi Demographic and Health Survey.

<sup>6</sup> 2009 is the most recent year that data was gathered for this indicator, as part of the Welfare Monitoring Survey of the National Statistical Office of Malawi.

<sup>7</sup> The National Statistical Office, Welfare Monitoring Survey 2005 and 2009. The percentage of the rural population with diarrhea remained at just under two percent.

<sup>8</sup> This is the increase from 2005-2009. Malawi Irrigation, Water, and Sanitation 2010 Sector Performance Report, Ministry of Irrigation and Water Development, Government of Malawi, May 2011, 26. The FAO reports that the irrigation potential of Malawi is 161,900 hectares.  
[http://www.fao.org/nr/water/aquastat/countries\\_regions/malawi/tables.pdf#tab1](http://www.fao.org/nr/water/aquastat/countries_regions/malawi/tables.pdf#tab1). The FAO study takes into account land suitability and water availability. Other studies estimate irrigable potential as large as 485,000 hectares.

<sup>9</sup> Summary of Background Paper 9, Africa Infrastructure Country Diagnostic: Irrigation Investment Needs in Sub-Saharan Africa, Environment and Production Technology Division of the International Food Policy Research Institute (IFPRI), June 2008



to manage irrigation schemes, attributable to budget constraints. This was partially overcome during the study period through increased community involvement in irrigation projects.<sup>10</sup>

### **Conclusions from the Public Expenditure Review**

The WSSI received a substantial increase in funding during the period from 2006 to 2010. This increased funding led to significant capital investments, much of which produced positive results, particularly through expanding the level of access to water supply. The Second National Water Development Project—the largest, and arguably the most important, project in WSSI in Malawi—is indicative of the improvement of the effectiveness of projects and the results of the capital investments in the sector. According to the World Bank:

*The project has been rated as satisfactory in its likelihood to meet its development objectives and its implementation progress for all 9 Implementation Status Report (ISRs), including the most recent ISR posted in March 2011. The project has produced measurable impacts: It is estimated that 510,000 people have benefited from new or rehabilitated water supply as a result of the project as of December 2010 and a strong pipeline of water resources projects is being developed for future priority investments.*<sup>11</sup>

Achieving the Government's objectives in water supply, sanitation, and irrigation will require increasing the amount of capital investments and also ensuring that the efficiency and effectiveness of those capital investments improves. This is underlined by the fact that, despite recent increases in spending, improvements in water supply, sanitation, and agricultural outputs have lagged somewhat behind expected targets. This is particularly true for sanitation. For example, the World Bank in its Project Paper for additional financing for the Second National Water Development Project dated 4 May 2011, indicates:

*The project has lagged in achieving the targets relating to sanitation due to poor formulation of the sanitation targets and constrained leadership in MoIWD, among other reasons; however this is largely due to the way the sanitation indicator has been formulated, and this has been changed in the Additional Financing. (page 3)*

Rural water supply and the rehabilitation of irrigation schemes have also performed less well than expected.<sup>12</sup> Furthermore, there also remains large potential to increase the supply of piped water in urban areas and to improve the operating efficiency—and financial performance—of the Water Boards.

There is considerable scope to improve the approach for allocating funds for capital investments among proposed projects in the WSSI sector. The current approach selects projects based primarily on their alignment with the Government's development objectives, as stated in the Malawi Growth and Development Strategy (MGDS). For selecting which projects to fund within a sub-sector, criteria based on cost-effectiveness of projects would

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<sup>10</sup> Report and Recommendation of the President to the Executive Board on a Proposed Loan to the Republic of Malawi for the Irrigation, Rural Livelihoods and Agricultural Development Project, International Fund for Agricultural Development, 23 November 2005, 2. Available at: <http://www.ifad.org/gbdocs/cb/86/c/EB-2005-86-R-18.pdf>.

<sup>11</sup> The World Bank, "Project Paper on a Proposed Additional Credit in the Amount of SDR 60 Million (US\$95 Million Equivalent) and a Proposed Additional Grant in the Amount of SDR 15.8 Million (US\$25 Million Equivalent) to the Republic of Malawi for a Second National Water Development Project", 4 May 2011, 3.

<sup>12</sup> Malawi Irrigation, Water, and Sanitation Sector Performance Report, Ministry of Irrigation and Water Development, Government of Malawi, May 2011, 27.

increase the impact of capital investments on water service levels and agricultural outputs. For the selection of projects between sub-sectors, it is recommended that a method of cost-benefit analysis be adopted. Since irrigation is clustered with water and sanitation strategies, proposed projects from each of these sub-sectors compete for funding within the same sector. Volume IV of this Working Paper offers such guidelines for investment in the sector.

Finally, cost overruns have been a key challenge during the implementation of the Second National Water Development Project. These cost overruns were related to external factors, but also to the processes and procedures in place for evaluating and procuring the projects, as indicated by the following quote from the World Bank in its Project Paper on a Proposed Additional Credit for the Second National Water Development Project:

*During the implementation of NWDP II GoM has experienced considerable cost overruns due to the volatility of global prices over this period and lack of attention to updated costing during preparation. Cost volatility has been driven by global factors such as escalating oil prices (which impacts most works, goods and services procured by the project) and regional factors such as the impact of the World Cup in South Africa that pushed up prices in the regional local markets. At the same time, many of the contracts included in the procurement plan were based on out-of-date feasibility studies and cost estimates that were not adequately updated prior to bidding.*

In sum, despite some difficulties (such as cost overruns), the increased capital investments in the sector have expanded access to water supply and helped put in place a process that is leading to a more effective mechanism for identifying, selecting, and developing projects in WSSI.

### **Structure of the Public Expenditure Review**

In the remainder of this Public Expenditure Review we present sections on:

- Allocating investments in water supply, sanitation, and irrigation (Section 1)
- Reviewing expenditures in water supply and sanitation (Section 2)
- Reviewing performance in water supply and sanitation (Section 3)
- Reviewing expenditures in irrigation (Section 4)
- Reviewing performance in irrigation (Section 5)

# **1 Allocating Investments in Water Supply, Sanitation, and Irrigation**

The process for selecting projects in WSSI in Malawi depends on the source of funding. Projects funded by Development Partners have to be approved by three participants: the Development Partner, the Ministry of Agriculture, Irrigation, and Water Development (MoIWD), and the entity that will execute the project<sup>13</sup>. Projects funded from the Government's budget are mainly selected by the entity that will execute the project, such as one of the Water Boards, or a District Assembly. The Government provides funding to these entities; they then determine internally how funds will be allocated.

Irrespective of the source of funding, there are a few established principles used to guide investment decisions in the sector. At a minimum, all projects are supposed to be demand-driven and consistent with the MGDS and, where funded by Development Partners, the internal standards of the Development Partners. Beyond that, a wide range of criteria appear to be used by executing entities for deciding which projects should be proposed for funding.

These criteria may include whether there is a gap between the size of the community and the facilities available, project costs, and political considerations. Many of the selection criteria would fit easily into an economic analysis of benefits and costs. However, our understanding is that these criteria are not applied systematically across projects. This suggests that projects may be selected for funding even if they are not the most efficient or effective way of achieving the Government's objectives for the sector.

## **1.1 General Criteria that Projects Must Satisfy**

According to the Government's policies, projects in the WSSI sector must satisfy certain broad criteria. They must be in line with the MGDS and demand-driven. The Ministry responsible for Water Supply and Sanitation aims to ensure that only projects that satisfy a real need are funded. One way it does this is by requiring that communities request the development of facilities, and contribute to their construction and operation. This approach is intended to ensure the upkeep of the facilities.

The first step in ensuring that a facility is demand-driven is requiring that the community request the facility be built. In rural areas, communities express their interest to the District Development Planning Office through traditional authorities or Members of Parliament. In urban areas, community members communicate with the Water Board that services the area.

In addition to requesting the facility, communities are often asked to contribute to the costs of constructing and operating the facility. In some cases, community members must contribute labor and materials to the construction of the project. In other cases, the community is expected to establish the governance structures required to maintain and operate the facility, before construction begins. This is an important way of demonstrating that the beneficiaries are committed to the facility. At a minimum, before construction begins, the community is supposed to demonstrate it is willing and able to pay fees to cover the expected operating and maintenance costs of the project.

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<sup>13</sup> Furthermore, the Ministry of Finance is responsible for approving all projects with Development Partners that create an obligation on the Government.

## 1.2 Process and Criteria for Selecting Projects Funded by Development Partners

A significant portion (over 40 percent) of capital investment in Malawi's water supply, sanitation, and irrigation sector is funded by Development Partners. As illustrated in Figure 1.1, the process for securing funding from Development Partners consists of three steps:

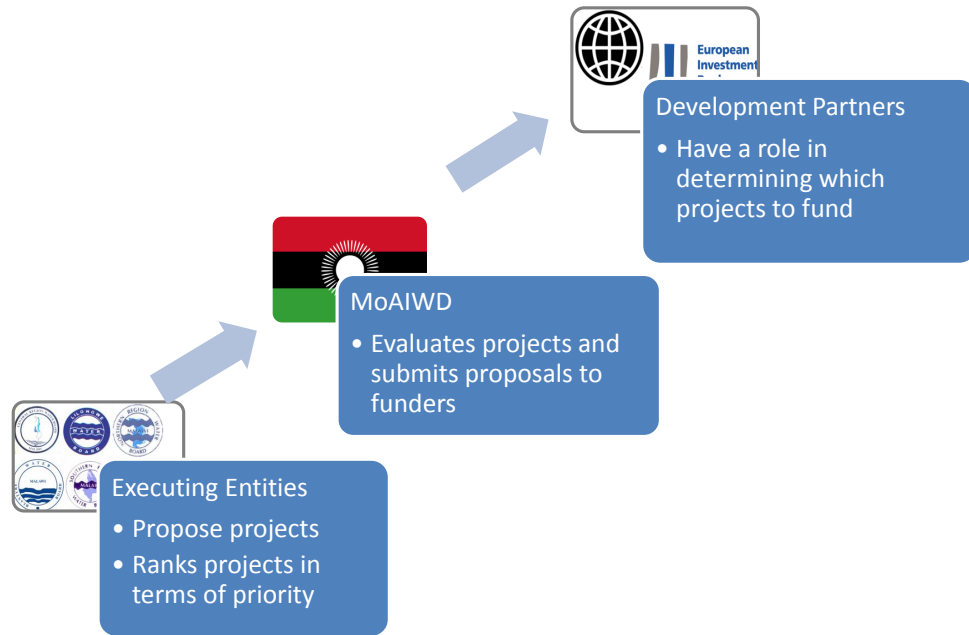
- **Executing entities propose projects to the Ministry responsible for Water Supply and Sanitation**—the entity that will execute a project proposes its ideas to the Ministry. If it proposes multiple projects, they are often ranked according to priority.
- **Ministry responsible for Water Supply and Sanitation selects projects**—the Ministry reviews the proposed projects and determines which ones should be awarded funding. In the case of the NWDP, the Ministry mainly follows the ranking provided by the Water Boards to determine which projects should be funded from the available budget
- **Development Partners decide whether to provide funding**—The MoAIWD, in conjunction with and following the approval of the Ministry of Finance, provides the related project or program information to the Development Partners for their consideration. Development Partners determine whether an individual project, or a program as a whole (for example, a multi-project program such as the NWDP II), satisfies their internal criteria. In the case of the NWDP II, the World Bank evaluated the overall program and determined that it was financially sustainable and had a sufficiently high economic return to justify providing funds.<sup>14</sup>

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<sup>14</sup> World Bank, 2007 "Project Appraisal Document on a Proposed Credit in the amount of SDR 15.0 million (US\$22.5 million) Equivalent to the Republic of Malawi for a Second National Water Development Project," April 27, 2007

**Figure 1.1: Process for selecting projects funded by Development Partners**

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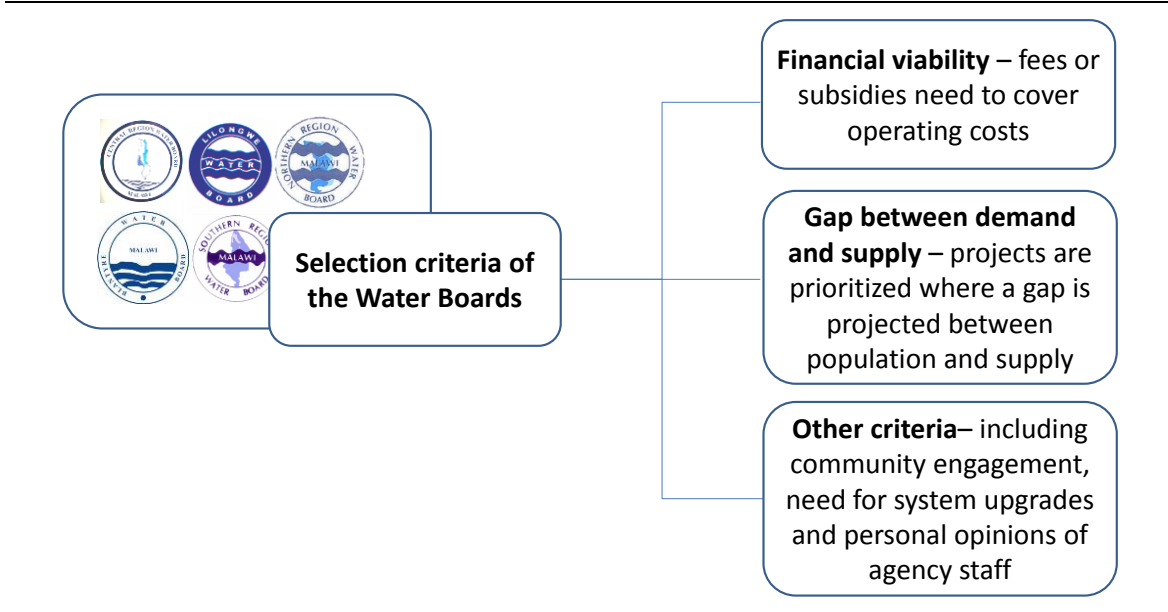


The MoAIWD may also be an executing entity.

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The key step in the process is the development of project ideas by the executing entities. This is illustrated in Figure 1.2, which shows the criteria that we understand are used by the Water Boards to evaluate ideas for projects. This includes the financial impact on the Water Board, the need for the project, and other criteria such as political considerations. While these criteria are used to evaluate projects, it does not appear that they are applied in a systematic way in the ranking process.

**Figure 1.2: Selection criteria of the Water Boards**



### **1.3 The Process and Criteria for Selecting Projects Funded by the Government**

The process appears to be less formal for projects funded with the Government's own funds. However, the Government gives consideration to the benefits and costs of a proposed project. In particular, the Government expects that every public investment program or project will undergo the PSIP appraisal and screening process.<sup>15</sup>

As an example, earthen dams are a category of projects that is typically funded from the Government's Budget and executed by the Ministry responsible for Water Supply and Sanitation. We understand that the Ministry receives eight to ten requests for dams per year, of which it is only able to fund between three and five. Requests are first screened on the basis of whether the site is appropriate for a dam. Out of the sites that are appropriate, projects are selected based on the comparison of cost and the number of people that will be served.

The Water Boards also execute some projects with Government funding. These are typically relatively small, often less than US\$100,000 in value. The Water Boards first develop the project—for instance, for pipe replacement projects, extension of service, or maintenance works. They then propose project ideas to the Ministry. Once a Government budget is approved, the Ministry endorses the proposals in line with the available budget.

<sup>15</sup> The Public Sector Investment Programme 2010/11-2014/15.

## 2 Reviewing Expenditures in Water Supply and Sanitation

Expenditures in the water supply and sanitation (WSS) sub-sector can be categorized as those that cover recurrent costs, or those that go towards capital investments. For the Government bodies that operate in water supply and sanitation, recurrent costs include salaries and other expenses associated with day to day operations. For the Water Boards, recurrent costs are equivalent to operating expenses. Capital investments can include expenditure for the construction or rehabilitation of sector infrastructure, training and capacity building for sector leaders, and awareness campaigns for sanitation. For the purposes of this review, we have not included any outlays for servicing debt.

This PER disaggregates spending in the WSS sub-sector into the categories of Urban and Rural. **Urban** includes urban expenditure by the Government, and all expenditure by Water Boards. Since some of the Water Boards received grants from external sources during the review period, Urban also includes some contributions from Development Partners (about US\$8 million from 2006 to 2010). The **Rural** category includes rural expenditure by the Government, as well as all expenditures that were possible because of Development Partner funding that was not channeled through the Water Boards.<sup>16</sup>

Over the period from 2006 to 2010, spending in the Water Supply and Sanitation sub-sector amounted to approximately US\$292 million, with expenditure in 2010 more than double the amount in 2006. Of this total expenditure:

- Recurrent costs, and capital investments, each accounted for 50 percent
- Spending in Urban areas accounted for 62 percent (or US\$181 million), with the remaining 38 percent (or US\$111 million) spent in Rural areas
- The Government contributed 10 percent, the Water Boards 61 percent, and Development Partners 29 percent.

Table 2.1 provides an overview of the distribution of expenditures in water supply and sanitation for the period from 2006 to 2010.

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<sup>16</sup> This is a slight approximation. There is some funding from Development Partners in Urban areas that is not captured in the expenditures of Water Boards. For example, Development Partners may fund the development of boreholes in urban areas, without going through the Water Boards. The data provided for this review was not specific enough to allow for an estimation of the size of Development Partner contributions in Urban areas beyond the amounts given to Water Boards.

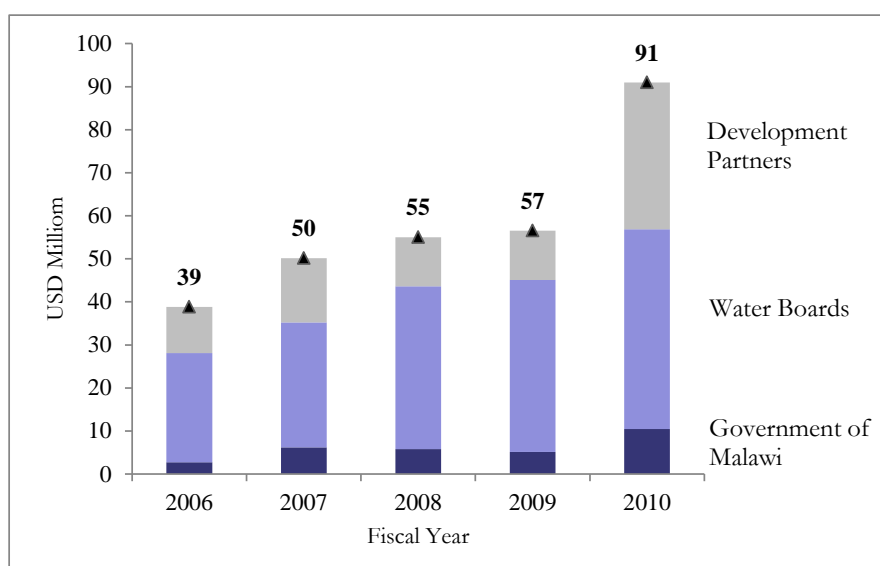
**Table 2.1: Distribution of Expenditures in Water Supply and Sanitation (2006-2010), in US\$ million**

	Recurrent Costs	Capital Investments	Total
Urban	144	37	181
Rural	2	109	111
Total	146	146	292

Source: Analysis by Castalia, based on data provided by the Ministry of Finance

Figure 2.1 below shows the evolution of the composition of funding of total expenditure on water supply and sanitation from 2006 to 2010.

**Figure 2.1: Evolution of Sources of Funds for Expenditures in Water Supply and Sanitation**



Source: Analysis by Castalia, based on data provided by the Ministry of Finance

It is clear that the five Water Boards account for the largest share of expenditures in Malawi's water supply and sanitation sub-sector, at 61 percent of total sub-sector expenditure between 2006 and 2010. The Water Board expenditures in this PER are based on the operating costs and capital expenditures reported by each company in its annual financial statements.

Since the Water Boards may receive funding from the Government of Malawi and Development Partners, 'Water Board' expenditure values include a portion from these two sources. From 2006 to 2010, the approximate contribution of the Government to Water Boards was US\$3 million. The corresponding figure for Development Partners was US\$8

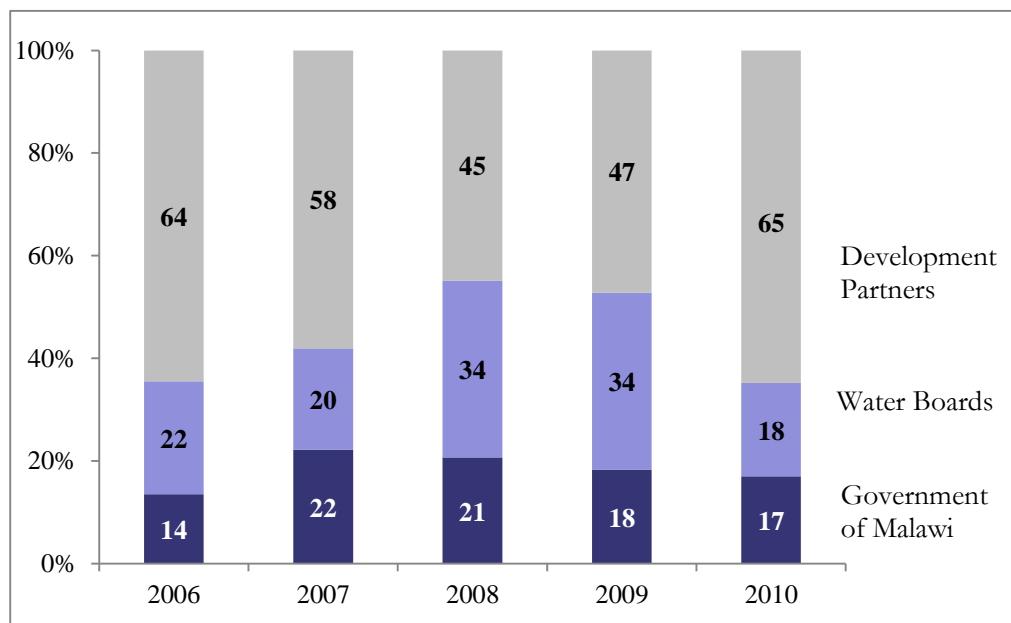


million<sup>17</sup>. Since the Water Boards are the entities that execute the projects funded by these sources, this PER categorizes Government of Malawi and Development Partner funding that was channeled through the Water Boards as ‘Water Board’ expenditure. An adjustment for these amounts changes the proportion of expenditure attributable to the Water Boards from 61 to 57 percent. Notwithstanding this detail, the Water Boards accounted for the majority of total spending on water supply and sanitation in Malawi from 2006 to 2010. 80 percent of expenditures by the Water Boards were used to cover recurrent costs (the majority of this being through cash collected from customers), and the remainder was used for capital investments.

### Capital Investments in Water Supply and Sanitation

Between 2006 and 2010, capital investments in water supply and sanitation more than tripled and totaled approximately US\$146 million. The majority of these capital investments—around US\$83 million or 57 percent—were possible because of funding from Development Partners. Various bilateral and multilateral entities funded 45 percent or more of capital investments every year (see Figure 2.2).

**Figure 2.2: Percent Contributions to Capital Investments in Water Supply and Sanitation**



Source: Analysis by Castalia, based on data provided by the Ministry of Finance and on the financial statements of each Water Board

The majority of Development Partner funding went to two areas:

- the Second National Water Development Program (NWDP II)
- Water, Sanitation, and Hygiene (WASH) activities.

<sup>17</sup> This amount reflects grants given to Water Boards. Multilateral loan amounts were not included, as it is assumed they will be repaid by the Water Boards.

The overall development objective of the NWDP II is to increase national access to sustainable water supply and sanitation services, and improve water resources management at the national level.<sup>18</sup> Between 2006 and 2010, the World Bank contributed US\$37 million to the NWDP II. The African Development Bank contributed nearly US\$4 million. Following the end of the first NWDP in 2003, the NWDP II began in 2007 and is scheduled to close in 2015.

The Government coordinates a number of WASH activities nationwide, for which it receives support from Development Partners. Funding for WASH activities in Malawi between 2006 and 2010 was provided by a number of sources: US\$15 million came from the Government of the Netherlands; US\$3 million from the Government of Malawi; US\$7 million from UNICEF; and US\$4.3 million from ‘Community.’ Expenditure on WASH activities totaled US\$29 million, thereby accounting for 10 percent of total expenditures in the sub-sector between 2006 and 2010.<sup>19</sup>

The capital investments of the Water Boards during this time totaled about US\$35 million. Lilongwe Water Board (LWB), with a total of US\$11 million for the period, made the most investment. The details on the nature of capital investments are not available for Lilongwe Water Board, although it is known that it was able to clear “*a sizeable backlog of postponed maintenance expenditures*” before 2008, including some rehabilitation, upgrading, and extension works.<sup>20</sup>

Blantyre Water Board (BWB) invested US\$7 million between 2006 and 2010. With this money, the Water Board was able to rehabilitate the Walker’s Ferry and Chileka pumping stations. The Water Board also invested in an electrical-mechanical design study for the rehabilitation and expansion of its pumping infrastructure, and in its financial management, with the launch of a ‘new accounting package’.<sup>21</sup>

Northern Region Water Board (NRWB) made US\$7 million worth of investments. These investments funded: extension of services and rehabilitation of water works; feasibility studies and design of works for water supply and sanitation schemes in towns and some market centers; staff training; purchase of company vehicles; and a contract for the production of a radio and television documentary.<sup>22</sup>

Central Region Water Board (CRWB) invested US\$4 million between 2006 and 2010. These funds went to internal staff training, preventative and corrective maintenance of machinery and the water supply network, rehabilitation and expansion of projects, and infrastructure replacement.<sup>23</sup> Southern Region Water Board (SRWB) invested US\$6 million, towards the following areas: pre-feasibility, feasibility, and design studies for water supply projects, tree

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<sup>18</sup> Second National Water Development Project, Project Appraisal Document, The World Bank, 27 April 2007.

<sup>19</sup> Based on data provided to Castalia by the Ministry of Finance, 4 November 2011. Data source is the Malawi Aid Management Platform.

<sup>20</sup> Lilongwe Water Board Corporate Plan, 2008-2013.

<sup>21</sup> 2006-2008 Annual Reports, Blantyre Water Board.

<sup>22</sup> 2006-2010 Annual Reports, Northern Region Water Board.

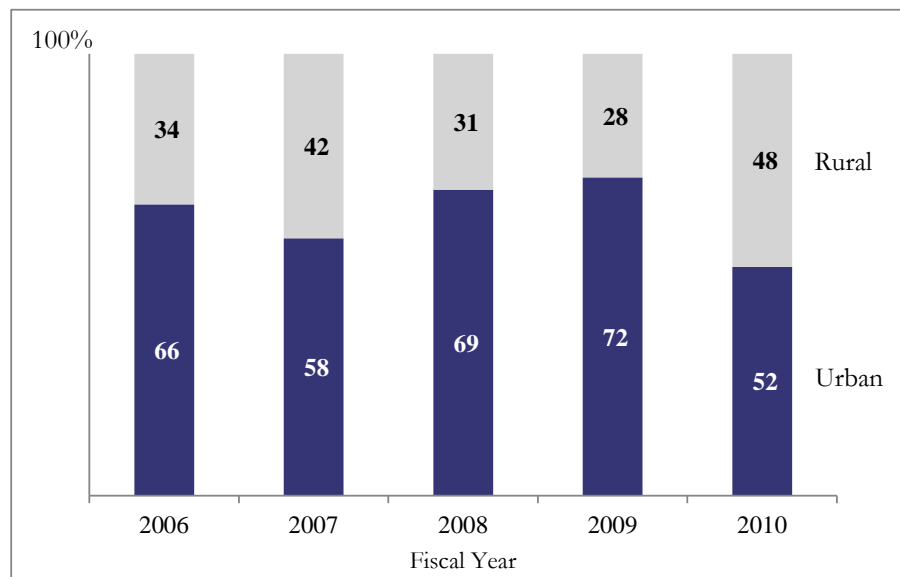
<sup>23</sup> 2009 Annual Report, Central Region Water Board.

planting to conserve water catchment areas, office construction, new and replacement infrastructure.<sup>24</sup>

### Rural Versus Urban Split of Water Supply and Sanitation Expenditure

Demographically, Malawi is 84 percent rural,<sup>25</sup> yet from 2006 to 2010 the majority of funds for water supply and sanitation were spent in Urban areas (see Figure 2.3). This is partly due to the fact that the distribution of water point technologies used in urban areas is very different than in rural areas, as is illustrated below in Figure 2.4.

**Figure 2.3: Rural vs. Urban Split of Water Supply and Sanitation Expenditure**

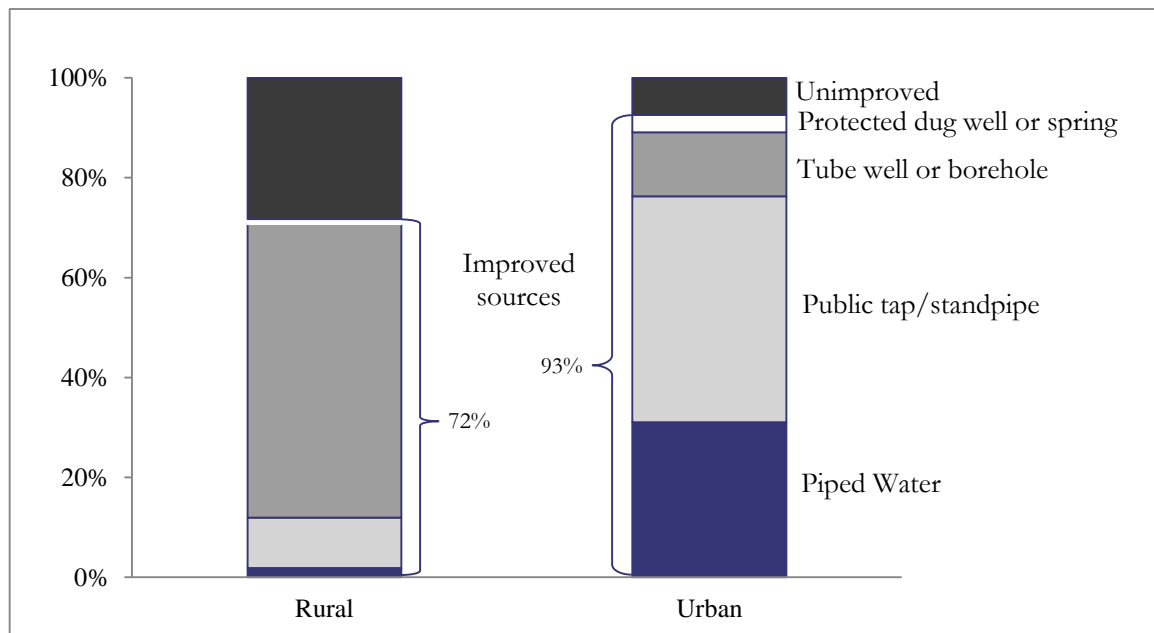


Source: Analysis by Castalia, based on data provided by the Ministry of Finance and the audited financial statements of the Water Boards

<sup>24</sup> 2008-2010 Annual Reports, Southern Region Water Board.

<sup>25</sup> According to most recent household data, from the 2010 Malawi Demographic and Health Survey.

**Figure 2.4: Distribution of Household Source of Drinking Water, Malawi 2010**



Data Source: Malawi Demographic and Health Survey 2010, National Statistical Office of Malawi, Government of Malawi.

The initial cost per capita of water infrastructure is undoubtedly higher in urban areas than in rural areas; in urban areas a greater percentage of the population uses standpipes or piped water connections. As shown in Table 2.2, these two technologies have the highest initial investment costs; piped water connections also have a sizeable annual cost. In contrast, most of the population in rural areas receives water via boreholes, which are lower-cost overall.<sup>26</sup>

**Table 2.2: Relative Costs of Providing Improved Water Supply Technologies in Africa**

Technology	Initial investment cost per capita	Annual improvement cost per person reached
Dug well	\$28	\$2.00
Borehole	\$30	\$2.23
Standpipe	\$41	\$3.15
Piped water in house	\$134	\$12.73

Source: Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level, World Health Organization 2004. The 2000 prices given in the report are adjusted here, to 2011 prices.

Notwithstanding the fact that the infrastructure of urban water supply is more expensive than that of rural water supply, investment in rural areas is nevertheless disproportionately

<sup>26</sup> This assumes, based on Government of Malawi data, that the average urban household to be of size 4.4, and the maximum number of users of a borehole to be 250 people. The Government categorization of “urban” and “rural” is not the exact distinction made in this PER. There is no standard density that makes an area urban, versus rural.

low compared to the percentage of the population that is considered rural. What is more, of the expenditure in Urban water supply and sanitation between 2006 and 2010 (US\$181 million), 79 percent went to covering the recurrent costs of the Water Boards.

### 3 Reviewing Performance in Water Supply and Sanitation

The performance in water supply and sanitation provides a good indication of the efficiency and effectiveness of public expenditures in the sub-sector. At the national level, Malawi's aggregate indicators for access compare well with other African countries with similar or higher income levels. Within urban water supply and sanitation, the Water Boards made some progress in increasing access; however, further improvement is necessary in quality of service, operating efficiency, and financial performance. The data for rural areas is much less complete than for urban areas. However, it is clear that access to improved water and improved sanitation increased substantially during the period of analysis for this public expenditure review.

Here, we proceed to provide an overview of aggregate performance in water supply and sanitation (Section 3.1). This is followed by a detailed review of performance in urban areas (Section 3.2), and is completed with a review of performance in rural areas (Section 3.3)

#### 3.1 Aggregate Performance in Water Supply and Sanitation

In this section, performance in the water supply and sanitation sub-sector is assessed by reviewing the level and quality of access to water supply services and sanitation facilities. In urban areas, the analysis is deepened by reviewing the financial and operational efficiency of the five Water Boards.

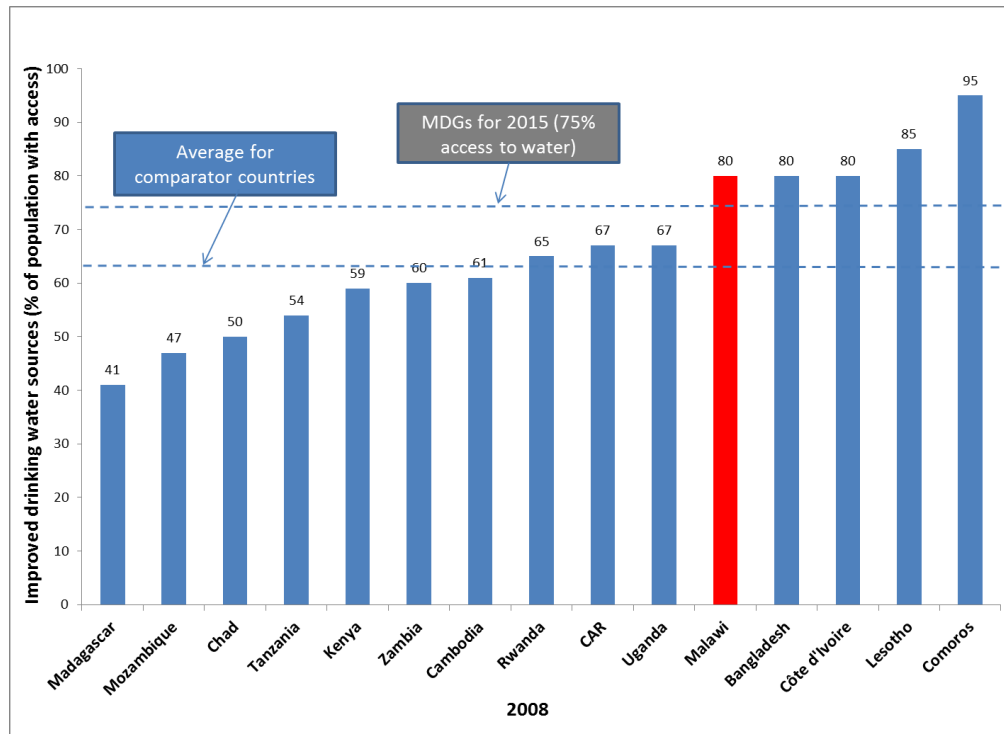
In terms of access to improved water and sanitation, Malawi performs relatively well when assessed against a group of comparator countries.<sup>27</sup> As seen below, Malawi has one of the highest levels of access to improved drinking water source (Figure 3.1) and the highest level of access to improved sanitation facilities (Figure 3.3). It has achieved this despite the country's relatively low GDP per capita (Figures 3.2 and 3.4).

Figure 3.1 illustrates the population of Malawi's access to drinking water relative to its comparator countries. With 80 percent of its population having access to water, Malawi exceeded the MDGs target and ranks third among comparator countries.

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<sup>27</sup> For the purposes of this comparison with other countries, we use the values for improved sanitation from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation found in the report titled *'Estimates for the use of Improved Sanitation Facilities, Updated March 2010'*. As described further in Volume III of this Working Paper, this values are different from those in WMS 2009 and DHS 2010.

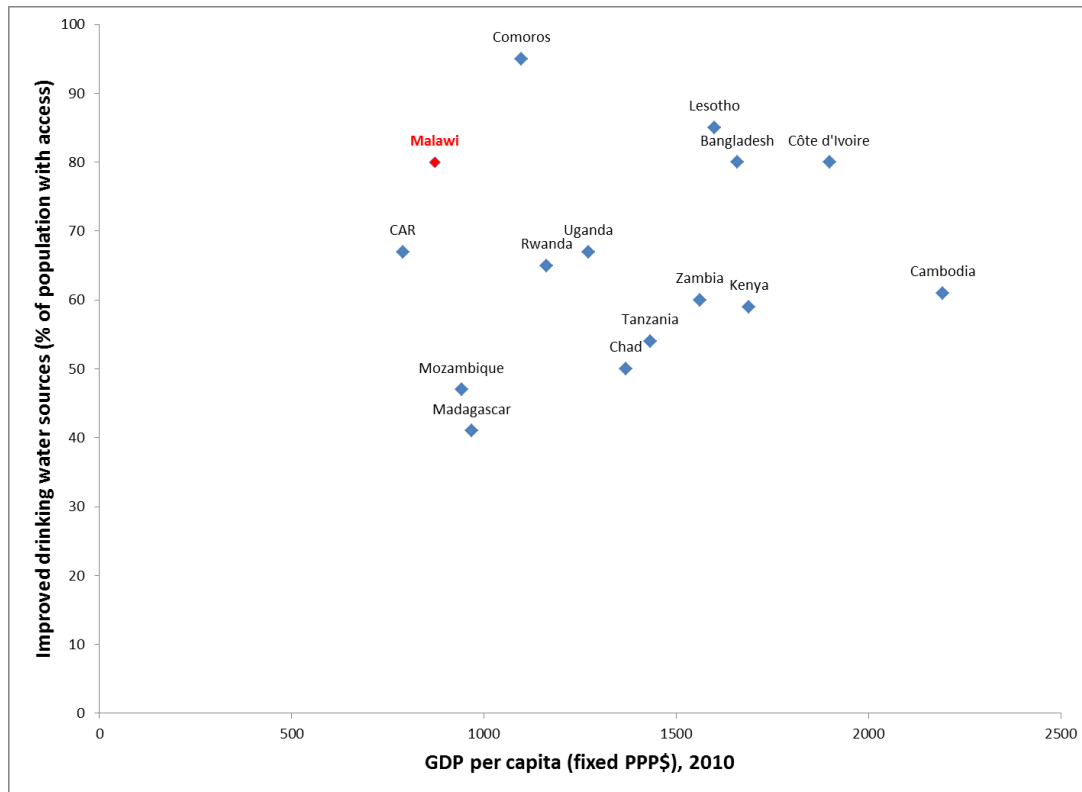
**Figure 3.1: Access to Improved Drinking Water Sources in Malawi and Comparator Countries**



Source: Global Development Indicators, World Databank, World Bank.

Figure 3.2 illustrates that, in spite of a lower GDP per capita, Malawi has been able to guarantee access to improved drinking water sources for a higher percentage of its population than most other comparator countries. For example, it provides the same level of access as Bangladesh and Côte d'Ivoire even as these two countries have double the GDP per capita.

**Figure 3.2: GDP Per Capita and Improved Drinking Water Source in Malawi and Comparator Countries**

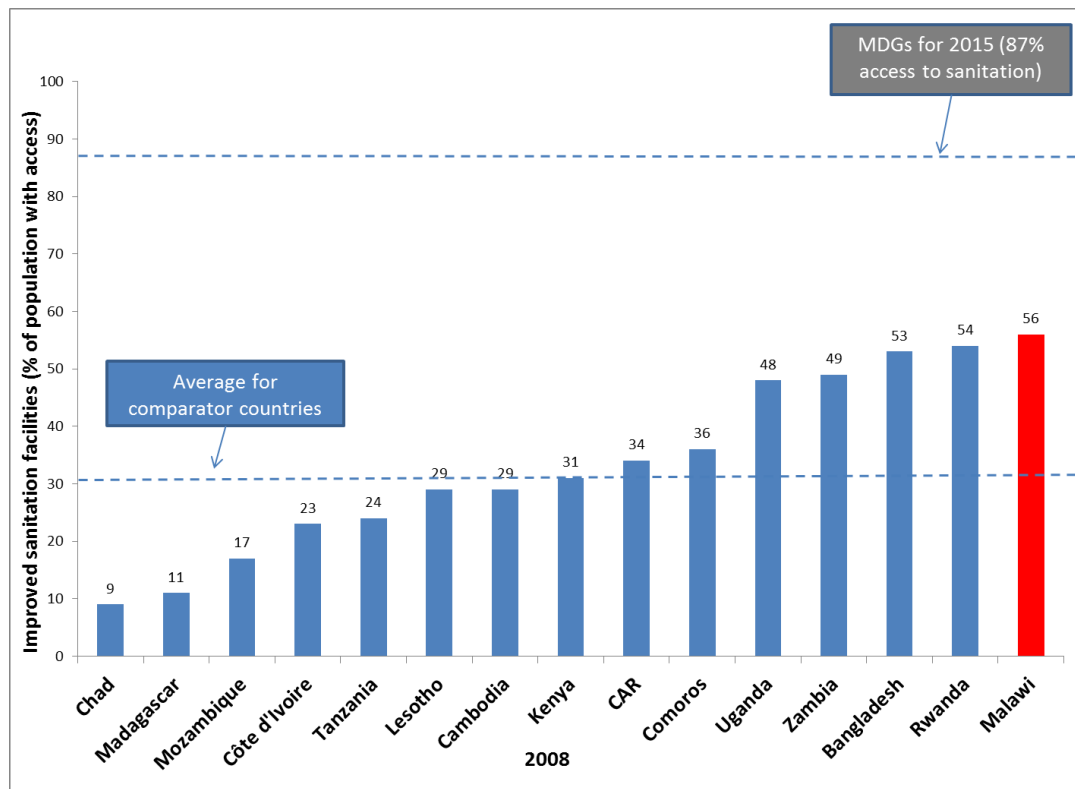


Source: Global Development Indicators, World Databank, World Bank.

Figure 3.3 highlights Malawi's relative advantage in providing access to sanitation facilities among comparator countries. Malawi ranks highest in this category and is above the average for all comparator countries. However, it is still well under the 87 percent sanitation access target proposed by the MDGs.



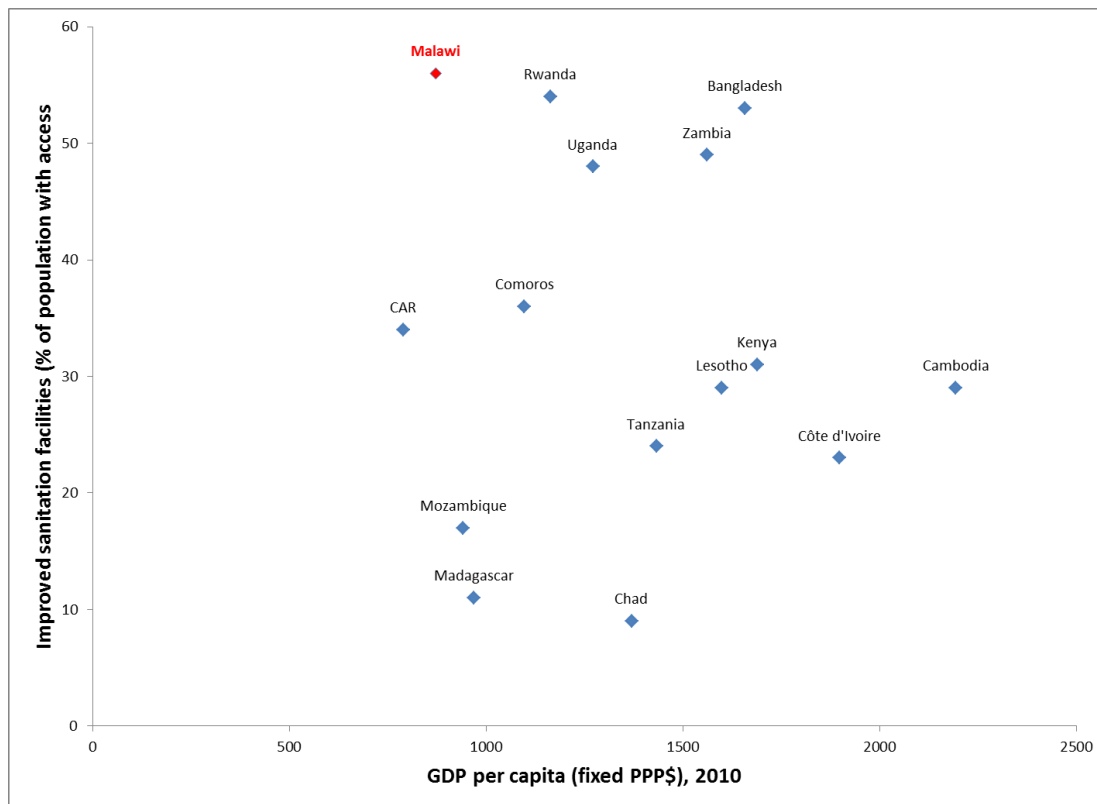
**Figure 3.3: Access to Improved Sanitation Facilities in Malawi and Comparator Countries**



Source: Global Development Indicators, World Databank, World Bank.

Figure 3.4 illustrates that, in spite a lower GDP per capita, Malawi has been able to guarantee access to improved sanitation facilities for a higher percentage of its population than all other comparator countries. Malawi's closest competitors on the list, Rwanda, Bangladesh, Uganda and Zambia, have a significantly higher GDP per capita and yet remain below Malawi's numbers.

**Figure 3.4: GDP Per Capita and Improved Sanitation Facilities in Malawi and Comparator Countries**



Source: World Databank, World Bank.

One explanation for Malawi's comparatively good performance is that the Government put in place—and has largely followed, with some revisions—a long-term plan for developing the water supply and sanitation sector. Despite some lags in the expected achievements of this plan, the indicators of water supply and sanitation have improved. However, despite the relative strength of Malawi among comparator countries, there is still much room for improvement in water supply and sanitation (in particular, noting that the data on improved sanitation needs to be further improved). For this reason, it is important to look at the country's own performance over the last few years, to assess strengths and weaknesses in the sector over time.

### 3.2 Reviewing Performance in Urban Areas

This PER defines Urban areas as those that are served by the five Water Boards of Malawi. During the period from 2006 to 2010, some of the Government's key objectives for the Water Boards were increasing the volume of water produced, reducing NRW, improving commercial efficiency, and increasing the population with improved access to water supply (particularly in low-income areas)<sup>28</sup>. With the aim of achieving these objectives, the Water

<sup>28</sup> The World Bank's Project Appraisal Document on a proposed credit to the Republic of Malawi for a Second National Water Development Project (Report No: 38457-MW) dated 27 April 2007, states, "The main objectives of the above project are to: (i) raise performance capacity to LWB and BWB; (ii) actual restructuring/reforming of the Water Boards (not only training); and (iii)

Boards made capital expenditures totaling approximately US\$34.6 million during the period. At an average of between US\$1 to 2 million per year for each Water Board—and, in particular, due to the rapid growth in the Urban population—this pace will not be sufficient for achieving the Government’s objectives in the Urban areas.

The Water Board’s capital expenditures from 2006 to 2010 did contribute to achieving some of the Government’s objectives. For example, the Water Boards achieved increases in the number of connections (by an average of 63 percent for all Water Boards) and the volume of water produced (an average of about 10 percent across all Water Boards), and some improvements in operational efficiency (for example, four of the five Water Boards show an increase in staff productivity). However, the operating efficiency and financial performance of the Water Boards did not improve as much as may have been expected. Furthermore, the data regarding the quality of service provided by the Water Boards is not sufficient to assess any potential improvements in that area.

Table 3.1 provides our subjective assessment of the overall performance of the Water Boards in 2006 and 2010 with regard to access, quality of service, operating efficiency and financial performance. A few key points emerge from this assessment. First, in general, the Water Boards increased access and improved operating efficiency. Second, the aggregate financial performance of the Water Boards deteriorated somewhat. Third, the Water Boards in Malawi need to improve considerably to be considered among the better water utilities in Africa. Immediately below we provide our reasoning and the evidence for these ratings.

**Table 3.1: Reviewing the Performance of the Water Boards, 2006 to 2010**

	Rating (2006)	Rating (2010)
Access	1	1-2
Quality of Service	?	?
Operating Efficiency	2	2-3
Financial Performance	2-3	2

Rating: On a scale of 1 to 5, where a 1 would be poorly functioning utility in Africa and a 5 would be a very well-functioning water utility in Africa.

? = insufficient information to make a reasonable estimate.

### **Access—Slight increase despite substantial growth in urban population**

During the period, the population in the Urban areas increased by an average of about 5 percent per year (well above the 2 percent rate in the Rural areas).<sup>29</sup> Despite this rapid increase in the Urban population, the Water Boards achieved some improvement in access to piped water. According to the Malawi Demographic and Health Survey, the percent of the

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*implementation of an investment program (improve production, reduce NRW, extend service to low-income areas). The key performance indicators for the project include reduction in non-revenue water, improvements in commercial efficiency, increased production volume, and population with improved access to water supply with particular focus on the low income and unserved areas.”*

<sup>29</sup> We calculated these growth rates using the values for Malawi that form part of the "state of world population 2007, Unleashing the Potential of Urban Growth" (United Nations Population Fund, 2007) found at [https://www.unfpa.org/swp/2007/presskit/country\\_data/malawi.xls](https://www.unfpa.org/swp/2007/presskit/country_data/malawi.xls)

urban population with access to piped water increased from 29.2 percent in 2004 to 32.2 percent in 2010. Furthermore, the number of connections for all Water Boards increased by 63 percent, with NRW's increase of 75 percent being the highest (see Table 3.2).

**Table 3.2: Indicators of Access**

	BWB	LWB	NRWB	CRWB	SRWB	All
Number of connections (2010)	40,000	39,626	31,505	15,711	28,390	155,232
Increase in number of connections, 2006-2010	14%	58%	75%	46%	35%	63%

Source: Audited financial statements and annual reports of the Water Boards.

### Quality of Service—Insufficient data to adequately assess

The quality of service provided by water utility is generally measured based on continuity of service, pressure of the water, time required to respond to requests or complaints from customers, and quality of the water provided. As indicated in the Sector Performance Report dated May 2011, “it has been difficult to get access to data to measure this water quality and systems need to be developed to gain regular access to water quality data. This is an indication that the Water Boards need to focus more on customer service and to develop the systems to adequately collect information related to the quality of service provided.

Reported continuity ranges from a low of 16 hours (CRWB) to a high of 24 hours (LWB) (see Figure 3.5). Also, due to the substantial increase in number of connections without a corresponding increase in volume of water produced, the volume of water billed per connection by the Water Boards fell by an average of about 25 percent from 2006 to 2010. Therefore, it seems likely that, while more people are being connected, the quality of the service received by already connected people is deteriorating. This may indicate a mis-prioritization of investment toward expanding distribution networks, without ensuring that complementary investments in leakage reduction or bulk supply expansion are made.

**Figure 3.5: Indicators of quality of service**

	BWB	LWB	NRWB	CRWB	SRWB
Average continuity (hours per day), 2010	20	24	20	16	22
Increase in volume of water produced, 2006-2010	4%	10%	23%	15%	16%
Billed water per connection (m3 per year), 2010	386	518	198	325	261
Decrease in billed water per connection, 2006-2010	-5%	-36%	-24%	-23%	-27%

Source: Audited financial statements and annual reports of the Water Boards.

### Operating Efficiency—Some improvement, but scope for much more

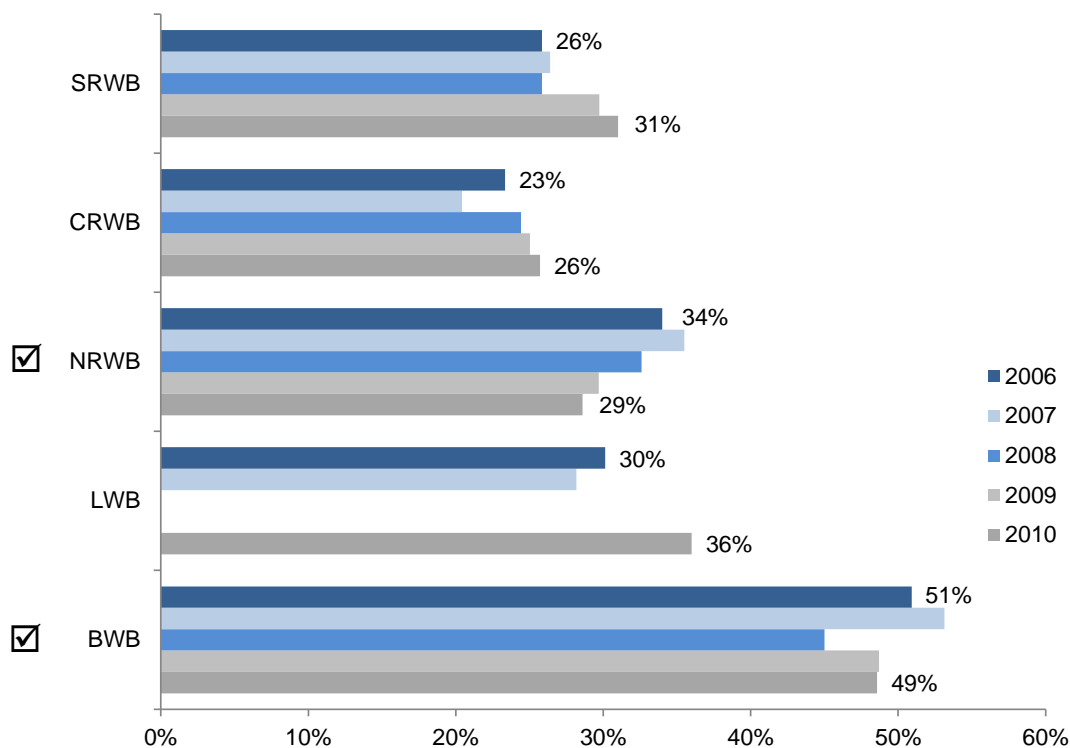
Three key measures of the operating efficiency of a water utility are NRW, staff productivity, and collection efficiency. NRW, due to its pervasive impact on a utility's performance<sup>30</sup>, is the most important of these measures. Despite variations across the Water Boards, collection efficiency was the only one of these measures on which all the Water Boards improved

<sup>30</sup> Reducing NRW can lead to improving the quality of water delivered and the quality of the service delivered, increasing operating revenues, decreasing operating expenditures, and reducing capital expenditures needed to meet growth in demand.

during the period. Furthermore, as of 2010, all of the Water Boards have substantial scope for improving operating efficiency.

Most of the Water Boards did not achieve their objectives in reducing NRW during the period from 2006 to 2010 and still have scope for reducing those levels to what is considered best practice (recommended as 23 percent in a paper published by the World Bank, based on the performance of the top 25 percent of developing country utilities<sup>31</sup>). For example, LWB's NRW increased from 30 to 36 percent; according to its 2008-2013 Corporate Plan, it was supposed to decrease to 25 percent by 2010. The only two Water Boards to have reduced NRW were SRWB and BWB (see Figure 3.6). BWB's achievement was limited since it reduced NRW by two percent and its NRW in 2010 was very high at about 49 percent.

**Figure 3.6: Comparing NRW of the Water Boards (2006-2010)**



Sources: NRW of the Water Boards in Malawi is from their annual reports. The best practice value is from Kingdom, B. and Tynana, N. (2002) "A Water Scorecard: Setting Performance Targets for Water Utilities" *World Bank Public Policy for the Private Sector Note Number 242*.

Staff productivity—generally measured as number of employees per thousand connections—in another important indicator of a water utility's operating efficiency. It is an important indicator because staff costs usually represent a high percentage of a utility's total operating expenses; in Malawi, this percentage ranges from about 32 percent for BWB to 44 percent for SRWB (see Table 3.3).

<sup>31</sup> Kingdom, B. and Tynana, N. (2002) "A Water Scorecard: Setting Performance Targets for Water Utilities" *World Bank Public Policy for the Private Sector note Number 242*.

**Table 3.3: Indicators of Staff Productivity of the Water Boards (2010)**

	<b>BWB</b>	<b>LWB</b>	<b>NRWB</b>	<b>CRWB</b>	<b>SRWB</b>
Staff productivity (employees per thousand connections)	14	11	9	21	11
Average annual staff compensation (in MK 000s)	1,125	1,511	327	543	1,032
Staff costs as a percent of operating expenses	32%	42%	40%	37%	44%

Source: Audited financial statements and annual reports of the Water Boards.

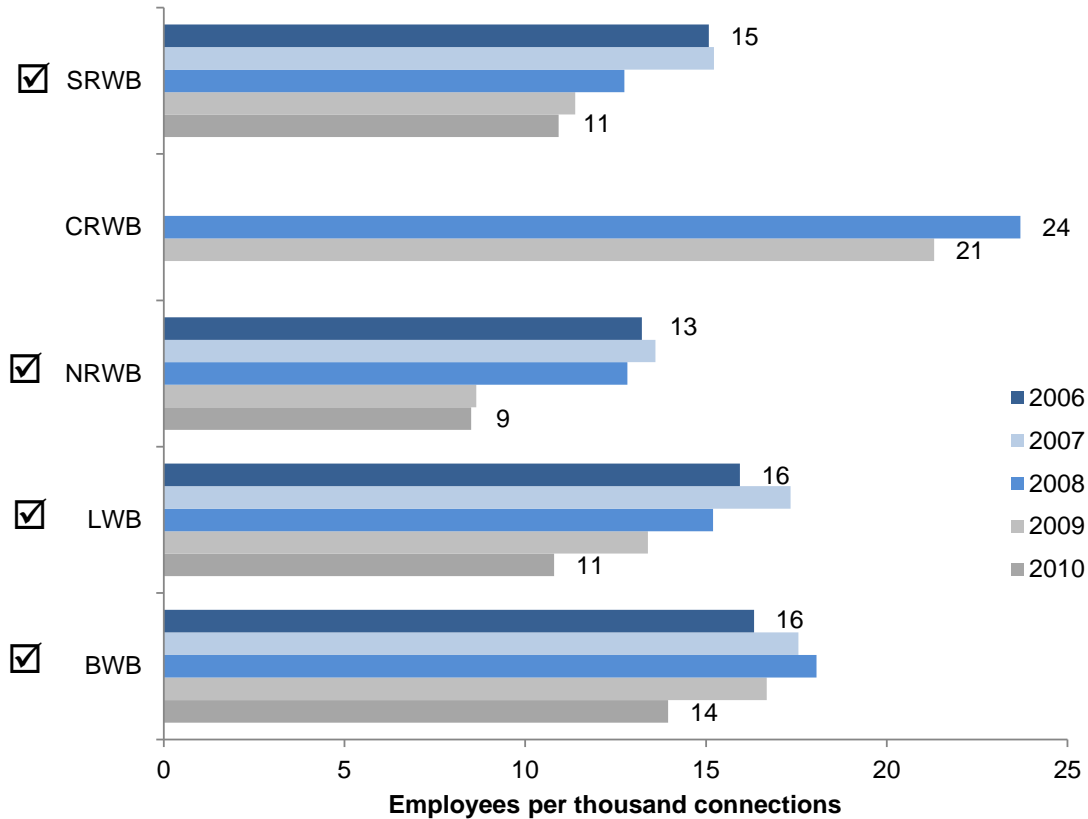
Note: Value for CRWB is for 2009

From 2006 to 2010, the four Water Boards with available data show an improvement in staff productivity. LWB achieved the greatest improvement with a reduction in the number of employees per thousand connections from 16 in 2006 to 11 in 2010 (see Figure 3.7). However, even with the improvements achieved by the Water Boards, staff productivity is still well below what could be considered an efficient level. A paper published by the World Bank suggests that the target for a water utility in a developing country should be 5 or fewer employees per thousand customers<sup>32</sup>.

A more comprehensive assessment of staff productivity takes into account average staff compensation. Average staff compensation for the five Water Boards varies considerably with LWB having the highest value at about MK1.5 million per year (see Table 3.3).

<sup>32</sup> Kingdom, B. and Tynana, N. (2002) "A Water Scorecard: Setting Performance Targets for Water Utilities" *World Bank Public Policy for the Private Sector note Number 242*.

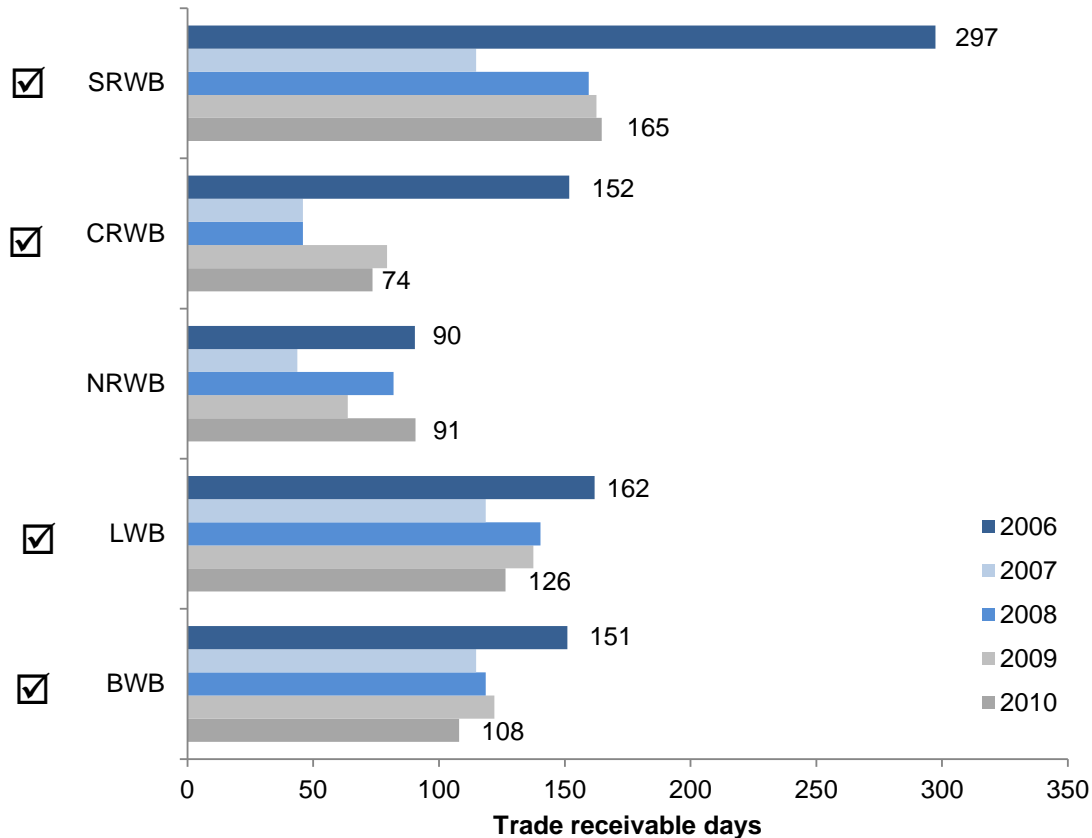
**Figure 3.7: Comparing Staff Productivity of the Water Boards (2006-2010)**



Source: Audited financial statements and annual reports of the Water Boards.

The collection efficiency—as measured in trade receivable days (calculated as net trade receivables divided by operating revenues times 365)—decreased from an average of about 160 days for each Water Board in 2006 (with SRWB registering the highest value at 297 days) to less than 100 days in 2010 (ranging from 26 days for LWB to 165 days for SRWB). In comparison, a World Bank paper recommends a target of about 90 days (in 2010, CRWB and NRWB were the two Water Boards near or below this target).

**Figure 3.8: Comparing Collection Efficiency of the Water Boards (2006-2010)**



Source: Audited financial statements and annual reports of the Water Boards.

The collection ratio—calculated as cash collections divided by operating revenues—is another good measure of the collection efficiency of a water utility. A well-performing water utility will usually achieve a collection ratio above 95 percent. NRW is the only Water Board for which we have information on cash collections, and can therefore calculate its collection ratio. Its collection ratio increased from about 71 percent in 2007 to 82 percent in 2010. These values indicate scope for considerable improvement.

**Financial Performance—Need to better define expectation of financial performance of the Water Boards, and to improve it**

The Government needs to better define its expectations of the financial performance of the Water Boards, and, then provide or obtain the support necessary to improve that performance. It is clear that the Government expects the Water Boards to become more autonomous financially. However, the threshold or target for defining that financial performance needs to be clarified. With that clarification, it will be easier to develop a credible and realistic plan for improving the financial performance of the Water Boards (one indication of poor performance is that, in 2010, the ‘going concern’ status of three of the five Water Boards was in doubt).

In 2010, the Minister of Finance clearly indicated that at least one of the Water Boards should strive for financial performance equivalent to that of a commercial entity. A



commercial entity can cover the full cost of service, and, in some cases, pay dividends through their own revenues (and, therefore, reduce the required subsidies from the Government to cover capital expenditures and debt service). The Minister of Finance, in his 2010/11 budget statement stated that *“in order to improve the delivery of public goods and services of these entities within the 2010/11 Financial Year, the Government has decided to streamline and rationalize the sub-vented organizations as follows: ... The Lilongwe Water Board and the Central Region Water Board will be dissolved and their functions will be taken up by a new Central Region Water Board...”*<sup>33</sup> Furthermore, parastatals resulting from this restructuring, including the new Central Region Water Board, *“will be expected to strive for profitability and that we will introduce a dividend policy to obligate them to pay dividends to the Government.”*<sup>34</sup>

After having indicated that the expectation was for the Water Boards to become commercial entities that could pay dividends, in 2011, the Government entered into an agreement with the World Bank for an additional credit for the Second National Water Development Project. One of the development objectives for this project is that all the Water Boards achieve a working ratio—defined as ‘collected revenues’ divided by ‘cash operating expenses’—of 1.1 by 2015<sup>35</sup>. This working ratio would fall short of the threshold for a commercial entity since it would indicate that the Water Boards would not be able to cover the full cost of service. In other words, a working ratio of 1.1 would not be sufficient to service debt, cover a reasonable portion of capital expenditures, or provide any returns to shareholders through dividend payments.

Another target that the Government is using for the financial performance of the Water Boards is the ‘Operating Ratio’. This ratio is calculated by dividing operating costs by operating revenues. According to the Sector Performance Report dated May 2011, the target for the operating ratios of BWB and LWB is 0.5<sup>36</sup>. The working ratio and the operating ratio are closely related as we demonstrate in Figure 3.9 using data for NRW (since it's the only Water Board for which we have information on its actual collection rate). In the case of NRW, the one Water Board for which we had the data to calculate the collection rate and that also had the highest operating cost recovery ratio, in 2010, its operating ratio of 0.76 translated into a working ratio of 1.08. In comparison, the operating ratios for the other four Water Boards have exceeded a value of 0.84.

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<sup>33</sup> 2010/2011 Budget Statement Delivered in the National Assembly of the Republic of Malawi by the Minister of Finance Honourable Ken E. Kandodo, MP, 28 May 2010, paragraph 124

<sup>34</sup> 2010/2011 Budget Statement Delivered in the National Assembly of the Republic of Malawi by the Minister of Finance Honourable Ken E. Kandodo, MP, 28 May 2010, paragraph 125

<sup>35</sup> National Water Development Program, Implementation Support Mission: October/November 2011, Draft Aide Memoire, Annex 3—Updated results matrix

<sup>36</sup> Page 61 of the Sector Performance Report states, *“Both water boards are some way from the target of 0.5, hence they lack funds for investment in rehabilitation and extension services.”* The report does not indicate by when the Water Boards are intended to meet the target of 0.5.

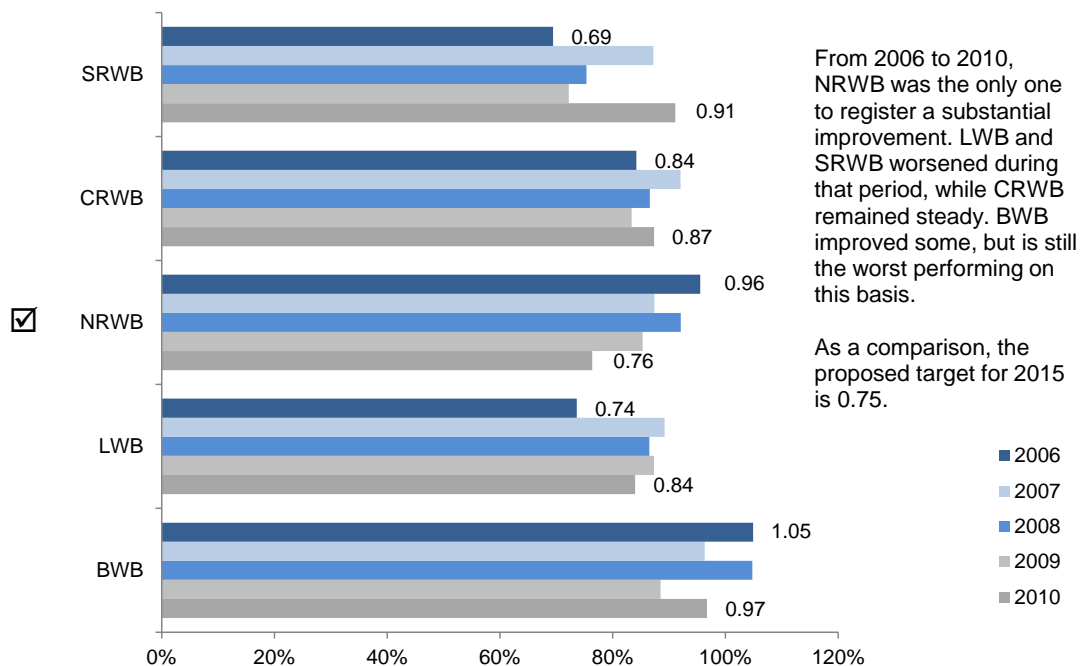
**Figure 3.9: Comparing NRW's Operating Ratio with its Working Ratio**

		2007	2008	2009	2010
1	Operating Revenues (MK millions)	373	473	719	853
2	Collection Rate (MK millions)	71%	73%	76%	82%
3	Cash Collections (MK millions) = (1) * (2)	264	343	547	702
4	Operating Expenses (MK millions)	326	435	614	651
5	Operating Ratio = (4)/(1)	0.87	0.92	0.85	0.76
6	Working Ratio = (3)/(4)	0.81	0.79	0.89	1.08

Source: Audited financial statements and annual reports of the Water Boards.

In practice, as of 2010, the financial performance of the Water Boards has been well below a 'commercial' level (see Figure 3.11). For example, the operating ratio for LWB, CRWB, and SRWB worsened during from 2006 to 2010 (see Figure 3.10). NRW was the only Water Board to register a substantial improvement, with its operating ratio falling from 0.96 in 2006 to 0.76 in 2010. Despite some improvement during the period, BWB remained the worst performing Water Board on this basis.

**Figure 3.10: Comparing Operating Ratios of the Water Boards (2006-2010)**



Source: Audited financial statements of the Water Boards.

Furthermore, in 2010, the Government converted more than MK7.2 billion (an equivalent of almost US\$50 million) owed to it by the Water Boards into equity in the Water Boards. Finally, in 2010, the independent auditors of BWB, LWB, and NRW indicated that these

three Water Boards could not be considered ‘going concerns’ without the expectation of continued support from the Government<sup>37</sup>.

**Figure 3.11: Indicators of financial performance**

	BWB	LWB	NRWB	CRWB	SRWB
'Going concern basis' questioned, 2010	yes	yes	yes	no	no
Operating Ratio, 2006	1.05	0.74	0.96	0.84	0.69
Operating Ratio, 2010	0.97	0.84	0.76	0.87	0.91
Average tariff per m3 billed (MK/m3), 2010	122	86	126	112	102
Average operating expenditure per m3 billed (MK/m3), 2010	128	74	104	86	99
Cash from operations in MK million	340	196	118	443	178
Net Income/(Loss) in MK million, 2010	77	(48)	(90)	(101)	30
Debt Service Coverage Ratio, 2010	0.4	94.7	1.9	7.8	55.4
Real increase in average tariffs from 2006 to 2010	24%	20%	58%	13%	27%
Real increase in operating expenses from 2006 to 2010	30%	32%	66%	34%	68%

**Notes:**

Operating Ratio is Operating Expenses divided by Operating Revenues

Operating Cost Recovery Ratio is Operating Revenues divided by Operating Expenses

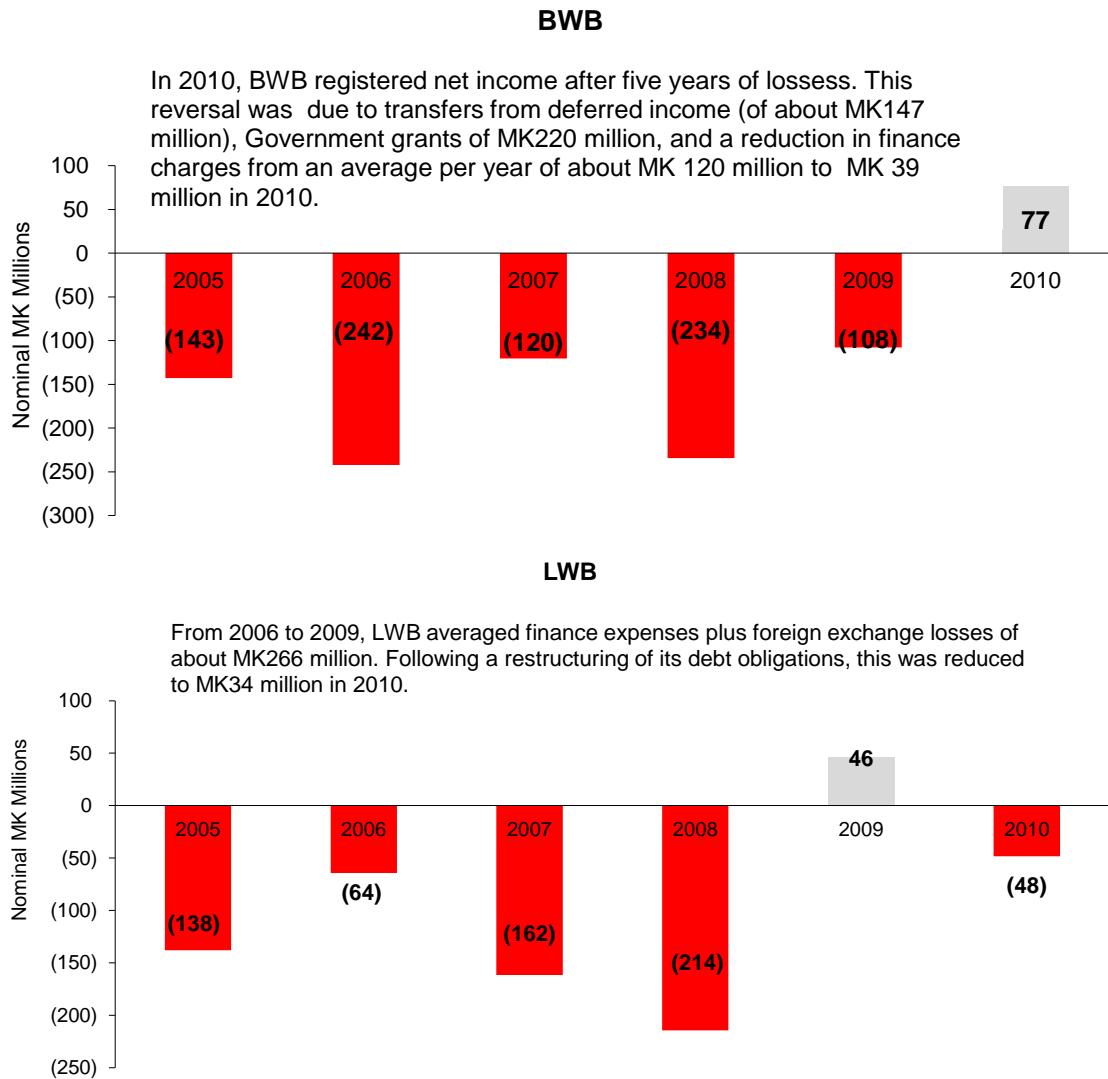
Debt Service Coverage Ratio is EBITDA divided by Debt Service

Source: Audited financial statements and annual reports of the Water Boards.

Finally, LWB and BWB both registered net losses on their income statements during four of the five years in the period from 2006 to 2010 (see Figure 3.12). The Government's forgiveness of debt owed to it by the Water Boards accounted for a substantial portion of this improvement. For example, from 2006 to 2009, LWB averaged finance expenses plus foreign exchange losses of about MK266 million. Following the forgiveness of its debt, the total for finance expenses plus foreign exchange losses was reduced to MK34 million in 2010. In 2010, BWB also benefitted from grants provided by the totaling MK220 million.

<sup>37</sup> For example, Note 38 of LWB's audited financial statements for the year ended 30 June 2010 states, "The Board has posted a loss before tax amounting to K13 million (2009: K200 million). In addition, this year the Board has net current assets of K761 million (2009: net current liabilities K1,885 million). These financial statements continue to be prepared on going concern basis on the understanding that the Board will revert to a profitable performance and also continued support from the Malawi Government."

**Figure 3.12: Net Income/Loss for BWB and LWB (2006-2010)**



Source: Audited financial statements of the Water Boards.

CRWB and NRWB registered losses on their income statements in every year from 2006 to 2010, meanwhile SRWB oscillated between minor losses and gains (See Figure 3.13). Finance expenses were largely responsible for the losses registered by CRWB and NRWB. Following a restructuring of their debt, each Water Board achieved a substantial improvement in 2010.

**Figure 3.13: Net Income/Loss for CRWB, NRW and SRWB (2006-2010)**



Source: Audited financial statements of the Water Boards.

As a result of this financial situation, the Water Boards do not have the capacity to fund any significant portion of capital expenditure in the urban water and sanitation sector. The reality is that the expenditure in urban areas is financed with money lent by development partners and repaid (eventually through forgiveness of debt) by the Government. This approach is not conducive to getting good value for Public Expenditure. Stakeholders are planning on assumptions that are not in fact realized, and the Government is exposed to significant, unplanned fiscal expenditures.

### Comparing Performance of the Individual Water Boards in 2010

Table 3.4 provides our subjective assessment of the performance of each of the Water Boards as of 2010 in the areas of access, quality of service, operating efficiency, and financial performance. In the following section we provide a detailed review of the performance of each Water Board with the evidence supporting this comparison.

**Table 3.4: Comparing the Performance of the Water Boards (2010)**

	BWB	LWB	NRWB	CRWB	SRWB
Access	?	?	2	?	?
Quality of Service	?	?	?	?	?
Operating Efficiency	1-2	2	3-4	3	1-2
Financial Performance	1-2	2	2-3	2	1-2

Rating: On a scale of 1 to 5, where a 1 would be poorly functioning utility in Africa and a 5 would be a very well-functioning water utility in Africa.  
? = insufficient information to make a reasonable estimate.

### 3.3 Reviewing Performance in Rural Areas

Investment in rural water supply (predominantly boreholes) contributed to a large increase in access to improved water supply over the period. While, there was a large increase in access to improved water, access to improved sanitation remained relatively low. A review of the experience suggests a number of key findings with respect to implementation of projects over the period:

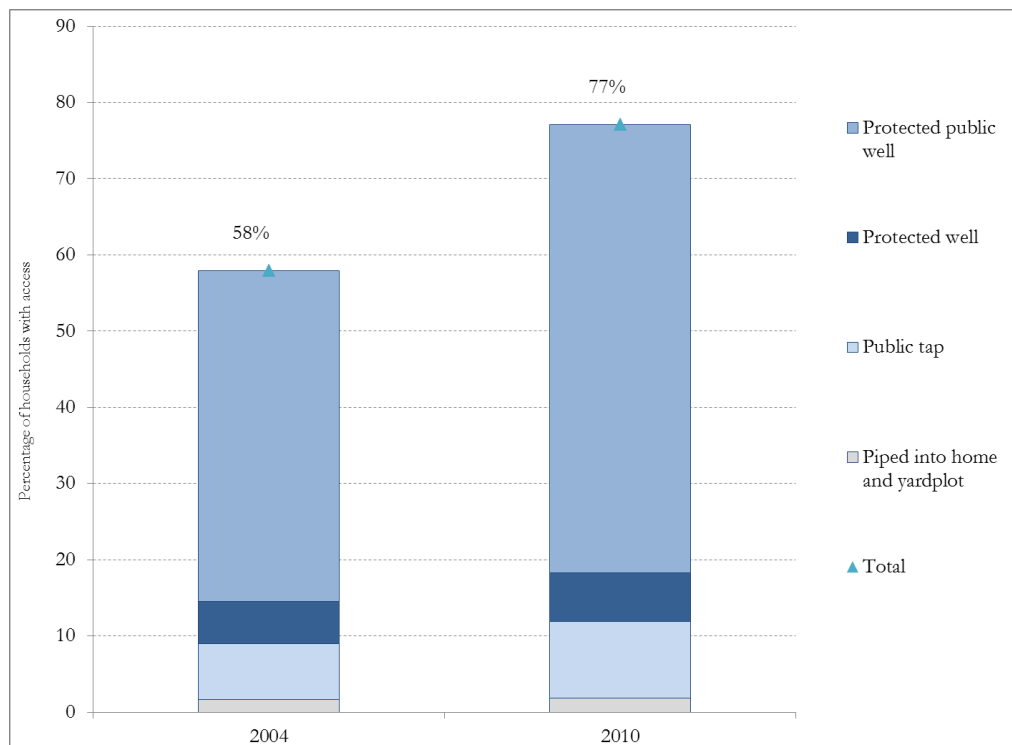
- **Investment appears unequal**—indications are that access, and by implication spending, has been highly unequal between and within districts
- **Little capacity to sustain investments** —shortages of staff at the Ministry’s district offices combined with nascent capacity at District Assemblies has limited investment expenditure and reduced the sustainability of investment
- **NGOs played an important role**—NGOs have played an important role increasing capacity and investing in infrastructure.

This section begins by providing an overview of performance in the sector. It is followed by a discussion of the three findings on rural investment.

#### 3.3.1 Overview of performance

Access to improved water in rural areas increased by 33 percent from 2004 to 2010 (see Figure 3.14). The increase in access largely resulted from an increase in access to protected public wells (boreholes) from 43 percent to 59 percent (a 35 percent increase). There was also an increase in access to public taps from 7.4 percent to 10 percent (a 36 percent increase).

**Figure 3.14: Access to Improved Water in Rural Areas**

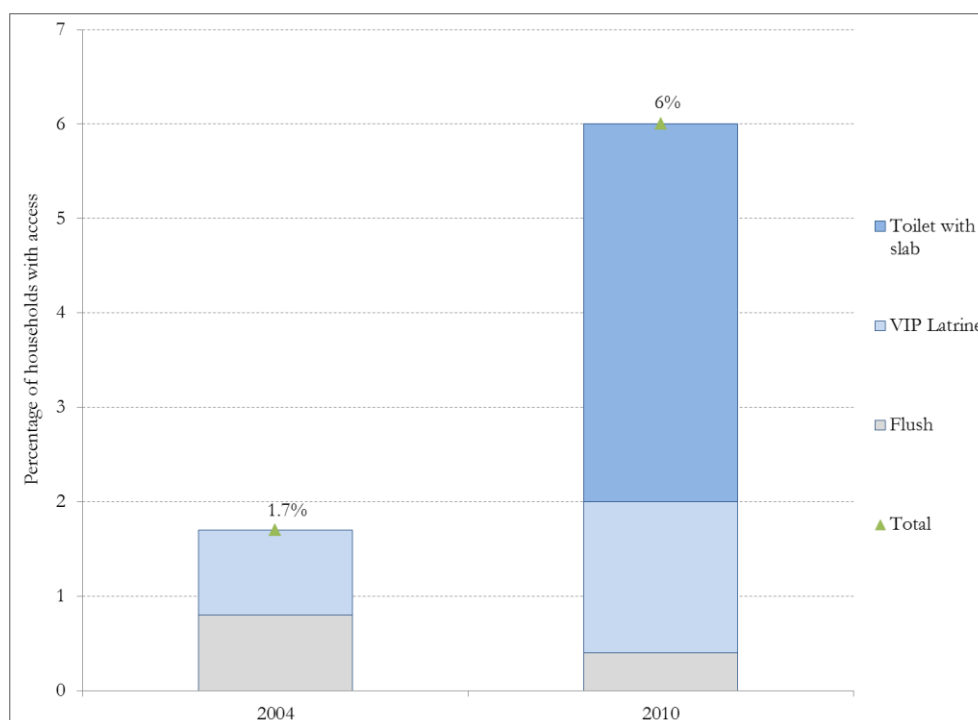


Source: Malawi Demographic and Health Survey, 2004 and 2010.

According to the values from the Demographic and Health Survey 2010, which differ from those presented in the WMS 2009, Figure 3.15 shows that the proportion of households with access to improved sanitation increased between 2004 and 2010. Access to flush and VIP toilets was relatively low in 2004 (1.7 percent) and increased by 0.3 percentage points from 2004 to 2010. According to this survey, in 2010, four percent of people in rural areas had access to toilets with slabs. The corresponding figure was not reported in 2004. Even including access to this form of sanitation, only 6 percent of rural Malawians had access to improved sanitation in 2010.<sup>38</sup>

<sup>38</sup> In addition to the 6 percent of the rural population with access to improved sanitation an additional 3.3 percent shared an “improved toilet facility” with another family. The Joint Monitoring Program for the MDGs does not consider people who share a facility to have “access” to improved sanitation. Including this 3.3 percent, only 10 percent of Malawians in rural areas had access to improved sanitation.

**Figure 3.15: Proportion of Households in Rural Areas with Access to Improved Sanitation**



Source: Malawi Demographic and Health Survey, 2004 and 2010

### 3.3.2 Unequal access and investment

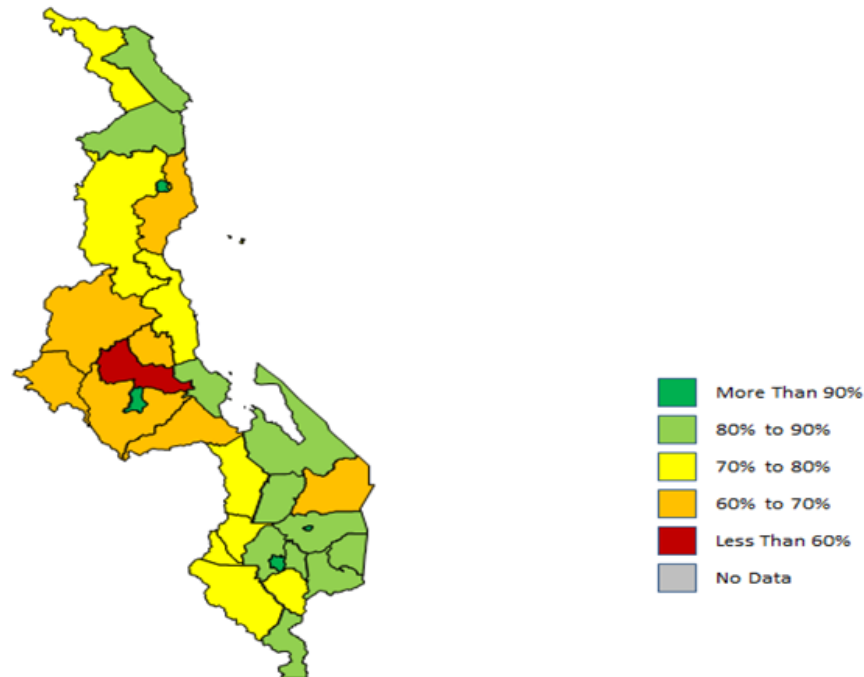
As illustrated in Figure 3.16 there are dramatic differences in access across Districts in Malawi. A number of rural districts in the North have access rates above 80 percent whereas some districts in the Center and the South have access rates below 40 percent. This appears to reflect a tendency of investment continuing to flow into areas where it has happened historically. For instance, Stoupy and Sougden<sup>39</sup> found that in Salima “*investments in new water points between 1998 and 2002 continued to be disproportionately channelled to those already served, at the expense of the un-served population, thereby widening rather [than] narrowing inequity in distribution*”. This result was confirmed by the national water point mapping exercise completed by 2007 which found that investment continued in areas with high levels of access.<sup>40</sup> Continuing to invest in areas that have already received investment is inequitable in the face of the dire need for that investment elsewhere. It is also likely to be inefficient. Those communities without any access to improved water are likely to benefit more from an additional water point than a community that already has access. This, combined with the likelihood that costs are similar in both communities, suggests that the most cost effective projects are likely to be in areas where less investment has occurred historically.

<sup>39</sup> Stoupy O. and Sugden S. (2003a): Halving the Number of People without Access to Safe Water by 2015 – A Malawian Perspective. WaterAid, Malawi Country Programme as referenced in WaterAid, 2005 "WaterAid learning for advocacy and good practice" WaterAid water point mapping in Malawi and Tanzania

<sup>40</sup> Robert Kampala 2007, “Waterpoints Mapping WSSCC’s Experience from Malawi by Robert I.J Kampala” 16 April 2007 Geneva, Switzerland [http://www.wsscc.org/sites/default/files/malawi\\_presentation\\_waterpoints\\_mapping\\_2007.pdf](http://www.wsscc.org/sites/default/files/malawi_presentation_waterpoints_mapping_2007.pdf)



**Figure 3.16: Access to Improved Water by District in Malawi**



Source: Average of the Malawi Multiple Indicator Cluster Survey (2006), the National Census (2008), and the Welfare Monitoring Survey (2009)<sup>41</sup>

### 3.3.3 Capacity constraints

Capacity constraints inhibit developing, making and sustaining investments in rural areas. There are shortages of staff at district water offices and the districts themselves. According to the Sector Performance Report dated May 2011, of the more than 2,000 positions open in 2009 little more than 1,000 were filled.<sup>42</sup> Further, it is reported that there is little pre-existing capacity at many District Assemblies.<sup>43</sup> As the Sector Performance Report indicates, “*the budget allocations for water in Chikhwawa and Dedza districts represent only 0.33% and 0.19% respectively of the total district budgets. This calls into question the capacity of the districts to manage, plan, co-ordinate and monitor their water supply, sanitation and hygiene services*”.<sup>44</sup> The low level of capacity contribute to the low level of functionality of water points in Malawi since neither staff from district water officers, nor the local authorities, are on hand to assist with the monitoring, operation and maintenance of water points. In a 2004 study it was found that “in a national

<sup>41</sup> Owen Scott "Malawi Water Access Data + Maps", Engineers Without Borders Canada. Accessed 4/26/2012

<sup>42</sup> Malawi Government, 2011 "Ministry of Irrigation and Water Development, Malawi Irrigation Water and Sanitation Draft Sector Performance Report 2010" April 2011

<sup>43</sup> Interviews with Government Officials

<sup>44</sup> Malawi Government, 2011 "Ministry of Irrigation and Water Development, Malawi Irrigation Water and Sanitation Draft Sector Performance Report 2010" April 2011

2004 mapping exercise, functionality was estimated at about 76% for the estimated 22,000 boreholes and only 51% for the estimated 10,900 community taps.”<sup>45</sup>

Over the period, capacity has been increased at a District level through programs by Development Partners and NGOs. For instance, UNICEF reports that in their experience capacity has increased at the District Assembly officers it has worked with.<sup>46</sup>

### **3.4 NGOs Played an Important Role in the Sector**

It is reported that “several hundred civil society, faith-based organizations, and international non-governmental organizations are working, often in an uncoordinated fashion, to increase water access.”<sup>47</sup> They are doing this through building physical infrastructure such as boreholes and by developing institutional capacity. For instance, as much as 15 percent of stand-alone water points in the early part of the 2000s were funded by NGOs.<sup>48</sup> An example of NGOs providing institutional support is the role that Concern Universal played in assisting to develop the Dedza District Wide Sector Investment Program.<sup>49</sup>

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<sup>45</sup> Malawi Government, 2011 "Ministry of Irrigation and Water Development, Malawi Irrigation Water and Sanitation Draft Sector Performance Report 2010" April 2011

<sup>46</sup> Interview with UNICEF representative

<sup>47</sup> USAID, “Malawi, Water and Sanitation Profile” [http://pdf.usaid.gov/pdf\\_docs/PNADO934.pdf](http://pdf.usaid.gov/pdf_docs/PNADO934.pdf)

<sup>48</sup> ICWP

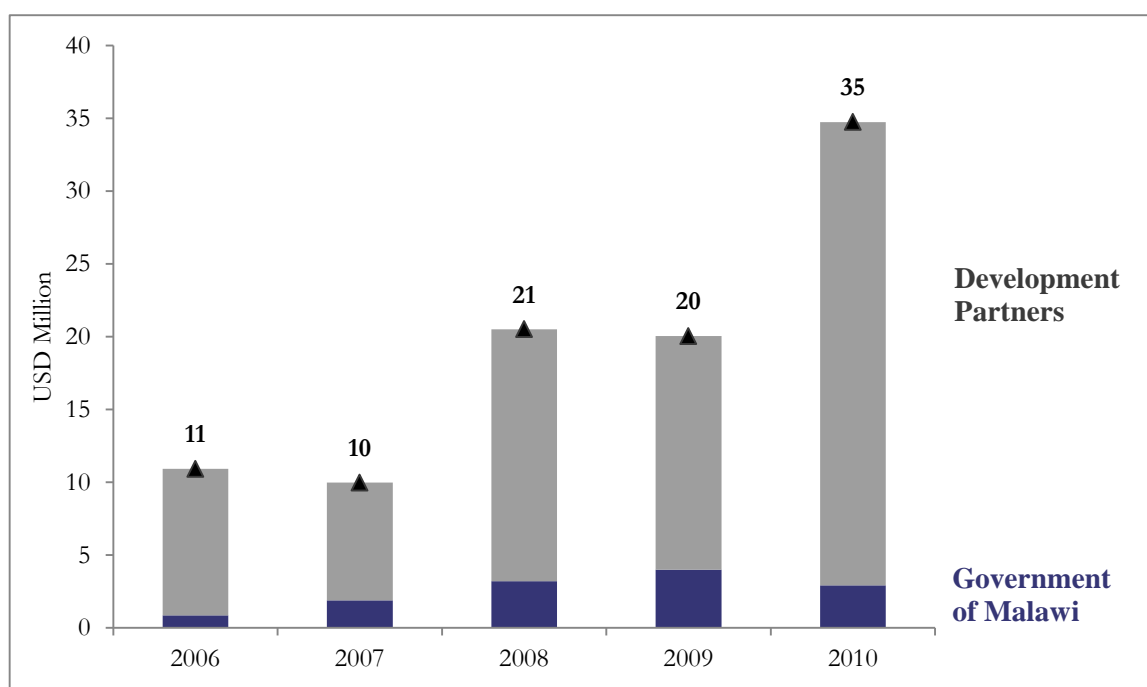
<sup>49</sup> Ministry of Irrigation and Water Development, 2009 "Dedza District Wide Sector Investment Plan for water, sanitation hygiene 2009-2015"

## 4 Reviewing Expenditures in Irrigation

As in the WSS sub-sector, expenditure in irrigation is categorized into spending to cover recurrent costs, and spending on capital investments. Unlike the WSS sub-sector, however, the majority of irrigation expenditure was in capital investments, with only four percent going towards the coverage of recurrent costs. Not surprisingly, all expenditure in irrigation during the period from 2006 to 2010 occurred in rural areas, and the Water Boards did not contribute to irrigation. Therefore, expenditure on irrigation in Malawi was all funded by the Government or Development Partners.

Between 2006 and 2010, spending in the irrigation sub-sector totalled US\$96 million, with expenditure in 2010 three times greater than in 2006. This change can be explained by a tripling in contributions provided by Development Partners. Between 2006 and 2010 the Government contributed US\$13 million to irrigation, accounting for only 13 percent of total sub-sector expenditure. The relative contributions of each are shown below in Figure 4.1.

**Figure 4.1: Composition of Funding for Expenditures on Irrigation, 2006-2010**



Source: Castalia analysis based on data provided by the Ministry of Finance

### 4.1 Capital Investments in Irrigation

Total capital investments in irrigation between 2006 and 2010 amounted to US\$92 million, or 95 percent of all expenditure on irrigation. Contributions by Development Partners accounted for 91 percent of this US\$92 million, and the Government accounted for the remaining nine percent (US\$8 million). All of the Development Partner contributions were used for capital investments, and sixty-five percent of expenditure on irrigation by the Government was put towards capital investments.

#### 4.1.1 Notable irrigation projects

Most of the projects that were funded between 2006 and 2010 entailed constructing irrigation facilities and supporting investments in capacity building and administration. Two projects that did not have a construction aspect are also discussed below. These are the Shire Valley Irrigation Scheme, which entailed the design of a new scheme, and the NWDP II, which funded policy creation in areas relevant to irrigation.

##### **Projects with a project construction component**

Most of the irrigation projects had, as a core component, the construction of new irrigation facilities. However, they also tended to include components that increased farmers' productivity and Government capacity. The projects with a project construction component in irrigation were:

- **Irrigation, Rural Livelihoods, and Agriculture Development (IRLAD) Project**<sup>50</sup>: This project is co-financed by the World Bank and the International Fund for Agricultural Development (IFAD). It began in 2006 and is expected to be completed in 2012, with a planned total contribution from the World Bank of US\$40 million and from IFAD of US\$8 million. The project components and their relative proportion of total cost are:
  - Irrigation rehabilitation and development (25.5 percent)
  - Farmer services and livelihoods fund (48.3 percent)
  - Institutional development (21.4 percent)
  - Project coordination, and monitoring and evaluation (4.8 percent)

The Government and project beneficiaries are also expected to contribute to the project, at US\$5.4 and US\$2.5 million, respectively. The MoAIWD is the lead Government agency on the project, with a project steering committee chaired by the Principal Secretary. It is estimated that the project will benefit 827,000 individuals in total and 10,200 farm families are expected to benefit from small-scale irrigation<sup>51</sup>

- **Smallholder Irrigation Project (SHIP)**: The project's objective is to contribute to food security by increasing total land under irrigation by 4,600 hectares, and increasing the agricultural productivity of 12,000 smallholder farmers.<sup>52</sup> The project was started in 2000 and completed in 2008. During this time, the AfDB contributed US\$6 million in funding. The project had three main components: (i) establishment of small scale irrigation schemes and rehabilitation of earth dams; (ii) the provision of credit through microfinance schemes for treadle and motorized pumps, sprinkle irrigation systems, and other agricultural investments;

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<sup>50</sup> World Bank Project ID P121120.

<sup>51</sup> International Fund for Agricultural Development, 2005. Report and Recommendation of the President to the Executive Board on a Proposed Loan to the Republic of Malawi for the Irrigation, Rural Livelihoods and Agricultural Development Project, at pages 10-11. Available at: <http://www.ifad.org/gbdocs/eb/86/e/EB-2005-86-R-18.pdf>.

<sup>52</sup> African Development Fund, 1998. "Appraisal Report, Smallholder Irrigation Project, Republic of Malawi". REF.NO MAI/PAA I/98/02.

and (iii) capacity building at the MoAIWD, Bunda College of Agriculture, the University of Malawi, and Namral Resource College

- **Bwanje Irrigation Scheme (Bwanje II):** During the period from 2005 to 2010, the Bwanje Irrigation Scheme was rehabilitated with about US\$8 million in funding from Japan's Ministry of Foreign Affairs, provided via the Japanese International Cooperation Agency (JICA). The original Bwanje Irrigation Scheme (Bwanje I) was completed in 1997. The Scheme was damaged by severe flooding arising from a tropical cyclone. A number of dikes collapsed causing the system to stop functioning effectively.<sup>53</sup> Additionally, the rehabilitation leveled off the irrigated farmland, something the original project did not do.
- **Smallholder Crop Production and Marketing:** This project developed 39 small-scale irrigation schemes and provided training for 39 Water User Associations. The project was initiated in 2007 and is expected to be completed in 2013. Between 2006 and 2010, the AfDB provided US\$14 million in funds for the project. The irrigation schemes are expected to extend irrigation to 4,560 hectares and provide farmers with 1,140 treadle pumps. This investment in physical infrastructure is combined with extensive training programs. These programs aim to provide 600 smallholder farmers (half of whom are women) with training in water management, 350 smallholder farmers (175 women) with training in crop production, and thousands more farmers with training in environmental mitigation measures, financial planning, and basic market research<sup>54</sup>
- **Horticulture and Food Development:** This project aimed to increase food security, partly by increasing land under irrigation, through the rehabilitation of 25 small earth dams.<sup>55</sup> From 2006 to 2010, the project was provided with nearly US\$5 million by the AfDB.<sup>56</sup> The project began operations in 2004. Aside from rehabilitating the dams, the project provided marketing training to farmers

### **Project with a design and policy component**

An important irrigation project over the period which did not directly result in the construction of additional facilities was the Shire Valley Irrigation Scheme. During the 2006-2010 period, extensions were designed to irrigation facilities in the Shire Valley. Irrigation in this area was first constructed in 1952 and spans 13,800 hectares. The designs look into extending this area by 42,000 hectares which would benefit some 73,500 families in the

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<sup>53</sup> Japan MOFA, 2005. "Reference" [http://www.mofa.go.jp/policy/oda/evaluation/annual\\_report\\_2005/text-pdf/reference.pdf](http://www.mofa.go.jp/policy/oda/evaluation/annual_report_2005/text-pdf/reference.pdf).

<sup>54</sup> African Development Fund, 2006. "Republic of Malawi, Smallholder crop production and marketing project appraisal and rural development department, North, East and South."

<sup>55</sup> Nkhoma, B.G. 2011 "The politics, development and problems of small irrigation dams in Malawi: Experiences from Mzuzu ADD." *Water Alternatives* 4(3), 383-398.

<sup>56</sup> FAO, 2010. "Project Portfolio, Malawi." AQUASTAT <http://www.fao.org/nr/water/aquastat/sirte2008/index.stm>

districts of Chikhwawa and Nsanje.<sup>57</sup> The Government is seeking US\$191 million in funding for the first phase of the project.<sup>58</sup>

#### 4.1.2 Total Expenditure in Irrigation, 2006-2010

Table 4.1 below shows the sources of funding and amount of expenditure in the irrigation sub-sector between 2006 and 2010.

**Table 4.1: Summary of Contributions to Irrigation in Malawi, 2006-2010**

Source of Funding	Amount (US\$)
World Bank	30 million
African Development Bank	25 million
Government of Malawi	13 million
Japanese International Cooperation Agency	12.5 million
Arab Bank for Economic Development	8 million
The Republic of India	7.5 million
United States Agency for International Development	0.40 million
Total	96 million

Source: Analysis by Castalia, based on data provided by the Ministry of Finance

In addition to the projects described above, between 2006 and 2010, India, the Arab Development Bank, and the United States all contributed to the irrigation sub-sector. In 2010, India contributed US\$15 million to the **Green Belt Initiative** (GBI) and other initiatives related to Integrated Rural Development (IRD). Data is not available to analyze what percentage of this funding went specifically to irrigation; irrigation is one of the many components of the GBI. We have estimated half of this total (US\$7.5 million) as contributing to an increase in the area of land under irrigation.

The Arab Bank for Economic Development contributed US\$8 million to irrigation in Malawi, towards the **Small Farms Irrigation Project**. Finally, the United States Agency for International Development contributed US\$0.40 million to irrigation in Malawi between 2008 and 2009.

<sup>57</sup> World Bank and Ministry of Irrigation and Water Development Privatization Commission, 2011. "Public Private Partnership Options Study and Awareness raising for irrigation investment in Malawi."

<sup>58</sup> FAO, 2008. "High-Level Conference on: Water for Agriculture and Energy in Africa: the Challenges of Climate Change, Republic of Malawi." Sirte, Libyan Arab Jamahiriya, 15-17 December 2008.

## 5 Reviewing Performance in Irrigation

This section describes the irrigation sector's performance over the period of this PER (2006–2010). The analysis has three main findings:

- **Investment was in line with government priorities:** investment in irrigation mostly benefited smallholders, the type of farmers to which the Government aimed to extend irrigation. However, the increase in irrigation achieved over the period was only a small proportion of the increase that the Government was aiming to achieve
- **Projects were mostly well-designed:** projects over the period, especially those designed towards the second half of the 2000s, tended to be relatively well-designed. Low cost irrigation technologies were implemented with substantial community involvement in the initiation and management of the projects. This brought them in line with the projects that have tended to be successful in Sub-Saharan Africa and elsewhere<sup>59</sup>
- **Government capacity is crucial:** the “near failure” or failure of a number of projects can be ascribed to the absence of sufficient government capacity. Projects that over-estimated government capacity were especially susceptible to failure.

The importance of this section for the Government going forward is twofold. First, the Government should consider continuing to focus on smallholder projects, with low unit costs and substantial community involvement. Secondly, to increase investment, the Government should focus on increasing capacity to implement projects since this has been a major stumbling block for projects in the past.

### Background and Limitations

The Presidential target for area of land developed for irrigation in Malawi is one million hectares.<sup>60</sup> Studies have estimated that the total potential for irrigation in Malawi lies between about 162,000 hectares<sup>61</sup> and 485,000 hectares.<sup>62</sup> According to the MoAIWD, the potential lies between 400,000 and the Government's target of one million hectares.<sup>63</sup> To date, Malawi has developed somewhere between 56,000 and 90,000 hectares of its agricultural land.<sup>64</sup>

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<sup>59</sup> AfDB, FAO, IFAD, IWMI and World Bank, 2007. “Investment in Agricultural Water for Poverty Reduction and Economic Growth in Sub-Saharan Africa.”

<sup>60</sup> Draft Strategic Plan for the Green Belt Development Initiative. Office of the President and Cabinet, Government of Malawi, March 2011.

<sup>61</sup> Malawi country statistics, Aquastat, Food and Agriculture Organization Water Report 29, 2005. Available at: [http://www.fao.org/nr/water/aquastat/countries\\_regions/malawi/tables.pdf#tab1](http://www.fao.org/nr/water/aquastat/countries_regions/malawi/tables.pdf#tab1).

<sup>62</sup> Water Resources Investment Strategy, Component 2, Final Report, August 2011, MoAIWD, NWDP II, IBRD, World Bank, WS Atkins International Ltd., Wellfield Consulting Services Ltd., Interconsult Malawi.

<sup>63</sup> Malawi Irrigation, Water, and Sanitation 2010 Sector Performance Report, Ministry of Irrigation and Water Development, Government of Malawi, May 2011, page 25.

<sup>64</sup> The 56,000 hectares estimate is from the 2010 Africa Infrastructure Country Diagnostic (AICD) Malawi Country Report. The 90,000 hectares estimate is from 2010, as reported in the MoAIWD's Sector Performance Report dated May 2011.

The evident lack of consensus on both the amount of land that is currently irrigated, and the irrigable potential of Malawi, is the result of a fundamental data limitation. None of the studies that have been carried out include both formal and informal irrigation, and therefore do not give a measure of irrigable potential.<sup>65</sup> Furthermore, the data on land suitability, water availability, and the relative efficiencies of irrigation technologies—all key inputs to estimating irrigable potential—are outdated. There is urgent need for a new land and irrigation assessment in Malawi; good data will build a foundation for consensus about the potential of the sector and, therefore, for sector planning.

Due to the lack of data, measurement of progress of the irrigation sector is difficult, although some reports offer partial insight. As reported by the World Bank, between 1973 and 2003 irrigated area in Malawi expanded at about six percent per year.<sup>66</sup> This is in line with the most recent target for the irrigation Headline Indicator of the MoAIWD. However, since 2003 the annual growth rate has slowed considerably, to 0.6 percent. During roughly the same period, Malawi's agricultural sector grew at about 0.75 percent annually.<sup>67</sup>

The following discussion has two components. First, to provide context and an overview of the sector, certain notable irrigation projects implemented over the period are highlighted. Secondly, the impact that these investments had is examined in order to extricate lessons that can be implemented going forward. The extent to which investments in the sector achieved the Government's objectives is also reviewed and their efficiency, effectiveness and impact are discussed.

## 5.1 Measuring the Impact of Investments in Irrigation

This section measures how successfully investment in the irrigation sector has achieved the Government's objectives. The "efficiency, effectiveness and impact" of individual projects is then discussed.

### 5.1.1 Investment objectives

According to the MGDS I, the Government's objective for irrigation was to increase "*agricultural land under irrigation*" and reduce "*dependence on rain-fed agriculture*." The MGDS I had a target to increase land under irrigation by 74,000 hectares by 2011. The MGDS I also included targets for rehabilitation of irrigation schemes and installation of treadle pumps and motorized pumps. These technologies are typically used by smallholders. Extending access to smallholders is an important component of the Government's aim to increase "*small scale irrigation (e.g water harvesting) and use winter cropping/water harvesting at the smallholder level*" and "*develop farmer groups/cooperatives to use irrigation systems and maintain irrigation*." The investment in irrigation occurred within the broader objective of the MGDS I to "*increase agriculture productivity*".<sup>68</sup>

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<sup>65</sup> 'Formal' irrigation schemes are typically large, engineered projects that are under the control of a government body. Irrigation schemes instituted by individual farmers or smallholders are categorized as 'informal.' The distinction can also be phrased as 'estate' and 'smallholder' irrigation.

<sup>66</sup> The World Bank, 2010. Malawi's Infrastructure: A Continental Perspective. Country Report, Africa Infrastructure Country Diagnostic (page 20).

<sup>67</sup> The August 2011 Water Resources Investment Strategy cites that between 2002 and 2010, Malawi's agricultural sector grew by six percent, suggesting an average annual growth of 0.75 percent. (page 37).

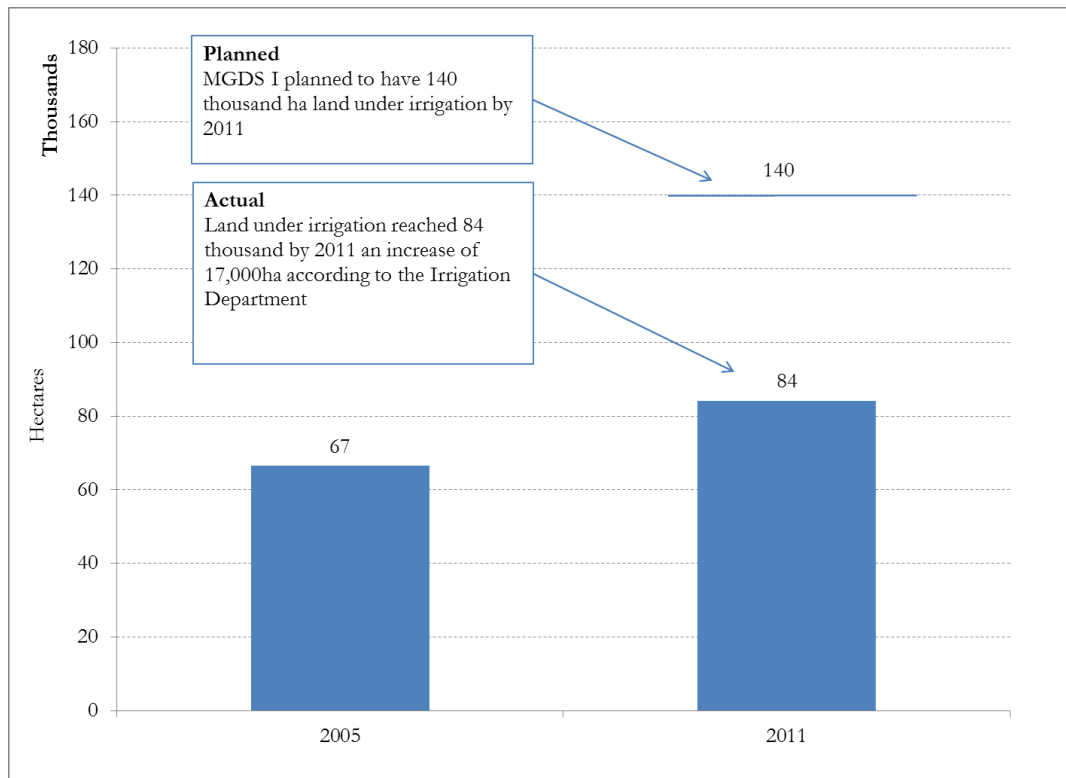
<sup>68</sup> Government of Malawi, 2006. "Malawi Growth and Development Strategy, from Poverty to Prosperity 2006-2011."



### The increase in irrigation was below the Government's objectives

According to the Irrigation Department, the total increase in irrigated land in Malawi from 2006 to 2011 was 17,000 hectares. This increase came from a combination of public sector sources including Government programs, NGOs, and a small component of private investment (principally in private estates and watering cans). As can be seen in Figure 5.1 the overall increase was much lower than the 74,000 hectares that the Government aimed to achieve in the MGDS I.

**Figure 5.1: MGDS I Objective for Irrigation and Actual Outcome**

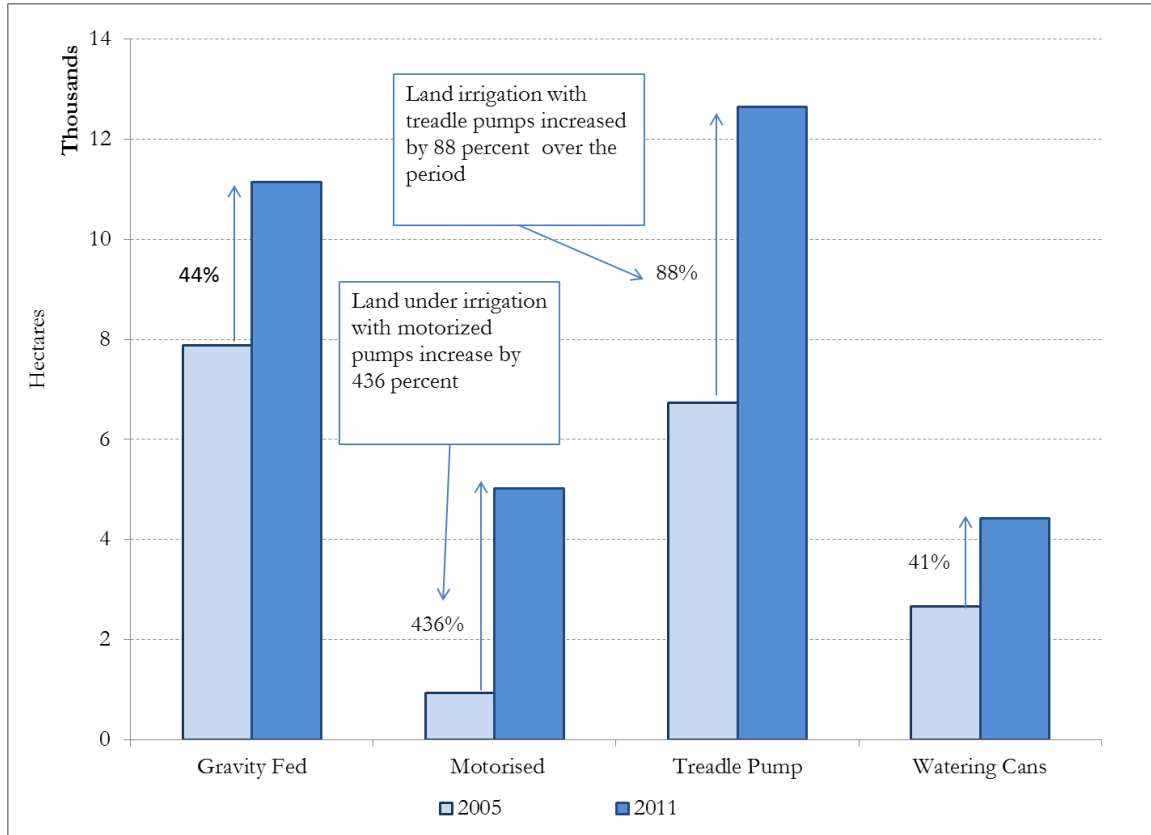


Source: MGDS I and Irrigation Department

### Irrigation investment largely benefited smallholders

Investment over the period was in line with the Government's objectives. The MGDS I focused on irrigation for smallholder farmers. In line with this focus, over the period there was a dramatic increase in smallholder irrigation (irrigation by watering cans, treadle pumps, gravity and motorized pumps), as reflected in the increase in land irrigated by treadle and motorized pumps. This type of irrigation increased dramatically over the period. Motorized pumps increased by 436 percent and treadle pumps increased by 88 percent. Overall, smallholder irrigation increased by 82 percent over the period, from 18,000 hectares in 2005 to 36,000 hectares in 2010. This constituted an 85 percent increase in irrigation over the period. Despite this large increase in smallholder irrigation, large plantations continued to constitute the majority of land under irrigation. Plantation irrigation covered 50,000 hectares in 2011, still substantially higher than the 36,000 irrigated by smallholders. However, plantation irrigation increased a modest 5 percent over the period.

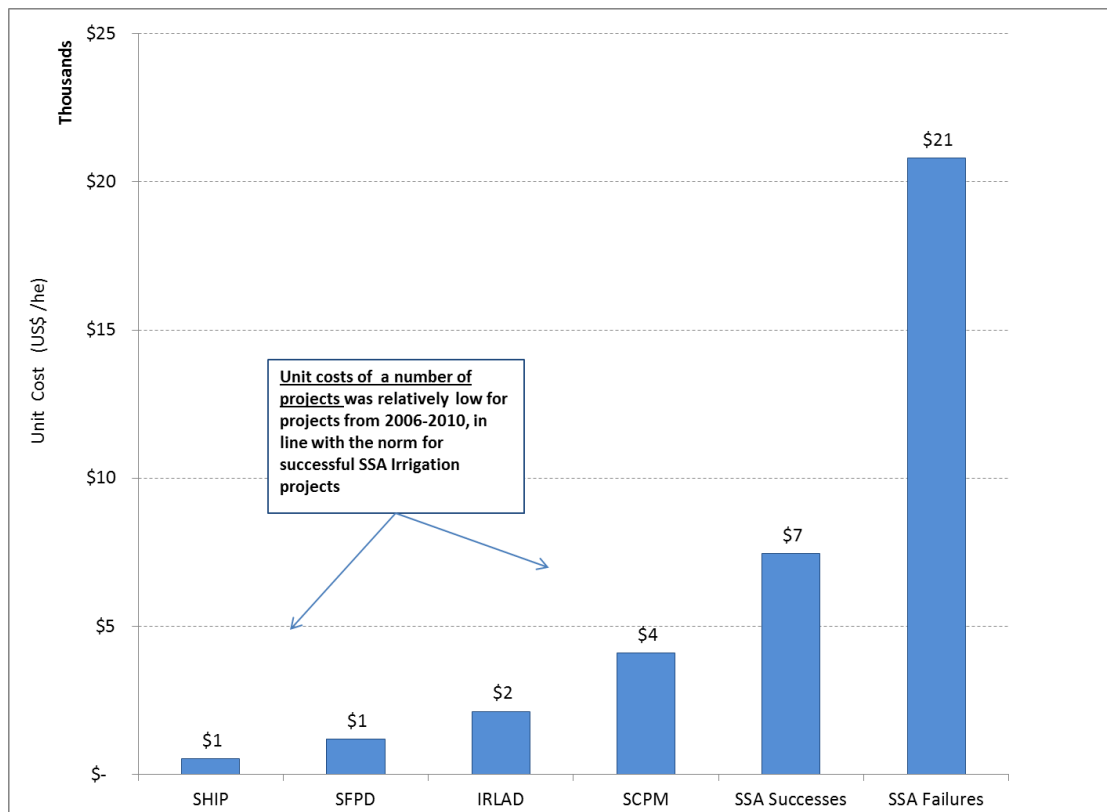
**Figure 5.2: Types of Irrigation for Smallholders in 2005 and 2011**



Source: Irrigation Department of the MoAIWD.

The use of relatively simple, low cost irrigation technology meant that the costs of irrigation projects were relatively low on a per hectare basis. Historically, lower unit cost projects have (on average) generated higher Economic Internal Rates of Return (EIRR) on investment. This is illustrated in Figure 5.3. It compares their unit costs to projects in Sub-Saharan Africa (SSA) that previous research has shown were successful (EIRR above 10 percent) and those that failed (EIRR less than 10 percent).

**Figure 5.3: Unit cost of projects compared to successful and unsuccessful projects in Sub-Saharan Africa**



Source: Castalia calculations, project documents<sup>69</sup> and Inocencio *et al* (2007)<sup>70</sup>

### 5.1.2 Efficiency, effectiveness and impact of investments

This section reviews the experience of individual projects to understand the drivers of the impact of individual projects. The effectiveness of the projects, for which we have information, ranges from “Success” to “Close Calls” to “Failure”. In line with previous experience in Malawi and elsewhere<sup>71</sup>, projects succeeded when they had the following characteristics:

<sup>69</sup> African Development Fund, 2006. “Republic of Malawi, Smallholder crop production and marketing project appraisal and rural development department, North, East and South”, May 2006. International Fund for Agricultural Development, 2005. Report and Recommendation of the President to the Executive Board on a Proposed Loan to the Republic of Malawi for the Irrigation, Rural Livelihoods and Agricultural Development Project, , pages 10-11. Available at: <http://www.ifad.org/gbdocs/eb/86/e/EB-2005-86-R-18.pdf>. African Development Fund, 1998. “Appraisal Report, Smallholder Irrigation Project, Republic of Malawi” REF.N0 : MAI/PAA I/98/02.

<sup>70</sup> Arlene Inocencio, Masao Kikuchi, Manabu Tonosaki, Atsushi Maruyama, Douglas Merrey, Hilmy Sally and Ijsbrand de Jong, 2007. Costs and Performance of Irrigation Projects: A Comparison of Sub-Saharan Africa and Other Developing Regions. International Water Management Institute, Report 109 <http://ageconsearch.umn.edu/bitstream/44516/2/RR109.pdf>

<sup>71</sup> AfDB, FAO, IFAD, IWMI and World Bank, 2007. “Investment in Agricultural Water for Poverty Reduction and Economic Growth in Sub-Saharan Africa” (Chapter 3).

- **Community orientated management:** projects with a community orientation appeared to be successful and sustainable. Those, such as Bwanje I, appeared to have failed, in part, because the Government, rather than the community, ran the scheme.
- **Designed to fit the capacity of the Malawi Government:** projects that could be implemented within the constraints of the institutional capacity of the Government were more likely to be successful. Those, such as the SHIP, which required the Government and private sector to have capacity in a field such as micro-finance in which they did not have any institutional capacity, failed.
- **Sufficient capacity in Malawi Government:** the HFCDP project appears to have failed due to a severe shortage of staff tasked with implementation at both a national and local level. That said, it appears that all projects (successful or not) faced difficulties with implementation arising from limitations in institutional capacity within the Government.

The discussion begins by reviewing a clear success, the IRLAD project.

### Success

The IRLAD project successfully established “1,496 hectares of mini-scale schemes ....on time.” The result of this and other interventions made in terms of the project, was a “30% improvement in maize yield [and a] 38% increase in farm incomes among project beneficiaries.” While the project was clearly successful, it did face challenges. There was a cost overrun which necessitated a request for additional financing.<sup>72</sup> The progress reports also suggest that the project faced challenges (a) getting approval for documents for the establishment of water user associations and (b) too few extension officers (too few positions rather than unfilled positions).

### Close Calls

The close calls initially struggled for a variety of reasons. Bwanje I, established in the late 1990s had not worked effectively due to problems with its construction and its institutional design. In contrast, SHIP struggled due to the inclusion of difficult to implement MFI components in the project. Ultimately, both projects appear to have been successful, at least in part.

Bwanje I struggled in the early 2000s because farmers did not use the irrigation facilities. When they did use the irrigation facilities, they used them for dry land agriculture such as maize and beans rather than for its intended purpose, growing rice. Veldwisch et al.<sup>73</sup> suggest the underlying reasons for the failure of the original project was the “top down” approach used in developing the project with the consequent failure of the community to support the project as well as the failure to flatten the land during the construction phase, despite plans to do so. The problems with the “top down” approach are not unique to

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<sup>72</sup> The additional financing was also used to extend the project. World Bank, 2010. “Irrigation, Rural Livelihoods and Agricultural Development Project”  
<http://web.worldbank.org/external/projects/main?pagePK=64312881&piPK=64302848&theSitePK=40941&Projectid=P084148>.

<sup>73</sup> Gert Jan Veldwisch, Alex Boldingb and Philippus Wester, 2009. “Sand in the Engine: The Travails of an Irrigated Rice Scheme in Bwanje Valley, Malawi.” *Journal of Development Studies*, Volume 45, Issue 2, 2009.

Bwanje I. In light of the experience with top-down approaches on irrigation projects in sub-Saharan Africa, a multi-donor review found that “*approaches that empower farmers by taking them in as partners and decision makers from the beginning .... appear to have the potential to improve the economics and prospects for sustainability of projects*”.<sup>74</sup>

Despite its inauspicious beginning in the early 2000s, by 2010 Veldwisch reports that the project was working successfully with all 800 hectares of the project being used for rice cultivation in the wet season, with a smaller area (145 hectares) planted with maize during the summer season.<sup>75</sup> A number of reasons lie behind the scheme’s resurrection after its rehabilitation under Bwanje II. This includes improvements to the scheme and institutional changes. A component of the rehabilitation was to flatten the land. This made irrigation work more effectively by allowing the water to be distributed throughout farmers’ fields.<sup>76</sup>

Another factor behind the resurrection of the Bwanje scheme was the transfer of management from the Government to a co-operative in 2004. The co-operative sells rice for 50 percent more than surrounding farmers because the co-operative has better “grading, milling and packaging skills” than surrounding farmers. The scheme has support from the community and the Government. When the co-operative was established each member contributed MK500. The co-operative is supported by four extension officers from the Local Assembly with an extension officer acting as “Irrigation Scheme Manager”.<sup>77</sup>

Like Bwanje I, SHIP faced a number of challenges. This is best illustrated by the struggle to disburse the funds. The documents were signed in April 2000 with the AfDB and the project was intended to last five years. One year after the project was supposed to be completed (in 2006), only 14 percent of the funds had been disbursed. The AfDB suggests several reasons for the delay for this, and other, projects. Projects were overly complex. For instance, the public and private sector did not have the capacity to implement the micro-finance components. There was also an absence of skilled staff at the project implementation units and Ministry.<sup>78</sup> This finding is in line with the multi-donor review’s finding that “public agencies have often lacked the skills, resources, and incentives to do the job assigned to them.”<sup>79</sup> Despite the challenges that SHIP faced, it did lead to the establishment of a number of irrigation facilities. The BSID sites inventory reports that a number of ongoing gravity and other types of irrigation schemes were created by SHIP. This qualifies SHIP as a partial success.

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<sup>74</sup> AfDB, FAO, IFAD, IWMI and World Bank, 2007. “Investment in Agricultural Water for Poverty Reduction and Economic Growth in Sub-Saharan Africa” (Chapter 3).

<sup>75</sup> James Johnstone, 2011. “Vulnerability of a run-of river irrigation scheme to extreme hydrological conditions - a case study of the Bwanje Valley Irrigation Scheme, Malawi.” A Thesis presented to The University of Guelph <http://dspace.lib.uoguelph.ca/xmlui/bitstream/handle/10214/3008/Thesis%20v13.pdf?sequence=3>

<sup>76</sup> Wageningen University, “Irrigation and Water Engineering, The Resurrection of Bwanje Valley Irrigation System, A re-study of BVIS 10 years after.”

<sup>77</sup> OVOP Group, “Bwanje Rice Cooperative.” [http://www.ovop.org.mw/group\\_bwanje.html](http://www.ovop.org.mw/group_bwanje.html)

<sup>78</sup> African Development Fund, 2006 “Republic of Malawi, Smallholder crop production and marketing project appraisal and rural development department, North, East and South.”

<sup>79</sup> AfDB, FAO, IFAD, IWMI and World Bank, 2007 “Investment in Agricultural Water for Poverty Reduction and Economic Growth in Sub-Saharan Africa” (Chapter 3).

## **Failure**

The HFCDP appears to have failed due to capacity shortages in the local and national government. According to Nkhoma, seven dams were supposed to have been rehabilitated in the Mzuzu District. By the end of the project, none of the dams had been rehabilitated. According to staff involved in the project, the project's difficulties arose because the project "was managed by the Ministry of Agriculture and Irrigation headquarters in Lilongwe." For this reason "it became extremely difficult to manage and supervise the projects in Mzuzu. At the local level, Mzuzu ADD was equally heavily understaffed and underfunded to effectively monitor and supervise the project; for instance, most of their vehicles were down."<sup>80</sup>

### **5.1.3 Conclusion**

This section has reviewed investments in the irrigation sector during the period from 2006 to 2010. The investments were in line with the Government's objectives in the sector. Although the land under irrigation increased, it did not increase as much as the Government targeted. Projects were well-designed and many were, ultimately, successfully implemented. The design features that led to successful projects included community orientation and the implementation of low cost technology. The main challenge over the period was an absence of capacity. Projects that required too much capacity from the Government came close to failure or failed.

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<sup>80</sup> Nkhoma, B.G. 2011. "The politics, development and problems of small irrigation dams in Malawi: Experiences from Mzuzu ADD" *Water Alternatives* 4(3): 383-398.

# Monitoring and Evaluation in the Water Sector

## 1 Introduction

During the past two decades or so, the Government of Malawi has made important progress toward increasing its citizens' access to water supply and sanitation. However, current access is well below the Government's objectives for the year 2025. Achieving those objectives will require substantial capital investments and considerable development of the relevant institutions and systems in the sector. The Water Sector Investment Plan (WSIP) we have developed provides the Government with a valuable tool for identifying and planning those investments and institutional developments.

Having agreed upon the objectives and the means it will pursue to achieve those objectives (as described in the WSIP), the Government needs an effective way to track its progress. Monitoring progress is a way to align plans with what is actually happening in the sector, by evaluating actual performance against targeted performance and feeding the information from the comparison back into the planning process. This sort of dynamic planning is done with a Monitoring and Evaluation (M&E) system.

In general, an M&E system allows for coordinated and comprehensive gathering, storage, communication, and analysis of relevant information. It ensures that stakeholders are provided with early indications of progress or obstacles towards achieving stated goals, and identifies achievements and areas of weakness that may need special attention. M&E is widely applied throughout the world, from monitoring governance to conflict prevention, to investment planning. An M&E system specific for water supply and sanitation must cover the activities and performance of a wide range of individuals and entities (from households to schools to local governments to water boards to the national government). Uganda has made great progress toward developing such an M&E system for water supply and sanitation.

This document outlines a way to develop an M&E system for the water sector in Malawi. It also proposes specific indicators for monitoring performance in water supply, sanitation, and irrigation. It begins with an overview of the reasons for and ways to monitor and evaluate in Section 2. Section 3 then provides the justification and target values for recommended performance indicators for water supply, sanitation, and irrigation. Section 4 describes the process for monitoring those performance indicators, and Section 5 discusses how evaluating and learning are key aspects of the planning and implementation process.

This document serves as a primer and an introduction to the development and use of an M&E system for the Ministry responsible for Water Supply and Sanitation. The Department of Planning expects to contract another consulting firm in the near future that will be responsible for developing a complete M&E system. In the meantime, this document should be helpful for conceptualizing and illustrating the importance and usefulness of an M&E system.

### 1.1 Work in Monitoring and Evaluation in Malawi

Monitoring and Evaluation systems have been used in Malawi for program monitoring, by entities such as the World Food Programme (WFP). Although there is not a sector-wide

M&E system in place for water, there is upcoming work in M&E in the sector, as described below.

### **Pan African Water Sector Monitoring and Evaluation Assessment**

The report provides an overview of the state of water sector monitoring and evaluation systems across Africa and the reasoning behind the need for their systematic improvement. It includes a section on Malawi, detailing the institutional arrangements, and data collection and management systems of M&E, and offers a diagnostic assessment of the state of M&E in the country.

### **Strengthening Water Sector Monitoring and Evaluation Project**

The AfDB and the Government are supporting a EUR 2.2 million project to develop an M&E system for the water sector. We understand that the Department of Planning of the Ministry responsible for Water Supply and Sanitation is in the process of contracting consultants for this project is underway; work on the project is expected to begin by the end of June 2012.

The expected output of the M&E project is a system that covers all activities in the water and sanitation sector and is operational in most of Malawi's 28 districts. The plan is to run a pilot program in a number of selected districts to enable each department of the Ministry a chance to develop a standard procedure, before expanding the M&E system nationally. This will be done by the departments for water resources, water supply and sanitation, and irrigation.

The objective of the M&E system is increased efficiency and effectiveness of investments in water and sanitation. To maximize the impact of this system, the consultancy chosen for the project should build upon the recent work of the Water Sector Investment Program, completed in April 2012 (as discussed in Section 1.2 below). Additionally, the consultancy should keep in mind the forthcoming work of the Government to develop an irrigation investment strategy when developing an M&E system for the sector.

### **Technical Working Group on Monitoring and Evaluation**

The Department of Planning of the Ministry of Agriculture, Irrigation, and Water Development (MoAIWD) currently chairs the Technical Working Group (TWG) on Monitoring and Evaluation. This effort is grouped under the larger Government effort to move towards a Sector Wide Approach (SWAp) in the Water and Sanitation sector. The TWG on M&E is taking a lead role on several initiatives. These include an effort to standardize the definitions of "improved water" and "improved sanitation" that are used in all reporting and household surveys of Malawi. Furthermore, the TWG for M&E in the water sector is also working to refine and develop the Headline Indicators used for measuring performance against targets within a Monitoring and Evaluation system for the water sector.

### **Development of a Monitoring and Evaluation System for Rural Water Supply and Sanitation**

The Ministry of Health, with support from the Open Defecation Free Task Force, is developing a Monitoring and Evaluation system for rural sanitation and water supply in Malawi. The system aims to collect comprehensive village-level information on water supply and sanitation, and, after a pilot period, will be scaled up to all districts in Malawi.



## 1.2 Building upon the Water Sector Investment Program

The need for an M&E system arises from recent advances in investment planning in the water sector. This planning is achieved with the Water Sector Investment Program (WSIP), completed in April of 2012. The WSIP is a planning tool for short- and long-term investments. It provides an evaluation of the long-term investment requirements for water supply and sanitation, based on a targeted level of sector performance. An M&E system will work in conjunction with the WSIP (and the equivalent plan for the irrigation sub-sector, which is forthcoming) to track the efficiency and effectiveness of investments in the water sector.

As part of its assignment for developing a WSIP, Castalia developed a set of performance indicators that the Government can use for monitoring its objectives in the water supply and sanitation sector. This set includes indicators for water supply, sanitation and hygiene, and also for irrigation, and should serve as the starting point for an M&E system that is used to analyze the effectiveness of sector investments as outlined in the WSIP.<sup>81</sup> Section 3 details these indicators.

## 2 Monitoring and Evaluation: What and Why

An assessment of the effectiveness of investments in water supply and sanitation requires a way to monitor the changes that result from those investments. If investments are effective, they will lead to improvements in performance that contribute to reaching the goals that were set during investment planning. In order to know if the sector is improving, measurements of performance need to be taken periodically and compared to the investment goals. For example, if the Government wants 100 percent of the population to have access to improved water by 2025, it should determine what percentage of the population has such access today, then measure access periodically (say every three years) to see if it is increasing at a rate that will achieve the goal for 2025.

The results of periodic measurements will inform the Government of the effectiveness of the chosen investments. If performance is not progressing at a rate that will reach the targeted level by the specified date, the Government can respond in the short term by taking corrective action. In the long term, analysis of the data on performance can inform the Government of what may have gone wrong; investment planning can then be adjusted based on the lessons learned in the process.

Monitoring and evaluation is an on-going process that should occur in parallel with investment planning. As performance targets for investment are updated (routinely, every three to five years), the evaluation yardstick for performance measurements should also be updated. In this way, investment planning and monitoring and evaluation inform and supplement each other, resulting in better information exchange and coordination in the sector.

### 2.1 Definitions

There are three main components to any M&E system. These are defined below:

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<sup>81</sup> The existing set of 18 indicators will need to be supplemented with a number of additional performance indicators for the irrigation sub-sector.

- **Information**—a collection of facts from which conclusions may be drawn and is the result of processing and analyzing data that have been collected over time
- **Monitoring**—the continuous collection, transmission, storage, and treatment of data and information to assess the achievement of established or agreed targets
- **Evaluation**—the periodic assessment of a project, program, or strategy, relative to an objective. The assessment may be made on the basis of relevance, performance, efficiency, or impact.

A sustainable M&E system will be strong in each of these three areas, but information is the most essential component for an M&E system to be effective. Reliable and appropriate information is necessary for effective planning, management, and investment in water supply and sanitation.

## 2.2 The Cycle of Monitoring and Evaluation

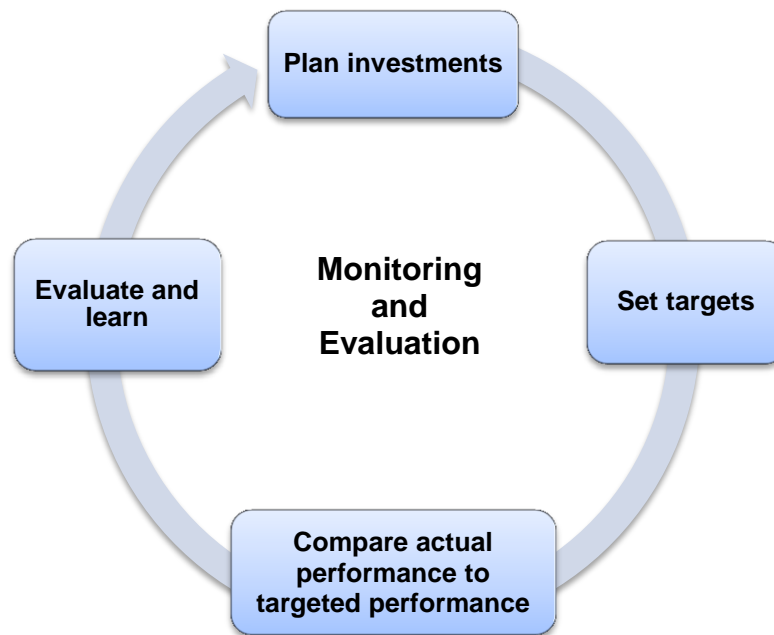
Ideally, planned investments in water supply and sanitation will improve the level of access, efficiency, and quality sufficiently to reach the level of performance targeted during the investment planning phase. However, during the three to five years that elapse between planning phases, the situation and needs of the sector may change. These changes have implications for investments that need to be accounted for when new plans are made. An M&E system is a way to track and respond to these changes on a continuous basis, in order to maintain the level of progress that is desired for the sector.

A well-developed M&E system provides a steady flow of information that can be used to track performance in the areas targeted during investment planning. In order to track the effectiveness of investments, future goals for performance must be set using quantitative targets. For instance, progress in providing the population with potable water can be quantified in percentage terms (for example, the proportion of the population that has access to improved water). By taking periodic measurements on this and other indicators of performance in the sector, the Government can learn what sorts of investments are effective, and which are not.

The information generated by the M&E system should be evaluated before the next investment planning process so that the Government can analyze the appropriateness of past investments and performance targets. Lessons learned through this analysis should be applied to the next round of planning in order to adjust performance targets and achieve greater effectiveness of investments. This iterative process is illustrated in **Figure 2.1** below.

**Figure 2.1: The Cycle of Monitoring and Evaluation**

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In sum, an effective M&E system will provide the Government and relevant stakeholders with a valuable tool for tracking performance and achievements in the short, medium, and long term. It also allows for a dynamic and flexible approach to planning that can respond to unexpected changes (such as shifts in population migration or availability of water resources). For example, in Malawi, the WFP's program monitoring is found to ensure:

- Greater accountability in the use of resources
- Greater focus on achievement
- Clearer basis for timely decision-making
- Promotion and enhancement of institutional learning and knowledge sharing.

Without such a system, it is difficult to identify key areas for improvement and necessary changes for achieving the Government's objectives.

### 3 Choosing Indicators and Setting Targets

The creation of an M&E system for the water sector starts with the selection of indicators for tracking performance within each of the sub-sectors: water supply; sanitation and hygiene; and irrigation. For each indicator, short, medium, and long-term targets for performance should be set. This will enable the Government to track actual progress against targets; such monitoring can then guide adjustments to planning in the sector. This sort of iterative process can achieve more efficient investment over time.

Tracking actual performance against planned targets requires a standard set of indicators that are applied to the entire country over many planning periods. It also requires that the data collected on each of the indicators be reliable, consistently reported, routinely aggregated, and easily accessible as public information. The Government must establish and strengthen mechanisms for ensuring data quality, and the upkeep and accessibility of data. Ideas for doing so are discussed in Section 4.

There has been significant work to develop indicators for monitoring performance in the water sector of Malawi, mainly as part of the annual Sector Performance Review (SPR). The ‘Headline Indicators’ of the SPR were further developed in early 2012 into a set of 20 performance indicators.<sup>82</sup> Subsequently, the Government asked Castalia to remove the indicators regarding water supply in schools; this section therefore presents 18 indicators. The Technical Working Group on Monitoring and Evaluation for the water sector—chaired by the Department of Planning at the Ministry of Agriculture, Irrigation, Water, and Development—is also working on refining and further developing these indicators.

The Water Sector Investment Plan of April 2012 contemplates some of these indicators—specifically, those that relate to access to improved water and improved sanitation, and the operational and financial efficiency of the five Water Boards. In order to build upon existing knowledge and progress in the sector, this previous work is the basis for the set of M&E indicators described below.

#### 3.1 Performance Indicators and Targets for Monitoring and Evaluation

Table 3.1 below summarizes the short, medium, and long-term targets for each of the performance indicators that should serve as the basis for an M&E system for the water sector. Note that there is a need to develop more indicators to track performance in the irrigation sub-sector; this is further discussed in Section 3.4.1.

**Table 3.1: Recommended Performance Indicators and Targets for the Water Sector of Malawi**

	Recommended Targets		
	2015	2025	2030
Water Supply			

<sup>82</sup> See Volume III: Proposed Performance Indicators for the Water Supply, Sanitation, and Irrigation Sector of *Working Paper on the Water Supply, Sanitation and Irrigation Sector of Malawi*, Report to the World Bank and the Government of Malawi, Castalia, 16 January 2012. This work built upon the Headline Indicators of the 2011 Sector Performance Review.

	Recommended Targets		
	2015	2025	2030
1. Percentage of people in urban areas within 200 meters of an improved drinking water source	95	98	98
2. Percentage of people in rural areas within 500 meters of an improved drinking water source	73	98	98
3. Percentage of drinking water samples taken at the point of water collection that comply with national standards	40	80	90
<b>Water Boards</b>			
4. Average hours of service provided per day			
BWB	24	24	24
LWB	20	24	24
NRWB	23	24	24
CRWB	24	24	24
SRWB	22	24	24
5. Operating Ratio (same for all water boards)	0.75	0.5	0.5
6. Percentage of water put into supply that is Non-Revenue Water			
BWB	41	28	20
LWB	30	23	20
NRWB	25	20	20
CRWB	25	20	20
SRWB	26	20	20
7. Collection Rate (same for all water boards)	90	95	95
<b>Sanitation and Hygiene</b>			
8. Percentage of urban households with access to improved sanitation	15	78	98
9. Percentage of rural households with access to improved sanitation	12	78	98
10. Percentage of urban primary schools that have 60 pupils or less per every one improved sanitary facility	80	100	100

	Recommended Targets		
	2015	2025	2030
11. Percentage of rural primary schools that have 60 pupils or less per every one improved sanitary facility	50	100	100
12. Percentage of samples taken at effluent discharge points that comply with national standards	90	99	99
13. Percentage of urban households with functioning hand washing facilities, with water and soap	20	60	80
14. Percentage of rural households with functioning hand washing facilities, with water and soap	15	55	75
15. Percentage of urban primary schools with functioning hand washing facilities, with water and soap	98	100	100
16. Percentage of rural primary schools with functioning hand washing facilities, with water and soap	85	100	100
<b>Irrigation</b>			
17. Percent annual increase in total area of land that is developed for irrigation	6	6	6
18. Total land under irrigation, in hectares	128,000	229,000	306,000

Sources: Volume III: Performance Indicators of *Working Paper on the Water Supply, Sanitation and Irrigation Sector of Malawi*, Report to the World Bank and the Government of Malawi, Castalia, 16 January 2012.  
Targets updated based on the 'Recommended Scenario' of the *Malawi Water Supply and Sanitation Investment Plan (WSIP)*, Report to the World Bank and the Government of Malawi, Castalia, 2012.

The sections below describe these 18 performance indicators that can serve as the foundation for further development of an M&E system for the water sector. For each indicator, we include a definition and suggestions for its measurement, as well as a rationale for why it is useful within the sector.

### 3.2 Description of M&E Performance Indicators for Water Supply

Performance Indicators for the water supply sub-sector cover:

- Access to water
- Quality of water supplied
- Financial and operational performance of each of the five Water Boards.

The indicators for access are categorized into measurement at the level of individuals and targets for access are different for urban and rural areas. The use of a separate indicator for

urban and rural areas allows for the identification of inequality within Malawi, which can help guide investment. Performance indicators for the Water Boards are based on key indicators that are used internationally to monitor the progress of water utilities.

### 1. Percentage of people in urban areas within 200 meters of an improved drinking water source

The Government of Malawi has been using an indicator for access to improved drinking water since 2000. It is the indicator that is most well-documented in planning and measurement in the water supply, sanitation, and irrigation sector. Despite this, there remain discrepancies between sources that measure performance, primarily in the definition of important terms. The section below aims to clarify these terms to enable clear and consistent measurement.

#### Definition and measurement

The *percentage of people in urban areas within 200 meters of an improved drinking water source* measures the proportion of the population whose main source of drinking water is from any of the technologies categorized as ‘improved’ in **Table 3.2** below.

**Table 3.2: Types of Water Technologies**

Improved	Unimproved
<ul style="list-style-type: none"> <li>▪ Piped water into dwelling, plot or yard</li> <li>▪ Public tap/standpipe</li> <li>▪ Tube well/borehole</li> <li>▪ Protected dug well</li> <li>▪ Protected spring</li> <li>▪ Rainwater collection</li> </ul>	<ul style="list-style-type: none"> <li>▪ Unprotected dug well</li> <li>▪ Unprotected spring</li> <li>▪ Cart with small tank/drum</li> <li>▪ Bottled water</li> <li>▪ Tanker-truck</li> <li>▪ Surface water (river, dame, lake, pond, stream, canal, irrigation channels)</li> </ul>

Source: WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation in Malawi (updated March 2010).

The terms ‘urban’ and ‘rural’ in Malawi have not been clearly or consistently defined by the Government. The 2010 Sector Performance Report identifies urban, peri-urban, town, and market center water services as distinct from rural water services.<sup>83</sup> Since the indicators that the Government uses for monitoring access to improved water (and access to improved sanitation) are in terms of ‘urban’ and ‘rural’, we strongly suggest that the Government clearly classify each area in Malawi as either Urban or Rural. This could be done on the basis of a population density threshold. In the United States, for example, the threshold for Urban is at least 193 people per square kilometer. Urban areas that contain at least 2,500 people but

<sup>83</sup> For the purposes of this report, we have defined Urban in Malawi to be those areas where the Water Boards provide service. This is based on the assignment of the provision of water services in urban areas to the five Water Boards in the 1995 Waterworks Act. This definition is nearly in line with the SPR definition of rural as urban, peri-urban, town, and market centers: we understand that the Water Boards provide services in some, but not all, market centers.

less than 50,000 people are designated as urban clusters, and urban areas that contain more than 50,000 people are designated as urbanized areas; any other area is defined as Rural.<sup>84</sup>

Currently the measurement of the *percentage of people in urban areas within 200 meters of an improved drinking water source* indicator is computed as the ratio of the number of people that use any of the improved water sources in **Table 3.2** above to the total population, expressed as a percentage. Access to improved water among households is currently measured with the Household Questionnaire used in the Malawi Demographic and Health Survey (MDHS), with the Welfare Monitoring Survey (WMS), and with the Integrated Household Survey (IHS).<sup>85</sup>

These surveys do not measure access to an improved drinking water source in the same way. We suggest that measurement be harmonized across surveys. Moreover, none of the surveys address the distance traveled when collecting water. The MDHS and WMS do ask respondents how long it takes to travel to the source, collect water, and return home. This is a proxy for measuring distance to the source, but needs to be converted to actual distance in order to truly measure performance in the sector against the indicator.

### **Rationale for the indicator**

The international use of an indicator for access to improved water is based on the assumption that improved sources are more likely to provide safe water. Access to improved water reduces the rate of waterborne disease, a serious problem in Malawi. In Malawi's worst Cholera outbreak, there were 33,150 cases and 981 deaths.<sup>86</sup> Waterborne infectious diseases are a leading cause of child mortality and contribute to forms of growth retardation, including stunting and wasting. In Malawi, 48 to 53 percent of children under the age of five suffer from stunted growth.<sup>87</sup> In 2010, more than 30 percent of children in Malawi from the age of six to 23 months had suffered from diarrhea in the two weeks preceding the survey, with more than three percent having blood in their stool<sup>88</sup>. Furthermore, waterborne diseases keep students out of school. Increased access to improved water would therefore decrease the rate of waterborne diseases, and increase Malawi's education rate.

There are at least two reasons to specify a distance within which an improved water source should be located: productivity and sustainability. An improved water source is an important achievement; however, it is not very useful if a person has to spend an unreasonable amount of time collecting water for their household. The time the family member spends collecting water could instead be spent in school, or doing some form of productive work. A quarter of households in urban areas spend more than 30 minutes a day collecting water. This is a task

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<sup>84</sup> United States Federal Register, Volume 76, Number 164, Part II, Census Bureau, United States Department of Commerce, "Urban Area Criteria for the 2010 Census."

<sup>85</sup> All of these surveys are conducted by the National Statistical Office of Malawi. The MDHS was conducted in 1992, 2000, 2004, and 2010. The WMS is conducted annually, and the IHS was conducted in 1998 and 2005.

<sup>86</sup> The outbreak was from October 2001 to April 2002. WHO, 2008. "Global Task Force on Cholera Control, Cholera Country Profile: Malawi".

<sup>87</sup> Ariana Weisz, Gus Meuli, Chrissie Thakwalakwa, Indi Trehan<sup>1</sup>, Kenneth Maleta and Mark Manary, 2011. "The duration of diarrhea and fever is associated with growth faltering in rural Malawian children aged 6-18 months" *Nutrition Journal* 2011.

<sup>88</sup> MDHS 2010, National Statistical Office of Malawi, Government of Malawi.



that burdens mainly women and girls, who are responsible for collecting water in 57 percent of urban households.<sup>89</sup> If a family cannot afford to send someone on long trips to collect water, there is a risk that it will instead use a more convenient source that is unsafe. What is more, drinking water that must be carried a long distance from the improved source may be contaminated during transport or storage.

## **2. Percentage of people in rural areas within 500 meters of an improved drinking water source**

The Government of Malawi promotes that an improved drinking water source be available to rural households within 500 meters of the home.<sup>90</sup> The definition, measurement, and rationale for improved drinking water are the same as for the indicator on access to improved drinking water in urban areas. Measurement of this indicator will be easier following the adoption of a clear definition of ‘Rural’ in Malawi.

## **3. Percentage of drinking water samples taken at the point of water collection that comply with national standards**

This indicator was included in the 2010 Sector Performance Report, and favored by the ‘Core Ministry Team’. However, measurements have not been gathered to provide a baseline idea of where performance is today. The 2008 Malawi School WASH report measured the quality of drinking water sources in schools. We understand that measurements of water quality are taken at other water source points, but do not have data on these measurements. We suggest that Malawi measure *and report* the quality of water at all points of water collection, not just those used by schools.

### **Definition and measurement**

A ‘point of water collection’ should be understood as any source of improved drinking water. The end-goal of increased access to improved drinking water is safe—and affordable—water for all citizens. Therefore, water samples need to be taken to check that ‘improved’ sources are in fact safe. Quality sampling should therefore be done on water supply systems of the five Water Boards (piped water into homes or public plots), public taps and standpipes, boreholes, protected wells and springs, and rainwater collection.

The Malawi Bureau of Standards (MBS) has standards on water quality, such as MS 214 of 2005 for the quality of water supplied by the Water Boards. The MBS standards are used by the Central Water Laboratory, a body under the Water Quality Division of the Ministry of Agriculture, Irrigation, and Water Development. These standards should be periodically reviewed to ensure that they are up-to-date with international guidelines for drinking water quality, as recommended by the World Health Organization (WHO).<sup>91</sup>

Water quality can be measured in terms of the biological, chemical, or physical properties of water. Ideally, all three of these elements should be measured. Biological contamination of

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<sup>89</sup> MDHS 2010, National Statistical Office of Malawi, Government of Malawi.

<sup>90</sup> 2010 Malawi Irrigation, Water, and Sanitation Sector Performance Report (SPR), Ministry of Irrigation and Water Development, Government of Malawi, May 2011.

<sup>91</sup> The WHO guidelines provide recommendations for managing the risk from hazards that may compromise the safety of drinking water, including water quality. They are available at: [http://www.who.int/water\\_sanitation\\_health/publications/2011/dwq\\_guidelines/en/](http://www.who.int/water_sanitation_health/publications/2011/dwq_guidelines/en/).

water can be tested using a relatively inexpensive test, such as a hydrogen sulfide strip.<sup>92</sup> Physical properties of water such as color, taste and odor, and acidity can also be measured inexpensively.<sup>93</sup> Water should also be checked for chemical contamination, whether the contamination is naturally occurring, or due to industrial activity, solid waste, agricultural activities, or any other source.

Water quality is currently tested by the Central Water Laboratory, but alternatively could be monitored by an independent entity, such as the Technical Services Department of the Malawi Bureau of Standards, or by a regulator.

### **Rationale for the indicator**

Safe drinking water is required for a number of domestic purposes, including drinking, food preparation, and personal hygiene. Water that is unsafe for drinking can spread infectious diseases caused by pathogenic bacteria, viruses, and parasites. Examples of diseases transmitted through water contaminated by human waste include diarrhea, cholera, dysentery, typhoid, and hepatitis A. Moreover, unsafe levels of chemicals in drinking water can lead to long term exposure of the population to pollutants. This can have a range of serious health implications. For example, arsenic can cause cancer, and unsafe levels of fluoride can cause tooth and skeletal damage.<sup>94</sup> Drinking-water quality management has been a key to primary prevention of waterborne diseases globally for over one and a half centuries.

The international interest in increasing access to improved water sources is based on the assumption that improved sources are more likely to provide safe water.<sup>95</sup> However, this assumption is not always correct. For example, if a borehole is situated too close to a latrine, water from the source may be biologically contaminated. Malawi already demonstrates high levels of access to improved sources for drinking water; the next step is to ensure that, in fact, water from those sources is safe for drinking.

## **4. Average hours of service provided per day by each of the Water Boards**

One of the primary objectives of the Water Boards, as for any water utility, is to provide service of good quality to its customers. Good quality service means providing water service that is reliable, safe, and available 24 hours a day. Customers who are connected to a water utility through a pipe expect to be able to turn the tap on at any time of day and obtain water that is safe to drink. The number of hours during which the service is available is referred to as the 'continuity' of the service.

Further to being an indicator of the quality of service provided, the continuity of the service has a significant effect on the quality of the water received by customers. According to the WHO,

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<sup>92</sup> An 'H<sub>2</sub>S strip' is a strip of paper that is treated with lead acetate. The strip is placed into a small sample of water for 24 hours. The presence of hydrogen sulfide in the sample will turn the water black, indicating that it is unsafe. This is because harmful microorganisms produce hydrogen sulfide.

<sup>93</sup> Relatively inexpensive and simple strips also exist for measuring the pH level of a water sample.

<sup>94</sup> World Health Organization, 2010. Water for Health: WHO Guidelines for Drinking-water Quality..

<sup>95</sup> United Nations Development Group, 2003. Indicators for Monitoring the Millennium Development Goals.

*These classifications reflect broad categories of continuity, which are likely to affect hygiene in different ways. Any interruption of service is likely to result in degradation of water quality, increased risk of exposure to contaminated water and therefore increased risk of waterborne disease. Daily or weekly discontinuity results in low supply pressure and a consequent risk of in-pipe recontamination.* <sup>96</sup>

This indicator monitors the performance of the Water Boards where it matters most; that is, in delivering service of good quality to the customers.

### **Definition and measurement**

Continuity of service is defined as the average number of hours of service provided per day by each Water Board. Adequate measurement of this indicator requires having in place appropriate metering so that service interruptions can be identified and quantified. The Water Boards should be responsible for measuring and reporting their performance against this indicator.

### **Rationale for the indicator**

This is a standard indicator of the performance of water utilities. Water utilities, regulators, and governments use it to measure the quality of the service provided to customers. The continuity of service is a key measure of the quality of the service provided, and an important determinant of the quality of water provided. It also has important effects on customers' behaviors, such as willingness to pay and propensity to seek alternative means of supply. Furthermore, continuity of supply is one of the indicators in the Project Results Framework in the agreement between the World Bank and the Government of Malawi for Additional Financing for the Second National Water Development Project (NWDP II).

## **5. Operating ratios of the Water Boards**

The financial performance of the Water Boards is key to the Government's objectives for providing good quality water service to an expanding portion of the population within the service area of the Water Boards.

A minimum threshold for the financial performance of any water utility is that it is able to cover its operating expenses (this excludes depreciation and interest expenses) with its operating revenues (this excludes any grants or subsidies received from third parties). The 'operating ratio'—defined as operating expenses divided by operating revenues—indicates whether a water utility is meeting this minimum threshold. For example, a water utility with an operating ratio of 1.0 is exactly covering its operating expenses with its operating revenues.

Three key determinants of the operating ratio of a water utility are:

- The tariffs that it charges its customers—tariffs that are able to cover a greater portion of costs will improve the operating ratio
- Its customer composition—if tariffs have cross subsidies, having a higher percentage of those that subsidize others will improve the operating ratio

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<sup>96</sup> World Health Organization, 2011. Guidelines for Drinking-water Quality.

- Operating efficiency—greater efficiency leads to lower operating expenses and therefore improves the operating ratio.

A water utility that is more financially sound will have an operating ratio lower than 1.0, and will therefore be able to cover a greater portion of the costs of service with its operating revenues. A fully commercial water utility will be able to cover all costs of service (including depreciation, interest on debt, and a return on the capital provided as equity) with its revenues. Depending on a number of factors—such as its capital structure and requirement for capital investments—a fully commercial water utility could be expected to have an operating ratio of about 0.50.

In his budget statement of May 2010, the Minister of Finance indicated that the Government intends for the Water Boards to become commercial entities with the capacity to pay dividends to the Government (this statement did not specify when this would be achieved).<sup>97</sup> This means that the Water Boards will need to improve their current financial performance—in 2010, their operating ratios ranged from 0.76 (NRWB) to 0.97 (BWB). Improving the operating ratio of the Water Boards will require increasing their operating efficiency and real increases in the tariffs charged to customers.

### **Definition and measurement**

The ‘Operating Ratio’ is defined as operating expenses (this excludes depreciation and interest expenses) divided by operating revenues (this excludes any grants or subsidies received from third parties). The audited financial statements of each of the Water Boards should be used to calculate this indicator.

### **Rationale for the indicator**

Measurement of the operating ratios of each of the Water Boards is one of the Headline Indicators included in the 2010 Sector Performance Review (it is indicator number 13). The solid financial performance of the Water Boards is an important element to expanding the provision of good quality service to the households and businesses within their service areas. Since the Water Boards are not yet in a position to cover a larger portion of the cost of service through their own revenues, the operating ratio is a good indicator of whether they are meeting the minimum threshold of covering operating expenses with operating revenues.

Once the financial capacity of the Water Boards improves, it will be possible and useful to consider more comprehensive financial indicators, such as return on equity and the debt service coverage ratio.

## **6. Percentage of water put into supply that is non-revenue water, for each of the Water Boards**

Achieving the Government’s objectives in water supply requires having Water Boards that operate efficiently. One of the key measures of the operating efficiency of any water utility is its level of Non-revenue Water (NRW). NRW is the difference between the volume of water that has been produced or put into the system and the volume of water that is billed.

Among the benefits that result from a reduction in NRW are:

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<sup>97</sup> 2010/11 Budget Statement Delivered in the National Assembly of the Republic of Malawi by the Minister of Finance, 28 May 2010.

- Increased revenues by reducing the level of commercial losses
- Reduced operating expenses
- Reduced level of future capital investment required to meet the same level of demand
- Increased lifespan of infrastructure
- Improved quality of water provided by reducing the amount of pollutants that can enter pipes through cracks.

For all of these reasons, owners, managers, and regulators of water utilities closely monitor the level of NRW.

### **Definition and measurement**

Non-revenue water is computed as the difference between water supplied and water sold, as a percentage of water supplied.<sup>98</sup> Obtaining precise measurements of NRW requires having adequate metering and information systems in place. The Water Boards are working on improving their capacity to adequately measure NRW. The performance of the Water Boards against this proposed indicator should be measured based on data provided by the Water Boards.

### **Rationale for the indicator**

Measurement of the level of non-revenue water is the most comprehensive measure of the operating efficiency of a water utility. It is of particular importance for cases where the costs of producing or acquiring water are very high—for example, in Blantyre. This is one of the Headline Indicators in the 2010 Sector Performance Review, and is favored by the Core Ministry Team. Furthermore, this is one of the indicators in the Project Results Framework of the agreement between the World Bank and the Government for Additional Financing for the NWDP II.

## **7. Collection rate for each of the Water Boards**

The financial sustainability of the Water Boards requires that each develop an efficient and effective way to collect payments from their customers. Without adequate collection of payments, the Water Boards will not have the cash required to meet operating expenses or other financial obligations.

One standard way of measuring the collection efficiency of a water utility is the ‘collection rate’. The collection rate is calculated by dividing total cash collections during the year by operating revenues during that same year; it is expressed as a percentage. For example, if a water utility has revenues of \$100 in one year and only collects \$80 during that same year its collection rate will equal 80 percent.

If the Water Boards are to become commercial entities, they will have to markedly improve their collection rates. Based on the information received from the Water Boards, we were only able to calculate the collection rate for NRW. In 2010, NRW’s collection rate was approximately 82 percent.

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<sup>98</sup> “A Water Scorecard,” The World Bank Group Private Sector and Infrastructure Network, Public Policy for the Private Sector Note Number 242, April 2002.

## Definition and measurement

The collection rate is defined as cash collections for a year divided by operating revenues during that same year. It is expressed as a percentage. The Water Boards must provide data on collections in their audited financial statements or annual reports in order to calculate this indicator.

## Rationale for the indicator

A water utility that has a poor collection rate will not be financially sound. This is true regardless of the efficiency of its other operations and the level of its tariffs. Ultimately, water utilities must pay for operating expenses and other financial obligations with cash. With a poor collection rate, a water utility will not have the necessary cash to operate (unless its operating expenses are subsidized or its tariffs are excessively high). As such, the collection rate is a standard measure of the operating efficiency and financial performance of a water utility.

## 3.3 Description of M&E Performance Indicators for Sanitation and Hygiene

Performance indicators and targets for the sanitation and hygiene sub-sector should cover access to sanitation and hygiene facilities in households and schools. Targets for access are different in urban and rural areas. The disaggregation of urban and rural performance is important, as disparities would be masked by total numbers. An indicator is also proposed for monitoring the quality of treated effluent at discharge points.

Investments in sanitation and hygiene have a high economic return that benefits households, communities, and entire nations. It is estimated that improved sanitation in developing countries typically yields about US\$9 worth of benefits for every US\$1 spent.<sup>99</sup>

## 8. Percentage of urban households with access to improved sanitation

Increased access to improved sanitation is one of the targets of the Millennium Development Goals, which the Government has been working to achieve for over a decade. This proposed indicator provides a way to monitor progress towards increasing access to improved sanitation at the household level in both urban and rural areas.

## Definition and measurement

'Improved sanitation' refers to a facility that hygienically separates human excreta from human, animal, and insect contact. As shown in Table 3.3, facilities such as sewers or septic tanks, pour-flush latrines, and simple pit or ventilated improved pit latrines are considered improved, provided they are not shared by two or more households. To be considered effective, facilities must be correctly constructed and properly maintained.<sup>100</sup>

**Table 3.3: Types of Sanitation Facilities**

Improved	Unimproved
<ul style="list-style-type: none"><li>▪ Connection to a piped sewer system</li><li>▪ Connection to a septic tank</li></ul>	<ul style="list-style-type: none"><li>▪ Service or bucket latrines</li><li>▪ (where excreta are manually</li></ul>

<sup>99</sup> UN Water, United Nations. International Year of Sanitation 2008, Factsheet 2, 'Sanitation generates economic benefits.'

<sup>100</sup> United Nations Development Group, 2003. Indicators for Monitoring the Millennium Development Goals. pg. 66.

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|--|--|
| <ul style="list-style-type: none"> <li>▪ Pour-flush latrine</li> <li>▪ Simple pit latrine (with impermeable floor)</li> <li>▪ Ventilated improved pit latrine</li> </ul> | removed) <ul style="list-style-type: none"> <li>▪ Public latrines</li> <li>▪ Open latrine</li> </ul> |
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Source: WHO/UNICEF *Global Water Supply and Sanitation Assessment Report*, 2010.

Notes: Sanitation facilities that are shared among households—whether fully public or accessible only to some—are not considered ‘improved’ facilities, according to the definition used for the MDG indicators.

Access to improved sanitation should be measured using the Malawi Demographic and Health Survey or the Welfare Monitoring Survey. It is important that definitions and measurement methods be harmonized across national surveys.

### Rationale for the indicator

There is a clear rationale for including an indicator that monitors access to improved sanitation in an M&E system. The Global Water Supply and Sanitation Assessment states that “*improved sanitation facilities interrupt the transmission of fecal [matter] ....Epidemiological evidence suggests that sanitation is at least as effective in preventing disease as improved water supply.*”<sup>101</sup> In addition to these public health benefits, investments in sanitation save time that can be spent on productive activities, increase the return on investments in education, and safeguard water resources. In general, it is estimated that every US\$1 invested in improved sanitation translates into an average return of US\$9.<sup>102</sup>

UNICEF’s experience in Malawi suggests that increasing access to improved sanitation can be done relatively effectively and efficiently. UNICEF’s Water, Sanitation and Hygiene (WASH) program—which used various interventions to motivate villages in rural areas to build improved toilets and achieve Open Defecation Free (ODF) status—has persuaded around 200,000 households to build latrines. The program has benefited close to one million people and has required less than US\$30 million in funding.<sup>103</sup>

### 9. Percentage of rural households with access to improved sanitation

The definition, measurement, and rationale for this indicator and its proposed targets are the same as for Performance Indicator 8, as the two are complementary.

### 10. Percentage of urban primary schools that have 60 pupils or less per every one improved sanitary facility

The 2008 Malawi School WASH reported for the first time the status of improved sanitary facilities in Malawi’s primary education system. The result of this survey was the most comprehensive data set that exists for water supply and sanitation. The Government should conduct this survey regularly, and use the same indicators each time in order to accurately track performance in Malawi’s 5,460 primary schools.

<sup>101</sup> WHO/UNICEF, 2000. Global Water Supply and Sanitation Assessment 2000 Report.

<sup>102</sup> UN Water, United Nations. International Year of Sanitation 2008, Factsheet 2, ‘Sanitation generates economic benefits.’

<sup>103</sup> Based on interviews and data provided by UNICEF.

## Definition and measurement

The 2008 Malawi school WASH explains that a ratio of sixty pupils per every one improved sanitation facility is considered to be the minimum acceptable goal, ‘as long as there are [also] improved urinal blocks for both boys and girls available.’<sup>104</sup>

An improved sanitation facility can be a connection to a piped sewer system or septic tank, a pour-flush latrine, a simple pit latrine with an impermeable floor, or a ventilated improved pit latrine. Progress on this indicator should be measured at least every three years with a survey similar to the 2008 School WASH.

## Rationale for the indicator

The National Sanitation Policy recognizes that the infrastructure for sanitation in schools should be that of improved, not merely basic, sanitation facilities. Two of the strategies identified for achieving this objective are to *provide separate and adequate improved latrines or toilets and urinals for boys and girls*. Teaching children good sanitation and hygiene behaviors at school can make them ‘agents of change’ in their families and wider community, and serve them well into their adult lives.

It has been found that providing children with a healthy learning environment encourages their attendance in school. In fact, in Malawi, the provision of improved sanitation facilities for girls has been found to improve the gender balance in education. As found in the 2008 School WASH, “*proper facilities for menstrual hygiene contribute to girls attending school during days of their period instead of staying home, or even dropping out altogether at puberty.*” It should also be noted that providing separate and adequate improved sanitary facilities for male and female staff in schools that are separate from those of pupils helps to attract and retain teachers in schools.<sup>105</sup>

Perhaps most importantly, improved sanitation facilities in schools helps to reduce diseases among children and staff, including the occurrence of diarrhea, cholera, and dysentery. Children suffer the most from diarrhea, with every episode reducing calorie and nutrient uptake, setting back growth and development.<sup>106</sup> There is clearly good reason to invest in sanitation in schools.

## 11. Percentage of rural primary schools that have 60 pupils or less per every one improved sanitary facility

The current level of access to improved sanitation facilities in rural primary schools is only half those of urban areas. The definition, measurement, and rationale for this indicator are the same as for Performance Indicator 10.

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<sup>104</sup> Ministry of Education, Science & Technology, 2009. Malawi School WASH 2008: A Status Report on Water, Sanitation and Hygiene in Primary Schools.

<sup>105</sup> Ministry of Education, Science & Technology, 2009. Malawi School WASH 2008: A Status Report on Water, Sanitation and Hygiene in Primary Schools.

<sup>106</sup> The International Network to Promote Household Water Treatment and Safe Storage, The World Health Organization. “Combating Waterborne Disease at the Household Level.”



## **12. Percentage of samples taken at effluent discharge points that comply with national standards**

The 2010 Sector Performance Report included a measurement of drinking water quality as one of its proposed Headline Indicators. It is also important to monitor the quality of water at effluent discharge points.

### **Definition and measurement**

Wastewater is any water that has been polluted due to human use. Wastewater discharge points include all points in which water is released back into the environment after human use. This may include municipal or industrial wastewater discharges into surface waters, or onto ground surfaces. Examples include the drainage of sewage directly into watersheds, or the release into the environment of water used to rinse the chutes of concrete mixers after delivery of cement.

Malawi has not set national standards for effluent quality. We suggest that standards be set; only then will this indicator be of benefit. Once standards are in place, the quality of effluent discharged into the environment should be tested by an independent entity, such as the Technical Services Department of the Malawi Bureau of Standards.

### **Rationale for the indicator**

Excessive levels of bacterial organisms and other contaminants in effluent water can be harmful to people and to the environment. For this reason, wastewater should be treated and brought up to a level that complies with health and environmental standards.

Proper management and regulation of wastewater plays an important role in protecting community health and local water quality. All sectors of the economy rely on water. It is no surprise that Malawi's National Sanitation Policy lists as one of its goals the provision of *"adequate wastewater treatment and disposal services for all new water supply programs and projects."*

## **13. Percentage of urban households with functioning hand washing facilities, with water and soap**

Households should have access to water and soap so that members can practice good hygiene by washing their hands and thereby prevent the transmission of disease. As with previous indicators, we propose a separate measurement for urban and rural areas in order to identify geographical differences in performance; this allows for the adjustment of investment in line with those differences.

### **Definition and measurement**

Water for hand washing should come from an improved source, including piped water into a home or plot, a public tap or standpipe, a borehole, a protected dug well, or a protected spring. In line with the recommendations of the 2008 Malawi School WASH, all hand washing facilities should ideally provide water which is running or in a pour system; that is, water should be used by only one person, and not communal.

There are currently no baseline data available on the percentage of households that have functioning hand washing facilities with water and soap. The 2010 Malawi Demographic and Health Survey included in its Household Questionnaire a question on the presence of functioning hand washing facilities. Surveyors were instructed to request to observe where the household members wash their hands, and to record the presence or absence of water and soap. Although this question is included in the survey, data results were not included in

the 2010 MDHS. The survey should continue to be conducted on a regular basis, and the results of this component, when statistically meaningful, should be used to measure progress on this indicator.

### **Rationale for the indicator**

There are important health benefits from hand-washing. Often, endemic diarrhea is transmitted from person to person because of poor hygiene practices. Promotion of hand washing reduces the incidence of diarrheal disease by 40 percent and respiratory infections by 25 percent.<sup>107</sup> However, hand washing with soap is seldom practiced in Malawi. A recent study in Mzuzu City found that only four percent of households had hand washing facilities with soap and water.<sup>108</sup>

If increased access to an improved water source is achieved as planned, there will be very little additional investment needed to meet this indicator. What is more, investing in soap to prevent diseases is much more cost-effective than investing in disease treatment post-transmission.

### **14. Percentage of rural households with functioning hand washing facilities, with water and soap**

The definition, measurement, and rationale for this indicator and its targets are the same as for Performance Indicator 13. Targets may need to be adjusted as data on this indicator improves.

### **15. Percentage of urban primary schools with functioning hand washing facilities, with water and soap**

It is important that not only households, but all public places, have adequate hand washing facilities. Investing in public schools is a reasonable way for the Government to begin increasing national access to proper hand washing facilities. Efficient investment should make universal access achievable before 2025.

### **Definition and measurement**

All schools should provide children and staff with suitable facilities for washing their hands after they visit a latrine, and before preparing and eating food. These facilities should be located close to latrines or toilets, and water for hand washing in schools should come from an improved source. The water should be used in a pour system so that only one person washes his or her hands with the water. The water should not be provided in a basin where more than one student washes his or her hands with the same water.

### **Rationale for the indicator**

The direct health benefits of hand washing facilities in schools are similar to those for households. It has been found that *“hygiene education and promotion of hand washing are simple, cost-effective measures that can reduce diarrhea cases by up to 45%. Even when ideal sanitation is not available, instituting good hygiene practices in communities will lead to better health.”*<sup>109</sup> Teaching students about

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<sup>107</sup> Ministry of Irrigation and Water Development, 2010. “Malawi Irrigation, Water & Sanitation, 2010 Sector Performance Review” May 2011.

<sup>108</sup> Baseline survey, WATSAN Centre of Excellence, Mzuzu University (2011) as referenced in the 2010 Sector Performance Review.

<sup>109</sup> World Health Organization. Fact File: 10 Facts on Sanitation.

the importance of hand washing at a formative age can help establish routines that last the rest of their lives. The education that students receive can also be passed on to their families, thus increasing the practice of hand washing in the wider community.

There are relatively inexpensive ways to introduce more hand washing into the school system. The 2008 Malawi School WASH estimated that the costs to ensure all schools have acceptable hygiene facilities (including those for hand washing) would be less than US\$5 million.

#### **16. Percentage of rural primary schools with functioning hand washing facilities, with water and soap**

The definition, measurement, and rationale for this indicator and its targets are the same as for Performance Indicator 17. Like schools in urban areas, we propose that the Government aim to achieve universal access before the year 2025.

### **3.4 Description of M&E Performance Indicators for Irrigation**

In addition to water supply and sanitation needs, Malawi's water resources are important for agricultural purposes. In 2010, water for irrigation accounted for 77 percent of overall water demand in the country, and agriculture accounted for over 35 percent of GDP. Previous work in the irrigation sub-sector has focused on indications of the total area of land developed for irrigation. Two potential indicators for monitoring this are presented below.

#### **17. Percent annual increase in total area of land that is developed for irrigation**

According to the 2010 SPR, the potential for irrigation in Malawi lies between 400,000 and one million hectares of land. The Government aims to achieve 400,000 hectares of land under irrigation,<sup>110</sup> and has set a target for annual increase of six percent, as a way to track progress towards this goal.<sup>111</sup>

##### **Definition and measurement**

According to the Food and Agriculture Organization of the United Nations, irrigation occurs when water is diverted from a river, or pumped from a well, and used for the purpose of agricultural production.<sup>112</sup> For the purpose of the proposed indicator, irrigation includes formal irrigation practices that occur on private estates, as well as 'informal' smallholder irrigation.

The annual increase in total area of land that is developed for irrigation is the amount of additional hectares added over the course of one year, as a percentage of total hectares under irrigation at the beginning of that same year. For instance, if in 2010 there were 100,000 hectares of irrigated land in Malawi, and in 2011 there were 110,000 hectares, the annual increase between these two years would have been 10 percent.

The total area of land under irrigation is reported semi-annually in the Semi-Annual Irrigation Report, and these results should be the basis for measuring progress towards this

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<sup>110</sup> Government of Malawi. Second Malawi Growth and Development Strategy for the years 2010 to 2016.

<sup>111</sup> Ministry of Irrigation and Water Development, Government of Malawi. Malawi Irrigation, Water, and Sanitation Sector Performance Report, May 2011, page 26.

<sup>112</sup> Natural Resource Management and Environment Department, Food and Agriculture Organization. Irrigation potential in Africa: A basin approach (Chapter 2: Methodology and data used). .

indicator. In order for this Performance Indicator to be meaningful, data on the total area of land under irrigation must be gathered on an annual basis at minimum.

### **Rationale for the indicator**

An increase in land under irrigation is an important objective of the Government, as irrigation is seen as a way to increase productivity in the agricultural sector. This is important to Malawi's economy: agriculture accounts for more than 80 percent of Malawi's export earnings, contributes 35-40 percent of GDP, and provides a livelihood for 85 percent of the population.<sup>113</sup> Due to the relatively low rainfall in parts of the country, the potential for increased production through higher cropping intensities is severely limited without some form of irrigation.<sup>114</sup>

### **18. Total land area under irrigation, in hectares**

Tracking performance in expansion of the area of land under irrigation can also be accomplished by setting targets for the total number of hectares under irrigation. Performance on such an indicator should be measured at least annually; measurements for both area indicators can be taken using the same data set.

#### **3.4.1 The need for additional performance indicators for irrigation**

The irrigation indicators described above are those that relate only to the total amount of land area developed for irrigation, and the pace of that development. This is only a preliminary start to a set of indicators for monitoring performance in irrigation; future consultancies in irrigation<sup>115</sup> should propose additional indicators in line with international good practice. This may include monitoring things such as:

- Water intensity of irrigation
- Cropping intensity and types of crop grown on irrigated areas
- Productivity of irrigated land
- Profitability of irrigated crops on international markets
- The cost of developing irrigation
- An indicator for import substitution.

After additional indicators are selected, short, medium, and long-term targets should be set based on past performance in the sector and regional and international best practice.

### **3.5 Setting Targets for Performance**

Setting targets for performance requires judgment and good public consultation. Targets must be sufficiently ambitious while maintaining some realism. If either of these are not respected, the targets will discourage most people from making an effort (in cases where they are too ambitious) or be insufficient to make significant progress (in cases where they are too

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<sup>113</sup> MoAIWD, NWDP II, IBRD, World Bank, WS Atkins International Ltd., Wellfield Consulting Services Ltd., Interconsult Malawi. Draft Strategic Plan for the Green Belt Development Initiative, Office of the President and Cabinet, Government of Malawi, March 2011; Water Resources Investment Strategy, Component 2, Final Report, August 2011.

<sup>114</sup> International Food and Agriculture Organization. Malawi Country Profile.

<sup>115</sup> This will be part of the work to develop an Irrigation Investment and Financing Plan.

realistic). Good targets will provide incentive to and encourage all relevant parties to make their best effort toward achieving them.

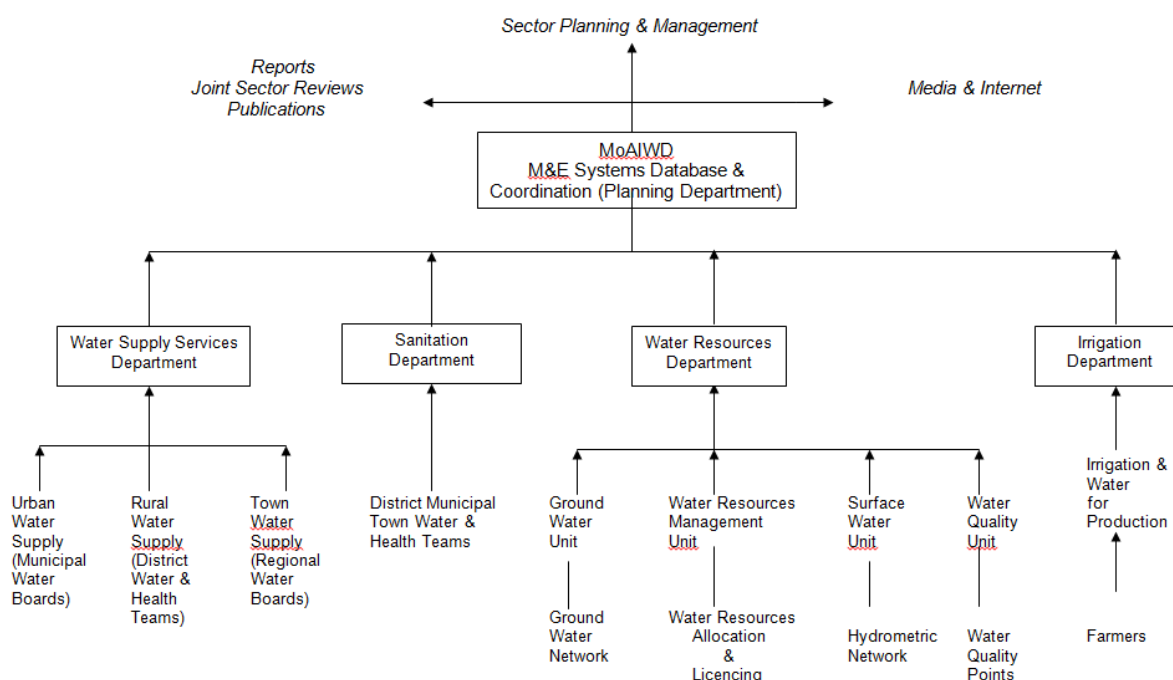
In the water supply, sanitation, and irrigation sector in Malawi, achieving specific targets will depend on availability and efficiency of capital investments as well as developing and strengthening the capabilities of specific stakeholders (such as farmers, schools, water boards, and local governments). Providing these stakeholders with an opportunity to contribute to setting targets will ensure greater accountability for those targets. Having contributed to the targets, the stakeholders will have a greater sense that the targets are useful and achievable.

## 4 How to Monitor

Coordination of all relevant stakeholders may be the biggest challenge in developing and maintaining a sector-wide M&E system. This section addresses how to organize and mobilize those stakeholders. It also gives guidelines for how to systematically manage the data and information that result from monitoring, in order to ensure effective evaluation.

An M&E system for an entire sector can be thought of as a means of information flow among sector participants. Information is collected at the grassroots level throughout the country, and reported upwards to inform Government of the effectiveness of investment decisions. In developing an M&E system, it is useful to structure and map out the way that information will be expected to flow. **Figure 4.1** below offers an example organization chart for information flow in the sector as part of M&E.

**Figure 4.1: Example Information Chain for Water Sector Monitoring and Evaluation**



Source: Adapted from Annex 2, Project Appraisal Report, *Strengthening Water Sector Monitoring and Evaluation*, August 2009, Government of Malawi.

For all Performance Indicators, the ‘Monitoring’ component of M&E starts at the bottommost rungs in the above organization chart, in the form of numerous points of data collection throughout the country. For example, individual farmers should know how many hectares of their land are under irrigation, and what sorts of crops are on that land.

These numerous data points will become more and more aggregated as they are reported up the information chain, along the lines of the arrows in **Figure 4.1** above. For example:

- Farmers should be expected to keep an annual record of the number of hectares they have under irrigation

- Each District should require that farmers report this information annually, or employ a surveyor to talk to farmers in the field to get the information, and keep an aggregated record of land in its jurisdiction
- District staff then report this information to the Irrigation Department of the Ministry of Agriculture, Irrigation, and Water Development (MoAIWD)
- The MoAIWD manages and maintains the irrigation data internally, as part of a sub-sector database. The Ministry makes the database accessible to anyone via the Internet, along with monitoring data from the other departments
- Water sector data can then be queried to track progress over time, and inform investment planning decisions.

The set of Performance Indicators that have been selected require information from many sources across the country. These include: households, schools, Water Boards, farmers, and independent entities such as a regulator. The lines below specify the source of information for each of the Performance Indicators detailed in **Table 3.1** on page 56.

Households—Indicators 1, 2, 8, 9, 13, 14

Schools—Indicators 10, 11, 15, 16

Water Boards—Indicators 4, 5, 6, 7

Farmers—Indicators 17, 18, and others that will be developed

Independent entities—Indicators 3, 12, potentially new irrigation indicators

The Ministry must specify, document, and inform all M&E stakeholders of the expectations it has for reporting data and managing information. Important components of M&E to specify include:

**Data collectors**—for each of the sources of information listed above, the Ministry should give guidance to Districts on how to identify and mobilize individuals to collect data

**Reporting methods**—determine a protocol for how those who collect data will report it upwards in the M&E information chain

**Reporting frequency**—for M&E to be effective, there must be a reliable and continuous reporting of data. The Ministry should specify, for each indicator, the frequency of reporting and of aggregation from the bottom to the top of the information chain. The reporting frequency may vary depending on the nature of the indicator; reporting should never be less frequent than annually

**Documentation and storage**—there are numerous points of aggregation along the information chain, in which data are turned over from one participant in the M&E system to another. The Ministry must stress meticulous documentation to ensure the integrity of the data

**Data maintenance**—clear guidelines for database upkeep need to be specified, and those who are responsible for such data maintenance should be held accountable

**Audits**—the Ministry should build into the M&E system period audits of data collection and reporting throughout the country

The sequencing and timing of these activities must be conducted to ensure consistency with the timeline for planning capital investments. An effective approach will ensure that the required information—such as updated baseline values and data regarding the effectiveness of past investments—is available when new capital investments are being planned. This will help ensure that the estimated amount and expected outcomes capital investments are reasonable and consistent with the Government’s overall objectives.



## 5 Evaluate and Learn

Whereas monitoring focuses on inputs and activities, evaluation focuses on the impact of a project, program, strategy, or investment to assess whether the original goals were achieved. The evaluation will help identify activities that could have been done better, techniques for dealing with unexpected obstacles, and a more appropriate level of resources for achieving expected targets. It leads to learning how to achieve targets more efficiently and effectively and can also contribute to taking corrective actions more quickly.

In practice, evaluation involves comparing the values from periodic measurements with the baseline values that were established for each indicator at the beginning of the planning phase. The evaluation process can be carried out directly by staff of the Government or it can be outsourced to specialized individuals or firms. Outsourcing is a good option since evaluations are not conducted continuously and it may require a larger number of more specialized staff than what the Government needs on a full-time basis.

Once the Government has put in place a plan or strategy for achieving certain objectives, it should review any gaps between actual performance levels and those targeted for each output indicator. This evaluation should correspond with investment planning, and should therefore happen on a three or five year rolling basis. When actual performance does not meet the expected targets, the M&E system can help identify the reasons for this underperformance.

An effective and sustainable M&E system requires solid institutional capacity to handle data and information generation, collection, storage and analysis to support decision making in planning. Any M&E system should have a component for capacity building in M&E so that all stakeholders have the capacity to use and maintain the M&E system. A comprehensive and robust M&E system with a wide spectrum of contributors and users can make the difference between setting and achieving meaningful targets and failing to make progress.

# A Summary of Work in Water Resources Management

## Executive Summary

The objective of this report is to summarize the work that has been completed under other consultancies on water resources management in Malawi. Specifically, the focus here is the Government of Malawi's Water Resources Investment Strategy (WRIS), as it relates to water supply and sanitation, and irrigation in Malawi. A team of consultants ("Atkins")<sup>116</sup> completed the WRIS in August of 2011. The WRIS is the most recent and comprehensive work on water resources management in Malawi, and it incorporates earlier work in the sector.

The WRIS is based on a technical water resources assessment at the level of Malawi's 17 Water Resource Areas (WRAs). The assessment looks closely at water supply versus water demand in Malawi (the "supply-demand balance") in 2010; this data then serves as the base year for forecasts of the supply-demand balance under various scenarios, to 2035. This summary will include information on the 2010 base year and on the Medium Growth Scenario for 2035.<sup>117</sup>

### Water Resources Availability

There are about 65,300 mega-liters of water available per day in Malawi, or approximately 1.7 mega-liters per person, per year. This availability makes Malawi "water vulnerable" according to international standards.<sup>118</sup> Two percent of available water is groundwater, and 98 percent is surface water from Lake Malawi, which accounts for 95 percent of all surface water resources in the country. Lake Malawi flows out into the Shire River, the largest river in the country.

### Uses of Water Resources

Water resources are used for a number of purposes, including human use (potable water supply and sanitation), agriculture, mining, and electricity generation using hydropower schemes. In 2010, human use and irrigation together made up the majority of water demand for consumptive use, totaling 21 and 77 percent, respectively.<sup>119</sup> Among other uses, water

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<sup>116</sup> The team was comprised of WS Atkins International Ltd., Wellfield Consulting Services (Pty) Ltd., and Interconsult Malawi. The team is referred to as "Atkins" throughout this summary report.

<sup>117</sup> The 2035 Medium Growth Scenario was constructed based on assumptions of what is most likely to happen in Malawi. Atkins used sensitivity analysis above and below this, with Low and High Growth Scenarios.

<sup>118</sup> The per capita water availability per year is equivalent to 1,712 cubic meters (m<sup>3</sup>). According to international standards, 0-1000 m<sup>3</sup> per person per year = water scarce; 1000-1700 m<sup>3</sup> per person per year = water stressed; 1,700-2,500 m<sup>3</sup> per person per year = water vulnerable. <http://www.un.org/waterforlifedecade/scarcity.shtml>.

<sup>119</sup> The other four percent of water demand was attributable to livestock agriculture and mining. 'Water demand' does not include water used for non-consumptive purposes, such as forestry, water-dependent tourism, or hydropower. Atkins notes that "the exclusion of these sectors was considered appropriate given that the majority of hydropower systems in Malawi are run-of-the river operations and tourism activity which is concentrated around Lake Malawi is not considered to result in significant diminishment of the source."

from the Shire River is used for hydroelectric generation, the source of 98 percent of Malawi's grid electricity.

In 2010, demand for water for human use was 717 mega-liters per day. This amount is forecast to triple by 2035, to 2,154 mega-liters per day, representing average annual growth of eight percent. This is driven by population growth and expected increases in the percentage of the population with access to 'improved' rather than 'unimproved' sources of water. Even so, water consumed for human use will total only three percent of total available water resources in 2035.

Demand for water for irrigation is expected to, on average, increase by 19 percent a year through 2035, from daily demand of 2,632 mega-liters in 2010 to 15,364 mega-liters per day in 2035. This will total 23 percent of the expected water resources available in 2035, on an annual average basis. Due to seasonal differences in the amount of surface water available, dry season water shortages are expected in 2035 if irrigation expansion plans of 485,000 hectares are carried out.

### Key Conclusions

The most important points from the Water Resources Investment Strategy are as follows:

- **Water resources are ample for human use**, though two Water Resource Areas will need to use existing storage to meet demand in the dry season. These are WRA 4 (Lilongwe) and WRA 6 (Kasungu). Water demand for human use will total 3 percent of available water resources in 2035
- **The country is lacking in infrastructure for water storage.**<sup>120</sup> As a result of low storage capacity, large volumes of wet season rainfall are lost. They cause flooding during the wet season rather than serving as reserve for the dry season, when rainfall and groundwater resources may be insufficient to meet demand for water
- **If by 2035 irrigation is expanded to 485,000 hectares, the result would be a water deficit.**<sup>121</sup> After demand for water for human use is met, there would not be enough water to irrigate 485,000 hectares, even after accounting for the use of available storage capacity. This implies a need for adjustment—the Government should either: scale back irrigation expansion plans; increase water storage capacity; strategically expand irrigation in those areas where water is most abundant; or apply a combination of these approaches.
- **Water is worth more upstream of hydropower schemes along the Shire River.** Diversion of water upstream of hydropower sites decreases the flow of the river, thereby reducing the generation capacity of hydropower schemes downstream. Therefore, when choosing where to expand irrigation, the

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<sup>120</sup> Dams are an example of large-scale water storage infrastructure. Small-scale options include off-stream reservoirs, on-farm ponds, networks of small reservoirs, groundwater storage, or storage through a root zone with a variety of water-harvesting techniques. (<http://www.infrastructureafrica.org/key-msg/sector/additional-water-storage-infrastructure-needed-manage-subcontinent%E2%80%99s-hydrological-var>).

<sup>121</sup> 485,000 hectares represents the development of all of those areas of the Government's Green Belt Initiative that are considered irrigable, according to recent feasibility studies by the Ministry of Agriculture, Irrigation, and Water Development.

Government should think about the economic benefit of irrigation relative to that of electricity produced from hydropower schemes along the Shire River. In order to justify irrigation upstream of hydropower sites, the increase in crop value achieved by irrigation must be greater than the costs of investing in irrigation infrastructure, and the value of the foregone hydropower generation. To justify investments in irrigation upstream of hydropower generation, the value of the yields *with* irrigation should be 3.25 to 3.71 times greater than their yield value *without* irrigation.

- **Water values should be reassessed using more realistic electricity values.**<sup>122</sup>  
In order to compare the costs and benefits of using water for hydropower generation versus irrigation schemes, Atkins valued electricity at \$0.43 per kilowatt-hour. This is the cost of generation from back-up diesel generators. In the short term this is a reasonable estimate, since Malawi is suffering power cuts. However, in the medium term the country is likely to add more generating capacity, probably from a coal-fired power plant. Generation costs from such a plant are around \$0.08 per kilowatt-hour.<sup>123</sup> This number should be used to re-estimate minimum benefit-cost ratios for irrigation schemes upstream of hydropower generation sites
- **There is a significant risk of low or no flow in the Shire River.** It is estimated that there is a 20 percent probability of zero flow in the Shire River, and a 32 percent probability that the flow will be less than the current target minimum flow required for hydropower and irrigation schemes located along the Shire River. Reduced flows to the Shire River could have large-scale implications for water availability in WRA 1, which contains Blantyre, Malawi's second largest city.

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<sup>122</sup> This is a Castalia comment on the work of the WRIS.

<sup>123</sup> Appendix C, Malawi Water Supply and Sanitation Investment Plan (WSIP), Castalia, 2012 (72).

# 1 Introduction

Strong management of water resources is necessary to meet demand for water in Malawi as its population increases, as well as to achieve the Government's irrigation expansion plans. The Government needs to understand the location and distribution of water resources throughout the country; it needs to know if there is enough water available to meet demand for all uses; and if not, it needs to identify the types of investments necessary to meet demand.

To do this, the Government engaged a team of consultants ("Atkins")<sup>124</sup> to develop a Water Resources Investment Strategy (WRIS), completed in August 2011. The WRIS is the most recent and comprehensive work on water resources management (WRM) in Malawi, and itself incorporates earlier work in the sector. This summary of the key findings of the WRIS includes information on the 2010 base year and on the Medium Growth Scenario for 2035.<sup>125</sup> It begins with a look at the supply and demand of water in Malawi, in Section 2. Section 3 summarizes the implications of the water supply-demand balance for human use (potable water supply and sanitation). Section 4 discusses water for irrigation and other competing uses.

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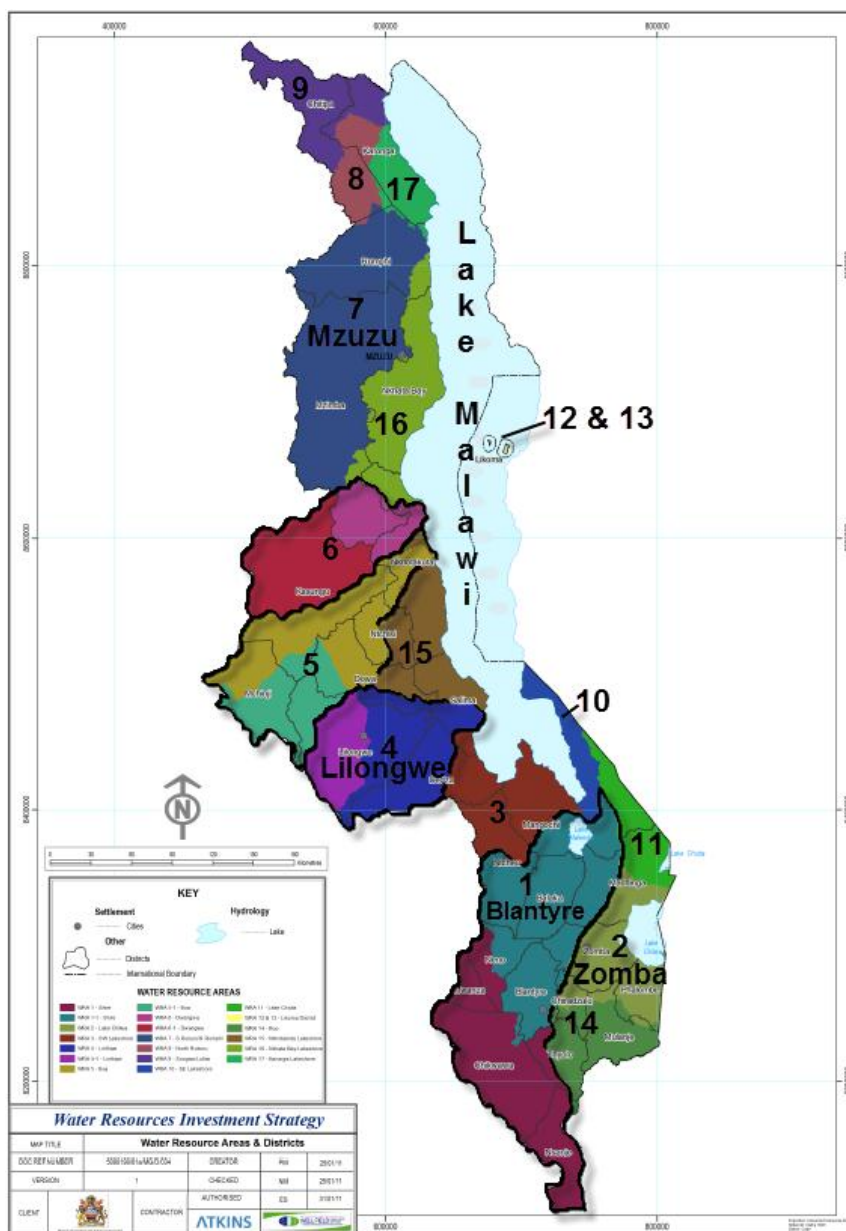
<sup>124</sup> The team was comprised of WS Atkins International Ltd., Wellfield Consulting Services (Pty) Ltd., and Interconsult Malawi. The team is referred to as "Atkins" throughout this summary report.

<sup>125</sup> The 2035 Medium Growth Scenario was constructed based on assumptions of what is most likely to happen in Malawi. Atkins applied sensitivity analysis above and below this, with Low and High Growth Scenarios.

## 2 Supply and Demand of Water Resources

WRM analysis is conducted at the level of Water Resource Areas (WRAs). Malawi has 17 WRAs, corresponding to the river basin areas of the country, as identified in the 1986 National Water Resources Master Plan. Figure 2.1 below shows a map of the Water Resource Areas.

**Figure 2.1: Map of National Water Resource Areas and Districts**



Source: Water Resources Investment Strategy: Component 2, Government of Malawi, 2011, (13).

## 2.1 Water Resources Availability

Available water resources in Malawi currently total 65,341 mega-liters per day. Table 2.1 below summarizes this supply, by WRA. The table shows an average annual water availability of 65,341 mega-liters per day. The total amount of water available per day during the dry season is approximately half of the amount available during the wet season.

**Table 2.1: Available Water Resources in Malawi by Water Resource Area, 2010**

WRA	Name	Annual Average	Wet Season	Dry Season
1	Shire	35,733	38,759	32,707
2	Lake Chilwa	1,528	2,675	382
3	South-West Lakeshore	3,403	5,428	1,325
4	Linthipe	2,608	4,922	295
5	Bua	2,252	4,074	430
6	Dwangwa	961	1,949	34
7	South Rukuru	2,476	3,991	963
8	North Rukuru	672	1,218	126
9	Songw/Lufira	982	1,503	461
10	South East Lakeshore	591	818	365
11	Lake Chiuta	910	1,285	536
12 & 13	Likoma & Chizumulu Islands	-	-	-
14	Ruo	5,233	9,268	1,200
15	Nkhotakota Lakeshore	3,441	6,098	786
16	Nkhata Bay Lakeshore	3,877	4,085	3,671
17	Karonga Lakeshore	674	727	621
<b>All</b>	<b>Total for Malawi</b>	<b>65,341</b>	<b>86,855</b>	<b>43,902</b>

Source: Water Resources Investment Strategy: Component 2, Government of Malawi, 2011.

It is estimated that water availability in 2035 will be 67,081 mega-liters per day on an annual average basis, with total wet season supply amounting to approximately 2.25 times more than dry season supply (89,496 ML/day and 39,484 ML/day, respectively).

## 2.2 The Supply-Demand Balance

Demand for water is made up of domestic and institutional consumption (water supply and sanitation), arable agriculture (irrigation), livestock agriculture, commercial uses, and mining. Table 2.2 below shows the current and expected future composition of national water demand.

**Table 2.2: Composition of Water Demand in Malawi, 2010 and 2035**

Demand Component	Percent of National Demand (Annual average basis)	
	2010	2035
Domestic	16	8
Arable Agriculture (irrigation)	77	86
Livestock Agriculture	2	1
Commercial	2	2
Institutional	1	1
Mining	< 1	1
Unaccounted for Water (UFW)	2	2

Source: Castalia analysis. Demand values provided by Atkins.

### 2.2.1 The current supply-demand balance

Table 2.3 below shows water supply, demand, and the supply-demand balance (a water surplus in green, or a water deficit in red), by Water Resource Area, for 2010.

**Table 2.3: 2010 Supply-Demand Balance by Water Resource Area (mega-liters per day)**

Water Resource Area		Annual Average			Dry Season		
		Supply	Demand	Balance	Supply	Demand	Balance
1	Shire	35,733	1,013	34,720	32,720	1,075	31,632
2	Lake Chilwa	1,528	101	1,427	382	112	270
3	South West Lakeshore	3,403	69	3,334	1,325	76	1,249
4	Linthipe	2,608	214	2,394	295	236	59
5	Bua	2,252	208	2,044	430	305	125
6	Dwangwa	961	539	422	34	624	-590
7	South Rukuru	2,476	115	2,361	963	154	809
8	North Rukuru	672	23	649	126	27	99
9	Songwe/Lufira	982	37	945	461	45	416
10	South East Lakeshore	591	15	576	365	15	350
11	Lake Chiuta	910	35	875	536	34	502
12&13	Likoma & Chizumulu Islands*	-	0.6	-		1	-



Water Resource Area		Annual Average			Dry Season		
		Supply	Demand	Balance	Supply	Demand	Balance
14	Ruo	5,233	386	4,847	1,200	731	469
15	Nkhotakota Lakeshore	3,441	67	3,374	786	82	704
16	Nkhata Bay Lakeshore	3,877	180	3,697	3,671	313	3,358
17	Karonga Lakeshore	674	45	629	621	52	569
<b>All</b>	<b>Total for Malawi</b>	<b>65,341</b>	<b>3,047</b>	<b>62,293</b>	<b>43,902</b>	<b>3,882</b>	<b>40,020</b>

Notes: 'Supply' represents the total amount of surface and ground water resources available. Malawi's 4 largest cities—Blantyre, Zomba, Lilongwe, and Mzuzu, are located in WRAs 1, 2, 4, and 7, respectively.

\*No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

Source: Water Resources Investment Strategy: Component I—Water Resources Assessment, Government of Malawi. Annex I (i) for WRAs 1-4; Annex I (ii) for WRAs 5-10; Annex I (iii) for WRAs 11-17.

Table 2.3 above shows that every WRA has enough water available to meet demand without using storage infrastructure, except for WRA 6 (containing the town of Kasungu), which has a dry season water deficit of 590 mega-liters per day. Water deficits can be avoided by storing water during the wet season, when there is a water surplus, to be used during the dry season. The storage capacity of WRA 6 is only 659 mega-liters per day; the water demand deficit in 2012 was forecast to exceed this storage capacity (with an approximate dry season deficit of 688 Ml/day). Therefore, WRA 6 will likely begin to experience water deficits during the dry season, even after employing all available storage capacity.

### 2.2.2 Future increases in demand

Demand for water for all uses in Malawi is expected to increase five-fold by 2035, from 3,048 mega-liters demanded per day in 2010, to 15,643 mega-liters demanded per day in 2035. This represents an average annual growth of 17 percent over 25 years. This growth is largely driven by increased demand for water for irrigation.

Demand for water for human use (water supply and sanitation) is expected to triple over this period, from 717 mega-liters per day in 2010 to 2,154 mega-liters per day in 2035. Even so, water demanded for human use will total only three percent of total available water resources in 2035.

Demand for water for irrigation is expected to, on average, increase by 19 percent a year to 2035, from daily demand of 2,632 mega-liters in 2010 to 15,364 mega-liters per day in 2035. This will total 23 percent of the expected water resources available in 2035, on an annual average basis. Due to seasonal differences in the amount of surface water available, dry season water shortages are expected in 2035 if irrigation expansion plans of 485,000 hectares are carried out.

### 2.2.3 The future supply-demand balance

Table 2.3 below shows water supply, demand, and the balance (a water surplus in green, or a water deficit in red) in Malawi, by WRA, for 2035.

**Table 2.4: 2035 Supply-Demand Balance by Water Resource Area (mega-liters per day)**

WRA	Annual Average			Dry Season				
	Supply	Demand	Balance	Supply	Demand	Balance	Storage Capacity	Balance after storage capacity
1	36,688	3,132	33,556	29,245	5,256	23,989	1,139	25,128
2	1,566	1,159	407	350	1,691	-1,341	67	-1,274
3	3,491	2,584	907	1,205	3,162	-1,957	67	-1,890
4	2,671	600	2,071	253	640	-387	237	-150
5	2,318	876	1,442	373	1,577	-1,204	115	-1,089
6	998	1,073	-75	10	1,854	-1,844	659	-1,185
7	2,540	468	2,072	874	880	-6	147	141
8	689	87	602	106	114	-8	28	20
9	1,006	516	490	423	820	-397	49	-348
10	607	241	366	339	328	11	8	19
11	933	747	186	492	862	-370	32	-338
12&13	-	2	-	-	2	-	-	
14	5,366	674	4,692	1,062	1,163	-101	661	560
15	3,543	1,867	1,676	700	2,969	-2,269	74	-2,195
16	3,975	882	3,093	3,464	1,295	2,169	308	2,477
17	690	735	-45	588	1,014	-426	75	-351
<b>All</b>	<b>67,081</b>	<b>15,643</b>	<b>51,438</b>	<b>39,484</b>	<b>23,627</b>	<b>15,857</b>	<b>3,666</b>	<b>19,525</b>

Notes: 'Supply' represents the total amount of surface and ground water resources available.  
Malawi's 4 largest cities—Blantyre, Zomba, Lilongwe, and Mzuzu, are located in WRAs 1, 2, 4, and 7, respectively.

\*No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

Source: Water Resources Investment Strategy: Component I—Water Resources Assessment, Government of Malawi. Annex I (i) for WRAs 1-4; Annex I (ii) for WRAs 5-10; Annex I (iii) for WRAs 11-17

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The dry season water deficits expected to occur in 2035 (shown as red cells in in Table 2.4 above) can be eased by employing available storage capacity. However, many dry season water deficits cannot be met with the use of stored water surpluses from the wet season, because the size of the deficit in most WRAs is expected to be greater than the size of available water storage capacity.

#### **2.2.4 Priorities for water use**

In order to avoid inter-sectoral competition for water resources, the WRIS identified an order of prioritization for various uses of water in the economy. In areas or instances where water may be scarce, water use should be prioritized as follows:

- Water for human use, including public water supply and sanitation
- Hydropower generation schemes
- Irrigation schemes
- Navigation.

### 3 Demand for Water for Human Use

Today, Malawi's water resources are ample for meeting the total demand for water for human use. This will also be true in 2035.

#### 3.1 Water is Adequate for Human Use

The 2010 water surpluses in every WRA, show in Table 3.1 below, demonstrate that there is currently adequate water supply to meet demand for human use in Malawi.

**Table 3.1: Demand for Water for Human Use, 2010 (mega-liters per day)**

WRA		Average Annual			Dry Season		
		Supply	Demand	Deficit/ Surplus	Supply	Demand	Deficit/ Surplus
1	Shire	35,733	195	35,538	32,720	195	32,512
2	Lake Chilwa	1,528	78	1,450	382	78	304
3	South West Lakeshore	3,403	33	3,370	1,325	33	1,292
4	Linthipe	2,608	126	2,482	295	126	169
5	Bua	2,252	68	2,184	430	68	362
6	Dwangwa	961	27	934	34	27	7
7	South Rukuru	2,476	53	2,423	963	53	910
8	North Rukuru	672	4	668	126	4	122
9	Songwe/Lufira	982	10	972	461	10	451
10	South East Lakeshore	591	8	583	365	8	357
11	Lake Chiuta	910	13	897	536	13	523
12&13	Likoma & Chizumulu Islands*	-	1	-	-	1	-
14	Ruo	5,233	51	5,182	1,200	51	1,149
15	Nkhotakota Lakeshore	3,441	28	3,413	786	28	758
16	Nkhata Bay Lakeshore	3,877	15	3,862	3,671	15	3,656
17	Karonga Lakeshore	674	7	667	621	7	614
<b>All</b>	<b>Total for Malawi</b>	<b>65,341</b>	<b>717</b>	<b>64,624</b>	<b>43,902</b>	<b>717</b>	<b>43,185</b>

Notes: "Human use" includes domestic, institutional, and commercial consumption, and system losses.

\*No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

Source: Supply figures: Annex I (i), (ii), and (iii).

Demand figures: Provided by Atkins

As discussed in Section 2.2.2, there will be water deficits in 2035 if the Government expands the area of land under irrigation to 485,000 hectares. This should not affect public access to

water for consumption, since meeting demand for water for human use is the Government's foremost priority.

### 3.2 By 2035, Extra Storage will be needed in Some Areas

It is estimated that by 2035 Malawi will experience growth in water demanded for human use of 200 percent, or average annual growth of eight percent. This is driven by population growth and expected increases in the percentage of the population with access to 'improved' rather than 'unimproved' source of water. The expected demand values for 2035 are shown in Table 3.2 below. The table shows a dry season water deficit in WRA 4 (Lilongwe) and WRA 6 (Kasungu) in 2035. This deficit should not be cause for concern, as these WRAs have storage capacity of 237 and 659 mega-liters per day, respectively. Water from the wet season will need to be stored in order to meet demand for human use during the dry season.

**Table 3.2: Demand for Water for Human Use, 2035 (mega-liters per day)**

WRA		Average Annual			Dry Season		
		Supply	Demand	Deficit/ Surplus	Supply	Demand	Deficit/ Surplus
1	Shire	36,688	581	36,107	29,245	581	28,664
2	Lake Chilwa	1,566	194	1,372	350	194	156
3	South West Lakeshore	3,491	96	3,395	1,205	96	1,109
4	Linthipe	2,671	453	2,218	253	453	-200
5	Bua	2,318	220	2,098	373	220	153
6	Dwangwa	998	80	918	10	80	-70
7	South Rukuru	2,540	144	2,396	874	144	730
8	North Rukuru	689	17	672	106	17	89
9	Songwe/Lufira	1,006	26	980	423	26	397
10	South East Lakeshore	607	26	581	339	26	313
11	Lake Chiuta	933	37	896	492	37	455
12&13	Likoma & Chizumulu Islands*	-	1	-	-	1	-
14	Ruo	5,366	143	5,223	1,062	143	919
15	Nkhotakota Lakeshore	3,543	81	3,462	700	81	619
16	Nkhata Bay Lakeshore	3,975	35	3,940	3,464	35	3,429
17	Karonga Lakeshore	690	20	670	588	20	568
<b>All</b>	<b>Total for Malawi</b>	<b>67,081</b>	<b>2,154</b>	<b>64,927</b>	<b>39,484</b>	<b>2,154</b>	<b>37,330</b>

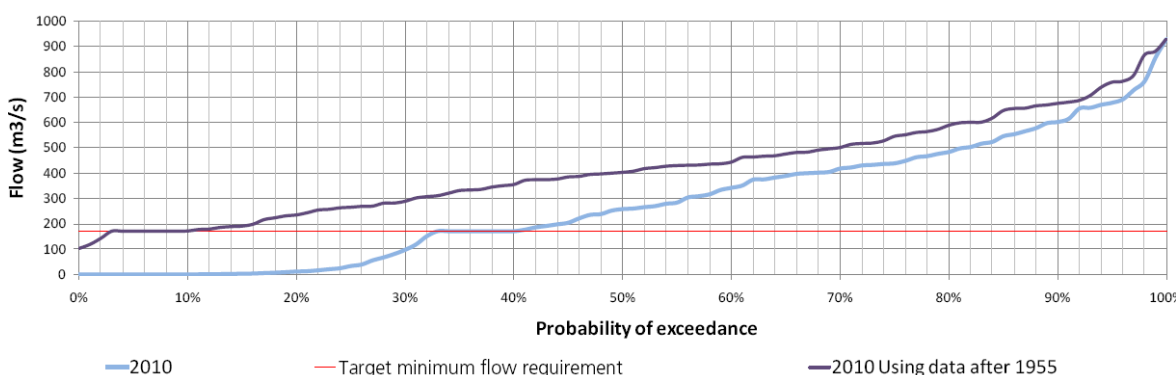
Notes: “Human use” includes domestic, institutional, and commercial consumption, and system losses.  
 \* No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

Source: Supply figures: Annex I (i), (ii), and (iii).  
 Demand figures: Provided by Atkins

### 3.3 Hydrological Risk on the Shire River

The availability of water resources forecast for 2035 assumes that there is water available from the Shire River, the largest river in Malawi. It should be noted that Atkins calculates a 20 percent probability of zero flow in the Shire River, and a 32 percent probability that the flow will be less than the current target minimum flow required for hydropower or irrigation schemes located along the Shire River. These probabilities are illustrated in the flow duration curves in Figure 3.1 below, where the light blue curve falls below the red line, which represents the target minimum flow requirement.

**Figure 3.1: Flow Duration Curves for the Shire River**



Source: Water Resources Investment Strategy: Component 2, Government of Malawi, 2011, (70).

Flows in the Shire River are driven by water levels in Lake Malawi. With the use of the Kamuzu Barrage at Liwonde, the lake serves as a buffer, reducing the impact of seasonal variations in rainfall and single year droughts on the Shire River. However, multiple year droughts have in the past led to no outflow from Lake Malawi, as described in Table 3.3 below.

**Table 3.3: Some Key Events that Influenced the History of Lake Levels and Outflows for Lake Malawi**

Period	Description
1800-1839	Levels were “so low that local inhabitants traversed dry land where a deep lake now resides”. The Ruhuhu tributary was completely desiccated. Levels may have been about 465m at the start of the century
1850-1859	Lake level very high from 1857
1860-1869	Lake level very high to 1863
1870-1879	Lake level high in 1873 (~475m), but falling in 1875-78
1880-1889	Lake level high in 1882 (~474m)

Period	Description
1890-1899	Lake level very low in 1890 but rising in 1892-95
1900-1909	Lake levels dropped with the outflow stopped by a sandbar in 1908
1910-1919	No outflow. Minimum level of 470.1m reached in 1915 following which levels rose by 0.5m to 1919
1920-1929	No outflow. Levels rose by 1.75m over the decade
1930-1939	Levels rose by 2.5m from 1930 to a peak in 1937. Outflows resumed from 1935
1940-1949	Country-wide drought in 1949
1950-1959	Temporary bund in place at the outlet from the lake from October 1956 to July 1957
1960-1969	Bund placed across the Shire River at Liwonde in 1965 during construction of the Kamuzu Barrage, which was also commissioned in 1965
1970-1979	Peak annual levels of 476.9-471.2m reached in the years 1978, 1979, and 1980 with inundation of lakeshore areas and high flows in the Shire River
1990-1999	Levels declined from 474m to 473m from 1991 to 1997, affecting Shire flows and hydropower generation
2000-2009	Unusual rainfall patterns in the 2001/02 crop season caused both drought and flooding. Country-wide drought following rainfall deficits in the 2004/05 wet season.

Source: Table 4-2, Component 2, Water Resources Investment Strategy, Government of Malawi, 2011, (68).

Reduced flows to the Shire River could have large-scale implications for water availability in WRA 1, which contains Blantyre, Malawi's second largest city.

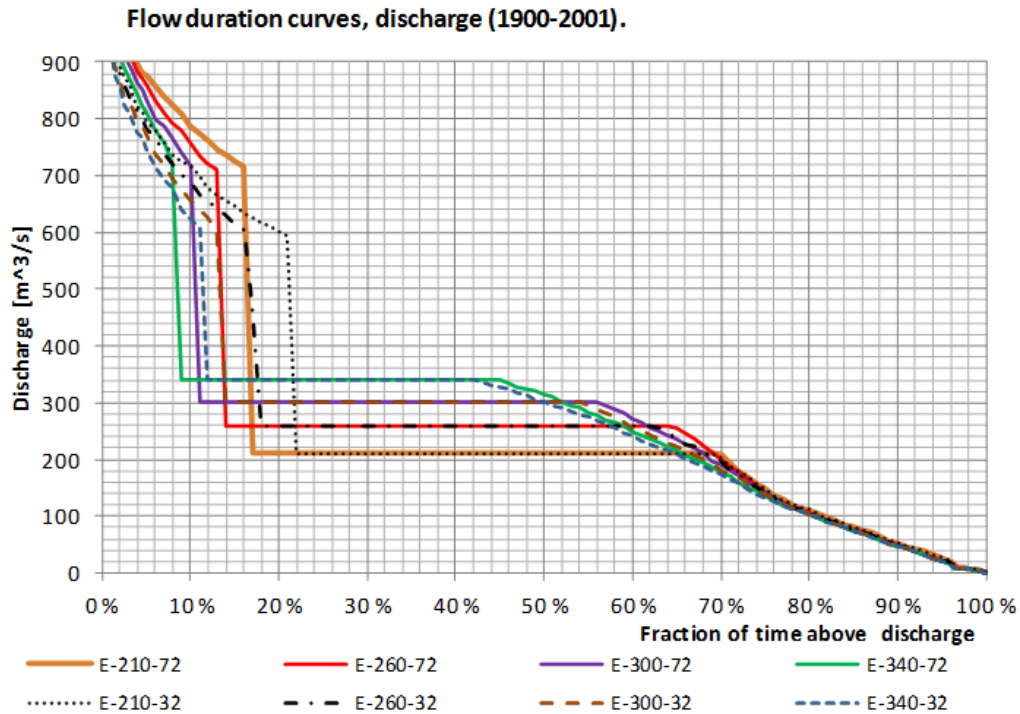
### 3.4 Castalia Comments on the Hydrological Risk on the Shire River

Since Atkins completed the WRIS in August 2010, new studies on the water flow in the Shire River suggest that the hydrological risk might not be as great as Atkins indicated. We understand that Norplan, an engineering and techno-economic consulting firm, is currently working to model flow duration curves for the Shire River that reflect planned upgrades to the Kamuzu Barrage at Liwonde.

The Kamuzu Barrage was created in 1965 to help mitigate some of the risk of inter-annual flow variation. The barrage will be upgraded under the proposed Shire River Basin Management Program to further increase the amount of water stored in Lake Malawi to an equivalent of two full years of Shire River flow. Although this infrastructure improvement will not completely eliminate the risk of the river running dry, it will help further mitigate the risk of low or no flows.

Figure 3.2 below previews the forthcoming work of Norplan. For the period 1900 to 2001, it shows the percentage of time the Shire River has exceeded various flow rates. The model takes into account the low flow period at the start of the 20<sup>th</sup> century, as well as the influence of the current (32) and a potentially upgraded (72) Kamuzu Barrage at Liwonde. Figure 3.2 suggests that 96 percent of the time the flow rate of the Shire River will be twenty cubic meters per second, which exceeds the current demand for water in Blantyre.

Figure 3.2: Shire River Flow Rate (1900-2001)



This sort of analysis can help guide planning towards investments that reduce the risk that the water resources of the Shire River would become insufficient to meet demand for potable water supply, hydroelectric power generation, and irrigation. The last time the Shire River ran dry was in the early 20<sup>th</sup> century, and water and irrigation experts in Malawi are of the opinion that the Shire would run dry only after about ten years of severe drought across the region.



## 4 Water Resources for Irrigation

After demand for water for human use is met, the majority of the surplus water is assumed to be applied to irrigation schemes.<sup>126</sup> Atkins modeled an expansion of irrigation to 485,000 hectares by 2035, which represents the development of all of those areas of the Green Belt Initiative considered irrigable by recent Government feasibility studies.<sup>127</sup>

### 4.1 Irrigation Potential

Table 4.1 below summarizes the irrigation potential of Malawi by WRA.

**Table 4.1: Assumptions for Irrigation Potential by Water Resource Area**

WRA	Irrigation Potential (hectares)
1	103,450
2	61,500
3	43,300
4	4,890
5	21,200
6	28,800
7	31,200
8	1,700
9	18,300
10	3,600
11	12,630
12&13	-
14	28,100
15	94,500
16	16,800
17	15,000
<b>All</b>	<b>484,970</b>

Source: Table 5.2, Annex VIII, Component I—Water Resources Assessment, Water Resources Investment Strategy, Government of Malawi, 55.

<sup>126</sup> Less than one percent of the surplus is demanded by mining and livestock agriculture during the dry season in both 2010 and 2035.

<sup>127</sup> The Government launched the Green Belt Initiative in 2011. Among other components for agricultural development, it initially aimed to expand the area of land under irrigation to 1,000,000 hectares. Recent feasibility studies found that 485,000 hectares are suitable for irrigation development. It is also understood that the Government is now developing a Strategic Plan for the Green Belt, which may scale back the irrigated area targets to 200,000 hectares.

## 4.2 Water Demand for Irrigation

In 2010, water demand for irrigation totaled 3,892 mega-liters per day during the dry season. Table 4.2 below shows the balance between water available after demand for human needs is met, and demand for water for irrigation during the dry season in 2010.

**Table 4.2: Supply-Demand Balance for Water for Irrigation, 2010**

	WRA	Surplus supply <sup>1</sup>	Demand	Deficit/ Surplus
1	Shire	32,492	1,081	31,411
2	Lake Chilwa	301	48	253
3	South West Lakeshore	1,289	55	1,234
4	Linthipe	157	118	39
5	Bua	353	287	66
6	Dwangwa	0	740	-740
7	South Rukuru	900	114	786
8	North Rukuru	120	27	93
9	Songwe/Lufira	446	42	404
10	South East Lakeshore	357	7	350
11	Lake Chiuta	522	27	495
12&13	Likoma & Chizumulu Islands*	-	-	-
14	Ruo	1,145	845	300
15	Nkhotakota Lakeshore	755	67	688
16	Nkhata Bay Lakeshore	3,653	374	3,279
17	Karonga Lakeshore	612	60	552
<b>All</b>	<b>Total for Malawi</b>	<b>43,102</b>	<b>3,892</b>	<b>39,210</b>

Notes: <sup>1</sup>This is the remaining water supply after demand for human use, livestock agriculture, and mining has been met.

\* No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

Source: Demand values provided by Atkins.

Table 4.2 above shows a water deficit in WRA 6 in 2010. The actual size of the deficit is 81 mega-liters per day, after accounting for the storage capacity available in WRA 6 (659 mega-liters per day).

## 4.3 Future Demand for Water for Irrigation

Assuming development of all 485,000 hectares that are feasibly irrigable, water demanded for irrigation during the dry season is expected to reach 28,219 mega-liters per day in 2035. This represents a nearly six-fold increase from 2010. Table 4.3 below illustrates that, under these

assumptions, demand for water for irrigation will exceed supply in 13 out of 17 WRAs during the dry season in 2035. After accounting for available storage capacity,<sup>128</sup> the number of WRAs with a water deficit is reduced to 12.

**Table 4.3: Supply-Demand Balance for Water for Irrigation, 2035**

WRA		Surplus supply <sup>1</sup>	Demand	Water Deficit/ Surplus	Storage Capacity	Actual Deficit/Surplus
1	Shire	28,594	5,830	22,764	1,139	22,764
2	Lake Chilwa	148	2,018	-1,870	67	-1,803
3	South West Lakeshore	1,100	4,290	-3,190	67	-3,123
4	Linthipe	-258	171	-429	37†	-392
5	Bua	127	1,707	-1,580	115	-1,465
6	Dwangwa	-88	2,196	-2,284	589†	-1,695
7	South Rukuru	686	867	-181	147	-34
8	North Rukuru	84	133	-49	28	-21
9	Songwe/Lufira	356	1,023	-667	49	-618
10	South East Lakeshore	312	430	-118	8	-110
11	Lake Chiuta	453	1,152	-699	32	-667
12&13	Likoma & Chizumulu Islands <sup>2</sup>	-	-	-	-	-
14	Ruo	909	1,297	-388	661	273
15	Nkhotakota Lakeshore	610	3,949	-3,339	74	-3,256
16	Nkhata Bay Lakeshore	3,424	1,744	1,680	308	1,680
17	Karonga Lakeshore	562	1,412	-850	75	-775
<b>All</b>	<b>Total for Malawi</b>	<b>37,019</b>	<b>28,219</b>	<b>8,800</b>	<b>3,396</b>	<b>10,749</b>

<sup>128</sup> Assuming 75 Ml/day in WRA 4 and 45 Ml/day in WRA 6 is already used to meet public water supply.

Notes: <sup>1</sup>This is the remaining water supply after demand for human use, livestock agriculture, and mining has been met.

<sup>2</sup> No detailed hydrological assessment was undertaken for WRAs 12 & 13 as neither island has any significant watercourses and all water resources are currently taken directly from Lake Malawi, which is expected to continue through 2035. For this reason, it is assumed that supply meets demand.

†Some of the storage capacity of WRA 4 and WRA 6 is assumed to be used to cover water demand for human use in these areas, as explained in Section 3.

Source: Demand values provided by Atkins.

### Limits on supply, competing uses, and implications

The Government of Malawi will need to develop a way to manage the water deficits forecast for 2035. This may include scaling back irrigation plans to align them with the amount of surplus water available after demand for water for human use has been met. The Government could also expand storage capacity in those WRAs that will experience deficits, where technically possible, as there is sufficient wet season water surplus to meet the expected dry season deficits in 2035.

Water consumption upstream of Lake Malawi reduces the availability of water downstream of the lake; significant water diversions from Lake Malawi would reduce the flow of the Shire River. Since 98 percent of all grid electricity in Malawi is produced using hydropower schemes along the Shire River, maintaining inflows to the Lake Malawi-Shire River system is valuable.

The cost of irrigating land upstream of hydropower schemes along the Shire River is the value of the electricity produced from hydropower schemes downstream. For this reason, the value derived from any irrigation scheme upstream of hydropower generation sites must cover the cost of the investment plus the value of the foregone electricity from hydropower schemes.

The factor by which the *total value of crop yield per hectare* would need to increase to justify irrigation upstream of hydropower generation sites varies, depending on the assumptions made for the expansion of hydropower schemes along the Shire River, and for the value of electricity. Table 4.4 below summarizes the conditions for the economic justification of irrigation under three potential expansion scenarios.

**Table 4.4: Conditions for the Economic Justification of Irrigating 100,000 hectares of Land Upstream of Lake Malawi**

Crop yield per hectare <sup>1</sup> must increase by	Assuming	Yield value must increase by a factor of
225%	Current hydropower production capacity	3.25
237%	Hydropower expansion as a result of Nkula Upgrade and Kapichira II	3.37
271%	Hydropower expansion as a result of Mpatamanga, Mkula Upgrade, Kapichira II	3.71

Notes: <sup>1</sup> Crop yield per hectare assumes the current yield value of un-irrigated crops.

Source: Water Resources Investment Strategy: Component 2, Government of Malawi, 2011, (88).

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If the Mpatamanga, Nkula Upgrade, and Kapichira II hydropower expansion plans go forward, only high-benefit irrigation will be economically justified upstream of Lake Malawi. Therefore, preference should be given to arrangements where water abstraction for irrigation takes place downstream of hydropower production.

In order to compare the costs and benefits of using water for hydropower generation versus irrigation schemes, Atkins valued electricity at \$0.43 per kilowatt-hour. This is the cost of generation from back-up diesel generators. In the short term this is a reasonable estimate, since Malawi is suffering power cuts. However, in the medium term the country is likely to add more generating capacity, probably from a coal-fired power plant. Generation costs from such a plant are around \$0.08 per kilowatt-hour. This number should be used to re-estimate minimum benefit-cost ratios for irrigation schemes upstream of hydropower generation sites. A lower assumed value for electricity will reduce the factor by which the value of crop yields must increase in order to justify investments in irrigation schemes upstream of hydropower generation.

# **Terms of Reference: Preparation of an Irrigation Investment and Financing Plan**

## **1 Introduction**

The Government of Malawi seeks to enhance irrigated agricultural production in order to contribute to sustainable economic growth and development. A key way to do this is to develop and manage water and land resources for diversified, economically sound, and sustainable irrigation and drainage systems under organized smallholder and estate management institutions. The World Bank is supporting the Government with the preparation of an irrigation investment and financing plan, which will be carried out by a consultancy under these terms of reference.

This consultancy should link to other work in the sector. This includes on-going work by the Japanese International Cooperation Agency (JICA) to develop a Monitoring and Evaluation Framework for irrigation; the Green Belt Initiative; and the work to develop a National Irrigation Development Fund. Background on the irrigation sub-sector can be found in Appendix A, and a list of resources that can be drawn on for this work can be found in Appendix B.

## **2 Objective of the Assignment**

The objective of the consultant's work is to provide the Government of Malawi with a practical irrigation investment and financing strategy to significantly increase agricultural productivity.

This "Irrigation Investment and Financing Plan" ("the Plan") shall set out specific ways in which improved irrigation development and management can deliver higher incomes to smallholder and estate farmers, as well as accelerate economic growth through development of entrepreneurial high-value farming. The Plan must be fiscally and environmentally responsible, and socially inclusive. It should include an investment action plan, and recommend institutional arrangements that will allow the potential gains to be realized. It should include specific programs and physical projects to be implemented, as well as policies and processes that will allow additional market- and community-driven projects to be identified, appraised, and implemented over the next 20 years.

The Government requires that the Plan:

- Be founded on stakeholder demand and market potential, as well as on the hydro-meteorological and geophysical potential of Malawi's water and land resources
- Differentiate between types of productive opportunities or 'Business Lines', with appropriate strategies for each, to be used for project identification and implementation<sup>129</sup>

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<sup>129</sup> See 2010 AgWA report for a definition of business lines.

- Be costed, with planned investments identified and taken to a pre-feasibility level, where possible

In addition, the Plan will need to be:

- Complete, with all elements needed for success identified and, where possible, costed
- Economically justified, with costs, benefits, and potential beneficiary groups identified
- Financeable, with potential financing sources identified
- Environmentally and socially sustainable
- Supported by stakeholders; built on stakeholder engagement in developing the Plan

### 3 Methodological Approaches to be followed

In carrying out the scope of work, the consultant is expected to use appropriate methodological approaches, including the following:

- Place irrigation within an overall context of **sustainable land management**, following Malawian policies and the guidance in the “TerrAfrica Country Support Tool for Scaling up Sustainable Land Management in sub-Saharan Africa”
- Place irrigation in a context of overall **sustainable water resource management**. This requires attention to how to connect irrigation developments to bulk water provision (dams), multiple use schemes with the energy sector, abstraction permits, Water User Association rules, water availability analyses, and catchment management to protect irrigated schemes from sedimentation. The Malawi Water Resources Investment Strategy (WRIS) will be the starting point in this regard
- **Ensuring that the Investment and Financing Plan is stakeholder- and market-led.** This means avoiding planning based simply on hydro-meteorological and geophysical potential, and existing transport links. It will require active engagement with stakeholders, in which they are educated about possibilities, and their desires are made central to the Plan. It will involve helping the Government to develop flexible approaches that can respond to emerging needs of entrepreneurial commercial farmers, as well as cross-sector approaches to ensure that roads, power, and supply-chain linkages accompany irrigation investment where needed and justified. It will also involve development of appropriate public-private partnership and cost-recovery strategies
- **Cost-benefit justified.** This involves ensuring that the benefits of irrigation investment are clearly identified, and that these benefits exceed the costs. The methodology must recognize that the Government wishes to avoid costly investment in physical infrastructure to meet physical targets. Rather, it seeks optimized levels of investments directed at increasing returns to farmers by significant margins above the cost of the investment

- **Institutionally focused.** This involves a recognition that engineering-driven provision of infrastructure often fails to deliver the intended benefits because of institutional failures. The Plan must include recommendations for institutional development to ensure that suitable irrigation programs and projects are: identified; appraised properly; developed in cost-effective ways; and crucially, operated and maintained in a way that provides the intended benefits to farmers. It also must include recommendations on institutional arrangements to ensure that complementary or cross-sector inputs—such as agronomy outreach, or transport linkages—are provided in parallel with irrigation investments where needed for success.

## 4 Scope of Work

The consultancy under these TOR should give comprehensive coverage of the irrigation sector of Malawi. This should include a Situation Analysis, the development of a Typology of Irrigation Opportunities, and identification and appraisal of Irrigation Improvement Opportunities. The consultant is expected to develop a Draft Irrigation Investment and Financing Plan, which should include a funding plan, recommended policy improvements, ideas for institutional development, and ideas for capacity building for farmers and Water User Associations. Finally, the consultant should recommend a Monitoring and Evaluation system for the irrigation sector taking into account existing M&E arrangements.

### 4.1 Situation Analysis

The consultant's work should start with an analysis of the current situation; this should allow the consultant to identify the government's key objectives, the opportunities, issues, and constraints relevant to achieving those objectives, in so far as they can be ascertained from an initial review.

The situation analysis should include a review of the following:

- Principal Government mechanisms and instruments (policies, strategies, plans etc.)
- Current institutional responsibility for irrigation, including key institutional linkages and interfaces
- What the Government is aiming to achieve through irrigation; where Government intends to target irrigation; how Government intends to implement irrigation
- Existing irrigation schemes, including an identification of investment opportunities for improving them
- Public expenditure plans
- The social and economic outcomes (and their scale) that are intended to be delivered through agricultural water management, including the connections and benefits of irrigation into household-level farming strategies
- Description of irrigation within the Country Assistance Strategies/Country Strategy Papers/Country Strategic Opportunities Programmes (COSOPs) of development partners



- Existing material on the potential for irrigation in Malawi, in particular the Water Resource Investment Strategy, the Green Belt Initiative, and the Irrigation, Rural Livelihoods, and Agriculture Development (IRLAD) project

The consultant should analyze experiences with irrigation projects of various sorts in Malawi to date, and identify the lessons learned.

## 4.2 Define Typology of Irrigation Opportunities

The consultant should not treat ‘Agricultural Water Management’ as a single block. Rather, opportunities and strategies should be differentiated according to:

- The types of water user (for example, smallholders versus high-value commercial farming)
- The business model employed (for example, traditional production for own use and the local market versus new crop varieties for export)
- The water management techniques employed

The consultant should develop a typology of opportunities taking into account these criteria. The consultant may adopt the following ‘Business Line’ typology used by the World Bank elsewhere (or may give reasons for using a different typology):

1. **Market-oriented irrigation on a PPP basis.** Past experience is that medium and large scale irrigation development presents enormous challenges to African governments, but that partnership approaches between the public and private sector can develop successful commercial irrigation. The range of institutional options is broad, from private sector ‘third party’ management of public schemes, to simple facilitation by Governments of private sector investments, as in Zambia. One attractive model of PPP is the Green Scheme in Namibia, where since 1994 government has developed basic water delivery infrastructure and allocated 50 percent of the irrigated area to larger scale farmers, who then provide water and other services to smallholder commercial farmers.
2. **Individual smallholder irrigation for high value markets.** In areas close to urban or export markets, there has been considerable success with individual smallholder irrigation, usually based on pump technology, either manual or motorized. In Kenya, it is estimated that these systems benefit 300,000 households. Investment costs can be as low as \$300-600 per hectare. An excellent example of this is from Niger, where the Niger Pilot Private Irrigation Project has spread a variety of manual and small-scale mechanized irrigation technologies. This created a demand and supply-chain, and a network of irrigator organizations. Manual pumping technology that is affordable to poor farmers allowed a doubling of the cultivated area and earned a 68 percent economic rate of return.
3. **Small scale community-managed irrigation for local markets.** Opportunities exist for creating or improving small-scale community-managed irrigation. Under the Ethiopia Social Rehabilitation and Development Fund, community-based irrigation, supplied largely from earth dams and river diversions, benefited 40,000 households. There was visible improvement in the lives of villagers, including increased purchase of water pumps, milk cows, and radios, as well as regular schooling for children. Much development of small-scale irrigation has been done

through integrated rural development, CDD, or Social Fund programs where agricultural water is only one amongst several investments on offer.

4. **Reform and modernization of existing large scale irrigation.** Several countries in the region have invested heavily in large-scale irrigation. The Sudan Gezira scheme is the largest irrigation area in the world under single management – 880,000 hectares. Madagascar, Sudan, Mali and Kenya have a history of large-scale irrigation that goes back more than 50 years.. Yet, it is hard to find examples of successful, or even adequate, results from these investments over the past decades, and there have been a number of spectacular failures. However, recent results, particularly from the Office du Niger in Mali, have shown that institutional reforms can make management accountable and obtain high rates of cost recovery. If associated with selective investment and profitable market opportunities, these reforms can make large scale irrigation schemes in Africa viable and sustainable. Given the large number of these schemes and their potential for contributing to poverty reduction and inclusive economic growth, this could be an important business line.
5. **Improved water control and watershed management in a rain-fed environment.** The potential for growth and poverty reduction through improved rain-fed agriculture is theoretically vast: across sub-Saharan Africa more than 80 percent of the region's households are rain-fed farmers. In Malawi, dambo farming on rain-fed subsistence plots totals at least 600,000 hectares (six times the land area of irrigated farming). Projects in several countries have developed profitable technologies, although there is little evidence that these technologies are readily adopted spontaneously. Scaled up at the catchment level, these technologies also form an important part of soil and water conservation programs.

For each type of opportunity in the Typology, the consultant should identify key objectives, constraints, and prerequisites for success. These could include:

- **Objectives**

- The types of benefits expected (e.g., food security, income for small-holder families, development for women, development for the poor, general growth and development)

- **Constraints:**

- Land-holding patterns (e.g., can a commercial farmer anchor a development if land is not available)
- Political economy issues (e.g., are the beneficiaries of the scheme not appropriately represented in Government processes)
- Risks and risk management (e.g., identifying risks such as the need to adopt new crops or new technologies, or to access new markets, and how these risks can best be allocated, managed and mitigated)
- Issues of environmental and social sustainability

- **Prerequisites for success:**

- Types of market and supply chain linkages required
- Technology and agricultural outreach assistance required
- The appropriate roles for Government, farmers, and other stakeholders
- Appropriate strategies for funding and cost recovery

The consultant is encouraged to develop a more complete and comprehensive set of factors for characterizing irrigation opportunities of each type.

This Typology should provide an organizing principle for the remainder of the project, with opportunities being divided into the various categories, and recommendations being appropriately differentiated between the different categories.

### **4.3 Identify and Appraise Irrigation Improvement Opportunities**

The consultants should identify and appraise opportunities to increase agricultural productivity through irrigation, including opportunities to invest in upgrades to existing irrigation schemes. This should be completed along the lines of the chosen typology, for instance by business line. For each business line, the consultant should first identify opportunities for irrigation investment by screening for:

1. **Geophysical feasibility.** This should take into account land type, available water resources, and topography, as well as other relevant factors. The irrigation master plan may be a good reference document for this step.
2. **Market-orientation and linkages.** This should include evidence of transport links to markets suggesting the potential to sell the increased yield profitably, or evidence of the potential for transformational investments that will create their own markets, or supply chain and transport linkages
3. **Economic viability.** Preliminary economic analysis should be done to screen out those opportunities which are likely to cost more to implement than they yield in benefits
4. **Environmental acceptability.** Preliminary environmental screening should indicate whether or not the potential development would likely comply with Malawian environmental standards and the requirements of funding agencies.
5. **Stakeholder support.** The consultant should gauge support for each project, from the farmers who will benefit, as well as other key stakeholders

The consultant should keep in mind that the initial screening process will be different for each business line—for example, the geophysical feasibility considerations for upgrades to existing large scale irrigation schemes (business line 4) will obviously not be the same as those for individual smallholder irrigation schemes (business line 2).

The consultant may find it useful to map steps one through four and perform a weighted overlay analysis (either manually or with the help of GIS software) to identify areas where irrigation investments will likely be most successful, by business line. Once these areas have been identified, the consultant should engage with stakeholders to complete step five. The result will be a list of viable investment opportunities, organized by business line.

The consultant should create a detailed description of each viable opportunity. For example, opportunities to increase productivity of smallholder farmers growing traditional crops for local markets can be described in quite specific physical terms—the water resource area, the size of the project in hectares, the beneficiaries, the expected increased yield, etc. On the other hand, opportunities for irrigation to support the development of entrepreneurial export-oriented farmers growing non-traditional high-value crops may have to be described in a way that is less specific, and that captures the need for processes to turn potential into a project. In such cases, investment in infrastructure cannot be defined, and should not be started, until farmers have expressed interest in the opportunity. The consultant may therefore describe the potential, and outline a process that the Government could adopt, to inform the market and seek interest in developing the opportunity.

### **Development of an Action Plan for Irrigation Investments based on Cost-Benefit Analysis**

The next step is to create an Action Plan for irrigation investments into the future. The consultant should appraise and rank order the list of viable irrigation investment opportunities, as well as the existing super scheme investment plans, to identify a pipeline of investments for the next 20 years.

The appraisal of super schemes and other irrigation investment opportunities should be completed using cost-benefit analysis for each project or program. There are a number of key components that must be part of this analysis, including:

- **The types of benefits expected**—for example, food security, income for smallholder families, development for women, development for the very poor, general growth and development
- **The value of water in the Malawian economy**—the competing demand for water use in Malawi is hydropower generation, as nearly all of the country's electricity is produced using hydropower schemes. The value of water for irrigation can be thought of as the opportunity cost of not using it for hydropower generation
- **The price of electricity in the Malawian economy**—in order to compare the costs and benefits of using water for hydropower generation versus water for irrigation schemes, the consultant should determine a realistic value for electricity in the Malawian economy. This value lies somewhere within the range of \$0.08—\$0.43 per kilowatt-hour. To determine a more precise value for electricity, the consultant should look into the likelihood and timing of Malawi linking to the Southern African Regional Electricity Grid, and also of the construction of a coal-fired power plant
- **Hydrological risks associated with the Shire River**—The consulting firm Norplan is currently undergoing detailed modeling of this risk; the consultant should incorporate the results of this work into the cost-benefit analysis
- **Environmental considerations**—the consultant should be mindful of the amount of water that can be abstracted while still maintaining Environmental Flow Rates at an acceptable level. Other environmental implications of investments should also be valued.

The consultant should estimate financial and economic Net Present Values and Internal Rates of Return for each program or project; only viable projects with a positive economic Net Present Value at an agreed discount rate (such as 10 percent) should be recommended. Where public investment dollars are inadequate to fund all economically justified investments that need public funding, priority should be given to those projects with the highest economic net benefits per dollar of public funding required. The analysis should provide a basis for the Ministry of Finance and donors to fund the investment plan, by clearly demonstrating that it is cost-benefit justified.

The consultant should then recommend which opportunities should be developed, based on the above appraisal, in the form of an investment Action Plan.

#### **4.4 Draft Action Plan**

The Action Plan should include the recommended projects, and should also involve developing the following additional items:

- Strategies to capitalize on opportunities
- Funding plan
- Policy
- Institutional development
- Capacity building for farmers and Water User Associations

Each of these is detailed below.

##### **4.4.1 Strategies to capitalize on opportunities**

The consultant should recommend a strategy for the development of those opportunities recommended for development in the Appraisal component. The strategy will vary between projects and business lines. For example, schemes to provide water for existing smallholders should be based on user demand, but may be planned out and costed in a traditional physical planning approach. On the other hand, water for high-value market-led agricultural opportunities cannot be planned out in isolation from the entrepreneurs who will drive these opportunities, and so a different strategy would need to be recommended to allow the Government to identify and work with these entrepreneurs.

In any event, for each opportunity, the strategy should make recommendations on the following points:

- Engagement with beneficiaries and other stakeholders
- The physical location of infrastructure; where water resources will be drawn from; the technologies to be used; and the types of crops expected
- Complementary on-farm work and inputs needed
- Supply chain and market linkages
- Probable costs, financing and cost recovery
- Institutional responsibility for construction, operation and maintenance of the schemes

#### **4.4.2 Funding plan**

The consultancy should develop a Funding Plan which indicates where funds to support the recommended Investment and Financing Plan should come from. The Funding Plan should be tailored to the interest and requirements of the Ministry of Finance, development partners, and potential private investors. It should be tested with them for realism, and also be capable of being used by Government as a marketing or advocacy document.

The consultant should consider the National Irrigation Fund (NIF), the establishment of which is provided for in the 2001 Irrigation Act. The NIF is meant to consist of Government funds budgeted for the sector, as well as any other form of funding raised by the Board of Irrigation. The consultant should consider the Agriculture SWAp as a possible vehicle for coordinating alternate sources of funding.

#### **4.4.3 Policy**

The consultant should recommend any changes to Malawi's policies related to irrigation it considers warranted, in order to ensure that:

- National policies for the agricultural water sector provide the necessary framework for investments to be sustainable; are capable of promoting growth and contributing directly and indirectly to poverty alleviation; and are embedded in national development strategies and poverty reduction plans
- These policies are well-integrated within broader management of country or river basin water resources strategies
- Policies define the respective roles of water users, the public and private sectors, and of the ways to foster private investment
- Policies squarely deal with the specific issues that need to be tackled to ensure proper water delivery, operation and maintenance (O&M), water charges, and cost recovery for irrigation systems.

#### **4.4.4 Institutional development**

Where helpful for the success of the strategy, the consultant may clarify, or recommend changes to, the roles of actors in the sector, including:

- The Ministry of Agriculture, Irrigation, and Water Development
- District Councils
- The office of the Green Belt Initiative
- Water User Associations
- Farmers
- Civil society
- Private firms
- Investors

In particular, the consultant should recommend any changes it considers necessary in the following areas:

- The ability of the Government to work with farmers of all types, and to identify and pre-appraise a pipeline of demand-responsive, cost-benefit justified irrigation opportunities
- Decentralized, participatory management by farmer groups, and governance and management arrangements for those groups, including Water User Associations. This will enable the various farmer groups to participate in project design, implementation and management, and to compete in markets that enable them to function in a liberalized socio-economic environment, supported by service providers that are accountable and responsive to their needs
- Sustaining post-development partner interest, including by empowering District staff, overcoming low efficiency of water productivity, and securing access to good prices (through farmer control), and civil society messages
- Greater involvement by the private sector through institutional arrangements that support public-private partnership (PPP) initiatives
- Organizational and management reform of the large-scale irrigation sub-sector (estate irrigation).

#### **4.4.5 Capacity building for farmers and Water User Associations**

The consultant should recommend the components it considers necessary for outreach, advice and assistance to farmers and Water User Associations. This includes considering what advisory and extension items should be incorporated into the Plan. These may include the following:

- Explanations to farmers of the financial benefits of irrigation, in terms that are simple and easy to understand
- Advice from economists and agronomists, that is tied into agribusiness, marketing, and the value chain, in particular on managing the transition to new, higher-value crops
- Improving irrigation performance, based on successful integration of use of water, fertilizer and certified seeds, targeting water wastage, and through simple crop water requirements and irrigation scheduling
- Compliance (for example, with abstraction permits) with functions of Water Resource and River/Lake Basin Authorities
- Identifying local sites that are viable for irrigation
- Equipment packages aimed at emerging smallholders.

### **4.5 Monitoring and Evaluation**

A monitoring and evaluation (M&E) system is currently being developed for the irrigation sub-sector under a consultancy supported by the Japanese International Cooperation Agency (JICA). As part of the Irrigation Investment and Financing Plan, the consultant should identify and discuss the implications of the Plan for this M&E system. The consultant may also make recommendations on the M&E system; recommendations should address the following points:

- **Indicators**—these should be a hierarchy of indicators, starting with measurement of the benefits of irrigation in terms of increased crop values and farmer incomes. They should include supporting indicators on intermediate inputs, such as crop types and yields, land area irrigated, volumes of water used, and scheme efficiency (both physical and financial). The indicators should, if appropriate, be drawn from the 20 recommended indicators within the 2010 AgWA M&E Report. The categories under which indicators should be developed include:
  - ♦ Institutional framework and development
  - ♦ Agricultural water management area developed and users served
  - ♦ Infrastructure management, operation, and maintenance
  - ♦ Agricultural productivity and value added
  - ♦ Profitability, cost effectiveness and employment
  - ♦ Environmental impact and sustainability
  - ♦ Poverty reduction and food security
- **Targets for each indicator**—these targets should be in line with the benefits and investments recommended in the Plan. They should be set for the short, medium, and long term
- **Monitoring mechanism**—a mechanism should be recommended which is simple and workable, and that will allow the Government to gather reliable information on actual performance on each of the indicators (at appropriate intervals) and to compare this to targets
- **Difference analysis and intervention**—the consultant should recommend a procedure and institutional approach that will allow the Government to detect when it is going off target, analyze the reasons why, and where appropriate take corrective action
- **Lessons for future projects and plans**—the consultant should also provide process and institutional recommendations to enable the Government to use the monitoring data to reflect periodically on what works and what does not, and to incorporate insight from this analysis into design of future projects and strategies.

The consultant can draw on the June 2010 AgWA M&E Report, *Study on Monitoring and Evaluation of Agricultural Water Management in Africa* sponsored by the Partnership for Agricultural Water in Africa. That review focused on an M&E process that builds connectivity between project and program level results, organizational Results-Based Management, and high-level objectives.

## 5 Deliverables

The consultant will be expected to submit the following deliverables:

- Objectives and Context Report
- Proposed Irrigation Typology Report
- Project Potential and Appraisal Methodology Report



- Recommended Opportunities Report
- Draft Action Plan
- Final Action Plan

The content of each of these deliverables is described below.

## **5.1 Objectives and Context Report**

This report should collate key points on the situation in the sector, including:

- Principal Government mechanisms and instruments (policies, strategies, plans etc.)
- Current institutional responsibility for irrigation, including key institutional linkages and interfaces
- Public expenditure plans
- What the Government is aiming to achieve through irrigation; where Government intends to target irrigation; how Government intends to implement irrigation
- The social and economic outcomes (and their scale) that are intended to be delivered through irrigation, including the connections and benefits of irrigation into household-level farming strategies
- Description of irrigation within the Country Assistance Strategies/Country Strategy Papers/Country Strategic Opportunities Programmes (COSOPs) of development partners
- Lessons learned from experiences with irrigation in Malawi to date

From this, the consultant should summarize the Government's key objectives, as well as the opportunities, issues, and constraints relevant to achieving those objectives, in so far as they can be ascertained from the initial situation assessment.

## **5.2 Proposed Irrigation Typology Report**

This report should propose the typology or 'Business Lines' that the consultant intends to use to group various irrigation opportunities in development of the strategy, and should indicate the key characteristics and requirements of each type. It should also justify the typology adopted, explaining why it is useful.

## **5.3 Project Potential and Appraisal Methodology Report**

This report should indicate the projects identified as having potential and hence being worthy of appraisal. It should also describe the methodology the consultant intends to use to appraise the projects. This appraisal methodology should be agreed with the Government and the World Bank before being applied.

## **5.4 Recommended Opportunities Report**

This report should indicate the irrigation opportunities that the consultant recommends be developed under the strategy, supported by reasoning based on the agreed appraisal methodology.

## **5.5 Draft Action Plan**

This should incorporate the results of the analysis and activities required by Section 4.4 of these terms of reference (explaining the Draft Action Plan scope of work).

## **5.6 Final Action Plan**

The final report should provide a coherent story showing:

- Where improved irrigation development is needed
- What it will cost
- What benefits it will bring
- How development partners and the Ministry of Finance should engage
- How institutional design and capacity will ensure value for money and sustainability
- How a Monitoring and Evaluation framework will provide accountability and allow for systematic learning from experience.

Annexes should provide:

- Additional detail needed on any particular points
- Data used
- Analysis and calculation performed to support the conclusions
- A record of stakeholders consulted

## **5.7 Preparation of the Terms of Reference for Subsequent Consulting Services**

The Terms of Reference should be created for a subsequent consultancy to advise on:

- The development of technical standards, adapted from others used internationally in irrigation
- The development of technical manuals for irrigation, based on existing manuals used for irrigation and adapted for the context of Malawi
- Other logical follow-on work, to be identified while the Investment and Financing Plan consultancy is carried out

## Appendix A: Background on Irrigation in Malawi

Agriculture is the most important sector of the Malawian economy, accounting for over 80 percent of total export earnings, 32 percent of GDP as of the year 2010, and over 80 percent of the workforce. Production includes two main sub-sectors: traditional small-scale farming (“smallholders”), and the commercial sector (“estates”). Smallholder agriculture is estimated to contribute over 70 percent of all agricultural GDP, with estate agriculture accounting for the remainder.

Smallholder irrigation is dominated by food crops—mainly maize and rice—and typically experiences lower yields than the estate sub-sector. Commercial estates mainly grow high value cash crops for export, such as tobacco, tea, sugarcane, and coffee. A significant amount of land (600,000 hectares, or six times the current area of land under irrigation) is dambos.<sup>130</sup> These are mainly rain-fed subsistence schemes.

The recent Water Resources Investment Strategy (WRIS) estimates that the area of land under irrigation in 2010 was approximately 100,000 hectares. This represents 20 percent of the irrigable potential that has been identified by the Government as feasible (485,000 hectares). Smallholder irrigation accounts for approximately 35 percent of all irrigation; estates account for 46 percent; the remaining 19 percent is dimba<sup>131</sup> irrigation.

Farmers grow maize, rice, wheat, coffee, cotton, sugarcane, tea, vegetables, and tobacco on irrigated land areas. Table A.1 below gives the estimated land area under irrigation for each of these main crops, as well as the respective percentage of total land under irrigation.

**Table A.1: Irrigated Area and Crop Estimates in 2010**

Irrigated Crop	Estimated Area (hectares)	Percentage of total irrigation
Maize	22,926	23
Rice	5,076	5
Wheat	691	1
Coffee	800	1
Cotton	5,866	6
Sugarcane	22,097	22
Tea	30,999	30
Tobacco	11,539	12
All	99,094	100

<sup>130</sup> A dambo is valley-bottom land temporarily flooded and waterlogged by upslope rather than upstream water (usually marked by an absence of a defined river channel) (IFAD 1995, as cited on page 25 of Component I of the Water Resources Investment Strategy—Government of Malawi, 2011). Dambo cultivation is not generally considered irrigation as there is limited water management and dambo crops are generally grown under rain-fed conditions.

<sup>131</sup> A dimba is a small garden located in valleys, floodplains, within dambos, and the command areas below small earth dams which use residual water supplemented by ground or surface water. (IFAD 1995, as cited on page 25 of Component I of the Water Resources Investment Strategy—Government of Malawi, 2011).

Smallholders use four main types of irrigation technology: gravity-fed schemes, motorized pumps, treadle pumps, and watering cans. Table A.2 below shows the distribution of irrigation technologies used by smallholders, by region.

**Table A.2: Smallholder Irrigation Development up to August 2010** (in hectares)

Region	Agricultural Development Division	Gravity-fed	Motorized pump	Treadle pump	Watering cans	Total
Northern	Karonga	2,551	29	46	4	2,631
	Mzuzu	2,238	404	1,514	0	4,157
Central	Kasungu	2,170	683	1,357	1,308	5,518
	Lilongwe	4,433	300	1,512	1,271	7,515
	Salima	677	326	591	156	1,750
Southern	Machinga	2,043	1,272	1,123	1,335	5,774
	Blantyre	1,482	387	3,020	685	5,573
	Shire Valley	1,407	102	1,890	88	3,488
Total		17,001	3,503	11,053	4,847	36,406

Source: Component I—Water Resources Assessment. Water Resources Investment Strategy, Government of Malawi, 2011 (25).

In Malawi, irrigation development is the responsibility of the Ministry of Agriculture, Irrigation and Water Development. Donors active in the sector include the World Bank, the African Development Bank (AfDB), the European Investment Bank (EIB), the Japanese International Cooperation Agency (JICA), the United States Agency for International Development (USAID), and the Government of India. Table A.3 below shows recent expenditure totals in irrigation.

**Table A.3: Expenditure in Irrigation in Malawi, 2006-2010**

Source of Funding	Amount (US\$)
World Bank	30 million
African Development Bank	25 million
Government of Malawi	13 million
Japanese International Cooperation Agency	12.5 million
Arab Bank for Economic Development	8 million
The Republic of India	7.5 million
United States Agency for International Development (USAID)	0.40 million
Total	96 million

To date, the main focus in irrigation in Malawi has been on expansion of the area of land under irrigation. In 2011, the Government embarked on implementation of the Green Belt Initiative (GBI). The program aims to ensure that 1,000,000 hectares of land is under irrigation. The Government has developed a five year Strategic Plan for the Green Belt Initiative, which aims to ensure 200,000 hectares are under irrigation by 2016.<sup>132</sup>

The motivation for the Green Belt Initiative is greater food security and less dependence on rain-fed agriculture, driven in part by a severe drought in 2002 that led to three years of hunger. The purpose of the initiative is to create wealth among Malawians through increased agricultural production and productivity, enterprise development, and increased exports.

The Government identifies the following as major challenges for irrigation development:

- Low levels of irrigation culture among rural communities
- Limited resources for irrigation development
- Limited crop diversification
- Inadequate markets for farm produce
- Poor land use practices
- High development and farm input costs
- Limited agro-processing and storage facilities

There is strong Government commitment to improved irrigation development and management in Malawi. This is clear from the:

- Malawi Growth and Development Strategy
- Comprehensive Africa Agricultural Development Programme (CAADP) Compact (signed in April, 2010)
- The inclusion of irrigation as a sub-sector within the Agriculture Sector Wide Approach (ASWAp)
- The National Irrigation Policy and Development Strategy (NIPDS)
- The Green Belt Initiative
- The completion of a National Water Resources Investment Strategy

In this context, the Government is concerned to achieve:

- A more coherent understanding of the role and value of irrigation, and how the various policies and instruments align to support it

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<sup>132</sup>As reported in the WRIS (Component 2, page 38). The WRIS assumed expansion of irrigation to 485,000 hectares by 2035, which “represents the development of all of those areas of the GBI considered irrigable by recent MoIWD feasibility studies” (Component 2, page 19).

- Greater clarity over the actual and appropriate roles and responsibilities of various Ministries and decentralized entities
- Clarity as to the appropriate roles and potential for engagement with NGOs, large commercial farmers, and potential private parties to public private partnerships
- Harmonization among development partners and with Government in sector approaches, avoiding isolated projects and programs
- Clarity around the various distinct benefits irrigation can bring, differentiating between: food security, income enhancement, and growth and development
- Setting targets for the sector in terms of benefits achieved, with any physical infrastructure targets clearly related to the economic and social benefits that would accrue
- The expansion of irrigation under commercial farmer engagement, with cost-sharing and cost recovery arrangements, and following from market demand
- An understanding of how to plan for irrigation investment when the crops to be grown are not known in advance. This includes how to choose the suitable irrigation system, how to estimate revenues, and how to provide closer linkages to agronomy, and to supply-chains and markets, to ensure that farmers are willing and able to cultivate appropriate new varieties made possible by irrigation.

Government is also looking to improve project flow in the sector. Currently, the pipeline of projects is initiated by Governments, based on pre-feasibility studies. Individual development partners express interest, and often proceed to frame projects with little consultation with Government and among other partners. This has in some cases been done based on experience from other countries but missing important national perspectives. By the time projects reach appraisal stage, staff movements within Government may lead to a loss of continuity, and consequently redesign, ultimately leading to delays and poor project performance. Government would like to have the ability to develop projects further in advance of development partner engagement on specific opportunities, and wishes to ensure greater control and institutional continuity as projects are being developed and implemented.

Government is also seeking to improve Monitoring and Evaluation (M&E) systems for irrigation. Currently there are multiple responsibilities for conducting M&E, based on Ministry of Foreign Affairs and International Cooperation (overall, and with responsibility for Malawi MDG reports), Ministry of Finance (budget division on GBI results), Debt and Aid on partner projects, Ministry M&E officers, and others. The Government would prefer to streamline the Monitoring and Evaluation responsibilities. At the same time, the Government is interested in developing appropriate indicators that track the social and economic benefits of improved irrigation development and management.

## Appendix B: Resources to be Drawn On for the Irrigation Investment and Financing Plan

The consultant is expected to be familiar with, and to draw on as appropriate, the following materials:

*AgWA Country Support Tool Definition*. Final Report. (November 2010). (Especially Annexes 4, 5, 6, 7).

AgWA M&E Report: *Study on Monitoring and Evaluation of Agricultural Water Management in Africa*, Partnership for Agricultural Water in Africa (June 2010).

<http://www.ukia.org/agwa/AgWA%20ME%20Report%20main.pdf>

*The Agriculture Sector Wide Approach (ASWAp)*. Government of Malawi (2010).

<http://www.nepad-caadp.net/pdf/Investment%20plan%20-%20Malawi.pdf>

*Comprehensive Africa Agricultural Development Programme (CAADP)*. New Partnership for Africa's Development (NEPAD), Food and Agriculture Organization (FAO) (2002).

<http://www.nepad.org/system/files/caadp.pdf>

Comprehensive Africa Agricultural Development Programme (CAADP) Implementation Guide. [http://www.caadp.net/pdf/CAADP\\_imp\\_guide\\_WEB.pdf](http://www.caadp.net/pdf/CAADP_imp_guide_WEB.pdf)

Malawi CAADP Compact. <http://www.nepad-caadp.net/pdf/malawi.pdf>

Country Support Tool for Scaling-up Sustainable Land Management in sub-Saharan Africa. TerraAfrica (2009).

<http://www.caadp.net/pdf/Country%20Support%20Tool%201.0.pdf>

*World Development Report 2008: Agriculture for Development*. World Bank (2008).

[http://siteresources.worldbank.org/INTWDR2008/Resources/WDR\\_00\\_book.pdf](http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf)

*Investment in Agricultural Water for Poverty Reduction and Economic Growth in sub-Saharan Africa—Synthesis Report*. AfDB, FAO, IFAD, IWMI & World Bank.

(2007). <http://siteresources.worldbank.org/RPDLPROGRAM/Resources/459596-1170984095733/synthesisreport.pdf>

*Accelerating Development Outcomes in Africa: Progress and Change in the Africa Action Plan*. IMF, World Bank (2007).

[http://siteresources.worldbank.org/DEVCOMMINT/Documentation/21289631/DC2007-0008\(E\)-AfricaActionPlan.pdf](http://siteresources.worldbank.org/DEVCOMMINT/Documentation/21289631/DC2007-0008(E)-AfricaActionPlan.pdf)

*Re-engaging in Agricultural Water Management: Challenges and Options*. World Bank (2006).

[http://siteresources.worldbank.org/INTARD/Resources/DID\\_AWM.pdf](http://siteresources.worldbank.org/INTARD/Resources/DID_AWM.pdf)

*Shaping the Future of Water for Agriculture*. World Bank (2005).

[http://siteresources.worldbank.org/INTARD/Resources/Shaping\\_the\\_Future\\_of\\_Water\\_for\\_Agriculture.pdf](http://siteresources.worldbank.org/INTARD/Resources/Shaping_the_Future_of_Water_for_Agriculture.pdf)

*Making a Large Irrigation Scheme Work: A Case Study from Mali*. World Bank (2005).

[http://siteresources.worldbank.org/INTARD/Resources/making\\_a\\_large\\_scale\\_irrigation\\_system\\_work\\_DID.pdf](http://siteresources.worldbank.org/INTARD/Resources/making_a_large_scale_irrigation_system_work_DID.pdf)