Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI)

Gap Analysis and Action Plan – Scoping Report (Final)

February 2019

Tanzania

Report Number 1.13

SADC

SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

TOWARDS A COMMON FUTURE

GROUNDWATER MANAGEMENT INSTITUTE

This report emanates from the project Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI) commissioned by the Southern African Development Community Groundwater Management Institute (SADC-GMI), and executed by Pegasys.

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This report is accessible online through SADC-GMI website: www.sadc-gmi.org

Citation: SADC-GMI, (2019). *Gap Analysis and Action Plan – Scoping Report: Tanzania.* SADC GMI report: Bloemfontein, South Africa.

FOREWORD

The Southern African Development Community (SADC) Member States, through the support of International Cooperating Partners have gone through a series of Water Sector Reforms which varied in terms of policy, legal and institutional development. The focus of the water sector reforms has been on Integrated Water Resources Management and aimed at achieving sustainable and equitable distribution of water resources in the respective Member States. To a large extent, the water sector reforms did not comprehensively address the sustainable management of groundwater resources, yet 70% of the population in the SADC region depend on it. Climate change continues to negatively affect the availability of surface water, placing significance reliance on the use of groundwater for both urban and rural supply throughout the region. Human wellbeing, livelihoods, food security, ecosystems, natural habitats, industries and urban centres growth throughout the SADC Region are increasingly becoming more reliant on groundwater. The SADC region in general has an abundance of groundwater resources. However, due to several factors which include the lack of an enabling policy, legal and institutional environment, only an estimated 1.5% of the available renewable groundwater resources are currently being utilised.

It is estimated that there are about 30 Transboundary Aquifers (TBAs) and 15 transboundary river systems and that these systems are central to the water security of the region. There is therefore a need for Members States to establish and strengthen existing policy, legal and institutional frameworks to achieve equitable and sustainable access to water resources through joint management of the transboundary resources. It is in view of the above and in response to the need to strengthen the sustainable use of groundwater resources conjunctively with surface water at both the national and regional level, that the Southern African Development Community – Groundwater Management Institute (SADC-GMI) was established by the SADC Secretariat, on behalf of the Member States.

The vision of the SADC-GMI is, “to be a Centre of Excellence in promoting equitable and sustainable groundwater management in the SADC region”. The key focus areas of SADC-GMI are to 1)advocate, raise awareness and provide technical support in SADC around sustainable management through the dissemination of information and knowledge; 2) create an enabling environment for groundwater management through policy, legal and regulatory frameworks; 3) promote action-oriented research; 4) promote impact-oriented capacity building and training for groundwater management in the region; 5) lead and promote regional coordination for groundwater management; and 6) support infrastructure development for groundwater management.

In pursuance of the focus area of creating an enabling environment, SADC-GMI implemented the project entitled "Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States, (GMI-PLI)". The methodology for said project included the development of the Desired Future State, conducting a baseline study of best practices, and description of policy, legal and institutional frameworks which promote sustainable groundwater management. Using an in-Country Experts model, a systematic analysis of the existing policy, legal and Institutional frameworks in comparison with the Desired Future State was conducted to identify gaps that required to be addressed in order to fulfil the SADC-GMI mandate – to achieve sustainable groundwater management in all 16 SADC Member States. The analytical assessment of the gaps identified at national level culminated in the production of 16 National Gap Analysis & Action Plan Reports and the higher-level Regional Gap Analysis Report. The latter summarises the findings across the SADC region.

This National Gap Analysis for Tanzania provides an overview of the existing gaps in policy, legislation, strategy, guidelines and the institutional frameworks and further suggests enablers required to unlock the identified gaps/challenges. The report provides a clear guidance for Tanzania to develop an implementation roadmap through a process of prioritising the Strategic Actions in close liaison and in consultations with all relevant stakeholders. It is hoped that these National/Regional Gap Analysis and Action Plan Reports will aid Tanzania to develop their own Roadmap which will ultimately advance the groundwater narrative and bring it at par with surface water in terms of policy, legal and institutional frameworks which will no doubt enhance sustainable groundwater management at a national and regional level in the SADC Region.

James Sauramba
Executive Director

ACKNOWLEDGEMENTS

The following individuals and organisations are thanked for their contributions to the project:

SADC – Ground Water Management Institute

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Stakeholders Engaged

The project team would like to thank all those stakeholders that contributed to the project from Government, Private Sector, Civil Society and Academia and Research.

The authors also like to express sincere appreciation to members of the **SADC Sub-Committee on Hydrogeology** for identifying the need for this project, following on the numerous challenges that they experience in their respective countries. Without the dedicated facilitation and support from the members of the SADC Sub-Committee on Hydrogeology, who also serve as focal points for groundwater development in their respective countries, this exercise would not have been accomplished.

In this regard, special thanks are given to:

Mr Manuel Quintino, Angola; Mr Kedumetse Keetile, Botswana; Mr Cyrille Masamba, Democratic Republic of Congo; Mr Trevor Shongwe, Kingdom of eSwatini, Ms Christinah Makoae, Lesotho; Mr. Luciano Andriavelojaona, Madagascar; Ms Zione Uka, Malawi; Mr Pokhun Rajeshwar, Mauritius; Ms Ana Isabel Fotine, Mozambique; Ms Maria Amakali, Namibia; Mr Frankie Jose Dupres, Seychelles; Mr Zacharia Maswuma, South Africa; Ms Mwanamkuu Mwanyika, United Republic of Tanzania; Mr Frank Ngoma, Zambia; and Mr Robert Mutepfa, Zimbabwe.

Additionally, the authors thank all other professionals from the Member States who contributed to the project by providing ideas and feedback, in particular, professionals from various organisations who contributed to the over-all project, and senior officials from the Member States. The contribution of all institutions and individuals who supported the project through ideas and comments and may not have been credited by name, is greatly appreciated.

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LIST OF ACRONYMS

ACRONYM	DEFINITION
AGW-Net	Africa Groundwater Network
BAU	Business as Usual
BWB	Basin Water Board
CEO	Chief Executive Officer
CIWA	Cooperation in International Waters in Africa
COWSO	Community Owned Water Supply Organization
CWC	Catchment Water Committee
DAWASA	Dar es Salaam Water and Sewerage Authority
DAWASCO	Dar es Salaam Water and Sewerage Company
DDCA	Drilling and Dam Construction Agency
DWR	Director of Water Resources
ERB	Engineers Registration Board
FAO	Food and Agriculture Organization (of the United Nations)
GEF	Global Environment Facility
GESI	Gender, equity and social inclusion
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMI	Groundwater Management Institute
GMI-PLI	Groundwater Management Institute – Policy, Legal and Institutional
GW	Groundwater
IDB	Internal Drainage Basin
IWaSP	International Water Stewardship Programme
IWRM	Integrated Water Resources Management
JICA	Japan International Corporation Agency

ACRONYM	DEFINITION
MCM	Million Cubic Meters
MDG	Millennium Development Goal
MoWI	Ministry of Water and irrigation
MSP	Multi-Stakeholder Platform
NAWAPO	National Water Policy
NBS	National Bureau of Statistics
NGO	Non-Governmental Organisation
NRWSSP	National Rural Water Supply and Sanitation Programme
PLI	Policy, Legal and Institutional
SADC	Southern Africa Development Community
SADC-GMI	Southern Africa Development Community – Groundwater Management Institute
SUA	Sokoine University of Agriculture
SWL	Static Water Level
TBL	Tanzania Breweries Ltd
TCC	Tanzania Cigarette Company
TGS	Tanzania Geological Survey
ToR	Terms of Reference
TPS	Tanganyika Plantations Company
UFI	Ubungo Farm Implements
URT	United Republic of Tanzania
WB	World Bank
WD & DI	Water Development and Irrigation Division
WPP	World Population Prospects
WRG	Water Resources Group

ACRONYM	DEFINITION
WRM	Water Resources Management
WRMA	Water Resources Management Act
WSDP	Water Sector Development Program
WSDS	Water Sector Development Strategy or National Water Sector
WUA	Water Users Association

1. INTRODUCTION

1.1. Background to the GMI-PLI Project

The critical role of groundwater in building the region's resilience to climate change and improving water security is reflected by the World Bank in their June 2017 online article: *People in Southern Africa are largely dependent on groundwater shared between countries and communities for health and well-being, food production, and economic growth*. As climate variability alters the amount of surface water that is available, people in the region are increasingly turning to groundwater, a resource that is already challenged by threats of depletion and pollution.

The sustainable management of groundwater is a key part of the broader water security for the region, especially in understanding transboundary aquifers. The Southern African Development Community (SADC) has established the Groundwater Management Institute (GMI) to better understand the region's needs and improve their groundwater management capabilities.

The SADC Groundwater Management Institute (SADC-GMI) is the implementing agency of the World Bank funded Sustainable Groundwater Management in SADC Member States Project. This funding is secured through the Global Environment Facility (GEF) and the Cooperation in International Waters in Africa (CIWA) trust. Part of this funding has been dedicated by the SADC-GMI to respond to gaps in the existing policy, legal and institutional (PLI) frameworks for groundwater management in the region towards fulfilling one of four main components of the project –"Enhancing institutional capacity of governments in SADC Member states and transboundary organisations". The objective is to be met through a series of organised steps which broadly included the development of a benchmark document called the Desired Future State Document, a Gap Analysis and high-level Action plan for all SADC Member States and for the region, development of a suite of guidelines to strengthen groundwater management regionally. To inform the guideline on the development of a groundwater PLI Roadmap, Tanzania was selected as a pilot from which to draw lessons and develop the process.

This report presents the outcomes of the gap analysis for Tanzania.

1.2. Socio-economic drivers for Tanzania

1.2.1. National Development Plans

Toward the end of 1990s, Tanzania drafted her National Development Vision which was meant to guide economic and social development efforts up to the year 2025 (URT, 1999). The objective of this Development Vision is to lift the country to a middle-income nation through awakening, co-ordinating and directing the people's efforts, minds and national resources (including water) towards those core sectors that will enable the nation attain development goals and withstand the expected intensive economic competition ahead. Water Resources sub sector is at the centre of propelling this targeted economy by fostering clean energy security, food security, agricultural raw material for industries and the social well-being around health and sanitation indicators.

1.2.2. Population Projections

With 947,300 km^2 of land, Tanzania is the 31st largest country in the world and the 13th largest in Africa. The estimated 2018 population of Tanzania is 59.09 million, up from the 2014 estimate of 50.8 million, ranking 27th in the world (http://worldpopulationreview.com/countries/tanzania-population/). The last official census recording the population of Tanzania occurred in 2012 and showed there were 44,928,923 people living in the country (NBS, 2013). Of this total population, 1.3 million reside on the islands of Zanzibar (NBS, 2013). This equates to a population density of 47.5 people/km^2 (123.1 people per square mile). The population is now estimated at over 59.09 million, as Tanzania has one of the highest birth rates in the world and more than 44% of the population is under the age of 15 (http://worldpopulationreview.com/countries/tanzania-population/).

Tanzania has a very uneven population distribution. In the arid regions, population density is as low as 1 person/km^2, about 53 people/km^2 in the water-rich mainland highlands and up to 134 people/km^2 in the capital city of Zanzibar. About 80% of the population lives in rural areas. Note that, Tanzania's total renewable water resources are estimated at 96.27 MCM/Year, a value that does not change appreciably with time. The major shift in total water availability per capita is largely a result of rapid population growth rates (WB, 2017).

1.3. Water resources

Tanzania is endowed with relatively abundant freshwater sources, including rivers, springs, lakes, wetlands, and aquifers. However, these resources are unevenly distributed in time and space (URT, 2002). While some critical areas e.g. The Great Ruaha River Catchment, experiences total drying of the river for increasingly longer sections of the year, there is limited understanding of the underlying aquifers that could cater for the deficit.

1.3.1. Status of water resources (surface, groundwater and transboundary)

Tanzania's water resources are declining at an alarming rate since the first assessment during the development of the 2002 National Water Policy (NAWAPO). According to the Ministry of Water and Irrigation (MoWI), an average volume of renewable freshwater per capita per year has been declining, from 2,700 m^3/capita/year in 2001 to 2000 m^3/capita/year in 2012 (URT 2014). In addition to that, a country economic update report by the World Bank, 2017 (Figure 1) indicated that Tanzania is already below the water scarcity indicator of 1700 m^3 per capita per year (Falkenmark, 1989) that is 1608 m^3 per capita as of 2015. If Business as Usual (BAU) scenario persist in Water Resources Management (WRM) practices, assessments project the status of these vital resources to decline to 1500 m^3 per capita by 2025 (URT, 2014). This status of affairs will inevitably undermine national economic growth target to middle income by 2025 since water availability is highly variable in space and time. Taking into account environmental flow requirements, during dry periods, national demand is 150 percent of accessible water (2030 WRG, 2014). Under a business as usual scenario and factoring in economic growth projections, this increases to 216 percent by 2035 (2030 WRG, 2014).

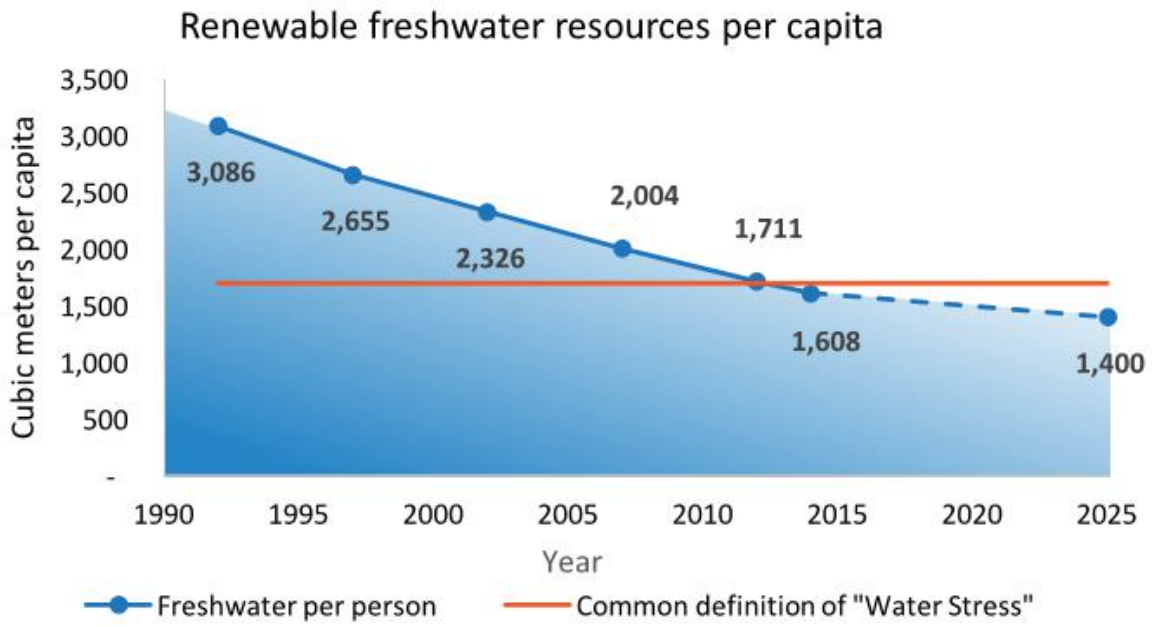

Figure 1: Trend of status of renewable water status in Tanzania – [Source: WB Open Data]

According to Sanga et al., 2018, little is known to substantiate the transboundary exchange of groundwater. However, it is known (Figure 5) that, of the 9 river and lake basins of Tanzania, only Rufiji and Wami-Ruvu are not transboundary (URT, 2002). This requires international diplomacy when the country is to develop its water resources for social economic development of its thirsty population.

1.3.2. Groundwater environment and ecology

Little is known on interaction of groundwater and surface ecosystems, but several wetlands are linked with groundwater discharge. Study carried out by Sadiki, 2009 underscored the importance of groundwater as a vital source of major rivers in the Pangani River Basin e.g. a number of hot springs around Mt. Kilimanjaro, Mt. Meru and L. Manyara (Sadiki, 2009).

Table 1: Specific groundwater provisions in national strategies and action plans

N	Reference Section	Document	Brief Description
1	2.8. Environment	NAWAPO	▪ Role of pollution and over exploitation of GW and its impacts to the ecosystem e.g. Species depended of the Ihefu wetland in the Great Ruaha River Catchment in Rufiji Basin
2	4.2.1. Water Conservation	NAWAPO	▪ Mentioned as one of the important parts of Water Resources in the country and that its miss management threatens ecosystem integrity.
3	10.2.1. IWRM	WSDS	▪ Utilization of water resources within sustainable limits for assimilative capacities for discharge of pollutants

Table 2: Specific groundwater provisions in the legislation

N	Reference Section	Document	Brief Description
1	38 (2)(c)	WRM Act No. 11	▪ Possible adverse impacts by the exploitation of groundwater on the availability of surface water;
2	68	WRM Act No. 11	▪ Protection of waste discharge onto underground strata or groundwater recharge zones
3	80 (1)	WRM Act No. 11	

1.3.3. Status of groundwater infrastructure

The most recent country-wide assessment of groundwater touching on its development potential, has been carried out by (J. J. Kashaigili, 2010). This study indicated that, groundwater development has concentrated mainly on shallow wells for domestic purposes over a wide part of the country (mainly rural areas)because it is relatively easy and cheap to develop as compared to surface water and it can be developed where it is required (J. J. Kashaigili, 2010). Furthermore, it is associated with low operation and maintenance costs and not much affected by drought unlike surface water resources. Owing to that, it is commonly used in the peri-urban fringes where there is no distribution network and places with unreliable supply. In Tanzania, groundwater is an important water source supplying more than 25 % of the domestic water consumption (JICA, 2002). Groundwater is the main source of water for most rural water systems and municipalities like Dodoma, Arusha, Shinyanga, Moshi and Singida mostly in and around Internal Drainage Basin (IDB). This basin is characterized by semi-arid to arid conditions with rainfall less than 550 mm annually, making the dwellers dependent mostly on groundwater as the main source for water supply. Recently, Dar es Salaam City Utility (DAWASCO) has drilled even dipper aquifers of Kimbiji down to 600 m and struck arguably[1] reliable portable water to supply to city dwellers (DAWASA, 2008b). Increasingly, many other urban areas exploit groundwater to augment supply from surface water sources.

More boreholes were also planned to be sunk through the implementation of the Water Sector Development Program (WSDP). This is through its component 3, the National Rural Water Supply and Sanitation Programme (NRWSSP) which aimed to provide access to safe water to an additional 14.5 million people by 2015 at a cost of USD 533 million. This provided a substantial market for drilling of about 1,600 boreholes annually (Baumann, Ball, & Beyene, 2005). The existing borehole record indicates that in town; about 1,000 boreholes (registered and not registered) are drilled each year. At the time of survey (2005), about 9,000 boreholes maintained by the Dodoma central database were estimated to extract 50,000 to 70,000 m^3/day from the aquifer (Baumann et al., 2005). This excessive use may cause salt-water intrusion and damage to the aquifer.

1.3.4. Groundwater supply and demand

Groundwater recharge is controlled by various factors including climate, geomorphology and geology (Rwebugisa, 2008). In most areas of Tanzania, the recharge occurs in topographic high areas mostly by

[1]There are “silent” discussions amongst local groundwater experts that the aquifer waters are ancient hence no connection with any recharge (alarming on sustainability) and have huge drawdowns signifying potentially huge pumping costs – a burden to water users.

direct rainwater infiltration, preferential flows and through fractures. Most recharge areas include alluvial fans with coarsely grained sands, where enhanced high infiltration rate occur. In fractured rocks, flow is often localized in a few main flow paths that control most of the hydrological response of the aquifer (Le Borgne et al., 2007). Presence of termite mounds (as observed in the Makutapora groundwater basin) in the pediment area and on the upland slopes adjacent to the fault systems acting as preferential flows of rainwater to infiltrate to the subsurface, enhance recharge (Shizuo Shindo, 1989). Nevertheless, there are limited extensive studies on recharge in Tanzania. Few detailed studies have been conducted by (Shizuo Shindo, 1989) (S Shindo) (S Shindo, 1991) in Makutapora groundwater basin; (Mjemah, Van Camp, Martens, & Walraevens, 2011) in quaternary sand aquifer in Dar es Salaam; (Sandström, 1995) in Babati District, and JICA, 2002 in Internal Drainage Basin).

The estimated recharge flux in Makutupora basin (Shizuo Shindo, 1989) (S Shindo) (S Shindo, 1991); (J. Kashaigili, Mashauri, & Abdo, 2003) in the basin range from 5 to 10 mm/year, averaging to 1.3% of the annual rainfall. However, the area of the basin is just a fraction of the Tanzania mainland and owing to that the recharge rates are not applicable country-wide. A study by (Mjemah et al., 2011) in quaternary sand aquifer in Dar es Salaam indicate that groundwater recharge range between 0 and 570 mm/year depending on the rainfall amount in that particular year. The average aquifer recharge for the period 1971 to 2006 is estimated at 240.7 mm/year. (Meyboom, 1961) estimated 10 percent groundwater recharge in many areas to be the maximum that can be expected, but that in other localities the percentage recharge may well fall to 4 percent or even below. A study by (Sandström, 1995) in Babati District indicate that in the wet year, almost all rainfall events generate recharge, i.e. the lightest rainfall events, representing 50% of annual total, also provided about 50% of all recharge. In the dry year, however, an imbalance developed, i.e. the same portion of the rainfall events provided only about 25% of the recharge.

JICA (2002) based upon hydrological information through a water balance analysis tried to estimate the basin groundwater recharge and basin evapotranspiration at the river basin scale across the country. The findings of the study are summarized in Table 3. The total ground water recharge on annual basis is estimated at 3,725 MCM (0.4 %) (JICA, 2002). A general outlook on the various recharge estimates indicate that the values are greatly variable location wise and are a function of the methods used. The estimated basin recharge (JICA, 2002) rates are very low and contain a great deal of uncertainty, implicating on groundwater development potential. Therefore, more detailed studies on groundwater recharge are imperative.

Table 3: Estimated recharge from hydrological Balance by River Basin (J. J. Kashaigili, 2010)

No	Drainage Basin	Catchment Area (km^2)	Inflow	Outflow			Remarks
			Annual Mean Rainfall* (mm)	Annual Mean Runoff* (mm)	Evapotranspiration from the basin ** (mm)	Groundwater Recharge *** (mm)	
I	Pangani	56,300	1,001.9	31.5	966	4.0	Into the Indian Ocean
II	Wami/Ruvu	72,930	765.1	51.7	710	3.0	Into the Indian Ocean
III	Rufiji	177,420	988.3	185.9	799	3.0	Into the Indian Ocean
IV	Ruvuma	103,720	1,050.0	20.5	1,028	2.0	Into the Indian Ocean
V	L. Nyasa	39,520	1,672.5	344.6	1,324	4.0	Into L. Nyasa System
VI	IDB	153,800	619.0	36.6	577	5.0	Into IDB System
VII	L. Rukwa	88,180	1,095.0	104.5	985	6.0	Into L. Rukwa system
VIII	L. Tanganyika	151,900	1,173.6	124.7	1,045	4.0	Into L. Tanganyika system
IX	L. Victoria	79.570	1,111.1	18.6	1,087	6.0	Into Mediterranean Sea
Average			**1,053**	**102**	**947**	**4.0**	

**: These were analysed using data of 143 gauging stations.*

***: These were estimated deducting (Runoff) and (Groundwater recharge) from (Rainfall).*

****: These were tentatively estimated consulting the groundwater potential map in "RAPID WATER RESOURCES ASSESSMENT, 1995". Source: JICA, 2002.*

Groundwater demand is increasingly used more in the domestic water supply followed by other uses such as irrigation. The implementation of NRWSSP for domestic supply in urban and rural settings (which are the largest users of groundwater) was estimated to consume 755,000 m^3/day (60% of total use) against demand of 0.8 to 3.4 MCM/day (Kongola, 2008; DWR, 2010). These infrastructures are operated using submersible electric pumps (diesel, electricity and a growing use of solar panels), hand pumps and wind mill. However, these systems suffer functionality issues for a number of reasons including District capacity, Water Extraction Method and Use Fee Arrangements. Irrigation for sugarcane, flowers, vegetables and fruits such as grapes consumes 130,000 m^3/day (10%) while mining and industrial use consume about 30,000 m^3/day (2%) (Figure 2 and 3). Livestock and others such as dry land fishing use

about 350,000 m^3/day (28%). The total groundwater use is about 1.265 MCM/day which is about 12% of available groundwater resources (11 MCM/day) (DWR, 2010 – working reports).

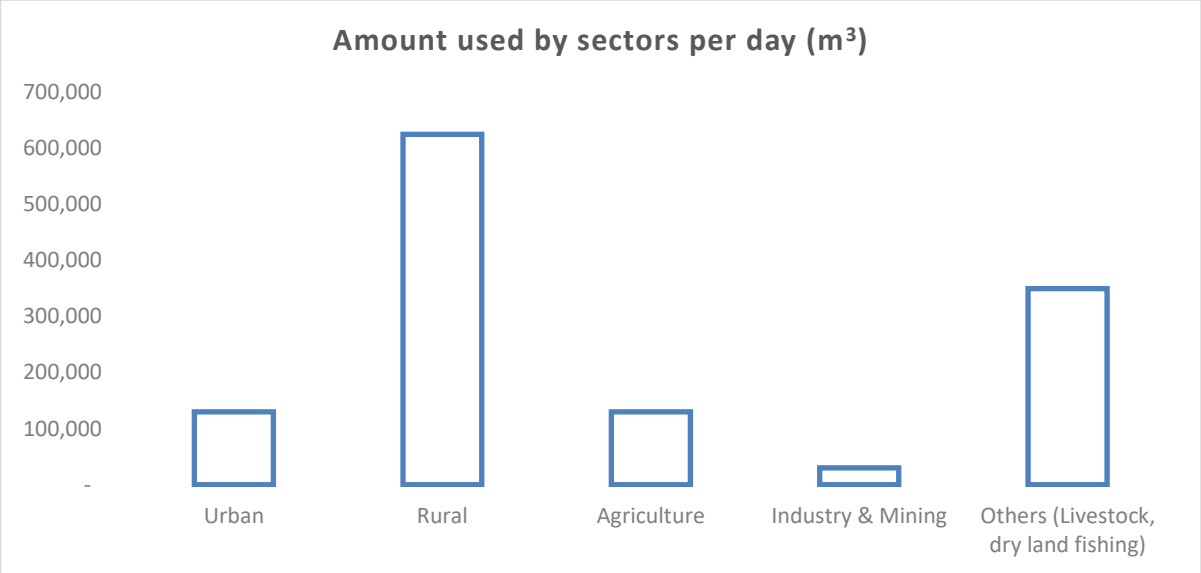

Figure 2: Volumes of groundwater consumed by different sectors (Modified after DWR, 2010 http://xa.yimg.com/kq/groups/22477246/889666431/name/Aquifer+characteristics.pdf

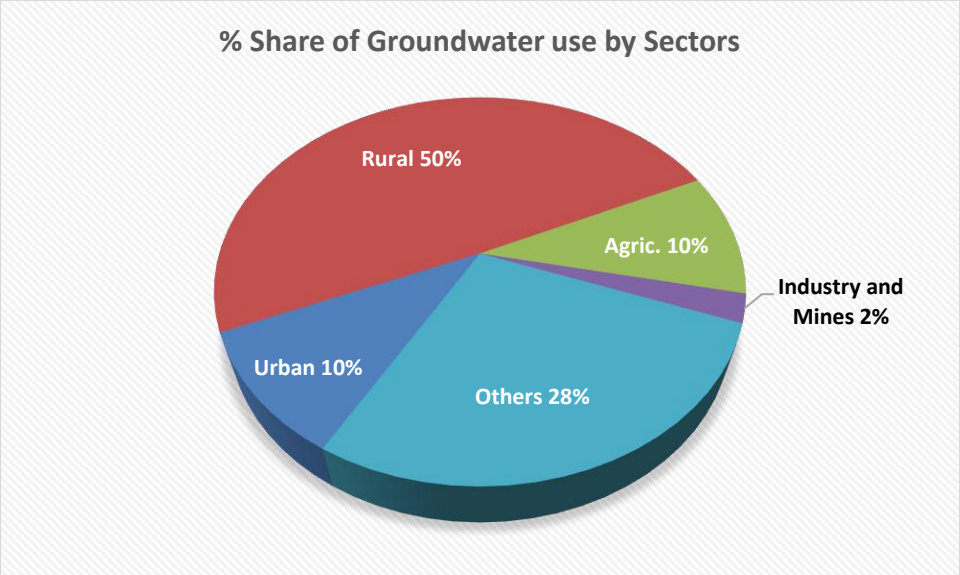

Figure 3: Percentage share of consumption by different sectors (Modified after DWR, 2010 - http://xa.yimg.com/kq/groups/22477246/889666431/name/Aquifer+characteristics.pdf

Groundwater utilization for industrial use is more concentrated in urban areas, especially Dar es Salaam where about 80% of the industries are located. Due to inadequate water supplies many industries have opted for constructing private wells to augment surface water supply. Industries in Dar es Salaam, like Tanzania Breweries Ltd. (TBL), Tanzania Cigarette Company (TCC), Friendship Textile (Urafiki), Ubungo Farm Implements (UFI), Kibuku, Mpishi, and Tanzania Portland Cement factory (TPC - Wazo Hill) etc, have

private wells (DDCA, 2001). The list is rapidly increasing, and similar trends are observed in Arusha, Mwanza and Mbeya City municipality (DDCA, 2001).

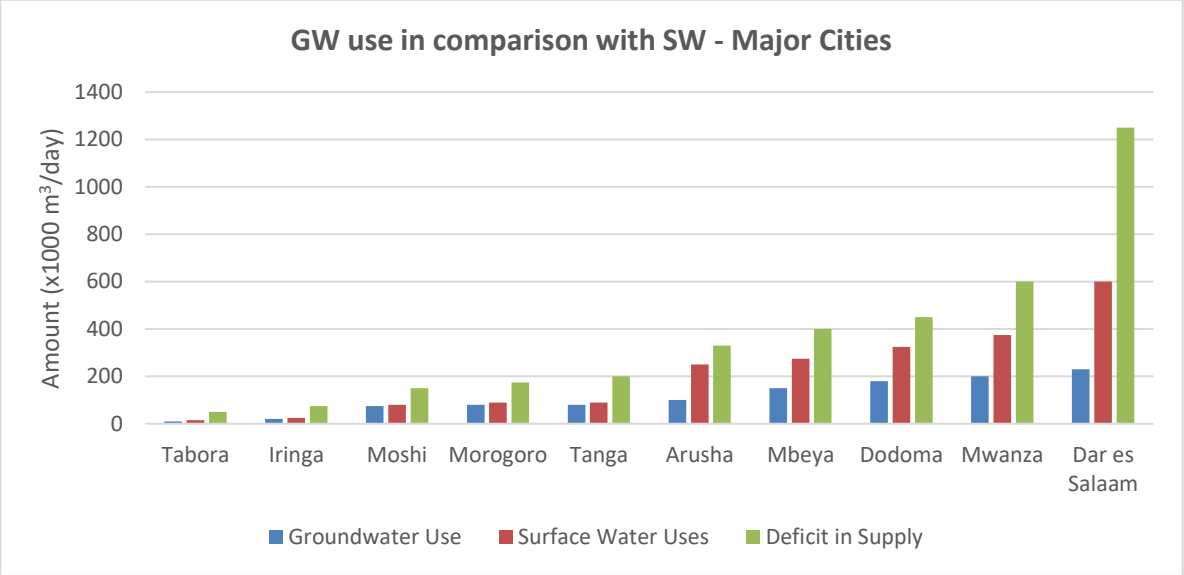

Figure 4: Role of Groundwater in different major cities in Tanzania (Modified after Mato, 2002)

2. METHODOLOGY

2.1. Overview

The methodology for the gap analysis included conducting a desktop review of available literature. This was coupled with the development of a desired future state to provide a baseline for groundwater management and is discussed in more detail below. Key stakeholders were also identified during the early stages of the gap analysis and multiple engagements were held whereby a questionnaire was administered to evaluate the current state of groundwater management in the country. Based on the desktop review, stakeholder engagements and results from the questionnaire, a draft gap analysis report and action plan was developed which was then validated at Validation Workshops. These workshops involved key groundwater actors from the Member State and provided an opportunity to obtain buy-in and support for the gap analysis reports as well as obtaining further inputs. The draft report was also circulated to broader stakeholders i.e. Water User Associations, Water Service Providers etc. whereby written comment was received. The draft gap analysis report was then finalised based on the comments received from the Validation Workshops and broader stakeholders. The methodology outline is illustrated in the figure below.

Figure 5: Methodology Outline

A list of existing documents reviewed are included in **Appendix A** and is based on different white and grey literature from various researchers, government departments, NGOs, donor reviews and reports, research theses and consultant reports.

Several individuals/institutions **(Appendix B)** were engaged for data collection using the structured questionnaire, based on the Desired Future State, elaborated on below.

The desired future state has been contextualised for the SADC region, taking into account:

- The high levels of groundwater dependency in many SADC countries, in rural areas in particular;

- The variety of geohydrological contexts;
- High levels of poverty, gender disparities, social exclusion and pollution; and
- Relatively low levels of state capacity – skills, infrastructure and finance.

It sets out the ***minimum*** requirements that support the delivery of national, regional and international developmental goals, including the Sustainable Development Goals, meeting basic human needs to water, energy and food (the WEF nexus), and the protection of ecosystems that are dependent on groundwater.

The sections below describe, at a high level, what is considered to be the minimum best practice for policy, legislation and subsidiary legislation, regulations and standards for effective groundwater management. For a more detailed description of the desired future state, see **Appendix C**.

The **minimum policy requirements** that should be in place are:

- A long-term policy to protect groundwater by preventing pollution and overuse.
- The social, economic and environmental values of groundwater are all recognised.
- The human right to water is recognized and a rights-based approach to groundwater management is taken.
- Groundwater is recognised as a highly important source of domestic and agricultural water supply and a key resource for poverty alleviation, food security, and the sustainable economic development of rural areas.
- The biophysical and ecological linkages between ground and surface water for their use, protection and management are recognised, including land use zoning for groundwater protection and recharge (conjunctive use).
- The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones).
- Intersectoral collaboration is promoted and facilitated.
- The need for adaptive management is recognised.
- The roles of various stakeholders and water users in groundwater management is recognised and participation of stakeholders is promoted and facilitated.
- An apex body that is responsible explicitly for GW management and playing the role of custodian/trustee on the part of the state is clearly defined.
- Effective institutional arrangements are coordinated at transboundary, national and local levels.
- Public access to geohydrological data held by the state is promoted and facilitated.
- Additional environmental principles necessary to protect and sustain groundwater are mandated, including: the precautionary principle, the principle of gender equity and social inclusion (GESI), the principle of subsidiarity, and the principle of intergenerational equity.

The **minimum legislative requirements** that should be in place are those that explicitly addresses the use, management, and protection of groundwater and provides the necessary tools for the state to regulate, manage, control, protect and develop groundwater resources in conjunction with surface water resources. At a minimum, legislation and/or subsidiary regulations should:

- Provide the status of groundwater noting that all water has a consistent status in law, irrespective of where it occurs, and there is explicit reference to groundwater and conjunctive use management; and recognise the human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users.
- Regulate groundwater quantity by providing conditions for accessing groundwater through water use authorisations system that does not discriminate (especially against the rural poor), is not tied exclusively to land tenure and enables effective compliance monitoring and enforcement.
- Provide groundwater protection mechanisms that includes regulating pollution (point source and non-point source), regulates depletion, regulates abstraction and recharge (usually via permitting) and provides for the sustaining wetlands;
- Enables integrated planning through specifying the need for long term plans (at catchment or basin level) to ensure the sustainable use of groundwater, including drought management plans and cross-sectoral coordination.
- Make provision for institutional arrangements including the mandate, competence and power of the relevant authorities, enabling the integrated management of groundwater and surface water resources, engaging in the arbitration of competing demands and diverging interests regarding groundwater abstraction and use, and support the collaborative engagement with other sector authorities, competent for public health, land-use planning, soils management, and waste management.
- Support effective stakeholder engagement through specifying when and how stakeholders, the public and/or other water users are to be engaged in the development of laws and regulations, planning, decision making and self-management regarding groundwater and should specifically address the issue of the involvement of women and youth in decision-making and the implementation of groundwater supply schemes.
- Provide for Monitoring and data collection to support regulation including protocols for data collection, management, exchange and dissemination, including standardization and harmonization of data, as well as national monitoring and information systems for the management of data and information.
- Regulate to ensure water conservation and efficiency of use.
- Support compliance and enforcement through clear mechanisms for promoting compliance with groundwater regulations through enforcement provisions that enable inspections, the imposition of fines and/or additional administrative penalties and other instruments to address failure to comply with the law.
- Conflict resolution mechanisms and/or the right to appeal.
- Enable the development of regulations on any relevant matter in the legislation to regularise aspects of groundwater management and incentivise appropriate use of groundwater resources.

The actual **requirements for subsidiary regulation** will differ from country to country, according to their own National Legislation. However, it is important to understand the extent to which critical issues

around groundwater management have been translated into regulations. Below are some examples of how this could look.

- Subsidiary legislation or regulations pertaining to use, protection including on-site sanitation, borehole drilling, and appropriate financial and economic regulatory tools e.g. water pricing.
- Clear protocols and standards on data collection and storage.
- Templates for municipal by-laws.
- Community management of groundwater and community participation in groundwater management.

From an **institutional perspective**, it is critical that countries have as a minimum, a dedicated Ministry for water resource management, which is also the custodian for ground water management. Noting that the groundwater is a localised resource, decentralised institutions at trans-boundary, catchment and local government level are crucial, where groundwater management fits into overall mandate for water resource management.

3. POLICY

3.1. Evolution

The Tanzania water sector reforms have been well documented by (Doering, 2005). According to him, the history of the Water Sector in Tanzania dates back to the 1930s when water supply was confined to urban areas and farming settlements owned by settlers. In order to redress the urban bias in water supply service provision, the government of the Tanzania proclaimed a 20-year (1971-1991) Rural Water Supply Programme that aimed at providing access to adequate, safe, dependable water supply within a walking distance of 400 metres from each household. Under this programme, water was to be provided freely by the government. However, this programme largely failed to meet its targets due to non-involvement of the beneficiaries, use of inappropriate technologies, use of a top down approach, and lack of decentralisation. In order to arrest this situation, the government adopted the first National Water Policy in 1991, which had a number of deficiencies too and needed to be revised. The departure from past approaches and the initiation of the current water sector reforms came in the course of the Urban Water Supply Project in Moshi, Tanga and Arusha, where the whole urban water sub-sector started to be reshaped. Simultaneously, a number of Rural Water Supply Projects, mainly in the Kilimanjaro region, helped to break the ground for a major shift in the rural water supply sub-sector towards community ownership and management.

The need for an integrated approach to water resources management became obvious and led to the commencement of the implementation of this approach within the priority river basins. It was in this context, that the National Water Policy of 1991 was revised after a lengthy consultation process, which ended with Cabinet approval of the new National Water Policy (NAWAPO) in July 2002. The NAWAPO is believed to have rectified all the previous policy shortfalls and has introduced decentralisation of water supply management in line with Agenda 21 of the United Nations Environment Meeting held in Rio de Janeiro in 1992, which emphasised on the “subsidiarity principle” whereby water supply management should be at the lowest appropriate level. The new policy also stresses on an integrated approach to water resources management based on river and lake basin boundaries (URT, 2002).

Tanzania has adopted a practical and phased approach in improving the arrangements for managing its water resources. The reform actions commenced with the Water Sector Review and the Rapid Water Resources Assessment Study, continued through implementation of study findings and recommendations, including policy review and institutional restructuring at the basin level. The development of the National Water Sector Development Strategy also continued along with revisions to the legislation, and preparation of a National Water Sector Strategic Implementation Plan as basis for the medium-term expenditure framework.

3.2. Policies to support groundwater management

Tanzania has revised its water policy in 2002. This was partly in response to political commitment to supply the population with clean water within 400 m by 2025 as direct strategy for the poverty reduction and National Strategy for Growth and Reduction of Poverty 2005 – 2010. Following this, it was aimed that 79,754 water supplying facilities shall be constructed by year 2025 for the 34.5 million people with unsupplied water. According to the plan, 91 percent of the planned facilities rely on the groundwater. To achieving this goal, 1,200 wells in average per year were required to be drilled. With this level of commitment, it was important to institute important measures which influenced the management of groundwater and other resources. These are:

- Community-owned management of the scheme (with at least one-third female members),
- Participation of private sector organizations for the operation and maintenance of the scheme,
- Integration of water supply into the strategy for national hygiene promotion,
- Strengthening decentralized planning, project implementation and management through local government were promoted,
- Promotion of gender balance in the management of the resources (with at least one-third female members),
- Promotion of Management of water resources in line with hydrologic units.

3.3. Gaps and challenges identified

Responses from questionnaires and knowledge of groundwater issues agree well with several scholars who researched and identified challenges facing groundwater as a resource. These scholars include: (Mato, 2002); (Sadiki, 2009); (Kongola, 2008). Challenges related to policy are listed here:

- Inadequate policy guidance on institutional arrangement to regulate groundwater resources. Currently, it is managed in the framework provided in the WRMA No. 11 of 2009. Although quite holistic on paper, this approach may pause a challenge in having discussions predominantly on surface water. This is more relevant in a common situation where very little is known on groundwater dynamics.
- Limited policy guidance around building the capacity of private sector in groundwater management and development. Although the 2002 National Water Policy has recognised the importance of private sector in service delivery, their capacity, role and the operation environment for groundwater development and management is not yet well established.
- Little mention of centralised data collection and management in policy.
- Inadequate policy guidance on borehole maintenance and operation, of specific importance to the rural areas.
- Inadequate policy guidance on groundwater monitoring networks.

3.4. Enablers required to unlock these gaps/challenges

Table below gives a summary of gaps/challenges and Enablers

Table 4. Enablers required to unlock the policy gaps and challenges - (Mato, 2002); (Sadiki, 2009); (Kongola, 2008)

Groundwater gap/challenges	Enablers
Inadequate policy guidance on institutional arrangement to regulate groundwater resources;	▪ Engagement of the stakeholders to develop policy objectives that enhances a sustainable management of groundwater, ▪ Building on existing framework to provide a requirement for GW representative as per the role that the sub sector plays in respective basins. ▪ However, the above enablers might require a significant amount of time to change the existing framework.
Limited policy guidance on mechanisms for public awareness on the importance and potential sources of pollution of groundwater resources;	▪ Drafting of policy on safeguarding groundwater from pollution. Include also a structured awareness campaign to different levels (districts, farmers etc)
Limited policy guidance around building the capacity of private sector in groundwater management and development.	▪ Enhancement of DDCA's ability to impart techniques, equipment and skills regarding water well drilling to private drilling sector (JICA, 2016). ○ Survey on the capacity and needs of private sector (Baseline Survey), ○ Formulation of a Capacity Development support plan for private drilling companies, ○ Establishment of a technical instruction system for private drilling companies, ○ To support the DDCA in carrying out technical instruction for private drilling companies, ○ To conduct an end-line survey to collect information and to evaluate the effect of the project on private companies.
Little mention of centralised data collection and management in policy especially operationalization	▪ A centralised data collection and readily available dissemination mechanism is paramount to guide design and development of groundwater in the country (JICA, 2016). There needs to be operationalization mechanism/guide to aid in expanding monitoring network
Inadequate policy guidance on borehole maintenance and operation, of specific importance to the rural areas	▪ Development of unified guidelines for groundwater drilling should be initiated to guide the ongoing drilling programs. ○ This should not intend to limit peoples' own development initiatives.
Inadequate policy guidance on groundwater-specific monitoring networks	▪ Establish mechanisms for data management (Baumann, Ball, & Beyene, 2005), ▪ Develop guideline/policy to use private wells for data collection

4. LEGISLATION

4.1. Evolution

The management of water resources in Tanzania is discharged through the nine river and lake basins (Figure 5) following a "participatory" institutional framework (Figure 6). This regulatory and institutional framework for sustainable development and management of water resources (including groundwater) is provided for in the Water Resource Management Act no. 11 of 2009 (URT, 2009). The act repealed the Water Utilization (Control and Regulation) Act No. 42 of 1974 and the subsequent amendment Act No. 10 of 1981 and the Water Laws (Miscellaneous Amendments) Act No. 8 of 1997, and Water Laws (Miscellaneous Amendment) Act of 1999. The act outlines principles for water resources management, provide for the prevention and control of water pollution, and for participation of stakeholders and the general public in implementation of the National Water Policy of 2002 (URT, 2002).

4.2. Legislation to support groundwater management

As noted in 3.2 and 4.1, the Ministry drafted two key pieces of legislation i.e. the Water Resources Management Act No 11 of 2009 and the Water Supply and Sanitation Act No 12 of 2009 (URT, 2009 a & b). This was to guide management of water resources and delivery of water and sanitation services respectively. With reference to GW sub sector, the WRM Act, emphasized and/or instituted the following important areas:

- Groundwater protection areas.
- Regulations for licensing of drillers and surveyors.
- Permitting for drilling and water abstraction as standalone permits.
- Promotion of conjunctive use of surface and groundwater resources.
- Institutional mechanism for management and delivery of services.

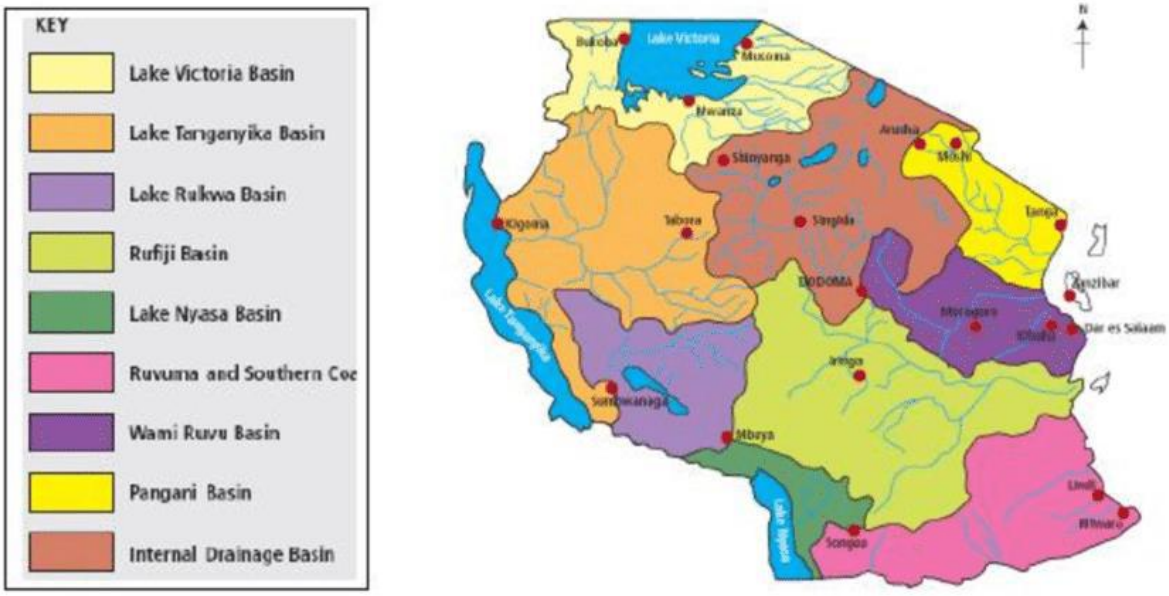

Figure 6: The map of Tanzania illustrating spatial distribution of the nine river and lake basins (URT, 2002)

4.3. Gaps and challenges identified

The identified gap is around lacking legal provision for establishment of groundwater management institution. Currently the same is being taken care of within the established WRM institutional framework. Tanzania's current water resource management follows an integrated approach that does not differentiate between groundwater and surface water. This results in legislation with inadequate provisions for the creation of groundwater-specific institution. However, as noted in this document on the growing importance of groundwater, a more visible representation of groundwater in the institutional hierarchy will be ideal. Furthermore, a thorough study on aquifer extent should be carried out to accommodate occasional cross-catchment nature of aquifers.

4.4. Enablers required to unlock these gaps/challenges

The drafting or review of the Water Resources Management Act will help to address the gaps in the legislation. This can be guided by a thorough study on areas such as recharge zones, volumes, demand, potential and safeguarding the resources from potential pollutions.

Table 5. Sectoral legislation and implication for groundwater management

Groundwater gap/challenges	Enablers
Inadequate legal provision for establishment of groundwater management institution	▪ Engage the stakeholders to add a legal basis for the same in the review process of the WRM Act No 11 of 2009 in line with SADC protocol ▪ Groundwater management issues can easily be lost in the current framework as it lacks representation

5. STRATEGY AND GUIDELINES

5.1. Evolution

In Tanzania, there are no specific strategy on management of groundwater resources. Only the Water Sector Development Strategy that has been developed in 2006 to guide implementation of the National Water Policy of 2002. This followed the water sector reforms which is embedded in a comprehensive economic and administrative reform programme. These aim at economic growth and reduction of poverty in the country. The underlying principles of the water sector reform were elimination of conflicts of interest through clear division of powers, management of water services at the lowest appropriate level, cost recovery and integrated approach to water resources management. Consequently, National Water Policy (NAWAPO) July 2002 was drafted (URT, 2002) and has the following overall objectives:

- To address cross-sectoral interests in water, watershed management and participatory integrated approaches in water resources planning, development and management;
- To lay a foundation for sustainable development and management of water resources in the changing roles of the government from service provider to that of coordination, policy and guidelines formulation and regulation;
- To ensure full cost recovery in urban areas with considerations for provision of water supply services to vulnerable groups through various instruments including lifeline tariffs; and
- To ensure full participation of beneficiaries in planning, construction, operation, maintenance, and management of community-based water supply schemes in rural areas.

In addition to the NAWAPO, the National Vision 2025, the Millennium Development Goals (MDGs), the National Water Sector Development Strategy (NWSDS) as well as sector plans derived thereof, form the important building blocks of the sector framework. The NWSDS is a single strategy document for the whole water sector, which sets out how the Ministry of Water and Irrigation (MoWI) will implement the National Water Policy to achieve the national sector targets. The NWSDS contains a new definition of the overall institutional framework for both, water resources management and water supply and sanitation.

5.2. Strategies and guidelines to support groundwater management

Currently, Tanzania implements the overall water resources management through the Water Resources Management Act No 11 of 2009 and its respective groundwater specific guidelines. These are:

- The groundwater (Exploration and Drilling) Licensing Regulations, 2013
- The Water Resources Management (Water Abstraction, Use and Discharge) Regulations, 2010

In addition, within the implementation of WSDP II program, ad hoc training of staff is undertaken benefiting staff from MoWI and BWBs. Furthermore, awareness programs are carried out for drillers.

5.3. Gaps and challenges identified

Tanzania is currently developing a Guideline for Groundwater Exploration and Development that aims to provide direction around groundwater management and development, particularly borehole drilling, development, pump installation, data collection from existing and privately owned wells, well abandoning etc. However, this has not been approved and is still in the final draft stage. Furthermore, the licensing regulations emphasises more on possession of equipment rather than owning. However, proven technical training is the most important for instance the registration of Engineers by Engineers Registration Board who requires a degree and some professional attachments.

- Lack of groundwater resources management plans
- Lack of standalone groundwater strategy

5.4. Enablers required to unlock these gaps/challenges

Table 6. Enablers required to support strategy and guidelines implementation

Groundwater gap/challenges	Enablers
Lack of guidelines/regulations to standardize well drilling, development, pump installation, well abandoning etc	▪ Approve and implement the Guidelines for Groundwater Exploration and Development that is still under development and is in the final draft phase.
Licencing of actors (i.e. GW surveyors) puts emphasis on equipment rather than proper training	▪ Establishment of licencing board that will supervise licensing process including registration of players e.g. GW surveyor basing on formal training
Lack of standalone groundwater management strategy	▪ Can be considered to be included in the revised NWSDS
Lack of guidelines for raising public awareness on the importance and potential sources of pollution of groundwater resources;	▪ Drafting of guideline to increase public awareness and broaden stakeholder participation in the planning and management of WRM, especially groundwater management and potential sources of pollution of groundwater resources. This will include sensitization, community education, consultation and discussion ▪ Conduct structured awareness campaigns at different levels (districts, farmers etc.)

6. INSTITUTIONAL FRAMEWORK

6.1. Evolution

One of the major water sector reforms that was done, is the introduction of water resources institutions. In previous policy "The National Water Policy 1991", only water supply was the focus of the government and the management part of water resources fell within the mandates of water supply institutions i.e. District and Regional Water Engineers as appropriate. With Tanzania signing the UN Agenda 21 in 1992, the push for reforms became imminent and gave rise to adoption of hydrologic units (figure 5) as appropriate jurisdiction for sustainable water resources management (URT, 2002).

6.2. Institutional arrangements to support groundwater management

The regulatory and institutional framework for sustainable development and management of water resources (including groundwater) is provided for in the Water Resource Management Act no. 11 of 2009 (URT, 2009). The act outlines principles for water resources management, provide for the prevention and control of water pollution, and for participation of stakeholders and the general public in implementation of the National Water Policy of 2002 (URT, 2009).

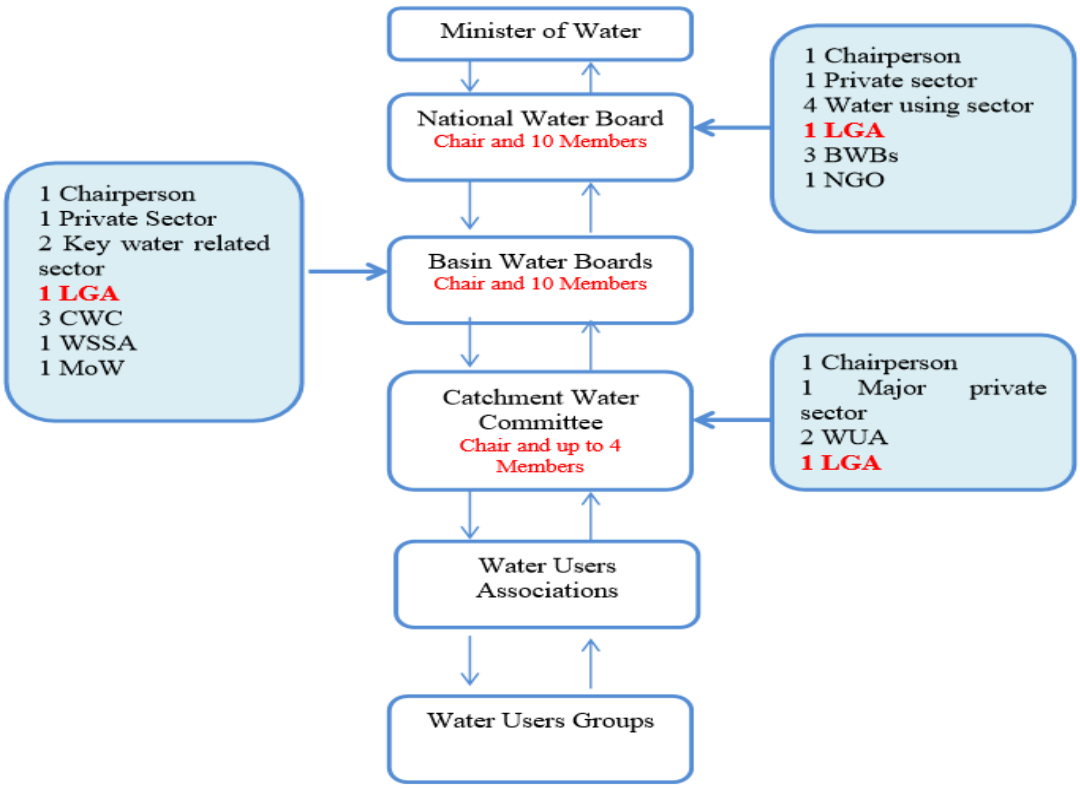

Figure 7: Institutional Hierarchy for Water Resources Management in Tanzania (Modified basing on the WRM Act 2009 and WSDS 2006). Basin Water Boards are the regulators with little devolution to Catchment Water Committees (yet to be rolled out)

The act provides for the water resources management through a Hydrologic Basin Management Approach that was adopted in Tanzania since 1980s. As such, the country is divided into nine hydrologic

basins which include; (i) Pangani (ii) WamiRuvu, (iii) Rufiji, (iv) Ruvuma and Southern Coast, all of which drain into the Indian Ocean. Others are (v) Lake Nyasa, (vi) Lake Rukwa, (vii) Lake Tanganyika, (viii) Lake Victoria, and (ix) the Internal drainage basins of Lake Eyasi, Manyara and Bubu depression. The thrust of the current water resource management in Tanzania is to implement water management at the basin level following subsidiarity principle. The National Water Policy (URT, 2002) recognises an institution framework that includes the water users at grass root level to the National Level (figure 6). The policy advocates for an integrated approach in water resources and addresses participatory, multi-sectoral, multidisciplinary river-basin management. Gender balance is provided for in achieving female count to at least one-third of member of all levels.

The roles and responsibilities of these different levels are outlined in the WRM Act part iv that focuses on Management of Water Resources (URT, 2009). Following subsidiary principle, most mandates for management and allocation of water resources now falls at Basin Water Board who may delegate some functions to Catchment Water Committees. Functions of the Ministry are more on resource mobilisation and formulation of policies where as that of the National Water Board remains to be advisory to the minister.

Section 23 of the WRM act further gives an outline of roles and responsibilities of BWBs to whom most of the mandates are bestowed to, including all mandates related to groundwater management. These include:

- Water Resources Monitoring and Assessment
- Water Allocation (Issuing and Managing of Water Permits)
- Strengthen Community Participation in WRM
- Coordinate Water Resources Management and Development Planning
- Water Quality Monitoring and Pollution Control
- Water Use Conflict Management
- Water Sources Protection and Conservation

In addition, an important feature of the WRMA is the provision under section 80 for the formation of water user's associations (WUA) by agreement of the majority of a group of water users. The specified purposes for which WUAs may be formed are with respect to any one or a combination of the following:

- the management, distribution and conservation of water from a shared water source;
- the joint acquisition and operation of any permit;
- the resolution of conflicts between members of the association with regard to the joint use of a water resource;
- collection of water user fees on behalf of the Basin Water Board;
- Representing the special interests and values relating to water used for public purpose such as in a conservation area.

6.3. Gaps and challenges identified

The gap associated with the institutional arrangement focuses on the lack of institution solely dealing with groundwater management or development. Although the current framework employs a holistic approach of IWRM where groundwater and surface water are regarded as one, this approach results in groundwater achieving a secondary priority when compared to surface water. This agrees well with (Kongola, Nsanya, & Sadiki, 1999) with their contribution to development of NAWAPO (URT, 2002). Although groundwater seems to be a critical resource for social economic development of the country (JICA, 2008), there is still a lack of strategic planning to assure its management is institutionalised. As noted, little is known of the transboundary exchange of aquifer waters, perhaps this constitutes to lack of clear mandate of the division dealing with transboundary resources on issues of transboundary groundwater management (SADC GMI focal point leads this department).

In addition, there is an inadequate technical capacity amongst the BWBs and the ministry on matters of groundwater assessments and management. Situation is worsened when only University of Dar es Salaam offers degree on Geology that encompasses groundwater as a core course.

6.4. Enablers required to unlock these gaps/challenges

Table 7. Enablers required to support strategy and guideline implementation

Groundwater gap/challenges	Enablers
The lack of institution solely dealing with groundwater management or development (Kongola, Nsanya, & Sadiki, 1999) and (JICA, 2008)	▪ Design and institute a legally recognised institution to manage GW or establish adequate representation of the same in the existing framework. A leaf can be borrowed in the need for MSPs run by organisations such as the 2030 Water Resources Group and/or GIZ/IWaSP
Licencing of actors (i.e. GW surveyors) puts emphasis on equipment rather than proper training	▪ Establishment of licencing board that will supervise licensing process including registration of players e.g. GW surveyor basing on formal training, ▪ Training of important players should be channelled through accredited institutions/universities and networks (e.g. AGW Net) to be sure of the quality offered. Possession of equipment does not give a proper emphasis on knowledge which is important in this case (good example is Engineers Registration Board – ERB)

7. CHALLENGES TO IMPLEMENTATION

- Inadequate awareness on groundwater pollution sources amongst the general public causes deteriorating quality,
- Limited knowledge of recharge areas and volumes leaves overexploitation of groundwater resources and dwindling borehole yields. In some cases, e.g. parts of Makutopora basin supplying Dodoma Municipality and parts of Arusha aquifers are also showing declining water levels where as some of boreholes in Sanawari area operated by the Arusha Urban Water and Sanitation Authority also shows declining borehole yields,
- Poor workmanship during construction of boreholes which leads to caving in of boreholes and exposure of deeper aquifers to pollution sources,
- Inadequate institutional arrangement to regulate groundwater resources, Current setup lamps everything under the wider water resources sub sector and dominated by surface water knowledge which is widely available,
- Although the 2002 National Water Policy has recognised the importance of private sector in service delivery, their capacity, role and the operation environment for groundwater development and management is not yet well established;
- There is an inadequate monitoring system and inadequate centralised data collection protocol and dissemination mechanisms. Available data is scattered, fragmented and usually incomplete;
- Lack of groundwater resources management plans even in the face of growing significance of the resources especially in major cities (although the Guideline for Groundwater Exploration and Development is currently being developed);
- Increased climate variability and change, bringing about uncertainty in terms of rates of replenishment.
- Inadequate capacity (technical, tools and financial) in regulating even the existing water act. The suggested changes should be thoroughly budgeted

8. ACTION PLAN

The MoSCoW method of prioritisation has been used to develop the action plan. This method identifies the *Must have*, *Should have*, *Could have*, and *Won't have* elements for the Groundwater Management Regulatory Framework.

Table 8: Action Plan "Must Haves"

Prioritisation	Element	Description
Must have: ***those elements of the regulatory framework that are critical***	**Policy**	▪ The current water policy should allocate adequate section(s) to address groundwater issues raised by respondents, researchers and is common knowledge among practitioners. These issues include: (i) GW protection to cutter for the growing dependency on this resource, (ii) Monitoring network to characterise GW dynamics,
	Legislative	▪ To develop regulations and specific guidelines that guides on: drilling quality, well abandonment, management of groundwater allocation permits, conduct of pumping test, groundwater sources demarcation and protection.
	Institutional	▪ Capacity building of relevant institution on groundwater hydrology especially on assessment and/or quantification of water balance, recharge and interaction between surface, groundwater and other changes e.g. land-use, climate change etc., ▪ Creating an appropriate institutional arrangement or introduce an adequate representation of the groundwater players/institution,
	Strategy/ Guidelines	▪ Develop strategy for groundwater management and sustainable development. It should incorporate how to engage private sector, CSOs and public institutions. The same should provide means to use existing individual wells for data collection to expand monitoring network and robust decision making.

Table 9: Action Plan "Should Haves"

Prioritisation	Element	Description
Should have	**Policy**	▪ Guidance on the space for private sector as a key stakeholder esp. GW development, ▪ GW resources evaluation and management plan (to be more pronounced within the IWRM Plans).
	Legislative	▪ Develop law sections and/or regulations to allow for data collection from existing individual wells and guidelines for data sharing from drillers and owning institutions
	Institutional	▪ Adequate staffing of appropriate number of professional and technicians ▪ Adequate working tools e.g. monitoring tools, softwares, field vehicles, computers,

Prioritisation	Element	Description
	Strategy/ Guidelines	▪ Develop monitoring strategy efficiently enough to include existing wells from individuals and data sharing protocols with drillers and well owners

Table 10: Action Plan "Could Haves"

Prioritisation	Element	Description
Could have	**Policy**	▪ Mechanisms for regular update of groundwater status through a linkage with learning institutions who runs research more regularly ▪ Programs for artificial recharge mechanisms in critical aquifers, ▪ Mechanisms to clean polluted aquifers.
	Legislative	▪ Harmonised legislation that safeguards GW resources from pollution and depletion e.g. settlements allocation in prime recharge areas
	Institutional	▪ A designated department within the planned Centre of Excellence (CoE) adequately resources to provide linkages between academia, developers, conservators and others
	Strategy/ Guidelines	▪ A clearer strategy that promotes and sets mechanism for conjunctive use of groundwater and surface water

Table 11: Action Plan "Won't Have"

Prioritisation	Element	Description
Won't have	**Policy**	▪ Bleary visibility of groundwater in the policy even with the significant growing dependence on the resource
	Legislative	▪ Legislations that do not provide clarity on means to safe guard groundwater e.g. GW mining, pollution etc
	Institutional	▪ A continues lacking institutional framework or a slim/no clear representation of GW actors in the current framework, ▪ Lack of monitoring mechanism and inadequate capacity of institutions and respective staff to handle GW issues holistically
	Strategy/ Guidelines	▪ A lacking strategy that provides an effective groundwater management and sustainable development

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APPENDIX A: LITERATURE INVENTORY LIST

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
1	2002	National Water Policy	Government of Tanzania, Ministry of Water and Irrigation	Government Publisher	N/A	http://www.tawasanet.or.tz/files/Tanzania%20water%20policy%20-%202002.pdf
2	2009	Water Resources Management Act No 11 of 2009	Government of Tanzania, Ministry of Water and Irrigation	Government Publisher	N/A	http://extwprlegs1.fao.org/docs/pdf/tan96340.pdf
3	2016	Groundwater Development and Management Capacity Development Project in The United Republic Of Tanzania - Final Report	Water Resources Division, Ministry of Water and Irrigation	JiCA	GE-JR- 08-010	http://open_jicareport.jica.go.jp/pdf/12261285_01.pdf
4	2016	Challenges in groundwater resource management in coastal aquifers of East Africa: Investigations and lessons learnt in the Comoros Islands, Kenya and Tanzani	Comte et al	Elsevier		http://aura.abdn.ac.uk/bitstream/handle/2164/5487/1_s2.0_S2214581815002232_main.pdf?sequence=2&isAllowed=y

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
5	2015	Hydrogeological mapping and estimation of potential evapotranspiration and recharge rate of Quaternary sand aquifers in Da r-es-Salaam, Tanzania	Mjema and Walravens	International Journal of Geomatics and Geosciences	ISSN 0976 - 4380	http://www.ipublishing.co.in/jggsarticles/volsix/EIJGGS6020.pdf
6	2012	Characterization of the status of Dar es Salaam aquifer in view of salt water intrusion and nitrate contamination, PhD Thesis	Ine De Witte	Gent University		https://lib.ugent.be/fulltxt/RUG01/001/892/507/RUG01-001892507_2012_0001_AC.pdf
7	2013	Saltwater intrusion in the coastal strip of Dar es Salaam Quaternary aquifer,Tanzania. PhD thesis	Mtoni	Gent University		www.vliz.be/imisdocs/publications/254642.pdf
8	2018	Hydrogeology of Tanzania	Hosea Sanga, Dr. Dochartaigh and Dr. Bellwood-Howard	Wikipedia		http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Tanzania
9	2010	Assessment of Groundwater Availability and its Current and Potential use and Impacts in Tanzania - Final Report	Prof Kashaigiri for IWMI	Unpublished		http://gw-africa.iwmi.org/Data/Sites/24/media/pdf/Country_Report-Tanzania.pdf

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
10	2000	Visit to undertake groundwater development studies in Tabora region Tanzania (July - September 2000) - Technical Report	J Davies and B Ó Dochartaigh	Natural Environment Research Council	IR/00/50	https://core.ac.uk/download/pdf/19962747.pdf
11	2017	Another decade of water quality assessment studies in Tanzania: Status, challenges and future prospects	HariethHellar-Kihampa	African Journal of Environmental Science and Technology	DOI: 10.5897/AJEST2017.2319 or ISSN 1996 - 0786	http://www.academicjournals.org/journal/AJEST/article-full-text-pdf/00DE37E64760
12	2016	Groundwater use in Climate Adaptation in Moshi District, Tanzania	Emanuel L. Mchome	Journal of the Geographical Association of Tanzania		http://journals.udsm.ac.tz/index.php/jgat/article/view/685/666
13	2017	Occurrence of nitrate in Tanzanian groundwater aquifers:A review	EliapendaElisante, Alfred N. N. Muzuka	Journal of Applied Water Sciences	DOI 10.1007/s13201-015-0269-z	https://link.springer.com/content/pdf/10.1007%2Fs13201-015-0269-z.pdf
14	2012	Groundwater policy and law in South Africa and mainland Tanzania: A comparative study	Abdikadir Hussein Ali	University of Western Cape	N/A	
15	2012	Groundwater availability and use in Sub-Saharan Africa: a review of 15 countries. Colombo, Sri Lanka:	Pavelic, P.; Giordano, M.; Keraita, B.; Rao, T.; Ramesh, V. (Eds.)	International Water Management Institute (IWMI).	DOI and ISBN No: ISBN 978-92-9090-758-9	

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
16	2001	Groundwater Management in the Usangu Catchment - Final Report.	SMUWC Project	SMUWC Project		
17	2018	Groundwater user' awareness of ater institutions in Tanzania: A case study of Mbarali District, Mbeya Region	Gudaga Johnson, Kabote J. Samwel, Tarimo KPR Andrew, Mosha B Devotha and Kashaigiri J Japhet	Journal of African Studies and Development	DOI: 10.5897/AJEST2017.2319 or ISSN 1996 - 0786	
18	2017	Effectiveness of groundwater governance structures and institutions in Tanzania	Gudaga Johnson, Kabote J. Samwel, Tarimo KPR Andrew, Mosha B Devotha and Kashaigiri J Japhet	Joulnal of Applied Water Science		
19	2016	Assessment of groundwater vulnerability zone using GIS-based DRASTIC Model: A case of Makutupora Basin, Dodoma - Tanzania	Mary J. Kisaka, Meserecordias W. Lema	International Journal of Environmental Sciences	ISSN 0976 - 4402	

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
20	2015	Groundwater Regulation, Licensing, Allocation and Institutoions - A training Manual by AGW-Net	Vanessa Vaessen and Ramon Brentführer	Integration of Groundwater Management into transboundary Basin organization in Africa		
21	2008	Groundwater Recharge Assessment in the Makutupora Basin, Dodoma - Tanzania	Rwebugisa A. Rose	The International Institute for Geo-information Science and Earth Observation - Enschede, Tha Netherlands		
22	2013	Groundwater (Exploration and Drilling) Licensing Regulations, 2013	Government of Tanzania, Ministry of Water and Irrigation	Government Publisher	GN No 219	

APPENDIX B: STAKEHOLDER LIST

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5	Wankuru	M. Maswi	MASWI DRILLING CO. LTD	maswidrillinco@yahoo.com	Yes
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13	Reddy		ARDHI WATER WELLS LTD	ardhiwaterwells@gmail.com	Yes
14	Alais	Ndooki	MAJITECH ENGINNERING LTD	sales@majitech.com	Yes
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18	Abuu		AS DRILLING & CONSTRUCTION COMPANY	asdrilling@gmail.com	Yes
19	Siraji	A.Basiga	ORTHODOX CHURCH IN TANZANIA	orthodoxtz@yahoo.com	Yes
20			MCRM EXPLORATION SERVICES LTD - KUCHIMBA (T)	info@kuchimbadrilling.com	No
21			AQUA WELL DRILLING COMPANY LTD	info@aquawell.co.tz	No
22			THREE DIMENSIONS DRILLING SERVICES LTD		No
23			AL-AMRY DRILLING COMPANY LTD	alamry.company@gmail.com	No
24			AZUSTONE MINING COMPANY LTD	c/o Mariam U. Omary P. O. Box 977 DSM	No
25	Sleyyum		AL-TTAI DRILLING CO. (T) LTD		No
26			SUPER ROCK DRILLING(T) LTD	superrockdrillers@gmail.com	No
27			WATER PRO COMPANY LTD	superrockdrillers@gmail.com	No
28			DRILL MAT & GROUNDWATER SERVICES LTD (DRIMA DRILLING)	drimadrill@gmail.com	No
29	Mr. Aluka		HAIF (T) LTD	abdallahswalehe30@gmail.com	No
30			MITCHELL DRILLING TANZANIA LTD	g.thomas@mitchellgroup.net	No
31			TARGET BOREWELLS LTD	targetborewells@gmail.com	No
32			SOCIETY OF THE PRECIOUS BLOOD -C.PP.S MISSION	cpps.water@gmail.com	No

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33			NANGWAI ENLIGHTED DRILLERS CO. LTD	nangwai.drillers@gmail.com	No
34	Charles	Kaaya	O.C.INDUSTRIAL HOLDINGS LTD	o.c.industrialholdingsltd@gmail.com	Yes
35			SERVING FRIENDS INTERNATIONAL	tanzania@ngosfi.org	No
36			SEBA CONSTRUCTION & DRILLING CO.LTD	sebadrilling@gmail.com	No
37			BAHEDELE DRILLING COMPANY	-	No
38			CHEM CHEM DRILLING	chemchemdrillingtz@gmail.com	No
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44			DRILLING AND SPARES SERVICES (T) LTD	dssltd@gmail.com	No
45			SUPREME WATER WELL DRILLING LTD	supremewaterwelltz@gmail.com	No
46			GO DRILL INTERNATIONAL	scott@godrill.org	No
47			SUPER SHARIF INVESTMENT LTD	shebbycosra@gmail.com	No
48			WISI TRADING AND		No

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49			HELP FOR UNDERSERVED COMMUNITIES (H.U.C)	ksam1175@gmail.com	No
50			NASSA DRILLING & GENERAL SUPPLY LTD	-	No
51			COTECH DEVELOPERS LTD	info@cotech.co.tz	No
52			MASTER DRILLING AND EXPLORATION LTD	masterborewells@gmail.com	No
53			JERSEY DRILLING COMPANY LTD	jerseydrilling@gmail.com	No
54			VACUUM ROTARY DRILLING COMPANY LTD	vrdrilling.tz@gmail.com	No
55			NDOBOKA COMPANY LTD	ndobokaltd@gmail.com	No
56			RUKOS GENERAL SUPPLIES Co. LTD	rgsc@yahoo.com	No
57			INTERNATIONAL EVANGELISM CHURCH	Israel.maasa@yahoo.com	No
58			HYDRO TECH TANZANIA LTD	-	Yes
59	Twaha	Nkya	STALLION GENERAL SUPPLIES LTD	nkyatwaha@gmail.com	No
60	Mustafa	Mtenga	ASHRAAF WATER WELL DRILLING Co.	mustafamtenga@gmail.com	No
61	Andrew		MIGHTY MEN WELLS DRILLING & SUPPLY Co. LTD	abelko12@gmail.com	No
62			WILLY ENTERPRISES LTD	info@willy.co.tz / willyenter99@yahoo.com	Yes
63			VIJAYA BOREHOLES LTD	vijayaboreholes17.tanzania@gmail.com	No
64			THANZANIA BOREHOLE	tbhdrilling.tz@gmail.co	No

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			COMPANY LTD	m	
65	REDDY		COREWORTHY DRILLING (T) LTD	info@coreworthydrilling.com	No
66			JIANGXI GEO-ENGINEERING (GROUP) CORPORATION	jdtzhq@hotmail.com	Yes
67			SHINXI CONSTRUCTION ENGINEERING CORPORATION & MINERALS	jdtzhq@hotmail.com	Yes
68	Kassim	Mussa	Sokoine University of Agriculture	kassimr@gmail.com	Yes
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Mr. Sylvester Matemu	MoWI, Assistant Director – Transboundary Waters (SADC GMI Focal Point)	Government
Mr. Hosea Sanga	Ag. Assistant Director Water Monitoring and Assessment	Government
Dr. Ibrahim Mjema	SUA – Head of Department - Geography and Environmental Studies	Academia
Ms. Domina Makene	Ag. CEO, DDCA – (Main Driller in the country)	Parastatal

Validation Workshop and Scoping &Planning Workshop

Name	Position	Stakeholder Group
Hosea Sanga	Hydrogeologist at Ministry of Water and Irrigation	Government (Validation Workshop and Scoping & Planning Workshop)
Emmanuel Nahozya	Hydrogeologist at Ministry of Water and Irrigation	Government (Validation Workshop and Scoping & Planning Workshop)

Name	Position	Stakeholder Group
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David Manyama	Hydrogeologist at Ministry of Water and Irrigation	Government (Validation Workshop and Scoping & Planning Workshop)
Erwin Sizinga	Ministry of Water and Irrigation - District Water Supply and Sanitation	Government (Scoping & Planning Workshop)
William Mabula	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Estella Mgala	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Tumaini Mwamyalla	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Callistus Mponzi	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Annastazia Bugold	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Marobho Peter	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Peter Mdalangwila	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Praxeda P. Kalugendo	Ministry of Water and Irrigation	Government (Scoping & Planning Workshop)
Said Mdungi		Government (Scoping & Planning Workshop)
Kirstin Conti	World Bank - Governance	Developmental Partners (Scoping & Planning Workshop)
Ivo van Haren	World Bank	Developmental Partners (Scoping & Planning Workshop)

APPENDIX C: DESIRED FUTURE STATE SUMMARY

Based on the evaluation of the policies analysed, and compared with the minimum requirements for the desired future, in Tanzania policy the following situation can be shared:

Table C-1: Reflection of Policy Framework as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
A long-term policy to protect groundwater by preventing pollution and overuse. This policy is comprehensive, implemented at all appropriate levels, consistent with other water management policies and be duly taken into account in other sectorial policies;	Partially achieved	The police do not make a clear reference to the ground water and the implementation at the appropriate level is not satisfactory
The social, economic and environmental values of groundwater are all recognised;	Partially achieved	GW is considered as an important resource. Policy and legislation state as such. However, not appropriate resources in term s of human and finance is allocated in assessment and development. This happens only when there is stress
The human right to water is recognized and a rights-based approach to groundwater management is taken, *inter alia*, through:	Partially	Policy and legislation recognises water resources holistically through the WRM Act No 11 of 2009. Through this, duties of different actors is explicitly outlined. However, capacity and awareness of right holders is low
Prioritization of drinking water/basic human needs in water legislation;	Partially Achieved	In water resources allocation, domestic water is given priority no. 1 followed by environment then other economic activities. This isn't consistently followed though
Ensuring that land-based rights cannot entitle unlimited access/use of freshwater, including groundwater;	Achieved	Land ownership or other forms of permits such us mining licences does not grant automatic permit to water use. At all times one has to apply separately
Ensuring groundwater is legally recognized as a public good;	Achieved	Water resources in general is considered a public good and custodian is placed in the head of state
Recognising the role of groundwater in meeting basic human needs for food security;	Achieved	There is a growing awareness on the use of groundwater for irrigation purposes. However, due to costs involved in drilling and operations, Small holder farmers (80% of farming and food basket for Tanzanians), have not yet tapped on this resource. In places such as Pangani Basin, government has piloted conjunctive use of GW to argument SW (15 BH in Sanya plains have been drilled)
Legal recognition of customary rights to freshwater, including groundwater;	Partially achieved	Very minimum recognition of such rights. Occasionally, development endeavours consult with such rights but in most cases political influence overwhelms considerations for such rights,
Legal mechanisms to ensure gender equity in access, use and management of freshwater, including groundwater;	Partially Achieved	At least one-third of members in all decision-making bodies on water are females. However, they don't occupy strategic positions – in community based institutions at least they are trusted to hold treasury positions.
Provision of pricing mechanisms that incentivize equitable distribution of rights to	Partially	Block tariffs is instituted to accommodate poor and special groups. However, the same groups are ones

Minimum requirement for desired future	Status	Comment
access and use of groundwater, as well as prioritization of small-scale users' livelihoods and food security needs, especially youth and women.		without public water infrastructures.
Groundwater is recognised as a highly important source of domestic and agricultural water supply and a key resource for poverty alleviation, food security, and the sustainable economic development of rural areas;	Partially achieved	Domestic water is the largest user of GW in Tanzania. There is a growing awareness on the use of the resources for food security
The biophysical and ecological linkages between ground and surface water for their use, protection and management are recognised, including land use zoning for groundwater protection and recharge (conjunctive use);	Partially achieved	There is recognition of the connection between GW and SW. However, decision making on protection of such interactions falls short of information on GW resource.
The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones);	Partially achieved	This is considered holistically under water resources and SW occupies majority of attention
Intersectoral collaboration is promoted and facilitated so that the needs and impacts of different sectors (e.g., land, agriculture, mining, municipal, and environment) are taken into account in groundwater management and the impacts of developments in those sectors on groundwater are accounted for;	Partially achieved	Although different boards do accommodate multi-sectoral needs, there is very weak engagement of private sector. Only recently has 2030 Water resources Group (www.2030wrg.org) has initiated national and catchment level MSPs
The need for adaptive management is recognised due to the inherent limitations in the nature of scientific information in conjunction with the widely occurring dynamic processes of climate, social and institutional change;	Partially	The need of deep studies of the aquifers have been identified for a better understand of the situation
The roles of various stakeholders and water users in groundwater management is recognised and participation of stakeholders in decision-making and groundwater management is promoted and facilitated;	Partially	There is no particular legislation for ground water management. However, this window is opened for the water resource as all.
An apex body that is responsible explicitly for GW management and playing the role of custodian/trustee on the part of the state is clearly defined;	Not achieved	No such body has been created in Tanzania. All decisions are lumped in water resources management institutional arrangement.
Effective institutional arrangements are coordinated at trans boundary, national and local levels;	Not Achieved	There is an institutional framework in place. However, none of the basin has completed to include catchment water committees. In addition, although these grass root level are important, they are the weakest institutions in terms of understanding of the resource, managing finances etc.
Public access to geo-hydrological data held by the state is promoted and facilitated	Not achieved	There is no mechanism for data access. This is currently on request basis where data access is still tedious and patchy

Minimum requirement for desired future	Status	Comment
- Additional environmental principles necessary to protect and sustain groundwater are mandated, including: the precautionary principle, the principle of gender equity and social inclusion (GESI), the principle of subsidiarity, and the principle of intergenerational equity.	Achieved	Legislation stipulates for instance the need for notifying basin water boards whenever mining activities strike aquifers. Furthermore, dumping of the encountered water requires a permit

Table C-2: Reflection of Legal Framework as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
I. Provide Status of Groundwater		
All water has a consistent status in law, irrespective of where it occurs	Partially Achieved	Although legislation is clear on that, in practice GW receives minimum attention mostly due to low understanding of the resource
Explicit reference to groundwater and conjunctive use management in catchment/water management and development plans and drought/emergency management plans	Partially Achieved	As above, legislation provides for that but in practice this is patchy
Human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users	Achieved	Domestic water supply is given priority in water allocation
ii. Regulate Groundwater Quantity ***a. Provide conditions for accessing groundwater*** i. Water use authorizations:	Partially Achieved	Legislation demands drilling and abstraction permits. However, because of resources (Man power, finances and tools) this is a challenge for most Basin Water Boards
Legislation must enable the authorisation of groundwater use (with a system that does not discriminate, especially against the rural poor);	Partially Achieved	Pro poor approaches and guidelines are set forth but politics and cultural dynamics outplays the legislation. Often times the poor suffers
The permitting of groundwater use should not be tied exclusively to land tenure;	Not achieved	Right now, water parmitts in general are granted to land permit owner
Legislation should allow for the categorisation of water users;	Achieved	Legislation categorises different thematic users e.g. power, irrigation, domestic etc. Also volumetric users e.g. large scale uses etc. Costing is different for these different uses – but not known by right owners
Groundwater should be declared a public asset and/or authority vested in government to restrict, in the public interest, the rights accruing from its private ownership to prevent over-abstraction or inequitable access/use by landowners;	achieved	Same for all natural resources in Tanzania, they are all vested in the president
New legislation should strive towards changing ownership rights to use (usufruct) rights, subject to a government-controlled, permit system for large scale users with appropriate non-permit systems for addressing the needs of small scale users	Achieved	Tanzania has moved from water rights including whole flow rights to permit system where no one gets whole flow and BWB can alter a permit at any time should need arise

Minimum requirement for desired future	Status	Comment
The legislation recognises and legalises affordable, small-scale and indigenous solutions;	Not achieved	No such provisions
The legislation should enable the regulation of borehole drillers, regulation for drilling, control of drillers, information from drillers and standards for borehole drilling;	Partially Achieved	It has just been introduced since 2014 but has not been rolled out across the country
Legislation should give water inspectors the right to enter land with the offenses and associated penalties noted in the legislation (this includes appropriate fines and jail time that needs to be adjusted annually);	Achieved	Legislation provides for that inspection right. However, some permission have to be requested to avoid abuse of power e.g. court orders
The legislation should enable the regulation of exploration;	Achieved	Legislation provides for registration of groundwater surveyors. However, requirements should be tired to credibility of knowledge e.g. certificate from accredited institutions rather than possession of instruments
The legislation should allow for zoning for overused/fragile aquifers;	Achieved	Legislation provides for that but zoning suffers the issues of liitle knowledge of the resources and political influence e.g. allocating settlements is more influential that quest to safeguard the resource. Good example is Arusha (Ngaramtoni-Magereza well field)
Groundwater use organizations should be integrated into existing institutional frameworks (e.g., catchment management, customary institutions)	Not achieved	All resources are governed with the same institutions where GW discussions are very limited
iii. Stakeholder engagement		
The legislation should specify when and how stakeholders, the public and/or other water users are to be engaged in planning, decision making and self-management with regard to groundwater;	Partially Achieved	It is specified in the legislation that this could be discussed in the BWBs and Catchment Committee, which includes the community, civil society, users, etc. However, there has been missing forums at all levels to allow for inclusion of everybody
There should be specific mechanisms for directly involving stakeholders in the development of laws and regulations related to groundwater and decisions that may impact the use or quality of groundwater on which they depend for drinking, livelihoods, food security, economic or cultural well-being; and	Partially Achieved	Process of developing laws is meant to involve stakeholders but experience shows no knowledge of such process by most of players including myself (report writer) although I seat in many strategic forums e.g. leading WRM component from donors group, WSDP technical Working Groups etc
The legislation should specifically address the issue of the involvement of women and youth in decision-making and the implementation of groundwater supply schemes.	Partially Achieved	The legislation only mentions the woman's where one-third is the level of female mebers that should be achieved. However, big water supply schemes do carry out gender assessments
iv. Monitoring and data collection to support regulation		
The legislation should specify the need and parameters for a sustainable system for data collection, management and dissemination, including standardization and harmonization of data. This entails a national monitoring and information system which captures quantity	Not Achieved	No such provision yet

Minimum requirement for desired future	Status	Comment
and quality data from key aquifers;		
The legislation should specify the need for drought monitoring systems which extend beyond rainfall, surface water and food security indicators to groundwater and groundwater supply status, including the appropriate prediction of future hydrogeological conditions;	Not Achieved	Very limited knowledge of GW linkage with other systems other than SW
In transboundary basins, legislation should address the need for standardization and exchange of data as well as the establishment of joint inventories; and	Partially Achieved	The agreements on the transboundary water courses already include these needs. However, the process of standardize the parameter and the way it should be disseminated is a process that the implementing entities of the agreement should follow.
The legislation should enable access by the public to geohydrological data held by the state.	Not achieved	No such provision and no centralised unit to host these data
v. Water conservation and efficiency of use Legislation should enable regulation to ensure the efficient use of groundwater, such as the use of economic incentives and imposition of technologies.	Partially Achieved	Provisions for efficient uses for overall water resources are promoted by legislation. However, monitoring is a big challenge
vi. Compliance and Enforcement		
Clear mechanisms for promoting compliance with groundwater regulations should be included in the legislation	Not Achieved	Knowledge of the GW resources, limited resources is an impending block
Enforcement provisions should include, *inter alia*, inspections authority for groundwater management institutions, the ability to impose fines and/or additional administrative penalties and adjust those as necessary, and enumerate criminal offenses associated with failure to comply with the law.	Achieved	Institutions (BWBs) are bestowed with such mandates
vii. Conflict resolution mechanisms and/or the right to appeal	Partially achieved	Legislation provides for mechanisms for this. However, resources impede realisation of the same
viii. Regulatory measures		
The legislation must enable the relevant authority (Minister) to make regulations on any relevant matter in the legislation	Achieved	This is the practice
Legislation should provide a clear ability for the government to pass regulatory measures, such as abstraction fees and waste disposal charges, to provide revenue to water management institutions and to incentivise appropriate use of groundwater	Achieved	As above

TableC-3: Reflection of Strategy and Guidelines Framework as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
II. Provide Status of Groundwater		
ix. Groundwater Protection Mechanisms ***a. Regulating Pollution (Point source and non-point source)***		
i. Water quality targets; ii. Regulation of emissions/wastewater discharge/waste storage including the impact of mines on groundwater quality: Permits can be used to regulate the discharge, disposal and possibly the storage of waste should specifically take into account the vulnerability of the aquifer concerned and the provisions necessary for its protection;	Achieved	Legislation requires mine operators to notify BWB upon encountering aquifers. After this disposal/storage of such waters requires facility operators to seek permission
iii. Classification of water bodies; and	Not achieved	Not classified at all. Things like 60 m demarcation are conducted only generally e.g. same weight is given to spring and water course
iv. Reducing and regulating abstraction.	Achieved	The abstraction is regulated through the tariff police, Licence and concession police.
v. Powers of compliance monitoring and enforcement	Partially achieved	Although included in the legislation there is a need to ensure the monitoring process of the explorations.
b. Regulating Depletion		
Regulation of abstraction and recharge (usually via permitting);	Partially Achieved	Only drilling and abstraction are stipulated in the legislation. None on recharge
Sustaining wetlands;	Partially achieved	This is considered holistically as water resources bust stipulated as one of the resources to be safe guarded
Land use zoning – prohibition of abstraction in certain zones; cropping or irrigation practices; protection zones for recharge areas; no surfacing/drainage requirements; and	Achieved	Legislation provides for zoning of GW protection areas
Legislation must make it mandatory for installation of monitoring equipment of	Not	Not provided for

Minimum requirement for desired future	Status	Comment
boreholes especially for large-scale users (the information must then be supplied to the state).	achieved	
Powers of compliance monitoring and enforcement	Partially achieved	BWB are bestowed with this mandates but strategy is not in place
x. Planning		
The legislation should specify the need for long term plans to ensure the sustainable use of groundwater, including drought management plans and cross-sectorial coordination;	Not Achieved	No standalone plane for GW
Where water legislation provides for catchment level or basin level planning, groundwater should be integrated into those plans (for example through impact assessment requirements);	Partially achieved	Legislation provides for holistic consideration of all water resources but limited knowledge of GW is the main impeding block
The legislation should specify that groundwater management planning should take into account and be integrated into land use and environmental planning; and	Partially Achieved	By law the planning process should take this in consideration. A better coordination among the institutions to include the results of the ESIA in the monitoring platform is needed
Planning should be cyclical and based on continuous learning from data and stakeholder feedback to ensure adaptive management and effective responses to changing climatic, social, political and institutional contexts/drivers.	Partially Achieved	The legislation specify that the basin plans should be updated every 5 years. However, it is critical to arrange the budget to ensure the said activity happen for all the principal basins at least. A more realistic timeline should be set.

Table C-4: Reflection of Institutional Framework as per the minimum requirement for the Desired Future State

The gaps and challenges identified are summarized in the table below.

Minimum requirement for desired future	Status	Comment
Legislation should contain provision for its effective implementation, including the mandate, competence and power of the relevant authorities in accordance with uniform governance principles;	Partially achieved	This is provided for, but capacity of institutions is very law especially on GW
Water authorities or coordinating bodies should have the competence to integrate all aspects of water management and should be rendered competent to arbitrate among	Partially achieved	Very limited capacity

various competing demands, and diverging interests regarding groundwater abstraction and use, both in the short-term and in the long-term;		
The authority or body should collaborate with other authorities, competent for public health, land-use planning, soils management, waste management;	Achieved	This is clear indicated in the legislation. However, there is a need of a clear protocols for the management of the licences, data, and monitory. This could only be reached with a strong authority on this subject.
Water user associations and other appropriate forums (such as municipalities) should be utilized to strengthen the user advocacy role and achieve new partnerships and a joint management of the common resource.	Partially achieved	Very minimum political, social and economic influence is in these institutions

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