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

Gap Analysis and Action Plan – Scoping Report (DRAFT)

February 2019

Madagascar

Report Number 1.6

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 (DRAFT): Madagascar.* 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 Madagascar 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 Madagascar 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 Madagascar 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:

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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
ANDEA	National Water and Sanitation Authority
APIPA	Antananarivo Plain Flood Protection Authority
BDEA	Database on Water, Hygiene and Sanitation in Madagascar
BPOR	Budget Program by Objective per Regional
CIWA	Cooperation in International Waters in Africa
CNAGER	National Centre for Water, Sanitation and Rural Engineering
CNRE	National Environmental Research Centre
GDP	Gross Domestic Product
GEF	Global Environment Facility
GESI	Gender, equity and social inclusion
GMI-PLI	Groundwater Management Institute – Policy, Legal and Institutional
GW	Groundwater
IWRM	Integrated Water Resources Management
JIRAMA	Malagasy Water and Electricity Utility
JMP	Joint Monitoring Program
MAE	Ministry of Agriculture and Livestock
MEAH	Ministry of Water, Sanitation and Hygiene
MEEF	Ministry of Environment, Ecology and Forest
MEP	Ministry of Economy and Planning
MID	Ministry of Interior and Decentralization
MoSCoW	Must have, Should have, Could have, and Won't have
NGO	Non-Governmental Organisation
PANA	National Action Program for Adaptation to Climate Change
PES	Payment of Environmental Services
PLI	Policy, Legal and Institutional
PNAEPA	Adoption of the National Program for Access to Drinking Water and Sanitation
PSNA	National Policy and Strategy of Sanitation
SADC	Southern African Development Community
SADC-GMI	Southern African Development Community – Groundwater Management Institute
SAMVA	Urban Solid and Sewage Management Authority Autonomy in Antananarivo
SDAGIRE	Master Plan and Water Resource Management
SDEA	Master Plan of Water and Sanitation
SIM	Trade Union of Industries
SOREA	Public Service of Water and the Sanitation

ACRONYM	DEFINITION
SSPA	Strategy sectorial and Action plan for Water and Sanitation
TFP	Technical and Financial Partners
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USD	United States Dollar
WASH	Water, Sanitation and Hygiene

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 Madagascar.

1.2 Socio-economic drivers for Madagascar

Madagascar's development has been hindered by chronic political crises (1972, 1991, 2001, and 2009) occurring every decade on average since the country's independence in 1960. The latest crisis followed the unconstitutional change of regime in 2009. It left the economy severely crippled and led to a sharp rise in poverty levels. Figure 1 shows the economy growth (in %) after the latest crisis period. In 2016, income per capita had fallen to USD 408. The size of the population was estimated at 25 million with an annual 2.8 % population growth.

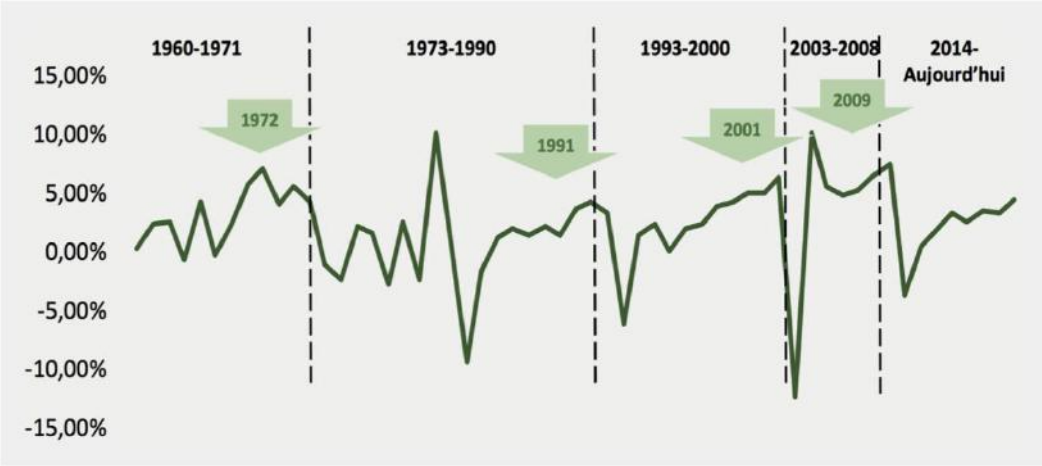

Figure 1: Madagascar economic paradox from 1960 to 2013 (Source: Presidence, 2017)

Madagascar economy is based on the Agriculture, Textile industry, Mining and Tourism. 70 to 75 % of the population live in rural areas and, mainly depend on agriculture, livestock and fishing. The primary sector accounts for 25.7 % of the national GDP, with agricultural activities being the most important contributor, followed by livestock and fisheries and forestry activities[1].

According to the latest data from the Joint Monitoring Program (JMP, 2013), Madagascar has 34% improved access to water in rural areas, and only 12% coverage for improved access to sanitation, representing the lowest water and sanitation coverage rates in Southern Africa. The poor quality of existing latrines combined with the high prevalence of open defecation (45% of the rural population) is one of the main sources of water pollution. In addition, health problems are aggravated by the frequency of floods and cyclones. Existing water and sanitation infrastructure have not been designed and constructed taking into consideration extreme weather events.

1.3 Water resources

Madagascar has abundant water resources, however, its distribution is not even across the Island because there are marked differences in rainfall on a regional scale, affecting water availability. The eastern and northern parts of the country typically have abundant rainfall, while the western and southern parts are drier and experience recurrent drought. Over 90 percent of annual rainfall occurs during the November to April period; rainfall from May to October is less than 150 mm/year. Average annual rainfall amounts to 1.500 mm. The East coast receives more than 1.200mm of rain per year, the Highlands between 900 and 1.500mm, the West from North to South 1.650 to 400mm, and region in the far South 500 to 700mm. Total renewable water resources per capita (annual surface runoff plus groundwater infiltration) are about 15.000 cubic meters. Water resources leave of rain: 900 Mm3/year with an evapotranspiration of 410 Mm3/year. The groundwater exploited is less than 5 percent, compared with 26 percent in neighboring

[1] Les données présentées ici sont tirées de la *Stratégie Nationale face au Changement Climatique (SNCC) – Secteur Agriculture-Elevage-Pêche 2012-2025.*

Mauritius[2].Madagascar suffers from the impact of cyclones. The prevalence of natural disasters, such as cyclones, flooding and especially endemic droughts in south part of island, is particularly challenging for the country's already vulnerable populations. Flooding can pollute surface water and groundwater and lead to disease outbreaks while longer dry spells result in crop failure and shortages of food and clean drinking water. The south of the country is particularly vulnerable with an already critical WASH situation and frequent droughts resulting in extreme water insecurity.

The increase in the frequency and intensity of cyclones will be likely to have a negative impact on the water and sanitation systems of households and communities. Cyclones could cause the flooding of rivers and sewage canals to increase the number of days the evacuation channels will have to be pumped and a more frequent overflow of toilet pits. This would include: risks of population exposure to pathogens and contamination of unprotected surface water and groundwater, increased sediments in water intakes due to runoff, destruction of water supply and sanitation infrastructures, the reduction of available safety drinking water for populations, and the increased unforeseen costs for sanitation and potable water supply.

Climate change is resulting in late rains, increasing the period of drought, and then brings very heavy rain. This increases risk of flooding and contamination of water resource due to overflowing sewers.

Since precipitation between May and October is low, it is necessary for Madagascar to develop storage capacity to accommodate for the dry months. Existing storage capacity is estimated at less than 500 million cubic meters, which represents less than 3 percent of the amount of water abstracted for irrigation. It is important to assess the natural capacity of storage of lakes, and aquifers, and how they can be used for water management.

1.3.1 Status of water resources

Madagascar geology is mostly composed of ancient crystalline basement rocks, largely granite, gneiss and schist, which form the high plateau regions. Also, there are the sedimentary basin which form the coastal lowlands and young alluvium occurs in inter-montane valleys in the plateau. These often have intercalations of volcanic rocks, largely of basaltic composition.

Water resources are unevenly distributed in the country. National data therefore mask important disparities at the basin and even sub-basin level. Episodic extreme weather events do occur and may impact at local scale. Deforestation and erosion of watersheds also contribute to silting of water storage facilities and siltation of lowlands. Climate change not only creates difficulties in the management and control of water resources, but also changes the biophysical quality of water. The water resources managed by the Madagascar Basin Agency comprises both surface water and groundwater.

Surface waters comprise few large rivers (e.g. Onilahy, Mangoky, Linta, mandare, Menarandra, Manampatrana, Mananara Sud) and their tributaries, and several lakes and ponds. Surface water is used as

[2] WAVES, (2015). Madagascar Country Report: Priority Policy linkage and Workplan

a complementary supply in some areas, notably the towns of Fianarantsoa and Antsirabe in central Madagascar.

Groundwater availability in the basement areas is generally has low potential, except where fractures are developed in the crystalline bedrock, principally at shallow levels, and where the weathered overburden is best-developed. Laterite aquifers are important and are considered the origin of surface water flow in Madagascar. According to the water balance of Madagascar prepared by the Ministry of Water, the surface water availability is 555 Mm3/year and groundwater is 140 Mm3/year. The most important uses are for agricultural supply, with 13 Mm3/year for irrigation, 1.6 Mm3/year for hydro-power, 42.9 Mm3/year for domestic use and 4.3 Mm3/year for productive use. All the necessary data has been collected to determine the water balance for the 2001–2013 period; they are currently being aggregated geographically on an annual basis for 31 basins and 530 sub-basins.

1.3.2 Groundwater environment and ecology

The geology of Madagascar comprises a variety of rocks of Precambrian age which make up the larger part of the east and centre of the Island (Pietersen and Beekman, 2016). They are intruded by basalts and rhyolites of Mesozoic to Cenozoic age. The western part of the island is formed by sedimentary rocks of Carboniferous to Quaternary age. There are four main coastal sedimentary basins in Madagascar, each with mixed sequences of sands and clays and with abundant carbonate material (marls, limestones) as well as volcanic formations (BGS, 2002). Groundwater abstraction is from a large number of different formations, but usually from the sedimentary aquifers of which the limestone strata form the best aquifers (BGS, 2002). Groundwater quality varies considerably across the island and with depth, especially in the distinct sedimentary formations of the coastal basins but little information is available on the quality of groundwater in Madagascar's aquifers. Various sources suggest that salinity is a problem in some of the coastal aquifers, especially in southern Madagascar. Deeper groundwater from the basement complex is also affected by high salinity in some areas. Surface water has been polluted in places with raw sewage and other organic wastes (CIA, 2000)3. Hence, shallow groundwater has the potential to be affected. Many of the groundwater samples have high alkalinity values. High-iron content of groundwater is present in Cretaceous and young alluvial aquifers (UN, 1989).

1.3.3 Status of groundwater infrastructure

The vulnerability of water resources is compounded by the lack of an operational structure for the implementation of IWRM. Although ANDEA was established for this purpose, its legal status limits the organization's scope for implementing. In addition, with the decrease in the water table due to the depletion of rainfall, some water supply infrastructure is no longer functional, a case mainly encountered in southern Madagascar (MINEAU, 2013). The water available per person is estimated at 23,057 m3 / year, averaged for the period 2001 to 2013, and is one of the highest in the world, and 13,169 m3 / inhabitant /

[3] (CIA,2000)

year in 2012. But a country is water-stressed when its potential supply of water is less than 1,700m3/ person/year. It is water- scarce when the supply of water is lower than 1,000 m3/ person/year (UNDP 1998). Madagascar has a provision potential in water usable 490,000 million m3. With a population of 25,000,000 inhabitants, the equivalent is around the 25,600 m3 per person per year. Madagascar is therefore not in a situation of water-stress.

The agricultural sector uses an average of 14,340 hm3 of water (2012), mainly for irrigation purposes. Electricity supply uses 5,470 hm3 of water, or 11% of usage some water. Water resources are estimated at 286,550 hm3, although the water exploitation index is less than 5%.

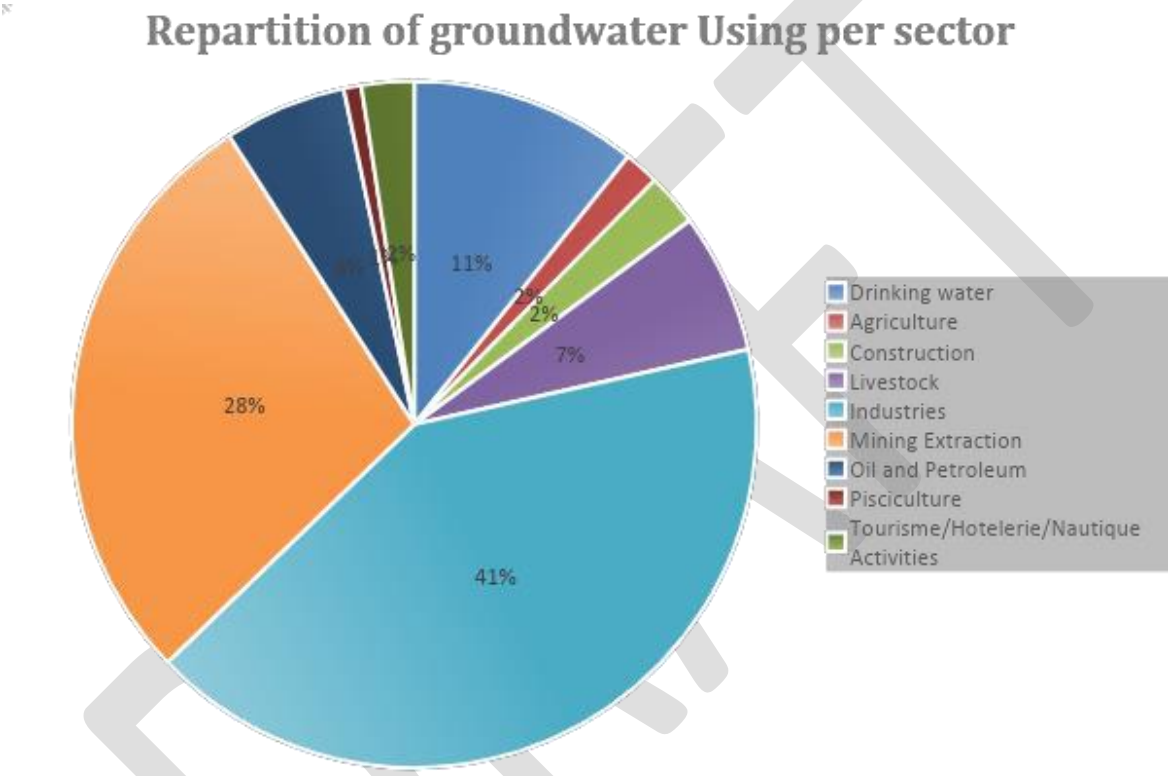

Figure 2: Groundwater use per sector (Source: ANDEA, 2018)

Thus, Madagascar needs to further develop storage capacity to enhance the access to water as needed and utilize the water collected during the rainy months during the dry season. The current storage capacity is less than 500 million m3, the capacity of the dams is about 429 million m3, i.e. less than 23% of the amount of water withdrawn for irrigation.

1.3.4 Groundwater supply and demand

The agricultural sector has the highest water use (estimated at 96 percent in 2000), followed by municipal use (1-3 percent) and industrial use predominantly for the textile, hydroelectricity generation and mining industries (2 percent). The irrigated agricultural surface in Madagascar, predominantly for rice growing, is estimated at 1 million hectares or 30 percent of the total of cultivated land. In 2010, 45 percent of

households had access to a secure water supply, mostly from groundwater (95% of the JIRAMA center was exploited and drilled). (see Figure 2 and Table 1 shows the number of water using by sector)

Table 1: Distribution of water used from groundwater

Drinking water	**13**
Agriculture	2
Construction	3
Livestock	8
Industries	50
Mining Extraction	34
Oil and Petroleum	7
Pisciculture	1
Tourisme/Hotelerie/Nautique Activities	3
Total	**121**

(Source ANDEA, 2017)

The growing large-scale mining sector will have significant water needs and availability of adequate secure resources will be essential to the development of this industry. Initial studies carried out by the World Bank and others indicate that the biophysical hydroelectric potential of the country's water resources is under-exploited and could be significantly increased. Currently hydroelectricity accounts for only two thirds of the national electricity production despite its potential economic advantages over thermal power production. Note that the efficiency of existing hydroelectric power stations is increasingly affected by sedimentation of dams.

Discussions are being held within the Ministry of WASH on basin delimitations (for 6 basins there have been feasibility studies), since these differ from one institution to another (ANDEA, CNAGER, JIRAMA, SAMVA[4], APIPA[5], Laboratory Consortium, and other ministries, NGOs, Civil Societies, CNRE, etc.). In parallel, the technical working group is collecting data and information on water use from relevant ministries and institutions, including the JI.RA.MA (Malagasy Water and Electricity Utility) and some of the ministries such as the Ministry of Agriculture and livestock, etc.

[4] SAMVA: Urban Solid and Sewage Management Authority Autonomy in Antananarivo

[5] APIPA: Institution of Urban of Flooding Management in Antananarivo

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 3: Methodology Outline

The list of stakeholders engaged are presented in **Appendix B** and the full list of documents reviewed are presented in **Appendix A**. The structured questionnaire is based on the Desired Future State and is 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

Several inconsistencies, gaps, discrepancies, contradictions, lack of application or obsolescence was identified during the analysis. The Water code mention that "water is part of the common heritage of the Nation" and specifies the fundamental role of the municipality for its management by stating that "Each community is the guarantor within the scope of its competences". It is concerned with all aspects relating to surface water and groundwater resources. With regard to water resources and water use, the water code has been generated by the various specific and applicable legal texts in force governing water and sanitation. In addition, there is currently a structure created by the National Water and Sanitation Authority (ANDEA), which has extensive authority over water resources and sanitation. It is a question of delimiting its relations with the other Ministries using these resources and to define without ambiguity its role and its attributions with regard to the IWRM. Finally, the water code, was promulgated in 1999 and was initiated the reform in the field of water through the liberalization of the drinking water sector, the integrated management of water resources and the financing of the sector.

Table 2: Evolution of the policy in the water and sanitation sector

Date	Policy environment	Gap and Challenge
1997	Declaration of sectorial water and sanitation policy, which provides for the liberalization of the sector and the adoption of the principle of non-free water code	No Water policy for groundwater management Implementing of water code
1999	Adoption of the Water Code: liberalization and opening up to the private sector, implementation of delegated infrastructure management and payment for the drinking water supply service.	Absence of the National policy of WASH

The Master Plan of Water and Sanitation specify the water policy of the country to reach the objectives of the State. The water policy is made up of 9 principles that guide sustainable development actions on water resources and services over the period of the Master Plan for Water and Sanitation until 2025.

3.2 Policies to support groundwater management

The Ministry of WASH is currently the custodian of providing drinking water and sanitation as envisaged in 2008 when it was created. The competencies related to Integrated Water Resource Management require institutionalization, which were entrusted to the ANDEA by the law n ° 98-029 based on the Water Policy. In the Water Code articles 6,7,8,9,10 and 11 mentions groundwater management. Currently, there is no established groundwater policy. The proposed structure for groundwater management from government central to local was not implemented and achieved. The Ministry of WASH, ANDEA, Basin Agencies and Committees has not clarified the roles and responsibilities related to groundwater management. The Ministry is coordinating all activities related to groundwater management through the ANDEA.

3.3 Gaps and challenges identified

Gaps

- Absence of national policy for groundwater management
- No clear understanding of the institutional roles and responsibilities of the different water management institutions related to groundwater management
- No enforcement mechanisms to collect taxes or fees (drilling and sampling) to protect groundwater resources

Challenge

- Develop a national groundwater policy which should be a key element for rational management of water resources
- The policy should recognize the watersheds and categorize water users

3.4 Enablers required to unlock these gaps/challenges

The table below reflects the enablers required to unlock the identified gaps and challenges being experience.

Table 3: Enablers required to unlock the policy gaps and challenges

Groundwater gap/challenges	Enablers
Absence of national policy for groundwater management	▪ To establish and update the National Water, Sanitation and Hygiene policy to include protection, development and use the of groundwater (art 6,7,8,9,10 and 11).

4. LEGISLATION

4.1 Evolution

Law No. 98-029 of 20 January 1999 on the Water Code, drawn up in 1998 by the inter-ministerial committee, composed of the main departments concerned with the water sector, was the subject of 13 decrees (regulations) of application as follows:

1. Decree No. 2003-191 of 4 March 2003 on the creation of Basin Agencies: organization, attributions and functioning;
2. Decree No. 2003-192 of 4 March 2003, establishing the organization, attributions and functioning of the ANDEA;
3. Decree No. 2003-193 of 4 March 2003 on the operation and organization of the drinking water and sanitation service for domestic wastewater;
4. Decree No. 2003-791 of 15 July 2003 on the tariff regulation of the public water and sanitation service;
5. Decree No. 2003-792 of 15 July 2003, relating to the levies and spills;
6. Decree N ° 2003-793 of 15 July 2003, laying down the procedure for granting authorizations for taking water;
7. Decree No. 2003-939, on the organization, allocation, operation and financing of the Regulatory Body of the Public Water and Sanitation Service (SOREA);
8. Decree N ° 2003-940 of September 9, 2003, relating to the perimeters of protection
9. Decree No. 2003-941 of 9 September 2003, relating to water monitoring, the control of water intended for human consumption and priorities for access to water resources;
10. Decree No. 2003-942 of 9 September 2003, on the hydroelectric use of water;
11. Decree No. 2003-943 of 9 September 2003, on spills, discharges, direct or indirect polluting load in surface water or groundwater;
12. Decree No. 2003-944 of 9 September 2003, on the disintegration of watercourses, a section of a watercourse or a lake in the public domain;
13. Decree No. 2003-945 of 9 September 2003, relating to the administrative organization of water and the transfer of powers between the different decentralized authorities.

4.2 Legislation to support groundwater management

The goal of the legislation was to strengthen the water and sanitation sector through rational and effective reorganization, which has been endorsed by all stakeholders. The legal texts governing the water and sanitation sector are articulated in the Water Code and its implementing decrees. The Water Code include provisions for groundwater management, the conservation of water resource and protection of the environment in the articles 5, 13,18, and 24. In addition to the Water Code and its implementing decrees, the other uses are governed by other legal texts which are complementary. The Water Code applies to all water dependent on the public domain, surface water and groundwater (art 3). In the development of water resource, the priorities for access to water resources both surface and groundwater are defined by decree, on the proposal of the National for Water and Sanitation Authority, according to the specific conditions of the water resource regions concerned. In the event of limitation of available water resources, priority is given to the supply of drinking water considering the consumption standards adopted in application of this Water Code (art 28).

4.3 Gaps and challenges identified

- Absence of a legal basis common to all activities on the groundwater management. The Water Code, object of law n ° 98-029 of 20 January 1999 cannot cover all activities likely to be subjected to its provisions;
- Implementation of regulatory in subsidiary legislation or regulations pertaining to groundwater management

4.4 Enablers required to unlock these gaps/challenges

Table 4:Sectoral legislation and implementation for groundwater management

Groundwater gap/challenges	Enablers
Absence of a legal basis common to all activities on the groundwater management. The Water Code, object of law n ° 98-029 of 20 January 1999 cannot cover all activities likely to be subjected to its provisions;	The national legal framework should reflect the national policy that would be developed according to the international policy orientations of the field: ▪ It regulates activities related to the use of groundwater at the national level, namely measures for the protection, conservation, recovery and rational use of water. ▪ It identifies the entities involved in the groundwater management ▪ It traces and defines the responsibilities and roles of the various stakeholders in the field of groundwater management; ▪ It regulates the procedures relating to the various authorizations and the payment of royalties and levies related to groundwater ▪ It defines the structures of the organization of the Integrated Management of Water Resources and Sanitation; ▪ It sets up the legal framework of the IWRM: Water Code and its implementing texts. ▪

5. STRATEGY AND GUIDELINES

5.1 Evolution

Major changes have happened in the strategy/guideline environment for groundwater management to support governance, management research and implementation.

Table 5. The policy environment and associated challenges

Date	Policy environment	Challenge
1994	Strategy sectorial and Action plan for Water and Sanitation (SSPA)	To establish a National groundwater policy, legislation and strategy to achieve the goals; To create and to mobilize the structure and institutional on the groundwater from central and local government.
2004	Adoption of the strategy document "Water and sanitation for all" in rural areas	
2007	Adoption of the National Program for Access to Drinking Water and Sanitation (PNAEPA)	
2008	National Policy and Strategy of Sanitation (PSNA) (Solid waste, Excreta, Sewage and storm water)	
2013	Policy and Strategy of Water, sanitation and Hygiene 2013-2018	
2014	Institutional and legal diagnosis on the Water and Sanitation areas at Ministry of Water, Sanitation and Hygiene	

The relevant strategies indicate how the specific objectives of the water sub-sectors will be achieved taking into account the main principles of Water Policy. These strategies are based on five sub-sectorial levels: drinking water, sanitation, agricultural water, pastoral water and water resources including groundwater management. Sub-sectoral strategies are complemented by two cross-cutting strategies: National Capacity Building and Organization Strategy and Internal and External Financial Mobilization Strategy.

5.2 Strategies and guidelines to support groundwater management

Madagascar has several policies and strategies related to water resource management including the groundwater management, agriculture, water supply and sanitation and environment. Madagascar completed its National Action Program for Adaptation to Climate Change (PANA) in 2006. The three strategic pillars of the PANA are: (i) capacity building, (ii) political reform, and (iii) integration of adaptation into sectorial policies and project activities for using the groundwater. The environmental charter represents the general framework for implementing the country's environmental policy. PNAEPA is a tool for operational planning of groundwater protection sector, a tool for monitoring and evaluating the implementation of the actions of the sector, and also a basic document in the context of negotiations with the groundwater for technical and financial partners (TFP) in support of the sector. TFP will be involved in the implementation of programs and projects initiated jointly with the Government so that there is coordination, planning and implementation according to the legal frameworks in force and the needs

identified in consultation with the different actors. They contribute to the implementation of the national policy and sectorial strategies in the field of IWRM including the groundwater.

Generally, the strategy describes and orients the development of the groundwater management and indicates the various actions to be implemented to achieve this, through an immediately operational planning to redraw the image of the sector and reconsider the roles that can be played by the different actors involved. Budget Program by Objective per Regional (BPOR) is a planning tool that sets out sectorial objectives for each region, prioritizing them according to regional service rates, and municipal and regional priorities. It is a support for the coordination by region of actors and technical and financial partners.

5.3 Gaps and challenges identified

- National organizational and strategy for capacity building in groundwater management;
- Strategy to mobilize financial internal and external to achieve the specific objectives of groundwater management
- Protocol between the ANDEA and Directorate General of Meteorology is not effective because they are not operational;
- Inventory data on the hydrology and hydrogeology are insufficient

5.4 Enablers required to unlock these gaps/challenges

- After establishing the National WASH policy, there should be an implementation strategy and an implementation planning for groundwater management
- Mobilize for IWRM including groundwater.

Table 6: Enablers required to support strategy and guidelines implementation

Groundwater gap/challenges	Enablers
Protocol between the ANDEA and Directorate General of Meteorology is not effective because they are not operational;	▪ Implement national WASH policy alongside an implementation and planning strategy to ensure alignment between sectors. ▪ Mobilise for IWRM including groundwater

6. INSTITUTIONAL FRAMEWORK

6.1 Evolution

It appears that the water, sanitation and hygiene sector which was established in March 2008, is now under the aegis of the Ministry of Water. Its institutional position has evolved from an incorporation before 1960, as a Division of Hydrogeology in a Department of Mines and Geology within a service in charge of water and electricity, to a service of hydrogeology (1973), then in the Directorate Energy and Water (1975-2000), Drinking Water and Sanitation Directorate (2000-2006), Directorate-General for Water and Sanitation (2007), and finally the Ministry of Water, Sanitation and Hygiene (July 2008 to present).

6.2 Institutional arrangements to support groundwater management

The Ministry of WASH is currently in charge of drinking water and sanitation as planned in 2008 when it was created. But it is urgent to delimit its competences with regard to the Water Resources Management, which competences were entrusted to the ANDEA by the law n ° 98-029 bearing the Code of the Water.

The state followed the global approach by reorienting the powers of the Ministry, in accordance with Decrees Nos. 2011-155 and 2012-633, towards the objectives of promoting the management of water resources. It does not manage of water resources. Its role is to create enabling conditions and environment for optimal management of groundwater.

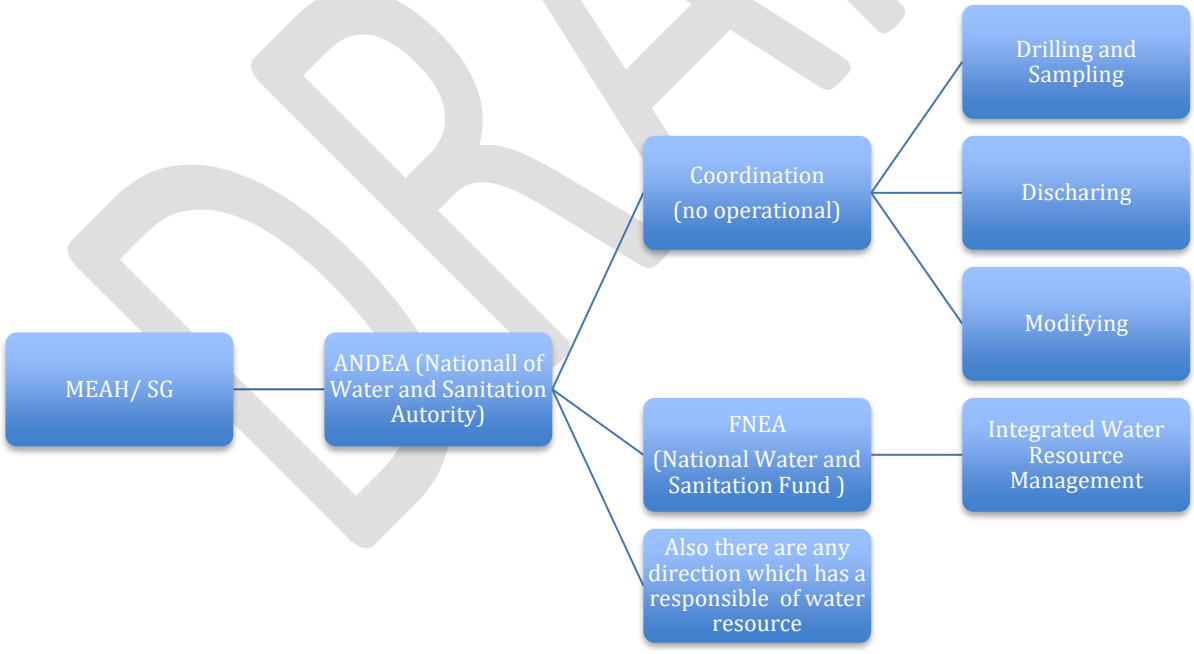

Figure 4. Scheme: Organigramme of relationship between the Minitsry of WASH and ANDEA

ANDEA is a public administrative institution with legal personality and financial autonomy, and should be coordinating all Basin Agency activities. Normally, it is establishing and monitoring a Master Plan and Water Resource Management (SDAGIRE) and the Master Plan of Water and Sanitation (SDEA) should reflect the

actual needs and aspirations of the population expressed in the Communal and Regional Development Plans and are the basis of a real program of integrated and sustainable development for groundwater.

At the local level, according to the Water Code, the role and responsibility of the Ministry of Interior and Decentralization through the municipalities are the contracting authority for protecting groundwater areas. However, the Ministry of WASH provides the delegated project management of municipalities pending their authorization. The role of municipalities is usually limited to identifying the needs of their constituency and the processing of applications from the Ministry of WASH. Ministry of Interior and Decentralization (MID): As part of cross-cutting areas, the texts on decentralization form a component of the legal and institutional basis of groundwater management (article 24, and Decree No. 2011-719, December 6th, 2011) MID is responsible for the design, coordination and implementation of government policy on decentralization.

In rural areas, simplified infrastructure management is generally provided by communities through groundwater management committees. In urban areas, the state-owned company JIRAMA is the main operator of drilling the groundwater and operates in 66 urban communes for water supply in Madagascar (Water Code, article 80).

Ministries responsible for the other water sub-sectors:

- Ministry of Agriculture and Livestock for Agricultural and Pastoral Water (decree n° 2009-1204). The Water Code in its articles 29, 30, 31 states that "any irrigation project stipulated and initiated by a natural or legal person of private law requires the opinion of the ANDEA regarding the use of resources in both surface and underground waters ".
- Ministry of Energy and Hydrocarbon (art 34, 35, and 36) for Hydropower use of water in the Water code.
- Ministry of Country Planning and the Land Service for Urban Sanitation.
- Ministry of Environment, Ecology and Forest **(**Law No. 90-033 of 21 December 1990). Water, as a natural resource, is the essential element of the environment, and can be considered as a state concern. The integration of the environmental dimension, in the case practice, IWRM and sanitation activities, is ensured through the execution of the missions and attributions of the MEEF in the process.
- Ministry of Economy and Planning (decree n°2011-717). The MEP in charge of Economy is responsible for the design, coordination, monitoring and evaluation of the implementation of state policy on economic and social development, and economic forecasts, on the one hand, and private sector development, particularly for the development of Madagascar's industry, technology transfer, competitiveness and integration into the world economy, on the other hand. This economic policy has a short- and medium-term horizon.
- Ministry of Industry and Privatization (art. 17 of the law 99-021). The management and the control of the industrial pollution fall under priority of the Ministry of the Industry in collaboration with the Ministry in charge of the Environment. Water code plays a key role in the IWRM mechanism to achieve the Sustainable Development Goals.
- Ministry of Mine and Petrol (decree n°2011-721). Government aiming at a durable and sustained development of the country, as regards with the aim of ensuring conditions for economic growth and well-being for the population, while respecting the environment. The same article is an exception to water resources and liquid or gaseous hydrocarbons which are governed by special provisions.
- Ministry of Public Health (decree No. 2011-473). The Minister of Public Health ensures the implementation of the framework of application of the general guidelines in the field of Health Policy.

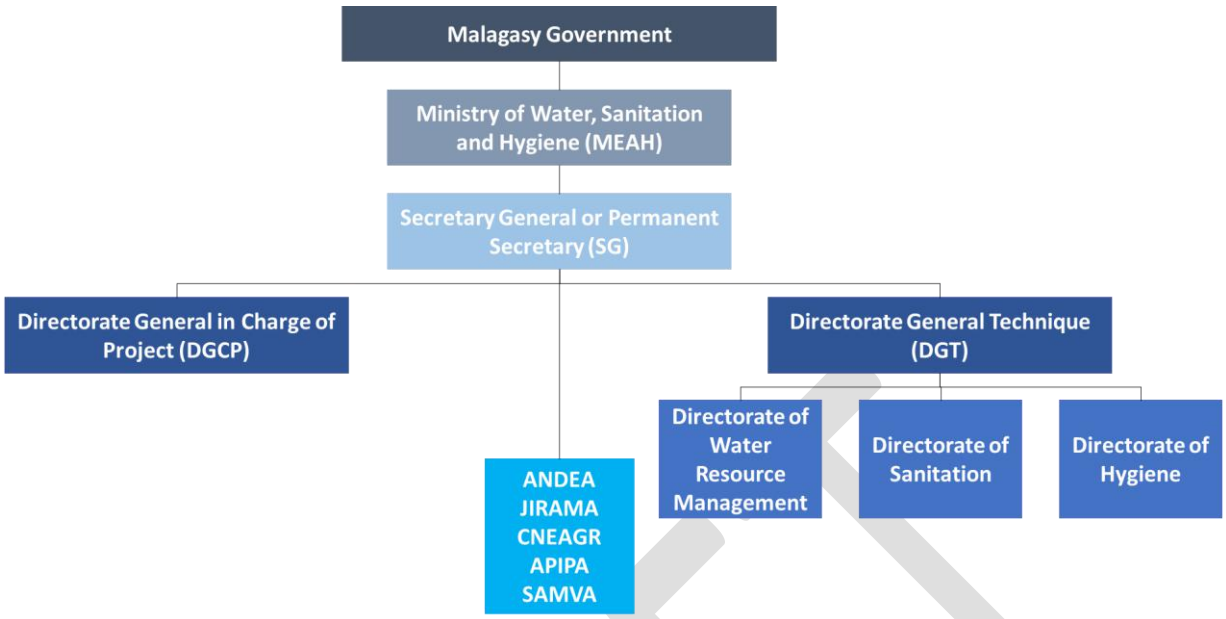

Figure 5: Government, Ministries and institutional relationship

The Ministry of Water is responsible for developing synergy with these Ministries for a better health of the population in order to support the process of rapid and sustainable development. Currently, the title of the Ministry of Water Sanitation and Hygiene is again part of the attribution by Decree No. 2018-548 in the vision to ensure a better on the groundwater management (qualitative and quantitative).

6.3 Gaps and challenges identified

- ANDEA and different ministries have no clear roles and responsibilities on the groundwater management;
- Restructuring of the ANDEA and establishing a groundwater policy.
- Lack of clear technical and administrative processes acceptable for actors
- Databases which are reliable and up-to-date (Hydrology and Hydrogeology), establish research facilities and CNEAGR
- Strengthening and operationalization of Basin Agencies and Committees (from central and local government)

6.4 Enablers required to unlock these gaps/challenges

The following enablers are required to unlock the institutional gaps and challenges.

Table 7: Enablers required to unlock the institutional gaps and challenges

Groundwater gap/challenges	Enablers
ANDEA and different ministries have no clear roles and responsibilities on the groundwater management;	▪ Restructuring of the ANDEA and establishing a groundwater policy. Institutional restructuring ▪ Strengthening and operationalization of Basin Agencies and Committees (from

	central and local government) ▪ ANDEA: coordination, management, continuous monitoring, implementation of planning for groundwater management process; ▪
Lack of clear technical and administrative processes acceptable for actors	▪ Clear management processes, technically sound, consistent and coordinated which are acceptable to all stakeholders ▪ A short, medium- and long-term implementation plan ▪ Management is also about mastering and coordinating governance skills and responsibilities both locally and nationally for common goals.
Inventory data on the hydrology and hydrogeology are insufficient	▪ Databases which are reliable and up-to-date (Hydrology and Hydrogeology), establish research facilities and CNEAGR

7. CHALLENGES TO IMPLEMENTATION

Absence of national groundwater policy which is key to the rational management of water resources. A groundwater policy provides an opportunity to recognize watersheds as ecosystems that require different management and conservation practices that are not obscured by other sectorial management objectives. A unique, independent policy for groundwater draws attention to the problems of water resources, including legislators and the stakeholders. It makes it possible to clearly state the goals and objectives to be achieved for these ecosystems, to specify the responsibilities of the government and the commitments it must fulfill. A National groundwater management process will serve as a framework for drawing clear conclusions about the required actions (without prescribing detailed measures) and determining the expected end result.

It limits itself to compiling the legal provisions in force (art. 28-35) governing these activities without having established the relations that must exist between their implementation and the use of water. The legal framework for water and sanitation could serve as a reference for activities (estimation, exploitation, exploration, protection and conservation of the groundwater) related to water use (art. 3,5,13,18,24, and 28).

Absence of a participatory approach or consultation, lack of ownership, for the actors, the Water code does not reflect the multi-sectorial dimension on the groundwater process which must be realized by a participative approach. They are aware of its importance, although they are willing to apply it, its application seems difficult, if not impossible. For example, in the case of the Agriculture sector, they do not understand the link between their activities and the levy to be paid on the groundwater using. This is the reason why the Trade Union of Industries in Madagascar (SIM) has challenged the application of the decree n ° 16284/08 of August 11th, 2008 fixing the rates of levies of sampling and discharge of water, because said arrested was not brought to the notice of the operators concerned nor published in the Official Journal. The procedures for the application of the fees must be concerted.

Absence of a clear, coherent, technical, administrative process acceptable to all actors on the groundwater management system

The national legal framework should reflect the national groundwater policy that would be developed according to the international policy orientations of the field.

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**	▪ To share responsibilities (administrative) between its different ministerial structures so that the multidisciplinary process of IWRM is part of a collaborative framework between all the actors at the national level as well as at the level of the river basin and the local communities, including protection zoning e.g. sub basin control areas ▪ To proclaim that the management of groundwater has a multi-sectorial dimension and proceeds from a participatory approach that is broken down into national and sectorial consultations, in order to allow the study and the elaboration of the policies involved in the regulation of activities. and investments that require the use of groundwater. Consider different types of water (freshwater vs. brackish) ▪ In the Water code, the water supply and sanitation are prioritized, the new Water code should develop the groundwater management process; ▪ National water policy must have including the groundwater management system. ▪ The use of water for agro-pastoral, industrial hydropower and for the satisfaction of other needs including fishing, recreation and transportation, requires easements and must comply with the texts and standards in force, including Articles 3, 5, 10, 11, 12, 18, 23, 24, 28, 32, 35, 58 and 69 of the water code. ▪ The order of priority may be temporarily modified when certain exceptional events occur such as cases of force majeure, drought and / or flood. ▪ The provisions of Articles 11 and 38 of the Water Code, decrees relating to protection areas and royalties, as well as those of Articles 5, 6 and 7 of this Decree apply to natural waters and mineral waters proposed in the trade for human consumption. Natural waters must, as a matter of principle, be used to capture a groundwater deposit taken either from a natural source or from an artificial structure such as a well or borehole. By way of derogation from this principle, and for a limited period of time, the use of an urban and public drinking water network may be authorized in certain cases for the production of natural water. But the product of such an operation can not claim the name "natural water". Mineral waters must come from the direct collection of an groundwater deposit.

Prioritisation	Element	Description
	Legislative	▪ To update the protocol of ANDEA and laboratory consortium teams for groundwater monitoring: capturing (including private held groundwater data), processing, reporting and sharing of data ▪ To regulate the procedures relating to the various authorizations and the payment of royalties on the water user (sampling, drilling, etc) and the discharge ▪ To establish national regulation for drilling, borehole construction and completion, pumping tests and water quality tests; ▪ The need to raise awareness of the inter sectorial nature of water issues and the introduction of a new development concept to integrate the technical, economic, environmental, social and legal aspects of groundwater management . ▪ Ensuring groundwater is legally recognized as a public health and environment; The water mobilization costs consist of all the expenses incurred by the ANDEA and the Basin Agency to make the water available to the user. These include expenditures relating to the inventory of water resources, their storage, transport, protection, preservation or restoration of their quality, the fight against siltation and artificial recharge and groundwater aquifers.
	Institutional	▪ To strengthen ANDEA on groundwater supply at national level, with enough staff and adequate equipment ▪ To establish a Regulator ▪ Establish local level groundwater governance organizations (agency and committee of basin) in all areas of over-abstraction (e.g. rural development) ▪ To ensure intellectual and managerial skills at all levels ▪ To establish local structures for the management of water resources must coincide with the boundaries of the river basins and not with administrative or political boundaries. ▪ The Basin Agency may request other documents and information that it deems necessary for the investigation of the application and in particular when one of the hydraulic works will be established on the water resources of the public domain.
	Strategy/ Guidelines	▪ Involve all national actors: government and ministries, local people, users and professionals from all sectors working in the field of water so that they can take ownership of it, develop its process and contribute to the financing mechanism. ▪ Ensure functional strategies that also address the economic and equity aspirations as communicated in the National Policy ▪ Develop awareness campaign on the costs and benefits of groundwater management targeted at the general public ▪ Establish Private-Public-Civil Society Partnerships on groundwater management

Table 9: Action Plan "Should Haves"

Prioritisation	Element	Description
Should have	**Policy**	▪ To develop groundwater management policy (qualitative, quantitative and groundwater dependent ecosystems and following the recommendations of the Conventions and International Agreements ratified by Madagascar ▪ This policy should protect groundwater by preventing pollution. ▪ To include provisions regulating the transitional period before full implementation of the groundwater management. ▪ To develop the groundwater policy
	Legislative	▪ To develop groundwater management regulations ▪ National and sectorial legislation is key to achieving the IWRM objectives of the groundwater and the optimal use of water resources. ▪ To update the text legal and regulation for being sanction of illegal and illicit water user ▪ To constitute a set of legal and regulatory provisions relating to the inseparable field of the natural element "water" and the "sanitation facility"; ▪ To retain their original scope and legal force. It is not a simple compilation of texts but a set of coherent legal provisions; ▪ The collection of groundwater for personal use does not require the authorization provided by Articles 10 and 11 of Law 98.029 of January 20, 1999 on the Water Code. The request for authorization to take water is sent to the Basin Agency which, after feasibility studies, forwards it to ANDEA for approval. In the case of groundwater, the application also mentions the depth of the structure and, if applicable, its diameter for the case of boreholes and wells; ▪ To prepare new legislation applicable to all sectors (local authorities, sectorial investments, TFP support, population)
	Institutional	▪ To defines the structures of the organization of the groundwater management; ▪ To organize and modernize of management structures through an operational institutional and legal framework; ▪ To install a structure of the SOREA for regulating the groundwater using
	Strategy/ **Guidelines**	▪ The main principles of this strategic management are grouped under "groundwater and sanitation system"

Table 10: Action Plan "Could Haves"

Prioritisation	Element	Description
Could have	**Policy**	▪ The national legal framework could reflect the national policy that would be developed according to the international policy directions of the field
	Legislative	▪ To regulate facts and activities related to the use of water at the national level, namely measures for the protection, conservation, recovery and rational use of water. ▪ Any spill, discharge, discharge, direct or indirect deposit in surface water or groundwater is subject to the payment of a fee, here in after referred to as a spill fee. ▪ The determination of the discharge standards and the receiving environments comply with the requirements of the decree on the regulation of discharges of liquid effluents and the provisions of this text.
	Institutional	▪ To establish strength institutional, interdependent and functions to achieve an integrated mechanism of groundwater management. ▪ To delimit clearly and simply role and responsibility of the different organs to intervene on the groundwater management
	Strategy/ **Guidelines**	▪ To elaborate a new strategy after the National policy (water and sanitation code) ▪ Update national guidelines and standards with reference to groundwater management regulations

Table 11: Action Plan "Won't Haves"

Prioritisation	Element	Description
Won't have	**Policy**	▪ Continued institutional dominance of surface water in a country where the majority relies on groundwater, and where surface water resources are fully allocated
	Legislative	▪ To continue with the execution of legal and policy in the sector (sanction, payment regulation, etc.)
	Institutional	▪ To continue dependently of administrative service and financial autonomous effectiveness of ANDEA institution ▪ To continue with centralized governance (central and local authorities)
	Strategy/ **Guidelines**	▪ lack of document strategy and guideline in this sector ▪ no contribution of development economic sustainability

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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	2015-2019	Development National Plan (PND)	MEP	Presidence		www.presidence.gov.mg
2	2016	Program Implementation of Sanitation of Antananarivo (PIAA)	M2PATE/MinWASH	M2PAT_MinWASH_AFD	Starting report	
3	2014	SDEA: South-West, West and South-East	MinWASH	MinWASH/PNUD	Final version report disponible at Ministry	
4	2004	SDAGIRE Grand Watershed and Sub-basin of Betsiboka		MinWASH		
5		Diagnostic institutional and juridication in water and sanitation areas	MinWASH	MinWASH_WB/PIC	Diagnostic and Orientation report (302 pages)	PIC_Madagascar
6		CLTS Approach harmonized	DioranoWASH/MinWASH	MinWASH		www.meah.gov.mg

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
7		SDAUM Document	MinWASH/BAD	Not published	encours	
8	2013	PSEAH Document valided	MinWASH/Diorano/WASH	MinWASH_WB/PIC	Rapport d'Etude validé et publié	www.meah.gov.mg
9		National Startegy of Water, Sanitation and Hygien from 2013 to 2018	MinWASH	MinWASH/DioranoWASH	**Decret** N° 2013-685 , February, 6th,2014	www.meah.gov.mg
10		Profesionalism of Sanitation and Hygiene Sector		MinWASH/DioranoWASH	Rapport de formation disponible	
11	2008	National Policy and Strategy of Sanitation (PSNA)	MinWASH	MinWASH/DioranoWASH	**Decret** N° 2008-1058, November, 10th,2008	www.meah.gov.mg
12	2003	Protection Areas Document	MinWASH		**Decret** N°2003-940, September, 9th,2003	www.meah.gov.mg
13		Déversements, écoulements, rejets, dépôts directs ou indirects dans les eaux	MinWASH	MinWASH	**Decret** N°2003-943 September,	

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
		superficielles ou souterraines			9th, 2003	
14		Redevances de prélèvements et de déversements			**Decret** N°2003-792, July, 15th,2003	
15		Portant réglementation tarifaire du service public de l'eau et de l'assainissement			**Decret** N°2003-791, July, 15th, 2003	
16	1999	Water CODE (It is updating in 2013 but it is not published)	MinWASH	MinWASH	**Law** N°98-029, January, 20th, 1999	www.meah.gov.mg
17		National Program for Access to Drinking Water and Sanitation (PNAEPA);	MINISTRY OF ENERGY AND MINES DIRECTORATE-GENERAL FOR WATER AND SANITATION	ISCED		http://www.cite.mg/raneau/download/ pnaepa_madagascar.pdf
18		National Policy and Strategy for Sanitation (PSNA);	MinWASH	MinWASH		

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
19	2009	Integrated Water Resource Management Survey and Status Report: Madagascar;	IWRM	IWRM		https://www.gwp.org/globalassets/global/gwp-saf-files/madagascar-iwrm-report.pdf
20	2008 - 2013	Document Strategy for the Water, Sanitation and Hygiene Sector				
21	2006	Database of the Water and Sanitation Sector (BDEA)	BDEA			
22	Since 2007	Program Budget by Regional Objectives (BPOR)				
23	2014	Program of activities for the next three months in Water, Sanitation and Hygiene				
24	2014	Institutional and Legal Diagnosis of the Water and Sanitation Sector				
25	2015	Draft Law on the Code of Water, Sanitation and Hygiene in				Not Available

No.	Year	Title of Document	Author	Publisher	Report Number	Link (if it is a website document)
		Madagascar				

APPENDIX B: STAKEHOLDER ENGAGEMENT LIST

Full Stakeholder List

No.	Title	Name	Surname	Affiliation	Role	Sector Group	Telephone	Email	Priority (yes/no)
1	General Secreatary	Lalaina	Andrianamelasoa	Engineer Hydrolician	Point focal SADC Water Division	MinWASH	340703844	sg.meah@gmail.mg	No
2	General Director	Luciano	Andriavelojaona Nirina	Engineer Hydrolician	Point focal SADC Water Division,	MinWASH	342051009	luciano.andriavelojaona@gmail.com	Yes
3	Director of Water Resource Management	Christian Gabriel	RaFaralahimboa	Engineer Hydrolician	WRTC Member	MinWASH	333301931	dgre@meah.gov.mg	Yes
4	Director of Sanitation	Antsatiana	Ravaloera	BTP Engineer	Alternative WRTC Member	MinWASH	342051096	da.75meeh@gmail.com	No
5	Environmentalist	Holinantenaina	Rakotobe	DSSE	RSAP Focal Person	MinWASH	340750849	rholinantenaina@yahoo.fr	yes
6	Engineer	Patrick. F.	Rakotoarison	Hydraulician	Sub-Committee on Hydrology	MinWASH	343638356	saaep@meah.gov.mg	Yes
7	Engineer	Dominique	Randriamamory	Hydrogeologue	Sub-Committee on Hydrogeology	MinWASH		rhdominic@gmail.com	Yes
8	Environmentalist	Mireille Natacha	Andrianaharinosy	Hydraulician	Sub-Committee on Water	MinWASH	342051114	natachamie@yahoo.fr	Yes

No.	Title	Name	Surname	Affiliation	Role	Sector Group	Telephone	Email	Priority (yes/no)
					quality and Aquatic Weeds				
9	Chief of service	Mialy Rolande	Andriamanantenasoa	Hydraulician Engineer	Sub-Committee on Water Quality and Sanitation	MinWASH	342051075	sgdl.dah@meah.gov.mg	Yes
10	Chief of service	Rindratiana Voninoliva	RASOARINESY	Hydraulician Engineer	Gender Focal Person	MinWASH	342051136	sahge.dph@meah.gov.mg	Yes

Stakeholders Engaged

Name	Organisation
DGRE	Ministry of Water, Sanitation and Hygiene
Mr. Henri Ravaliso	Water and Electricity Utility Malagasy (JIRAMA)
Mr Naina Ramaro	ANDEA
Mr Serge Ranaivojaona	BushProof
Dr. Yves Mong	National Environmental Research Center

Stakeholders that completed the questionnaires

Name and Surname	Role	Organisation
Naina Ramaro	Government Administration	ANDEA (Government)
Henri Ravaliso	Deputy General Manager, Water	JIRAMA (Government)
Serge Ranaivojaona	Managing Director	BushProof (Private)
Yves Mong	Head of Laboratory	CNRE (Academia)
Department of Water Resources Management; Ministry of Water, Sanitation and Hygiene; Madagascar		

Broader Stakeholders

Name	Position	Stakeholder Group
Mr Serge Antoine F. Ranaivojaona	General Manager at BushProof	Water Service Provider (Broader Stakeholder)

APPENDIX C: DESIRED FUTURE STATE SUMMARY

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 water code do not make a clear reference to the ground water and the implementation is not achieved
The social, economic and environmental values of groundwater are all recognised;	Achieved	Although it is included in general terms for the water resource as a natural resource
The human right to water is recognized and a rights-based approach to groundwater management is taken, *inter alia*, through:	Not Achieved	No specific reference to ground water but water resource management is developed
Prioritization of drinking water/basic human needs in water legislation;	Achieved	The government is prioritize to supply of population in urban and rural areas
Ensuring that land-based rights cannot entitle unlimited access/use of freshwater, including groundwater;	Achieved	This is included in the water code of the tariff polices
Ensuring groundwater is legally recognized as a public good;	Partially achieved	In Madagascar all the natural Resources are public good. This is included in the constitution and stressed in the water code
Recognising the role of groundwater in meeting basic human needs for food security;	Not achieved	The water resource management is developed in the water code but it is not clear the groundwater management
Legal recognition of customary rights to freshwater, including groundwater;	Achieved	The water code indicates that the access to water for human consumption is free. Groundwater using is not clear in.
Legal mechanisms to ensure gender equity in access, use and management of freshwater, including groundwater;	Not achieved	The water code needs to develop the provision for the inclusion of the woman's in the water management process.
Provision of pricing mechanisms that incentivize equitable distribution of rights to access and use of groundwater, as well as prioritization of small-scale users' livelihoods and food security needs, especially youth and women.	Not achieved	
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	The water code considers only the water source without a discrimination among the surface and ground water.

Minimum requirement for desired future	Status	Comment
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);	Not achieved	The water code make reference to the intrinsic relation among the surface and ground water. Usually, Madagascar drilled of the groundwater for water supply (e,g: 65 sources from groundwater)
The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones);	Not achieved	The water code mentioned that the aquifers serving to the water for different uses need to be identified and protected.
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;	Not achieved	The provision is included in the legislation. However, the exchange of information that could allow a better water resource management are not been made in a way that allow an adequate management of the resource
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;	Not achieved	Madagascar needs to study for collecting the scientific data.
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 achieved	In the water code, the groundwater management is not developed;
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	
Effective institutional arrangements are coordinated at trans boundary, national and local levels;	Partially Achieved	Existing water resources management institutions need to be reinforced on groundwater matters.
Public access to geo-hydrological data held by the state is promoted and facilitated	Partially achieved	This information is free, but the institution concerned need to develop for studying the geo-hydrological data.
- 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	Not achieved	

Minimum requirement for desired future	Status	Comment
intergenerational equity.		

Reflection of Legal Framework as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
Provide Status of Groundwater		
All water has a consistent status in law, irrespective of where it occurs	Achieved	In the water code is mentioned but is not applied
Explicit reference to groundwater and conjunctive use management in catchment/water management and development plans and drought/emergency management plans	Partially Achieved	South part of Madagascar is frequently suffered and AES created to supply of the drinking water for population
Human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users	Not achieved	To be established a revision of the water code, water policy and law
ii. Regulate Groundwater Quantity ***a. Provide conditions for accessing groundwater*** i. Water use authorizations:	Partially Achieved	Madagascar government has a regulation for the exploration of the ground water.
Legislation must enable the authorisation of groundwater use (with a system that does not discriminate, especially against the rural poor);	Not achieved	
The permitting of groundwater use should not be tied exclusively to land tenure;	Not achieved	To be needed a review of the legislation
Legislation should allow for the categorisation of water users;	Achieved	ANDEA has done, the general categorization of water uses was already included in the legislation and the same are useful for ground water
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	The proposed legislation review should account for specificities of ground water,
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	Not Achieved	The Malagasy government should not take a volunteer to change the legislation
The legislation recognises and legalises affordable, small-scale and indigenous solutions;	Partially achieved	Madagascar has a basic manual which established by Ministry of WASH, WaterAid and DioranoWASH that includes provisions for

Minimum requirement for desired future	Status	Comment
		ground water exploration. It is using for the borehole construction in rural areas.
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	Madagascar has a basic guideline that includes provisions for ground water exploration, it is using for drinking water supply , it need the norm and standard to protect the groundwater.
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);	Partially Achieved	In the water code, it should create one institution as like SOREA to monitor the groundwater.
The legislation should enable the regulation of exploration;	Achieved	Existing the regulation
The legislation should allow for zoning for overused/fragile aquifers;	Achieved	SDAGIRE Studies but it is not applying a legislation
Groundwater use organizations should be integrated into existing institutional frameworks (e.g., catchment management, customary institutions)	Partially achieved	ANDEA should be established the basin Agency and Committee in the rural areas .
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 basin committee, which includes all stakeholders to discuss these subjects as well as part of they normal agenda.
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	The water code promote and develop a largely and open discussion of the instruments as part of the approval process.
The legislation should specifically address the issue of the involvement of women and youth in decision-making and the implementation of groundwater supply schemes.	Not achieved	
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 and quality data from key aquifers;	Not Achieved	The ANDEA work with another department to collect the dada but it is not achieved the goal. The Monitoring and Assessment office did no specify the nomenclature the parameters for groundwater monitoring. It should need to harmonize in the national, sub regional, regional and international

Minimum requirement for desired future	Status	Comment
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	ANDEA and Ministries focus determinate a common the parameter monitoring on the groundwater.
In transboundary basins, legislation should address the need for standardization and exchange of data as well as the establishment of joint inventories; and	Not achieved	Just the study has done
The legislation should enable access by the public to geo-hydrological data held by the state.	Achieved	Legislation is mentioned in the attribution of ANDEA.
iii. 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	Ministry of WASH and ANDEA collaborate with Directorate General of Meteorology for installing the equipment but it is not updating
Compliance and Enforcement		
Clear mechanisms for promoting compliance with groundwater regulations should be included in the legislation	Not Achieved	
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.	Not Achieved	
Conflict resolution mechanisms and/or the right to appeal		
Regulatory measures		
The legislation must enable the relevant authority (Minister) to make regulations on any relevant matter in the legislation	Not Achieved	There are proposal a legislation to manage the conflict the groundwater using with the private company
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	Not Achieved	

Reflection of Strategy and Guidelines Framework as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
Provide Status of Groundwater		
Groundwater Protection Mechanisms		
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;	Partially achieved	It is mentioned in the water code, the legislation is exiting but it is fully not applying
iii. Classification of water bodies; and	Partially achieved	ANDEA roles
iv. Reducing and regulating abstraction.	Achieved	ANDEA is able to give a authorization
v. Powers of compliance monitoring and enforcement	Not Achieved	
Regulating Depletion		
Regulation of abstraction and recharge (usually via permitting);	Not achieve	The existing regulation , but Madagascar is not achieve to inject zone recharge
Sustaining wetlands;	Not Achieved	This topic needs to be clearly included in the legislation
Land use zoning – prohibition of abstraction in certain zones; cropping or irrigation practices; protection zones for recharge areas; no surfacing/drainage requirements; and	Not achieved	Mismanagement between the Ministry of WASH, Ministry of Agriculture, or Ministry of Environment , it is benefit profit
Legislation must make it mandatory for installation of monitoring equipment of boreholes especially for large-scale users (the information must then be supplied to the state).	Not Achieved	It is included however an enforcement for the monitoring is needed
Powers of compliance monitoring and enforcement	Not achieved	
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	

Minimum requirement for desired future	Status	Comment
Where water legislation provides for catchment level or basin level planning, groundwater should be integrated into those plans (for example through impact assessment requirements);	Not Achieved	As Madagascar legislation the water resource management is made in a catchment-based model.
The legislation should specify that groundwater management planning should take into account and be integrated into land use and environmental planning; and	Not Achieved	
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. There are on project for realizing by Ministry of Agri, Ministry of Env and Ministry of WASH financed by World Bank Group

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	It is challenge for Malagasy government
Water authorities or coordinating bodies should have the competence to integrate all aspects of water management and should be rendered competent to arbitrate among various competing demands, and diverging interests regarding groundwater abstraction and use, both in the short-term and in the long-term;	Not achieved	No comment
The authority or body should collaborate with other authorities, competent for public health, land-use planning, soils management, waste management;	Partially achieved	It is not clear the legislation of attribution in the different departments
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	After the updating the Water code, it will be developing all process.

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SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
SADC
TOWARDS A COMMON FUTURE

GROUNDWATER MANAGEMENT INSTITUTE