

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



Gap Analysis and Action Plan – Scoping Reportb(Final)
April 2019
Mauritius
Report Number 1.8





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

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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 Mauritius 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 Mauritius 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 Mauritius 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.

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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 Makoe, Lesotho; Mr. Luciano Andriavelojaona, Madagascar; Ms Zion 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 Mutepe, 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
CEB	Central Electricity Board
CSO	Central Statistical Office
CIWA	Cooperation in International Waters in Africa
CWA	Central Water Authority
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organisation
GEF	Global Environment Facility
GESI	Gender, equity and social inclusion
GMI-PLI	Groundwater Management Institute – Policy, Legal and Institutional
GW	Groundwater
MAV	Mare aux Vacoas Upper System
MAV	Mare aux Vacoas Lower System,
MEPU	Ministry of Energy and Public Utilities
MoSCoW	Must have, Should have, Could have, and Won't have
PLI	Policy, Legal and Institutional
SADC	Southern African Development Community
SADC-GMI	Southern African Development Community – Groundwater Management Institute
URA	Utility Regulatory Authority
WMA	Water Management Authority
WRU	Water Resources Unit

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 Mauritius.

1.2. Socio-economic drivers for Mauritius

Mauritius has been a Dutch, French and British colony before gaining independence on 12 March 1968 becoming a Republic on 12 March 1992. The population is about 1.3 million whom are largely descendants of indentured labourers from the Indian subcontinent and slaves from the African continent that were both brought to work on the sugar cane plantations. The Mauritian economy has diversified from a sugar cane monocrop economy to an economy that, today, also include manufacturing (mainly textiles and garments) and tourism. Global business (offshore) and Freeport activities have also been growing continuously since the mid-1990s. The move away from a predominantly agriculture driven economy due to the manufacturing boom in the 1980s has resulted in many people migrating to the urban areas. In addition, Mauritius has become a tourist destination of choice with more than 1,000,000 foreign visitors

arriving in 2017. The rise in tourism resulted in Integrated Resort Scheme projects implemented all over the country. The above economic activities require water availability on a continuous basis. There has been government willingness to improve water supply since independence for nearly 50-years with the motto to have a 24/7 water supply. This objective has been largely achieved but there are areas that need storage (roof) tanks on the premises to ensure a 24-hour supply.

1.3. Water resources

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

The rainfall pattern of Mauritius is strongly influenced by topography. The average annual precipitation over the island is 2,120 mm, varying from 1,500 mm on the East Coast to 4,000 mm on the Central Plateau and 900 mm on the West Coast. About 10 % of the rainfall infiltrates into the ground and feeds the aquifers. The surface- and groundwater are closely related, although aquifer and water catchment boundaries do not coincide. Groundwater plays a major role in sustaining flows in the rivers. The geology of Mauritius consists of impermeable to highly porous basaltic rocks. The latter being the main aquifer. The aquifer properties, resulting from the different volcanic activities, determined the natural infiltration rates, the contribution of rainfall recharge to aquifers and the amount of runoff.

Tropical cyclones may bring very strong winds up to 250-300 km/h (with possible structural damage to buildings and crops – vegetables and sugar cane – as well as plenty of rainfall as well. A cyclonic event may easily bring up to 200 mm of rainfall over a few days. Extreme climatic conditions such as some 100 mm of rainfall over one hour are not known either. Such rainfall intensities do cause flooding in many areas, but also replenish the groundwater aquifers and fill up the impounding reservoirs when the rainfall occurs in the right places.

A cyclone very often affects the whole of the island, both in terms of wind and rainfall, while very intense rainfalls often are localized, though the island is small. It would seem that one of the effects of climate change is that, although the annual rainfall is only decreasing slightly, the rainfall events tend to be less frequent and more intense. The consequence is in the timely replenishment of aquifers and reservoirs. Having more rainfall at one go, does not help when the storage is already near the maximum. Thus, some of the possible benefits of the rainfall might be lost.

The total area of Mauritius is 1,865 km² and the total inhabited area connected with potable water supply is 1,260 km². The number of premises (houses, industries, etc) recorded by December 2012 was 330,330, for a total population of 1,250,000. According to the Central Statistical Office (CSO), 99.6 % of the population has access to potable water within their premises. The water demand over the island of Mauritius is 0.55 Mm³/day (550,000 m³/day) and will increase to 0.69Mm³/day in 2020 as per the estimate of the Ministry of Energy and Public Utilities (MEPU). About half of the water supplied to the population comes from groundwater. The Central Water Authority (CWA) is the sole supplier of potable water in the island. The CWA mission is to secure and provide an excellent sustainable water supply service of appropriate quality, at a reasonable price, which meets the growing needs of the people and to support

the economic development of the country. The total distribution network all over the island consists of 3,780 km of pipeline disregarding some 1,200 km as communication pipes (the pipes from the road to the house). The total annual water production for the year 2012 was 203 Mm³ and the volume of water sold for the same period was 94.3 Mm³ which represents an efficiency of 46.5 %.

There are six water distribution networks in Mauritius namely (Figure 1):

1. **The Port Louis system**, which covers the capital Port Louis and the suburbs of Pointe aux Sables, Petite Rivière, Pailles and Vallée des Prêtres.
2. **The North system**, covering the districts of Pamplemousses and Rivière du Rempart.
3. **The Mare aux Vacoas (MAV) (Upper) system**, which covers the upper areas of Plaines Wilhems and part of Moka.
4. **The Mare aux Vacoas (MAV) (Lower) system**, which covers the lower areas of Plaines Wilhems and the Black River district.
5. **The South system**, covering the districts of Grand Port and Savanne.
6. **The East system**, which covers Flacq, part of Moka and the South East coastal zones.

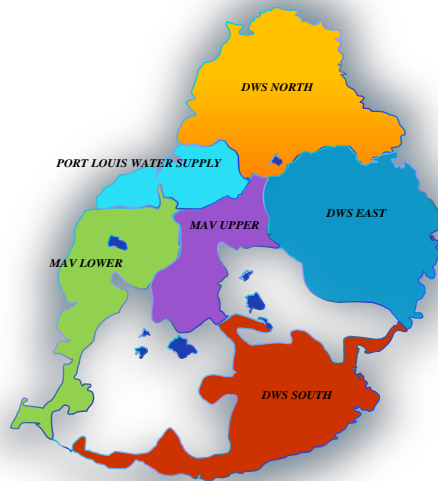


Figure 1. Map showing distribution zones in Mauritius

The following beneficial uses of groundwater are recognised:

- **Rural water supply:** There are very few places in Mauritius which can be classified as rural, as the standard of living is, overall, comparable to classified towns. In many of such areas, where supply difficulties were encountered, groundwater played an important role.
- **Urban water supply:** Although initially dependent on surface water from impounding reservoirs, the towns are increasingly served by additional water sources such as groundwater.
- **Water security:** Over the course of time, the CWA has developed several strategies to improve the resilience of the water supply network. Strategies to increase water security include the construction of impounding reservoirs, the latest one being Bagatelle dam (14 Mm³ capacity), the construction of additional service reservoirs (500 – 6,000 m³ capacity) for the water distribution network, providing subsidies to poor people to have a storage tank (500 – 1,000 litres) over their roof, and campaigns to practice rain water harvesting (for water conservation).
- **Food security:** Agriculture is the largest single user of water in Mauritius. As pumping is expensive, very few planters use groundwater for irrigation. Some sugar estates do have enough groundwater on their land and the means to harness it for irrigation of either sugar cane or vegetables. Several products (potatoes, onions, etc, sometimes imported) are stored by the Agricultural Marketing Board over months for release to retailers, However, it is difficult to store other types of perishable foods (tomatoes, carrots, beans, etc,) except through canning, which is done by two local companies. Tropical cyclones may bring heavy rains or strong winds or both. This may result in crops being destroyed or adversely affected by the heavy rains. It is difficult to plan against such impacts. However, heavy rains do increase the water stored in impounding reservoirs or substantially replenish the aquifer. One strategy, under such conditions, has been to pump from

boreholes, to meet water demand from aquifers instead of tapping from the impounding reservoirs.

- **Economic services:** Aquifers contribute to the economy of Mauritius through the sale of potable water to domestic consumers and the sale of bottled water by the private sector to tourists, etc. Many industries harness individual boreholes located on their premises or nearby. Such groundwater exploitation is subject to a yearly licence renewal.
- **Environmental services:** Although, many ecosystem services have a direct linkage with groundwater storage, recharge and discharge but this has not been studied in detail in Mauritius.

As a small island, Mauritius does not share any river catchment with another country. There are 25 main catchments, which are all exploited for surface water. There are 5 main aquifers which are also quite heavily exploited. The aquifers are the Curepipe/Vacoas/Flic-en-Flac commonly known as the Curepipe aquifer; aquifer of Phoenix/Beau-Bassin/Albion –Moka/Coromandel; aquifer of Nouvelle France/Rose-Belle/Plaisance; aquifer of Nouvelle Decouverte/Plaine des Roches/Trou d'eau Douce; and aquifer of Northern Plains (Nowbuth et al, 2012). Overall, groundwater contributes to about 52 % of water for domestic use.

1.3.2 Groundwater environment and ecology

Apart from being used for potable purposes (domestic and industrial), groundwater ecosystems provide other advantages, beneficial to society : (a) water from aquifers are, in most cases, potable and need only chlorination for disinfection, (b) natural decay of bacteria through long travel time to the borehole, (c) nutrient transfer, and (d) dampening of heavy and low rainfall effects. In many areas, the aquifers still give a significant yield even during several dry months.

1.3.3 Status of groundwater infrastructure

All boreholes operated by the CWA are properly equipped with pumps, a small pumphouse for the electrical panel and standby generator (in case of power cuts), and other monitoring equipment (abstraction and depth to water level). All such boreholes are equipped with a properly installed casing, screens and pump equipment, as well as well head protection and sanitary seal. Operation is usually over a 24-hour basis, with maintenance being carried out by a specialised CWA team, as and when required. As domestic water supplies rely heavily on groundwater, such maintenance is rarely delayed. There has been a continuous pipelaying programme during the last 40 years. The volume of water sold is much less than the apparent volume of water produced. However, there is uncertainty about this statistic due to wrong meter readings.

1.3.4 Groundwater supply and demand

Drilling of boreholes are carried out on a regular basis by the CWA and the Water Resources Unit (WRU) to meet additional demand. Private users need to apply for a licence before extracting groundwater. This includes formally applying to the authorities before they request a contractor to drill a potential borehole.

Subsequently, before a licence is granted, the test results are examined by the WRU, to ascertain the potential impact on the aquifer and competing users in the area. The public interest prevails with respect to individuals or the private sector when it comes to water use. As such, priority is given to public water supply. During droughts private boreholes have been used to supplement supply of water to the public network. There has been cases of boreholes and the surrounding land being purchased by the government, using compulsory expropriation in the public interest.

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 2: Methodology Outline

The list of literature collected is presented in **Appendix A**. The stakeholders engaged with are presented in **Appendix B**. 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

After a Dutch settlement which abandoned the island, Mauritius was colonised by France in 1715 until 1810 when the island and its dependencies became British. In 1968, Mauritius acquired independence. The National Water Policy in Mauritius dates to 2014 and is based on the Government's socio-economic policies. The National Water Policy is founded on principles of integrated water resources management that enhance sustainable development of the country. Prior to the 2014 National Water Policy, the different water management institutions (WMIs) have been following procedures emanating from the application of existing laws (discussed in the next section) or addressing issues arising in a fragmented manner. During the French period, the sugar cane growers received concessions for withdrawing water from the rivers bordering their land, while the population received their drinking water from similar sources or springs and wells on their land.

Overall, the policy was to provide water to the population through surface water, as far as possible, by gravity. As settlements started over the country, the ongoing approach was to develop the resources. In the late 1790s, a piped water supply was set up for the supply of water to Port Louis. In 1888, an impounding reservoir was built at Mare aux Vacoas to supply the central plateau of the island. In the late 1950s, the government hired consultants under an FAO study to investigate the groundwater potential of the whole island. Gradually, as from the late 1960s, groundwater exploitation on a large scale to supply potable water started to become a reality.

3.2. Policies to support groundwater management

All policies related to water resources management all revolve around the need to conserve water resources for optimal use. Water resources should be managed for everybody with the overarching principle that water resources belong to the State and should be managed for the common good.

The National Water Policy came out in July 2014, and lays down the following policies, as desirable or intended to be implemented.

Table 1: Policies advocated in the National Water Policy, July 2014

POLICY		Policy Details	
1	General and Sectoral Water Policy Statements	1	Water for socio-economic development and environmental sustainability
		2	Water for drinking and sanitation
		3	Water for agriculture and food security
		4	Water for energy development
		5	Water for industrial development
		6	Water for tourism development
		7	Water for sports and recreation
		8	Water and the environment
2		1	Dam development and management

POLICY		Policy Details	
	Water Resources Development Policy	2	Alternative sources of water supply
		3	Rehabilitation and maintenance of water and wastewater infrastructure
3	Water Resources Management Policy	1	Water resources management
		2	Integrated water resources management
		3	Water quality management
		4	Conservation and protection of water resources
		5	Water demand management
		6	Water allocation and apportionment
4	Water Security Policy	1	Climate change
		2	Protection from floods and droughts
		3	Disaster planning and mitigation
5	Water Knowledge and Information Policy	1	Water resources information management
		2	Information sharing among stakeholders
6	Water Capacities Development Policy	1	Human resources development
		2	Stakeholder participation in capacity building
		3	Capacity building and training
		4	Technology transfer and applied research
7	Water Financing and Pricing Policy	1	Financial sustainability
		2	Funding of water sector infrastructure
		3	Private sector participation
		4	Water pricing policy
8	Water Regulation Policy	1	Reform of the legal framework
		2	Water use authorization
		3	Enforcement
9	Water Sector Governance Policy	1	Participation of all stakeholders
		2	Water Sector Institutional Framework
		3	Monitoring and evaluation

The National Water Policy states in its concluding paragraphs that:

“The water resources management strategies are the medium to long-term actions that will pave the way for the implementation of the water-related policies and achieve the developmental goals for the water sector. The developmental goals shall focus on:

- *the provision of safe water supply to the growing population;*
- *food security;*
- *the preservation and protection of eco systems; and*
- *a proper balance in the ‘supply –demand’ nexus for the different sectors of the economy.*

3.3. Gaps and challenges identified

The literature review and consultation undertaken indicate that there are very few gaps in the policies. However, some gap includes:

- Strict adherence to certain guidelines may be difficult to implement due to lack of staff, expertise
- the reluctance to give public access to data and information

- Stakeholder involvement,

3.4. Enablers required to unlock these gaps/challenges

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

Table 2. Enablers required to unlock the policy gaps and challenges

Groundwater gap/challenges	Enablers
Strict adherence to certain guidelines may be difficult to implement due to lack of staff, expertise,	<ul style="list-style-type: none"> ▪ Reinforce institutions with adequate staff and resources coupled with appropriate training.
The reluctance to give public access to data and information	<ul style="list-style-type: none"> ▪ Promote sharing of information and make data readily available and accessible.
Lack of stakeholder involvement	<ul style="list-style-type: none"> ▪ Promote stakeholder engagement on key issues (e.g. tariff setting related to the water sector)

4. LEGISLATION

4.1. Evolution

Laws set out standards, principles, and procedures that must be followed in society, implement justice society, and enable government to put in place the necessary institutional and legal frameworks to achieve their aims as set out in the policy. In 1863, the Rivers and Canals Act was enacted, and is still in force. In 1970, the Ground Water Act was enacted, while the Central Water Authority Act was passed in 1971, empowering the CWA as the sole authority to look after water resources and ensure water distribution to consumers (for domestic, industrial, agricultural, hydroelectric or any other purposes). The CWA operates under the aegis of the MEPU. In 1993, the MEPU created a department within the Ministry called the Water Resources Unit (WRU) to look at the water resources component performed by the CWA. However, there is no legislation which gives the WRU legal powers of operation e.g. the WRU cannot give a license to applicants for groundwater extraction; it can only forward its recommendations to the CWA which then grants the license to the applicant, under the CWA Act.

Table 3. List of laws related to water use in Mauritius

Sr. No.	Act	Dates
1	Rivers and Canals Act	21.11.1863
2	Public Health Act	1925
3	Prevention of Malaria Act	01.11.1946
4	The Constitution - specially Article 8	12.03.68
5	Central Water Authority Act	19.07.71
6	Ground Water Act	01.09.70
7	Pesticides Control Act	01.01.1972
8	Irrigation Authority Act	20.01.79
9	Town and Country Planning Act	24.05.1980
10	Fisheries Act	24.12.1980
11	Wild Life Act	20.02.1984
12	Forest and Reserves Act	01.05.1984
13	Waste Water Management Authority Act	2001
14	The Environment Protection Act	2002
15	Utility Regulatory Authority Act	2004

4.2. Legislation to support groundwater management

The Rivers and Canals Act (1863) makes a first reference to groundwater through spring water in section 23.2(a): “All springs which the sources are either of a river, of a tributary of a river or of a stream, are public property.” The Ground Water Act (1970) specifically (section 2) provides that spring water is not groundwater.

*“**ground water**” means any water **under the surface of the ground**, and includes underground streams, natural subsurface reservoirs and lakes and any water held underground in a zone of saturation, but does not include water flowing in or contained in artificial pipes, conduits or reservoirs, **nor does it include***

*surface water having as its immediate origin atmospheric precipitation or **natural springs issuing at the ground surface, and flowing over, or retained on, the surface of the ground;***"

It does, however, (section 3) state that all groundwater is vested in (belongs to) the State. Anybody who wishes to extract groundwater is required to obtain a license from the CWA. The Act make provision for fines in case of illegal abstraction, etc.

The duties of the Utility Regulatory Authority include water services (from surface water and groundwater). More specific to the present study, the Utility Regulatory Authority Act (section 6), subject to the relevant Utility legislation, the Authority may

1. Regulate tariffs and other charges levied by a licensee in accordance with any rules specified in the relevant Utility legislation;
2. Mediate or arbitrate disputes between a customer and a licensee, or between 2 or more licensees.

Although the Utility Regulatory Authority Act was voted in 2004, it was only proclaimed in 2016 (The URA does not presently have powers to regulate the water sector, until a new Water Bill is enacted to include such powers).

4.3. Gaps and challenges identified

From discussions and the literature review, some issues need to be considered in the existing legislation:

- Stakeholders' consultations need to be promoted.
- Co-operation between different government departments involved in land-use management and activities which impact upon groundwater resources need to be reinforced.
- Monitoring of abstractions from boreholes need to be further reinforced together with the setting up of a conflict-resolution mechanism.
- Enforcement and compliance mechanism should be reinforced to curtail down theft and illegal tapping and abstractions.
- Although groundwater abstraction by private large-scale users is monitored through meters, this may not solely prevent over-abstraction due to illegal practices such as pipes by-passing the meter or tampering of a meter (although the law does provide for any inspection by the CWA/WRU, subject to 24 hours' notice).
- Setting up of a proper database management in order to update the status of the groundwater resources. The implementation of a legislation establishing the legal status of the WRU.

4.4. Enablers required to unlock these gaps/challenges

The main enabler relates to the implementation of policies and legislative measures, as indicated in Table 4.

Table 4: Gaps, challenges and enablers

	Groundwater gap/challenge	Enabler
1	Stakeholder consultation	<ul style="list-style-type: none"> Legal formulation of stakeholder involvement in local water management institutions
2	Co-operation between government departments	<ul style="list-style-type: none"> Provisions in legislation for multi-sectorial participations in local-level institutions for groundwater management
3	Conflict resolution	<ul style="list-style-type: none"> Conflict resolutions and mediation provisions in legislation
4	Unaccounted for water	<ul style="list-style-type: none"> Provisions for compliance monitoring and enforcement
5	Meter tampering	<ul style="list-style-type: none"> Provisions for compliance monitoring and enforcement
6	Data collection process	<ul style="list-style-type: none"> Clear standards and protocols for data collection, storage and management
7	WRU legal status	<ul style="list-style-type: none"> Legislative reform

5. STRATEGY AND GUIDELINES

5.1. Evolution

Although there are several laws which directly or indirectly concern groundwater management, there is the need for an enhanced groundwater strategic planning. Recently, a study was carried out for the northern aquifer to examine pollution and seawater intrusion.

5.2. Strategies and guidelines to support groundwater management

Since 1981, the Government of Mauritius has commissioned/updated Master Plans for water resources in Mauritius. These Master Plans have, inter alia, stressed the need to further investigate the possibilities of exploiting more water from the different aquifers.

Given that both surface water and groundwater are used to feed the distribution network, the strategies developed in these Master Plans have been to:

- Construct more dams to store surface water from rivers
- Exploit groundwater optimally (after heavy rains) when the aquifers are full, and the water table is quite close to the ground. It may be noted that the average depth of a borehole is some 30 metres, but the water depth to the aquifer often varies widely between 20 metres (wet season) and 40 metres (dry season). Although energy intensive, this practice helps in conserving water in the impounding reservoirs.
- Encourage individuals in rainwater harvesting.
- Better manage and monitor groundwater exploitation

Two important large dams (Midlands and Bagatelle) have been implemented, as well as doubling the number of boreholes. Duplicate boreholes are also drilled for optimal harnessing of groundwater. One borehole is equipped to pump water during the dry season when the water level is very low in the aquifer, while during the wet season, both boreholes are used to extract water when there is plenty of water.

A subsidy scheme has been set up at the MEPU to purchase a water tank to store tap water so as the consumer can cope with interruptions in water supply.

Groundwater management in Mauritius is complex, given that basalt geology is quite different from sedimentary rock geology.

5.3. Gaps and challenges identified

Apart from the above, other challenges include:

- Inadequate implementation of strategies and guidelines
- Shortage of staff to implement groundwater management provisions
- Inadequate monitoring of groundwater abstraction

- Gaps/inadequacies in procurement process that indirectly cause delays in equipment, instrumentation and renewal of laboratory contracts.
- Non-revenue water
- Lack of an established up-to-date guidelines and standards

5.4. Enablers required to unlock these gaps/challenges

The table below gives the enablers required to support the implementation of the strategy and guidelines implementation.

Table 5. Strategy gaps, challenges and enablers

Groundwater gap/challenges	Enablers
Change mindset of population towards water	<ul style="list-style-type: none"> ▪ Awareness campaigns over a long period
Inadequate implementation of strategies and guidelines	<ul style="list-style-type: none"> ▪ Strengthen implementation of strategies and guidelines
Staff shortage	<ul style="list-style-type: none"> ▪ Increase staff intake ▪ Training and education ▪ Facilitation and mentoring ▪ Collaborative research programmes
Inadequate monitoring of groundwater abstraction	<ul style="list-style-type: none"> ▪ Training and education ▪ Analysis of collected data
Gaps/inadequacies in procurement process that indirectly cause delays in equipment, instrumentation and renewal of laboratory contracts	<ul style="list-style-type: none"> ▪ Strengthen the procurement process to prevent delays in equipment, instrumentation and renewal of laboratory contracts
Non-revenue water	<ul style="list-style-type: none"> ▪ Enforce legal procedures
Lack of an established up-to-date guidelines and standards	<ul style="list-style-type: none"> ▪ Renewal of best practice guidelines

6. INSTITUTIONAL FRAMEWORK

6.1. Evolution

In the 1990s, the government was advised to set up Basin (Catchment Area) Management Agency(ies) based on the French system, wherein an organisation looks solely after water resources, while another one looks only after water distribution, with a provision to raise enough revenue to recover expenses.

As explained earlier, the WRU has been set up within the MEPU to look after water resources, while the CWA presently considers only water distribution. (see also Figure 3).

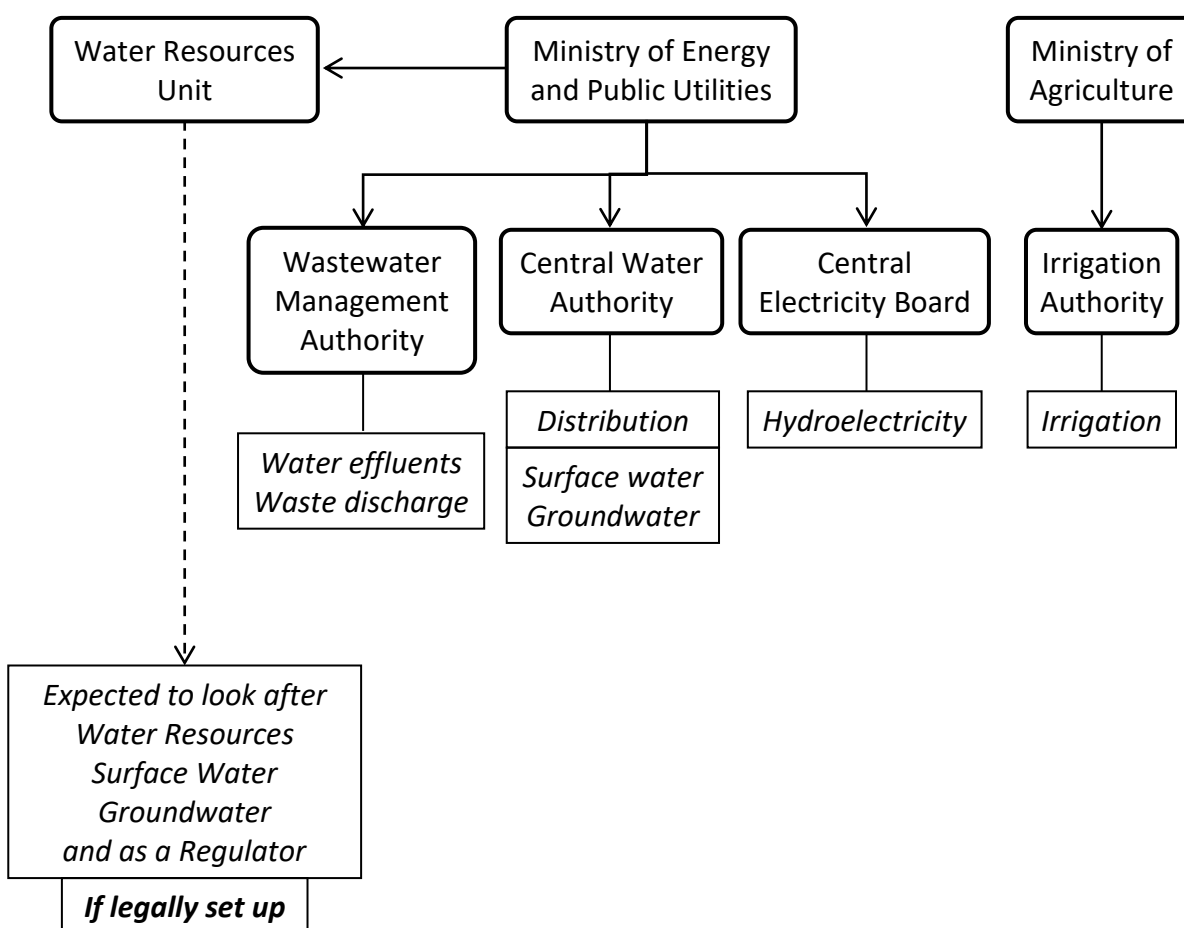


Figure 3. The Institutional Set Up

The organogram in Figure 2 shows that the MEPU oversees the Wastewater Management Authority (WMA), the Central Electricity Board (CEB), the CWA, and the WRU. With this setup, the WRU is expected to look at water resources – both surface and underground, its protection, and enforcing all pertinent laws regulations. Presently, the WRU does not have legal powers and can only grant licences through the CWA. Protection of surface water resources also falls within the purview of the Ministry of Environment (through the Environment Protect Act), but the demarcation line is not so clear. The WRU presently collects, jointly

with CWA, data from groundwater users, carry out regular drilling works and pumping tests. As the basaltic geology of Mauritius is complex (presence of lava tunnels, dykes, etc), the interpretation of such data is not always easy. Regularly, workshops have been held by foreign experts have been called in. There is the need to increase the number of staff at WRU, but due to budget constraints, this could span over a number of years. Furthermore, there would be opportunity for more water user associations being established, with an appropriate stakeholder's framework.

6.2. Institutional arrangements to support groundwater management

Although tariffs have increased over time, but the tariffs do not recover costs.

The Utility Regulatory Authority (The URA does not presently have powers to regulate the water sector, until a new Water Bill is enacted to include such powers) may

- (1) regulate tariffs and other charges levied by a licensee in accordance with any rules specified in the relevant Utility legislation;
- (2) mediate or arbitrate disputes between a customer and a licensee, or between 2 or more licensees;

The WRU functions under the aegis of the MEPU on issues related to water resources management while CWA is responsible for the treatment, supply and distribution of water to the various stakeholders.

The Utility Regulatory Authority was created later, with powers to resolve conflicts between private users and the state-owned parastatal bodies, supplying electricity, etc. The main issue at that time (2004) concerned electricity.

However, the final decision rests with government.

6.3. Gaps and challenges identified

In principle, the WRU is the apex body set up to look at both surface and groundwater resources management. However, until it is legally set up through an Act of Parliament, it will be difficult to carry out many legal enforcement duties.

6.4. Enablers required to unlock these gaps/challenges

The table below gives the enablers required to support the implementation of the institutional framework.

Table 6. Enablers required to unlock the institutional gaps and challenges

Groundwater gap/challenges	Enablers
WRU legal status	<ul style="list-style-type: none"> The government should establish the legal status of the WRU as a legal entity in its own right such that it can enforce rules and regulations for better water resources management
Stakeholder involvement	<ul style="list-style-type: none"> Furthermore, there is a need to enable relevant stakeholders to be involved at different stages of the decision-making process in managing water resources This could include discussions on specific water-related issues.

7. CHALLENGES TO IMPLEMENTATION

There are a few, but important challenges, namely:

Table 7: Challenges to Implementation

Challenge		Possible solutions
1	Lack of legal status to the WRU (A29)	<ul style="list-style-type: none"> Give legal status to the WRU through an Act of Parliament
1	Groundwater and management of the resource only receive particular attention during emergency and drought situations.	<ul style="list-style-type: none"> Groundwater resources need to be given priority status alongside surface water
3	The lack of capacity in government is hindering implementation.	<ul style="list-style-type: none"> Recruitment and staff training

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: <i>those elements of the regulatory framework that are critical</i>	Policy	<ul style="list-style-type: none"> Establish groundwater management framework involving stakeholders Information campaign on implementation of groundwater management policy.
	Legislative	<ul style="list-style-type: none"> Establish mediation mechanisms for conflict resolution Provide greater clarity of rights, duties and institutions for consistent jurisprudence
	Institutional	<ul style="list-style-type: none"> WRU to have a legal status with more staff and equipment Establish areas of potential over groundwater abstraction.
	Strategy/ Guidelines	<ul style="list-style-type: none"> Explicit requirements for groundwater reporting and monitoring Develop awareness campaign on the costs and benefits of groundwater management targeted at the general public Capacitate government institutions in groundwater management (skills and resources) through training, mentoring and funding

Table 9. Action Plan 'Should Haves'

Prioritisation	Element	Description
Should have	Policy	<ul style="list-style-type: none"> Develop groundwater management policy (to include groundwater quality, quantity and groundwater dependent ecosystems – the latter also with regards to marine discharge) <ul style="list-style-type: none"> Establish clear groundwater management objectives Include protection zoning around boreholes areas. Although a guideline is in place that that provides for a 200m radius, this is only for unsewered areas. Include multiple uses of the subsurface space Consider different types of water (freshwater vs. brackish groundwater) Include/exclude concessionary rights depending on availability Establish specific coordination mechanisms in policy for groundwater management
	Legislative	<ul style="list-style-type: none"> Develop groundwater management regulations <ul style="list-style-type: none"> Standard and operating procedures for compliance monitoring and enforcement (including groundwater metering) Establish fines for illegal water use Groundwater monitoring: capturing (including privately held groundwater data), processing, reporting and sharing of data Drilling, borehole construction and completion, pumping tests and water quality tests

Prioritisation	Element	Description
		<ul style="list-style-type: none"> Operation and maintenance of groundwater supply schemes
	Institutional	<ul style="list-style-type: none"> The returns of every ground water user should be compiled in a register. A zonal aquifer aggregate should be compiled and recorded
	Strategy/ Guidelines	<ul style="list-style-type: none"> Implement treasury regulations, guidelines and procedures to minimise delays in procurement by <ul style="list-style-type: none"> Setting priorities Performance monitoring and reporting

Table 10. Action Plan 'Could Haves'

Prioritisation	Element	Description
Could have	Policy	<ul style="list-style-type: none"> Make provisions for groundwater leadership
	Legislative	<ul style="list-style-type: none"> Establish a National Water Act to include provisions for groundwater management <ul style="list-style-type: none"> Statutory rules for timeframes of implementation / updates Multi-sectorial participations in various institutions Pre-authorisation for groundwater use Priority groundwater management areas for issuing groundwater abstraction licenses National Groundwater Strategy
	Institutional	<ul style="list-style-type: none"> Provide adequate training for young professionals
	Strategy/ Guidelines	<ul style="list-style-type: none"> Awareness creation on the value of groundwater infrastructure including instrumentation <ul style="list-style-type: none"> Protection measures Prosecution Incentives Update guidelines and standards with reference to groundwater management regulations

Table 11. Action Plan 'Won't Haves'

Prioritisation	Element	Description
Won't have	Policy	<ul style="list-style-type: none"> Continued overuse of surface "water rights" without proper justification.
	Legislative	<ul style="list-style-type: none"> Continued legal and policy uncertainty regarding groundwater institution
	Institutional	<ul style="list-style-type: none"> Need for organisational reinforcement
	Strategy/ Guidelines	<ul style="list-style-type: none"> Delay in enacting a National Water Law

9. REFERENCES

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APPENDIX A: LITERATURE INVENTORY LIST

No.	Year	Title of Document	Author	Publisher	Report Number
1	2017	National Integrated Water Resources Management (IWRM) Plan	Ministry of Energy and Public Utilities	Government of Mauritius	
2	2017	IWRM Targets & Indicators for Mauritius	Ministry of Energy and Public Utilities	Government of Mauritius	
3	2016	Water Quality Management of the Northern Aquifer of Mauritius	Ministry of Energy and Public Utilities	Government of Mauritius	
4	2014	National Water Policy	Ministry of Energy and Public Utilities	Government of Mauritius	

APPENDIX B: STAKEHOLDER ENGAGEMENT LIST

No	Title	Name	Surname	Affiliation	Role	Sector Group	Telephone	Email	Priority (yes/no)
1	Mr	Luyela	Jean Claude	Ministère du plan (Comité National de l'action de l'eau, de l'hygiène et de l'assainissement)		Ministry of Energy and Public Utilities	243819279331		
2	Mr	Masamba	Cyrille	Ministère de l'énergie (Département de l'eau et de l'énergie)	Director	Water Resources Unit	(230) 4035400	ljuggoo@govmu.org	Yes
3	Mr	Mulwa	Bienvenu	Ministère de l'environnement					(Focal point ?)
4	Mr	Koshi	Georges	Ministère du développement rural (Service National d'hydraulique Rurale)	Engineers	Central Water Authority	(230) 6015000		No
5	Mr	Katende	Trudon	Ministère de l'énergie (Regideso)					
6	Dr	Ilunga	Oly	Ministère de la sante (Pour la qualité des eaux dans les	Planters	Agriculture			No

No	Title	Name	Surname	Affiliation	Role	Sector Group	Telephone	Email	Priority (yes/no)
				zones éloignées de grands centres)					
7	Mr	Ndala	Benjamin	Commision Internationale du Bassin Congo-Oubangui-Sangha					
8	Mr	Jean Michel	Ossete	Global water paternship - Afrique centrale	Small industries	Industry			No
9				Ministère des transports (pour la collecte des données hydrologiques)					
10				Ministère de l'agriculture (Pour l'irrigation à petite échelle)					

Stakeholders Engaged

Name	Organisation
Mr Farook Mowlabucus	Private Consultant
Mr Gowreesunkur Rogbeer	Private Consultant
Mr Rajen Kauppaymuthoo	Private Consultant

Stakeholders that completed the questionnaires

Name	Role and Organisation
Mr Farook Mowlabucus	Former Hydrological Officer at the Central Water Authority, and later Water Resources Unit and presently, consultant
Mr Gowreesunkur Rogbeer	Former Hydrologist at the Central Water Authority, and later, Deputy General Manager, now retired.
Mr Rajen Kauppaymuthoo	Former Water Rights Administrator at the Central Water Authority and presently, consultant
Dr. Virendra Proag	Former Executive Engineer at the Central Water Authority, and presently Associate Professor, University of Mauritius

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 State	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 sectoral policies	Partially achieved	The policy do not make a clear reference to the ground water and the implementation at the appropriate level is not wholly satisfactory
The social, economic and environmental values of groundwater are all recognised	Achieved	
The human right to water is recognized and a rights-based approach to groundwater management is taken, <i>inter alia</i> , through:	Achieved	
Prioritization of drinking water/basic human needs in water legislation	Achieved	This is recognized as an axiom, in different action programmes or guidelines
Ensuring that land-based rights cannot entitle unlimited access/use of freshwater, including groundwater	Partially achieved	The water rights for riparians is still in use without having been updated.
Ensuring groundwater is legally recognized as a public good	Partially achieved	The Groundwater Act still caters for water found on private land.
Recognising the role of groundwater in meeting basic human needs for food security	Achieved	Groundwater contributes to more than 50% of the water supply in Mauritius.
Legal recognition of customary rights to freshwater, including groundwater	Partially achieved	Water Rights and the Groundwater Act have not been updated yet.
Legal mechanisms to ensure gender equity in access, use and management of freshwater, including groundwater	Achieved	All Mauritians are considered equal in Mauritian law.
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	Partially achieved	The water tariff probably needs an updating to ensure that each user understands the value of water.

Minimum Requirement for Desired Future State	Status	Comment
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	Groundwater accounts for more than 50% and is recognised from the Environmental point of view with the EPA Act. Otherwise, there is no distinction during distribution between surface and ground water.
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	Surface water sources are well protected. Boreholes are located away – as far as possible – from possible pollution sources.
The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones);	Partially achieved	The policy is there, but not always applied.
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	The exchange of information that could allow a better water resource management needs to be encouraged so that it allows 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;	Partially achieved	The need for deep studies of the aquifers have been identified for a better understanding of their status
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	Although the roles of the various stakeholders are accepted, their views – even when invited - are not always taken on board

Minimum Requirement for Desired Future State	Status	Comment
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;	Partially achieved	A body – Water Resources Unit (WRU) – has been set up as a department but does not yet have the necessary legal status.
Effective institutional arrangements are coordinated at transboundary, national and local levels;	Achieved	Mauritius is a small country. Transboundary issues not specifically applicable.
Public access to geohydrological data held by the state is promoted and facilitated	Partially achieved	Access to data needs to be made more accessible and readily available to the public
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	Partially achieved	Some of these principles are included in the existing legislation but are not always applied. E.g. exemption of EIAs for certain projects, etc.

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	Partially achieved	There is a need for improvement in awareness and understanding around the importance and contribution of groundwater. The Groundwater Acts is a strong step in that direction.
Explicit reference to groundwater and conjunctive use management in catchment/water management and development plans and drought/emergency management plans	Partially achieved	
Human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users	Achieved	This is provided for in the legislation. However, all strategies/actions have a special focus on basic human right to surface water.

Minimum requirement for desired future	Status	Comment
Regulate Groundwater Quantity		
<i>Provide conditions for accessing groundwater</i>		
Water use authorizations	Achieved	Mauritius has a regulation for the exploration of the ground water; regulation for licences and concessions, address this issue. However, an update would be welcome.
Legislation must enable the authorisation of groundwater use (with a system that does not discriminate, especially against the rural poor);	Achieved	However, an update of the Ground Water Act may be needed
The permitting of groundwater use should not be tied exclusively to land tenure	Partially achieved	An update of the Ground Water Act may be needed
Legislation should allow for the categorisation of water users;	Partially achieved	
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	This exists in the Ground Water Act as well as in the Rivers and Canals Act.t
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	Partially achieved	The Government – through WRU – has some authority, but an update of the Ground Water Act and other relevant Acts is needed
The legislation recognises and legalises affordable, small-scale and indigenous solutions;		Water table is quite deep. Boreholes have to be drilled.
The legislation should enable the regulation of borehole drillers, regulation for drilling, control of drillers, information from drillers and standards for borehole drilling;	Achieved	Mauritius has a basic guideline that includes provisions for groundwater exploration, such as borehole drilling permit system and groundwater licensing.

Minimum requirement for desired future	Status	Comment
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	Mauritius has a basic guideline that includes provisions for ground water exploration. It can be updated to fulfil the new knowledge of the art.
The legislation should enable the regulation of exploration	Achieved	The regulation already exists and is implemented
The legislation should allow for zoning for overused/fragile aquifers;	Partially achieved	The legislation exists, but not always easy to apply, as Mauritius is a small country.
Groundwater use organizations should be integrated into existing institutional frameworks (e.g., catchment management, customary institutions)	Partially achieved	There is no specific ground water use organization in Mauritius. Although the Water Resources Unit is responsible for the overall water resources, the lack of clarity around its legal status does create challenges
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	To be reinforced and inserted in the relevant legislation
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	Public consultation is present for any development project undergoing various assessments (e.g. EIA's, PER) but more extensive and meaningful participation of relevant stakeholders across all levels is required to contribute to decision-making 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.	Partially achieved	To be inserted in the relevant legislation
Monitoring and data collection to support regulation		

Minimum requirement for desired future	Status	Comment
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	Partially achieved	Although practiced as a guideline, there is still need for it to be inserted in the relevant legislation
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	Partially achieved	The water situation during the year is monitored at the Water Resources Unit and coordinated with other stakeholders at the level of Ministry of Energy and Public Utilities through the Water Resources Monitoring Committee, however there is the lack of clarity around the legal status of WRU.
In transboundary basins, legislation should address the need for standardization and exchange of data as well as the establishment of joint inventories; and	Not applicable	
The legislation should enable access by the public to geohydrological data held by the state.	Partially achieved	To be inserted in the relevant legislation
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	To be reinforced in the relevant legislation
Compliance and Enforcement		
Clear mechanisms for promoting compliance with groundwater regulations should be included in the legislation	Partially achieved	To be inserted in the relevant legislation
Enforcement provisions should include, <i>inter alia</i> , inspections authority for groundwater management institutions, the ability to impose fines and/or additional administrative penalties and adjust those as necessary, and	Partially achieved	To be inserted in the relevant legislation. The present procedure is very lengthy, and high chances of the contraveners escaping liability.

Minimum requirement for desired future	Status	Comment
enumerate criminal offenses associated with failure to comply with the law.		
Conflict resolution mechanisms and/or the right to appeal	Achieved	Exists in the rule of law of the country, but could be improved by specific insertion in the relevant legislation
Regulatory measures		
The legislation must enable the relevant authority (Minister) to make regulations on any relevant matter in the legislation	Achieved	The Minister has the power to do so.
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	There is appropriate legislation but lack of reinforcement and implementation challenges.

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

Minimum requirement for desired future	Status	Comment
Groundwater Protection Mechanisms		
<i>Regulating Pollution (Point source and non-point source)</i>		
Water quality targets;	Achieved	Exists in Regulations
Regulation of emissions/wastewater discharge/waste storage including the impact of mines on groundwater quality:	Achieved	Exists in Regulations
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	Exists in Regulations, can be further reinforced
Classification of water bodies; and	Achieved	Exists in Regulations

Minimum requirement for desired future	Status	Comment
Reducing and regulating abstraction.	Partially achieved	Exists in Regulations, requires further reinforcement
Powers of compliance monitoring and enforcement	Partially achieved	Exists in Regulations
Regulating Depletion		
Regulation of abstraction and recharge (usually via permitting)	Partially achieved	Exists in Regulations
Sustaining wetlands;	Partially achieved	Exists in Regulations
Land use zoning – prohibition of abstraction in certain zones; cropping or irrigation practices; protection zones for recharge areas; no surfacing/drainage requirements; and	Partially achieved	Exists in Regulations
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).	Achieved	Exists in Regulations, but enforcement is required
Powers of compliance monitoring and enforcement	Partially achieved	Exists in Regulations, but enforcement not always easy or possible.
Planning		
The legislation should specify the need for long term plans to ensure the sustainable use of groundwater, including drought management plans and cross-sectoral coordination;	Partially achieved	Master plans have been made for Water resources (including ground water) with phased implementation.
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	An integrated approach is adopted in planning of projects for water resources development, but greater emphasis on groundwater is needed in legislation.
The legislation should specify that groundwater management planning should	Partially achieved	Generally, guidelines exist, but not always followed and enforcement done but may require further consideration.

Minimum requirement for desired future	Status	Comment
take into account and be integrated into land use and environmental planning; and		
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	There is some feedback which takes place, but regularly (and seasonally) the public is advised to reduce their water consumption. Awareness campaigns are organised for efficient use of water

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

Minimum requirement for desired future	Status	Comment
Institutional Arrangements		
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	Some data, expertise, and staff are missing
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;	Partially achieved	
The authority or body should collaborate with other authorities, competent for public health, land-use planning, soils management, waste management; an	Partially achieved	Normally done but requires further consideration.
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	To be inserted in the relevant legislation

Reflection of subsidiary, legislation, regulations and standards as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
Subsidiary legislation or regulations pertaining to		
use	Partially achieved	Exists in several laws in other fields, e.g. environment, agriculture, industry, etc
protection including on-site sanitation	Partially achieved	
borehole drilling, and	Achieved	
Clear protocols and standards on data collection and storage		Maybe improved upon. May be inserted in relevant law updates.
Template for municipal by-laws. Municipality bylaws should be the preferred solution and advocacy should be with the municipalities. (Is the focus on both rural and urban municipalities, authorities, councils?)	Partially achieved	.
Community management of groundwater and community participation in groundwater management	Partially achieved	To be inserted in relevant law updates. However, community is involved in management of groundwater through sensitisation over the importance of this resource to Mauritius

Reflection of actors/role-players as per the minimum requirement for the Desired Future State

Minimum requirement for desired future	Status	Comment
An apex body responsible explicitly for Groundwater management and playing the role of custodian/trustee on the part of the state.	Partially achieved	A body – Water Resources Unit (WRU) – has been set up as a department but does not yet have the necessary legal status.
Some degree of stakeholder engagement so that water users, in particular, can engage with government on issues of groundwater management	Partially achieved	To be inserted in the relevant legislation

Minimum requirement for desired future	Status	Comment
Intersectoral collaboration so that the needs and impacts of different sectors e.g. agriculture, mining and industrial, domestic, ecosystems, are taken into account in groundwater management	Partially achieved	The exchange of information that could allow a better water resource management needs to be promoted. Nevertheless, intersectoral coordination does exist to a certain extent



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