



Joint Strategic Action Plan for the Ramotswa Transboundary Aquifer Area



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Executive Summary

Overview and Aims: The objective of the Joint Strategic Action Plan (JSAP) for the Ramotswa Transboundary Aquifer Area (RTBAA) is to contribute to the sustainable and equitable joint development of the RTBAA through consensus building between South Africa and Botswana on priority activities and investments in the use and development of the transboundary RTBAA and related resources. The JSAP process focused on developing an agreed-upon suite of objectives, targets and actions as a starting point for joint management of the shared RTBAA resources. While the JSAP provides a basis for resources mobilization and project implementation, these activities are viewed as next steps that follow the JSAP rather than forming part of the JSAP.

Background: The report first conceptualises the role and form of a JSAP and defines the precise geographic boundary of interest. The key issues for the sustainable use of the RTBAA are outlined, as identified in the RTBAA baseline report. These key issues include:

1. Understanding the resource
2. Groundwater contamination and vulnerability to pollution
3. Incongruity between water requirements and available water
4. Limited policy implementation
5. Access to water and sanitation for vulnerable people

Methods: In broad terms, the methodological approach focused on participation and consultation, moving through four phases, namely:

1. Development of a joint vision and framework for the RTBAA
2. Identification of objectives, targets and actions to achieve the vision and framework
3. Review of the compatibility of actions to the current institutional framework, and classification and filtration of actions to find those that are low-cost (< USD 50 000) and immediately implementable (<2 years)
4. Prioritisation and characterisation of actions to facilitate next steps based on the viewpoints of the Department of Water Affairs (DWA) Botswana, the Water Utilities Corporation (WUC) Botswana, and the Department of Water and Sanitation (DWS) South Africa

In late 2016, meetings were held at the DWS-BW, WUC and DWS-SA to elaborate the joint vision and framework. Throughout most of 2017, consultations were held with those same organizations to seek input on the objectives, targets and actions in the context of the agreed framework. At this time, an institutional analysis was undertaken to place proposed actions in context. Actions were filtered according to three criteria of 1) cost, 2) time frame and 3) national or transboundary orientation, in an attempt to identify cooperative actions that were more easily implementable, i.e., low-cost and short-term. Feedback was facilitated from the DWS and DWA. Consultations continued into 2018 to prioritise actions based on the views of the DWS and DWA and to develop actions into future projects.

Vision and Framework: The joint vision for shared management of the RTBAA is:

Water security and sustainable socio-economic development in the Ramotswa TBA area through joint research and management

The JSAP framework contains three components:

- i. Managing water for sustainable use, availability and access
- ii. Enhancing institutions and capacity
- iii. Expanding research and knowledge

Objectives, Targets, Actions: In each of the JSAP's three components, a set of objectives, targets and actions were elaborated. Elaboration of objectives and targets served as increasingly focused steps that allowed stakeholders to 'zoom in' to the more specific focus expressed in actions.

The first component focused on *managing water for sustainable use, availability and access*, for which four objectives were identified. These include 1) to enhance monitoring of the aquifer's groundwater levels, 2) to achieve sustainable and equitable water apportionment and/or allocation, 3) to develop measures to control pollution and 4) to improve agricultural water use efficiency. Within these three objectives, a set of 39 actions aimed at achieving 13 targets were specified.

The second component focused on *enhancing institutions and capacity*, with four objectives identified. These include 1) to foster harmonization across institutional structures, 2) to propose and develop relevant transboundary agreements, 3) to develop tools for institutional capacity needs assessments and implementation plans and 4) to increase technical capacity through tailored training. Within these four objectives, 11 targets were itemised and 35 actions were specified.

The third component focused on *expanding research and knowledge*, and four objectives were identified. These include 1) to develop a customized monitoring programme, 2) to explore and identify alternative management options, 3) to integrate different databases and 4) to enhance public and stakeholder communication and profile-raising. Within these 4 objectives, a set of 13 targets were identified and 41 actions specified.

Actions in institutional context: The legal and institutional contexts in the two countries are generally compatible with the JSAP and identified actions are largely supported by existing institutional structures. Further, the JSAP vision and framework is consistent with broader institutional frameworks for transboundary water management. Nevertheless, there may be certain gaps or loopholes which could be addressed to better enable SAP implementation. Examples of such gaps include the absence of a joint management structure that can coordinate RTBAA activities at the international level, the absence of a joint borehole monitoring system and unclear rights of the aquifer. Institutional reforms in certain areas may enhance the implementation of the JSAP. Such areas include establishing bilateral agreements to define rules and procedures on exploitation of the aquifer and putting in place an effective information exchange platform.

Classifying low-cost, short-term actions: More than forty actions were identified as low-cost, short term actions that can be undertaken in less than two years for under USD 50 000. More than half of such actions were judged to be transboundary rather than national in nature. In particular, actions within the components of *i) enhancing institutions and capacity* and *iii) expanding research and knowledge*, are frequently transboundary in orientation. These realities reveal the potential for movement on cooperation-strengthening activities in the near-term.

Prioritizing and characterizing actions: A set of 27 actions were identified as priority actions through further national consultations. These prioritised actions were characterised with specific estimations of cost, time frame and modalities of implementation. Approximately 50

actions showed potential for implementation immediately. More than half of these prioritised actions are common to the low-cost, short-term actions identified through the classification exercise. Examples of priority actions include:

- Review existing regulatory instruments and monitoring systems to assess compatibility and needed revisions
- Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling (distinguishing between municipality and community/individual boreholes)
- Revise by-laws to encompass groundwater protection
- Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access
- Conduct assessments (borehole monitoring) using measurements of abstraction, water level and water quality
- Identify gaps in existing data collection to set up new monitoring activities
- Investigate socio-economic implications of water access challenges
- Assess institutional arrangements for monitoring, including roles and responsibilities
- Identify data gaps on RIMS and locate missing data for upload
- Enter into transboundary dialogue to assess the similarities and differences in monitoring and research practices
- Formalise reporting process (prior notification) around plans between countries and foster interaction in planning process between countries (exchange draft plans concerning developments affecting transboundary Ramotswa area)
- Agree on joint monitoring practices for harmonised data collection that eliminates data gaps
- Improve public awareness for addressing myths and misunderstandings including 1) value of groundwater and confidence regarding its hidden nature; 2) the value of wastewater reuse; 3) the value of research and new technologies

Conclusions: This JSAP identified more than 100 actions that can improve water management in the RTBAA and build an enabling institutional context in which to pursue them. These actions contribute toward realisation of the joint vision and address key issues identified in the baseline report. More than one-third of the actions were determined to hold promise for implementation in the near-term at minimal expense. Of these low-cost, short-term actions, more than half were judged to be transboundary in nature. Actions within the components of institutions and capacity, and expanding research and knowledge, hold particular potential for cost-effective cooperative action in the near-term. Through the prioritization process it became evident that some action types were recurrent, including the need to establish joint data and monitoring, to put in place institutional structures that enable ongoing transboundary cooperation and to conduct further assessments and research to better understand the context for water management in the RTBAA.

Moving Forward: The JSAP process marks the first step of many in the joint management of the RTBAA. Moving forward, establishing joint data and monitoring practices and establishing the appropriate institutional structures for ongoing water management appear to be key enabling priorities. Critical to effective advancement of JSAP priorities is the active leadership from respective government ministries, coupled with broader regional facilitation through the JPTC and LIMCOM.

Acronyms and abbreviations:

AMCOW	African Ministers' Council on Water
DWA	Department of Water Affairs (Botswana)
DWS	Department of Water and Sanitation (South Africa)
EWR	Ecological Water Requirements
GWP	Global Water Partnership
IGRAC	International Groundwater Resources Assessment Centre
IWMI	International Water Management Institute
JPTC	Joint Permanent Technical Committee
JSAP	Joint Strategic Action Plan
LIMCOM	Limpopo Watercourse Commission
RAMOTSWA	Resilience in the Limpopo Basin: The potential role of the transboundary Ramotswa Aquifer project
RIMS	Ramotswa Information Management System
RTBAA	Ramotswa Transboundary Aquifer Area
SADC	Southern African Development Community
SAP	Strategic Action Plan
TDA	Transboundary Diagnostic Analysis
USAID	United States Agency for International Development
WLE	Water Land and Ecosystems
WUC	Water Utilities Corporation (Botswana)

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1. Introduction

1.1 Rationale and Aims

What is a Strategic Action Plan (SAP)?

In the context of water management, a strategic action plan (SAP) can be defined as a tool or framework for identifying investments and interventions that help improve water use and increase the composite benefits derived therefrom. The scale at which SAPs are undertaken often correspond to a hydrologic unit such as a basin, sub-basin or aquifer. Given that such units often cross borders, SAPs are often transboundary in nature, where they are jointly developed by involved states, hence the term joint strategic action plan (JSAP). A SAP has been referred to as “a tool that describes the framework for management of the water and related land resources in the basin” (GWP, 2012). It has also been called “...a framework for cooperation among the riparian countries to utilise the full potential of sustainable benefits of the water and related resources” (Mortensen, 1997). A SAP has also been described as “a negotiated policy document that identifies policy, legal and institutional reforms and investments needed to address water and environmental issues. It identifies priorities for action by all the riparian countries involved to resolve the transboundary problems that have been identified in the transboundary diagnostic analysis (TDA). A SAP is also a long-term framework for management, through which infrastructural investments for socio-economic development can be mobilised in a sustainable, equitable and efficient manner” (Volta Basin Authority, 2014).

A SAP typically builds on previous identification of priority issues to converge on a shared vision and objectives. This is followed by more specific articulation of actions under the basin plan (Figure 1).

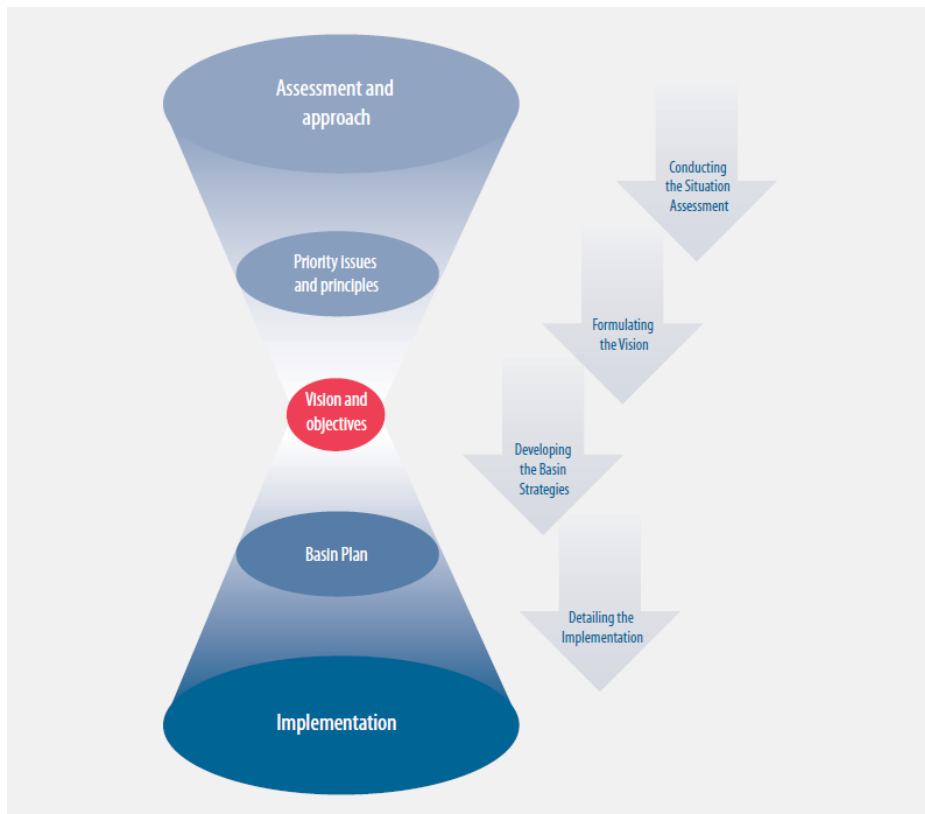


Figure 1: From TDA to Basin Plan/ SAP (Pegram et al., 2013)

Aims and Rationale for undertaking a JSAP in the Ramotswa Transboundary Aquifer Area (RTBAA)

The Ramotswa Transboundary Aquifer Area (RTBAA) Joint SAP (JSAP) was undertaken to identify and prioritise investments and actions that can be pursued to enhance the benefits derived from the shared resource. Investments and actions respond to key challenges identified in the baseline report (Altchenko et al., 2016), but also go beyond addressing challenges to consider ways to harness opportunities accruing from integrated management of the RTBAA system. Ultimately, identification and strategic formulation of interventions in the RTBAA is expected to contribute to optimizing management of the aquifer system and, through this, to contribute to broader developmental goals in the area and region, such as resilience-strengthening and socio-economic development. These are also the overall goals of the RAMOTSWA-2 project.

Structure of the RTBAA JSAP

This document provides a description of the process of JSAP development, outlines the actions identified through that process, and lays out some paths forward for implementation of identified actions. Structurally, JSAP document consists of seven main sections.

1. The first section reviews the key issues identified in the baseline report and introduces the JSAP.
2. The second section reviews the process through which the JSAP was developed, and how it builds on the baseline report.
3. The third section elaborates the JSAP framework and components.
4. The fourth section expounds the objectives, targets and actions that were identified in each component.
5. The fifth section reviews the institutional context in which implementation of the JSAP is situated.
6. The sixth section filters SAP actions according to three criteria – timeframe, cost and level of cooperative engagement (i.e. national or transboundary) – to identify low-cost, short-term actions.
7. The seventh section prioritises and characterises actions, a process derived from national consultations.
8. A final section looks at next steps and ways forward.

Uptake and Dissemination

While the JSAP is primarily intended for use by RTBAA-sharing states, it carries broader importance as one model of cooperation on a shared aquifer. As such, the completed JSAP will be announced and disseminated to regional and global institutes active in groundwater and transboundary water management. In particular, the JSAP will be shared with donors and other third parties (media, the public, transboundary and regional bodies) to attract attention, support and funding to foster progress on the JSAP implementation.

1.2 Background

The Ramotswa Aquifer and the Ramotswa Transboundary Aquifer Area

Ramotswa Aquifer The Ramotswa dolomitic aquifer extent is mapped based on surface geology (Figure 2, upper left). The island left blank (in white) is the area where dolomite is not mapped in the geological map from the Council of Geoscience, South Africa. However, based on airborne geophysics survey cross-section and the general geology, it was assumed that dolomite exists in that area.

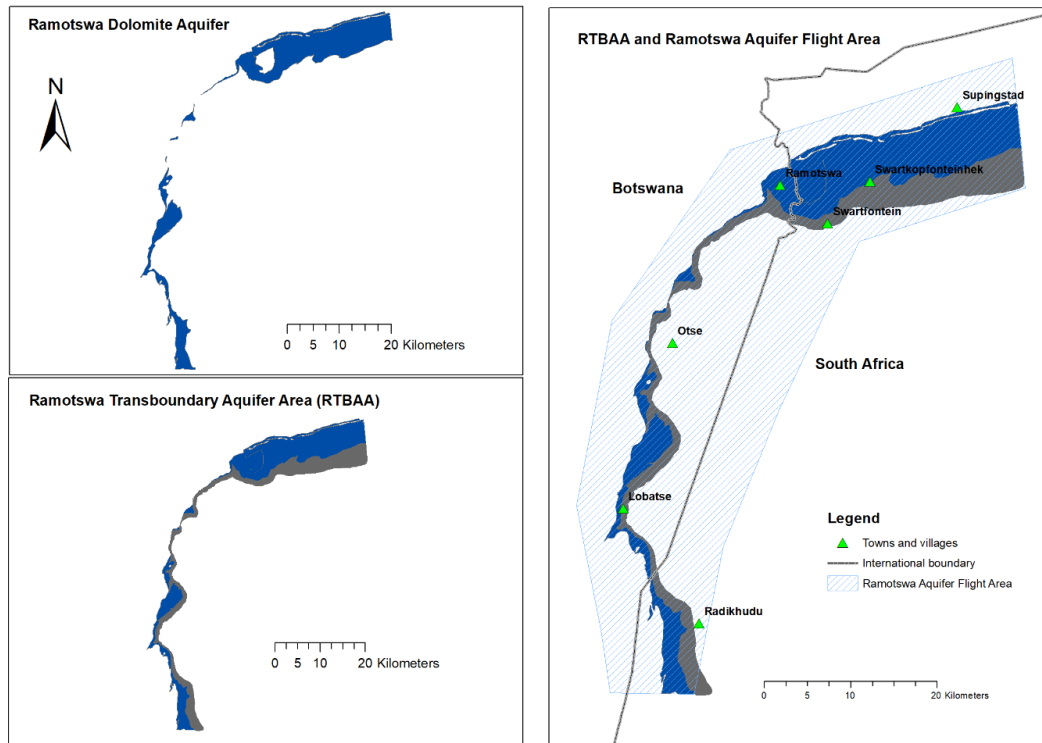


Figure 2: Ramotswa Aquifer, Ramotswa Transboundary Aquifer Area and Ramotswa Aquifer Flight Area

Ramotswa Transboundary Aquifer Area (RTBAA) RTBAA is a slightly broader term than the strict aquifer boundary. RTBAA is used to capture areas in the subsurface that are hydrologically linked to the aquifer, but which lie outside the dolomitic aquifer boundaries delineated based solely on surface geology. The boundaries of the RTBAA extend beyond the outcrop boundaries of the Ramotswa Aquifer (Figure 2, bottom left). The boundaries were extended based on dolomite sub crop and outcrop identified during the geophysics work (Genco and Pierce, 2016) and dolomite outcrop from the Google earth.

Ramotswa Aquifer Flight Area The flight area (about 1,500 km²) was commonly used as an encompassing boundary for the aquifer. It was used to overcome ambiguities surrounding the precise boundary of the aquifer. Airborne geophysical surveys conducted during phase 1 of the RAMOTSWA project took place within this flight area (Figure 2, right side).

Gaborone Dam Catchment The catchment area located in the Upper Limpopo River Basin (Area ~4,318 km², Figure 3) encompasses the immediate surface water boundaries within which the Ramotswa Aquifer is located. Given the linkages between surface and groundwater, the catchment is a very logical scale to use. Phase 2 of the RAMOTSWA project treats the Gaborone Dam Catchment as its project study area.

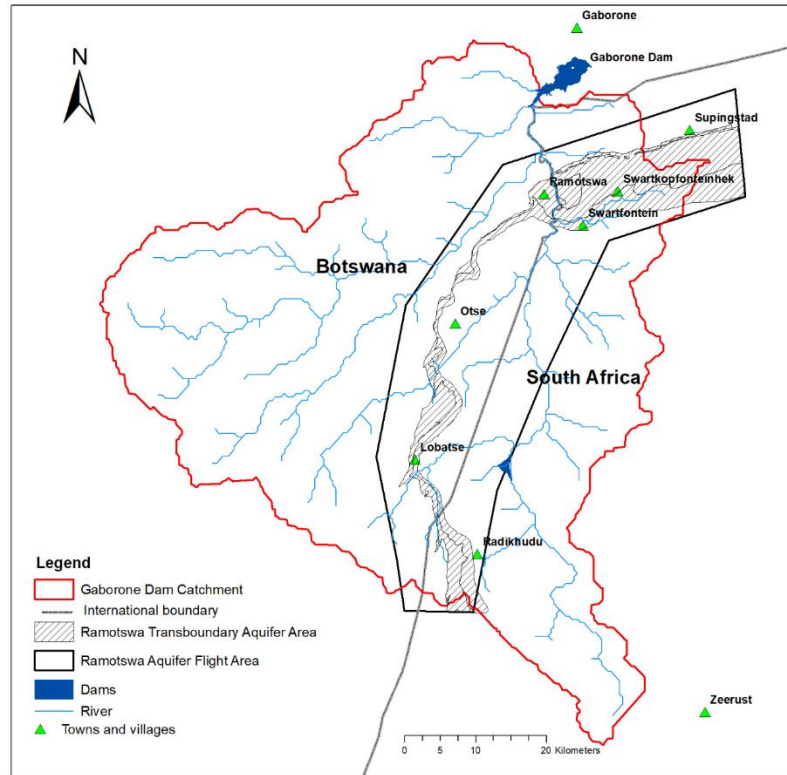


Figure 3: Gaborone Dam Catchment

The RAMOTSWA Project The overall objective of the “The potential role of the transboundary Ramotswa Aquifer” project (referred to as the RAMOTSWA project) is to support cooperation and a long-term joint vision on the shared groundwater resources of the Upper Limpopo region. The Upper Limpopo Region is a region in which states share significant and valuable underground freshwater resources, as well as space for enhanced subsurface water storage. The project aims to facilitate and promote joint management and better groundwater governance focused on coordination, scientific knowledge, social redress and environmental sustainability. Successful joint efforts, will result in reduced poverty and inequity, increased prosperity, and improved livelihoods through water and food security in the face of climate variability and change. The first phase of the RAMOTSWA project, which ran from July 2015 through February 2017, was funded by the Resilience in the Limpopo Basin (RESILIM) programme with matching funding from the CGIAR Research Programme on Water, Land and Ecosystems (WLE), the International Groundwater Resources Assessment Centre (IGRAC) and XRI Blue. RESILIM was funded by the United States Agency for International Development (USAID). A second phase of the RAMOTSWA project (known as RAMOTSWA-2) is directly funded by the USAID. It was launched in May 2017, and lasts through May 2019.

The Transboundary Diagnostic Analysis and the Baseline Report The RTBAA baseline report development was undertaken between September 2015 and November 2016 and involved participation from key partners. Partners from Botswana include the Water Utilities Corporation, the Department of Water Affairs (DWA), the University of Botswana and the Botswana Geoscience Institute (BGI). Partners from South Africa include the Department of Water and Sanitation (DWS), University of Witwatersrand and University of Free State (South Africa). The report presents climatic conditions, known characteristics of surface and groundwater resources, and water supply and sanitation conditions in the RTBAA. Socio-economic context and livelihoods are also covered. Further, the report highlights the stakeholders involved in water management and identifies key environmental issues and

existing data gaps in RTBAA. Ultimately, the expanded knowledge base on the RTBAA contained in the baseline report is distilled into five key issues for the sustainable use of the RTBAA.

Key issues for sustainable use of the Ramotswa Transboundary Aquifer Area The work undertaken to arrive at the baseline report was synthesised into five key management issues. These issues are:

1. *Understanding the resource:* The baseline report identifies substantial data gaps, which will need to be addressed in order to lay a basis for informed decision making on use of the groundwater. For example, management parameters related to groundwater recharge and withdrawal remain uncertain. Broader data needs cut across different areas, including climate, hydrology, hydrogeology, socio-economics and water supply and sanitation.
2. *Groundwater contamination and vulnerability to pollution:* One of the major issues concerns the risks associated with the proximity of on-site sanitation systems to boreholes. This presents an imminent threat, given that boreholes are a main source of water, especially in rural areas and in small urban areas such as Ramotswa and Lobatse where the risk of nitrate and faecal bacteria contamination from human excreta is recognized. Other sources and risks of groundwater contamination may be relevant but are so far un-recognized.
3. *Incongruity between water requirements and available water:* The discrepancy between local water availability and aggregate water requirements poses challenges to water security. These are manifested in two ways. Firstly, physical water scarcity - mainly on the Botswana side of the border - means that water is simply not available to meet requirements; and secondly, economic water scarcity – mainly on the South Africa side of the border – is evidenced by low levels of infrastructure and service delivery and constrains the use of water to meet requirements.
4. *Limited policy implementation:* Challenges with the policy implementation and institutional compliance have hampered the effectiveness of water management. Such challenges may be caused by a lack of capacity due to limited staff and financial resources, as well as constraints related to the technical skills or expertise of staff.
5. *Access to water and sanitation for vulnerable people:* A vulnerable group is a population that has some specific characteristics that make it at higher risk of falling into poverty than others living in area (World Bank, 2016). Vulnerable groups in the RTBAA face inadequate water and sanitation access, often due to a lack of financial resources to ensure sufficient and continuous service during drought conditions or infrastructure/service delivery failure. Data from census reports in both countries reveals disparities in socio-economic levels, which may manifest itself in inadequate access to water and sanitation for certain population groups.

Building on ongoing activities Recent and ongoing activity in the RTBAA fed into the process of defining and prioritising objectives, targets and actions. Information gathered from existing boreholes, including water abstraction, level and quality data, and available meteorological data helped understand the biophysical context. High-resolution airborne magnetic data, geological maps and groundwater vulnerability maps further supported this understanding, in addition to concurrent efforts to better characterise the aquifer using hydrogeological and water quality models under the RAMOTSWA project. Current and planned investments were considered through the knowledge of stakeholders engaged in the process.

2. Methods for Developing the JSAP

2.1 Approach and Process

A qualitative approach was employed, relying on acquisition and review of stakeholder views and policy documents. The process began with a project training workshop in Mahikeng in September 2016, and subsequently followed the steps shown in Figure 4. The background, rationale and process of the RTBAA JSAP are introduced and discussed here.

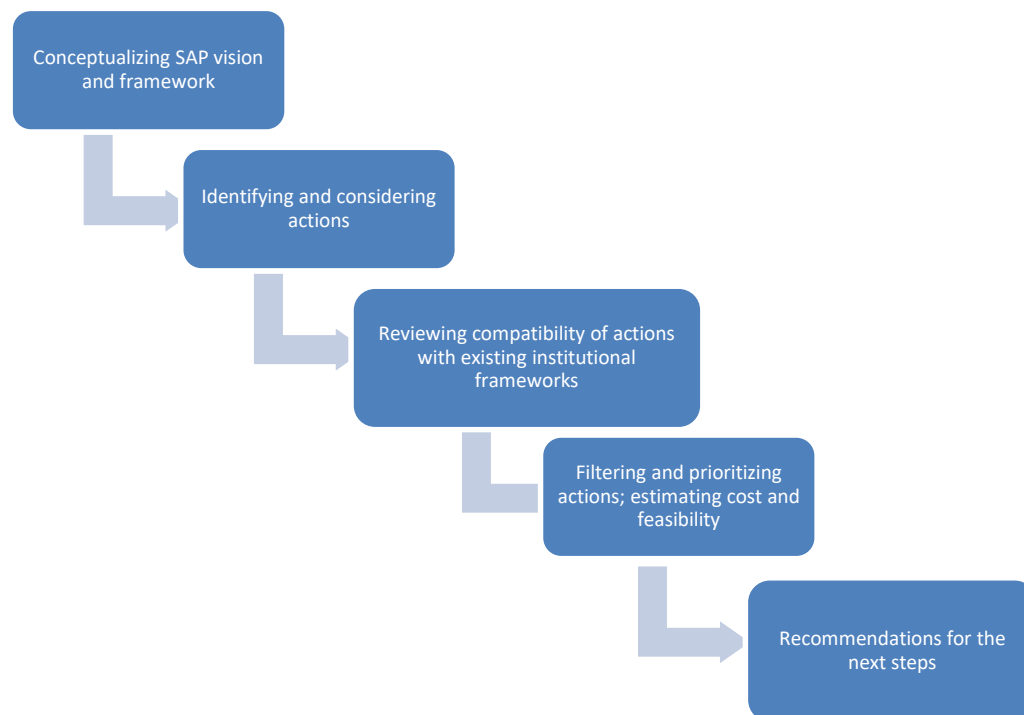


Figure 4: Steps for Developing the Joint Strategic Action Plan

Conceptualizing a shared vision and framework Development of the JSAP framework focused on identifying the set of components, into which priority actions could be logically clustered. The last quarter of 2016 was heavily devoted to finalizing the vision and framework. Important first steps in JSAP development, largely undertaken through the September 2016 workshop and November 2016 consultations, were: i) generating an overarching vision for the joint transboundary management of the RTBAA, and ii) working toward a framework within which particular actions would fall. Each consultation took approximately three hours, and focused on validating key issues for sustainable use of the RTBAA as identified in the baseline report, and brainstorming a JSAP vision statement and framework to structure the more specific management aims.

Identifying actions The process of discussing priorities for actions and investments commenced at the RAMOTSWA project training workshop on 1 and 2 December, 2016 in Johannesburg. Three focused consultations (~every third month) were then held in each country in 2017 to obtain inputs and feedback on progress. Participants numbered from roughly five to more than 10. Such consultations usually also included a review of the project and provision of any project updates. The primary focus of such consultations, however, was to brainstorm activities for the JSAP components, with each of the three consultations devoted to one of the three components in the JSAP framework. A framework using

objectives, targets and actions was adopted to allow participants to drill down to specifics. (Figure 5).

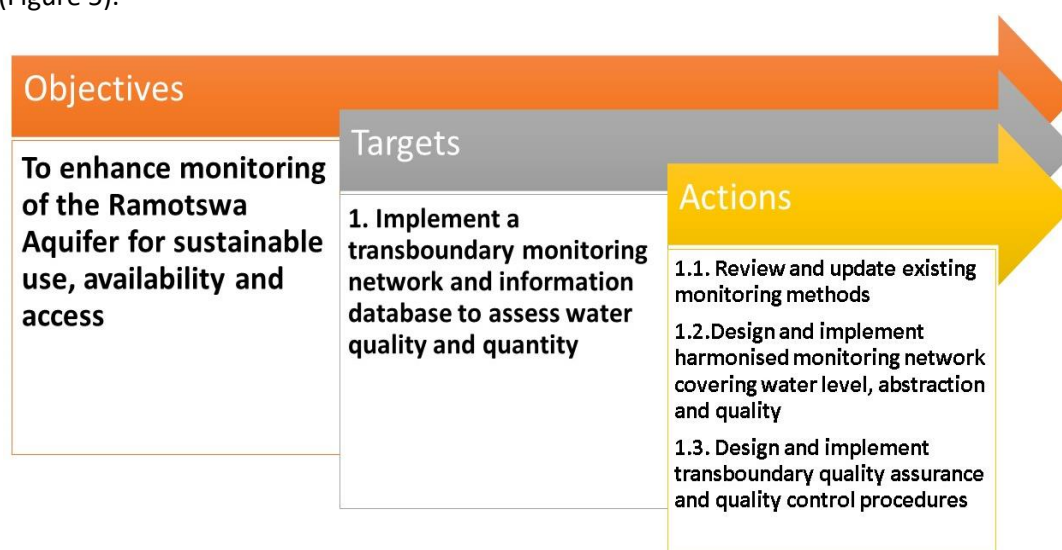


Figure 5: Format of objectives, targets and actions

Reviewing compatibility of actions with existing institutional frameworks A review of relevant international and regional frameworks and national institutions in Botswana and South Africa was undertaken to contextualise the set of actions identified in the JSAP. Thus, the degree to which proposed actions are consistent with existing institutions at all scales was evaluated. This was done by systematically considering each action against the procedural, substantive and structural elements of the institutional framework as a whole in its current state. Gaps or loopholes and constraints were also identified, which helped to reveal potential reforms that may facilitate implementation of the JSAP.

Classifying and filtering actions Following consideration of proposed actions within the existing institutional context, actions were classified according to three criteria: cost, time frame, and scale (Table 1). The thresholds for the criteria were adapted from similar SAP processes. Actions costing USD 50 000 or less were classified as low (\$), those with a budget of between USD 50 000 and USD 250 000 were classified as medium (\$\$), and those with a cost of over USD 250 000 were classified as high (\$\$\$). Actions that can be implemented within a two-year time frame were classified as short term (ST), those achievable between two and five years were classified as medium term (MT), and those that require longer than five years to complete were classified as long term (LT). Lastly, actions that appeared nationally focused and unlikely to benefit from cooperation were classified as national (N), and actions that outrightly required, or could benefit from, international cooperation were classified as transboundary (T).

Table 1: Filtering identified actions

Parameter	Categories	Explanation
Cost	Low (\$)	Cost of implementation < USD 50 000
	Medium (\$\$)	Cost of implementation from USD 50 000 to 250 000
	High (\$\$\$)	Cost of implementation > USD 250 000
Time Frame	Short term (ST)	Implementation within 2 years
	Medium term (MT)	Implementation from 2 to 5 years
	Long term (LT)	Implementation more than 5 years
Scale	National (N)	Implementation is nationally focused
	Transboundary (T)	Implementation may benefit from international cooperation

Filtering of actions was guided by the overarching aim of identifying low-cost, short-term actions. In practical terms, these were actions with low budgets of less than USD 50 000. They were also actions that could be realised in shorter times frames (i.e. less than two years). Following application of these two criteria, focus was placed on differentiation between actions that are national versus transboundary in nature. In principle, joint actions may be preferable to unilateral ones since joint actions also bring benefits associated with advancing cooperation; however, a combination of both national and transboundary actions enable a more holistic approach.

Prioritizing and characterizing actions In 2018, further consultations helped prioritise and characterise actions to move toward implementation. A local workshop in Mahikeng, South Africa, was held to add local context to the JSAP process, and an additional 3 national consultations were held (2 in Botswana, 1 in South Africa). These consultations were conducted in breakout groups according to the three components of the SAP: 1) managing for sustainable use, availability and access, 2) enhancing institutions and capacity, and 3) expanding research and knowledge. Participants in each group selected three priority actions from the larger list and then characterised each of the three priority actions with estimations of cost, time frame, and other modalities for implementation.

The process of reviewing, classifying and prioritizing the identified actions is summarised in Figure 6. In addition, the attendance lists of all workshops and national consultations is included in Annex 3.

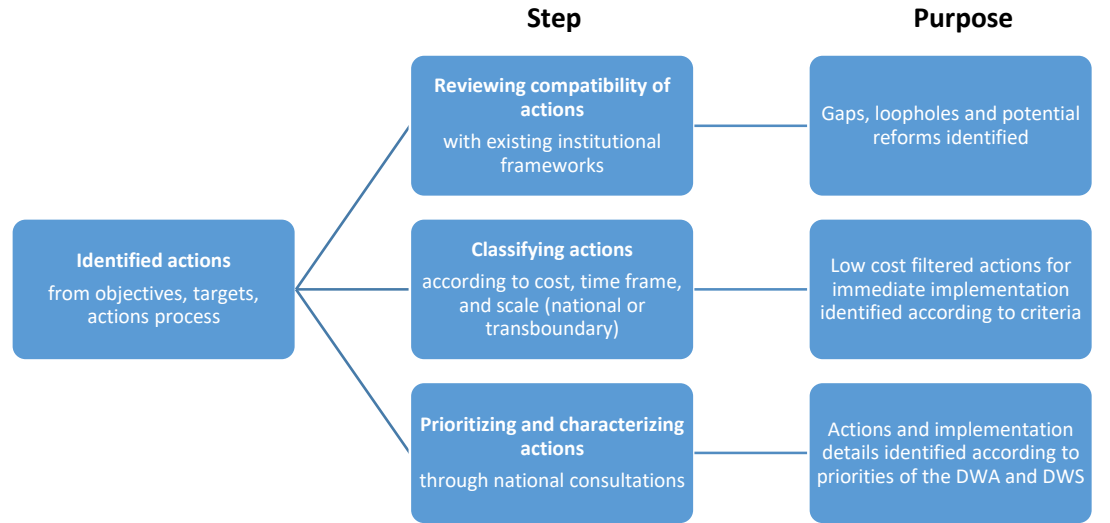


Figure 6. Outcomes of reviewing, classifying, prioritising and characterising identified actions

3. Vision and Framework

Development of the JSAP vision and framework focused on agreeing on a shared vision and identifying the set of components into which priority actions could be logically clustered.

3.1 Consultation in Botswana

Brainstorming around key elements of a vision in Botswana led to five key areas: sustainable socio-economic development, sharing and cooperation, guaranteeing future use, sustainable use, and protection of the resource. These key areas were synthesised into the following vision statement:

'To achieve cooperative and sustainable groundwater use and protection in order to guarantee future use and contribute to sustainable socio-economic development.'

Five components of the JSAP emerged. The first component focused on water quality, and included contamination, vulnerability and pollution sources. The second component focused on water quantity and filling knowledge gaps, including data monitoring and harmonization. The third component focused on water management, which included issues of demand management and vulnerability. The fourth component focused on capacity building, including training and retaining expertise and staff. A final component focused on climate change adaptation, which places focus on identifying climate change impacts on the aquifer.

3.2 Consultation in South Africa

Discussions in South Africa focused on areas that could fit into either or both the vision and framework. Emerging key areas included water security for different uses, improving understanding of the aquifer, activities in the aquifer area, land and water use, protection, management, capacity, sustainability, resource protection, harmonization with existing legal frameworks, joint monitoring and data sharing, as well as cooperation on all levels including stakeholders. Many of these key areas are principles of the South African Water Policy. These key areas were brought together into the following a vision statement from the South African side:

To improve understanding and management of the aquifer area to achieve water security, ensuring sustainable socio-economic development and environmental needs.

Discussions on vision statements fed directly into conceptualization of a framework. A framework emerged that focused on five key areas: 1) improving knowledge and understanding, 2) protection of the resource (quality and quantity), 3) resource availability and access, 4) sustainable use for socio-economic and environmental needs, and 5) strengthening capacity on all levels (financial, human resources / staff / expertise). Overlap was identified in some of these key areas, producing a refined framework that fed into the Joint Vision and Framework (Figure 7).

3.3 Shared vision and framework

Following the drafting of two separate JSAP visions and frameworks in the aquifer-sharing states, efforts were made to achieve a consolidated joint framework for the RTBAA. Vision statements were merged in a way that captures elements critical to both sides. A consolidated vision and framework were then presented and further refined at a RAMOTSWA project training on 1 and 2 December, 2016 in Johannesburg. These refinements primarily reduced the length of the vision to a more condensed statement. The framework, in turn, was reduced from four to three components; components that initially addressed water quality and water

quantity separately were merged into a consolidated component on water management. The joint working version of the vision was (Figure 7):

‘Water security and sustainable socio-economic development in the Ramotswa TBA area through joint research and management.’

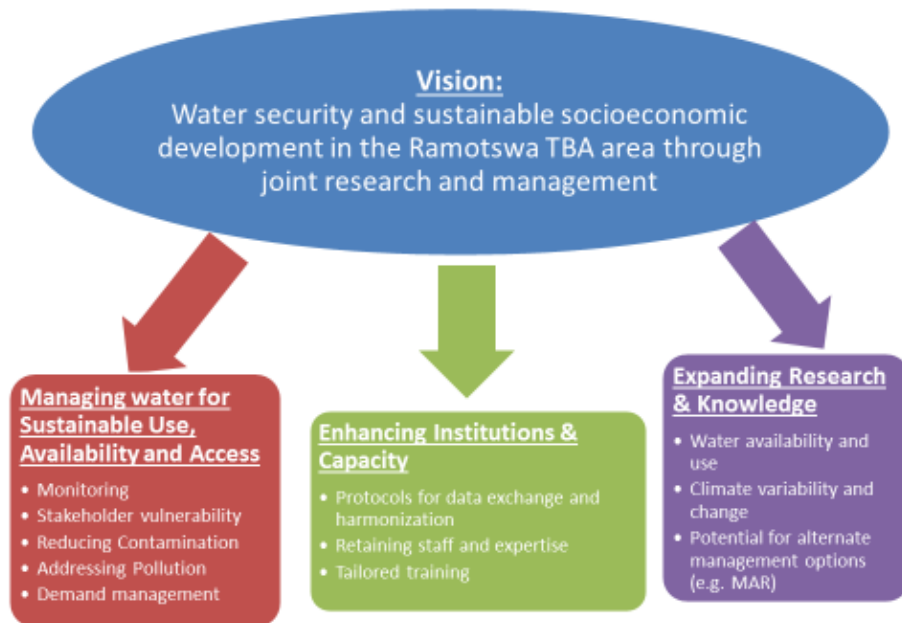


Figure 7: The Joint Vision and Framework

4. Actions

Identifying Actions Actions were identified in the JSAP's three main components: managing water for sustainable use, availability and access; enhancing institutions and capacity and expanding research and knowledge. As noted above, actions were achieved by 'zooming in', through progressively narrower frames of objectives, targets and actions. As such, a set of objectives were first identified. Second, for each objective, a set of targets that should facilitate achievement of identified objectives were identified. And third, for each target, a set of actions to achieve the target were specified.

4.1 Managing Water for Sustainable Use, Availability and Access

Four objectives and twelve targets were identified (Table 2).

Objective 1: Monitoring The first objective is monitoring, which seeks to achieve enhanced monitoring of the RTBAA for sustainable management, paying attention to abstraction levels. Four targets were identified under this objective, including municipal level monitoring, development of a borehole inventory and monitoring of wastewater from sanitation facilities. A set of fifteen actions were identified for these targets. For example, under the target related to local level municipal water, actions include a review of existing regulatory instruments and monitoring systems and the prioritization of specific monitoring parameters.

Objective 2: Water Apportionment/Allocation The second objective is to achieve sustainable and equitable water apportionment and/or allocation to stakeholders, while considering stakeholder vulnerability. This reflects the UN Watercourses Convention (1997), which addresses "sustainable utilisation" and the "use, development and protection of an international watercourse in an equitable and reasonable manner". The water apportionment/allocation objective has three targets, including the development of water provision schemes for lower income syndicates and the definition of water rights regarding the RTBAA. With a total set of nine actions under this target, a notable action under the water rights target is the 'development of a harmonised transboundary monitoring system'.

BOX 1: REMSAN contributes to Sanitation Control REMediation and SANitation (REMSAN) is an integrated approach where in-situ groundwater remediation and improved sanitation are combined. It remediates existing contamination, protects the resource and allows the use of naturally treated groundwater after minimal final ex-situ treatment for safe and affordable potable water supply. In-situ remediation means that contaminants are treated naturally while the water is still in the aquifer by using the aquifer as a natural bioreactor in a controlled way. Hence, water abstracted for water supply is close to drinking water quality, necessitating less treatment. One approach to in-situ remediation, applied here, is by injecting harmless natural additives (like vegetable oil) to a contaminated aquifer to trigger and accelerate nature's own bio-chemical remediation processes.

REMSAN Pilot in Ramotswa The REMSAN concept will be implemented as a pilot at a local/village scale in the Ramotswa village located in the border area between Botswana and South Africa. The aquifer is a complex dolomite system, which is presently investigated through monitoring and modelling in the RAMOTSWA Project. The pilot is anticipated to decrease the nitrate concentration in the dolomite aquifer to acceptable drinking water quality standard (for both countries: 10 mg nitrate-N L⁻¹) in the pilot area. Present groundwater concentrations have been found to be up to 29 mg nitrate-N L⁻¹, requiring reduction by a factor of at least three. Previous studies also indicate that the aquifer is chemically reactive with respect to removing nitrate, and that the limiting factor in achieving further reduction in principle can be addressed by in-situ bio-remediation. The

pilot will establish a benchmark case for bio-remediation of nitrate pollution in Africa under peri-urban conditions. The achievement of long-lasting cleaning of the aquifer will furthermore be tested through the improved sanitation solution.

Objective 3: Contamination Control This objective concerns the control of pollution through reduction in contamination, increased groundwater remediation and expansion of water treatment methods. This objective carries four targets with eleven actions. Under the target related to increased stakeholder awareness, a notable action is to establish education programmes through stakeholder public outreach programmes. Under the target relating to preventing contamination from on-site sanitation systems, required actions include the lining of on-site sanitation systems and investigation of the feasibility of dry sanitation.

Objective 4: Agricultural Water Use Efficiency The last objective follows the Agricultural Water Solutions activity conducted under the RAMOTSWA 2 project, which tested the water use efficiency impacts of using Wetting Front Detectors (WFDs) and Chameleons on farmer decision making for agricultural irrigation. The activity showed that the use of these simple tools resulted in significant water savings, nutrient loss reduction, and improved yield and gross water productivity. This objective carries 2 targets and 4 actions.

Table 2 illustrates the objectives (left column), targets (middle column) and actions (right column) for this component.

Table 2: Managing water for sustainable use, availability and access

Objective	Targets	Actions
1. <u>Monitoring</u> To enhance monitoring of the RTBAA water levels, abstractions and quality trends for sustainable management	1.1. Effective monitoring on the municipality and local level	1.1.a. Awareness raising and communication with local management
		1.1.b. Review of existing regulatory frameworks to assess compatibility and needed revisions
		1.1.c. Specific monitoring of 'shared' areas of the aquifer
		1.1.d. Prioritise specific parameters to monitor
	1.2. Develop a georeferenced inventory of boreholes and a common information system	1.2.a. Identify boreholes in the area and their existing use
		1.2.b. Borehole monitoring: water levels, abstractions and quality
		1.2.c. Develop procedure to keep this updated
		1.2.d. Harmonization of monitoring procedure with policies and processes relevant for borehole registration
		1.2.e. Harmonisation of regulatory instruments for borehole drilling
	1.3. Close monitoring of recharge zones for sustainable management	1.3.a. Develop a common platform for monitoring data to be uploaded by municipalities and stakeholders
		1.3.b. Identify recharge zones
		1.3.c. Identify sustainable methods of managing recharge areas
	1.4. Close monitoring of sanitation impacts and waste water effluent	1.4.a. Assessment of on-site sanitation system impacts
		1.4.b. Identify and implement methods of reducing on-site sanitation system impacts
		1.4.c. Undertake groundwater assessment of area before putting in sanitation systems according to relevant domestic laws/protocols
2. <u>Water apportionment/ allocation</u> To achieve sustainable and equitable water apportionment	2.1. Understand current and potential user needs and uses of the RTBAA	2.1.a. Analysis of the quality of water to identify potential/ appropriate uses of the resource
		2.1.b. Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access
		2.1.c. Review excessive requests for water allocation that end up unused, and could be reallocated

Objective	Targets	Actions
and/or allocation to stakeholders, while considering stakeholder vulnerability	2.2. Develop water provision schemes for lower income communities	2.1.d Implement metering of private boreholes to monitor and enforce abstractions
		2.2.a. Develop and implement interventions to address problems and power asymmetries within local water management bodies (e.g., WUAs, syndicates)
		2.2.b. Develop and disseminate template or guidelines for formation of local water management bodies (e.g., WUAs, syndicates)
	2.3. Define water licensing and water rights regarding the RTBAA	2.3.a. Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling
		2.3.b. Develop a harmonised (transboundary) licensing system in line with the JTPC processes of allocation
		2.3.c. Develop allocation rules based on stakeholder mapping and needs/impact analysis
3. <u>Contamination control</u> To develop measures to control pollution by reducing contamination, increasing groundwater remediation and expanding appropriate treatment methods	3.1. Increased public/stakeholder awareness of contamination control	3.1.a. Development and dissemination of appropriate promotional material to households / farmers etc.
		3.1.b. Education programmes through stakeholder public outreach programmes
		3.1.c. Ensuring that there is political 'buy-in' from stakeholders
	3.2. Protocols in place regarding prevention of contamination by on-site sanitation systems	3.2.a. Develop joint agreement across the two countries with standards for the RTBAA
		3.2.b. Identify methods of reducing on-site sanitation system contamination (e.g. lining)
		3.2.c. Identify alternative (dry) sanitation options (cross ref to component 3)
	3.3. Explore alternatives to conventional on-site sanitation systems	3.3.a. On-site sanitation system lining as first step
		3.3.b. Investigate dry sanitation options
	3.4. Land use management that is sensitive to groundwater contamination	3.4.a. Review community based and current management and implement restrictions on activities in vulnerable areas of the aquifer
		3.4.b. Ensure a transboundary EIA is conducted regarding planned measures that are likely to impact the aquifer system and incorporate groundwater sensitivity guidelines into land board structures
		3.4.c. Identify wider natural impacts to the aquifer system and methods of mitigation/adaptation
4. <u>Agricultural water use efficiency</u>	4.1. Enhancing farmer awareness about irrigation water use efficiency	4.1.a. Conduct trainings on water use efficiency and the use of WFDs and Chameleon Detectors with farmers and irrigation managers
	4.2. Expansion of tools for agricultural water solutions	4.2.a. Form partnerships with local agricultural departments and agricultural NGOs (e.g., to set up procurement and distribution of tools)
		4.2.b. Monitor progress on uptake and impact of the tools through subsequent studies following the Agricultural Water Solutions study

4.2 Enhancing Institutions and Capacity

This component addresses both national and transboundary institutions governing the framework for implementation. Key points of action emerging in this category are underpinned by four objectives and eleven targets, with a total of 35 actions (Table 3).

Objective 1: Institutional Harmonization The first objective concerns institutional harmonization, which aims for alignment across different institutional structures concerning the RTBAA, such as the Joint Permanent Technical Committee (JPTC) and the Limpopo Watercourse Commission (LIMCOM). Three targets are listed in this objective, the notable one being the harmonization of plans across countries. Actions under this target include joint monitoring practices for harmonised data collection to eliminate data gaps.

Objective 2: Agreements on Focused Transboundary Issues The second objective recommends transboundary agreement(s) focused on issues on which countries may wish to cooperate. Importantly, tools for assessing capacity needs and evaluating the enabling environment were considered important to help guide implementation of actions in this component. This objective contains two targets including the establishment of joint management structures, which require actions like protocol mandating engagement with communities and possible funding mechanisms, and the creation of memoranda of understanding (MOU) for groundwater monitoring. The latter target requires several actions, including agreements on protocols for data exchange and agreement on protocols for identifying joint issues.

Objective 3: Enhancing Implementation and Capacity The third objective is the development of tools for institutional capacity needs assessments and implementation plans. A notable target under this objective is the identification of avenues for mobilizing financial and human resources, which includes actions related to initiating secondment agreements or MOUs to mobilise human resources and secure public-private-partnership opportunities.

Objective 4: Tailored Training The last objective is tailored training, with two related targets. One target is the establishment of processes for knowledge exchange between public, private and research spheres. Actions here include knowledge exchange with universities and incorporating students to partner in projects. Table 3 shows the objectives (left column), targets (middle column) and actions (right column) for this category.

Table 3: Enhancing institutions and capacity

Objective	Targets	Actions
1. <u>Institutional harmonization</u> To foster harmonization across different institutional structures concerning the RTBAA	1.1. Internal harmonization within country government departments	1.1.a. Intergovernmental forum – proposals within the 3 levels of government (national, provincial and local) to align programmes; Create a platform so that the technical experts in various departments can come together and bring the key issues to the political level
		1.1.b. Identifying areas and sectors that need harmonizing in relation to the RTBAA (for example EIAs / DEA)
		1.1.c. Institutional reform to (a) account for the current situation, (b) legally mandate a review process for the future, (c) to establish a technical committee that is incorporated in the review process, and (c) which is coherent with recent institutional reforms
	1.2. Harmonise plans (and planned activities) across countries	1.2.a. Enter into transboundary dialogue to assess the similarities and differences in monitoring and research practices
		1.2.b. Formalise reporting process (prior notification) around plans between countries and foster interaction in planning process between countries (exchange draft plans concerning developments affecting transboundary RTBAA area)
		1.2.c. Agree upon joint monitoring practices for harmonised data collection that eliminates data gaps

	1.3. Joint management structure - establish “local”/ “operational” joint management committee comprising local based institutions (e.g. local-level catchment management, municipalities, water boards, irrigation stakeholders in SA side and counterparts in SE districts)	1.3.a. Investigate the existence of groundwater committees in transboundary arrangements including in river basins, such as the LIMCOM, ORASECOM, and the JPTC. Learn from their experiences
		1.3.b. Liaise with relevant commissions and agree upon a reporting structure to promote harmonization and establish synergies
		1.3.c. Seek to form JPTC subcommittee, seek endorsement and support and report to JPTC.
2. <u>Agreements over focused transboundary issues</u> To propose and develop transboundary agreement(s) on focused issues requiring cooperation, including protocols for data and information exchange	2.1. Agreement establishing Joint Management Structure – operational committee	2.1.a. Protocols for establishing the committee composition, distinguishing between 1) commission or senior officials and 2) operations or technical committee; for bringing local level institutions
		2.1.b. Protocols for data and information exchange – Observe pre-existing institutional framework for JPTC – identify if it has protocols for data exchange
		2.1.c. Protocol mandating engagement with communities
		2.1.d. Creation of possible funding mechanisms to the component actions
	2.2. Creation of a Memorandum of Understanding for groundwater monitoring, specific to the RTBAA and RIMS	2.2.a. Joint investments for combined/collaborative groundwater monitoring practices
		2.2.b. Agreement on a protocol for joint monitoring
		2.2.c. Agreement on a protocol for data exchange
		2.2.d. Agreement on protocols that respond to issues already identified
		2.2.e. Agreement on protocols for identifying joint issues
3. <u>Implementation and capacity</u> To develop tools for institutional capacity needs assessments and implementation plans	3.1. Strengthen capacity to cover GW in relevant water management structures	3.1.a. Attract/Hire people with GW expertise within local or catchment-level structures
		3.1.b. At municipality level, provide short training to orient non-specialists on basics of GW
	3.2. Development of an implementation plan	3.2.a. Conduct a needs assessment to identify constraints to implementation and to develop recommendations
		3.2.b. Review and consolidate implementation plans that are currently present in the National Water Master Plan
	3.3. Define key roles and functions and responsibilities for stakeholder institutions in regard to the municipalities	3.3.a. Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations
		3.3.b. Establish a role of municipalities to create awareness at community level
		3.3.c. Address gaps in municipalities’ knowledge in their capacity to do their training roles
	3.4. Identify ways of mobilizing financial and human resources	3.4.a. Link implementation activities with the relevant national-level development plans and activities to increase chances of higher allocation of the national budget

		3.4.b. Initiate secondment agreements to mobilise human resources
		3.4.c. Investigate PPP opportunities
4. <u>Tailored training</u> To increase technical capacity through facilitated technical trainings	4.1. Implement training and mentoring schemes to ensure continuity of institutional memory	4.1.a. Assign mentors to junior employees in departments across the water sector
		4.1.b. Promote specialised short courses specific to job description to increase employee satisfaction, expertise, and retention rates
		4.1.c. Identify issues leading to poor staff retention rates, and create recommendations to the government regarding training, salary, job security and employee satisfaction
	4.2. Establish processes for knowledge exchange between public, private and research spheres	4.2.a. Knowledge exchange with universities
		4.2.b. Identify if students from each country can partner on this project
		4.2.c. Identify who would be responsible for providing training
		4.2.d. Collaborate with relevant sectoral education authorities as well as organizations providing professional development training

4.3 Expanding Research and Knowledge

This component focuses on increasing knowledge and understanding of the aquifer for ongoing identification of issues and solutions. Key areas for action include development of a customised monitoring programme for particular needs, exploring alternative aquifer management options, harmonizing data and communication and raising the profile of the RTBAA (Table 4).

Objective 1: Monitoring To achieve the monitoring objective, four targets were identified including assessment of water demand, assessment of water quality, assessment of climate variability and investigation of institutional aspects of monitoring. Specific actions for assessing water demand include identification of existing gaps and building on current municipal monitoring programmes. Water quality assessment aim to be implemented through specific actions that include identifying causes of nitrate pollution and impacts of livestock on water quality. The climate variability assessment target includes actions like research on impacts of climate change on groundwater and development of early warning systems.

Objective 2: Exploring Alternative Management Options The targets that address the objective for exploring alternative aquifer management options includes the possibility of managed aquifer recharge (MAR), where determining aquifer storage capacity is key, and conducting the cost benefit assessment of MAR, where key actions include studies on how MAR can address drought.

Objective 3: Harmonizing Data Data harmonization targets include making the Ramotswa Information Management System (RIMS) sustainable, including specific actions such as conducting quarterly data uploads, and integrated analysis, including key actions such as harmonised monitoring procedures and joint data analysis.

Objective 4: Raising Awareness Raising awareness to enhance stakeholder communication is the last objective to be achieved through a set of eight actions related to three targets. These targets address water demand management, early warning information systems and information on groundwater attributes. The associated actions include information

dissemination through public education and mass media, building capacities within communities and creating communication links with local water management authorities.

Table 4: Expanding research and knowledge

Objective	Targets	Actions
1. <u>Monitoring</u> To develop a customised monitoring programme for particular needs, such as understanding water availability and use, and climate variability and change	1.1. Assessment of water demand and abstraction	1.1.a. Assessment using measurements of abstraction, water level and water quality
		1.1.b. Re-assess the data requirement for the formula determining water demand
		1.1.c. Continuous verification of demand on the ground with demand assessments and investigating why demand changes
		1.1.d. Investigate what DWS and municipal supply and services are already monitoring
		1.1.e. Identify gaps in existing data collection to set up new monitoring activities
	1.2. Assessment of water quality	1.2.a. Assessment of causes of high nitrate levels
		1.2.b. Investigation of causes and solutions of transboundary pollution issues
		1.2.c. Investigate water quality in pre-identified focus areas. Identify additional hot spot areas, prioritizing areas for potable domestic supply
		1.2.d. Implement research regarding the impacts of livestock on water quality and quantity
	1.3. Assessment of climate variability and change	1.3.a. Research study on the climate impacts on groundwater (climate and recharge level correlation)
		1.3.b. Monitor rainfall measurements and variability assessment in time and space (locate historical data)
		1.3.c. Develop an early warning system
	1.4. Investigate institutional and socio-economic aspects of monitoring	1.4.a. Investigate who is currently monitoring what
		1.4.b. Assess institutional arrangements for monitoring, including roles and responsibilities.
		1.4.c. Investigate socio-economic implications of water access challenges
2. <u>Researching alternative management options</u> To explore and identify alternative management options appropriate for the RTBAA (e.g. MAR)	2.1. Focused recharge assessment to assess the possibility of MAR	2.1.a. Research project to understand the connection between the river and the aquifer using water table fluctuation method
		2.1.b. Research to confirm the presence of dikes using ground-truthing with ground geophysics and other methods to supplement airborne data
		2.1.c. Determine storage capacity of aquifer
	2.2. Research to consider options for water sources for MAR	2.2.a. Assessment of wastewater recharge options and required water quality standards
		2.2.b. Assessment of using water from Gaborone dam
		2.2.c. Assessment of using water from the North
		2.2.d. Assessment of aquifer to aquifer transfer for optimal storage
	2.3. Cost/benefit analysis to assess practicality of MAR	2.3.a. Assess potential impacts of MAR on Gaborone Dam and other surface water sources
		2.3.b. Cost/benefit of using different water sources identified in 2.2.
		2.3.c. Cost/benefit study on how MAR can address drought
	2.4. Investigate different	2.4.a. Research into alternative management frameworks, identifying which have had success and which may work best in Ramotswa

	institutional options	2.4.b. Explore different models for achieving potable water standards, are there cheaper or more efficient ways of achieving potable water?
<p>3. <u>Harmonising data</u></p> <p>To integrate different databases in partnership with the Ramotswa Information Management System (RIMS) online platform</p>	3.1. Address sustainability of the Ramotswa Information Management System (RIMS) for data sharing	3.1.a. Identify data gaps on RIMS and locate missing data for upload
		3.1.b. Quarterly requests from the RIMS manager to the Water Resources Manager to provide data, which is uploaded to RIMS
		3.1.c. Quarterly requests from water managers for new data in and outside the department as it becomes available, to send to RIMS manager
		3.1.d. Develop and implement a clear governance model for the management of RIMS to assign responsibilities on collecting, processing, uploading, and publishing of new data, updating existing data, as well as quality control and publishing of data, access rights to RIMS, etc.
		3.1.e. In the longer term, migrate RIMS-data from IGRAC servers to LIMIS (LIMCOM Information Management System) that is currently under development.
	3.2. Integrated analysis	3.2.a. Investigate monitoring practices on both sides and propose options to harmonise.
		3.2.b. Joint/transboundary data analysis to create full understanding of the whole aquifer and its management
		3.3.c. Beneficiation and valuation. Investigate the benefits obtained from the Ramotswa's water and how equitably these are shared. Evaluate benefits of cooperative management.
<p>4. <u>Raising Awareness</u></p> <p>To enhance public and stakeholder communication and profile raising related to the RTBAA</p>	4.1. Water demand management	4.1.a. Public awareness for addressing "myths" and misunderstandings including (1) value of groundwater/trust regarding its hidden nature; (2) the value of wastewater reuse; (3) the value of research and new technologies
		4.1.b. Information dissemination and public education through various mediums (radio/ community gatherings etc.)
		4.1.c. Integration with the outreach team with public awareness raising track
		4.1.d. Working with schools to give talks, and integrating key water management messages into the curriculum
	4.2. Early warning information system	4.2.a. Link monitoring activities on climate variability (rainfall/ storage/ flooding) with public information channels
	4.3. Raising awareness regarding the importance of groundwater and its limits, groundwater protection and the importance of water saving	4.3.a. Training and capacity building within communities
		4.3.b. Understand the target groups
		4.3.c. Creating communication links and capacity building with local-level catchment management, WARD Councillors and Tribal Authorities

5. Legal and Institutional Framework for JSAP Implementation

The existing legal and institutional framework relevant to the RTBAA may support or constrain JSAP implementation. This section reviews the institutional context that applies to the RTBAA. This includes considering identified actions within this context in order to reveal the degree to which they are compatible. First, existing codification of water cooperation at various scales in which the RTBAA is nested is outlined. Second, national laws and policies of the two aquifer-sharing states are reviewed in order to identify commonalities that lend themselves to joint actions. Finally, this section assesses the degree to which actions emerging from the JSAP align with existing institutions at all scales, in order to flag areas that may require redressing before proceeding to implementation.

5.1 Existing Cooperation at Multiple Levels

International and Regional Frameworks

The 1997 International Watercourses Convention On the global level, both Botswana and South Africa have engaged in the development of the international legal principles applicable to international watercourses, which bears influence upon the management of the RTBAA. The 1997 UN *Convention on the Non-navigational Uses of International Watercourses* (Watercourses Convention) is the principal framework document codifying the principles of international water law. These principles are: the equitable and reasonable utilisation of and benefits derived from international watercourses, the obligation not to cause significant harm to other watercourse States, the general obligation to cooperate, the regular exchange of data and information, as well as the protection and preservation of ecosystems. The convention entered into force in 2014 making it a legally binding treaty for those States that have ratified it. This includes South Africa, one of the original group of States to become signatories, though Botswana is yet to sign this convention despite voting in favour of its adoption when it was initially presented to the UN General Assembly.¹ (see Table 5)

The 2008 Draft Articles The 2008 International Law Commission's *Draft Articles on the Law of Transboundary Aquifers* (Draft Aquifer Articles) applies to aquifers as permeable water-bearing geological formations *and* the water contained therein. While non-binding in legal status, this remains a key document regarding the specific governance of transboundary aquifers that the international community has endorsed through UN General Assembly Resolutions 63/124 in 2008, 66/104 in 2011, 68/470 in 2013, and 71/L.22 in 2016. However, these were all adopted without vote, and neither Botswana nor South Africa have offered comment through these resolutions on these Articles so far. Importantly however, the key principles of international water law are reinforced whilst also introducing rules relevant to the specific characteristics of aquifers, in contrast to surface water. The Draft Aquifer Articles add, among other things, the precautionary approach, the consideration of recharge and discharge zones, and consideration of the role of the aquifer or aquifer system in the related ecosystem.

SADC Water Protocols Within the SADC Secretariat, responsibility for increasing and facilitating water cooperation lies with the Water Division. Water has been a priority for the SADC since its establishment, characterised by the signing of the 1995 *Protocol on Shared Watercourses* (SADC Water Protocol), which was subsequently revised in 2000 to conform to the UN Watercourses Convention. Botswana and South Africa have both ratified this agreement which entered into force in 2003, and are thus bound by its provisions.

¹ UN General Assembly Official Records, 99th Plenary Meeting, 21 May 1997, UN Doc A/51/PV.99

Transboundary Frameworks at or within the Limpopo Basin

The Botswana-South Africa Joint Permanent Technical Committee A bilateral forum between South Africa and Botswana was established through the 1987 *Agreement on the Establishment of the Joint Permanent Technical Committee* (JPTC). This has reportedly been updated through the signing of a Memorandum of Understanding, although neither document is publicly available. The JPTC already acts as a formalised and functional forum for cooperation across the border regarding matters of transboundary water management between the two countries. In 2015, the JPTC established a subcommittee on the joint management of water quality and aquatic weeds in the Upper Limpopo River Basin, which has proposed practical measures to reduce proliferation of water hyacinth. Dialogues associated with the JPTC also resulted in an agreement over water transfers from South Africa's Molatedi dam in 1988 shortly following its construction, which was revised in 2014 (Tswasa Agreement) to account for changes in political governance structures around the border, as well as the LIMCOM Agreement and SADC Water Protocol. A general framework agreement regarding authorised water supply between the two countries was also concluded through the 2008 *Agreement on Water Supply Across the Border*.

Limpopo Basin Agreements At the basin level, riparian states Botswana, Mozambique, South Africa and Zimbabwe signed the 2003 *Agreement on the Establishment of the Limpopo Watercourse Commission* (LIMCOM), which built on the earlier 1986 *Agreement on the Establishment of the Limpopo Basin Permanent Technical Committee*. While implementation of the 2003 LIMCOM Agreement has been slow, a Secretariat and three technical task teams (legal, technical and floods) have been established, the first official meeting between the State parties took place in September 2017, and amendments to the initial agreement are under consideration. The *Limpopo River Basin Integrated Water Resources Management (IWRM) Plan 2016-2020* furthers LIMCOM's operations, and creates a monitoring and evaluation framework for implementation.

Africa Ministers' Council on Water Both South Africa and Botswana are Member States of the Africa Ministers' Council on Water (AMCOW), which was formed in 2002 to promote cooperation, security, social and economic development and poverty eradication among member states through effective management of water resources and provision of water supply services. AMCOW's workplan sets out actions at the continental, transboundary and national level, and outlines key actions that need to be taken to meet the political commitments made by various member states. Theme 2 of the workplan, 'Managing water resources (Transboundary water resources)' is the most relevant for the RTBAA (AMCOW 2011), in particular the development of transboundary plans and the development of a framework for monitoring groundwater on a basin level and in all transboundary aquifers.

Table 5: Relevant international agreements and principles

Agreement	Key Principles
1986 JPTC Agreement	<i>Agreement unavailable</i>
1988 Tswasa Agreement (with related updates in 2008 and 2014)	<ul style="list-style-type: none"> • Operation and maintenance of the scheme and assignment of responsibilities to the parties • The supply to the parties of water made available in the Marico River by virtue of construction of the scheme • Sharing of the operation and maintenance costs

Agreement	Key Principles
1997 UN Watercourses Convention	<ul style="list-style-type: none"> • Equitable and reasonable utilisation • No significant harm to watercourse States • General obligation to cooperate • Regular information and data exchange • Procedures for planned measures • Protection and preservation of ecosystems • Prevention, reduction and control of pollution
2000 SADC Water Protocol	<ul style="list-style-type: none"> • Regional integration and harmonisation • Respect of the existing rules of customary or general international law • Balance between people and environment • General obligation to cooperate • Regular information and data exchange • Equitable and reasonable utilisation • No significant harm to watercourse States • Procedures for planned measures • Protection and preservation of ecosystems • Prevention, reduction and control of pollution
2003 LIMCOM Agreement	<ul style="list-style-type: none"> • Sustainable development • Intergenerational equity • Prevention principle • Transboundary impact assessment principle • Equitable and reasonable utilisation • Harmonisation of policies • Exchange of information
2008 Draft Aquifer Articles Non-binding UN General Assembly Resolution	<ul style="list-style-type: none"> • Sovereignty of aquifer States • Equitable and reasonable utilisation • No significant harm to aquifers, aquifer systems or aquifer States • General obligation to cooperate • Regular information and data exchange • Protection and preservation of ecosystems • Prevent and minimise detrimental impacts on the recharge and discharge processes • Prevention, reduction and control of pollution • Precautionary approach • Monitoring • Procedures for planned activities

Common Threads of Cooperative Frameworks A review of the key tenets of the different agreements (Table 5) highlights a number of commonalities including information sharing and dispute settlement processes, equitable and reasonable use, solidarity and shared benefits. The Molatedi transfer scheme, for example, manifests equitable and reasonable distribution and shared financing and demand between states with non-equilibrium climates, while also providing rules regarding quality control which prevents transboundary harm. This aligns with the spirit of the SADC Water Protocol, which encourages equitable and sustainable sharing, regional integration, information exchange and no significant harm. Principles may face practical challenges, such as when agreed supply cannot be met due to drought.

Action-oriented cooperation in the Tswasa Agreement The Tswasa Agreement is an example of action-oriented cooperation with specific details governing a single issue, whereas the other agreements are facilitative and institutional in nature, providing cooperative

frameworks within which to work. The Tswasa Agreement is therefore an example of cooperation regarding a single issue, which could provide a practical precedent for future water benefit-sharing infrastructure project in the RTBAA.

Ramotswa-focused cooperation in the context of existing efforts Significantly, cooperation over the RTBAA has already been tentatively established through both the JPTC and LIMCOM. It was decided in a December, 2016 JPTC meeting that progress on the RAMOTSWA project shall be regularly reported to the JPTC. Similarly, the RAMOTSWA project was presented to LIMCOM in August 2017, where it was suggested that the RAMOTSWA project could serve as a pilot in the context of a to-be-developed groundwater task team for the Limpopo basin.

5.2 Relevant Institutions in Botswana and South Africa

Legal and institutional framework in Botswana

Botswana's organisational structure for governing water is divided between public sector water resources management and privatised water service delivery (see Figure 8). The Department of Water and Sanitation (DWS-BW) is responsible for the planning, development and management of Botswana's water resources, and its associated Water Apportionment Board (WAB) deals with applications for water rights, most often in relation to private borehole abstractions. The Water Utilities Corporation (WUC), a government-owned corporation, is responsible for water supply and wastewater management for major urban centres under the 1970 *Water Utilities Corporation Act*. The WUC's scope was revised in 2009 to cover service delivery to the whole country, taking over the role from District Councils under the Ministry of Local Government and Lands who were previously responsible for domestic water supply in rural areas (National Water Master Plan Review 2006) and the Department of Water Affairs that was responsible for major village water supply. Water supply is funded by customer water charges, as well as public funds, supported by a tariff structure. Non-payment of bills leads to disconnections, which is supported by Section 16 of the 1968 *Waterworks Act* which gives the water authority power to withhold supply of water when money for supply is owed; there is nothing stating that there is a right held by the public to be supplied with water.

The overarching legal framework is provided in the 1968 *Water Act*, which defines the ownership of rights of use of water and provides for the grant of rights and servitudes, while the 1956 *Boreholes Act* provides for the control on the sinking of boreholes more than 15 metres deep. The 1962 *Waterworks Act* outlines the powers and duties of water authorities and their associated waterworks, although the 2006 water sector reforms have rendered this and the 1970 *Water Utilities Corporation Act* out of date in regard to service delivery structures. The reforms gave rise to the 2005 *Draft Water Bill*, but this has not yet passed into the legislative framework. The Ministry of Local Government and Rural Development (MLG & RD) plays a role in local development and while the Ministry of Land Management and Sanitation Services (MLWS) is responsible for land allocation, sanitation and water supply and management.

In regard to development activities that may have a significant adverse impact on the environment including water resources, the 2011 *Environmental Impact Assessment Act* must be observed. While this is primarily relevant for water resources within Botswana territory, Article 68 requires triggers cooperation procedures when an activity is "likely to have a significant adverse environmental impact in another country". Further, the Environmental Impact Assessment Regulations (2012: reg.3(2)) require that an assessment must be conducted for "[a]ll projects that have transboundary impacts such as fences, bridges, water

transfer schemes and power plants and power lines”. Therefore, the legal framework provides some consideration for impacts upon neighbouring countries, such as impacts to South Africa through activities affecting the RTBAA.

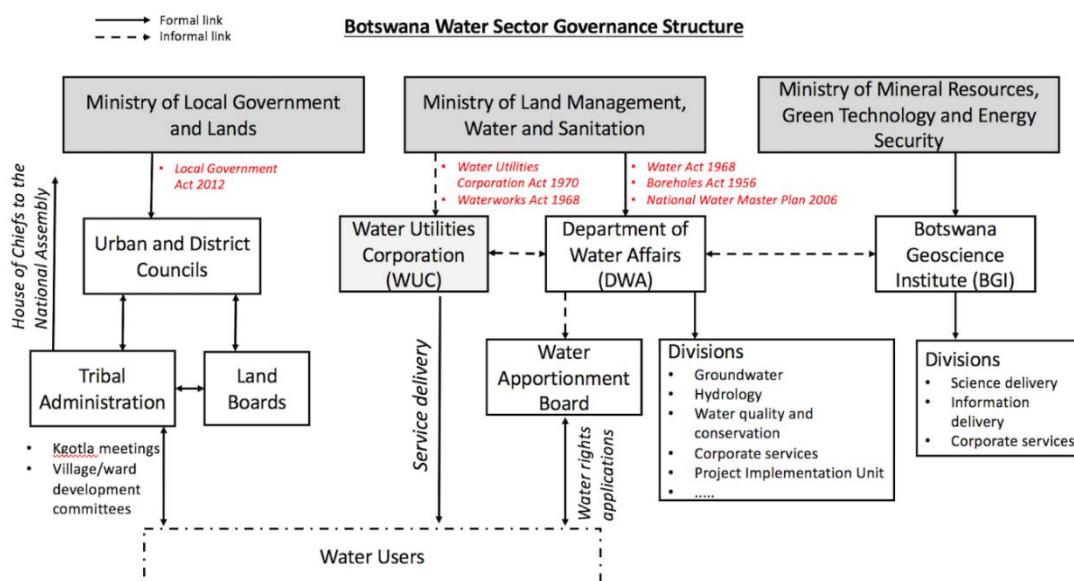


Figure 8: Institutional structures related to water management in Botswana (Source: Author’s elaboration)

Legal and institutional framework in South Africa

South Africa takes a decentralised approach to water services and disperses responsibilities across various departments and agencies (see Figure 9). The Department of Water and Sanitation (DWS) is responsible for the formation and implementation of policy for South Africa’s water resources, while Catchment Management Agencies (CMAs) are responsible for general water management within designated Water Management Areas (WMA). Local Municipalities are responsible for water service delivery in their respective political administrations. However, municipal authorities in rural areas often lack capacity to fully deliver and implement their responsibilities, relying on support from CMAs and independent consultants.

In addition to these levels of governance, government-owned Water Boards play an important role in the water sector in South Africa. Water Boards operate dams, bulk water supply infrastructure, wastewater systems and some retail infrastructure. The Water Boards report directly to the DWS-SA, with the three largest being Rand Water in Gauteng, Umgeni Water in Kwazulu Natal and Overberg Water. The Sedibeng Water Board has been assigned to the area jurisdiction including the RTBAA.

Regarding public participation channels, issues can be heard from community representatives by government through Water and Sanitation Forums established nation-wide since 2015. These exist in response to service delivery protests, and to promote transparency and stakeholder participation/engagement and empowerment (DWS 2015). The DWS has drafted a model Terms of Reference (ToR) for Water and Sanitation Community Forums, which can be customised to more appropriately address local issues, although these mechanisms are not yet incorporated into the legal framework. In addition, irrigation boards established under the former apartheid government should be transformed into Water User Associations (WUA)

under the 1998 *National Water Act* (sec.98), which engage in consultation processes with the associated CMAs. However, almost two decades later, this process is not yet complete.

Specific to the RTBAA, the resource sits in the Limpopo WMA under the remit of the Limpopo-NW Proto CMA (after Crocodile and Marico WMA was merged with Limpopo). Conversely, service delivery is the responsibility of the Ramotshere Moiloa Local Municipality (RMLM), guided by the RMLM Water Services By-Law (Local Authority Notice 101 of 2015). The Water Forums that have been established in the municipal area are in Supingstad, Gopane and Dinokana under the municipal clusters in their respective wards. However, the irrigation boards in the Limpopo WMA (including Crocodile River, Derdepoort and Warmbad) are still to be transformed into WUAs. For effective governance, this issue must be addressed, in addition to fully establishing the Proto-CMA.

The key legislation for water management in South Africa includes the 1998 *National Water Act*, which provides the core principles for the use, development, conservation, protection and management of water resources in South Africa and the institutional governance structure to this end. Conversely, the 1997 *Water Services Act* provides for the regulatory framework for water services institutions along with the rights of access to basic water and national standards for norms and tariffs. The structures for cooperative local governance between tribal and municipal authorities are set out under the 1998 *Local Government: Municipal Structures Act* and the 2000 *Local Government: Municipal Systems Act*, which provides the core principles, mechanisms and processes to ensure universal access to essential services that are affordable to all. Finally, in regard to matters affecting the environment, the 1998 *National Environmental Management Act* provides the institutional framework for cooperative governance and procedures for coordinating environmental functions in relation to water resources.

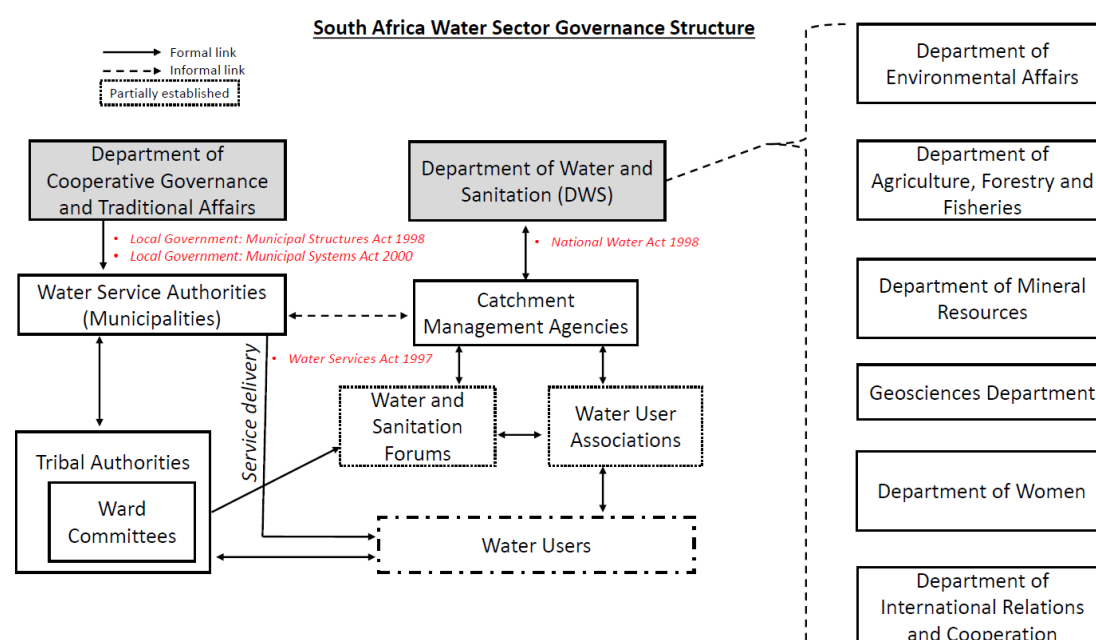


Figure 9: Institutional structures related to water management in South Africa (Source: Author's elaboration)

Common threads of National Frameworks in Botswana and South Africa Review of the contents of institutions in Botswana and South Africa reveals a number of points of harmony. These points include:

- **Water Cooperation** Botswana possesses policy to strengthen co-operation with riparian states in an effort to pursue the principles of equitable and reasonable utilization of internationally shared and transboundary surface water and aquifer resources, 2016 National Water Policy, sec.12.1.2. South Africa calls for establishment of bodies to implement international agreements, 1998 National Water Act, art.102.
- **Right to Water Access** Botswana possesses policy objective to assure access and affordability of water for all, 2016 National Water Policy, sec.1.1.3. South Africa calls for Right of access to sufficient food and water, 1996 Constitution, sec.27; Right of access to basic water supply and sanitation, 1997 Water Services Act, art.3.
- **Licences for Water Uses and Discharges** Botswana specifies that water rights needed to use and discharge into public water, 1968 Water Act, art.4-11 (*except* for domestic uses of public water). South Africa's 1998 National Water Act, arts.40.41 (Except for existing lawful uses outlined in Schedule 1) specifies that Water Boards must obtain licences, 1997 Water Services Act, art.32(e).
- **Prevention of Pollution** In Botswana unauthorised pollution is an offence 1968 Water Act, art.36; 1962 Waterworks Act, art.22. Implementation of the "polluter pays" principle to ensure the responsibility and accountability of polluters, 2016 National Water Policy, sec.6.1.15. In South Africa, 1998 National Water Act, art.19; violation of art.19 is an offence under art.151; protection of groundwater, 2016 Draft National Groundwater Strategy, sec.5.3.
- **Environmental Impact Assessment Required** In Botswana, the 2011 Environmental Impact Assessment Act, art.3-4 required EIAs for activities with potential environment impacts. Adoption of Environmental Impact Assessments (EIA) for all water resources projects in accordance with EIA regulations, 2016 National Water Policy, sec.6.1.10. In South Africa, the 1998 National Environmental Management Act, art.7; 1998 National Water Act, art.110 does the same.
- **Sustainable Management** In Botswana, there is an objective to promote effective, sustainable management of water resources, 2016 National Water Policy, sec.1.1.3.; sustainable management of the environment, 2011 Environmental Impact Assessment Act, art.24. In South Africa, efficient, sustainable and beneficial use of water is in the public interest, 1998 National Water Act, art.2; Sustainable use for water services, 1997 Water Services Act, art.9(c).
- **Groundwater Monitoring** In Botswana, the legal requirement for data maintenance includes implementation of a comprehensive, integrated hydro-meteorological monitoring network, National Water Policy 2016, sec. 6.1.16 to; the power to establish hydrological stations and make surveys, 1968 Water Act, art.30; Pump-tests and inspection by geological survey, 1956 Boreholes Act, arts.5-6. In South Africa, a national monitoring system to collect data on, among other matters, water quality, quantity, use, rehabilitation, compliance with quality standards, health of aquatic ecosystems, atmospheric conditions, 1998 National Water Act, art.137.
- **Information Systems (e.g. borehole inventories)** In Botswana, national Asset Register compiling GIS datasets, 2003 NWMP, volume 9; Register of water rights, 1968 Water Act, art.13; Notice of borehole sinking and keeping records, 1956 Boreholes Act, art.4; Policy strategies for inventory and assessment of monitoring systems and data, 2016 National Water Policy, sec.10. In South Africa, there is a national information system on water services, 1997 Water Services Act, art.32(e); National information system on water resources which may include hydrological, water quality, groundwater

information and register of water use authorisations, 1998 National Water Act, art.139.

- **Stakeholder Participation** In Botswana, a principle exists that management shall be through participatory approaches, involving users, planners and policy makers at all levels, 2016 National Water Policy, sec.1.2.4, 1.2.7 & 1.2.12.; Public participation required for activities likely to have adverse effects on the environment, 2011 Environmental Impact Assessment Act, art.7. In South Africa, CMA responsibility is to enable public participation, 1997 National Water Act, art.9; Culture of community participation in municipal governance, 2000 Local Government: Municipal Systems Act, arts.16-22; Objective of ward committees to enhance participatory democracy in local government, 1998 Local Government: Municipal Structures Act, arts.72; Equitable and effective participation in environmental governance, 1998 National Environmental Management Act, art.7; 1998 National Water Act, art.2(4)(f).
- **Social Equity** In Botswana, policy mechanisms exist for social equity, 2016 National Water Policy, sec.1.2.2, 1.2.6., 1.2.13., 5.1.4., 5.1.8. In South Africa, equitable water management, 1998 National Water Act, art.3; Social equity in tariff structures, 1997 Water Services Act, art.10; Social equity in environmental management, 1998 National Environmental Management Act, art.2(2).
- **Gender Considerations** In Botswana, policy for gender and social equity in accessing water resources exist, 2012 National Water Policy, sec.1.2.6.; Policy for gender equality and women's empowerment, 2015 National Policy on Gender and Development. In South Africa, there are calls for redress past gender discrimination and ensure racial and gender representation, 1998 National Water Act, art.2 and 79; Women and youth participation in environmental management, 1998 National Environmental Management Act, art.2(4)(q). Policy for gender equality and women's empowerment, 2000 National Policy Framework for Women's Empowerment and Gender Equality.

5.3 Compatibility of Existing Institutional Framework with JSAP Contents

Broad Compatibility Overall, the joint vision and framework for the Joint SAP is consistent with broader international, regional and transboundary institutional frameworks. The vision and framework are also consistent with relevant national institutions in the two countries. Progress toward achievement of the shared visions, therefore, should work to support existing efforts toward effective water management. Examination of the compatibility between existing institutional frameworks and specific JSAP contents in each component now follows.

Component 1: Managing water for sustainable use, availability and access

Component 1 identifies objectives surrounding monitoring, water apportionment, and contamination control. Nothing in the legal and institutional framework contradicts or prevents the implementation of the associated targets and actions. However, there are at times gaps or loopholes in the legal framework that could be addressed to strengthen the contemporary approaches to transboundary groundwater management and research development, as represented in this JSAP (Table 6).

Table 6: Potential Gaps in sustainable water management

Objective	Potential Gaps or Constraints
<i>To enhance monitoring of the RTBAA's water levels, abstractions and quality trends.</i>	<ul style="list-style-type: none"> No national legal provisions with requirement for monitoring in Botswana. Section 64 of the Ramotshere Moiloa Local Municipality water services bylaw states that the Municipality <i>may</i> require notification from any owner intending to sink a borehole. However, the fact that South Africa does not require water licenses for boreholes and abstractions for "reasonable domestic use of water" (art.4) limits the ability to keep track of private borehole drilling, and in turn, the ability to closely monitor water abstractions and understand the relationship between water levels and recharge rates.
<i>To develop measures to control pollution by reducing contamination, increasing groundwater remediation and expanding appropriate treatment methods.</i>	<ul style="list-style-type: none"> Transboundary EIA legislation in South Africa is not clear.
<i>To achieve sustainable and equitable water apportionment and/or allocation to stakeholders, while considering stakeholder vulnerability.</i>	<ul style="list-style-type: none"> Requires clearly delineated aquifer management boundaries established and supported by a bilateral agreement.

Component 2: Enhancing institutions and capacity

Component 2 identifies objectives surrounding the harmonisation of institutions and the development of institutional and technical capacity. The challenge is establishing joint managing structures in each country, and this seems more difficult for Botswana than South Africa. Further, implementation of capacity building is mainly hindered by both financial and human resources challenges (Table 7).

Table 7: Potential Gaps in water institutions

Objective	Potential Gaps or Constraints
<i>To foster harmonization across different institutional structures concerning the RTBAA</i>	<ul style="list-style-type: none"> Joint management structure comprising locally based institutions can be incorporated into South Africa's decentralised structure, but Botswana's centralised system would need careful consideration of the roles and responsibilities of local institutions vis-à-vis the structures and duties of the national government's role in water management and waterworks administered by the WUC.
<i>To develop tools for institutional capacity needs assessments and implementation plans.</i>	<ul style="list-style-type: none"> Financial and human capacity is a primary hindrance to implementation, although a needs assessment would characterise specific obstacles giving rise to solutions.

<i>To increase technical capacity through facilitated technical trainings</i>	<ul style="list-style-type: none"> Provision within Botswanan institutions for management services, training and other support services to water services institutions for capacity strengthening are not extensive
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Component 3: Expanding Research and Knowledge

Component 3 identifies objectives surrounding options for aquifer management and the integration of databases in partnership with RIMS. MAR is one such option, which does not seem to be constrained legally, in both countries. No legal frameworks hamper database integration either, but the data sharing protocols are currently unclear and can benefit from establishment of appropriate guidelines (Table 8).

Table 8: Potential Gaps for research and knowledge

Objective	Potential Gaps or Constraints
<i>To explore and identify alternative management options appropriate for the RTBAA.</i>	<ul style="list-style-type: none"> The South African 1997 Water Services Act requires that authorities must consider alternative ways of providing access to water services, however researching alternative management options is not a legal requirement in either country. To comply with the international legal obligation of equitable and reasonable utilization, the availability of alternatives to a planned or existing use must be considered, which could include alternative management options to increase efficiency. The JSAP objective and targets focused on the viability of Managed Aquifer Recharge (MAR) is therefore an appropriate approach to transboundary groundwater governance. It is also supported by aquifer specific provisions in the Draft Aquifer Articles, whereby States “shall take appropriate measures to prevent and minimise detrimental impacts on the recharge and discharge processes” (art.11). There is however, no legal guidance for managed aquifer recharge.
<i>To integrate different databases in partnership with the Ramotswa Information Management System (RIMS) online platform.</i>	<ul style="list-style-type: none"> Modalities of current data sharing practices and the appropriate institute to house shared data are currently unclear. Potential for processes of approval and sharing to be developed to draw directly from national databases into the RIMS platform. Potential for RIMS to be housed under SADC-GMI or similar institution while processes and capacity are developed.

4.4 Potential Institutional Reforms

There is general compatibility between the JSAP and current institutional frameworks. Largely, the existing institutional structures support the jointly identified targets and actions. Nonetheless, institutional reforms in certain areas could enhance the potential for JSAP implementation. These areas include:

Component 1:

- Public and private borehole monitoring system may be needed in both countries to monitor groundwater abstraction rates and understand groundwater demand.*** Such

a monitoring system would help South Africa's Ramotshere Moiloa Local Municipality to implement Section 64 of its water bylaw, without needing to address the licensing system.

- ***States may benefit from implementation of transboundary EIAs regarding planned measures that are likely to impact the aquifer system to support contamination control.*** EIAs are incorporated into water laws in South Africa, including the Ramotshere Moiloa Local Municipality water bylaw in relation to borehole drilling. EIAs are included in the Botswana National Water Policy, sec. 6.1.10 and are a large feature of the Botswana 2006 National Water Management Plan and environmental law revolves around the EIA process.
- ***Specific groundwater regulation can be strengthened in both countries.*** There is a lack of effective regulation of groundwater in both countries, although South Africa has developed the 2016 Draft National Groundwater Strategy. Any law reform should consider these contemporary groundwater management approaches.
- ***The target to define water licensing and water rights regarding the RTBAA is hindered by differing approaches to water services.*** Implementing this target in particular raises challenges in regard to harmonization with two different approaches to water licensing and services. Specific bi-lateral arrangements that allow for departure from the national systems would enable this, however it may cause issues regarding consistency of internal management for each state.
- ***Countries should address national and local institutional structures and relationships to enable conjunctive water and land use management for monitoring and contamination control.*** Land use is particularly important to control over aquifer recharge zones which are highly vulnerable to contamination, compromising the aquifer as a whole
- ***Implementation plans need to integrate the Ramotswa specific strategy with the national level approaches.*** For local level monitoring cooperation, Botswana may also benefit from greater definition of local level roles within its centralised water framework

Component 2:

- ***Institutional structures enable coordinated monitoring and enforcement.*** Coordinated monitoring and enforcement is not provided for in the institutional frameworks, although existing cooperation structures can enable the beginning of such a process
- ***A joint management structure may benefit from carefully defined linkages to the local level.*** A joint management structure comprising locally based institutions can be incorporated into South Africa's decentralised structure, but Botswana's centralised system would need careful consideration of the roles and responsibilities of local institutions vis-à-vis the structures and duties of the national government's role in water management and waterworks administered by the WUC.
- ***A joint management structure could institutionalise cooperation to address issues that require joint approaches.*** Within this JSAP, these joint approaches include harmonised approaches to water rights and licences (Component 1), joint monitoring and information exchange (Components 1 and 3), harmonization of standards and data collection (Component 3), integrated data analysis (Component 3) and Managed Aquifer Recharge research (Component 3)
- ***A joint management structure should be designed to optimise capacity.*** Where a localised joint management committee fits into the current cooperative structures must be carefully considered to avoid overlap and institutional fatigue.

- ***Bi-lateral agreements can define agreed rules and procedures between countries.*** An agreement can institutionalise agreed-upon rules and procedures regarding management of the RTBAA, whilst also setting out procedures for the settlement of disputes if they arise in relation to such management.

Component 3:

- ***Joint review of existing monitoring processes is needed.*** Both countries need to jointly review their monitoring processes to understand where changes can be made for harmonised standards and methodologies for monitoring and data collection
- ***Both countries need to coordinate internally across departments to prevent overlap.***
- ***Legal guidance for managed aquifer recharge in both countries is scant.*** A focused programme could work on developing legal and managerial guidance for MAR in a transboundary setting.
- ***Early warning information system would benefit from a stronger legal mandate.*** Botswana includes an objective to prepare and enact a strategy to operationalize an integrated national and international forecast system. South Africa includes early warning systems as part of its activities under the 1998 National Water Act. However, these are not mandatory objectives.

6. Classifying and Filtering Actions

Identified actions were classified according to three criteria. The first criterion stratified actions into three groups based on time scale: short term, medium term and long term. Actions that can be implemented within two years are considered short term. Actions that require a two-to-five-year implementation period are considered medium term. Long term actions require more than five years to implement. The second criterion divided actions according to estimated cost of implementation, with those requiring USD 50 000 or less as low cost, USD 50 000 to 250 000 as medium cost, and greater than USD 250 000 as high cost. The third criterion split actions according to international or transboundary orientation. The complete set of classified actions is found in Annex 1. The following section focuses on the short-term actions (less than 2 years) that can be implemented inexpensively (less than USD 50 000).

6.1 Managing Water for Sustainable Use, Availability and Access

A set of 15 actions from six targets appeared as short term (Table 9). Only five of the actions here are transboundary in nature, whereas 10 are likely to be more easily undertaken at a national level. Key short-term, inexpensive actions that are transboundary, or can be undertaken with both countries, include:

1.1.d. Prioritise specific parameters to monitor. This action can be undertaken within a year, as coordination between the two countries can potentially be done virtually. Only a couple of meetings may be necessary. Therefore, costs are very minimal.

1.2.b. Borehole monitoring: water levels, abstractions and quality. This may take up to a year or more, as ascertaining water levels or water quality normally requires periodic measurements. However, this is achievable using existing departmental staff at national level without any extra costs. Coordinated implementation across the border can improve effectiveness of monitoring.

1.2.c. Develop procedures to keep monitoring updated. Only further training of current staff, and basic equipment, is envisaged for this task. Although it is also achievable at national level at minimal costs, implementation can benefit from international cooperation.

1.2.d. Harmonization of monitoring procedures with policies and processes relevant for borehole registration. Building on the above process, this task only involves adjustment of processes. It is therefore not expected to carry any further costs, but can profit from international cooperation nevertheless.

The ten key short-term actions that are nationally oriented are:

1.1.a. Awareness raising and communication with local management. This action can build on existing communication channels between local water authorities and consumers. As such, it does not require the building of communication channels from scratch. No extra personnel need to be seconded to this task, and each country can implement its own programme at a local level. Therefore, it is inexpensive and does not need international cooperation.

1.1.b. Review of existing regulatory frameworks to assess compatibility and needed revisions. This can be achieved through a desktop study within a quarter of a year, using either a consultant or in-house expertise. Since no international cooperation is needed, each national water department can quickly complete the task with minimal budgets.

1.2.a. Identify boreholes in the area and their existing use. This can also be completed without extra staff since most of the borehole data exists. Mapping borehole use can be

accomplished using the local water authorities and brief site visits in the area. No international cooperation is necessary at this stage, so implementation is not expected to carry any further costs.

1.2.e. Harmonisation of regulatory instruments for borehole drilling. Again, this task can be done in-house. No legislative process is necessary as this entails only the changing of regulations. No extra costs are expected.

Table 9: Filtered Actions – Managing water for sustainable use, availability and access

Objective	Targets	Actions	N/T
<u>1. Monitoring</u> To enhance monitoring of the RTBAA's water levels and abstractions and quality trends for sustainable management	1.1 Effective monitoring on the municipality and local level	1.1.a. Awareness raising and communication with local management	N
		1.1.b. Review of existing regulatory frameworks to assess compatibility and needed revisions	N
		1.1.d. Prioritise specific parameters to monitor	T
	1.2 Develop a georeferenced inventory of boreholes and common information system	1.2.a. Identify boreholes in the area and their existing use	N
		1.2.b. Borehole monitoring: water levels, abstractions and quality	T
		1.2.c. Develop procedure to keep this updated	T
		1.2.d. Harmonization of this procedure with policies and processes relevant for borehole registration	T
		1.2.e. Harmonisation of regulatory instruments for borehole drilling	N
<u>2. Water apportionment/ allocation</u> To achieve sustainable and equitable water apportionment and/or allocation to stakeholders, while taking into account stakeholder vulnerability	2.1 Understand current and potential user needs and uses of the RTBAA	2.1.b. Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access	N
	2.3 Define water licensing and water rights regarding the RTBAA	2.3.a. Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling	N
<u>3. Contamination control</u> To develop measures to control pollution by reducing contamination, increasing groundwater remediation and expanding appropriate treatment methods	3.1 Increased public/stakeholder awareness of contamination control	3.1.a. Development and dissemination of appropriate promotional material to households / farmers etc.	N
		3.1.b. Education programmes through stakeholder public outreach programmes	N
		3.1.c. Ensuring that there is political 'buy-in' from stakeholders	N
	3.3 Explore alternatives to conventional on-site sanitation systems	3.3.1. On-site sanitation system lining as first step	N
		3.3.b. Investigate dry sanitation options	N

2.1.b. Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality

or access. This task requires field studies and stakeholder consultations. It therefore requires a longer period to implement but it is not expected to take longer than two years.

1.1.b. Review existing regulatory frameworks to assess compatibility and needed revisions. This can be done at the municipal level using current staff. It is a national level action that carries no extra costs

3.1.a. Development and dissemination of appropriate promotional material to households, farmers, etc. The development of the material into simple message platforms in local languages can be a lengthy, iterative process. However, it is achievable under two years at a national level. The cost of acquiring and distributing material is not expected to be expensive.

3.1.b. Education programmes through stakeholder public outreach programmes. Reaching out to all stakeholders requires committed programmes with the possibility of extra staff requirements. It also entails substantive travel budgets and allowances. While the education can be achieved at national level, harmonizing implementation at international level can make it less expensive and more effective.

3.1.c. Ensuring that there is political 'buy-in' from stakeholders. The above process can be used to solicit stakeholder buy-in, using the same staff and budget.

3.3.b. Investigate dry sanitation options. This task can commence immediately and use local researchers; expert knowledge is needed and then can be acquired through partnership with local academic institutions. However, the process of selecting the most feasible options entails expensive experiments at national level.

6.2 Enhancing Institutions and Capacity

Approximately 20 actions geared to achieve eight set targets were identified as low-cost, short-term actions in *ii) enhancing institutions and capacity*. Of these 20 actions, about half are internationally oriented (Table 10). Key actions in this component that are oriented toward joint undertaking, i.e., with international cooperation include:

1.2.c. Agree on joint monitoring practices for harmonised data collection that eliminates data gaps An action clearly compelling international cooperation, agreement upon of indicators and procedures for monitoring, can be agreed on within half a year. Given the work covered so far in the project, this task can be accomplished fairly quickly as both countries are familiar with most issues around the aquifer. The task can be completed during the current phase of the project without any need for a separate budget.

1.3.a. Investigate the existence of groundwater committees in transboundary arrangements including in river basins, such as the LIMCOM, ORASECOM, and the JPTC. Learn from their experiences. While this is a transboundary action, it is easily achievable since personnel involved in river basin institutions is normally composed of national departmental staff. Their experiences can be harnessed without any extra costs.

1.3.c. Seek to form JPTC subcommittee, seek endorsement and support and report to JPTC. This action can be completed with the help of committed sub-committees within current national departments. Since the JPTC already exists, the sub-committees can be formulated within the current functions of the institution at no extra costs.

3.2.a. Conduct a needs assessment to identify constraints to implementation and to develop recommendations. This task can be completed in six months using external (and neutral)

expertise. It can be implemented in tandem with other outreach programmes to take advantage of stakeholder reach and can benefit from cooperation.

3.3.a. Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations This task also requires field studies and stakeholder consultations. It therefore requires a longer period is achievable within two years. Each country can implement their own study independently, but coordinating the action across the border can make it more effective.

3.4.c. Investigate PPP opportunities. Achievable in a few months, this task can be completed by national departmental personnel in their current job functions. However, the process may need harmonisation in both countries. No extra funding is envisaged.

4.1.c. Identify issues leading to poor staff retention rates, and create recommendations to the government regarding training, salary, job security and employee satisfaction. This is achievable in just under two years with maximum cooperation from government, but specialist personnel are needed to undertake the exercise. The action can benefit from international cooperation in order to retain staff in both departments, making it fairly expensive.

4.2.a. Knowledge exchange with universities. Existing partnerships with universities in the project can be utilised to accomplish this task. It is an action that may benefit from international cooperation, and can be achieved with minimal coordination using a small budget.

4.2.b. Identify if students from each country can partner on this project. Universities can help identify these students at no extra cost. However, funding for graduate students may be required and can be jointly sought through bursaries or internships.

4.2.c. Identify who would be responsible for providing this training. The same academic partners can provide training in mutually beneficial agreements.

Table 10: Filtered Actions - Enhancing institutions and Capacity

Objective	Targets	Actions	T/N
1. Institutional harmonization To foster harmonization across different institutional structures concerning the RTBAA	1.1 Internal harmonization within country government departments	1.1.b. Identifying areas and sectors that need harmonizing in relation to the RTBAA (for example EIAs / DEA)	N
	1.2 Harmonise plans (and planned activities) across countries	1.2.c. Agree on joint monitoring practices for harmonised data collection that eliminates data gaps	T
	1.3 Joint management structure - establish "local" / "operational" joint management committee comprising local based institutions (e.g., local-level catchment management, municipalities, water boards, irrigation stakeholders in SA side and counterparts in SE districts)	1.3.a. Investigate the existence of groundwater committees in transboundary arrangements including in river basins, such as the LIMCOM, ORASECOM, and the JPTC. Learn from their experiences	T
		1.3.c. Seek to form JPTC subcommittee, seek endorsement and support and report to JPTC	T
3. Implementation and capacity	3.1 Strengthen capacity to cover GW in relevant water management structures including	3.1.a. Attract/Hire people with GW expertise within LOCAL OR CATCHMENT-LEVEL STRUCTURES	N

To develop tools for institutional capacity needs assessments and implementation plans	Limpopo-NW Proto-CMA and in municipalities		
		3.1.b. At municipality level, provide short training to orient non-specialists on basics of GW	N
	3.2 Development of an implementation plan	3.2.a. Conduct a needs assessment to identify constraints to implementation and to develop recommendations	T
		3.2.b. Review and consolidate implementation plans that are currently present in the National Water Master Plan	N
	3.3 Define key roles and functions and responsibilities for stakeholder institutions in regard to the municipalities	3.3.a. Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations	T
		3.3.b. Establish role of municipalities to create awareness at community level	N
	3.4 Identify ways of mobilizing financial and human resources	3.4.a. Link implementation activities with the relevant national-level development plans and activities to increase chances of higher allocation of the national budget	N
		3.4.b. Initiate secondment agreements to mobilise human resources	N
		3.4.c. Investigate PPP opportunities	T
4. Tailored training To increase technical capacity through facilitated technical trainings	4.1 Implement training and mentoring schemes to ensure continuity of institutional memory	4.1.a. Assign mentors to junior employees in departments across the water sector	N
		4.1.c. Identify issues leading to poor staff retention rates, and create recommendations to the government regarding training, salary, job security and employee satisfaction	T
	4.2 Establish processes for knowledge exchange between public, private and research spheres	4.2.a. Knowledge exchange with universities	T
		4.2.b. Identify if students from each country can partner on Ramotswa-focussed studies	T
		4.2.c. Identify who would be responsible for providing training	T
		4.2.d. Collaborate with relevant sectoral education authorities as well as organizations providing professional development training	N

Key actions that can be undertaken without international cooperation include:

1.1.b. Identifying areas and sectors that need harmonizing in relation to the RTBAA (for example EIAs / DEA). A desktop study and a few consultation meetings are needed to complete this task, which is likely to take up to two years. It will involve joint assessments and therefore transboundary cooperation is necessary, albeit at a low cost.

3.1.a. Attract/hire people with GW expertise within local or catchment-level structures. The cost of hiring the skilled personnel is high, but this action can be implemented fairly quickly at a national level.

3.1.b. At municipality level, provide short training to orient non-specialists on basics of GW. This task can be complemented with help from expert consultants using periodic refresher courses. Although it is informed by local needs, implementation can benefit from international cooperation.

3.2.b. Review and consolidate implementation plans that are currently present in the National Water Master Plan. This task can be completed in-house at national level using current staff at no extra costs.

3.3.b. Establish a role of municipalities to create awareness at community level. Building on current communication platforms between municipalities and communities, current resources can be utilised to increase effectiveness. Tailored short-term training can be done to upskill the staff. It is a national level task that can be inexpensively achieved.

3.4.a. Link implementation activities with the relevant national-level development plans and activities to increase chances of higher allocation of the national budget. This can be achieved through annual strategic planning efforts at national departmental level without any need for new funding.

3.4.b. Initiate secondment agreements to mobilise human resources. Achievable within a year, this task does not need new funding.

4.1.a. Assign mentors to junior employees in departments across the water sector. This is a national level action that can be implemented immediately, and requires no extra funding

4.2.d. Collaborate with relevant sectoral education authorities as well as organizations providing professional development training. On-going collaborations can be established fairly quickly at a national level, within a calendar year. Costs may vary according to institutional requirements, but are estimated at 25000 a year.

6.3 Expanding Research and Knowledge

Within the expanding research and knowledge component, 14 actions were judged to be short-term in nature and inexpensive. Of these, about 10 are more transboundary-oriented whereas only four may be best undertaken at a national level (Table 11). Key activities that are likely to draw on international cooperation include:

1.1.a. Assessment using measurements of abstraction, water level and water quality This may take up to a year or more, as assessments of water levels or water quality normally need more than one measurement each. However, this is achievable using existing departmental staff at national level in each country, with some level of coordination between the countries. It can be achieved with a minimal budget.

1.1.d. Investigate what DWS and municipal supply and services are already monitoring. This national level information can be acquired within days from relevant organisations at no cost. Nevertheless, cooperation is needed to ensure the same type of information is being gathered.

1.2.a. Assessment of causes of high nitrate levels. This task needs to be implemented jointly in order to produce objective results. Cooperation is therefore essential but costs can be contained well below USD50 000.

1.4.a. Investigate who is currently monitoring what. This information can be acquired within a few days using current personnel at no extra costs.

1.4.b. Assess institutional arrangements for monitoring, including roles and responsibilities. This is achievable within the duration of the current project using partner support. There is no new funding required.

3.1.d. Develop and implement a clear governance model for the management of RIMS to assign responsibilities on collecting, processing, uploading, and publishing of new data, updating existing data, as well as quality control and publishing of data, access rights to RIMS, etc. This was discussed at length in the RAMOTSWA 2 Closing Workshop, and is closely

connected to action 3.1.e., which connects RIMS to the LIMCOM data management portal that is under development.

3.2.a. Investigate monitoring practices on both sides and propose options to harmonise.

Current personnel involved in monitoring from both sides can discuss this in a single workshop and produce a harmonised procedure that can be adopted at a higher level. As such, the budget for this task is limited only to workshop logistics.

4.1.a. Public awareness for addressing “myths” and misunderstandings including (1) value of groundwater/trust regarding its hidden nature; (2) the value of wastewater reuse; (3) the value of research and new technologies

A consistent awareness programme that builds on existing communication channels can be implemented at the local level, with some level of international coordination needed in order to deliver uniform information.

4.2.a. Link monitoring activities on climate variability (rainfall/ storage/ flooding) with public information channels.

This task can be coupled with other media dissemination tasks, with the same level of cooperation desirable.

Table 11. Filtered Actions – Expanding Research and Knowledge

Objective	Targets	Actions	T/N
1. Monitoring To develop a customised monitoring programme for particular needs, such as understanding water availability and use, and climate variability and change	1.1 Assessment of water demand and abstraction	1.1.a. Assessment using measurements of abstraction, water level and water quality	T
		1.1.d. Investigate what DWS and municipal supply and services are already monitoring	T
	1.2 Assessment of water quality	1.2.a. Assessment of causes of high nitrate levels	T
	1.4 Investigate institutional and socio-economic aspects of monitoring	1.4.a. Investigate who is currently monitoring what	T
		1.4.b. Assess institutional arrangements for monitoring, including roles and responsibilities.	T
3. Harmonizing Data	3.1 Address sustainability of the Ramotswa Information Management System (RIMS) for data sharing	3.1.d. Develop and implement a clear governance model for the management of RIMS to assign responsibilities on collecting, processing, uploading, and publishing of new data, updating existing data, as well as quality control and publishing of data, access rights to RIMS, etc.	T
	3.2 Integrated Analysis	3.2.a Investigate monitoring Practices on both sides and propose options to harmonise	T
4. Raising Awareness To enhance public and stakeholder communication and profile raising related to the RTBAA	4.1 Water demand management	4.1.a Public awareness for addressing “myths” and misunderstandings including (1) value of groundwater/trust regarding its hidden nature; (2) the value of wastewater reuse; (3) the value of research and new technologies	T
		4.1.b. Information dissemination and public education through various mediums (radio/ community gatherings etc)	N
		4.1.c. Integration with the outreach team with public awareness raising truck	N
	4.2 Early warning information system	4.2.a. Link monitoring activities on climate variability (rainfall/ storage/ flooding) with public information channels	T
		4.3.b. Understand the target groups	N

	4.3 Raising awareness regarding the importance of groundwater, it's limits, groundwater protection and the importance of water saving	4.3.c. Creating communication links and capacity building with local-level catchment management, WARD Councillors and Tribal Authorities	N
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4.1.b. Information dissemination and public education through various mediums (radio/community gatherings etc.) The development of the material into simple message platform in local languages can be a lengthy iterative process. However, it is achievable under two years at a national level. Costs are only limited to the acquisition and distribution of material, and therefore no high costs are envisaged.

4.1.c. Integration with the outreach team with public awareness raising truck. This action can be implemented with the above task.

4.3.b. Understand the target groups. A short local survey can be implemented in each country, within outreach programmes, to map the different user groups at no further cost.

4.3.c. Creating communication links and capacity building with local-level catchment management, WARD Councillors and Tribal Authorities. This task can be jointly implemented with the 'training and capacity building within communities' task above albeit only at national level. It is achievable at a low cost.

7. Prioritizing actions and developing project ideas

Representatives from the Department of Water Affairs (Botswana) and the Department of Water and Sanitation (South Africa) participated in 4 national consultations (2 in Botswana, 2 in South Africa) that aimed to prioritise and characterise projects for implementation (Table 12). The second consultation and a joint workshop in September 2018 led to elaboration of more detailed project ideas.

Table 12. Location and date of national consultations for prioritizing and characterizing actions

	Location	Date
A	Mahikeng, South Africa	8 February 2018
B	Gaborone, Botswana	9 June 2018
C	Pretoria, South Africa	28 August 2018
D	Gaborone, Botswana	12 September 2018

7.1 Prioritised actions

Each consultation included three breakout groups according to the three components of the JSAP: managing for sustainable use, availability and access, enhancing institutions and capacity, and expanding research and knowledge. Participants in each group went through the following process:

1. Selected three priority actions from the larger list of actions
2. Characterised each of three priority actions according to:
 - Timeframe
 - Cost
 - Scale of implementation
 - Modalities for implementation

The actions that were prioritised and characterised through these consultations are listed in Table 13, with more detail of the descriptions or characterizations for implementation included in Annex 2. The column labelled 'filtered action' indicates which of these prioritised actions were also on the list of low-cost, short-term and transboundary.

Table 13. Prioritised actions (more details in Annex 2)

Component	Prioritized Actions	Short-term, low-cost, & transboundary
Managing Water for Sustainable Use, Availability and Access	1.1.a: Awareness raising and communication with local management	X
	1.1.b: Review of existing regulatory frameworks to assess compatibility and needed revisions	X
	1.1.d: Prioritise specific parameters to monitor	X
	1.2.b: Borehole monitoring: water levels, abstractions and quality	X
	1.2.e: Harmonisation of regulatory instruments of borehole drilling	X
	2.1.b: Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access	X
	2.3.a: Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling	X

	3.4.c: Identify wider natural impacts to the aquifer system and methods of mitigation/adaptation	
	Additional action: Revise by-laws to encompass groundwater protection	
Enhancing Institutions and Capacity	1.2.a: Enter into transboundary dialogue to assess the similarities and differences in monitoring and research practices	
	1.2.b: Formalise reporting process (prior notification) around plans between countries and foster interaction in planning process between countries (exchange draft plans concerning developments affecting transboundary Ramotswa area)	
	1.2.c: Agree on joint monitoring practices for harmonised data collection that eliminates data gaps	X
	2.1.d: Creation of possible funding mechanisms to the component actions	
	2.2.a: Joint investments for combined/collaborative groundwater monitoring practices	
	3.1.b: At municipality level, provide short training to orient non-specialists on basics of groundwater	X
	3.3.a: Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations	X
	3.3.b: Establish role of municipalities to create awareness at community level	X
	4.1.a: Assign mentors to junior employees in departments across the water sector	X
	Additional action: Attach junior staff to projects in departments across water sectors	
Expanding Research and Knowledge	1.1.a: Assessment using measurements of abstraction, water level and water quality	X
	1.1.e: Identify gaps in existing data collection to set up new monitoring activities	
	1.4.b: Assess institutional arrangements for monitoring, including roles and responsibilities	X
	1.4.c: Investigate socio-economic implications of water access challenges	
	Additional action: Development of monitoring programme	
	3.1.a: Identify data gaps on RIMS and locate missing data for upload	
	4.1.a: Public awareness for addressing myths and misunderstandings including 1) value of groundwater/trust regarding its hidden nature; 2) the value of wastewater reuse; 3) the value of research and new technologies	X
	4.1.c: Integration with the outreach team within the SADC region	X

7.2 Developed project ideas

Discussion about how best to move specific elements of the JSAP forward immediately occurred during consultations in late 2018 and the joint workshop in September of 2018. In addition to nationally-oriented actions that may be integrated directly into national water strategies and operations, two collaborative projects emerged as priorities for the member countries. This led to the development of two project proposals, summaries of which are included below.

7.2.1 Cooperation for resilience in the Ramotswa: A joint subcommittee for transboundary groundwater management

Objective

To support the institutionalization of joint management of the Ramotswa Transboundary Aquifer Area through capacity building and project development within the newly-formed Limpopo Groundwater Committee (LGC). These efforts will aid joint groundwater management for other shared aquifers between South Africa and Botswana.

Context

Under the joint management principles in the Protocol on Shared Watercourses in the SADC Region, management of shared groundwater resources in the Limpopo River Basin is the joint responsibility of the Department of Water and Sanitation (DWS-BW) Botswana and the Department of Water and Sanitation (DWS-SA) South Africa under an appropriate management structure. The Joint Permanent Technical Committee (JPTC) was established in 1987 between the Government of the Republic of Botswana and the Government of the Republic of South Africa, which oversees a number of joint decisions between the two governments. The Limpopo Watercourse Commission (LIMCOM) was established to manage transboundary water management in the Limpopo River Basin, which includes Botswana, South Africa, Zimbabwe and Mozambique. A newly-formed Limpopo Groundwater Committee (LGC) was established in 2019 to address transboundary aquifer management in the system.

The JPTC has built up capacity and structures for decisions about shared water resources, including the establishment of a joint subcommittee on water quality and aquatic weed management, referred to as a “Sub Technical Committee”. However, the newly-formed LGC under LIMCOM has now also been formed.

Basic project design

This project will facilitate creation of a Joint Groundwater Committee (JGWC) under the JPTC and LGC. The JGWC could follow a similar structure to the Water Quality and Aquatic Weeds Committee that was previously established under the JPTC, while reporting regularly to the LGC. The project may include 1) supporting establishment and sustenance of the Ramotswa subcommittee for a period of 3 years, 2) building capacity in the committee for the first two years, and 3) setting up and executing migration of the committee to LIMCOM during the third year

7.2.2 Understanding the resource in the Ramotswa: Data and information for resilient groundwater cooperation

Objective

To undertake joint data collection, monitoring, and interpretation in the RTBAA, and to utilize shared data to conduct priority studies and assessments.

Context

Cooperative water management in the Southern African Development Community (SADC) is critical for human development and wellbeing, and the extent of critical transboundary aquifers in the region is now widely recognized. While groundwater is increasingly relied upon as a strategic resource, a relative lack of attention to groundwater management has led to over- or under-exploitation of the resource and a lack of capacity for resilient groundwater management.

The Ramotswa Transboundary Aquifer Area (RTBAA), shared between South Africa and Botswana, has been the focus of a four-year USAID-funded, IWMI-implemented project focused on using scientific knowledge to improve joint management of the resource. Significant advances toward better data and information collection and sharing were made under RAMOTSWA I and II through the development of the Ramotswa Information Management System (RIMS), hydrogeological models, and the Baseline Report. However, a set of priority actions emerged from the SAP focusing on joint monitoring and collection to improve understanding of the shared resource.

Joint monitoring related to groundwater has not been undertaken on the Ramotswa Aquifer. In Botswana, a reasonable level of monitoring has been undertaken by the WUC and DWA. Monitoring on the South African side is not as extensive, but some has been undertaken. Joint monitoring of the shared groundwater resource by South Africa and Botswana together as not been undertaken.

Basic project design

This project envisions three components: 1) establishing a plan and process for ongoing joint monitoring, 2) installation of flow meters and monitoring boreholes to enable monitoring, working with the newly formed Ramotswa subcommittee, to jointly undertake periodic monitoring of the aquifer and related surface water resources (namely the Ngotwane river), and 3) conduct priority studies and assessments based on newly collected data.

8. Conclusions

Summing Up The JSAP for the RTBAA outlines a suite of actions that will improve joint management. These actions are the outcome of substantial stakeholder engagement that spanned some 18 months, beginning roughly in the latter part of 2016 and concluding in the first part of 2018.

Components and Actions Under the three components *i) managing for sustainable use, availability and access, ii) enhancing institutions and capacity, and iii) expanding research and knowledge*, a set of objectives guides the associated targets and actions. Of the entire suite of actions, more than one-third were determined to comprise low-cost, short-term actions. Of these low-cost, short-term actions, more than half were judged to be transboundary in nature. Actions within the components of *ii) enhancing institutions and capacity* and *iii) expanding research and knowledge*, hold particular potential for cost-effective cooperative action in the near-term.

Key Priorities In addition to opportunities to adopt low-cost, short-term actions, an emphasis was placed on the priorities of the DWS-BW, WUC and DWS-SA in Botswana and South Africa through targeted national consultations. Through the prioritization process, it became evident that some action types were recurrent, including 1) the need to establish sustainable joint data and monitoring practices for the region, 2) the need to institute structures and processes for ongoing transboundary cooperation and monitoring within regional frameworks, and 3) the need to conduct further assessments to understand the broader context and impacts within which groundwater management is conducted. It is suggested that these are the focus of immediate efforts upon endorsement of the JSAP.

Limitations While the JSAP represents a marked step forward for joint water management in the RTBAA, the JSAP is a means or tool rather than an end. It is a means to focusing joint efforts and a tool that can help leverage funding, as the JSAP is not accompanied by a financial package to enable its implementation. Related, implementation of joint actions in the JSAP will need to be nested in a joint framework namely either or both the JPTC and LIMCOM. Future effort may therefore be devoted to taking actions forward, and nesting the JSAP in the JPTC and LIMCOM.

Moving Forward The JSAP process marks the first step of many in the joint management of the RTBAA. Moving forward, focus should be placed in two areas. A first area is securing endorsement by the relevant regional bodies. The JPTC is the first step, given the present ability to review and endorse this product. Acknowledgement and/or endorsement by LIMCOM and SADC-GMI should also be sought out at the appropriate time. A second area on which focus should be placed is resource mobilization and project implementation. In particular, priority activities like establishing joint data and monitoring practices, establishing the appropriate institutional structures for ongoing water management, and further understanding the system appear to be key enablers to a much broader set of actions. Securing internal (country) resources and linking with key development partners may soon lead to practical realization of actions outlined in this JSAP.

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Annex 1: Classified Actions

Managing water for sustainable use, availability and access

Objective	Targets	Actions	National/ Transboundary	Timeframe	Cost (USD)
1. <u>Monitoring</u> To enhance monitoring of the RTBAA water levels, abstractions and quality trends for sustainable management	1.1. Effective monitoring on the municipality and local level	1.1.a. Awareness raising and communication with local management	N	ST	\$
		1.1.b. Review of existing regulatory frameworks to assess compatibility and needed revisions	N	ST - MT	\$
		1.1.c. Specific monitoring of 'shared' areas of the aquifer	T	MT	\$\$
		1.1.d. Prioritise specific parameters to monitor	T	ST	\$
	1.2. Develop a georeferenced inventory of boreholes and a common information system	1.2.a. Identify boreholes in the area and their existing use	N	ST	\$
		1.2.b. Borehole monitoring: water levels, abstractions and quality	T	ST	\$-\$\$
		1.2.c. Develop procedure to keep this updated	T	ST	\$
		1.2.d. Harmonization of monitoring procedure with policies and processes relevant for borehole registration	T	ST (2-5 years)	\$
		1.2.e. Harmonisation of regulatory instruments for borehole drilling	N	ST (2-5 years)	\$
	1.3. Close monitoring of recharge zones for sustainable management	1.3.a. Develop a common platform for monitoring data to be uploaded by municipalities and stakeholders	T	MT	\$\$
		1.3.b. Identify recharge zones	T	MT	\$\$
		1.3.c. Identify sustainable methods of managing recharge areas	T	MT	\$\$
	1.4. Close monitoring of sanitation impacts and waste water effluent	1.4.a. Assessment of on-site sanitation system impacts	N	MT	\$-\$\$
		1.4.b. Identify and implement methods of reducing on-site sanitation system impacts	N	MT	\$\$-\$\$\$
		1.4.c. Undertake groundwater assessment of area before putting in sanitation systems according to relevant domestic laws/protocols	T	MT	\$\$
2. <u>Water apportionment/ allocation</u> To achieve sustainable and equitable water apportionment and/or allocation to stakeholders, while considering	2.1. Understand current and potential user needs and uses of the RTBAA	2.1.a. Analysis of the quality of water to identify potential/ appropriate uses of the resource	N	MT	\$
		2.1.b. Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access	N	ST	\$
		2.1.c. Review excessive requests for water allocation that end up unused, and could be reallocated	N	MT	\$
		2.1.d. Implement metering of private boreholes to monitor and enforce abstractions	N	MT-LT	\$\$
	2.2. Develop water provision schemes	2.2.a. Develop and implement interventions to address problems and power asymmetries within syndicates	N	MT	\$\$

stakeholder vulnerability	for lower income syndicates	2.2.b. Develop and disseminate template or guidelines for syndicate formation	N	MT	\$
	2.3. Define water licensing and water rights regarding the RTBAA	2.3.a. Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling	N	ST-MT	\$
		2.3.b. Develop a harmonised (transboundary) licensing system in line with the JTPC processes of allocation	T	MT	\$
		2.3.c. Develop allocation rules based on stakeholder mapping and needs/impact analysis	N	MT	\$
3. <u>Contamination control</u> To develop measures to control pollution by reducing contamination, increasing groundwater remediation and expanding appropriate treatment methods	3.1. Increased public/stakeholder awareness of contamination control	3.1.a. Development and dissemination of appropriate promotional material to households / farmers etc.	N	ST	\$
		3.1.b. Education programmes through stakeholder public outreach programmes	N	ST	\$
		3.1.c. Ensuring that there is political 'buy-in' from stakeholders	N	ST	\$
	3.2. Protocols in place regarding prevention of contamination by on-site sanitation systems	3.2.a. Develop joint agreement across the two countries with standards for the RTBAA	T	MT	\$\$
		3.2.b. Identify methods of reducing on-site sanitation system contamination (e.g. lining)	T	MT	\$\$
		3.2.c. Identify alternative (dry) sanitation options (cross ref to component 3)	T	MT	\$
	3.3. Explore alternatives to conventional on-site sanitation systems	3.3.a. On-site sanitation system lining as first step	N	ST	\$
		3.3.b. Investigate dry sanitation options	T	ST	\$\$
	3.4. Land use management that is sensitive to groundwater contamination	3.4.a. Review community based and current management and implement restrictions on activities in vulnerable areas of the aquifer	T	ST	\$\$
		3.4.b. Ensure a transboundary EIA is conducted regarding planned measures that are likely to impact the aquifer system and incorporate groundwater sensitivity guidelines into land board structures	T	LT	\$\$\$
		3.4.c. Identify wider natural impacts to the aquifer system and methods of mitigation/adaptation	T	MT	\$\$
4. <u>Agricultural water use efficiency</u>	4.1. Enhancing farmer awareness about irrigation water use efficiency	4.1.a. Disseminate findings of Agricultural Water Solutions study from RAMOTSWA 2 to relevant stakeholders	N	ST	\$
		4.1.b. Conduct trainings on water use efficiency and the use of WFDs and Chameleon Detectors with farmers and irrigation managers	N	ST	\$\$

	4.2. Expansion of tools for agricultural water solutions	4.2.a. Form partnerships with local agricultural departments and agricultural NGOs (e.g., to set up procurement and distribution of tools)	N	MT	\$\$
		4.2.b. Monitor progress on uptake and impact of the tools through subsequent studies following the Agricultural Water Solutions study	T	MT	\$\$

Enhancing institutions and capacity

Objective	Targets	Actions	N/T	Timeframe	Cost (USD)
1. <u>Institutional harmonization</u> To foster harmonization across different institutional structures concerning the RTBAA	1.1. Internal harmonization within country government departments	1.1.a. Intergovernmental forum – proposals within the 3 levels of government (national, provincial and local) to align programmes; Create a platform so that the technical experts in various departments can come together and bring the key issues to the political level	N	MT	\$
		1.1.b. Identifying areas and sectors that need harmonizing in relation to the RTBAA (for example EIAs / DEA)	N	ST	\$
		1.1.c. Institutional reform to (a) account for the current situation, (b) legally mandate a review process for the future, (c) to establish a technical committee that is incorporated in the review process, and (c) which is coherent with recent institutional reforms	T	LT	\$\$\$
	1.2. Harmonise plans (and planned activities) across countries	1.2.a. Enter into transboundary dialogue to assess the similarities and differences in monitoring and research practices	T	MT	\$-\$\$
		1.2.b. Formalise reporting process (prior notification) around plans between countries and foster interaction in planning process between countries (exchange draft plans concerning developments affecting transboundary RTBAA area)	N	LT	\$\$
		1.2.c. Agree upon joint monitoring practices for harmonised data collection that eliminates data gaps	T	ST	\$
	1.3. Joint management structure - establish “local”/ “operational” joint management committee comprising local based institutions (e.g. local-level catchment management, municipalities, water boards, irrigation stakeholders in SA side and counterparts in SE districts)	1.3.a. Investigate the existence of groundwater committees in transboundary arrangements including in river basins, such as the LIMCOM, ORASECOM, and the JPTC. Learn from their experiences	T	ST	\$
		1.3.b. Liaise with relevant commissions and agree upon a reporting structure to promote harmonization and establish synergies	T	MT	\$
		1.3.c. Seek to form JPTC subcommittee, seek endorsement and support and report to JPTC.	N	ST	\$
2. <u>Agreements over focused transboundary issues</u>	2.1. Agreement establishing Joint Management Structure – operational committee	2.1.a. Protocols for establishing the committee composition, distinguishing between 1) commission or senior officials and 2) operations or technical committee; for bringing in local level institutions	T	MT	
		2.1.b. Protocols for data and information exchange – Observe pre-existing institutional framework for JPTC – identify if it has protocols for data exchange	T	ST-MT	\$-\$\$

To propose and develop transboundary agreement(s) on focused issues requiring cooperation, including protocols for data and information exchange		2.1.c. Protocol mandating engagement with communities	T	MT	\$\$
		2.1.d. Creation of possible funding mechanisms to the component actions	N/T	MT	\$\$
	2.2. Creation of a Memorandum of Understanding for groundwater monitoring, specific to the RTBAA and RIMS	2.2.a. Joint investments for combined/collaborative groundwater monitoring practices	T	LT	\$\$\$
		2.2.b. Agreement on a protocol for joint monitoring	T	MT	\$
		2.2.c. Agreement on a protocol for data exchange	T	MT	\$
		2.2.d. Agreement on protocols that respond to issues already identified	T	ST-MT	\$
		2.2.e. Agreement on protocols for identifying joint issues	T	MT	\$\$
3. <u>Implementation and capacity</u> To develop tools for institutional capacity needs assessments and implementation plans	3.1. Strengthen capacity to cover GW in relevant water management structures	3.1.a. Attract/Hire people with GW expertise within local or catchment-level structures	N	ST	\$\$
		3.1.b. At municipality level, provide short training to orient non-specialists on basics of GW	N	ST-MT	\$
	3.2. Development of an implementation plan	3.2.a. Conduct a needs assessment to identify constraints to implementation and to develop recommendations	N	ST	\$-\$\$
		3.2.b. Review and consolidate implementation plans that are currently present in the National Water Master Plan	N	ST	\$
	3.3. Define key roles and functions and responsibilities for stakeholder institutions in regard to the municipalities	3.3.a. Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations	T	ST	\$
		3.3.b. Establish a role of municipalities to create awareness at community level	N	ST	\$
		3.3.c. Address gaps in municipalities' knowledge in their capacity to do their training roles	N	MT	\$-\$\$
	3.4. Identify ways of mobilizing financial and human resources	3.4.a. Link implementation activities with the relevant national-level development plans and activities to increase chances of higher allocation of the national budget	N	ST	\$
		3.4.b. Initiate secondment agreements to mobilise human resources	N	ST	\$
		3.4.c. Investigate PPP opportunities	T	ST	\$
4. <u>Tailored training</u> To increase technical capacity through facilitated technical trainings	4.1. Implement training and mentoring schemes to ensure continuity of institutional memory	4.1.a. Assign mentors to junior employees in departments across the water sector	T	ST	\$
		4.1.b. Promote specialised short courses specific to job description to increase employee satisfaction, expertise, and retention rates	N/T	ST	\$\$
		4.1.c. Identify issues leading to poor staff retention rates, and create recommendations to the government regarding training, salary, job security and employee satisfaction	N	ST	\$
	4.2. Establish processes for knowledge exchange between public, private and research spheres	4.2.a. Knowledge exchange with universities	T	ST-MT	\$\$
		4.2.b. Identify if students from each country can partner on this project	T	ST	\$
		4.2.c. Identify who would be responsible for providing training	T	ST	\$
		4.2.d. Collaborate with relevant sectoral education authorities as well as organizations providing professional development training	T	ST	\$

Expanding Research and knowledge

Objective	Targets	Actions	N/T	Timeframe	Cost (USD)
1. <u>Monitoring</u> To develop a customised monitoring programme for particular needs, such as understanding water availability and use, and climate variability and change	1.1. Assessment of water demand and abstraction	1.1.a. Assessment using measurements of abstraction, water level and water quality	T	ST	\$
		1.1.b. Re-assess the data requirement for the formula determining water demand (Which formula is this?)	T	MT	\$
		1.1.c. Continuous verification of demand on the ground with demand assessments and investigating why demand changes	T	MT-LT	\$\$
		1.1.d. Investigate what DWS and municipal supply and services are already monitoring	N	ST	\$
		1.1.e. Identify gaps in existing data collection to set up new monitoring activities	T	MT	\$
	1.2. Assessment of water quality	1.2.a. Assessment of causes of high nitrate levels	T	ST -MT	\$-\$\$
		1.2.b. Investigation of causes and solutions of transboundary pollution issues	T	MT	\$\$
		1.2.c. Investigate water quality in pre-identified focus areas. Identify additional hot spot areas, prioritizing areas for potable domestic supply	T	ST-MT	\$\$
		1.2.d. Implement research regarding the impacts of livestock on water quality and quantity	N/T	MT	\$\$
	1.3. Assessment of climate variability and change	1.3.a. Research study on the climate impacts on groundwater (climate and recharge level correlation)	T	LT	\$\$\$
		1.3.b. Monitor rainfall measurements and variability assessment in time and space (locate historical data)	T	MT	\$\$
		1.3.c. Develop an early warning system	T	MT	\$\$
	1.4. Investigate institutional and socio-economic aspects of monitoring	1.4.a. Investigate who is currently monitoring what	T	ST	\$
		1.4.b. Assess institutional arrangements for monitoring, including roles and responsibilities.	T	ST-MT	\$
		1.4.c. Investigate socio-economic implications of water access challenges	T	MT	\$\$
2. <u>Researching alternative management options</u> To explore and identify alternative management options appropriate for the RTBAA (e.g. MAR)	2.1. Focused recharge assessment to assess the possibility of MAR	2.1.a. Research project to understand the connection between the river and the aquifer using water table fluctuation method	T	MT	\$\$
		2.1.b. Research to confirm the presence of dikes using ground-truthing with ground geophysics and other methods to supplement airborne data	T	MT	\$\$
		2.1.c. Determine storage capacity of aquifer	T	MT	\$\$
	2.2. Research to consider options for water sources for MAR	2.2.a. Assessment of wastewater recharge options and required water quality standards	T	MT	\$\$
		2.2.b. Assessment of using water from Gaborone dam	N	MT	\$\$
		2.2.c. Assessment of using water from the North	T	MT	\$\$
		2.2.d. Assessment of aquifer to aquifer transfer for optimal storage	T	MT	\$\$
		2.3.a. Assess potential impacts of MAR on Gaborone Dam and other surface water sources	T	MT	\$\$
		2.3.b. Cost/benefit of using different water sources identified in 2.2.	T	MT	\$\$

	2.3. Cost/benefit analysis to assess practicality of MAR	2.3.c. Cost/benefit study on how MAR can address drought	T	LT	\$\$
	2.4. Investigate different institutional options	2.4.a. Research into alternative management frameworks, identifying which have had success and which may work best in Ramotswa	T	MT	\$\$
		2.4.b. Explore different models for achieving potable water standards, are there cheaper or more efficient ways of achieving potable water?	T	MT	\$\$
3. <u>Harmonising data</u> To integrate different databases in partnership with the Ramotswa Information Management System (RIMS) online platform	3.1. Address sustainability of the Ramotswa Information Management System (RIMS) for data sharing	3.1.a. Identify data gaps on RIMS and locate missing data for upload	T	ST-MT	\$
		3.1.b. Quarterly requests from the RIMS manager to the Water Resources Manager to provide data, which is uploaded to RIMS	T	ST-MT	\$
		3.1.c. Quarterly requests from water managers for new data in and outside the department as it becomes available, to send to RIMS manager	T	ST-MT	\$
		3.1.d. Develop and implement a clear governance model for the management of RIMS to assign responsibilities on collecting, processing, uploading, and publishing of new data, updating existing data, as well as quality control and publishing of data, access rights to RIMS, etc.	T	ST	\$
		3.1.e. In the longer term, migrate RIMS-data from IGRAC servers to LIMIS (LIMCOM Information Management System) that is currently under development.	T	MT	\$
	3.2. Integrated analysis	3.2.a. Investigate monitoring practices on both sides and propose options to harmonise.	T	ST	\$
		3.2.b. Joint/transboundary data analysis to create full understanding of the whole aquifer and its management	T	MT	\$\$
		3.3.c. Beneficiation and valuation. Investigate the benefits obtained from the Ramotswa's water and how equitably these are shared. Evaluate benefits of cooperative management.	T	MT	\$\$
4. <u>Raising Awareness</u> To enhance public and stakeholder communication and profile raising related to the RTBAA	4.1. Water demand management	4.1.a. Public awareness for addressing "myths" and misunderstandings including (1) value of groundwater/trust regarding its hidden nature; (2) the value of wastewater reuse; (3) the value of research and new technologies	T	ST-MT	\$
		4.1.b. Information dissemination and public education through various mediums (radio/ community gatherings etc.)	N	ST-MT	\$
		4.1.c. Integration with the outreach team with public awareness raising track	N	ST-MT	\$
		4.1.d. Working with schools to give talks, and integrating key water management messages into the curriculum	T	MT	\$
	4.2. Early warning information system	4.2.a. Link monitoring activities on climate variability (rainfall/ storage/ flooding) with public information channels	T	ST-MT	\$
	4.3. Raising awareness regarding the	4.3.a. Training and capacity building within communities	T	ST-MT	\$-\$\$
		4.3.b. Understand the target groups	N	ST-MT	\$

	importance of groundwater and its limits, groundwater protection and the importance of water saving	4.3.c. Creating communication links and capacity building with local-level catchment management, WARD Councillors and Tribal Authorities	N	ST-MT	\$
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Annex 2: Prioritised Project Concepts

Representatives from the Department of Water Affairs (Botswana) and the Department of Water and Sanitation (South Africa) participated in 4 national consultations (2 in Botswana, 2 in South Africa) that aimed to prioritise and characterise projects for implementation. The four workshops were as follows:

	Location	Date
A	Mahikeng, South Africa	8 February 2018
B	Gaborone, Botswana	9 June 2018
C	Pretoria, South Africa	28 August 2018
D	Gaborone, Botswana	12 September 2018

The format was to break into three groups according to the three components of the SAP (i.e. managing for sustainable use, availability and access, enhancing institutions and capacity, and expanding research and knowledge). Participants were asked to:

3. Select three priority actions from the larger list of actions
4. Characterise each of three priority actions according to:
 - a. Timeframe
 - b. Cost
 - c. Scale of implementation
 - d. Modalities for implementation

Managing Water for Sustainable Use, Availability and Access (column 1 indicates the consultation(s) from the table that prioritised the action)

	Prioritised Action	Description from consultation
C	<p>Objective 1: Monitoring</p> <p>Target 1.1: Effective monitoring on the municipality and local level</p> <p>Action 1.1.a: Awareness raising and communication with local management</p>	<ul style="list-style-type: none"> • This action requires creation of education programmes at schools, community outreach programmes, workshops for stakeholder engagement and skill training programmes for the teachers and community. • This action can be implemented in 2-5 years at a high cost as it will require change of curriculum. • No international cooperation or MOUs are required. • Key stakeholders are DWA, DWS, the education sector, government. Beneficiaries are the community and learners. • The action can be financed from government and stakeholders.

		<ul style="list-style-type: none"> • Key obstacles will be communication between the three spheres of government, commitment and the securing of funds for the action.
A	<p>Objective 1: Monitoring</p> <p>Target 1.1: Effective monitoring on the municipality and local level</p> <p>Action 1.1.b: Review of existing regulatory frameworks to assess compatibility and needed revisions</p>	<ul style="list-style-type: none"> • This is a medium-term action with a budget not exceeding USD10 000. • The action requires international cooperation for implementation. • Tasks can all be implemented using in-house staff and financed by the regular municipal annual budget.
D	<p>Objective 1: Monitoring</p> <p>Target 1.1: Effective monitoring on the municipality and local level</p> <p>Action 1.1.d: Prioritise specific parameters to monitor</p>	<ul style="list-style-type: none"> • This action requires selection of critical water monitoring parameters for water resource management to enhance sustainable supply and eventually form part of an early warning system. There are four main critical parameters namely, water level, water quality, abstraction and rainfall data, however these will need outsourcing as not all boreholes available are being monitored. • This action can be implemented in 1-2 years and will be an on-going activity to sustain water quality and supply. The action will cost about P500 000(pula) for the installation of Rain gauges, data loggers and borehole drilling. Additional funds will be required from the DWA to sustain monitoring activities. • This action requires initial international cooperation to provide or assist in funding but, after implementation it will be a national issue to sustain so no MOU is required. • Key stakeholders are DWA, Water Utilities Corporation (WUC), Botswana Geoscience Institute, Department of Meteorological services (DMS) and the Ministry of Agriculture (MOA) as the departments that have daily impact on the water sources and key implementers being DWA and WUC. • This action utilises the skills and personal available internally and funding can come from donors as well as co-funding in-kind from DWA. • Key obstacles include securing funds from government and donors due to perception that this is a management rather than practical issue and commitment of stakeholders to sustain the action. • The immediate first step is to communicate conclusive recommendations of the ongoing RAMOTSWA project to secure the funds e.g. contribute to resilience in Limpopo basin.

B	Objective 1: Monitoring Target 1.2: Develop a geo-referenced inventory of boreholes and a common information system Action 1.2.b: Borehole monitoring: water levels, abstraction and quality	<ul style="list-style-type: none"> • 25 boreholes will be monitored for water level and water quality and abstraction rate. • Participants submitted that this action requires a two-year implementation period at a cost of USD300 000. • This action requires no international cooperation and skilled staff is available. • Donor funding is required, and participants suggested that USAID may be able to assist.
	C	<ul style="list-style-type: none"> • This action requires revision and optimisation of current monitoring networks that are available along with regional water use and quality. • This is an ongoing practice with no implementation time frame required and a low USD cost. • No international cooperation or MOUs are required. • Key stakeholders are Government (National and Provincial) and municipalities. • The action utilises existing skills, with no external funding required. • Key obstacles moving forward will be the level of commitment of stakeholders.
C	Objective 1: Monitoring Target 1.2: Develop a geo-referenced inventory of boreholes and a common information system Action 1.2.e: Harmonisation of regulatory instruments of borehole drilling	<ul style="list-style-type: none"> • This action requires revision of existing laws/by laws for borehole drilling and development of an explicit regulation (registration, permitting data storage/ sharing management). • This can be implemented in 2-5 years at a low USD cost. • No international cooperation is required. • Key stakeholders are the government (national and local). • Financing can be from government. • The key obstacle is expected to be commitment from government and the will to regulate the action.
A	Objective 2: Water Apportionment/ Allocation Target 2.1: Understand current and potential user needs and uses of the RTBAA Action 2.1.b: Conduct stakeholder analyses to identify stakeholder needs and priorities, including identifying those most reliant on the resource and most impacted by lack of sufficient quality or access	<ul style="list-style-type: none"> • This was considered a short-term action with a budget below USD20 000 to be implemented during current project consultations. • This action can benefit from international cooperation. • Skilled personnel are available from current departmental staff.
B		<ul style="list-style-type: none"> • This was considered a short-term action lasting about one and half years to implement with a budget of just below USD200 000. • This action does not require transboundary cooperation. • Funding must be sourced from outside government with a government contribution (possibly from SADC or USAID). • There is enough capacity in the existing staff to implement it.

D	<p>Objective 2: Water Apportionment/ Allocation</p> <p>Target 2.3: Define water licensing and water rights regarding the RTBAA</p> <p>Action 2.3.a: Review (and amend if necessary) existing regulatory instruments regarding water rights and licensing, including borehole drilling</p>	<ul style="list-style-type: none"> • This action focuses on drilling within water works areas and wellfields. It requires a review of protection zone studies that were done on boreholes and reservoirs as the main concern is pollution and private drilling in the area. • The implementation period for this action is 12 months and will cost about P 1Million (pula). • No international cooperation is required and no MOU is required. • Key stakeholders are Department of Town and Regional Planning (DTRP), DWA, BGI, MOA with implementers being DWA and WUC. • Skills and personnel are available internally for project scoping and supervision of implementation. • Funding is required from donors but mainly in-kind as they have the skills and personnel to implement. • The first step to take will be to build a case on the action, review and analyse data from Water Appointment Board (WAB) on applications of allocated licences, number of boreholes allocated in the wellfields and the conflicts that have raised from this. • The key obstacle can be revealing information as most of the information is private to DWA and applicants.
A	<p>Objective 3: Contamination Control</p> <p>Target 3.4: Land use management that is sensitive to groundwater contamination</p> <p>Action 3.4.c: Identify wider natural impacts to the aquifer system and methods of mitigation/adaptation</p>	<ul style="list-style-type: none"> • Participants considered this a medium-term action with a budget just over USD500 000. • The action will require international cooperation to implement. • Funding will be required from both government and donors. • Relevant skills are available in departmental staff.
B	<p>Additional action: Revise by-laws to encompass groundwater protection</p>	<ul style="list-style-type: none"> • This action can be implemented in 18 months with an estimated budget of USD200 000. • International cooperation is not required. • Funding will be required from both government and donors. • Relevant skills are available in departmental staff.

Enhancing Institutions and Capacity (column 1 indicates the consultation(s) from the table that prioritised the action)

	Action	Description
A	<p>Objective 1: Institutional harmonization</p> <p>Target 1.2: Harmonise plans (and planned activities) across countries</p> <p>Action 1.2.a: Enter into transboundary dialogue to assess the similarities and differences in monitoring and research practices</p>	<ul style="list-style-type: none"> • Participants identified this as a short-term action with a budget below USD10 000. • This action can benefit from international cooperation and implementation will require an MOU with country delegates (10 each) meeting regularly to discuss issues. • Funding can be sourced from the local water utilities and donor support. • Some negotiation skills training will be necessary for the delegates.
B	<p>Objective 1: Institutional harmonization</p> <p>Target 1.2: Harmonise plans (and planned activities) across countries</p> <p>Action 1.2.b: Formalise reporting process (prior notification) around plans between countries and foster interaction in planning process between countries (exchange draft plans concerning developments affecting transboundary Ramotswa area)</p>	<ul style="list-style-type: none"> • Participants decided this action will require a minimum of two years of implementation, but will cost less than USD50 000. • The action requires international cooperation, with some form of MOU between the parties. • The action can use available personnel but will require donor support (SADC-GMI may be well-positioned to champion and fund the process).
C	<p>Objective 1: Institutional harmonization</p> <p>Target 1.2: Harmonise plans (and planned activities) across countries)</p> <p>Action 1.2.c: Agree on joint monitoring practices for harmonised data collection that eliminates data gaps</p>	<ul style="list-style-type: none"> • This action requires investigation of existing monitoring practices in South Africa and Botswana and harmonization of the available data. • This can be implemented in 12 months at a cost of about R100 000 for workshop orientation. • This action requires international cooperation and MOUs. • Existing agreements and internal skills can be used (personal experience). • Key stakeholders are the DWA, DWS, RBOs and other water sectors as key implementers and water sectors as beneficiaries. • Funding will be required from DWA, DWS and International cooperating partners (ICPs) through submission of proposals or incorporating in existing operational plans of DWS/DWA. • Challenges of the action may be securing of the funds, capacity and commitment from stakeholders.

D		<ul style="list-style-type: none"> • This action requires investigation of existing monitoring practices in South Africa and Botswana and harmonization of available data through joint steering committees to achieve a common goal. • This can be implemented in 2-3 months at a cost of about USD 5000 for workshop orientation. • International cooperation and MOUs will be required along with MOUs. • Existing agreements and internal skills can also be used. • Key stakeholders are the DWA, DWS, Donors, farmers association local community members and land authorities. • Funding will be required from donors and member states through submission of proposals or incorporating in existing operational plans of DWS/DWA. • The challenges of the action can be securing of the funds and commitment from stakeholders.
A	<p>Objective 2: Agreements over focused transboundary issues</p> <p>Target 2.1: Creation of possible funding mechanisms to the component actions</p> <p>Action 2.1.d. Creation of possible funding mechanisms to the component actions</p>	<ul style="list-style-type: none"> • This action is short-term. • International cooperation would be desired. • The action will mainly be accomplished by current staff using desktop research and in-house committee meetings. Some essential stakeholders may be engaged now and then.
B	<p>Objective 2: Agreements over focused transboundary issues</p> <p>Target 2.2: Creation of MOU for groundwater monitoring, specific to the RTBAA and RIMS</p> <p>Action 2.2.a: Joint investments for combined/collaborative groundwater monitoring practices</p>	<ul style="list-style-type: none"> • This action can be implemented between 2 and 5 years at an estimated cost of USD100 000. • This action requires international cooperation and an MOU will be required to operationalise the action. • The action can be financed through public-private partnerships. • The current staff in both countries can be utilised for this.
B	<p>Objective 3: Implementation and capacity</p> <p>Target 3.1: Strengthen capacity to cover GW in relevant water management structures</p> <p>Action 3.1.b: At municipality level, provide short training to orient non-specialists on basics of GW</p>	<ul style="list-style-type: none"> • This action was considered short term, requiring less than 2 years to complete with a budget of less than USD50 000. • This action has no need for international cooperation. • The action can be wholly financed by government using current staff.

A	<p>Objective 3: Implementation and capacity</p> <p>Target 3.3: Define key roles and functions and responsibilities for stakeholder institutions in regard to the municipalities</p> <p>Action 3.3.a: Needs assessment for institutions in regard to fulfilling their mandate; needs assessment to identify constraints to implementation and to develop recommendations</p>	<ul style="list-style-type: none"> • This action was considered as an inexpensive, nationally focused and short term. • Respective government departments should provide funding. • For implementation, the first step is to form engagement committees, then engage relevant communities to develop a masterplan that will be implemented via local government programmes
C	<p>Objective 3: Implementation and capacity</p> <p>Target 3.3: Define key roles and functions and responsibilities for stakeholder institutions in regard to the municipalities</p> <p>Action 3.3.b: Establish role of municipalities to create awareness at community level</p>	<ul style="list-style-type: none"> • This action requires first mobilizing and involving the community using existing platforms in each country. • Participants outlined that this can be implemented in about 6 months at no cost as existing infrastructure will be used. • No international cooperation or MOUs will be required. • Key stakeholders for implementation are municipalities, DWS, DWA and the affected community with the community as beneficiaries. • Existing skills will be used. • The key obstacle will be the commitment of key stakeholders and communities in the area.
D		<ul style="list-style-type: none"> • This action requires forming consultations with local authorities and community meetings to educate the community about the on-going project and its primary objectives. • This action can be implemented in 6-7 months at a low cost of about USD 3000 to cover travel cost. • International cooperation will be required to accommodate both local communities surrounding RAMOTSWA who are affected, but no MOU is required. • Key stakeholders are DWA, local community members both from South Africa and Botswana, municipalities etc. • Skills and personnel will be incorporated internally with the source of funding from government. • The main obstacles may be commitment of stakeholders and buy-in from the locals. • The first step will be to approach municipalities with project objectives and explain how the locals will benefit.
C	<p>Objective 4: Tailored training</p> <p>Target 4.1: Implement training and mentoring schemes to ensure continuity of institutional memory</p> <p>Action 4.1.a: Assign mentors to junior employees in departments across the water sector</p>	<ul style="list-style-type: none"> • This action requires development of a mechanism on skill transfer to sustain water management skills within the water sectors and investigate the Gap skill analysis in the departments. • This can be implemented in 12 months at no cost as internal skills will be used. • No international cooperation is required and no MOUs are required. • Key stakeholders are DWA and DWS with the interns as beneficiaries. • Existing skills will be utilised. • Key obstacles for the action may be commitment from stakeholders and the availability of projects to create a platform for mentoring.

D	<p>Objective 4: Tailored training</p> <p>Target 4.1: Implement training and mentoring schemes to ensure continuity of institutional memory</p> <p>Attach junior staff to projects in departments across water sectors</p>	<ul style="list-style-type: none"> • This action requires identification of appropriate junior staff based on criteria of a project related to skill development. • This can be implemented for the duration of the project, or can be continuous if the project is on-going. It can be implemented at no cost because junior staff will be employees of the DWA. • International cooperation is required by both member states to indicate clear project roles of the junior staff, and no MOU is required. • Skills and personnel will be incorporated internally by senior staff who are well experienced. • Source of funding will be government as all are employees of DWA. • Key obstacles may be commitment from junior staff and project availability or sustainability. • First steps are to have a project available and funding available for payment of junior staff.
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Expanding Research and Knowledge (column 1 indicates the consultation(s) from the table that prioritised the action)

	Action	Description
A	<p>Objective 1: Monitoring</p> <p>Target 1.1: Assessment of water demand and abstraction</p>	<ul style="list-style-type: none"> • This is a medium-term action with a high estimated budget of about a million USD. • This action can benefit from international cooperation and an MOU will be required for implementation. • Funding should be sourced from large water users like industry, famers and municipalities. • Further skills training will be required.
B	Action 1.1.a: Assessment using measurements of abstraction, water level and water quality	<ul style="list-style-type: none"> • This is a medium-term action with a high estimated budget of about a million USD. • This action can benefit from international cooperation and an MOU will be required for implementation. • Funding should be sourced from large water users like industry, famers and municipalities. • Further skills training will be required.
D		<ul style="list-style-type: none"> • This action will require that six flow meters are installed along Ngotoane River/ RTBAA Area with flow being monitored daily, water quality weekly and monthly uploads of the time series to RIMS database. • The implementation period is 2 years at a cost of about USD 40 000. • Funding can be secured by linking the action with adapting to rainfall variability and climate change (SADC water fund and/or CRIDF). • An MOU between South Africa and Botswana is required. • Key implementers are DWA in Botswana, while the community will benefit with better planning and improved crop selection based on improved water quality knowledge. • The challenges can be the resistance from farmers and vandalism.
B	Objective 1: Monitoring	<ul style="list-style-type: none"> • This action can be implemented within two years at a cost below USD10 000, plus logistical costs.

	<p>Target 1.1: Assessment of water demand and abstraction</p> <p>Action 1.1e: Identify gaps in existing data collection to set up new monitoring activities</p>	<ul style="list-style-type: none"> • International cooperation and an MOU are required. • More groundwater experts will be required and IP assistance needed for funding e.g. IWMI.
A	<p>Objective 1: Monitoring</p> <p>Target 1.4: Investigate institutional and socio-economic aspects of monitoring</p> <p>Action 1.4.c: Investigate socio-economic implications of water access challenges</p>	<ul style="list-style-type: none"> • This action was considered short-term and inexpensive with an estimated annual budget of USD20 000. • International cooperation will be desired. • Implementation will mainly involve field surveys that can be done by graduate students. • Funding may come from local government.
B	<p>Objective 1: Monitoring</p> <p>Target 1.4: Investigate institutional and socio-economic aspects of monitoring</p> <p>Action 1.4.b: Assess institutional arrangements for monitoring, including roles and responsibilities</p>	<ul style="list-style-type: none"> • This action is short term, lasting only six months and costing about USD5000 including logistical costs. • International cooperation is required for the action and an MOU is needed. • The respective states should fund this action, and implement using current personnel in groundwater, legal and strategy.
C	<p>Objective 1: Monitoring</p> <p>Additional action: Development of monitoring programme</p>	<ul style="list-style-type: none"> • This action allows for baseline data reports, groundwater level trends, compliance and early warnings on hazardous events. • This can be implemented in 12 months at a cost of less than USD 10 000. • This action requires international cooperation and MOUs. • This action can be supported by LIMCOM and SADC-GMI, in addition to the JPTC. • Skills from DWA, DWS and RAMOTSWA staff to be transferred into the programme. • Finance will be insourced by DWA and DWS with an assistance from voluntary ICPs.
A	<p>Objective 3: Harmonizing data</p> <p>Target 3.1: Address sustainability of the Ramotswa Information Management System (RIMS) for data sharing</p> <p>Action 3.1.a: Identify data gaps on RIMS and locate missing data for upload</p>	<ul style="list-style-type: none"> • Participants also considered this action as short term at an estimated cost just under USD200 000. • This action will benefit from international cooperation. • Funding must come from the municipal budget. • Implementation can be done using in-house staff and committed project coordinators will be needed.

C	<p>Objective 4: Raising awareness</p> <p>Target 4.1: Water demand management</p> <p>Action 4.1.a: Public awareness for addressing myths and misunderstandings including 1) value of groundwater/trust regarding its hidden nature; 2) the value of wastewater reuse; 3) the value of research and new technologies</p>	<ul style="list-style-type: none"> • This action requires identification of existing communication platforms, ward counsels and tribal authorities as well as available government and local communities. • This can be implemented in 12 months at an ongoing cost of less than USD 10 000. • No international cooperation or MOU is required. • Skills required will be implemented by the RAMOTSWA staff team with funding incorporated from government. • The obstacle may be securing the funding for the action.
C	<p>Objective 4: Raising awareness</p> <p>Target 4.1: Water demand management</p> <p>Action 4.1.c: Integration with the outreach team within the SADC region</p>	<ul style="list-style-type: none"> • This action requires collaboration with SADC-GMI on conjunctive management of transboundary aquifer projects and learn from outcomes of different teams (projects). • This can be implemented in 12 months at a low cost (within the scope and budget of SADC-GMI). • This action will require international cooperation and MOUs from the countries involved.

Annex 3. Participant Lists, SAP Consultations

Event	Participants
Strategic Action Plan Consultation for RAMOTSWA Department of Water Affairs, Gaborone, Botswana 23 March 2017	Charles Nkile (DWA), Keodumetse Keetile (DWA), Thato Setloboko (DWA), Stephanie Hawkins (IWMI)
Strategic Action Plan Consultation for RAMOTSWA Department of Water Affairs, Gaborone, Botswana 1 August 2017	Keodumetse Keetile (DWA), Bochengebu Somolekae (DWA), Charles Nkile (DWA), Thato Setloboko (DWA), Piet Kenabatho (UB), K. Daniel (BGI), Sydney Ntshole (DWA), Moses Moehadu (WUC), Stephanie Hawkins (IWMI), Jonathan Lautze (IWMI), Girma Ebrahim (IWMI)
Strategic Action Plan Consultation for RAMOTSWA2 Department of Water and Sanitation, Pretoria, South Africa 18 August 2017	Artuno Lonento Ferras (DWS), Lephai Maunatlala (DWS), Moses Mukota (DWS), Selebaleng Gaebee (DWS), Thandilizwe Bengeza (DWS), Maoko Sydwell (DWS), Sivashni Naicker (DWS), Kwazikwakhe Majola (DWS), Mokgoberg Phirwa (DWS), Rachel Mpe (DWS), Stephanie Hawkins (IWMI), Jonathan Lautze (IWMI)
Attendance for Gender Presentation and Consultation for RAMOTSWA2 Department of Water Affairs, Gaborone, Botswana 12 October 2017	Keodumetse Keetile (DWA), Charles Nkile (DWA), Sydney Ntshole (DWA), Saniso Sakuringwa (DWA), Thato Setloboko (DWA), Moses Moehadu (WUC), Piet Kenabatho (UB), Bochengebu Somolekae (DWA), Manuel Magombeyi (IWMI), Girma Y. Ebrahim (IWMI), Stephanie Hawkins (IWMI), Jonathan Lautze (IWMI)
Attendance for Strategic Action Plan Consultation for RAMOTSWA2 Department of Water and Sanitation, Pretoria, South Africa 31 October 2017	Sakhile Mndaweni (DWS), Sivashni Naicker (DWS), Thandilizwe Bengeza (DWS), Awodwa Maginyia (DWS), Fennedy Manduauk (DWS), Liuhawani Romahuma (DWS), Margaret Matlelame (DWS), Martha Komape (DWS), Lephai Maunatlala (DWS), Maoko Sydwell (DWS), Ramogale Sekwele (DWS), Selebaleng Gaebee (DWS), Stephanie Hawkins (IWMI), Jonathan Lautze (IWMI)
Attendance for Strategic Action Plan Consultation for RAMOTSWA2 Department of Water Affairs, Gaborone, Botswana 19 June 2018	Alfred K. Petros (MLW-DWA), Phemelo Makoba (MLWS-DWA), Bochengebu Somolekae (DWA), Keodumetse Keetile (DWA), Moses Moehadu (WUC), Nelson Lekgetho (DWA), G. Ramoshibidu (DWA), Charles Nkile (DWA), Davies Saruchera (IWMI), Girma Ebrahim (IWMI), Manuel Magombeyi (IWMI)
Strategic Action Plan Consultation for RAMOTSWA2	Mirrandar Mapanzene, (DWS), Sivashni Naicker (DWS), Selebaleng Gaebee (DWS),

Event	Participants
<p>Department of Water and Sanitation, Pretoria, South Africa 27 June 2018</p>	<p>Thandilizwe Bengeza (DWS), Moses Mukota (DWS), Sakhile Mndaweni (DWS), Ramogale Sekwele (DWS), Adaora Okonkwo (DWS), Davies Saruchera (IWMI)</p>
<p>Strategic Action Plan Joint Workshop RAMOTSWA2 Farm Inn, Pretoria, South Africa 19 September 2018 (Day 1)</p>	<p>Andy Sambo (DWS), Benny Sithole (DWS), Kwazikwakhe Majola (DWS), Moloko Matlala (DWS), Moses Mukota (DWS), Pius Selebogo (DWS), Rachel Mpe (DWS), Ramogale Sekwele (DWS), Sakhile Mndaweni (DWS), Selebaleng Gaebee (DWS), Duduzile Twaji (DWS), Moses Moehadu (WUC), Keatlaretswe Gaogelwe (WUC), Keodumetse Keetile (DWA), Bochengebu Somolekae (DWA), Charles Nkile (DWA), Nelson Legketho (DWA), Phemelo Makoba (DWA), Thato Setloboko (DWA), Thabang Sebogodi, Motlhaka Scheme, Victor Maboka, Ngaka Modiri Molema, Brighton Munyai (SADC-GMI), Doreen Robinson (USAID), Natasha de Marcken (USAID), Geert-Jan Nijsten (IGRAC), Arnaud Sterckx (IGRAC), Anita Lazurko (IWMI), Girma Ebrahim (IWMI), Jonathan Lautze (IWMI), Karen Villholth (IWMI), Manuel Magombeyi (IWMI), Resego Mokomela (IWMI), Simon Trust (IWMI)</p>
<p>Strategic Action Plan Joint Workshop RAMOTSWA2 Farm Inn, Pretoria, South Africa 20 September 2018 (Day 2)</p>	<p>Andy Sambo (DWS), Benny Sithole (DWS), Kwazikwakhe Majola (DWS), Moloko Matala (DWS), Moses Mukota (DWS), Pius Selebogo (DWS), Rachel Mpe (DWS), Ramogale Sekwele (DWS), Sakhile Mndaweni (DWS), Selebaleng Gaebee (DWS), Keatlaretswe Gaogelwe (WUC), Moses Moehadu (WUC), Charles Nkile (DWA), Bochengebu Somolekae (DWA), Keodumetse Keetile (DWA), Nelson Legketho (DWA), Phemelo Makoba (DWA), Thato Setloboko (DWA), Brighton Munyai (SADC-GMI), Geert-Jan Nijsten (IGRAC), Arnaud Sterckx (IGRAC), Natasha de Marcken (USAID), Doreen Robinson (USAID), Thabang Sebogodi, Motlhaka Scheme, Victor Maboka, Ngaka Modiri Molema, Anita Lazurko (IWMI), Simon Trust (IWMI), Resego Mokomela (IWMI), Manuel Magombeyi (IWMI), Girma Ebrahim (IWMI), Jonathan Lautze (IWMI), Karen Villholth (IWMI)</p>