CITY WATER RESILIENCE ASSESSMENT

WATER RESILIENCE PROFILE

MUSANZE

ACKNOWLEDGEMENTS

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LETTER FROM THE DISTRICT OF MUSANZE

Musanze's topography and unique urban landscape makes the city prone to several water related shocks including flooding, and landslides. These shocks are further exacerbated by rapid urbanization, population growth, climate change, and infrastructure damage, among others.

The District of Musanze, with its vision to become a tourism center of excellence in the region, is committed to building a water resilient city by working to ensure that its urban development and planning decisions are in line with natural water related ecosystem services to sustain the city's water resources. The city recognizes that many of its water stresses and risks can be avoided through holistic and integrated planning both within the city boundary and the watersheds the city is dependent on. Through its work as part of the Urban Water Resilience in Africa Initiative (UWRI), Musanze has taken stock of its challenges and key needs to build water resilience.

Stakeholders from various water and urban development sectors including city, national and regional agencies, civil society, community groups and private sector were engaged to identify key areas of action to improve the city's water resilience. Six vision areas and 15 actions have been identified in the following Musanze Water Resilience Profile and Action Plan. These include actions to establish and operationalize a framework to optimize coordination of WRM stakeholders between City-District-Basin-National levels; develop neighborhood level plans that integrate water resilience to advance implementation of the Musanze Master Plan; apply Nature Based Solutions (NBS) in informal and formal settlements of Musanze City to build water resilience; and implement community awareness campaigns on water resilience issues to improve stewardship and compliance; among others.

As part of the initial UWRI cohort of six cities, Musanze is taking proactive action to build a resilient water future for all. On behalf of the District of Musanze, I would like to thank the World Resources Institute, Arup, the Resilient Cities Network, and the Resilience Shift for facilitating this project, and the diverse groups of stakeholders in Musanze who contributed their time and input to this process.

Janvier RAMULI
Mayor of Musanze District

LETTER FROM PARTNERS

The city of Musanze has taken various steps in its resilience planning journey and is the amongst the first cities in Rwanda to place holistic urban resilience thinking at its core. However, at the same time, the city faces various challenges that impact its ability to recover and respond to particularly water-related shocks and stresses. These challenges include including stormwater management, water infrastructure needs, land use development, wastes management, water sources management, water supply and sanitation concerns. To address these challenges in a sustainable, inclusive, and resilient manner, the city has taken important steps to develop the Musanze Water Resilience Profile and Action Plan.

The World Resources Institute, together with the City of Musanze Chief Resilience Officer, Arup, the Resilient Cities Network, and The Resilience Shift, has collaborated with key stakeholders in Musanze not only to advance the City's responses to addressing its water risks and vulnerabilities but also to utilize its very own capacities and strengths. This process, facilitated by the City Water Resilience Approach (CWRA), and integrated with research and spatial analysis, has moved the highlighted challenge areas in Musanze to identified place-based actions aimed specifically at improving the City's urban water resilience. The project team looks forward to continuing the work with city stakeholders to prioritize actions and advance them towards implementation. The Urban Water Resilience in Africa Initiative will additionally support knowledge exchange between the cohort of African cities each developing their own distinct action plans. Support for this initiative is provided by the German Federal Ministry for Economic Cooperation and Development (BMZ).

On behalf of the project partners, we would like to thank the City of Musanze and everyone who has engaged throughout the planning, assessment and visioning processes to develop this Water Resilience Profile and Action Plan.

Arup, Resilient Cities Network, the Resilience Shift, WRI

ARUP

RESILIENT CITIES NETWORK

THE RESILIENCE SHIFT

WORLD RESOURCES INSTITUTE

EXECUTIVE SUMMARY

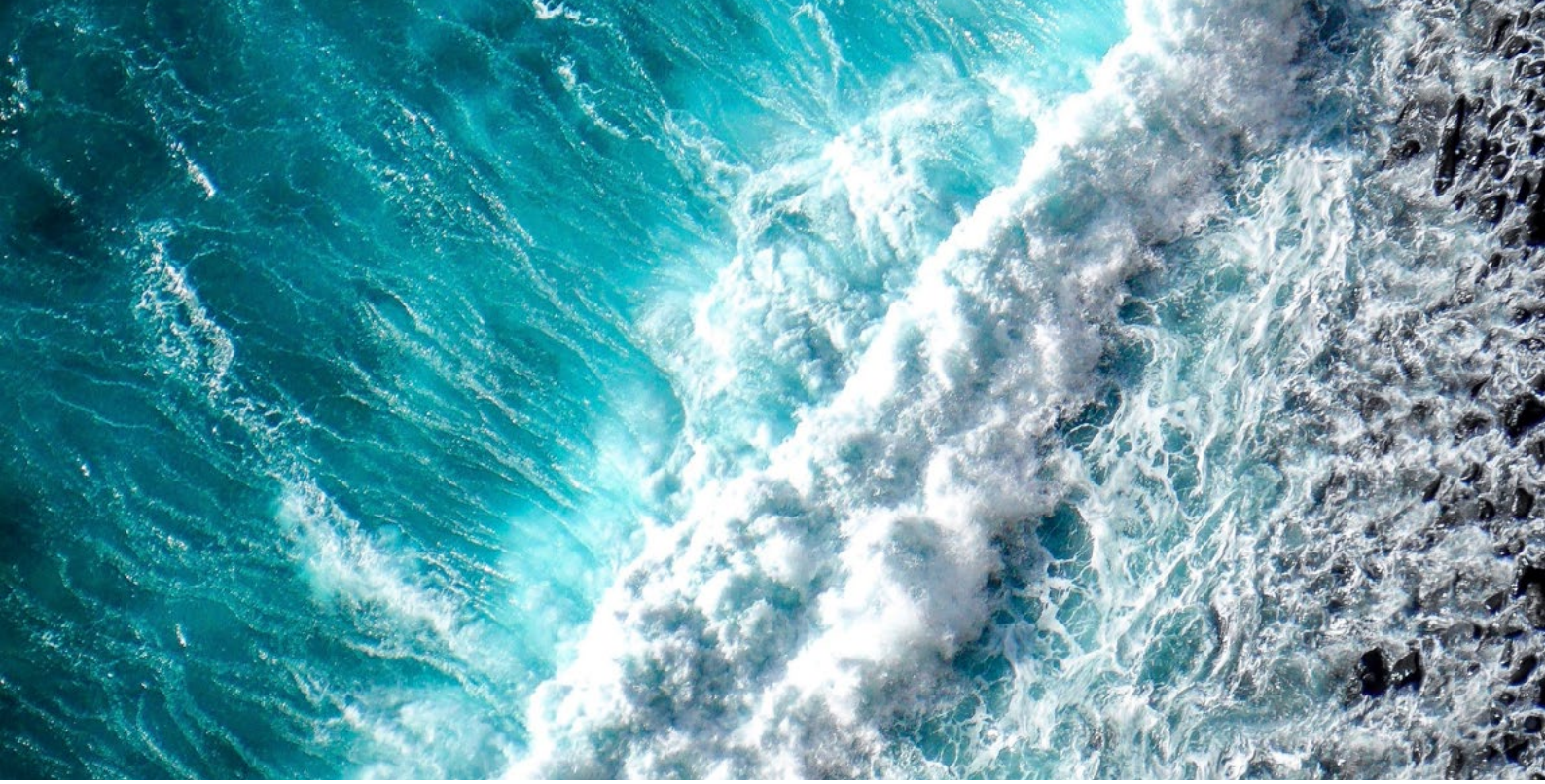
"Urban water resilience means equitable access to safe, reliable, and affordable drinking water and sanitation; flood-protected neighborhoods; and healthy regional watersheds resulting from water-sensitive infrastructure and aligned city and regional development, enabled by governance, planning, and finance systems that continually adapt to changing local contexts and climate risks"

- (World Resources Institute, 2021).

Water Resilience, as defined by City Water Resilient Approach (CWRA), is "the capacity of the urban water system, including the human, social, political, economic, physical and natural assets, to anticipate and absorb, adapt and respond to, and learn from shocks and stresses, in order to protect public health & wellbeing and the natural environment and minimize economic disruption." Water resilience, as defined in the white paper for the 2030 Africa Joint Agenda, outlines "Urban water resilience means equitable access to safe, reliable, and affordable drinking water and sanitation; flood-protected neighbourhoods; and healthy regional watersheds resulting from water-sensitive infrastructure and aligned city and regional development, enabled by governance, planning, and finance systems that continually adapt to changing local contexts and climate risks." Both definitions recognize that a systems approach is needed to address urban water resilience, this includes governance, planning and finance systems along with the physical systems that need to be redesigned in order to continually adapt to emerging risks. Additionally, both definitions acknowledge the key end goals as providing access to affordable water and sanitation for all; protecting people from water-related shocks and stresses; and aligning development objectives at the city-region scale. This action plan aims to address these core goals in order to support Musanze city in becoming water resilient.

Urban areas in Africa are facing water-related challenges (such as pollution, droughts and floods) which are causing health and wellbeing issues and threatening local economies. Developing urban water resilience action plans in African cities will guarantee communities have access to safe, reliable and affordable water and protected water resources. In turn, protecting human health and enabling a thriving economy, advancing food and energy security and maintaining a sustainable ecosystem. To address the outlined challenges in African urban areas, a fresh approach centered on holistic water resilience assessment and a plan of action in six African cities has been put in place. The plan has jointly been developed by World Resources Institute (WRI), ARUP and Resilient Cities Network, in close partnership with city leaders and stakeholders. The action plans aim at helping city's stakeholders better design specific interventions to address water-related complex challenges, risks, and vulnerabilities, and develop pathways for building urban water resilience in their respective cities. This will serve as an opportunity for African citizens to utilize this special initiative in time to get water right and to address various water-related challenges, including too much or too little water and polluted water.

A city that is resilient can overcome increasing water-related challenges, climate induced risks and rapid population growth issues, which are all related to water scarcity and flooding. For a city to transition to a water resilient city, it must connect local realities with basin level issues,



linking water to cross-cutting urban issues such as service provision and land use. As part of the Urban Water Resilience in Africa Initiative, a broad range of stakeholders from Musanze city, Rwandan public institutions, key NGOs in the water sector, and more were engaged and participated in roundtable discussions where the main challenges and opportunities for building urban water resilience in Musanze city were elaborated. Stakeholders discussed a range of opportunities and needs for integrated planning and investments across water resilience issues including stormwater management, water infrastructure needs, land use development, wastes management, water sources management, water supply and sanitation concerns.

To assess water resilience of urban systems in Musanze city, the methodology of the City Water Resilience Approach (CWRA) has been utilized. The CWRA enabled stakeholders to evaluate the strengths and weaknesses of the urban water system and the city's overall resilience to water-related shocks and stresses. It also provided best practice guidance on monitoring performance to ensure that objectives are met and the resources are used effectively. As part of the CWRA, a planning tool was used to guide the city through a multi-stakeholder process to identify specific challenges and solutions in Musanze's journey towards urban water resilience. Therefore, as part of Urban Water Resilience in Africa Initiative and one of the pilot cities for this initiative, Musanze city will continuously utilize the outcomes from the assessment to enhance its adaptation pathways to current and future water shocks and stresses. These pathways will result in improved water infrastructure and management, good water governance, strengthened urban water policies and regulations to address socioeconomic and climate risks, and the implementation of integrated water resources management (IWRM) to ensure long-term water resilience.

This Musanze Water Resilience Profile and Action Plan describes the process conducted to assess the urban water resilience of the city, and outlines potential actions that the city will build upon towards water resilience. As the initial stage of this work a Musanze City Characterization Report was completed. This included intensive research conducted by Rwanda Young Water Professionals (RYWP) in partnership with World Resources Institute (WRI) and in close collaboration with Musanze district leaders. In the same context, this Musanze city profile and action plan report has been developed by RYWP in close partnership with WRI. It is based on the outcomes from assessment and visioning workshops that were conducted in Musanze in January 2022. In addition, discussions with local experts and stakeholders allowed a deeper understanding of the shocks and stresses that the city is confronting with consideration of upstream and downstream issues. Towards this end, Musanze city, and other pilot cities in Africa where the CWRA is being implemented, will build a network of actors to increase ambition for building water resilience in African cities.

1. INTRODUCTION

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WATER RESILIENCE

The concept of resilience is new to the water sector. Globally it is often used in relation to flood and drought resilience, or climate resilience in a broader sense as well as infrastructure resilience or disaster preparedness and response. There is comprehensive guidance published covering resilience planning for critical infrastructure or specific aspects such as drought planning. However, most measures tend to be focused around one specific hazard or one means of mitigation.

The concept of resilience is new to the water sector. Globally it is often used in relation to flood and drought resilience, or climate resilience in a broader sense, as well as infrastructure resilience or disaster preparedness and response. There is comprehensive guidance published regarding resilience planning for critical infrastructure or specific aspects, such as drought planning. However, most measures tend to be focused around one specific hazard or one means of mitigation.

The concept of resilience widely encompasses the ability to "return to a new normal" by effectively coping with negative impacts or rapid-onset disasters, the ability to adapt to new circumstances effectively, and to accommodate radical shifts. In this context, the demand for new concepts, approaches, and guidance on resilience has increased dramatically over the last few years, particularly focusing on disaster risk reduction, closely linked to infrastructure resilience and climate adaptation. Though the topic has been covered extensively in theoretical studies, outstanding examples onresilience practice in the water sector are rare.
In the context of this proposal, a water resilient city is defined as a city or metropolitan area that exhibits the capacity to provide access to high quality water and wastewater services for all residents, businesses and industries and protects its inhabitants from water-related hazards while protecting the natural water cycle. A city that can survive and thrive in the face of water-related shocks and stresses— ranging from drought to flooding, storm surges, and sea level rise—and the potential impact of various shocks and stresses that are not limited to water-related hazards (for example, the impact of an earthquake on key water infrastructure).

Musanze's economy is quickly growing and undergoing fast urban transformation. Urban water resilience is an important prerequisite to create an environment for the city to withstand water-related shocks and stresses and continue to thrive. The World Resources Institute together with Arup and the Global Resilient Cities Network (R-Cities) are working to develop an understanding of water-related risks and needs to help advance Musanze's urban water resilience. This work is supported by Federal Ministry for Economic Cooperation and Development (BMZ) and the Resilience Shift.

A water resilient city recognizes that the urban water system it depends on is only one part of complex, overlapping and interdependent urban systems. The use and availability of water is impacted by energy supply and transportation networks, and directly affected by land use and waste management practices. Water is essential to economic growth and public health. However, the sector is driven by local politics and managed through siloed relationships without strategic alignment horizontally across sectors or vertically across jurisdictions. Integrated urban water management will require alignment between and across many actors and multiple nested, overlapping, and interconnected urban systems. Therefore, water resilience demands action at a large scale through interventions that meaningfully influence the myriad systems, which impact water resource management and

service delivery. Additionally, the natural water cycle does not neatly align with administrative or political boundaries of cities or metropolitan areas. This means that any work conducted in these spaces require the engagement of all actors working throughout the larger urban area and the catchment.

City, water, and catchment level resilience are all mutually interdependent. For this reason, an assessment of urban water resilience cannot be thought of in isolation from its hydrological context, including the basins, the built infrastructure, and the socio-political and economical context. A holistic approach is key to designing interventions that make systems resilient. As water is used every day in formal and informal ways, resilience needs to be grounded in the existing decision-making processes around the socio-political, economical, and hydrological context where the city lies. One fundamental challenge for most cities is that water governance functions are often siloed, and there is limited coordination, collaboration and knowledge sharing between actors working in the water system. In planning interventions to build resilience, it is therefore important to identify all stakeholders responsible for enhancing the system and making decisions about what should be made resilient and for whom. New resilience initiatives must strengthen existing infrastructure assets and systems, but also address the duplications, overlaps and gaps in the roles and responsibilities of the stakeholders across multiple levels and sectors when responding to different shocks and stresses. In addition, any response on the urban scale (though not confined to city limits) must be biased towards actions that can be performed at this level and seek to strengthen the symbiotic relationship between the city and its catchment, connecting the range of stakeholders and systems that bridge natural and urban systems.

THE URBAN WATER RESILIENCE IN AFRICA INITIATIVE

The Urban Water Resilience in Africa Initiative (UWRI) is a three-year program that aims to address water risks and vulnerabilities in six African cities towards a water resilient recovery post COVID-19. This work is generously supported by the German Federal Ministry of Economic Cooperation and Development (BMZ) through a grant of 3 million Euros (from January 1, 2020 to December 31, 2022). The UWRI program is led by the World Resources Institute (WRI) and partners. The program consists of a 3-part action plan:

COMPONENT 1: RESEARCH ON CHALLENGES AND PATHWAYS

WRI has worked with research partners to develop a report on urban water resilience, with a pan-African perspective, that identifies key pathways to address water scarcity, inadequate access, and flooding challenges in African cities. This report has been developed in partnership with African water experts and researchers with deep knowledge of the state of water and current practices in Africa. The report includes case studies of seven African cities and a spatial assessment of key urban growth trends, including an overlay assessment of how urban growth is impacting the increase in impervious areas, loss of blue and green cover and the impacts on city water basins. The report titled "Water Resilience in a Changing Urban Context: Africa's Challenge and Pathways for Action" is available online at: https://www.wri.org/research/urban-water-resilience-africa.

COMPONENT 2: DEVELOP URBAN WATER RESILIENCE ACTION PLANS IN CITIES

The second component of the work involves partnering with cities to assess the stresses and shocks to the city's water system and identify interventions to address the city's specific resilience needs (through policy, program, and infrastructure interventions). This work is being developed through facilitated, multi-stakeholder planning processes using tools such as the City Water Resilience Approach (CWRA) and informed by spatial analysis that examines the inter-relationship between urban and water systems. It is being implemented in six African cities including Addis Ababa and Dire Dawa in Ethiopia; Kigali and Musanze in Rwanda; and Johannesburg and Gqeberha in South Africa. WRI is partnering with Resilient Cities Network (R-Cities, formerly 100 Resilient Cities), the Resilience Shift, and Arup (International Engineering Consulting Firm) to co-implement this strategic planning process to develop city water resilience action plans specific to each city-region. The CWRA process will help city stakeholders develop a shared understanding of their water system, the shocks and stresses the city faces, its resilience, and pathways for change (i.e., policy, planning and governance interventions). The initiative aims to catalyze implementation of priority actions identified in the action plans through various capacity building initiatives including technical assistance and knowledge exchange modules.

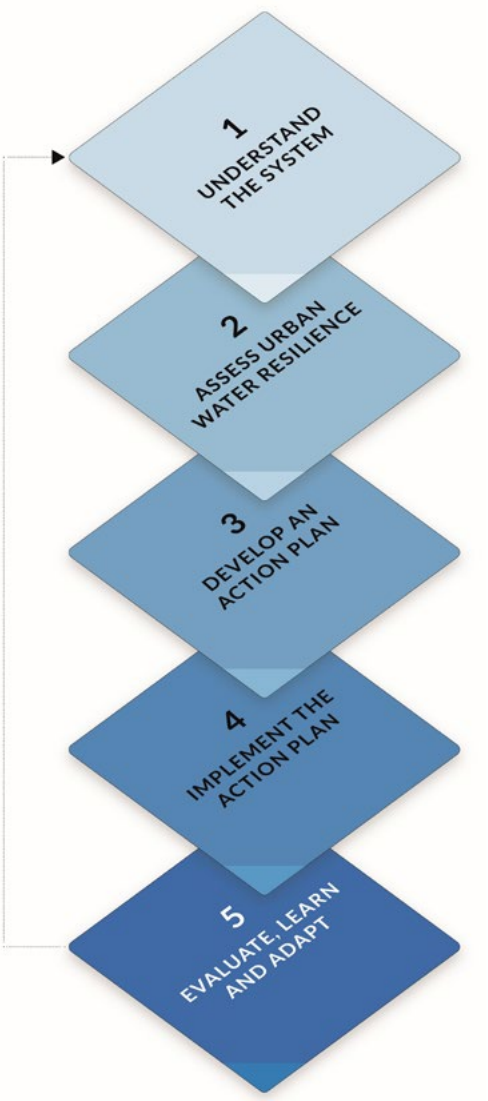
COMPONENT 3: BUILD A PAN-AFRICAN COALITION FOR COLLECTIVE ACTION ON URBAN WATER RESILIENCE ALONG WITH ESTABLISHING A CATALYTIC FUND

The third component of the program will work to create a larger coalition of partners to articulate a joint action agenda for urban water resilience in Africa. This joint agenda will act as an advocacy document to be used by a wide group of interested coalition partners to elevate the criticality of urban water resilience to the African development agenda. It will identify specific priority changes such as practice shifts needed to better align and connect the urban, water and climate agendas at the local, national, regional, and ultimately global scales. This agenda will showcase a bottom-up approach to building these integrated agendas. The consultations that lead to the development of this joint agenda are aimed at gathering policy and investment commitments from national stakeholders, regional institutes and financial institutions to enable and scale city actions on urban water resilience. The final piece of the UWRI program is to promote and scale up quality, sustainable investments in cities in Africa. The Catalytic Fund will be designed to inject greater public and private financial resources to jumpstart transformative projects on the ground, starting first in the six cities that are developing action plans and then scaling to other cities by 2030.

THE CITY WATER RESILIENCE APPROACH

The City Water Resilience Approach (CWRA) responds to a demand for new approaches and tools that help cities grow their capacity to provide high quality water resources for all residents, and to protect them from water-related hazards. The CWRA process outlines a path for developing urban water resilience and provides a suite of tools to help cities identify, assess, and take action to address and ultimately survive and thrive in the face of water-related shocks and stresses.

The CWRA is based on fieldwork and desk research, collaborative partnerships with subject matter experts, and direct engagement with city partners. The approach was developed, through investigations in eight cities and consultation with over 700 individual stakeholders, by Arup — working with the Stockholm International Water Institute (SIWI), Resilient Cities Network, the Organization for Economic Co-Operation and Development (OECD) and in close collaboration with city partners from Cape Town, Amman, Mexico City, Greater Miami and the Beaches, Hull, Rotterdam, Thessaloniki, and Greater Manchester. Each partner city confronts persistent water-related shocks or suffers chronic water-related stresses. They are committed to co-creating water resilience approaches.



The approach outlines five steps to guide partners through initial stakeholder engagement and baseline assessment, through action planning, implementation and monitoring of new initiatives that build water resilience:

1

Understand the system - the city's unique context is appraised to understand shocks and stresses, identify system interdependencies, engage local stakeholders to clarify gaps in information and map key infrastructure and governance processes. This first step of the CWRA process results in the City Characterization Report that summarizes the results of this research.

2

Assess urban water resilience - the city's current practices are assessed using the City Water Resilience Framework to identify areas of existing strengths and weaknesses and establish a baseline against which progress is measured. This second step results in a City Water Resilience Profile, which summarizes the assessment process and outlines potential actions to build resilience.

3

Develop an action plan - based on the city assessment, an action plan is developed for realizing interventions that develop water resilience. The action plan is based on holistic evaluation of anticipated benefits and costs and prioritization of projects identified in the previous step.

4

Implement the action plan - actions agreed upon during the previous step are implemented according to best practices. In this step, the CWRA provides best practice guidance for how ongoing actions can be monitored to ensure objectives are met and resources are used appropriately.

5

Evaluate, learn and adapt - implementation is evaluated. Adjustments are made to the implementation plan to account for new developments or changing circumstances in the city and to align with updated objectives for the next period.

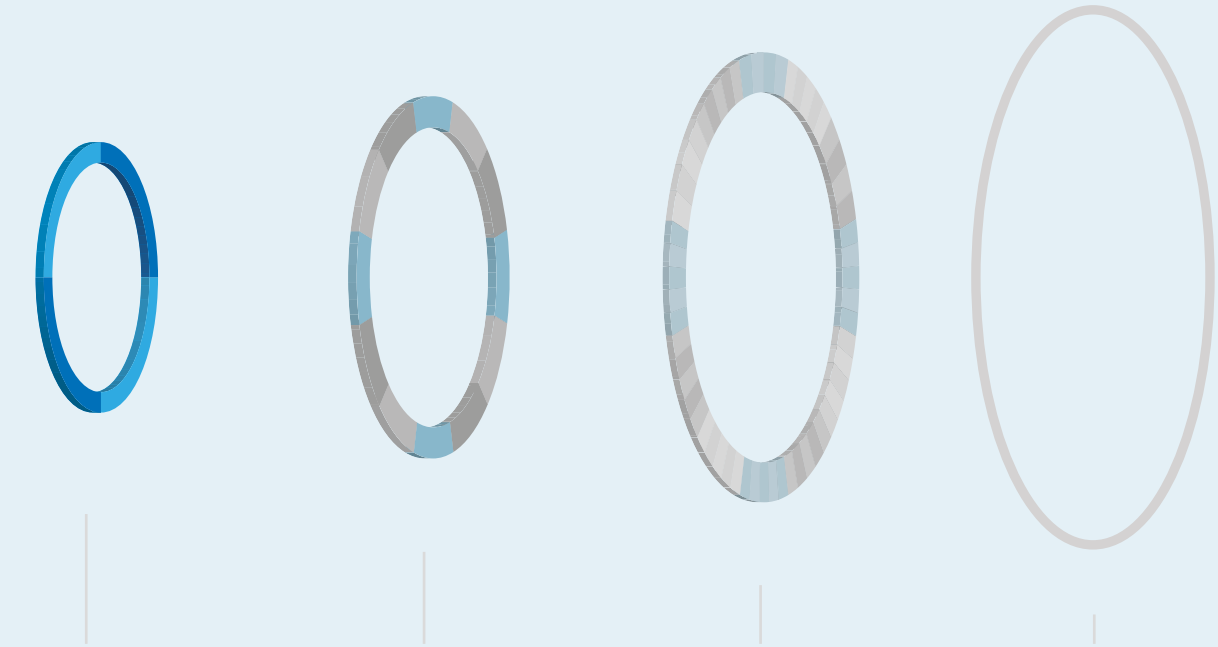
To guide cities through this process, the CWRA offers a suite of resources that target specific challenges identified by cities in their efforts to build water resilience:

- OurWater is a digital tool that helps cities better understand the types of shocks and stresses they confront, their impact on natural and man-made infrastructural systems, and the interaction between key stakeholders involved in urban water management. The OurWater tool is used in Step 1 of the CWRA to map the infrastructure and governance arrangements that define the urban water system.
- The City Water Resilience Framework (CWRF) assesses the resilience of a city to water-based shocks and stresses and allows the city to identify and prioritize future action. Understanding their resilience helps cities formulate a clear vision of what urban water resilience means to them, including what specific conditions must be in place to achieve this vision, what efforts will be required to build resilience and what actors are involved. The CWRF aligns with the second step of the City Water Resilient Approach, by helping cities assess strengths and weaknesses in their water system and generate a profile that aims to guide future developments around these issues.

The CWRF consists of three rings — dimensions, goals, and sub-goals — that describe a holistic model for city water resilience. The innermost ring consists of four dimensions. Within each dimension are goals that indicate what needs to be achieved in that category. Hybrid goals are used where goals can logically be placed in more than one dimension. They suggest how critical elements of water resilience often fall within multiple areas of influence. Sub-goals identify the critical elements for realizing each goal.

They provide additional detail and are referred to in guiding concrete actions that help realize their respective goals. The outermost layer of the CWRF wheel consists of indicators, a list of metrics used to measure how each city performs in each category. In answering indicator prompts, individual cities identify areas for improvement in cities' own water governance, measure their own progress over time, and make comparisons with peers around the world.

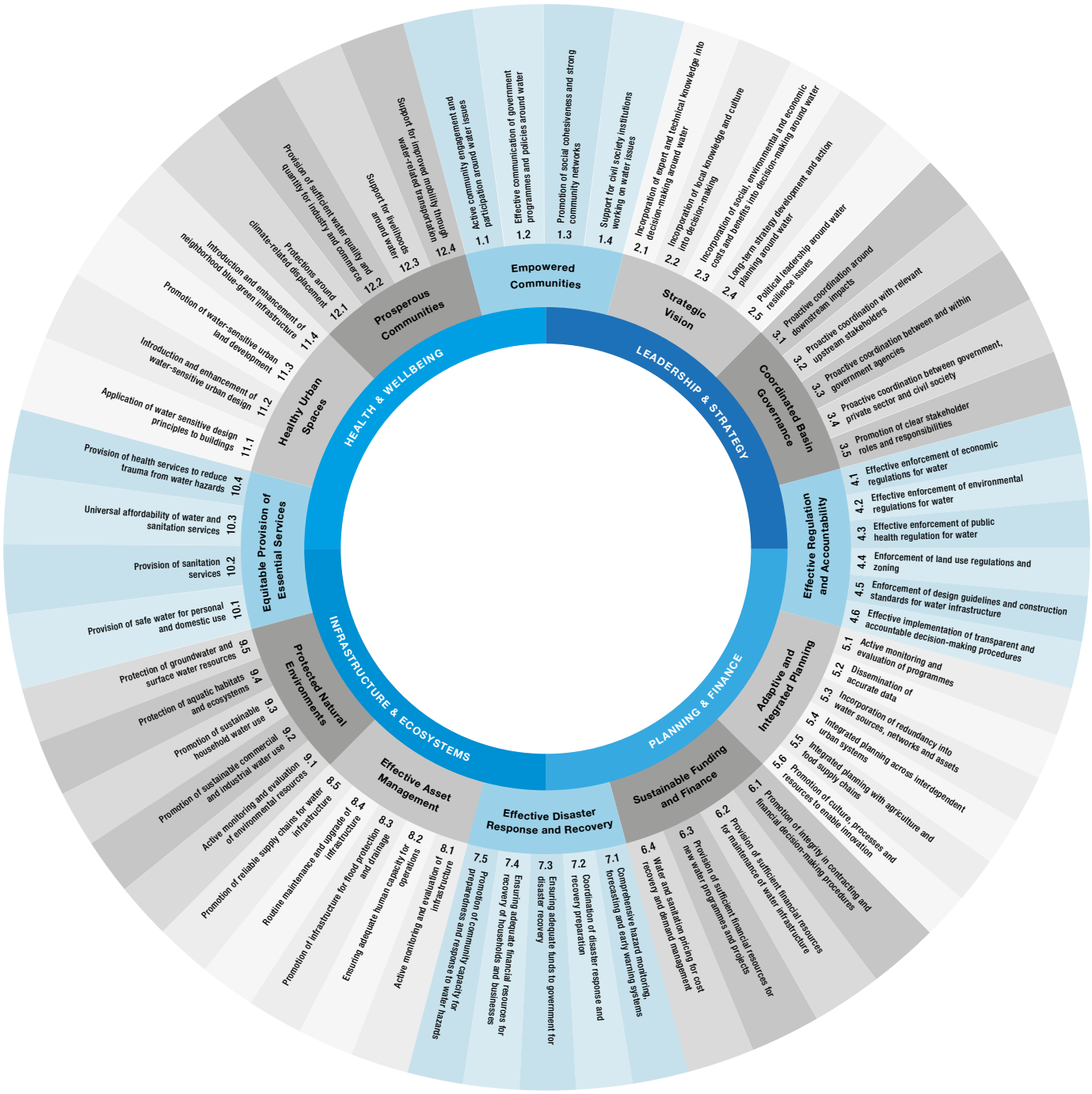
The CWRF can be broken down into dimensions, goals, sub-goals and indicators.



DIMENSIONS **GOALS** **SUB-GOALS** **INDICATORS**

(Qualitative and Quantitative)

The City Water Resilience Framework 2022



WORKSHOP METHODOLOGY

Two workshops were held in Musanze City to develop this Resilience Profile: an assessment and a visioning workshop. Both workshops were held for a consecutive period of five days with one day in between for facilitators and notetakers to pre-process the findings from the assessment workshop and to prepare the visioning workshop. This section describes how the workshops were conducted in Musanze City and presents a brief overview of the sessions. The outcomes of both workshops helped to spur the actions compiled in this profile. The actions presented in this Resilience Profile aim to strengthen resilience-building efforts for the city of Musanze. The agenda of the sessions is provided in Annex 1 of this report.

WATER RESILIENCE ASSESSMENT WORKSHOP

The two-day in-person assessment workshop, held in Musanze City, was attended by a wide range of stakeholders from different sectors and levels of government. The objective of this workshop was to assess the current situation of the city's water system, based on the City Water Resilience Framework (CWRF). Once scored, the measured indicators informed the baseline assessment against which Musanze's progress on building water resilience could be measured. Additionally, the analysis and findings of the assessment workshop enabled the team to identify the areas of existing strengths and weaknesses to be taken forward in the visioning workshop.

STAKEHOLDERS

A detailed stakeholder mapping and engagement strategy was developed before the workshop to identify all relevant sectors/agencies/organizations that needed to be engaged in the assessment process. This exercise was completed using the OurWater Governance Tool as described in the CWRA. Six stakeholder categories were identified: 1) Government Institutions; 2) Civil Society Organizations; 3) Development Partners; 4) Academia; 5) Intergovernmental Organizations; and 6) Private Sector. All were invited to participate in the assessment workshops. In total, more than 40 participants, representing all identified categories, took part . Prior to the workshop, participants were assigned to specific thematic working groups for discussion. These working groups were based on the developed stakeholder engagement plan to ensure that each goal and indicator of the City Water Resilience Framework (CWRF) was assessed by stakeholders with relevant experiences and diverse perspectives.

DAY 1 SESSION

For the first day of the workshop, a qualitative indicator assessment was carried out in the thematic working groups. For each goal, a rotation between two thematic working groups was applied to ensure robustness in the qualitative assessment of the indicators. The indicators were read out loud and explained by the facilitator in each group. Each participant was then asked to score the indicator while providing a clear justification for their scores and sharing their perspectives. Before assessing the next indicator, the participants were provided an opportunity to revisit their scoring if needed. These changes were recorded by notetakers using the CWRF template. Notetakers also recorded the participants' justifications, focusing on the water resilience challenges that Musanze city faces. The entire CWRF wheel was fully assessed by participants in Musanze city.

At the end of Day 1, the project team, consisting of both the workshop facilitators and notetakers, met to compile all of the water resilience related challenges highlighted during the scoring discussions. The challenges were then clustered into themes to be used for root cause analysis on the second day. The five challenge themes identified were: 1) community and stakeholder engagement challenge, 2) financial and technical capacity challenge, 3) infrastructure needs and management challenge, 4) data and knowledge management challenge; and 5) coordinated and integrated planning challenge.

DAY 2 SESSION

On the second day, the participants were reorganized into new thematic working groups for each challenge theme based on their area of intervention. This was to ensure each theme received sufficient analysis. Working groups of six to eight participants were identified for each theme. The root causes were analyzed using a fish diagram structure to facilitate the process of group collaboration. The analysis of root causes focused on aspects related to social, economic, technical, governance and legal, environmental issues, and any miscellaneous aspects that could have arisen from the discussion.

DAY 3 SESSION

1.4.2. All facilitators and notetakers convened to reflect on the workshop and participants' input collected during the root cause analysis exercise. After analyzing the results, the project team developed eleven (11) problem statements that reflected the identified water resilience challenges in Musanze City and their root causes.

VISIONING WORKSHOP

The objective of the visioning workshop is to facilitate a deeper understanding of the outcomes of the initial assessment process. The workshop aims to facilitate the collaborative development of water resilience initiatives by relevant stakeholders to collectively improve the resilience of the city's water systems. The visioning workshop took place for two consecutive days, on the fourth and fifth day of the overall workshop.. The workshop was done in two segments. The first segment focused on brainstorming areas of innovation to tackle the identified problem statement. The second focused on action planning for the prioritized interventions.

STAKEHOLDERS

All participants from the assessment workshop also attended the visioning workshop, which was held in Musanze City. All participants were reassigned to the challenge theme based thematic working groups for discussion, to ensure that each identified challenge was further assessed and opportunities to address them were developed.

DAY 4 SESSION

On the fourth day, after a day of break for participants, a design sprint exercise was undertaken by stakeholders in their respective challenge theme based thematic working groups. The facilitator of each group explained the design sprint by asking participants to first discuss critical needs to be addressed for each problem statement formulated and ways these needs can be addressed. Then to select one priority intervention per challenge statement to be assessed further. Participants brainstormed how to transform the needs statement into specific opportunities for the city of Musanze. A list of potential interventions and opportunities were developed incorporating areas of deficiency, but also areas in which Musanze City

is performing well. Each group selected two prioritized opportunities for further discussion and development during the session. Facilitators then invited participants to vote for one of the prioritized opportunities to begin designingin more detail. This detailed process includes outlining who benefits, who acts, and who are the enablers for each of the chosen interventions. In total eleven (11) interventions were defined to account for one intervention per problem.

DAY 5 SESSION

On the fifth and last day of the workshop, participants worked on a high-level action plan for each of the eleven (11) prioritized interventions. They identified the short-, medium- and long-term steps to implement the proposed intervention and estimated the costs and benefits, or resilience value, of the intervention. Alongside the costs and benefits, they identified implementation barriers and enablers to the progression of the intervention and the stakeholders that need to be engaged in the action.

AFTER THE WORKSHOPS

At the end of the workshops, the team had 11 (eleven) opportunity write-ups which were further assessed, refined, and merged into relevant visions to reflect the priorities for the resilient future outlined by Musanze's stakeholders. These inputs guided the development of Musanze's Water Resilience Profile and Action Plan.

2. RESILIENCE ASSESSMENT

To assess water resilience of urban systems in Musanze city, the methodology of the City Water Resilience Approach (CWRA) has been utilized. The CWRA enabled stakeholders to evaluate the strengths and weaknesses of the urban water system and the city's overall resilience to water-related shocks and stresses. It also provided best practice guidance on monitoring performance to ensure that objectives are met and the resources are used effectively. This Musanze Water Resilience Profile and Action Plan describes the process conducted to assess the urban water resilience of the city and outlines potential actions that the city will build upon. As the initial stage of this work, a Musanze City Characterization Report was completedwhich includes intensive research conducted by Rwanda Young Water Professionals (RYWP) in partnership with World Resources Institute (WRI) and in close collaboration with Musanze district leaders.

INDICATOR SCORES

Indicators describe the ideal or best-case scenario.The score provided for each indicator reflects how well Musanze city currently performs when compared to the best-case scenario. To help guide discussions, a series of "guiding criteria" were provided to participants at each table. Guiding criteria are based on desk research and expert inputs and they identify important considerations for each indicator. They establish a common language and frame of reference for workshop participants, who often bring different perspectives, interests, and expertise to the conversation. Where multiple indicators were required to assess a resilience sub-goal, each indicator was discussed by the group separately. All indicator questions are organized according to sub-goal and are provided in the following section. The CWRF wheel provides a snapshot of strengths and weaknesses for Musanze city in building its resilience to water-related shocks and stresses. It describes how the area performs against a best-case scenario for each of the 62 sub-goals. Scores for the resilience sub-goals are provided along the outer edge of the CWRF wheel and the averaged scores for the resilience goals are shown in the inner ring. Detailed results for each resilience indicator are provided in the next section, along with a summary of key points identified during roundtable discussions. The identified themes and the qualitative scoring results for the indicators reflect the opinions of individual participants. Prior to the workshop, participants were assigned to specific thematic working groups to ensure that each goal and indicator of the City Water Resilience Framework (CWRF) was assessed by stakeholders with relevant experiences and diverse perspectives.

INDICATOR SCORES

4.5-5.0 Optimal

The indicator fully reflects conditions in the city. No improvement is required.

3.5-4.4 Good

The indicator mostly reflects conditions in the city. Minimal improvement is required.

2.5-3.4 Fair

The indicator somewhat reflects conditions in the city. Some improvement is required.

1.5-2.4 Low

The indicator mostly does not reflect conditions in the city. Significant improvement is required.

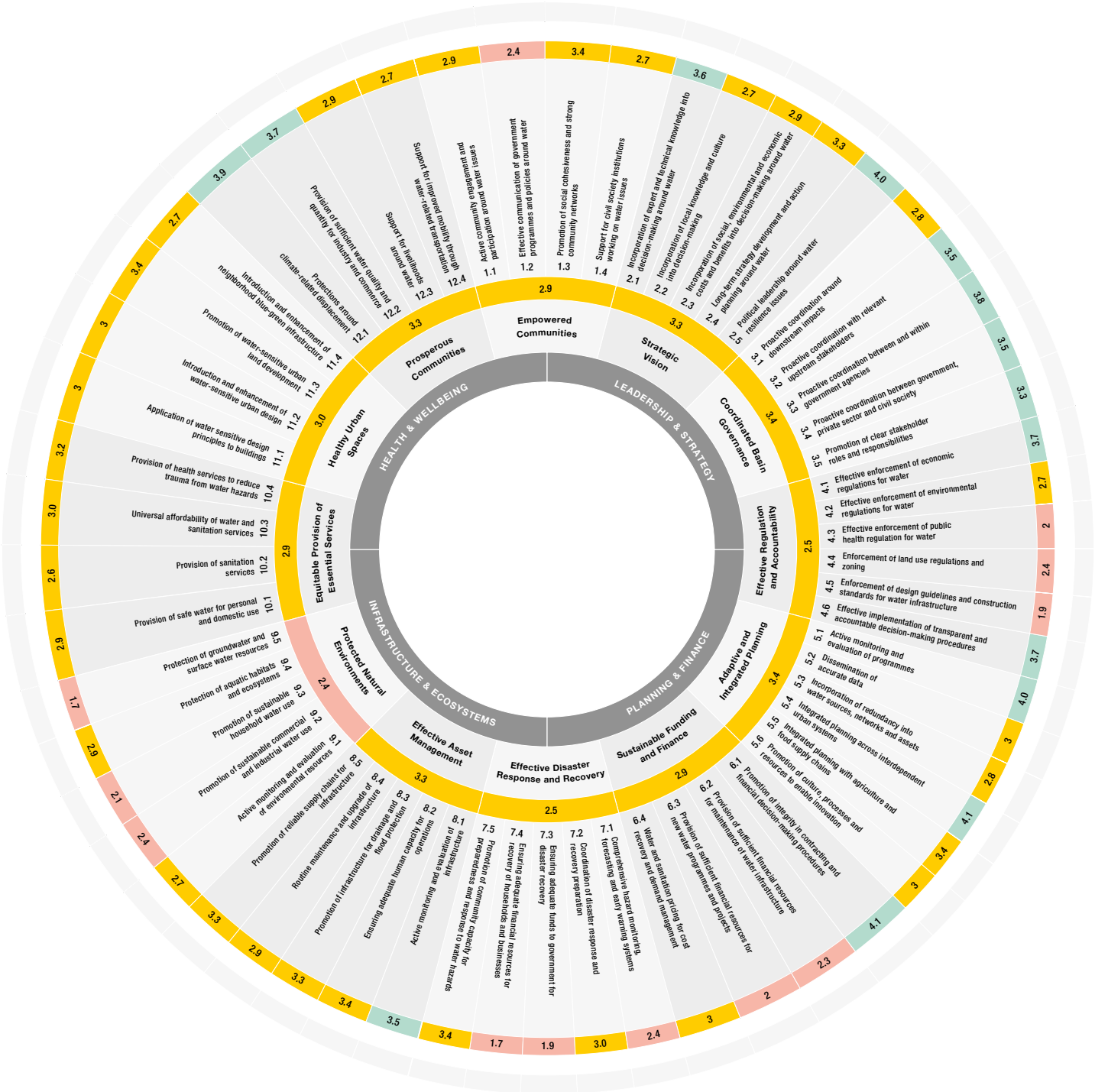
1-1.4 Poor

The indicator does not at all reflect current conditions in the city.

N/A

The indicator is not relevant to the city.

The City Water Resilience Framework qualitative scoring for Musanze



LEADERSHIP & STRATEGY

Overall, Musanze's political leadership has the willingness to promote resilience as a priority issue. However, that is fragmented by different factors including inadequate sector coordination and the city's lack of needed technical and financial capacity to address its resilience issues. Regarding water issues, the strong coordination and consultation, which exists between different government agencies at the central level, is hindered by poor basin level stakeholders' coordination and by the gap in engaging the local government in decision-making. Decision-making is generally top-down without a robust community-centered approachAdditional work is needed to effectively communicate water-related government programs and policies. This was suggested by a handful of non-government stakeholders who expressed that they have limited access to updated information, leading to their limited participation in the matter. This issue is also extended to the community of Musanze district, as its lack of ownership and participation in water-related issues was also indicated as a stress to the city. Effort is needed in disseminating water-related policies and the district's long-term strategies, such as the Musanze District Development Strategy, to all relevant stakeholders.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4.1 Effective enforcement of economic regulations for water
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4.4 Enforcement of land use regulations and zoning
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4.6 Effective implementation of transparent and accountable decision-making procedures
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5.3 Incorporation of redundancy into water sources, networks and assets
5.4 Integrated planning across interdependent urban systems
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5.6 Promotion of culture, processes and resources to enable innovation
6.1 Promotion of integrity in contracting and financial decision-making procedures
6.2 Provision of sufficient financial resources for maintenance of water infrastructure
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8.3 Promotion of infrastructure for drainage and flood protection
8.4 Routine maintenance and upgrade of infrastructure
8.5 Promotion of reliable supply chains for infrastructure
9.1 Active monitoring and evaluation of environmental resources
9.2 Promotion of sustainable commercial and industrial water use
9.3 Promotion of sustainable household water use
9.4 Protection of aquatic habitats and ecosystems
9.5 Protection of groundwater and surface water resources
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12.2 Provision of sufficient water, quality and quantity for industry and commerce
12.3 Support for livelihoods around water
12.4 Support for improved mobility through water-related transportation

EMPOWERED COMMUNITIES

1.1 Active community engagement and participation around water issues

› QUALITATIVE INDICATOR:

Legal and institutional frameworks and mechanisms to promote active, free, and meaningful participation around issues related to water supply, sanitation, drainage, and flooding.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

The community is only engaged when water projects are being implemented.This does not allow the citizens to have a say in the conception of projects, causing poor motivation when it comes to participating in the sustainable maintenance of projects. In most cases, project developers do not include community engagement within their budget and the local government (Musanze district) does not have enough financial capacity to engage the community. One of the consequences of this is user committees which are not operational and almost non-existent.

1.2 Effective communication of government programs and policies around water

› QUALITATIVE INDICATOR:

Mechanisms ensure that comprehensive information on government programs and policies is disseminated to all stakeholders.

QUALITATIVE SCORE:

2.4

SUMMARY OF ROUNDTABLE DISCUSSION:

The district has a will to disseminate the information and it is done to a certain level. However, it still has a low capacity of staff needed to ensure that the information reaches all stakeholders. Non-government stakeholders said that they have limited access to updated information and that additional information can be beneficialto the community if well customized (i.e., material and language). Additionally, poor early warning systems affect the level of information disseminated and its timeliness.

1.3 Promotion of social cohesiveness and strong community networks

› QUALITATIVE INDICATOR:

Inclusive and participatory social networks (formal and informal) enable communities to learn from each other, self-organize and act collectively in times of need.

QUALITATIVE SCORE:

3.4

SUMMARY OF ROUNDTABLE DISCUSSION:

There are existing social networks of communities such as umuganda[1]. However, the level of contribution is still low because the community lacks the level of technical or financial capacity that is sometimes required to contribute in times of need.

(1) Umuganda, also known as community work with the purpose to contribute to the overall national development, takes place on the last Saturday of each month at 8a.m. and lasts for at least three hours.

1.4 Support for civil society institutions working on water issues

› QUALITATIVE INDICATOR:

Mechanisms ensure that financial, institutional and technical support is provided to civil society institutions working on water issues.

QUALITATIVE SCORE:

2.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Existing civil societies in Musanze District are investing more in the rural areas of the district. Participants expressed that water related projects can be of high cost for urban areas and Civil Society Organizations (CSOs) usually have limited budgets. Moreover, it was highlighted that the lack of alignment between the private sector's interests and the government's plans contributes to the lack of support provided to the CSOs, further impacting the sustainability of projects implemented by CSOs.

2 STRATEGIC VISION

2.1 Incorporation of expert and technical knowledge into decision-making around water issues

› QUALITATIVE INDICATOR:

Technical knowledge is available, understood and continuously incorporated by the government into decision-making around water issues.

QUALITATIVE SCORE:

3.6

SUMMARY OF ROUNDTABLE DISCUSSION:

Technical expertise is valued and incorporated wherever possible in all District and city decisions. However, improvement is still needed because there is a lack of technical capacity to deal with issues, such as the flooding in Musanze city. Many solutions have been tried that mitigate the issue to some extent, but more technical capacity is needed.

2.2 Incorporation of local knowledge and culture into decision-making

› QUALITATIVE INDICATOR:

Local knowledge and cultural values of all population groups are referred to in government decision-making around water issues.

QUALITATIVE SCORE:

2.7

SUMMARY OF ROUNDTABLE DISCUSSION:

It was expressed that local knowledge is not given much importance in the decision-making process around water issues. This is mainly due to the local government and other investors in the sector prioritizing global or international trends.

2.3 Incorporation of social, environmental, and economic costs and benefits into decision-making around water

› QUALITATIVE INDICATOR:

The social, environmental, and economic impacts of increased water resilience are understood and incorporated into short, medium and long-term decision-making around water issues.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Environmental, social and economic impacts are a usually analyzed through Environment Impact Assessments (EIAs) of projects (EIAs are a mandatory requirements), however the implementation of recommendations from EIA studies are not followed 100% in project implementations. This was highlighted as a weakness because project development and implementation is not monitored to ensure that social, environmental, and economic aspects are properly taken into consideration throughout the project approval and implementation cycle.

2.4 Long-term strategy development and action planning around water

› QUALITATIVE INDICATOR:

A long-term strategy is in place to guide projects and programs that build water resilience over time.

QUALITATIVE SCORE:

3.3

SUMMARY OF ROUNDTABLE DISCUSSION:

Stakeholders expressed that there is no existing long-term strategy regarding Water Resources Management (WRM) that can be a guideline for building water resilience over time.There is also still a gap in enforcing water related policies at the local level. Moreover, the District's existing long-term strategies, such as the Musanze District Development Strategy, are not well disseminated to all relevant stakeholders.

2.5 Political leadership around water resilience issues

› QUALITATIVE INDICATOR:

Political leadership promotes resilience as a priority issue in government decision-making.

QUALITATIVE SCORE:

4.0

SUMMARY OF ROUNDTABLE DISCUSSION:

Participants expressed that the political will around water resilience issues is strong at all levels. However, there is still a gap in financial capacity to reflect that political leadership in the implementation of solutions.

3 COORDINATED BASIN GOVERNANCE

3.1 Proactive coordination around downstream impacts

› QUALITATIVE INDICATOR:

Coordination between city stakeholders and relevant downstream stakeholders minimize downstream impacts.

QUALITATIVE SCORE:

2.8

SUMMARY OF ROUNDTABLE DISCUSSION:

It was expressed that stakeholders, mainly community members, lack knowledge on how to minimize downstream impacts. This is mainly due to the poor dissemination of relevant information. The high score given by the first assessment group was to emphasize that the will to coordinate basin level communities is demonstrated through the existing formed committees at the community level (such as disaster management, water user, and environment protection committees). However, poor financial and technical capacity remains from the district's side.

3.2 Proactive coordination with relevant upstream stakeholders on water issues

› QUALITATIVE INDICATOR:

ameworks and mechanisms promote coordination between city stakeholders and relevant upstream stakeholders on water issues.

QUALITATIVE SCORE:

3.5

SUMMARY OF ROUNDTABLE DISCUSSION:

Water-related conflict among water users still occurs at the upstream and downstream levels. This is due to the lack of strategic planning for water use and coordination between stakeholders. However, the priority of proactive coordination is highlighted in relevant water policies and the Mukunga catchment plan is currently under development.

3.3.a Proactive coordination between and within government

› QUALITATIVE INDICATOR

Coordination exists between different government agencies operating at various administrative levels to define and implement water priorities.

QUALITATIVE SCORE:

4.0

SUMMARY OF ROUNDTABLE DISCUSSION:

It was highlighted that there is strong coordination and consultation between different government agencies. However, the second assessment group emphasized that a gap remains in how the local level is engaged in decision making and how relevant information is disseminated to them (i.e., sometimes in an untimely manner).

3.3.b Proactive coordination between and within government

› QUALITATIVE INDICATOR

Coordination exists within government agencies to define and implement water priorities.

QUALITATIVE SCORE:

3.6

SUMMARY OF ROUNDTABLE DISCUSSION:

There is a strong coordination within government agencies that can be seen when looking at different existing technical working groups (i.e., the Water Sanitation and Hygiene (WASH) technical working group) that engage various agencies working together in decision making processes related to water issues. However, the second assessment group highlighted there is still a conflict of interest regarding the representation of different water uses, such as use for agriculture, energy, storm water management and others. It was suggested that a joint strategic plan should be elaborated for proper prioritization of water issues.

3.4. Proactive coordination between government, private sector, and civil society

› QUALITATIVE INDICATOR

Frameworks and mechanisms promote dialogue and deliberation around water and resilience issues between the government and non-government actors.

QUALITATIVE SCORE:

3.5

SUMMARY OF ROUNDTABLE DISCUSSION:

It was expressed that the water policy encourages coordination between the government and other stakeholders. However, in the case of Musanze, the District lacks sufficient staff capacity for regular stakeholder engagement. This discourages the participation of relevant stakeholders in the private sector and CSOs.

3.5. Promotion of clear stakeholders' roles and responsibilities

› QUALITATIVE INDICATOR

Frameworks and mechanisms clearly define the roles and responsibilities of water stakeholders.

QUALITATIVE SCORE:

3.3

SUMMARY OF ROUNDTABLE DISCUSSION:

The water sector has been characterized by various changes in institutions and responsibilities over the years. These frequent changes have affected the way stakeholders understand and agree on who oversees what responsibilities in the water sector.

PLANNING & FINANCE

Musanze city has been found to face numerous planning and finance challenges, impacting the provision of basic water services and infrastructure and its preparedness to deal with shocks and stresses. Coordination exists between public sector water agencies, water utilities and organizations working in related domains at the national level but becomes weak at the city level as sometimes national priorities interfere with city planning.

The City lacks the technical and financial capacity to enforce environmental regulations for water and to effectively manage the catchments. Even if it is a mandatory requirement for businesses to complete environmental impact assessments, in practice this is rarely enforced. On the community side, they do not understand their role in water resources management and end up damaging water sources (i.e., encroaching river buffer zones). Moreover, the city has insufficient funds for operation and maintenance of water infrastructure and fornecessary new water infrastructure. In this regard, the city mainly relies on external funding.

The City's existing infrastructure is old and unmaintained to the point that enforcing public health regulations has become a real challenge. Water supply distribution networks need extensive upgrades, especially for a rapidly growing city like Musanze. There is currently no wastewater infrastructure in place in the city. Musanze also lacks a disaster risk management strategic planning framework. In addition, there are currently few regulatory tools that can be used to establish responsibilities, plans, and priorities in a coordinated manner with the participation of all actors including the community. The few guidelines that do exist are highly technical and are only understood by a very small number of specialists. Despite the city recently developing its land use masterplan, it was noted that the plan still lacked details on the neighborhood level to facilitate proper land use and urban expansion. Another critical component that was pointed out is the need to assess if the master plan is water resilient or green.

Accountability and transparent decision making are at a good level generally in the country with systems in place. However, at the city level, there is still a lack of robust stakeholders' engagement in project development and implementation, resulting in unsustainable decisions. There are robust systems and frameworks in place for monitoring and evaluation at a national level with an effective disaggregation at city level. However, participants pointed out the gaps in terms of water data accuracy and the lack of proper data sharing platforms.


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4 EFFECTIVE REGULATION AND ACCOUNTABILITY

4.1 Effective enforcement of economic regulations for water

› QUALITATIVE INDICATOR:

Economic regulation of water and sanitation services and water resources is performed effectively, resulting in adequate provision of key services, and high customer satisfaction.

QUALITATIVE SCORE:

3.7

SUMMARY OF ROUNDTABLE DISCUSSION:

The local community is not adequately engaged in determining the prices and other regulations for water and sanitation services. Additionally, the existing regulations are not properly communicated to the community leading to a lack of awareness of the regulations and changes that occur.

4.2 Effective enforcement of environmental regulation for water

› QUALITATIVE INDICATOR:

Environmental regulation is performed effectively, resulting in high quality, protected water environments.

QUALITATIVE SCORE:

2.7

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants assessed this sub goal from two perspectives. The first was from the city's perspective which has limited capacity to collect data that might be useful in the enforcement of environmental water regulations and to effectively manage the catchments. Another problem raised by participants was the ineffective use of limited available funds to enforce policy on water usage, which is still linked to lack of capacity. The second perspective was focused on community members themselves who do not understand their role in water resources management and end up encroaching river buffer zones, damaging water sources, etc.

4.3 Effective enforcement of public health regulation for water

› QUALITATIVE INDICATOR:

Public health regulation for water is performed effectively, resulting in water that is safe to consume and wastewater that can be returned to the water cycle with minimal environmental impact.

QUALITATIVE SCORE:

2.0

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants strongly felt this indicator should be very low scored in the city as the required infrastructure for public health regulation for water is insufficient. The existing infrastructure is old and unmaintained to the point that enforcing public health regulations has become a real challenge. Water supply distribution networks need extensive upgrades, especially now that the city has increased its storage capacity. Additionally, there is currently no wastewater infrastructure in place in the city.

4.4 Enforcement of land use regulations and zoning

› QUALITATIVE INDICATOR:

A sound regulatory framework controls land use and urban expansion and reduces growth in high-risk and water poor areas.

QUALITATIVE SCORE:

2.4

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants indicated that despite the city recently developing its land use masterplan, it was noted that the plan still lacked details on the neighborhood level to provide enough information for the enforcement of proper land use and urban expansion. It was also pointed out that the master plan is not water resilient or green, a large weakness of the plan. This discussion highlighted a lack of capacity in terms of human resources and funds to conduct the required inspections.

4.5 Enforcement of design guidelines and construction standards for water infrastructure

› QUALITATIVE INDICATOR:

Technical standards and design guidelines define best practice for critical infrastructure.

QUALITATIVE SCORE:

1.9

SUMMARY OF ROUNDTABLE DISCUSSION:

The availability of technical standards for critical water infrastructure is very low, or almost nonexistent. There are a few existing standards at the national level that mention aspects of critical water infrastructure, however, it is not the main focus of these standards. Of the few technical standards, community awareness is very low, hence it is not used or enforced as intended. Additionally, the community does not understand their role in efficient water management which is linked to both mindset and limited exposure.

4.6 Effective implementation of transparent and accountable decision-making procedures

› QUALITATIVE INDICATOR:

Decision-making procedures around water resources management, water and wastewater services are made clear and open to all stakeholders.

QUALITATIVE SCORE:

3.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Accountability and transparent decision making are at a good level generally in the country with systems in place. However, at the city level, there is still a huge gap of community engagement in project development and implementation and a lack of incorporating lessons learned from previous projects into the decision-making process of new projects, resulting in unsustainable decisions. Another aspect that was raised was around the disconnection of the temporal resolutions of planning projections between the city leaders (who are long-term focused) and community (who are short-term focused on addressing pressing needs).

5 ADAPTIVE AND INTEGRATED PLANNING

5.1 Active monitoring and evaluation of programs

› QUALITATIVE INDICATOR:

Monitoring and evaluation mechanisms and frameworks measure how programs have achieved intended outcomes and disseminate lessons learned.

QUALITATIVE SCORE:

4.0

SUMMARY OF ROUNDTABLE DISCUSSION:

There are robust systems and frameworks in place for monitoring and evaluation at a national level with an effective disaggregation at city level. However, the participants pointed out the lack of recording data based on lessons learned and using them in the consideration of designing projects in a sustainable manner.

5.2 Dissemination of accurate data

› QUALITATIVE INDICATOR:

Accurate data is used by key decision-makers in government, private sector and civil society to promote urban water resilience.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

There was a mix of feelings in participants on this indicator as some felt that there are efforts which need to be acknowledged for data collection and some completed efforts, such as the development of the city land use master plan, etc. However, the participants reached an agreement on the gaps in water data accuracy and the lack of proper sharing platforms.

5.3a Incorporation of redundancy into water sources, networks, and assets

› QUALITATIVE INDICATOR:

Redundancy exists in the networks and assets responsible for water supply, treatment, and sanitation.

QUALITATIVE SCORE:

1.0

All participants strongly agreed that this indicator does not apply to Musanze city. Already the distribution network needs serious upgrading, such that redundancy is not an option. It was also mentioned that the city has upgraded its storage capacity, but redundancy was not considered in it. The participants felt it is needed but it is not a priority for the city at this moment.

5.3b Incorporation of redundancy into water sources, networks and assets

› QUALITATIVE INDICATOR (5.3A):

Redundancy exists in the sources that supply water to the city.

QUALITATIVE SCORE:

4.6

SUMMARY OF ROUNDTABLE DISCUSSION:

It was indicated that the city has multiple (2) sources of water that serve the city's water treatment plant, but these were not designed for redundancy. However, one source of water can be utilized when the other source has a problem. Therefore, there was a split decision between the participants in the group on the score of this indicator.

5.4 Integrated planning across interdependent urban systems

› QUALITATIVE INDICATOR:

Coordination exists between public sector water agencies, water utilities and organizations working in related domains such as energy, telecommunications, waste management and transportation.

QUALITATIVE SCORE:

4.1

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants felt there is a coordination mechanism at the central level that coordinates the water agencies, utilities, etc. However, it was noted that the coordination at the city level is still weak in terms of making decision on priorities, as the central level government tends to interfere in their own priorities.

5.5 Integrated planning with agriculture and food supply chains

› QUALITATIVE INDICATOR:

Coordination exists between water agencies and organizations involved in food supply and production.

QUALITATIVE SCORE:

3.4

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants felt that a mechanism at the national level is available and making a positive impact but at the city (district) level, there are challenges of informal agriculture and food supply chain from the community perspective. Additionally, there is a lack of tools and means to optimize the framework of coordination with water agencies, thus affecting the city level planning.

5.6 Promotion of culture, processes, and resources to enable innovation

› QUALITATIVE INDICATOR:

Resources and processes reinforce a culture of innovation within the water sector.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants felt that culture is not promoted in water resources management. The comment was mostly linked to the fact that cultural heritage is not incorporated in water resources management. In addition, the participants felt that the University's research is not result oriented such that it could be used by the city to address the pressing issues they face.

6 SUSTAINABLE FUNDING AND FINANCE

6.1 Promotion of integrity in contracting and financial decision-making procedures

› QUALITATIVE INDICATOR:

Financial procedures promote transparency, minimize risk, and ensure that procurement processes are implemented fairly and efficiently.

QUALITATIVE SCORE:

4.1

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants strongly felt that the current contracting procedures and systems in place are robust and efficient. However, a few challenges were highlighted mostly regarding the instability of the system that easily crashes, especially when deadlines approach and many users are connected. There is a lack of refresher courses around using the system, especially for updates. The participants also noted there is still a challenge for those contracts requiring to go through manual bid, as subjectivity is still a major challenge.

6.2 Provision of sufficient financial resources for maintenance and upkeep of water infrastructures

› QUALITATIVE INDICATOR:

Adequate funding exists to maintain and operate water and sanitation infrastructure and to support existing programs.

QUALITATIVE SCORE:

2.3

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants strongly felt that there are insufficient funds for operation and maintenance of water infrastructure. And the limited available funds for maintenance, most of the time, are not properly used.

6.3 Provision of sufficient financial resources for new water programs and projects

› QUALITATIVE INDICATOR:

Adequate funding exists to finance new capital projects and programs that support water resilience.

QUALITATIVE SCORE:

2.0

SUMMARY OF ROUNDTABLE DISCUSSION:

The participants strongly felt strongly that there are no funds for new water projects and programs. And the city still relies very much on external financing, which is inefficient because of limited capacity for fund mobilization.

6.4 Water and sanitation pricing for cost recovery and demand management

› QUALITATIVE INDICATOR:

Water tariff systems are sustainable and equitable.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

There is a mechanism in place at central level for water pricing that is operational. However, participants noted that community engagement on the mechanism of water pricing remains low and the amount of water lost through the distribution network is still high. One of the participants also pointed out that the current pricing does not induce responsible water consumption at the community level.

INFRASTRUCTURE & ECOSYSTEMS

Natural hazards that may affect Musanze city are mainly floods, stormwater, landslides, and earthquakes sometimes. Monitoring and forecasting the hazards is centralized which means that the city does not have the monitoring and early warning systems in place. Disaster response and recovery plans exist and are coordinated by the Ministry of Emergency Management (MINEMA). However, adequate human and financial resources to carry out the implementation is required. Most post-disaster recovery funding is received from the national government but there are challenges with receiving these funds in a timely manner and in sufficient amounts. Recovery funds are only made available to vulnerable households, which sometimes leaves other affected residents and businesses with losses after disasters. Moreover, the city lacks adequate institutional capacity, technical skills and funds allocated to provide trainings to local communities on how to cope with disasters.

The water infrastructure within Musanze city is managed by the District and the Water and Sanitation Corporation (WASAC). Monitoring and evaluation plans, routine maintenance and upgrade plans of water infrastructure are developed, but limited funds and the district's technical staff capacity hinders effective implementation of the plans which increases the risk of the water infrastructure's failure.

Musanze city, over the past few years, has started strictly observing ecosystem restoration and rehabilitation. For example, public gardens are being established in Musanze city and home-grown gardens have started getting adopted in households. But attention needs to be paid to create community buy-in and strong implementation and monitoring pathways for these initiatives to be successful. The lack of a decentralized wastewater system in Musanze is a pertinent issue for the city considering the shallow ground water table and the need to reduce water pollution.

The high level of non-revenue water unsustainable use of household water, and the lack of wastewater treatment and reuse suggest that improvement is needed to promote sustainable water use in Musanze city. Policies and programs that protect aquatic habitats and ecosystems exist at the national level, but their enforcement is inadequate as these policies and programs are not properly mainstreamed locally, especially at the community level. Similarly, laws governing the protections over-abstraction and eliminating pollution of groundwater sources and surface water sources exist at the national level but are not known at the local level, hence the inadequate management of water sources.


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1.1 Active communication on degradation and pollution
1.2 Effective communication of government programmes and policies around water
1.3 Promotion of social cohesiveness and strong community networks
1.4 Support for civil society institutions working on water issues
2.1 Incorporation of expert and technical knowledge into decision-making around water
2.2 Incorporation of local knowledge and culture into decision-making
2.3 Incorporation of social, environmental and economic costs and benefits into decision-making around water
2.4 Long-term strategy development and action planning around water
2.5 Political leadership around water resilience issues
3.1 Proactive coordination around downstream impacts
3.2 Proactive coordination with relevant upstream stakeholders
3.3 Proactive coordination between and within government agencies
3.4 Proactive coordination between government, private sector and civil society
3.5 Promotion of clear stakeholder roles and responsibilities
4.1 Effective enforcement of economic regulations for water
4.2 Effective enforcement of environmental regulations for water
4.3 Effective enforcement of public health regulation for water
4.4 Enforcement of land use regulations and zoning
4.5 Enforcement of design guidelines and construction standards for water infrastructure
4.6 Effective implementation of transparent and accountable decision-making procedures
5.1 Active monitoring and evaluation of programmes
5.2 Dissemination of accurate data
5.3 Incorporation of redundancy into water sources, networks and assets
5.4 Integrated planning across interdependent urban systems
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5.6 Promotion of culture, processes and resources to enable innovation
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6.4 Water and sanitation pricing for cost recovery and demand management
7.1 Comprehensive hazard monitoring, forecasting and early warning systems
7.2 Coordination of disaster response and recovery preparation
7.3 Ensuring adequate funds to government for disaster recovery
7.4 Ensuring adequate financial resources for recovery of households and businesses
7.5 Promotion of community capacity for preparedness and response to water hazards
8.1 Active monitoring and evaluation of infrastructure
8.2 Ensuring adequate human capacity for operations
8.3 Promotion of infrastructure for drainage and flood protection
8.4 Routine maintenance and upgrade of infrastructure
8.5 Promotion of reliable supply chains for infrastructure
9.1 Active monitoring and evaluation of environmental resources
9.2 Promotion of sustainable commercial and industrial water use
9.3 Promotion of sustainable household water use
9.4 Protection of aquatic habitats and ecosystems
9.5 Protection of groundwater and surface water resources
10.1 Provision of safe water for personal and domestic use
10.2 Provision of sanitation services
10.3 Universal affordability of water and sanitation services
10.4 Provision of health services to reduce trauma from water hazards
11.1 Application of water sensitive design principles to buildings
11.2 Introduction and enhancement of water-sensitive urban design
11.3 Promotion of water-sensitive urban land development
11.4 Introduction and enhancement of neighborhood blue-green infrastructure
12.1 Protections around climate-related displacement
12.2 Provision of sufficient water, quality and quantity for industry and commerce
12.3 Support for livelihoods around water
12.4 Support for improved mobility through water-related transportation

7 EFFECTIVE DISASTER RESPONSE AND RECOVERY

7.1 Comprehensive hazard monitoring, forecasting and early warning system

› QUALITATIVE INDICATOR:

Monitoring, modelling and early warning systems mitigate hazard risks.

QUALITATIVE SCORE:

2.4

SUMMARY OF ROUNDTABLE DISCUSSION:

Natural hazards that may affect Musanze city are mainly floods, stormwater, landslides, and earthquakes sometimes. Monitoring and forecasting the hazards is centralized which means that the city does not have the monitoring and early warning systems in place. In addition, the information, such as rainfall and temperature forecast, is less accurate and not properly disseminated to the population to give enough time for preparation or evacuation.

7.2 Coordination of disaster response and recovery preparation

› QUALITATIVE INDICATOR:

Disaster response and recovery coordination plans and procedures are current, collaborative, well-rehearsed and properly funded.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

Disaster response and recovery plans exist and are coordinated by the Ministry of Emergency Management (MINEMA). However, the implementation of these plans are not well developed because financial resources are insufficient and the staff does not have enough technical capacity to implement them. Therefore, adequate human and financial resources to carry out the implementation are required. Participants highlighted that cooperation among relevant institutions and actors still needs some improvements to ensure efficiency in disaster response and recovery preparation.

7.3 Ensuring adequate funds to government for disaster recovery

› QUALITATIVE INDICATOR:

Public authorities have access to funds for disaster recovery.

QUALITATIVE SCORE:

1.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Musanze city has access to financial resources for disaster recovery. However, the resources are insufficient because funds are disbursed without clear plans. The inexistence of recovery plans is due to the fact that disasters occurring in Musanze are, most of the time, unpredictable. Consequently, the funds allocated to disaster recovery are reallocated to other urgent activities such as health insurance for vulnerable people, security related needs and recently Covid-19.

7.4 Ensuring adequate financial resources for recovery of households and business

› QUALITATIVE INDICATOR:

Households and businesses have access to sufficient financial resources for recovery and continuity following shock events or persistent stresses.

QUALITATIVE SCORE:

1.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Residents may have access to financial resources, although insufficient, to recover from water related shocks and stresses. Recovery funds are made available to vulnerable households meaning they are restricted to residents based on their socio-economic status. For businesses, there are no such funds because the city considers that they have enough money. Consequently, some businesses, especially small ones, are forced to cease operations following a natural disaster with a risk of not reopening again, because the owners do not have enough financial resources to recover from disasters.

7.5 Promotion of community capacity for preparedness and response to water hazards

› QUALITATIVE INDICATOR:

Mechanisms promote community preparedness for water-related shocks and stresses.

QUALITATIVE SCORE:

3.4

SUMMARY OF ROUNDTABLE DISCUSSION:

There are a lack of mechanisms that promote community preparedness for water-related shocks and stresses. Moreover, there is no adequate institutional capacity, technical skills or funds allocated to provide trainings to local communities on how to cope with disasters.

8 EFFECTIVE ASSET MANAGEMENT

8.1 Active monitoring and evaluation of water infrastructure

› QUALITATIVE INDICATOR:

Monitoring and evaluation of water infrastructure and networks ensures data is current and accurate.

QUALITATIVE SCORE:

3.5

SUMMARY OF ROUNDTABLE DISCUSSION:

Monitoring and evaluation plans are in place to assess water infrastructure related to water supply, sanitation and hygiene, drainage, and flood protection. However, the implementation of the plans is not efficient due to lack of financial resources. In addition, there is no updated information on existing new infrastructures.

8.2 Ensuring adequate human capacity for operations and implementation

› QUALITATIVE INDICATOR:

Technical and managerial staff are trained and knowledgeable in areas related to operation of key infrastructure and project implementation.

QUALITATIVE SCORE:

3.4

SUMMARY OF ROUNDTABLE DISCUSSION:

Existing human resources plans and strategies are neither encouraging qualified staff to work in the district nor attracting new qualified staff to work in the district. In addition, there are insufficient numbers of trained and knowledgeable staff.

8.3 Promotion of diverse infrastructure for flood protection

› QUALITATIVE INDICATOR:

'Grey' and 'green' infrastructure provide protection from flooding and ensure adequate urban drainage.

QUALITATIVE SCORE:

3.3

SUMMARY OF ROUNDTABLE DISCUSSION:

Grey and green flood protection infrastructure exist but are not enough. Efforts have been made to use nature-based solutions, such as green infrastructure, to complement the grey infrastructure. However, more efforts and sufficient funds are needed to reduce the impacts of floods in Musanze city. In addition, buffer zones on rivers and channels are still not respected.

8.4 Routine maintenance and upgrade of water infrastructure

› QUALITATIVE INDICATOR:

Existing infrastructure is regularly maintained and upgraded to reduce likelihood of failure.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Water infrastructure within Musanze is managed by the District and the Water and Sanitation Corporation (WASAC). Routine maintenance and upgrade plans of water infrastructure are developed but the implementation of the plans are ineffective due to limited funds and the district's technical staff capacity which increases the risk of the water infrastructure's failure.

8.5 Promotion of reliable supply chains for water infrastructure

› QUALITATIVE INDICATOR:

Supply chains for key water and sanitation infrastructure are reliable during normal conditions and in the face of shocks and stresses.

QUALITATIVE SCORE:

3.3

SUMMARY OF ROUNDTABLE DISCUSSION:

Supply chains are inefficient especially under conditions brought on by shocks and stresses, such as long rainy seasons. Inappropriate solid waste disposal and sedimentation were identified as factors that hinder the proper functioning of the water system and as a result stresses the supply chain. Additionally, in case of emergencies, such as when infrastructures are damaged, supply chains are stressed due to limited resources (technical and financial).

PROTECTED NATURAL ENVIRONMENTS

9.1a Active monitoring and evaluation of environmental resources

› QUALITATIVE INDICATOR:

Environmental monitoring is conducted to assess the quality of water used for human consumption.

QUALITATIVE SCORE:

2.5

SUMMARY OF ROUNDTABLE DISCUSSION:

Participants highlighted the lack of sufficient information regarding the assessment of the water quality used for human consumption. However, some participants mentioned that dissemination of the findings/information to both decision makers and the local community is needed. In addition, an improvement can be seen on the side of the government through the district in finding a solution to make the information accessible, clear, and easy to understand to relevant decision makers. The indicator was scored from low to fair because of of the amount of sediments originating from household trash that can be spotted in Mutobo river, which is the main river used for water supply in Musanze city.

Generally, the stakeholders in the second session pointed out that WASAC assesses water quality fairly at the intake of their water treatment plant and the water quality after treatment before conveying it in the distribution network of the city. However, other sources of water, such as rivers and springs, are not monitored regularly, and it was stated that the number of people who depend on piped water is still low. It was concluded that the water quality should be monitored more regularly not only for piped water but also for rivers, springs and wells. Piped water should also be well treated in the sense that no further treatment is required for end users.

9.1b Active monitoring and evaluation of environmental resources

› QUALITATIVE INDICATOR:

Environmental monitoring is conducted to assess the health of environmental systems.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Previously, there was no particular protection of environmental resources within the city, but now restoration and rehabilitation of the ecosystem is observed. For example, public gardens are being established in Musanze city and home-grown gardens are getting adopted in households. However, a significant amount of work needs to be done by the district to strengthen environmental monitoring coverage relative to ecosystems that serve the city and water resources within the city.

The stakeholders highlighted that Musanze city lacks a decentralized wastewater system which can help in reducing water pollution given that the ground water table of Musanze is shallow. Furthermore, it was stated that the environment is a vast subject and will require more regular monitoring to evaluate its health. The Rwanda Environmental Management Authority (REMA) is doing the assessment and it should also look at the dissemination of findings on a regular basis, given that processes and methods to conduct the assessment are already available.

9.2 Promotion of sustainable commercial and industrial water use

› QUALITATIVE INDICATOR:

Mechanisms promote sustainable water use for commercial and industrial users.

QUALITATIVE SCORE:

2.4

SUMMARY OF ROUNDTABLE DISCUSSION:

To score this indicator, the stakeholders discussed rationales related to current water consumption in the city. It is commonly known that commercial and industrial water consumers complain about the expensive/elevated cost of water and electricity bills, but have never seen initiative or action regarding investing in the protection of water bodies or in the effective usage of water. Hence, they are not sure if the mechanisms to promote sustainable water use exist.

It was also noted that, in Musanze city, industries are prioritized to have access to clean and sufficient water. Some participants mentioned that mechanisms are already in place. However, improvement is needed to replace the old pipelines (old pipes in the network). One of the stakeholders commented on the reuse of water since the water is wasted instead of reclaiming it and applying the right treatment to reuse it for other purposes like washing clothes, cleaning, and gardening.

9.3 Promotion of sustainable household water use

› QUALITATIVE INDICATOR:

Mechanisms promote sustainable water use for households.

QUALITATIVE SCORE:

2.1

SUMMARY OF ROUNDTABLE DISCUSSION:

The stakeholders recognized the existence of the mechanisms but questioned the implementation process and suggested the need of discussing it with the district. It has been noticed that in the city, respective household's taps have water meters. The suggested idea was, if possible, water meters can be used to set limits on water consumption to avoid an elevated water bill at the end of the month. However, it was mentioned that there is a possibility of resistance when it comes to innovations on how to sustainably use water to avoid elevated water bills. For example, some urban citizens might feel responsible and accountable for any costs related to water consumption (self-reliance). Therefore, the mechanisms exist but there is still a need for community engagement to properly implement them.

Other stakeholders were unsure if the mechanisms exist because the existing initiatives do not address specifically relevant household water users. The urban community is more interested in using water without restrictions as it is supplied without considering relative cost/bills at the end of the month. For instance, at the household level, after showering, the tap is sometimes left open and even the toilet might be flushed twice or more times per single use. On the other hand, some household water users try to explore alternative sources of water, such as rainwater harvesting, but it is not considered as clean of water among the community of Musanze city yet. To this end, it was mentioned that it is discouraging to see people walking around along the way to fetch water after it stops raining.

9.4 Protection of aquatic habitats and ecosystems

› QUALITATIVE INDICATOR:

Policies and programs protect aquatic habitats and ecosystems.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Policies to protect aquatic habitats and ecosystems exist at the national level, but the stakeholders were unsure if they were properly mainstreamed locally especially at the community level. Although policies and programs do exist, their enforcement is inadequate. Some of the stakeholders mentioned that this has limited the funds and resources needed so that the programs can effectively protect aquatic habitats and ecosystems. One of the stakeholders said that Rwanda Environment Management Authority (REMA) establishes environmental related policies in line with its mandate in collaboration with other public institutions at the national level, but they were unsure if the local authorities are aware of those policies. There is a need for community awareness and increased regular enforcement of the policies that are already established at the national level.

In the second assessment session, stakeholders identified that there are gaps and weaknesses within the existing policies and programs to protect aquatic habitats and ecosystems. This is because the stakeholders were not considered or consulted during the establishment of said policies. Some policies also need to be updated to comply with the current conditions of the city. Another weakness is the implementation of policies which can become difficult due to the limited collaboration between institutions and the lack of public opinion during the policy making process.

9.5a Protection of groundwater and surface water resources

› QUALITATIVE INDICATOR:

Protections exist to prevent over-abstraction and eliminate pollution of surface water sources.

QUALITATIVE SCORE:

1.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Protection is being established on the national level, however at the district and city level the protection of surface waters is not yet established as it should be. It was agreed that there is an existence of laws and regulations to protect surface water from over-abstraction/ elimination and pollution, but the community was not aware of their existence. This does not give a good image because no one has seen the district preventing people from fetching water directly from the rivers (Mutobo River). Therefore, it was highlighted that existing laws and policies need to be decentralized.

Stakeholders provided a good example of the water permit system owned by Rwanda Water Resources Board (RWB). The problem is that the dissemination of policy related information does not reach everyone, sometimes district staff included, and some water users are not aware of it at all. Furthermore, the upstream community still uses water directly abstracted from rivers as well as discharges their effluents without considering the consequences that might happen downstream.

9.5b Protection of groundwater and surface water resources

› QUALITATIVE INDICATOR:

Protections exist to prevent over-abstraction and eliminate pollution of groundwater sources.

QUALITATIVE SCORE:

2.3

SUMMARY OF ROUNDTABLE DISCUSSION:

After a long roundtable discussion, laws governing the protection of over-abstraction of groundwater were acknowledged by the participants.However, the policies exist at the national level, but are unknown locally. In that regard, there is no dissemination of ground water information and even the enforcement of those laws are considered problematic and challenging. Therefore, groundwater resources in Musanze city are not sufficiently managed.

The stakeholders identified the existence of the policies governing the over-abstraction/withdrawal and elimination of pollution of groundwater sources. No one is allowed to use groundwater without permission from the competent authority. However, it was also mentioned that there are limitations in exploring the groundwater due to a lack of knowledge, technology, and resources within the city.

HEALTH & WELLBEING

There is still a shortage in water supply in Musanze city and water supply facilities are not physically accessible to everyone within the city. Affordability of individual home connection is also an issue considering that some people cannot afford to pay even 20RWF (approximately 0.02 USD) per 20 liters of a jerrican every day from the public taps. Regarding sanitation, while their affordability is also an issue, the management of pit latrines is a very critical issue for Musanze city since there is no available data showing the final disposal of fecal sludge. Considering the shallow groundwater table of Musanze, it can be easily polluted. Unmaintained sanitation systems in the city are not safe for groundwater.

Water is taken as a principal element in the design and is incorporated in urban policy making. For example, at the national level, rainwater harvesting is currently a required in the design development of any house construction level, however this is still not mainstreamed at the local level and is not always considered during the building permitting system. In all land use planning and development, water is incorporated since public institutions with mandates related to water are consulted during planning to make sure that clean, safe and accessible water for the area can be among the development needs. However, this seems to be limited only to water supply without considering storm water management as well.

Laws and policies exist to minimize relocation of vulnerable populations as a result of water-related shocks and stresses. However, stakeholders still need to be engaged and consulted during the development of these policies to ensure proper representation of ideas and needs.


HEALTH & WELLBEING
LEADERSHIP & STRATEGY
PLANNING & FINANCE
INFRASTRUCTURE & ECOSYSTEMS
Empowered Communities
Prosperous Communities
Healthy Urban Spaces
Equitable Provision of Essential Services
Strategic Vision
Coordinated Basin Governance
Effective Regulation and Accountability
Adaptive and Integrated Planning
Sustainable Funding and Finance
Effective Disaster Response and Recovery
Effective Asset Management
Protected Natural Environments
1.1 Active community engagement and participation around water issues
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10 PROTECTED NATURAL ENVIRONMENTS

10.1 Provision of safe water for personal and domestic use

› QUALITATIVE INDICATOR:

All people have access to sufficient, safe, accessible, and affordable water for personal and domestic use.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

There is still a shortage in water supply in Musanze city. Moreover, stakeholders were unsure if the piped water can be accessible to everyone since it is not affordable considering the cost applied to the customer for registration, buying water meters and to finally buy pipes that might be long depending on the distance of the distributing pipes to everyone's home. In other words, water supply facilities are not physically accessible to everyone within the city. Sometimes the water quality becomes an issue as well, even if water resources are abundant in Musanze city.

In the second assessment session, stakeholders identified that in Musanze city, accessibility to clean water is possible for the entire city's community because the water supply network covers the main areas of the city and it will only require individual connectivity. The individual connection to the network can be a disadvantage due to the affordability issue. Furthermore, water bill consumption is made on a monthly basis. Public taps are also considered expensive across the city since some people cannot afford to pay 20RWF (approximately 0.02 USD) per 20 liters of a jerrican every day.

10.2 Provision of sanitation services

› QUALITATIVE INDICATOR:

All people have access to sanitation that is safe, hygienic, secure, affordable, and socially and culturally acceptable.

QUALITATIVE SCORE:

2.6

SUMMARY OF ROUNDTABLE DISCUSSION:

The discussion on the percentage of people that have access to clean water in Musanze city concluded that"not 100% of people have access to clean water." This consequently affects their health since sanitation services need clean water for hygiene purposes, given that everyone has access to pit latrines (sanitary toilet). The management of pit latrines is a critical issue since there is no available data showing the final disposal of fecal sludge. It is assumed that fecal sludge remains in pits hence the need for wastewater treatment facilities.

The groundwater table of Musanze is generally shallow and can be easily polluted. Unmaintained sanitation systems in the city are not safe for groundwater as well as for urban citizens of Musanze. Therefore, the pit latrines that are currently being used as sanitation systems at the household level are not safe. Some people still use dirty water (non-treated) in hygiene activities due to the elevated cost of clean treated water.

10.3a universal affordability of water and sanitation services

› QUALITATIVE INDICATOR (10.3A):

Safe water for consumption is made affordable to all users.

QUALITATIVE SCORE:

2.8

QUALITATIVE SCORE:

Participants identified that the old water supply network's pipes in Musanze city are made of cast or galvanized iron. In addition, it was mentioned that water supplied from the tap is not safe enough for direct consumption without further treatment by the end users. It was suggested that the customers (end users) should be informed about the quality of water they are going to use before billing on water consumed. Given the fact that most of the community in the city of Musanze values water quality, it was proposed to renew the existing

water supply networks and inform the citizens on the cost of the treatment process. This might convince people of the pricing that comes with water bills. Otherwise, some people prefer to use water from rivers since it is free of charge.

In Musanze city, there is a social belief that states, "most of the people who reside within the city can be able to afford clean water", this was said by one of the stakeholders. However, there are so many factors that disapprove this belief, including accessibility and old pipes in the supplying network. In addition, water bills differ from one consumption zone to another. For instance, bills for domestic consumption are very different and cheaper compared to those for industrial and commercial consumption.

10.3b universal affordability of water and sanitation services

› QUALITATIVE INDICATOR (10.3A):

Safe water for consumption is made affordable to all users.

QUALITATIVE SCORE:

3.1

QUALITATIVE SCORE:

Participants were concerned with the public sanitation services which are poorly managed within the city. However, at the household level it is considered an expensive facility. For example, the materials and equipment used in the construction of an improved sanitation facility cannot be afforded by everyone. Public sanitation services are insufficient due to low mobilization at the community, private sector, and administrative levels.

The stakeholders in the second assessment session first acknowledged that the pandemic has led to the improvement of the city's existing public sanitary facilities in order to abide with the restrictions set by the government to reduce the spread of COVID 19. This includes regular hand washing habits as advised by the WHO (World Health Organization). Thus, it has contributed to the overall hygiene since it is free of charge. The public toilets are still considered expensive (100RWF/use), leaving some people to walk to the bushes or even in nearby drains to use them for the same purpose. It was noted that Musanze city is improving on solid waste management flexibility, whereby rubbish collection is organized from households to the main collection area, then further transported to the dumping site free of charge in some neighborhoods of the city.

10.4 Provision of health services to reduce trauma from water hazards

› QUALITATIVE INDICATOR:

High quality health services are made available to residents to reduce impacts from water related shocks and stresses including water borne diseased.

QUALITATIVE SCORE:

3.2

SUMMARY OF ROUNDTABLE DISCUSSION:

Healthcare facilities are available and working all the time. However, there are concerns that these facilities are overcrowded and tend to have a limited number of service providers which delays patients in receiving the care they need. In times of water-related disasters, the management of the provision of health services tends to be on time. Normally, on usual working days, patients overcrowd the facilities and this becomes very problematic to receive any kind of needed services. In that regard, an extension of the health facilities and increasing the number of capable health care providers was recommended. The health care assistants (postes de santé) are available in Musanze city, but they provide basic medical treatment for children affected by waterborne diseases.

HEALTHY URBAN SPACES

11.1 Application of water sensitive design principles to buildings

› QUALITATIVE INDICATOR:

Design principles are promoted to improve water performance for buildings.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

The application of water sensitive design principles will depend on the income of the owner of the building or the building's allocated budget. The buildings with enough budgets allocated to them can consider water sensitivity in their design, but others with a limited budget will ignore it. There are existing design principles and before being granted a building permit one must comply with a set of requirements including water sensitive designs. However, it becomes challenging during the implementation stage. A different viewpoint was expressed by noting that design principles are only applied to large buildings but when it comes to household level and small commercial buildings it is not considered. It was also observed that there is a lack of long-term planning in the design of the city's drainage system. The limitation of funds in terms of implementing building projects was observed with specific concern on individual buildings where the design principles are not as well implemented as described in the building permitting process. Generally, the buildings that have been built since 2015 consider water as a key element in their design due to the establishment of the city master plan. However, during the implementation stage, it is typically observed and considered in public and commercial buildings only.

11.2 Introduction and enhancement of water sensitive urban design

› QUALITATIVE INDICATOR:

Water is incorporated as a design element in urban place-making.

QUALITATIVE SCORE:

3.0

SUMMARY OF ROUNDTABLE DISCUSSION:

Water is taken as a principal element in the design and is incorporated in urban policy making. For example, rainwater harvesting is currently being considered in the design development, but it was noted that it is still not mainstreamed on the local level and is not always considered during the building permitting system. It is also limited by insufficient resources. Hence, it was suggested that the water be first specified in the design and implementation of urban place making and then sensitize the community on the benefit of following the settled guidelines in their respective building zones.

11.3 Promotion of water-sensitive urban land development

› QUALITATIVE INDICATOR:

Water is incorporated as a key consideration in land-use planning and development.

QUALITATIVE SCORE:

3.4

SUMMARY OF ROUNDTABLE DISCUSSION:

There are concerns on the master plan zoning which can allocate residential housing in areas where the water supply network cannot reach. This can cause the problem of water insecurity in a new, habitable area. The water bodies are considered in the development of urban design, for instance the buffer zones are established on every river and lake to protect people's properties or vegetation from the floodplain. Regulations and policies are available and well developed but more effort is needed in the land use development planning. This might require investment to start but it will result in a sustainable path toward improved land use development in Musanze city.

In all land use planning and development, water is incorporated since public institutions with mandates related to water are consulted during planning to ensure that clean, safe and accessible water for the area can be among the development needs. However, this seems to be limited only to water supply without considering storm water management as well. As a result, it should be carefully considered in planning and development of land use.

11.4 Introduction and enhancement of neighbourhood blue-green infrastructure

› QUALITATIVE INDICATOR:

Blue and green infrastructure is adopted in neighbourhoods.

QUALITATIVE SCORE:

2.7

SUMMARY OF ROUNDTABLE DISCUSSION:

There was a lack of common understanding around blue and green infrastructure. It was unsure if green infrastructure is being adopted as this kind of information has only been published in research papers and does not reach the community level considering that research papers are not easily consulted in the design and planning of infrastructures.

In the second assessment session, some exisiting blue-green infrastructure in Musanze was identified, such as drains and rainwater harvesting for some households. For instance, the drain that was constructed to solve the Rwebeya gully problem of stormwater from the volcanoes to reduce flooding in the city of Musanze. However, there is a need for continuous improvements and monitoring. For green infrastructure, most of the households have gardens but some homes are still making the whole parcel pervious to allow water infiltration, and then avoid mud in their home during the rainy season. A need to adopt rainwater harvesting was underlined not only at the household level but also on public buildings.

PROTECTED NATURAL ENVIRONMENTS

12.1 Protections around climate-related displacement

› QUALITATIVE INDICATOR:

Policies exist that protect vulnerable populations from displacement as a result of water-related shocks and stresses.

QUALITATIVE SCORE:

3.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Laws and policies exist to minimize relocation of vulnerable populations as a result of water-related shocks and stresses. Nevertheless, stakeholders still need to be engaged during the development of policies. The implementation of those policies remains low.

12.2 Provision of sufficient water quality and quantity for industry and commerce

› QUALITATIVE INDICATOR:

Businesses and industry have access to sufficient water of appropriate quality.

QUALITATIVE SCORE:

3.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Water that is provided to businesses and industries is sufficient and of good quality except during seasonal water rationing where all businesses are required to have a rainwater harvesting tank.

12.3 Support for livelihoods around water

› QUALITATIVE INDICATOR:

Jobs and skills are developed, and new opportunities created for developing livelihoods around water.

QUALITATIVE SCORE:

2.9

SUMMARY OF ROUNDTABLE DISCUSSION:

Programs to support livelihoods are provided but they offer temporary jobs. And the human resources required to implement the plans are insufficient because the requirements in terms of qualification and professional experience in the water sector are very high.

12.4 Support for improved mobility through water-related transportation

› QUALITATIVE INDICATOR:

Jobs and skills are developed, and new opportunities created for developing livelihoods around water.

QUALITATIVE SCORE:

2.7

SUMMARY OF ROUNDTABLE DISCUSSION:

Existing water-related mobility through lakes and rivers in Musanze city is unreliable, unsafe, and inaccessible to communities because it is not affordable to everyone.

3. CHALLENGES AND OPPORTUNITIES

Challenges describes the approach taken to move from the assessment results to identifying a series of cross-cutting challenges emerging from the analysis. It describes how stakeholders were involved in reviewing, prioritizing, and shaping these challenges in preparation for the visioning and opportunities workshop.

Opportunities describes the process of moving from challenges to opportunities. Participants came together for an interactive 'Visioning Workshop' during which groups refined the challenges, then re-framed these to generate and develop a range of opportunities for a water resilient Musanze.

The project team developed ten problem statements based on analysis of qualitative indicators. From these, stakeholders identified nine problem statements to address during the Vision Workshop.

	CHALLENGE	CHALLENGE STATEMENT
Community and Stakeholder Engagement		
1	Limited awareness of water-related challenges and opportunities in Musanze city by the community, CSOs, and private sector.	How can we ensure increased awareness on water-related challenges and opportunities across all levels of stakeholders in a way that will motivate and give the capacity to stakeholders to participate in water resources management?
2	Inadequate engagement of the community in water related planning and management.	How can we ensure that the community is actively represented, engaged, and has the capacity to contribute to water-related planning and management?
Financial and Technical Capacity		
3	Limited capacity of district technical staff to develop bankable proposals and explore alternative revenue sources.	How can we ensure that district technical staff are strengthened enough to develop bankable proposals and explore alternative revenue sources?
4	Lack of knowledge sharing platforms and on-the-job trainings for district staff and practitioners.	How can we ensure that knowledge sharing platforms are improved and on-the-job, trainings are regularly implemented for district staff?
Infrastructure Need and Management		
5	Lack of sewerage system and stormwater management plan.	How can the sewerage systems be integrated in the city master plan and allocate funds towards its implementation to maximize the management of grey and black water within the city? How can we ensure that the stormwater is managed within the city and rainwater harvesting practices are mainstreamed at household level to reduce the impacts of runoff on both the environment and existing water-related infrastructure?
6	Lack of technology to track water losses in water supply networks.	How can we track water losses in new and old water supply networks to implement the water leakage control and enhance the compliance with increasing regulatory requirements to solve water quality and quantity concerns including water affordability in Musanze's urban community?
Data and Knowledge Management		
7	Lack of a water-related information system.	How to ensure that an accessible water-related information system is developed?
8	Lack of quality and updated water-related data.	How to ensure that water-related data collection and analysis is properly completed?
Coordination and Integrated Planning		
9	Inadequate coordination between the district and central level agencies in water-related planning and implementation in Musanze city.	How can the coordination between the district and central level agencies be improved to accommodate efficient water-related planning and implementation in Musanze city?
10	Redundancy in the establishment of water-related technical committees and ad-hoc basis.	How can the city of Musanze improve its responses and coordination to water-related shocks and stresses?
11	Lack of integrated planning and climate resilient tools at the neighborhood level.	How can district land use planning be adequately downscaled and implemented at neighborhood level in a climate resilient manner?

Community and Stakeholder Engagement

1.

Limited awareness on water related challenges and opportunities in Musanze city by the community, CSOs, and private sector.

CHALLENGE STATEMENT/QUESTION

How can we ensure increased awareness on water-related challenges and opportunities across all levels of stakeholders in a way that will motivate and give the capacity to stakeholders to participate in water resources management?

CHALLENGE DESCRIPTION

The community in Musanze city does not prioritize water-related issues. This is due to the limited knowledge around water resources management (WRM) and the community's potential contribution in finding solutions to existing issues. The community is not motivated to be involved in water-related opportunities, mainly because it is not seen as a priority. Additionally, people are unaware of how their direct actions are contributing to existing issues and therefore do not feel accountable to find solutions. Even existing community social networks do not have a particular emphasis on water-related issues. These networks may collaborate in times of disaster, but the level of contribution remains low and unorganized (i.e., no technician skills to contribute to disaster preparedness).

There are no existing awareness campaigns on WRM by the government or development partners to ensure that updates, challenges, and opportunities are known by relevant stakeholders, which contributes to the reason why WRM is not considered as a priority. As a result, WRM and basin level practices are not well understood by the community.

CSO's are more focused on soft interventions and they do not particularly see opportunities in water-related issues because the interventions are considered to be costly and on a larger scale. Due to this reasoning, CSO's are not actively involved in activities for the urban area of Musanze and their contribution is often limited at the city level.

The district's long-term strategies, new policies, laws, and other updates for the sector are not properly disseminated to all relevant stakeholders, hence the lack of awareness on potential opportunities. The limited involvement of stakeholders in setting up policies and strategies also limits their motivation to look for the information.

The private sector is not attracted by the sector. This can be caused mainly by their lack of awareness on available potential opportunities to invest and contribute.

Community and Stakeholder Engagement

1.

Limited awareness on water related challenges and opportunities in Musanze city by the community, CSOs, and private sector.

RELATED INDICATORS

- 1.2 Mechanisms ensure that comprehensive information on government programs and policies are disseminated to all stakeholders
- 1.4 Mechanisms ensure that financial, institutional, and technical support is provided to civil society institutions working on water issues
- 3.1 Coordination between city stakeholders and relevant downstream stakeholders minimize downstream impacts
- 3.2 Frameworks and mechanisms promote coordination between city stakeholders and relevant upstream stakeholders on water issues
- 3.3 Coordination exists between different government agencies operating at various administrative levels to define and implement water priorities
- 3.4 Frameworks and mechanisms promote dialogue and deliberation around water and resilience issues between government and nongovernment actors
- 4.1 Economic regulation of water and sanitation services and water resources is performed effectively, resulting in adequate provision of key services and high customer satisfaction
- 4.2 Environmental regulation is performed effectively, resulting in high quality, protected water environments
- 4.5 Technical standards and design guidelines define best practice for critical infrastructure
- 4.6 Decision-making procedures around water resources management, water and wastewater services are made clear and open to all stakeholders
- 6.4 Water tariff systems are sustainable and equitable
- 9.2 Mechanisms promote sustainable water use for commercial and industrial users.
- 9.3 Mechanisms promote sustainable water use for households
- 9.4 Policies and programs protect aquatic habitats and ecosystems
- 9.5a Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of surface water sources

ROOT CAUSES

Social Causes

- Lack of knowledge of water resources management and its value, this is due to the low level of education on the matter.
- Stakeholders in CSOs underestimate water issues because they are not prioritized by society.
- Population increases which leads to the prioritization of other issues rather than prioritization of natural resources preservation.
- A general mindset that undervalues water resources and natural resources.
- Community and stakeholder's overexploitation of limited available resources and high dependence on water resources.
- Lack of ownership of the public good.
- Lack of knowledge on long-term planning even though WRM requires long-term thinking. There are existing cultural stereotypes on long-term planning in Rwanda that undervalue long-term planning like "ibyejo bibara abejo" which can be translated as "The future counts for those who will live tomorrow".
- CSOs have limited knowledge about the environmental aspects of Musanze.
- CSOs, the private sector and community value direct monetary interest rather than long-term interest.
- No experience sharing or peer-to-peer learnings are exchanged on success stories related to water resources management.

Political and Governance Causes

- Lack of a capacity building plan for catchment committees and a proper way of monitoring them.
- No proper channel of communication regarding the community's WRM roles and responsibilities.
- Local government does not value community contribution/ideas (for example, the underestimation of community contribution during disaster preparedness and management)
- Lack of collaboration between stakeholders at early stage of projects development.
- Limited number of partners involved in environmental and water resources management.

Financial Causes

- High cost of dealing with the environmental complexity of Musanze (i.e., floods, landslides), and technologies to deal with water resource issues are costly.
- The community has a low level of income and limited financial means to contribute to dealing with water-related issues.
- Water resources management is not a financial priority of the community.

Community and Stakeholder Engagement

1.

Limited awareness on water related challenges and opportunities in Musanze city by the community, CSOs, and private sector.

- Limited financial capacity of the local government and project initiators to conduct grass roots studies (inclusive studies).
- CSOs focus on soft intervention and on raising awareness and advocacy, which are less costly than hard infrastructure.
- Low budget from CSOs to deal with water-related infrastructure, these types of interventions are usually done by government.
- No existing framework of mobilising and collecting community financial contribution for WRM.

Environmental Causes

- The complexity of environmental aspects of Musanze which is beyond the understanding of stakeholders/the community (i.e., soil structure, topography, ground water).
- Disasters (i.e., floods and landslides) are big issues beyond community capacity, CSO's capacity and private sector capacity.
- Limited knowledge surrounding the linkage between environmental aspects management and their impact on water resources.
- Environmental complexity of Musanze district which limits the level of investment from private sector and CSOs.

Technological Causes

- Lack of readily available data to be used in various projects related to water resource issues.
- Lack of archives to inform new technological solutions (i.e., what has been tried, what has worked or what has failed).
- New technological trends that conflict with existing natural practices (i.e., green construction solutions vs the trend of using concrete pavements).
- Scientific information and updates are not communicated to the community.
- Community lacks trust of the provided early warning information.
- Lack of long-term studies predicting water-related issues.
- Poor early warning system which provides inaccurate information.
- Not taking advantage of existing technological channels (i.e., radios, TV, internet, and social media) to communicate water-related updates.
- Lack of available scientific studies for specific solutions on water resources related problems (for example, the issue of ground water pollution due to high porosity soil structure).
- Community, private sector and CSOs lack knowledge on natural resources.

Other Causes

- Community has limited knowledge on safeguarding water resources infrastructure.

Community and Stakeholder Engagement

2.

Inadequate engagement of the community in water related planning and management.

CHALLENGE STATEMENT/QUESTION

How can we ensure that the community is actively represented, engaged, and has the capacity to contribute to water-related planning and management?

CHALLENGE DESCRIPTION

Sector related policies emphasize the importance of community engagement in water-related planning and management. However, this is not put into action and there is still poor engagement of the community at all levels of a project's implementation and at the decision-making level. There is no community voice represented in developing policies, strategies, or standards (water and sanitation services price regulation), hence policies and solutions do not fully reflect the reality of the community level.

Water-related infrastructure is sensitive and, in most cases, needs to be taken care of by the surrounding communities. This is why the community needs to be involved in the conception of projects for their input to be considered. In Musanze city, water users' committees are not very active and there is no water resources management committee. As a result, there is no facilitation of community engagement opportunities by various stakeholders including the local government. Even for the exiting community networks, there is unequal representation of community members (i.e., women, youth, the poor).

In Musanze city, the community is often engaged in water-related disaster mitigation and adaptation measures, however, their contribution is still limited due to their lack of financial and technical capacity.

RELATED INDICATORS

- 1.1 Legal and institutional frameworks and mechanisms promote active, free, and meaningful participation around issues related to water supply, sanitation, drainage, and flooding.
- 1.3 Inclusive and participatory social networks (formal and informal) enable communities to learn from each other, self-organize and act collectively in times of need
- 7.5 Mechanisms promote community preparedness for water-related shocks and stresses
- 10.3 Safe water for consumption is made affordable to all users and safely managed sanitation services are made affordable to all users
- 11.4 Blue and green infrastructure is adopted in neighbourhoods
- 12.1 Policies exist that protect vulnerable populations from displacement because of water-related shocks and stresses

ROOT CAUSES

Social Causes

- Culturally, women are not involved in water resources management or decision making.
- There is community frustration due to the lack of consideration of previous ideas, hence their reluctancy in contributing and participating in future public meetings.
- Limited natural resources causing conflict within different water users (i.e., water for agriculture, water for drinking, etc.).

Political and Governance Causes

- No existing framework allows community coordination at the catchment level (administration boundaries are more prioritized).
- Conflicting policies and plans which cause confusion to stakeholders at the implementation level.
- Conflict between grassroot leaders and the community on natural resources use and protection.

Community and Stakeholder Engagement

2.

Inadequate engagement of the community in water related planning and management.

- Poor coordination in existing community committees and overlaps of committee responsibilities (environmental committees, disaster management committees, water users' committees, etc.).
- Ineffective channels of information dissemination to the communities from stakeholders.
- Lack of early-stage involvement of communities in project implementation hence the lack of community ownership towards implemented projects.
- Poor engagement of the community in projects' data collection which results in the information shared not reflecting the community's reality.
- Poor involvement of the community in policy setting hence conflicts around natural resources.
- Channels for community grievances are unclear and ineffective.
- The district lacks financial capacity to operationalize catchment community committees and other community committees.
- District lacks staff capacity to ensure community engagement wherever needed.

Financial Causes

- No community involvement in the management of water infrastructure hence no ownership or sustainability.
- No existing framework of collecting community financial contribution regarding WRM.

Environmental Causes

- The complexity of environmental aspects of Musanze is beyond the understanding of the community hence no active community involvement and participation.

Technological Causes

- Lack of community centred design technologies (existing solutions or technologies are imposed on the community) without community contribution in the design phase, this has an impact on the technology's sustainability.
- The scientific language used to communicate water issues is not customized to the understanding of the community.
- No technological knowledge regarding WRM is transferred to the community.

Financial and Technical Capacity

3.

Limited capacity of district technical staff to develop bankable proposals and explore alternative revenue sources.

CHALLENGE STATEMENT/QUESTION

How can we ensure that district technical staff are strengthened enough to develop bankable proposals and explore alternative revenue sources?

CHALLENGE DESCRIPTION

The city of Musanze has limited technical and financial resources to ensure best management practices in the water sector. Moreover, funds allocated to the city for water planning and management as well as disaster recovery are insufficient. This is because the city's revenue sources mainly come from taxes. Therefore, the city experiences a lack of financial capacity to implement plans, enforce policy and programs on water usage, regularly maintain water-related infrastructure and develop and implement new projects and programs.

In addition to limited financial capacity, the district is lacking qualified and sufficient staff (i.e., understaffed) in some departments and the existing staff have limited technical expertise to develop projects, ensure effective continuation of projects and implement disaster and recovery plans. There is also a lack of culture for innovation related to water management as well as limited applied research support to respond to the needs of the district.

RELATED INDICATORS

- 1.2 Mechanisms ensure that comprehensive information on government programs and policies are disseminated to all stakeholders.
- 2.2 Local knowledge and cultural values of all population groups are referred to in government decision-making around water issues.
- 2.5 Political leadership promotes resilience as a priority issue in government decision-making.
- 3.2 Frameworks and mechanisms promote coordination between city stakeholders and relevant upstream stakeholders on water issues.
- 4.2 Environmental regulation is performed effectively, resulting in high quality, protected water environments.
- 4.3 Public health regulation for water is performed effectively, resulting in water that is safe to consume and wastewater that can be returned to the water cycle with minimal environmental impact.
- 4.4 A sound regulatory framework controls land use and urban expansion and reduces growth in high-risk and water-poor areas.
- 5.6 Resources and processes reinforce a culture of innovation within the water sector.
- 6.3 Adequate funding exists to finance new capital projects and programs that support water resilience.
- 7.2 Disaster response and recovery coordination plans and procedures are current, collaborative, well-rehearsed and properly funded.
- 7.4 Households and businesses have to access to sufficient financial resources to recover from shock events or persistent stresses
- 8.1 Active monitoring and evaluation of water infrastructure (water supply, sanitation, flooding, and drainage) ensures data is current and accurate
- 8.3 Grey and green infrastructure provide protection from flooding and ensure adequate urban drainage.
- 8.4 Existing infrastructure (water supply, sanitation, flooding, and drainage) is regularly maintained and upgraded to reduce likelihood of failure.
- 8.5 Supply chains for key infrastructure are reliable during normal conditions and in the face of shocks and stresses.

3.

Financial and Technical Capacity

Limited capacity of district technical staff to develop bankable proposals and explore alternative revenue sources.

- 9.2 Mechanisms promote sustainable water use for commercial and industrial users.
- 9.4 Policies and Programs protect aquatic habitats and ecosystems.
- 10.3 Safely managed sanitation services are made affordable to all users.

ROOT CAUSES

Social Causes

- Donor dependencies (external finances)
- Negligence of technician or local staff (carelessness) to respond to the technical problems

Political and Governance Causes

- Limited skills in leadership and governance
- Inadequate framework for private sector engagement for water-related businesses
- Lack of fund mobilization (internal and external)

Financial Causes

- Highly dependent on external partners because of low revenue/funds at district level.
- Limited funds for water-related research.
- Limited capacity to develop bankable proposals and explore income opportunities.

Environmental Causes

- Landscape of the district which increases need for water-related investments.
- Natural hazards disaster (floods & earthquakes) weakening the financial capacity.

Technological Causes

- Limited skills in developing bankable project for generating revenue.
- Limited skills (computer literacy) by district technicians.

Other Causes

- Unattractive compensation for qualified technical staff.

Financial and Technical Capacity

4.

Lack of knowledge sharing platforms and on-the-job trainings for district staff and practitioners.

CHALLENGE STATEMENT/QUESTION

How can we ensure that knowledge sharing platforms are improved and on-the-job trainings are regularly implemented for district staff?

CHALLENGE DESCRIPTION

Knowledge sharing platforms are very useful as they help to disseminate information which leads to a more proactive coordination between government, private sector and civil society organizations working in the water sector. In the city of Musanze, there is a lack of such platforms and the existing ones such as the e-procurement system are unstable, often crashing when many people are using it. Moreover, most of these platforms are designed by experts coming from outside the country and there is no knowledge transfer between international experts and district experts. Sometimes there is also a lack of sufficient resources for operation and maintenance of the platforms.

Limited technical capacity results in failure of certain water-related projects due to lack of training on advanced technology for technical and managerial staff. In addition, the current salaries are not encouraging for qualified staff to work at the district as the qualified ones prefer to quit.

RELATED INDICATORS

- 1.1 Legal and institutional frameworks and mechanisms promote active, free, and meaningful participation around issues related to water supply, sanitation, drainage, and flooding.
- 1.3 Inclusive and participatory social networks (formal and informal) enable communities to learn from each other, self-organize and act collectively in times of need.
- 1.4 Mechanisms ensure that financial, institutional, and technical support is provided to civil society institutions working on water issues
- 2.1 Technical knowledge is available, understood and continuously incorporated by government into decision-making around water issues
- 3.4 Frameworks and mechanisms promote dialogue and deliberation around water and resilience issues between government and nongovernment actors.
- 5.5 Coordination exists between water agencies and organizations involved in food supply and production.
- 6.1 Financial procedures promote transparency, minimize risk, and ensure that procurement processes are implemented fairly and efficiently.
- 6.2 Adequate funding exists to maintain water and sanitation infrastructure and to support existing programmes.
- 7.3 Public authorities have access to funds for disaster recovery
- 8.2 Technical and managerial staff are trained and knowledgeable in areas related to operation of key infrastructures
- 10.4 High quality health services are made available to residents to reduce impacts from water-related shocks and stresses, including water-borne diseases.
- 12.3 Jobs and skills are developed and new opportunities created for developing livelihoods around water

Financial and Technical Capacity

4. Lack of knowledge sharing platforms and on the job trainings for district staff and practitioners.

ROOT CAUSES

Social Causes

- Resistance to change according to cultural beliefs
- Limited technical capacity of some technical staff to adopt to new technologies
- Unplanned urbanisation rate
- Different understandings of needs due to age differences

Political and Governance Causes

- Lack of fund mobilization (internal and external) from the local authorities to conduct training and knowledge sharing events.

Financial Causes

- Lack of emergency funds to deal with water-related shocks.
- Limited financial resources to establish early warning systems.

Environmental Causes

- Environmental complexity of the volcano regions increase technical capacities needs.

Technological Causes

- Lack of knowledge transfer and sharing at district level.
- Limited access to innovative technologies by district technicians.
- Access to internet.

Infrastructure Need and Management

5.

Lack of sewerage system and stormwater management plan.

CHALLENGE STATEMENT/QUESTION

How can the sewerage systems be integrated in the city master plan and allocate funds towards its implementation to maximize the management of grey and black water within the city? How can we ensure that the stormwater is managed within the city and rainwater harvesting practices are mainstreamed at household level to reduce the impacts of runoff on both the environment and existing water-related infrastructure?

CHALLENGE DESCRIPTION

There is a lack of a sustainable infrastructure to manage wastewater in Musanze city in combination with poor quality of existing public and household sanitation facilities including the management of pit latrines within the city. This leads to the contamination of water sources which in turn contributes to the spreading of waterborne diseases given that the city has limited health facilities to accommodate the patients.

The lack of both effective sanitation and decentralized wastewater collection systems affects groundwater and surface water quality. Pollution of water sources will alter treatment processes requiring additional time and costs, thus resulting in water supply shortage. This pollutionis not only limited to pit latrines through leaching into groundwater, but communities also discharge other domestic wastes into water bodies. This is a result of the inadequate protection of water bodies in Musanze city. Additionally, there is inadequate water and wastewater infrastructure which affects the enforcement of public health regulations for water.

Furthermore, the city lacks a plan for integrating rainwater harvesting practices into commercial, industrial, public, and institutional building designs and at the household level. The city lacks a long-term proper drainage network plan which will require identifying areas that can be affected by inundation. This insufficiency of drainage was observed in Cyuve sector at a dumpsite where run-off carries solid waste into the wetlands. The city also demonstrates seasonal water shortage due to the inexistence of implemented rainwater harvesting practices and the increase of water turbidity which has further implications in treatment capacity and related energy costs.

RELATED INDICATORS

- 2.1 Technical knowledge is available, understood and continuously incorporated by government into decision-making around water issues
- 2.4 A long-term strategy is in place to guide projects and programs that build water resilience over time
- 4.5 Technical standards and design guidelines define best practice for critical infrastructure
- 5.3.a. Redundancy exists in the networks and assets responsible for water supply, treatment, and sanitation
- 5.3.a. Redundancy exists in the sources that supply water to the city
- 5.4 Coordination exists between public sector water agencies, water utilities and organizations working in related domains such as energy, telecommunications, waste management and transportation.
- 6.2 Adequate funding exists to maintain water and sanitation infrastructure and to support existing programs.
- 6.4 Water tariff systems are sustainable and equitable.
- 8.1 Active monitoring and evaluation of water infrastructure (supply, sanitation, flooding and drainage) ensures data is current and accurate
- 8.3 'Grey' and 'green' infrastructure provide protection from flooding and ensure adequate urban drainage.
- 8.4 Existing infrastructure (water supply, sanitation, flooding and drainage) is regularly maintained and upgraded to reduce likelihood of failure.

Infrastructure Need and Management

5.

Lack of sewerage system and stormwater management plan.

- 9.2 Mechanisms promote sustainable water use for commercial and industrial users
- 9.3 Mechanisms promote sustainable water use for households
- 9.4 Policies and programs protect aquatic habitats and ecosystems
- 9.5a. Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of surface water sources
- 9.5.b. Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of groundwater sources
- 10.1 All people have access to sufficient, safe, accessible, and affordable water for personal and domestic use
- 10.2 All people have access to sanitation that is safe, hygienic, secure, affordable, and socially and culturally acceptable.
- 10.3a. Safe water for consumption is made affordable to all users
- 10.3.b. Safely managed sanitation services are made affordable to all users.
- 11.1 Design principles are promoted to improve water performance for buildings
- 11.2 Water is incorporated as a design element in urban place-making.
- 11.4 Blue and green infrastructure is adopted in neighbourhoods.
- 12.2 Businesses and industry have access to sufficient water of appropriate quality
- 12.3 Jobs and skills are developed and new opportunities created for developing livelihoods around water.

ROOT CAUSES

Social Causes

- Lack of knowledge around water infrastructure including management and maintenance.

Political and Governance Causes

- Gaps within the institutional set up affecting infrastructure planning and management.
- Staff turnover affecting the quality and productivity through loss of valuable knowledge and experience around water-related infrastructure.
- Inadequate commitment to roles and responsibilities of local staff.
- Inadequate collaboration between the district team and stakeholders in the management of water-related infrastructure.
- Prioritization of project (public initiative)
- Low compliance with sanitation standards at household level.
- Inadequate law enforcement in implementation of water-related infrastructure.
- Too much bureaucracy, which delays planning and implementation of water-related infrastructure projects.
- Lack of common understanding of existing policies and programs on both national and international levels.
- Inadequate transparency in development of water-related infrastructure.

Financial Causes

- Limited financial capacity to invest in grey water-related infrastructure.
- Ad-hoc priorities regarding planned investment including water-related infrastructure.
- Complexity of the environment (volcanic region) affecting investors to be attracted in water-related infrastructure.

Environmental Causes

- Complexity of the environment (volcanic region and topography).
- Fear of establishing industrial infrastructure due to the fact that Musanze is considered as volcanic region.
- Population density affecting infrastructure planning.

Technological Causes

- Lack of storm water management plan for Musanze city
- Lack of sewerage system for Musanze city
- Lack of early warning system to disaster management
- Lack of available technologies adapted to current situation
- Limited adaptation of rainwater harvesting system
- Limited understanding of water supply network
- Limited capacity of designers of water-related infrastructure

Other Causes

- Limited on the job trainings

Infrastructure Need and Management

6.

Lack of technology to track water losses in water supply networks.

CHALLENGE STATEMENT/QUESTION

How can we track water losses in new and old water supply networks to implement the water leakage control and enhance the compliance with increasing regulatory requirements to solve water quality and quantity concerns including water affordability in Musanze's urban community?

CHALLENGE DESCRIPTION

The water supply networks in Musanze city are not safe for water transport (for example, some of them are old and made from cast iron). The old networks are concerned with rust which can affect the water quality of the conveyed water and can pose health concerns to Musanze city's community. The need for a modern water transport infrastructure was repeatedly raised as something that is currently missing in the city. However, the corporation in charge still faces challenges of rehabilitation cost of the networks due to unsatisfactory cost recovery caused by water losses .

The Mutobo river is being impacted by large amounts of sediment which pose cost implications in the Mutobo water treatment plant (WTP) that result in water supply shortage, even reduced access to clean water in some neighbourhoods. There is also a lack of modern facilities (technology) to extract ground water in Musanze city that can support the existing Mutobo WTP in increasing the number of urban citizens with access to clean water.

Lack of modern water treatment facilities for the city, and WASAC being the main competent institution in charge of water supply, caused the private operators to be limited and unsure if their investment might be recovered due to lack of the technology to reduce and manage non-revenue water including the lack of redundancy systems in water supply networks. Therefore, strategic repair needs to be undertaken to fix leaks, replacing the deteriorated parts of the network to reduce loss, and improve the quality of water in Musanze city.

RELATED INDICATORS

- 1.4 Mechanisms ensure that financial, institutional, and technical support is provided to civil society institutions working on water issues
- 4.3 Public health regulation for water is performed effectively, resulting in water that is safe to consume and wastewater that can be returned to the water cycle with minimal environmental impact.
- 4.5 Technical standards and design guidelines define best practice for critical infrastructure
- 5.2 Accurate data is used by key decision-makers in government, private sector, and civil society to promote urban water resilience.
- 5.3a. Redundancy exists in the networks and assets responsible for water supply, treatment, and sanitation
- 5.3.b. Redundancy exists in the sources that supply water to the city
- 5.6 Resources and processes reinforce a culture of innovation within the water sector
- 6.2 Adequate funding exists to maintain water and sanitation infrastructure and to support existing programmes
- 6.3 Adequate funding exists to finance new capital projects and programs that support water resilience
- 7.1 Monitoring, modelling and early warning systems mitigate hazard risks
- 8.1 Active monitoring and evaluation of water infrastructure (supply, sanitation, flooding and drainage) ensures data is current and accurate
- 8.2 Technical and managerial staff are trained and knowledgeable in areas related to operation of key infrastructure and project implementation
- 8.4 Existing infrastructure (water supply, sanitation, flooding and drainage) is regularly maintained and upgraded to reduce likelihood of failure
- 9.2 Mechanisms promote sustainable water use for commercial and industrial users
- 9.3 Mechanisms promote sustainable water use for households

Infrastructure Need and Management

6. Lack of technology to track water losses in water supply networks.

- 9.5a. Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of surface water sources
- 9.5.b. Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of groundwater sources
- 10.1 All people have access to sufficient, safe, accessible, and affordable water for personal and domestic use
- 10.2 All people have access to sanitation that is safe, hygienic, secure, affordable, and socially and culturally acceptable
- 10.3a. Safe water for consumption is made affordable to all users
- 10.3.b Safely managed sanitation services are made affordable to all users
- 10.4 High quality health services are made available to residents to reduce impacts from water-related shocks and stresses, including water-borne diseases
- 12.2 Businesses and industry have access to sufficient water of appropriate quality
- 12.3 Jobs and skills are developed, and new opportunities created for developing livelihoods around water
- 12.4 All communities have access to safe and reliable water-related transport where it is feasible to operate

ROOT CAUSES

Social Causes

- Social cultural beliefs which discourage the adoption of water infrastructure.
- Lack of ownership of water infrastructure by the community.
- Resistance to change.
- Rapid population growth
- Vandalism of water-related infrastructure (water supply network's pipes) due to poverty
- Lack of knowledge around water infrastructure including management and maintenance
- Community does not consider water as an economic good
- Poor implementation of grievance mechanisms
- Damage to water infrastructure (pipeline) because of poverty
- Poor implementation of resettlement action plan
- Social conflict over water supply in neighbourhoods
- Reluctance of the community to provide any contribution to the development of water-related infrastructure.
- Lack of community involvement in action planning of water-related infrastructure.

Political and Governance Causes

- Inadequate monitoring of existing projects
- No compliance with standards in the implementation of water-related infrastructure
- Gaps within the institutional set up affecting infrastructure planning and management
- Poor implementation of grievance mechanisms
- Unplanned settlement patterns
- Inadequate commitment to roles and responsibilities of local staff
- Inadequate collaboration between the district team and stakeholders in the management of water-related infrastructure
- Insufficient support from the government in the management and operation of the water supply network, managed by the private operators in Musanze city
- No enforcement of laws and penalties to deal with vandalism on infrastructure
- Poor dissemination of information on existing incentives on water-related infrastructure
- Delay in response from local institutions regarding the complaints of private operators
- Poor management of some green spaces, which in turn, affects water-related infrastructure
- Inequality in water supply rationing
- Lack of integrated planning on water infrastructure
- Inadequate transparency in development of water-related infrastructure
- Inadequate coordination in implementing water-related projects

Financial Causes

- Low affordability on the side of the beneficiaries (urban population)
- Water-related infrastructure is still dominated by public institution because the private sector remains weak for investment buy-in
- Inadequate budgeting of the project resulting in low quality of implemented infrastructure
- Limited finances to manage water infrastructure
- Private investors constrain on return on investment
- Ad-hoc priorities regarding planned investment including water-related infrastructure

Infrastructure Need and Management

6.

Lack of technology to track water losses in water supply networks

- Limited finances and budget allocation of water-related infrastructure management
- Complexity of the environment (volcanic region) affecting investors to be attracted in water-related infrastructure

Environmental Causes

- Degradation of forest increases the risk of landslides and soil erosion, which damages water-related infrastructure in the city
- Heavy rainfall damages water-related infrastructure
- Contamination of water bodies
- Appearance of new streams along water-related infrastructure
- Poor solid waste management causing water pollution affecting flood control infrastructure
- Fear of establishing industrial infrastructure as Musanze is considered a volcanic region
- Population density affecting water-related infrastructure planning

Technological Causes

- Lack of stormwater management plan for Musanze city
- Lack of sewerage system for Musanze city
- Lack of early warning system for disaster management
- Lack of available technologies adapted to current situation
- Limited adaptation of rainwater harvesting system
- Limited understanding of water supply network
- Limited capacity of designers of water-related infrastructures

Other Causes

- Gaps between theoretical and practical knowledge on water-related infrastructure
- Limited on the job trainings

Data and Knowledge Management

7.

Lack of a water-related information system.

CHALLENGE STATEMENT/QUESTION

How to ensure that an accessible water-related information system is developed?

CHALLENGE DESCRIPTION

The water sector in Musanze district lacks an information system where institutions, organizations, and local communities can have access to or be able to share information on Musanze's water system. There is poor communication of government plans and programs mainly because of inadequate information dissemination between agencies (from high to low level). Consequently, issues such as duplication of projects and programs arise among agencies acting in the water sector.

Besides the lack of an information system, there is limited knowledge of agencies' mandates, roles, and responsibilities in regard to water resources management making it difficult for stakeholders to know which agency they should contact in order to access the information they need.

RELATED INDICATORS

- 1.2 Mechanisms ensure that comprehensive information on government programs and policies are disseminated to all stakeholders.
- 2.2 Local knowledge and cultural values of all population groups are referred to in government decision-making around water issues.
- 3.1 Coordination between city stakeholders and relevant downstream stakeholders minimize downstream impacts.
- 3.3a Coordination exists between different government agencies operating at various administrative levels to define and implement water priorities.
- 3.5 Frameworks and mechanisms clearly define the roles and responsibilities of water stakeholders.
- 7.1 Monitor, modelling and early warning systems mitigate hazards risk
- 8.1 Active monitoring and evaluation of water infrastructure (water supply, sanitation, flooding and drainage) ensures data is current and accurate
- 9.2 Mechanisms promote sustainable water use for commercial and industrial users
- 9.3 Mechanisms promote sustainable water use for households
- 9.5a Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of surface water sources.
- 9.5b Protections exist to prevent over-abstraction/ over-withdrawal and eliminate pollution of groundwater sources.
- 11.4 Blue and green infrastructure is adopted in neighbourhoods.

7.

Data and Knowledge Management

Lack of a water-related information system.

ROOT CAUSES

Social Causes

- Limited trust on the transparent use of the shared information.
- Cultural reluctance in information sharing.

Political and Governance Causes

- Overlapping and gaps in mandates in institutions.
- Lack of clear channels for information/data.

Financial Causes

- Data and knowledge management are not budgeted at the district level.

Environmental Causes

- Complex environmental set up of the area (volcano zone)

Technological Causes

- Lack of platforms for data sharing

Data and Knowledge Management

8.

Lack of quality and updated water-related data.

CHALLENGE STATEMENT/QUESTION

How to ensure that water-related data collection and analysis is properly completed?

CHALLENGE DESCRIPTION

Quality and current water-related data is lacking in the city of Musanze. For example, there are no updated maps identifying existing water infrastructure in the district or historical flood maps. Musanze city is a flood-prone area, however, forecasts and predictions from Rwanda Meteorology Agency are inaccurate and do not consider Musanze soil parameters/hydro systems. There is no available data on water quality, wastewater released in the city, or illegal abstraction.

In terms of data technologies and capacities, there is an issue of financial means to buy equipment for data collection and monitoring of water quality/quantity and an issue of technical capacity as there are not enough local experts in data collection and analysis. There is a need to purchase more equipment and apply new technologies used for data collection and analysis.

RELATED INDICATORS

- 4.2 Environmental regulation is performed effectively, resulting in high quality, protected water environments
- 5.2 Accurate data is used by key decision-makers in government, private sector, and civil society to promote urban water resilience
- 7.1 Monitor, modelling and early warning systems mitigate hazards risk
- 8.1 Active monitoring and evaluation of water infrastructure (water supply, sanitation, flooding, and drainage) ensures data is current and accurate
- 9.1a Environmental monitoring is conducted to assess the quality of water used for human consumption
- 9.1b Environmental monitoring is conducted to assess the health of environmental systems
- 10.3 Safely managed sanitation services are made affordable to all users.

8.

Data and Knowledge Management

Lack of quality and updated water-related data.

ROOT CAUSES

Social Causes

- Limited interest for technicians in data collection, no self-documentation or learning interest
- Poor reading culture

Political and Governance Causes

- Inadequate structure for data and knowledge management at district level.
- Unavailability of downscaled information

Financial Causes

- Limited financial capacity for data collection.

Environmental Causes

- Complex environmental set up of the area (volcano zone)

Technological Causes

- Limited tools (ground water, etc.) for data collection.
- Lack of state-of-the-art technologies for data management.
- No standard and guidelines for data collection and management process.

Other Causes

- Most of the available data is not user-friendly

Coordination and Integrated Planning

9.

Inadequate coordination between the district and central level agencies in water-related planning and implementation in Musanze city.

CHALLENGE STATEMENT/QUESTION

How can the coordination between the district and central level agencies be improved to accommodate efficient water-related planning and implementation in Musanze city?

CHALLENGE DESCRIPTION

The city of Musanze has a critical challenge of coordination in water-related planning and implementation that leads to many negative impacts to the city's water resilience. In terms of planning, decision making in water-related projects remain unsustainable as decisions are not based on lessons learned from previous projects. Additionally, water-related project planning is not done early enough to allow the incorporation of local data and knowledge which, in turn, could guarantee implementation success and beneficiary ownership. Infrastructure in water supply chains is not implemented in a coordinated manner (different timing and locations) making it difficult to operate, especially during shocks and stresses, as well as maintain. The challenge of coordination also affects the city's ability to adequately manage conflict of interest between different government agencies representing various major water users (mainly energy, water supply and agriculture). In terms of policy development and implementation, policy enforcement and program implementation for water and wastewater management is inadequate. Policy development at national level is not linked with its implementation at the local level resulting in a low level of implementation as policies and programs are developed with no practical interventions to implement them at city level. The latter results in issues such as buffer zone deterioration, unfunctional water user communities, lack of long-term WRM specific strategy, etc.

The current dynamics of institutional set up, at the national and decentralised level, has many impacts on the coordination capabilities of the city. Institutional structures are recurrently revised, leading to unclear definition of roles and responsibilities as well as reduced understanding/familiarity of the community and stakeholders on the institutional arrangement. As a result of the recurrent changing of institutional frameworks, the ability of the city to coordinate is impacted. This is highlighted in the lack of coordination between public agencies to address existing problems and poor coordination between public sector water agencies, utilities, and organizations at city level to meet the city's priorities. Consequently, the city lacks: i) a joint plan between government institutions for optimum prioritization of water issues, ii) a strategic plan on upstream impact mitigation, iii) a mechanism for continuous follow up on water related projects implementation and lesson learned from various stakeholders including the civil society, iv) a disaster recovery plan, v) a mechanism to ensure proactive participation and coordination between government, private sector, and civil society, as well as vi) a mechanism to align private sector interest and city government plans.

Part of the short to medium term solutions to the issues of coordination is the availability of tools that could strengthen the city's ability to coordinate. Unfortunately, this is also lacking in the city of Musanze. The available tools are entirely centralised making it challenging for the city to align all other plans, including stakeholders, with its priorities. Tools such as early warning systems (for water related disaster prevention), smart water management systems (to promote sustainable water uses at household level as well as for commercial and industrial users), knowledge repository accessible to the public, among others, are needed.

Coordination and Integrated Planning

9.

Inadequate coordination between the district and central level agencies in water-related planning and implementation in Musanze city.

RELATED INDICATORS

- 5.5. Coordination exists between water agencies and organization involved in food supply and production
- 5.4. Coordination exists between public sector water agencies, water utilities and organizations working in related domain such as energy, telecommunication, waste management and transportation.
- 4.6. Decision-making procedures around water resources management, water and wastewater services are made clear and open to all stakeholders
- 4.2. Environmental regulation is performed effectively, resulting in high quality, protected water environment.
- 8.5. Supply chains for key infrastructure are reliable during normal conditions and in the face of shocks and stresses.
- 8.4. Existing infrastructure (water supply, sanitation, flooding and drainage) is regularly maintained and upgraded to reduce likelihood of failure.
- 6.4. Water tariffs are sustainable and equitable.
- 6.1. Financial procedures promote transparency, minimize risk, and ensure that procurement processes are implemented fairly and efficiently.

ROOT CAUSES

Social Causes

- Awareness messages are not well packaged
- Lack of community engagement before project implementation
- Conservative culture due to low exposure
- Low level of education, exposure, and understanding among grass root leaders (village leader, opinion leader and community)
- Lack of systematic awareness aimed to explain interlinkages of environmental aspects, water aspects, etc.

Political and Governance Causes

- Lack of strong engagement of concerned stakeholders in planning (Central level agencies).
- Lack of complementarity between policies and laws creating coordination challenges at district level.
- Involvement of district level in strategic decision-making taken at central level to be implemented in the district.
- Low level of collaboration between government institutions, development partners and stakeholders.
- Limited influence of the district in driving stakeholder actions in line with district priorities (Central level agencies).
- Inadequate follow up of ongoing activities in the district implemented by stakeholders.
- Lack of adequate tools to engage private and civil society (guidelines, checklist, etc) by the district.
- Planning which is not climate resilient.

Financial Causes

- Limited funds for disaster recovery (including stakeholder mobilization and recovery activities implementation).
- Limited financial means for follow up on ongoing activities in the district.
- Limited investment in water supply at household level (affecting sustainability of water supply).
- Limited availability of finance to implement the masterplan.
- Lack financial resources for stakeholder engagement.
- Low level of financial autonomy (rely very much on central level and development partner funds).

Environmental Causes

- Conflict of interest
- Balancing nature conservation and development.
- Climate change impact

Technological Causes

- Interconnectivity of existing planning system or platform
- Lack of data and information platforms (Musanze district data dashboard or portal)

Coordination and Integrated Planning

10.

Redundancy in the establishment of water-related technical committees and ad-hoc basis.

CHALLENGE STATEMENT/QUESTION

How can the city of Musanze improves its responses and coordination to waterrelated shocks and stresses?

CHALLENGE DESCRIPTION

Due to poor coordination and the lack of appropriate tools to support coordination, the city of Musanze's response to water-related shocks and stresses is heavily affected. At the moment, city operations during water-related shocks and stresses are not proactive and is heavily dependent on central government support. Additionally, the city's current practice towards addressing shocks and stresses is based on the establishment of technical committees on an ad-hoc basis, composed of different government institutions to provide support. This practice has been observed to have a high rate of redundancy in these technical committees, as for any kind of unforeseen shock or stress, a committee is established. The result is that the city has numerous technical committees, mostly composed of the same experts, which only operate with low efficiency during the crisis and then become dormant.

There are many causes of the technical committees' inefficient operations. Some of the main reasons are related to 1) poor coordination, as the city's institutional framework is not clearly defined and responsive to its context, while at the same time undergoing recurrent restructuring such that the reporting chain from these committees to decision makers becomes unclear; 2) poor planning, as the city lacks a plan for disaster prevention (early warning system) and recovery, and a city level water resources management strategy that also incorporates upstream impact mitigation; 3) limited finance, as the city does not have the financial capacity to support the operation of these committees and avail funds for disaster prevention and/or recovery.; 4) inconsistency in decision making, as the city lacks appropriate mechanisms to collect, store and utilize the lessons learned from previous disasters for decision making. The latter is mainly associated to the redundancy in the establishment and operations of these technical committees; and 5). low level of policy implementation, as the city's priorities (based on the policies) are overshadowed by unexpected and regular water related shocks and stresses, consequently preventing the city to prioritize vulnerable communities in high-risk zones as well as operationalizing the water user committees at catchment level (the latter are provided by the water law of 2018).

10.

Coordination and Integrated Planning

Redundancy in the establishment of water-related technical committees and ad-hoc basis.

RELATED INDICATORS

- 4.6. Decision-making procedures around water resources management, water and wastewater services are made clear and open to all stakeholders
- 11.1. Design principles are promoted to improve water performance for buildings.
- 12.1. Policies exist that protect vulnerable populations from displacement as a result of water-related shocks and stresses.
- 7.3. Public authorities have access to funds for disaster recovery.
- 7.1. Monitoring, modelling, and early warning systems mitigate hazard risks
- 3.2. Frameworks and mechanisms promote coordination between city stakeholders and relevant upstream stakeholders on water issues.
- 1.2. Mechanisms ensure that comprehensive information on government programs and policies are disseminated to all stakeholders.
- 1.1. Legal and institutional frameworks and mechanisms promote active, free and meaningful participation around issues related to water supply, sanitation, drainage and flooding.
- 2.4. Technical knowledge is available, understood and continuously incorporated by government into decision-making around water issues.

ROOT CAUSES

Political and Governance Causes

- Lack of community inclusion in the planning process.
- Too many water-related technical committees.

Financial Causes

- Limited funds for disaster recovery (including stakeholder mobilization and recovery activities implementation).

Environmental Causes

- Unprecedented disaster.

Coordination and Integrated Planning

11.

Lack of integrated planning and climate resilient tools at the neighbourhood level.

CHALLENGE STATEMENT/QUESTION

How can district land use planning be adequately downscaled and implemented at neighbourhood level in a climate resilient manner?

CHALLENGE DESCRIPTION

TThe development of settlement in Rwanda has been unplanned up to date. The latter has induced unplanned land use development. Musanze City is no exception to this. As the city grows rapidly, consequences of unplanned development, in a changing climate, are being experienced frequently. To address this issue, the district of Musanze has embarked, as the rest of the country, in developing a land use master plan to transition it to sustainable development. However, the developed land use master plan only focuses on land use zoning at high level with limited water-related consideration, hence not water resilient. The consideration of water in the master plan has always been challenging because of the lack of an integrated plan between government institutions for proper prioritization of water issues. In addition, detailed land use masterplan at neighbourhood level is missing in the city, which is affecting the implementation and enforcement of the master plan at city level. One of the highlighted challenges in detailing the land use master plan at neighbourhood level, is the difference between the planning timelines of the community (mostly short term) and the city's leaders (mostly medium to long term). The latter is interpreted by the community as a prioritization of international trends over their local needs.

Additionally, the city of Musanze lacks the appropriate tools to facilitate the detailing of the land use master plan at the neighbourhood level. Such tools (mainly on the ground result based) could be developed with close collaboration with academic and research institutions and would help i). the community understand better how their present needs are incorporated in the long-term goals of the city development plan and what is required to achieve them; ii). the implementation of the master plan as these could be developed as legal instruments, technical guidelines and standards that will ensure that implementation is coordinated and integrated at all levels; iii). mainstream water resilient practices, environment and social aspects in neighbourhoods and CBDs in the city of Musanze in a manner that foster equitable access to water resources; and iv). Inspection, monitoring, and enforcement of the implementation of the land use master plan and its associated regulations (including environmental impact assessment) and zoning.

Coordination and Integrated Planning

11.

Lack of integrated planning and climate resilient tools at the neighbourhood level.

RELATED INDICATORS

- 5.6. Resources and processes reinforce a culture of innovation within the water sector.
- 9.5. Protections exist to prevent over-abstraction/over-withdrawal and eliminate pollution of surface water sources
- 4.6. Decision-making procedures around water resources management, water and wastewater services are made clear and open to all stakeholders
- 4.5. Technical standards and design guidelines define best practice for critical infrastructure
- 4.4. A sound regulatory framework control land use and urban expansion and reduce growth in high-risk and water-poor areas
- 11.3. Water is incorporated as a key consideration in land-use planning and development
- 11.1. Design principles are promoted to improve water performance for buildings
- 2.3. Political leadership promotes resilience as a priority issue in government decision-making
- 2.2. A long-term strategy is in place to guide projects and programs that build water resilience over time
- 9.3. Mechanisms promote sustainable water use for households
- 9.1. Environmental monitoring is conducted to assess the health of environmental systems
- 3.3b. Coordination exists within government agencies to define and implement water priorities.
- 10.1. All people have access to sufficient, safe, accessible, and affordable water for personal and domestic use

ROOT CAUSES

Social Causes

- Awareness messages are not well packaged
- Level of poverty among the community
- Conservative culture due to low exposure
- Low level of education, exposure, and understanding among grass root leaders (village leader, opinion leader and community)
- Resistance to Change
- Lack of systematic awareness aimed to explain interlinkages of environment aspect, water aspect, etc.)

Political and Governance Causes

- Lack of inclusiveness of community in planning process.
- Low level of community participation in planning
- Favouritism in the masterplan implementation.
- Planning which is not climate resilient.
- Inconsistencies in building permitting process.

Financial Causes

- Limited availability of finance to implement the masterplan.

Environmental Causes

- Economic development is given more importance than environment degradation mitigation in plans.
- Conflict of interest
- Balancing nature conservation and development.

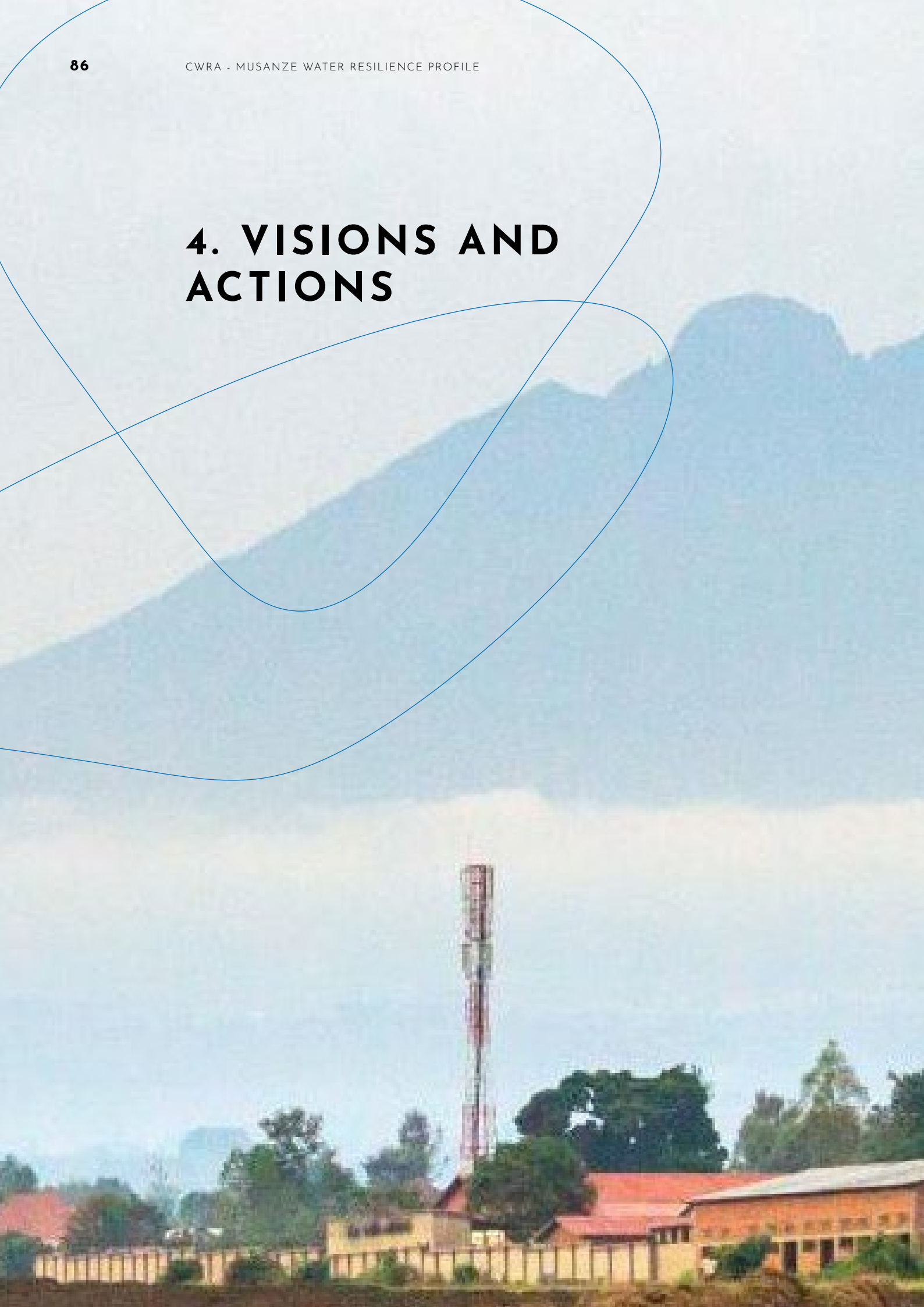
Technological Causes

- Lack of detailed physical plan (integrated neighbouring development plan)
- Lack of data and information platforms (Musanze district data dashboard or portal)
- Issue with the building permit information system.
- Land use Monitoring system for regular monitoring, evaluation, and inspection on the fly.

Other Causes

- Uncontrolled Rural urban migration linked to population growth not matching to job creation.

4. VISIONS AND ACTIONS



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VISION 1

VISION STATEMENT

Create stakeholders' awareness for improved water resource management

RELATED CHALLENGES

Challenges 1.1: Limited awareness on water-related challenges and opportunities in Musanze City by the community, CSOs and Private sector
Challenges 1.2: Inadequate engagement of the community in water-related planning and management

VISION DESCRIPTION

Sustainable water resources management requires the participation of water stakeholders at different levels. Decentralization of water management, including participation of communities, has been identified as a tool for better and more efficient water management. This especially applies to Musanze as a high-risk zone, it requires the involvement of all user groups in the design, implementation, operation, and maintenance of water services. To ensure an effective stakeholders' engagement, raising awareness on issues surrounding water resources is increasingly seen as important. Raising awareness for water issues is a way to build a common understanding of water issues to different stakeholders and to create shared values on how water should be used and managed. In the context of Musanze city, the level of awareness of stakeholders on water related issues and opportunities is still limited hence the low capacity of stakeholders to participate in water resources management.

This vision aims to increase awareness at two levels, the first being the public/communities, the second level being other different actors like civil society organizations and the private sector. Regarding community awareness, there are two different areas that activities should cover, one is the more general public awareness, which involves wide-spread acknowledgement and understanding of water issues, second is self-awareness, which means understanding the relation between personal water use and natural and societal impacts. For other key actors, there is a need of a framework to optimize coordination of the various stakeholders between city district basin and national levels. Increased awareness on the issues will trigger an improved awareness on available opportunities and this will result in an effective participation of stakeholders in the City's water resources management.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- Need for community consultation at various project's stages
- Need to strengthen community technical capacity to contribute to water-related disaster mitigation and adaptation measures
- Water-related information collection and sharing at all levels
- Increased awareness on water resilience issues
- Community ownership and participation in maintaining water-related infrastructure

OVERALL VISION RELEVANT ASSETS AND RESOURCES

Policy

- National sanitation policy, 2016 (Link)
- Rwanda Environmental Policy, 2003 (Link)
- National water supply policy, 2016 (Link)
- Law of 2018 determining use and management of water resources in Rwanda (Link)
- National policy for water resource management, 2011 (Link)

VISION 1

- National land policy, 2019 (Link)
- Community development policy, 2006 (Link)
- National decentralization policy, 2012 (Link)

Information

- Musanze City Master plan (Link)
- National land use and development master plan (Link)
- Water resources management sub-sector strategic plan (2011-2015) (Link)
- Mukungwa catchment information (Link)
- Rwanda natural capital account for water, 2019 (Link)
- Musanze district development strategy (2018-2024) (Link)
- Stakeholder engagement plan 2021 (Link)

Other assets

- Existing administrative structure (Link)
- Rwanda national land use planning Guidelines 2017 (Link)
- Joint Action Development Forum (JADF[2]) instructions and roles (Link)
- District fixed assets such as offices, vehicles
- Existing community committees in charge of other sub sectors related to water (environment and disaster management committees)
- Available human resources at the district level to contribute to projects development and implementation process
- RBA Musanze District radio station and social media platform (Link1, Link2)

(2) The mission of JADF is " to ensure a sustainable socio-economic development and improved service delivery for Rwandan communities through active participation, dialogue, and accountability by sharing information, effective coordination of stakeholders' interventions in decentralized entities".

SHOCKS AND STRESSES

Shocks

- Climate-related disasters (flood and landslide) severely affect unprepared / uniformed population

Stresses

- Inadequate collaboration between relevant stakeholders to deal with water reliance issues
- Inadequate dissemination of water-related information to all stakeholders
- Lack of community ownership of water infrastructure
- Limited contribution of stakeholders and community in waterrelated disaster mitigation and adaptation measures

OVERALL CHAMPIONS

Lead

Musanze District

Partners

Community based organizations, CSOs, WASAC, RWB, REG, REMA, INES, RYWP, RMB, LODA, RAB, and other partners. Potential donors include ENABEL, GCF, FONERWA, SNV, GIZ, GGGI, IGCP, Agriterra, Gorilla doctors, Action Aid

Approval

Musanze District Council

ACTION 1.

One year – Establish and operationalize a framework to optimize coordination of water sector stakeholders at City level (between City-District-Basin-National level Actors)

DESCRIPTION

There are existing channels of collaboration between water sector stakeholders in Musanze city (District WASH board and District's environment committee), but they have not been as effective as expected., This is mainly because the sector is still characterized by issues of coordination of stakeholders at different levels. This action is a solution to the issue and to ensure effectiveness. It will start by evaluating the existing frameworks and identifying the gaps. The action will deliver a framework in which water-related information and updates will be disseminated to all stakeholders in a timely and comprehensive way. This framework will equip stakeholders with the information they need to participate in water resilience activities for the city of Musanze.

The scale of this action is at the city level and it will ensure a well-coordinated framework across all levels (community, city, and catchment) with the leadership of the city of Musanze. The complexity of this action is low since there are existing forums. They only need to be strengthened, in order to establish their network and ensure that water management is prioritized in the discussions. If financial capacity is available, this action should not take more than a year for its implementation. However, the impact assessment may take more time.

Different institutions will benefit from the strengthened framework. Local administration entities (sectors, District) will benefit from a well-structured framework with clear roles and responsibilities, and other government institutions, like RWB, REMA, REG, RAB and WASAC, will benefit from the framework in sub sectors' contributions. The private sector will benefit from the collaboration with relevant stakeholders and citizens and CSOs will benefit from having a space to provide inputs & support in the coordination of programs.

STAKEHOLDERS

- **Lead:** Musanze District
- **Partners:** Community based organizations, CSOs, WASAC, RWB, REG, REMA, INES, RYWP, RMB, LODA, RAB, and other partners. Potential donors include ENABEL, GCF, FONERWA, SNV, GIZ, GGGI, IGCP, Agriterra, Gorilla doctors, Action Aid
- **Approval:** Musanze District Council

NEXT STEPS

Short term

- Project action plan
- Identification of all existing stakeholders regarding WRM & WASH
- Gaps and needs assessment on the existing coordination and stakeholders' engagement
- Drafting of an improved coordination framework

Medium term

- Present the coordination framework to stakeholders to review, input & approval
- Elaborate guideline material for the coordination framework (a detailed Training to the concerned stakeholders on the coordination framework and its guideline material)
- Implementation (capacity building)

Long term

- Monitoring and Evaluation of the established coordination framework and its effectiveness

OUTCOME

- Effective coordination of water sector stakeholders and management of water systems at city level
- Improved, strong and effective information sharing channels among stakeholders
- Defined clear roles and responsibilities of all water sector stakeholders (No overlap and no gap)
- An effective forum of discussion between relevant stakeholders before decision making
- All decisions to be made will be based on a strong input from relevant stakeholders

COSTS/FUNDING

The cost of this action has been estimated to be relatively low, mainly because it is a soft intervention and will be implemented within the existing framework at different level.

CASE STUDIES

Governance and stakeholders in IWRM along Vietnam's Red River

This case study in Vietnam shows the success of three projects with different goals and ambitions for stakeholding. The first project, the National Hydropower Plan Study (NHP), was carried out country-wide between1995 – 2004. The Second Red River Basin Sector Project, Part A (2RRBSP Part A) took place from 2003 – 2006. And the Nam Puoi Resettlement Project was carried out between 2006 – 2007. They all concern relations between authorities and civil society expressed in stakeholder interactions. (Link)

ACTION 2.

Recurrent – Develop and implement community awareness campaigns on water resilience issues to improve stewardship and compliance

DESCRIPTION

The aim of raising community awareness for water issues is to engage the public in topics such as water conservation or preservation of ecosystems. The aim also includes increasing the willingness to pay or contribute to water services; increasing community ownership of water infrastructure, awareness for planning for emergencies; and strengthening political will. In the context of Musanze city, community awareness will not be a one-way communication, but an interaction of many active stakeholders who influence each other and provide social control by mutually reinforcing agreed sets of values.

Awareness can be raised through a variety of channels which should be planned and coordinated in a Musanze context to develop a customized communications strategy. Those channels include water campaigns, engaging with relevant NGOs and community groups, making information available to the general public through regular radio shows, street shows, best practice/ knowledge-based competitions, educational materials, artistic events like theatres, etc. Even if awareness campaigns are not something new for the Musanze city community, water-related campaigns are not common. This action will use a well-targeted range of media and existing networks familiar to the community to increase the impact and lower the cost of campaigns.

The water campaigns will be addressing relevant issues to the community of Musanze. The message of a campaign should be clear and simple and to reach maximum effect,it will be sustained over time. Choices need to be made regarding the reach of the campaign, the target group, the desired change in perception and/or behaviour, and the likely influence of the target group on the campaign outcomes. Involving a campaign specialist who has experience in managing similar programs can improve the success rate of a campaign.

The campaigns can use a number of communication methods such as:

- Direct use of conventional media (printed media, TV, radio) and/or non-conventional media (messages on water bills, games, transport tickets, etc.), through the visual and performing arts.
- Organization of large events and/or endorsement by celebrities (generating media attention).
- Use of existing networks (religious networks, social movements, NGO networks, business associations).

STAKEHOLDERS

- **Lead:** Musanze District
- **Partners:** Community based organizations, CSOs, WASAC, RWB, REG, REMA, INES, RYWP, RMB, LODA, RAB, and other partners. Potential donors include ENABEL, GCF, FONERWA, SNV, GIZ, GGGI, IGCP, AGRITERRA, Gorilla doctors, Action Aid
- **Approval:** Musanze District Council

NEXT STEPS

Awareness campaign design, development of materials and implementation

- Identification and assessment of different existing campaign channels in Musanze City
- Gaps and needs assessment on community knowledge on water resilience issues
- Development of Musanze customized awareness campaign and materials
- Implementation of awareness campaign

Medium term

- Impact evaluation

Long term

- Continuous implementation of campaign components

OUTCOME

- Community awareness of water resilience issues
- Community understanding of their roles and responsibilities in water resources management
- Increased community participation in water related actions or project
- Increased community knowledge and intervention in water related disaster management

COSTS/FUNDING

The cost of this action has been estimated to be relatively low, mainly because it is a soft intervention and will be implemented within the existing framework.

CASE STUDIES

Community Based Interventions to Improve River Health (Aller River)

This is a project of the eThekwini Conservancies Forum (ECF). It was implemented on the 5.8 km stretch of the Aller River, which passes through New Germany and Clermont. The project approach provided an opportunity to assess how river ecosystems can be managed and monitored through active engagement of citizens who have been appropriately capacitated to undertake the work that is required, thereby contributing towards building a resilient and sustainable city. (Link)

VISION 2

VISION STATEMENT

Improve multi-level governance for robust and integrated water systems management

RELATED CHALLENGES

Challenge 5.1: Inadequate coordination between the district and central level agencies in water-related planning and implementation in Musanze city.
Challenge 5.2: Redundancy in the establishment of water-related technical committees and ad-hoc basis.
Challenge 5.3: Lack of integrated planning and climate resilient tools at the neighbourhood level.

VISION DESCRIPTION

Several factors have been observed to contribute to the poor water resilience related multi-stakeholder coordination and governance in the city of Musanze. The factors are 1) thelack of adequate tools to facilitate coordination and enhance the quality of planning and coordination, 2) limited technical and human capacity exacerbated by the lack of an appropriate retention policy of inhouse experts in decentralized entities, 3) the interference of central level agencies in decentralized entities priorities implementation and decision making because of no clear mandates limitations at each level, and 4)inadequate engagement and communication with users and stakeholders when developing new policies, programs and plans in the water sector.

The existing centralized planning tool, IFMIS, is used by the government of Rwanda. The tool has a top-down approval mechanism that mostly favours central level government priorities rather than the city level priorities. Also, the tool is mainly composed of quantitative indicators that are not spatially distributed, making it difficult to adequately track the implementation of interventions on the ground. The latter results in duplication and overlap of interventions. Additionally, the monitoring and evaluation of the interventions is inadequate as their quality cannot be assessed.This is mainly due to the lack of proper qualitative indicators in the system and limited technical capacity of those in charge of monitoring.

Because of the current planning structure, the ability for decentralized entities to set their own priorities and coordinate efforts with stakeholders is inefficient because of the interference from the central level government with advanced capacity and means. Theoretically, central level agencies are supposed to provide technical support for decentralised entities by helping them achieve their priorities. Unfortunately, priorities of central level government do not necessarily match with decentralized entities priorities, thus resulting in an interference from central level agencies pushing their priorities first. Also, when conflict arises due to central level agencies using high amounts of water resources, decentralized entities usually are not in the position to resolve the conflict as divergence of priorities heavily affects the city's ability for conflict resolution.

To address this challenge sustainably, adequate mechanisms at the district level should be established and implemented in a way that they are integrated and optimize the existing planning tools efficiency. But also foster alignment of the district priorities with central level agencies. It is also important that the existing planning tools incorporate qualitative and spatial dimensions to the established quantitative indicators for enhancing the evaluation and monitoring of the impact of programs/projects.

VISION 2

The efficiency and performance of decentralized entities are dependent on the adequacy and clarity in the setting of their structures and respective mandates, as well as how they interact with central level government. Currently, this is still a challenge in the city of Musanze and at the central level in general, despite numerous restructurings conducted by the government with the attempt to improve service delivery to citizens through better coordination and high institutional performance. The issue remains the basis on which the restructuring is done. A proper detailed analysis of the adequate organizational structure and relations between the central level and decentralized level can be conducted in close collaboration with the institution mandated for public service management with the expectation that the analysis will be considered in the next restructuring of the government agencies and decentralized entities. Such an analysis is needed to provide additional insight to decision-makers on the technical needs required to reach urban water resilience in the city of Musanze, as well as other cities in Rwanda.

There is a need to improve communication and engagement of users and community in the planning cycles and investments in the water sector to improve ownership and awareness of water resilience needs and actions among citizens and users. Such an inclusive approach will improve uptake and compliance with regulations and reduce the need for enforcement and promote responsible use of water resources.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- The planning of programs and projects need to include qualitative indicators in their log frame.
- Spatial characteristics need to be considered when assessing the plans.
- There is a need to produce standardized and complementary spatial data for better planning.
- There is a need to conduct a detailed assessment of the appropriate institutional structure to inform decision-makers.
- The planning at the national and local level needs to be improved, well communicated, and understood by the civil society, communities, and other stakeholders.
- There is need to improve the collaboration capacity of the private sector and public institutions on water-related issues/ opportunities.

RELEVANT ASSETS AND RESOURCES

- District Development Strategy (CDS) 2018-2024
- Mukungwa Catchment Management Plan 2020-2024
- Service delivery report/score card by the Rwanda Governance Board
- Water resources management law and its implementing orders (most specifically the ministerial order determining the function and attribution of catchment committee)
- Established catchment committee
- Existing civil society platforms of environment and natural resources-based NGO
- Musanze District land use masterplan
- The State of Civil Society in Rwanda in National Development report
- The WHO Community Engagement Framework and Experiences from Rwanda.
- National capacity building strategy
- Decentralization policy
- Decentralization implementation plan
- Integrated household living conditions survey 6

VISION 2

SHOCKS AND STRESSES

- District management structure restructuring
- Health crises
- Water pollution
- Water resources mismanagement
- Overlapping and contradicting plans and programs
- Decreasing availability of funds
- Flooding
- Earthquakes

OVERALL CHAMPIONS

Lead

District of Musanze; Ministry of Local Government

Partners

Ministry of Agriculture, Ministry of Commerce, Ministry of Environment, Ministry of Infrastructure, Ministry of Public Labour, Ministry of Emergency Management, Private Sector Federation, Rwanda Water Resources Board; Rwanda Utilities Regulatory Authority (RURA); Rwanda Environment Management Authority (REMA); Rwanda Governance Board (RGB); Rwanda Agriculture Board; Rwanda Mining Board, Water and Sanitation Corporation (WASAC), Rwanda Energy Group (REG) and other sectors as well; Private sector

Approval

City Council, Ministry of Local Government, MINECOFIN

ACTION 1.

2

Short term to medium term – (Short term to medium term) - Establish cell level WRM committees to enable impactful and effective community engagement in water-related planning and management

DESCRIPTION

Currently, stakeholder engagement in planning for water-related programs or projects is still inefficient and therefore overlooked by agencies. The challenge is mostly related to the poor communication skills on both sides, such as conveying the message to the beneficiaries and incorporating beneficiaries' expectations in project plans and designs. The end result reflects a lack of ownership of what has been implemented, therefore a lack of operation and maintenance is experienced, affecting the sustainability of the implemented activities. This issue is still experienced at the approval level in the Ministry of Finance because of the lack of a diverse or interdisciplinary technical group assessing the framing of the program and projects. Communication in water resilience-based plans is key for its successful implementation and longevity. Strategies and skills for effective stakeholder engagement in the water sector are needed to address this issue of the lack of ownership after implementation.

This action will develop a framework at cell level of water resources management committees that will be serving as liaison for community engagement during any water-related development that is happening in the city of Musanze. The committees will also play a central role in ensuring the community is adequately engaged and their needs are well considered while developing water-related programs and projects. The action will also develop guidelines for their operation and training modules to acquaint the members of the committee with enough water resources knowledge for optimum efficiency in operation. These committees will be the basis for defining the city's water-related priorities but also support in monitoring the interventions as well as operating and maintaining water-related infrastructure and utilities wherever applicable.

STAKEHOLDERS

- **Lead:** District of Musanze, Ministry of Local Government
- **Partners:** MININFRA, RWB, WASAC, Private Sector Federation.
- **Approval:** City Council, Ministry of Local Government
- **NGOs:** Water for People, RISD. All NGOs operating in the water sector and in good governance (list of all registered NGOs can be found on the RGB website). Local NGOs are normally organized into platforms, the latter can be consulted in addition to INGOs such WaterAid, Water for People, IUCN, etc.

NEXT STEPS

- Assess the current community engagement framework for water resources management
- Identify gaps in the current community engagement framework
- Develop a framework for water resources management at cell level, taking into account the identified gaps (the framework would be in this case a cell level committee for water resources management)
- Develop training modules for members of the IWRM Cell committee for proper operations and understanding of their role
- Develop protocols for active involvement of the community, through the framework, across the various phases of infrastructure planning and implementation.
- Devise experimental and innovative ways for communities to increase their technical knowledge and understanding of water-resilience, while bringing their own knowledge to the table, within a structured participatory planning and implementation processes.

2

OUTCOME

- Improved coordination and ownership of projects and infrastructure investment for water resilience.
- Active participation of stakeholders in project planning and implementation.
- Improved planning at all levels that is well communicated and understood by civil society, communities, and stakeholders.
- Improved knowledge of water resilience for various stakeholders, including a better understanding of each other's roles and responsibilities.
- Enhanced participation, inclusion, and opportunities for communities to participate and contribute to building water resilience in Musanze.

COSTS/FUNDING

- The cost of this action has been estimated to be relatively low, mainly because it is a soft intervention and will be implemented within the existing framework at different level.

CASE STUDIES

Sharing city project: Seoul, South Korea

The sharing city project was based on the cooperation between the private and public sectors, steered by a committee that the city established in February 2013 to promote sharing. The committee is made up of representatives working in areas such as the media, law, IT, corporate social responsibility, welfare, and social innovation. In 2013, Mayor Park set up the Seoul Innovation Bureau. The Bureau encourages people's engagement in all aspects of city life, from identifying challenges to providing policy ideas and participating in the sharing economy.

References:

[1] [2] [4] [5] [7] C. Johnson (2014), "Sharing City Seoul: A Model for the World".

[3] Urban sustainability exchange (n.d), "The Sharing City Seoul Project".

[6] [8] Centre for Public Impact (2017), "The Seoul Innovation Bureau and its "Sharing City" initiative".

ACTION 2.

Short term to medium term – Optimize technical committee framework to improve disaster prevention and recovery at the district level

DESCRIPTION

Currently, because of the lack of disaster prevention and recovery plans at both national and decentralized level, the City of Musanze operates on ad-hoc basis mostly by establishing technical committee as a shock or stress is experienced. The established committee is tasked to follow up on that particular event. Once addressed, the committee is neither dissolved or properly operationalized. The latter has led to the establishment of many redundant technical committees operating with low efficiency.

This action will develop a framework that will help the city of Musanze establish highly effective technical multi-stakeholder and multi-disciplinary committees that will support the city in preventing disaster and recovering from disaster by providing technical expertise required, sensitizing the communities towards behavioral change in terms of disaster protection, providing solutions to addressing the issue of people in high risk zones, coordinating partners and fostering experience exchange, and mobilizing funds.

STAKEHOLDERS

- **Lead:** District of Musanze, Ministry of Disaster Management
- **Partners:**MININFRA, MoE, RWB, REMA, RAB, RTDA, WASAC, REG
- **Approval:** City Council, Ministry of Local Government, MINECOFIN

NEXT STEPS

- Assess the existing disaster management plan,
- Assess the establishment of technical committees and associated gaps,
- Develop a framework for establishing technical committees including their mode of operations,
- Develop protocols for active involvement of the community, through the framework, across the various stage of disaster prevention and recovery.
- Devise innovative ways of funding the operations of the technical committees.

OUTCOME

- Improved disaster management at district level.
- Active participation of stakeholders in disaster management.
- Improved community behaviour towards disaster protection.
- Improved knowledge of water resilience for various stakeholders, including a better understanding of each other's roles and responsibilities.

COSTS/FUNDING

The cost of this action has been estimated to be relatively low, mainly because it is a soft intervention and will be implemented within the existing framework at different level.

CASE STUDIES

Smart Water Management: Seosan, Korea

Implementing Smart Water Management (SWM) technology by itself will not always resolve the water challenges faced by a project. In some cases, a two-pronged approach is necessary to address the complex nature of each challenge. The second element of the two-pronged approach can include community engagement, governance schemes or business models, and is equally as important to the success of many of the projects as the SWM tools themselves. (Link)

ACTION 3.

Short term to medium term – Development of an enforcement mechanism of existing storm water and sewer management regulations to enhance water resilience in the city of Musanze

DESCRIPTION

Developing strategies for agencies in charge of enforcement will first require the awareness of appropriate information on regulations to the general public and the partnership with academia institution that can play an important role in imparting such knowledge. The mechanism should have a comprehensive plan with defined goals and objectives and engage community members that can help in the documentation of procedures involved in the management of storm water and sewer.

The development of these enforcement mechanisms will be led by Musanze district as enforcement agency with guidance from RWB and REMA. NGOs, community based organizations, and the private sector should work hand in hand with local governments to devise innovative strategies and assist in their implementation. The results will be approved and owned by Musanze district.

This action can be implemented within a period of two years after the development of a plan for the implementation of existing storm water and sewer management regulations. Compliance with the regulations will reduce groundwater pollution and increase the adoption of nature-based solutions including the rainwater harvesting system which can decrease the impact of natural disasters facing the city.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget
- External Grants

Policy

- Sanitation Policy, 2016 (Link)
- National environment and climate change policy, 2019 (Link)
- National policy for water resources management, 2011 (Link)

Information

- Rwanda Water Resources Board (RWB) Information system (Link),
- REMA Information system (Link),
- Musanze District Information system (Link),
- Musanze District Development Strategy, 2018 (Link),
- Musanze master plan
- Water Enforcement Policy, Guidance and Publications (Link),
- Storm water program (Link)

STAKEHOLDERS

- **Lead:** Rwanda Water Resources Board (RWB), Rwanda Environment Management Authority (REMA), and Musanze district
- **Partners:** Water and Sanitation Corporation (WASAC), Rwanda Regulatory Utility (RURA), Rwanda Standards Board (RSB), World bank, UNDP, Global Green Growth Institute (GGGI), Enabel, Rwanda Young Water Professional (RYWP), Global Water Partnership (GWP)
- **Approval:** Musanze district council

NEXT STEPS

Short term: Develop an enforcement plan

- Development of an enforcement plan for existing water regulations.
- Identify collaboration opportunities with key stakeholders
- Disseminate regulations and educate stakeholders

Medium term: Compliance evaluation

- Conduct compliance reports
- Continuously monitor problems and challenges with periodic review of regulations

2

OUTCOME

- Reduced discharge of solid waste in the drainage systems of the city
- Reduced pollution of rivers and lakes
- Reduced cost of water treatment
- Inclusion of storm water management plan in the building permit process
- Increased adoption of RWH systems at household level

COSTS/FUNDING

The cost of the development of enforcement mechanisms of existing regulations in Musanze city was estimated at 100 thousand dollars. This cost is mostly allocated for the purpose of dissemination and capacity building of key stakeholders involved in the compliance inspection and community engagement since the regulations are already established and can require little to no review.

It was identified that to afford the development of this program, the national budget can be complimented by grants and other donor's mechanism to allow for the capacity building of relevant stakeholders. The continuous monitoring of compliance and periodic review of regulations cost will be estimated depending on the needed evaluations hence it was not estimated.

CASE STUDIES

Water and wastewater recycling: Chennai, India

The city of Chennai in southern India has been experiencing water scarcity due to rapid population growth and a rising demand for energy following higher levels of economic activity.

Over several years, city officials passed a set of regulations and bylaws to stabilize and manage water sourcing and use. These aimed to ensure maximum reuse of water and to see that wastewater met the safe quality standards required by the city. The new regulatory framework was complemented by partnerships between the private sector and governmental agencies in order to promote innovation.

References:

[1][3][4][5] International Water Association (2018), Wastewater Report 2018: The Reuse Opportunity.

[2] A. Trivedi and M. Chertock (2019), "Responding to Day Zero Equitably: Water Crisis Lessons from Cape Town and Chennai".

[3][8] S. Raghavan (2019), "The success and failure of Water management in Chennai", Future Directions.

[6] A. Natarajan (2020), "Metro Water's 10 big promises for Chennai citizens in 2020".

[7] M. F. Alam, S. S. Guntoju and A. Sikka (2019), "Chennai: Water crisis: a wake-up call for Indian cities", Down to Earth.

ACTION 4.

2

Medium term – Develop neighbourhood level plans that integrate water resilience to advance implementation of the Musanze Master Plan

DESCRIPTION

Musanze District had developed a land use masterplan that is at city level, and currently a district level land use master plan is in itts final stage of development. The current master plan of the city is mainly focusing on land use zoning and necessary large-scale infrastructures like transport, water supply and sanitation, etc. However, not much consideration for water resilience was incorporated in the plan, also the disaggregation of the plan at neighborhood level is missing and this is affecting the adequate implementation of the master plan.

This action disaggregates the land use master plan at neighborhood level for the city of Musanze based on a detailed assessment of the topography, hydrology, and impervious area patterns in the city as well as the projection of future development as determined in the city level land use master plan. In the disaggregation up to the neighborhood level, detailed consideration of water resilience (including nature-based solutions) will be incorporated to ensure the city has all the requirements for a water resilient development. In addition, all the policy and legal requirements to adequately implement the master plan in the city will be assessed and policy recommendations and regulations will be developed to help the city to make the right decisions. A prioritization and phasing of groundwork and basic infrastructures needed to facilitate the implementation of the master plan at neighborhood level will be done as well.

This action will focus on increasing the awareness of decision makers and the community on the implementation and regulations of the land use master plan in the city of Musanze. This action will leverage on the existing work that has already been completed for the city of Musanze.

STAKEHOLDERS

- **Lead:** District of Musanze, RLMUA
- **Partners:** MININFRA, RWB, WASAC, RTDA
- **Approval:** City Council, MINALOC
- **NGOs:** All NGOs operating in the water sector and in good governance (list of all registered NGOs can be found in the district JADF office).

NEXT STEPS

- Assess the current city and district master plan
- Assess the current regulations (and their enforcement mechanisms) of the master plan implementation
- Identify all water resilience related gaps in the master plan
- Identify and map all neighbourhoods in the city of Musanze
- Develop neighbourhood development plan in line with the city master plan zoning
- Formulate adequate regulations and policy recommendations for the neighbourhood plan implementation
- Develop enforcement mechanisms to support compliance to the neighbourhood plan implementation

OUTCOME

- Improved coordination and ownership of projects and infrastructure investment for water resilience.
- Improved planning at all levels.
- Improved knowledge of water resilience for various stakeholders, including a better understanding of each other's roles and responsibilities.
- Enhanced city level water resilient development

2

COSTS/FUNDING

The cost of this action has been estimated to be high, mainly because it is a very intensive fieldwork and engineering design that will set up the implementation of basic infrastructure for neighbourhood development.

CASE STUDIES

Co-designing and co-creating urban solutions: Cluj-Napoca, Romania

In 2017, Cluj-Napoca established the Civic Imagination and Innovation Centre (CIIC), offering residents the opportunity to take part in shaping their city and community. The inauguration of the CIIC was marked with a debate to identify solutions for the regeneration of a local park. Local government representatives, residents, specialists, and academics meet at the CIIC to collaborate on transforming the city.

ACTION 5.

2

Medium term – Digitize the Musanze city master plan and make it accessible for stakeholders to advance integrated planning

DESCRIPTION

Information of the master plan needs to be more easily accessible among stakeholders. One way to accomplish this is to avail the master plan in a digital format, making it easily accessible, readable, and usable. Accessibility can be guaranteed through innovative data platforms, that also provide areas for data users to connect and give constructive comments on the data that is put into place. In addition, innovative platforms will enable public agencies to connect with local experts who understand and can share the appropriate water background needed to interpret specific types of data useful for the city of Musanze. This action will help the city harmonize its planning among all stakeholders and be able to track the implementation progress and violation of the master plan easily.
This action aims to digitize the Musanze City master plan including its disaggregation to the neighborhood level and then avail this data on a data sharing platform, such as a city dashboard, for the stakeholders and communities to access. The dashboard will leverage existing data platforms locally available to facilitate its implementation.

RESOURCES

- Musanze District website
- National Spatial Data Infrastructure (NSDI)
- Spatial Data Framework
- NISR Data Repository
- Rwanda water portal

STAKEHOLDERS

- **Lead:** City of Musanze, Ministry of ICT
- **Partners:** RWB, RMA, RAB, WASAC, NISR, RISA, REMA, RFA, RLMUA, RHA, RTDA, NIRDA, NAEB, RDB, RURA, MTN, AIRTEL, NCST, Private sector and start-ups

NEXT STEPS

- Map of all existing databases and systems for data storage in the Musanze city that can incorporate the master plan. Map ownership and relationships of database owners. Prioritize existing databases and gather insights on what information is conducive for building and integrating a dashboard with Musanze city master plan.
- Develop policies and standards around collection and sharing between the existing databases and systems as required for the integration of Musanze city master plan in dashboard.
- Mobilize funding to launch a data platform that can integrate information from the various related data systems in existence in the city.
- Improve accessibility of innovative data platforms.

OUTCOME

- Musanze city master plan accessible to the public
- Improve spatial planning in Musanze city
- Public awareness raised on the city master plan and its associated regulations
- Aligned planning in the city of Musanze

COSTS/FUNDING

The cost of this action has been estimated to be relatively low, mainly because it is a soft intervention and will be implemented within the existing framework at different level.

2

CASE STUDIES

Cloud infrastructre and data services - Busan, South Korea

In line with the national strategy, the Busan government adopted a cloud-based infrastructure, collaborating with Cisco and South Korea's leading telecom operator, KT, to build a more cost-effective green u-City – an ICT infrastructure-based green growth initiatives. It hoped to transform physical communities into online ones by using the network as the platform for more efficient city government planning and management and for information collection, processing and sharing in real time. (Link)

VISION 3

VISION STATEMENT

Build technical capacity for improved financial planning in the water sector

RELATED CHALLENGES

Challenge 2.1: Limited capacity of district technical staff to develop bankable proposals and explore alternative income opportunities.
Challenge 2.2: Lack of knowledge sharing platforms and on job trainings for District's staff and practitioners.

VISION DESCRIPTION

To build a sustainable water management system, the city of Musanze needs to improve its financial planning capacity. The district's technical staff need advanced capacity building programs to increase their competencies in water financial planning specifically. Capacity building needs in the district have been identified specifically in two different aspects. The first one being capacity development of District's planning and technical staff to develop attractive and bankable proposals suitable for both private investors and grant providers in order to address the financial gap in the sector. The second aspect is about capacity building for District's technical staff and other key stakeholders to increase their knowledge about water resilience in their city context, hence enhance their capacity to address the technical skills gap.

This vision aims to: 1) strengthen staff capacity at the district level to develop business cases and explore new revenue opportunities; 2) develop a framework that facilitate the city to mobilize funds and have access to experts to advise on best approaches to developing bankable projects; 3) equip technical staff with knowledge and skills to learn about new water resilience initiatives and technologies through continuous capacity building. This will not only take place in the context of formal courses or training, but also as training on the job.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- Limited capacity of district technical staff to develop bankable proposals and explore alternative income opportunities.
- Lack of knowledge sharing platforms and on job trainings for District's staff and practitioners.

OVERALL VISION RELEVANT ASSETS AND RESOURCES

- Rwanda's Vision 2050 (Accountable and Capable State Institutions) (Link)
- Manual of Public Financial Management (PFM) Policies and Procedures
- Musanze District Development Strategy (Link)
- Water strategy 2021-2025, AFDB Group.
- Capacity development and building a capable state (Rwanda country report), 2007, (Link)
- Mapping of Ongoing and Planned Capacity Building Activities in Rwanda (Link)
- Information and communication technology policy in Rwanda

VISION 3

SHOCKS AND STRESSES

- Unattractive compensation for qualified technical staff.
- Instability of the e-procurement system
- Low staff capacity.
- Insufficient funds
- Rapid population growth
- Floods and landslides

OVERALL CHAMPIONS/STAKEHOLDERS

- **Lead:** Musanze District
- **Partners:** WASAC, RWB, METEO, RDB, LODA, Relevant NGOs
- **Approval/ buy-in:** MINALOC, MINECOFIN, MIFOTRA RWANDA

ACTION 1.

Five to 10 years – Strengthen staff capacity at the district level to develop business cases and secure financing projects

DESCRIPTION

Musanze district's source of funds comes mainly from tax revenues as well as external funds from development partners. Funds are insufficient in the district and therefore, there is a need to explore other funding opportunities to support and implement water-related plans and projects. Currently, technical and planning staff of Musanze district have limited capacity to develop bankable proposals and explore new revenue opportunities and some departments, especially in the water department are relatively understaffed. In addition to that, since staff salaries are not motivating, skilled staff prefer to quit for better paying jobs. This means that the district needs to recruit new skilled personnel which ends up hindering the district's progress in having the capacity required.

This action will contribute to developing the district's human resources (the planning and technical staff) capability to mainly formulate innovative projects and secure financial investments that will support the water sector in the city of Musanze. The action will be implemented at city level within a short time frame of five to ten years. The main beneficiaries are the technical staff and planning staff of the district. Private sectors such as academicians, consultants and businesses as well as the local community will also benefit.

Another component that needs to be done to strengthen staff capacity is to recruit new skilled staff to fill the vacant positions and review their respective salaries to increase motivation to work in the district. The degree of complexity for the implementation of the action is high because the review of national employees' jobs profiles and salaries structures (restructure) is another process that requires a multi-sectoral planning at the country's national level.

RELEVANT RESOURCES TO THE ACTION

Policy

- Manual of Public Financial Management (PFM) Policies and Procedures, 2019, (Link)

Information

- Musanze city Master plan
- Musanze District Development Strategy, 2018, (Link)
- Capacity development and building a capable state (Rwanda country report), 2007, (Link)
- Information on activities done in capacity building in Rwanda: Mapping of Ongoing and Planned Capacity Building Activities in Rwanda, 2008, (Link)

STAKEHOLDERS

- **Lead:** Musanze District
- **Partners:** Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Development Board (RDB), Local Administrative Entities Development Agency (LODA)
- **Approval:** Ministry of Local Government (MINALOC), Ministry of Finance and Economic Planning (MINECOFIN), MIFOTRA (Ministry of Public Service and Labour)
- **NGOs:** Water-related NGOs

NEXT STEPS

Short term – The short-term next steps defined here are early activities not exceeding two years after the project's initiation. These are:

- Capacity building for existing staff
- Filling vacant positions

Medium term – The medium-term next steps defined here are the activities that will be implemented in between three to six years after the project's initiation. These are mainly to:

- Increase district staff
- Conduct various trainings for the new staff

Long term – The long term's next step defined here is an activity that will be implemented between six to ten years after the project's initiation. This is to:

- Increase salaries of the Musanze district's staff

OUTCOME

- Quality Bankable proposals for water resilience projects will be available.
- External expert's dependency and related cost will decrease.
- Contribution to the urban water resilience of the district.
- District's income will increase (financial autonomy)

COSTS/FUNDING

The cost of the action was estimated as high, approximately 5 billion Rwandan francs. However, the cost can increase depending on the numbers of new staff that will be hired as well as increase of the staff's remuneration (salaries). It was highlighted that the degree of complexity of the initiative when it comes to its implementation is high because the restructuring of job profiles and salaries might be a complex process as it applies to all Districts'staff in Rwanda. Once salaries are increased for Musanze's officials, it has to be increased for all national officials.

CASE STUDIES

- An example of expert's workshop done at Paris with aim of turning good ideas to bankable projects, 2013, (Link)
- An example of a program implemented by the World Bank which aimed to strengthen the capacity of local governments in South-East-Africa. (Link)
- An example of the city of Rijeka in Croatia. The city undertook several investments to address its environmental challenges and the strategic objectives of the city were to attract global investment through the development of the Rijeka Gateway project, to develop a competitive economy based on knowledge and new technology, and to strengthen social inclusion through the implementation of capital investment projects. (Link)

ACTION 2.

Two years – Develop a framework that facilitate the city to access empanel experts to advise on developing bankable projects

DESCRIPTION

Building the capacity of key districts' staffs to develop bankable projects is very crucial, and it requires resources to conduct trainings and hire experts. Currently, there is a gap between the need for water resources management investments and potential available funding. This action aims to develop, under the district of Musanze, a framework that enables stakeholders from organisations in the private, public, academic/research, and NGO institutions to contribute to the development of bankable water resilient projects in the city. Specialized knowledge-based organization or research institution will help the district to overcome the challenge related to limited in-house technical capacity.

Through this framework required financial resources will be mobilized to train technical staff and give advice on developing bankable projects. The action will be implemented at city level within a short time frame of zero to two years . The direct beneficiary is the district of Musanze whereas the indirect beneficiaries are the public and international institutions, private institutions such as academic, knowledge hubs, NGOs acting in the water sector, consultants, as well as entrepreneurs.

The implementation of the action is not very complex as it requires mobilization of funds as well as agreements and Memorandum of Understandings (MoUs) between stakeholders.

RELEVANT RESOURCES TO THE ACTION

Policy

- Manual of Public Financial Management (PFM) Policies and Procedures, 2019, (Link)
- Rwanda Aid Policy Manual of Procedures, 2019, (Link)

Information

- Cities Support Program Framework Document – Final Draft, Case study of South Africa (January 2012), (Link)
- Water strategy 2021-2025, AFDB Group, (Link)
- Public Financial Management Learning and Development Strategy, 2018, (Link)

Funding

- Internal revenues: EICV3 DISTRICT PROFILE Musanze, (Link)
- 2020-2021 Earmarked transfers guidelines to decentralized entities with legal personality, 2020, (Link)

STAKEHOLDERS

- **Lead:** Musanze district
- **Partners:** Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Development Board (RDB), Local Administrative Entities Development Agency (LODA), the Ministry of ICT and Innovation as well as NGOs working in the Water Sector (Water Aid, Water for People, Water Partnership-Rwanda, WRI, etc)
- **Approval:** Ministry of Local Government (MINALOC), Ministry of Emergency Management (MINEMA), MoE (Ministry of Environment)

NEXT STEPS

- Foster partnership between the City of Musanze and government institutions, private companies working in the water sector, national/ international experts, universities in designing bankable projects and for in-kind contributions of expertise, technical assistance, and capacity building.
- Develop a framework for mobilization of financial resources to hire experts and support capacity building of district's staffs.

OUTCOME

- Funds will be mobilized.
- Technical assistance to develop bankable projects will be provided.
- Partnerships will be more efficient among stakeholders.

COSTS/FUNDING

The cost of the action was estimated as medium, approximately 1.5 billion Rwandan francs which will cover the cost of capacity building and hiring of experts.

CASE STUDIES

- An example of a platform that helps to convene and exchange knowledge among all relevant actors dedicated to urban development, climate action, and/or financing (cities climate finance leadership alliance). (Link)
- The Government of Tuvalu (the Government) requested the Asian Development Bank (ADB) to provide technical assistance (TA) to support its fiscal stability and capacity-building initiatives, in conjunction with a proposed ADB program grant. (Link)
- An example of platform for knowledge sharing on IWRM: GWP IWRM Toolbox (Link)

ACTION 3.

Recurrent – Continuous capacity building for city technical staff and relevant stakeholders to ensure that they are skilled in developing water resilience initiatives and technologies

DESCRIPTION

The city of Musanze has demonstrated a strong commitment to provide high quality water services to its population. For the city to meet that commitment, adequate and effective technical capacities in the district of Musanze is vital. This action aims to develop continued capacity development training programs to address the skills gap of the district's technical staff and other key stakeholders to increase their knowledge on water resilience and enhance their personal development. The programs will provide employees and civil servants with a platform to exchange knowledge and to learn about new technologies and approaches that can be used to improve water resilience in the city of Musanze. This program will also aim to promote academic learning and research among technical staff in the fields of WASH, water resources management, climate adaptation and mitigation among others.

RELEVANT RESOURCES TO THE ACTION

Policy

- Revised National employment policy, 2019, (Link)
- Information and communication technology policy in Rwanda, 2005, (Link)

Information

- Capacity development and building a capable state (Rwanda country report), 2007, (Link)
- Information on activities done in capacity building in Rwanda: Mapping of Ongoing and Planned Capacity Building Activities in Rwanda, 2008, (Link)

STAKEHOLDERS

- **Lead:** Musanze district
- **Partners:** Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Development Board (RDB), Local Administrative Entities Development Agency (LODA), the Ministry of ICT and Innovation as well as NGOs working in the Water Sector (Water Aid, Water for People, Water Partnership-Rwanda, WRI, etc)
- **Approval:** Ministry of Local Government (MINALOC), Ministry of Emergency Management (MINEMA), MoE (Ministry of Environment)

NEXT STEPS

- Carry out an employee's assessment to know where employees have gaps and how to improve their performance capacity.
- Assess the resources allocated to capacity building at district level and mobilize funds to support additional capacity building.
- Identify relevant consultants/partners who will conduct the trainings and coordinate with them to design the training module that matches Musanze city's priorities and context.
- Implementation of the training program and monitor learning outcomes.
- Adjust the training program as necessary.

OUTCOME

Capacity-building interventions in Musanze city will enhance knowledge, skill, and self-efficacy (including confidence) of the staff/employees. It will also change the staff's practices and behaviour. The quality of work will be high hence efficient deliverables. Consequently, this will help achieve development goals of the city.

COSTS/FUNDING

The cost of the action will be medium with potential funding from the district of Musanze and other development partners.

CASE STUDIES

- Capacity building strategy in Cameroon developed by the Cameroon Policy Analysis and Research Center (CAMERCAP-PARC). The document proposes a Capacity-Building Strategy in Cameroon, because of the proven inefficiency, ensuing from a lack of the necessary capacities, despite the abundantly available resources. (Link)
- Strengthening Capacity for the Consensual and Sustainable Management of Land and Natural Resources. This was a UN-EU Partnership (2008) which aimed at developing and implementing a strategic multi-agency project focused on building the capacity of national stakeholders, the United Nations system, and the European Union to prevent land and natural resources from contributing to violent conflict. (Link)

VISION 4

VISION STATEMENT

Advance data management and use of technology platforms for effective water management

RELATED CHALLENGES

Challenge 4.1: Lack of water-related information system
Challenge 4.2: Lack of quality and updated water-related data
Challenge 3.2: Lack of technology to track water losses in water supply networks
Challenge 5.1: Inadequate coordination between the district and central level agencies in water-related planning and implementation in Musanze city.

VISION DESCRIPTION

Advanced data management and use of technology platforms are required to sustainably manage urban water resources. This calls for intelligent data sensing, data collection, data processing and accessible platforms to disseminate reliable, up-to-date and relevant information to water resources managers and stakeholders for their activities related to water regulation, planning, adaptation to climate change and water risk management. In Musanze district, data collection processes are limited due to insufficient resources. In addition, most of the water-related data are produced at the national level by various institutions. The available datasets are usually fragmented, incomplete, dispersed and not easily accessible due to the lack of a cooperation framework for organizing data management between institutions in the water sector.

This vision aims to: 1) organise the production of new datasets and the enhancement of existing ones, in order to generate information and useful services for decision-making purposes and inform partners and the public, 2) establish institutional frameworks for data sharing among partners as well as the processing and dissemination of the results; 3) develop climate resilient guidelines and standards for water infrastructure systems, 4) build smart water management that can provide more resilient and efficient water systems planning and management in the city of Musanze.

The main processes to be considered during the implementation of the vision are data governance, data production, and integrated data management, data sharing between institutions as well as information production and dissemination. With the district's dashboard, water-related data and information will be accessed in an effective and sustainable way through computers, tablets, and smartphones.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- There is a need to build an accessible water-related information system for the district of Musanze
- There is a need to develop a smart water management system to enable coordinated implementation of project/plans between the district and national government on one hand and ensure a more resilient and efficient water supply on the other hand.
- There is a need to create a dashboard to share projects and studies in the water sector to encourage knowledge building among stakeholders
- There is a need to raise awareness on available water-related information systems locally, in the region and internationally
- There is a need to develop climate resilient guidelines and standards for sustainable water infrastructure systems as well as for data collection and analysis.

VISION 4

OVERALL VISION RELEVANT ASSETS AND RESOURCES

- Rwanda's Vision 2050 (Export-oriented knowledge services: big data management) (Link)
- National Strategy for Transformation (2017-2024) (Link)
- Musanze Master Plan
- National Land Use and Development Master Plan (2020-2050) (Link)
- Republic of Rwanda National Roadmap for Green Secondary Cities (Link)
- Rwanda's Green Growth and Climate Resilience Strategy (GGCR)
- National Information and Communication Technology policies. (Link)
- Guidelines by RISA on the establishment of information systems in public institutions; (Link)

SHOCKS AND STRESSES:

- Increased flooding and landslides due to climate change impacts
- Water pollution
- Lack of sufficient data

OVERALL CHAMPIONS/STAKEHOLDERS

- **Lead:** District of Musanze
- **Partners:** Rwanda Information Society Authority (RISA), Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Environmental Management Authority (REMA), Youth organizations and programs in the water-related field, NGOs working in the Water Sector (Water Aid, Water for People, Water Partnership-Rwanda, WRI, etc)
- **Approval:** RISA, Musanze District, Water and Sanitation Corporation (WASAC), Ministry of Finance

ACTION 1.

Two years – Develop a District water data dashboard to promote the use of evidence-based decision making in order to advance effective water resilience projects

DESCRIPTION

In Rwanda, most of the necessary water-related data is produced at the national level by various government institutions and organizations working in the water sector. Consequently, data is usually incomplete, dispersed, and non-homogeneous at district level, making it difficult for organizations involved in water resources management to have access to reliable data and information for their activities. This action aims at developing a water-related dashboard for the city of Musanze to provide access to locally relevant information needed to: 1) manage water resources in a sustainable way; 2) reduce risk and vulnerability, 3) improve networking and knowledge sharing to disseminate good practices and; 4) foster multi-stakeholder partnerships.

The development of the water-related data dashboard for Musanze district will be done in accordance with the guidelines by the Rwanda Information Society Authority (RISA) and the system will be linked to the district's website for easy accessibility. The development of the information system will be technically led by the partner knowledge-based organization with guidance from RISA and the system will be approved and owned by Musanze district. The system will be linked to other relevant information systems at the national level such as the water portal, climate change portal, etc.

This action can be implemented within a period of two years after partnering with a knowledge-based organization. The information system will be benefited by various institutions and organizations operating or having interventions in Musanze district, tourists as well as the local community.

RELEVANT RESOURCES TO THE ACTION

- Guidelines by RISA on the establishment of information systems in public institutions; (Link)

Existing water related information systems at National level such as:

- Water portal by Rwanda Water Resources Board; (Link)
- Climate Change portal by Rwanda Environment Management Authority; (Link)
- Musanze district information system; (Link)

STAKEHOLDERS

- **Lead:** Musanze district
- **Partners:** Rwanda Information Society Authority (RISA), Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Environmental Management Authority (REMA), World bank, UNDP, Global Green Growth Initiative (GGGI), Enabel, Rwanda Young Water Professional (RYWP), Global Water Partnership (GWP)
- **Approval:** Musanze district and RISA

NEXT STEPS

- Review of existing water-related information systems at the national level.
- Review of guidelines by RISA on the establishment of information systems in public institutions.
- Development of the water data dashboard for Musanze district.
- Raise awareness on the availability of the information system.
- Regular update of the dashboard and collect users' feedback for continuous improvement.

OUTCOME

Sustainable and well-informed water related plans.

COSTS/FUNDING

The cost for developing the water-related information system for Musanze district could be around $150,000 while the annual operational cost could be around $15,000. The investment cost for setting up the information system can be mobilized from development partners while the annual operation costs can come from the district revenues with some additional support from development partners.

CASE STUDIES

- Data Eye: Intelligent ICT Implementation Project in the Takahashi River Basin that aims to re-vitalize the region using data utilisation activities through collaborations between public and private sectors of the local community (Link)
- Global database such as Water Productivity Open-access Portal (WaPOR): FAO (Food and Agriculture Organization) portal which uses remote sensing technologies to monitor and report on agricultural water productivity over Africa and the near East. (Link)

ACTION 2.

Medium term – Develop and implement a smart water management system to enable efficient water systems planning and management

DESCRIPTION

To achieve the overall efficiency of water systems and management, the development of smart water supply management system in the water supply network will be of great importance. To address the existing challenges in water supply network, this action will include the following:

- The water quality device to monitor the water quality within the distribution line.
- The Pressure control and leakage detection device to monitor for possible leakages across the network.
- Automated valves control in a water supply system
- Water level device for reservoir/storage monitoring
- Smart water meters
- The incorporation of an early warning system for disaster preparedness

This action will benefit the city's water supply network by turning it into an automated system and the water quality will be improved since the system will report possible change within the water quality supplied, the water pressure in the networks will be controlled and leakages will be tracked. The system will contribute a lot in reduction/elimination of water losses in the water supply system.

The action is not complex to implement since the system can be introduced in the existing water supply network, and the technician already working in the water supply sector will support in the installation making it practical to identify customers with which a pilot can be conducted. The scale of the action impact will mostly be observed on the city level because the project will be implemented in the water supply networks of the city, however the community will benefit from an automated and sustainable water supply system as well.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget (Link)
- Grants
- Concessional loans (AFDB and World Bank)
- Mobilization of Private sector through Public-private partnership (PPPs) mechanisms.

Policy

- Smart city policy (Link)
- Water supply policy
- Water tariff regulations (Link)
- National Information and Communication Technology policies (Link)

Information

- Pilot smart water supply management system in WASAC facilities of Bugesera district (ongoing)

Other assets

- Existing water supply system of Musanze city (Link)
- Organization structure can facilitate the easy transition and adoption of the technology (Link)
- K-lab, Fab-lab considered as innovation hub and they are currently working with Musanze district as youth center for development (knowledge hub). This can facilitate in forming capable technical staffs that are able to operate the system. (Link)

STAKEHOLDERS

- **Lead:** Water and Sanitation Corporation (WASAC)
- **Partners:** Musanze district, Rwanda Energy Group (REG), Ministry of ICT and Innovation (MINICT), World Vision, SNV Rwanda, WASH Partners, Rwanda Utilities Regulatory

Authority (RURA), Ministry of Trade and Industry (MINICOM), Rwanda Standards Board (RSB), and Rwanda Information Society Authority (RISA)

- **Approval:** Ministry of Infrastructure (MININFRA), Ministry of ICT and Innovation (MINICT) and Ministry of Finance and Economic Planning (MINECOFIN)
- **NGOs**: All community-based organizations, charity organizations and Civil society organizations

NEXT STEPS

Short term – The short term defined here is between zero to five years.

- In the beginning of the project, development of a project charter which involves the project scope, objectives, responsibilities agreed by all wash sector stakeholders in order to get approval will be needed.
- And therefore, initiate the project.
- Since this project will be introduced in the existing water supply network, a pilot project has to be conducted to evaluate the effectiveness of the smart water management system
- Identification of customers and pipeline in which this pilot will be effective with quicker feedback will follow.

Medium term – The medium term defined here is between five to ten years.

- In the medium term, the variables from the pilot project will be analysed to refine the implementation and execution of the project. The project will be controlled for one year to be handed over to WASAC for further management and maintenance.

Long term – The long-term defined here is beyond ten years.

- This will include operation and maintenance plus yearly upgrade depending on the new technology innovated related to installed system.

OUTCOME

- Increased national revenue due to reduction of non-revenue water
- Improved hygiene and sanitation in Musanze city due to sufficiency in water supply
- Reduction of leakages due to controlled pressure remotely in water supply networks
- Decreased complaints of end-users over water supply related issues
- Efficiency in monitoring and operating of water supply systems of the city
- Accurate water bills due to smart water meter introduced in the networks
- Improved customer services of the water supply operators (WASAC)
- Availability of real time data of water supply network due to an automated system which will monitor the water supply system of the city.

COSTS/FUNDING

The origin of funds for the action was proposed to come from the National Budget and funds for capacity building from grants, materials acquisition, and their installation to come from concessional loans (AFDB, World Bank). Another proposed alternative is to mobilize the private sector through Public-Private Partnership (PPPs) mechanisms to implement this project and allow them to operate the facilities for a specific timeframe for recovering the investment to make the project public owned or public asset in the end.

CASE STUDIES

Seosan City (South Korea) Smart Water Management (SWM): Water management using ICT, known as Smart Water Management (SWM), aims to sustainably manage the limited water resources by reducing water leakages while improving water service using remote metering and smart meters. (Link)

ACTION 3.

Short to medium term – Develop climate resilient guidelines and standards for water related infrastructure to enhance water resilience in the city of Musanze

DESCRIPTION

Climate resilient guidelines and standards will serve as roadmaps for sustainable water-related infrastructure systems. Musanze city faces water resilience issues related to water resources pollution, floods, and poor waste management systems for both solid waste and wastewater. This action aims at giving guidance to Musanze city's professionals who manage drinking water, wastewater, and storm water systems on adopting more efficient management practices that ensure the successful operation of these systems for years to come as it relates to climate risks and stresses these systems face. The action will also detail possible guidelines for standardizing materials and equipment used in water-related infrastructures which will strengthen and refine the journey towards water resilience in the city.

The development of the climate resilient guidelines and standards will technically be led by the partner knowledge-based organization with guidance from MININFRA, RWB and WASAC and the results will be approved and owned by Musanze district. This action can be implemented within a period of two years after partnering with a knowledge-based organization. The guidelines and standards for water-related infrastructure will be benefited by various institutions and organizations operating or having interventions in Musanze district, tourists as well as the local community.

RELEVANT RESOURCES TO THE ACTION

Funding

- Grants
- National Budget (Link)

Policy:

- Smart city policy (Link)
- National environment and climate change policy (Link)
- National policy for water resources management (Link)
- National Urbanization Policy (Link)
- National construction industry policy (Link)
- An Integrated ICT-led Socio-Economic Development Policy and Plan for Rwanda (2001 – 2005) (Link1, Link2)

Information

- Weather data by METEO
- Hydrological data by RWB
- Water access data from WASAC
- Smart city Rwanda master plan
- Rwanda building permit system
- Climate risk country profile RWANDA (Link)
- Rwanda Water Board (RWB) Information system (Link)
- REMA Information system (Link)
- Musanze District Information system (Link)
- Rwanda NCA Water Accounts (Link)

STAKEHOLDERS

- **Lead:** Musanze District
- **Partners:** Rwanda Information Society Authority (RISA), Rwanda Water Resources Board (RWB), Rwanda Meteorology Agency (METEO Rwanda), Water and Sanitation Corporation (WASAC), Rwanda Environment Management Authority (REMA), World bank, UNDP, Global Green Growth Institute (GGGI), Enabel, Rwanda Young Water Professional (RYWP), Global Water Partnership (GWP)
- **Approval:** Musanze District

NEXT STEPS

Short term: Develop a plan and budget

- Baseline assessment to gather existing information related to the structure of the guidelines and standards.

- Preparation of a budget for the development of the guideline and standards
- Identification of a relevant Partner Knowledge-Based Organization who will support in developing the climate resilient guidelines and standards
- Identification of key stakeholders who can contribute to the development of the guidelines and standards
- Disseminate regulations and educate stakeholders
- Community engagement in establishing fine upon failure of compliance

Medium term: Develop and disseminate guidelines and standard

- Decide on a process for priority setting of guideline topics needed and who will be responsible for directing the process
- Develop guidelines and standards based on national and international standards related to water infrastructure
- Dissemination and implementation of standards
- Evaluate and periodically update standards guidelines and standards

OUTCOME

- Detailed climate resilient guidelines and standards for water-related infrastructure
- A secure, reliable water infrastructure system
- Local water resources protected from pollution
- Reduction of runoff and improved flood control in the city
- Improved design of water-related infrastructure
- Improved management plan for water resources of Musanze city

COSTS/FUNDING

The development of climate resilient guidelines and standards for water-related infrastructure will be short to medium and can be partly funded by climate grants for the development of climate resilient guidelines since they can be developed referring to the existing guidelines for the climate change adaptation and mitigation already developed at the national level. The climate resilient standards for water-related infrastructure will be a medium cost and can be funded by grants and partly by the national budget.

CASE STUDIES

- Drinking water supply system for rural population of Eastern Tucuman, Argentina: The project aimed to develop a feasibility study and technical projects for a small community through interdisciplinary approach and it was found that there is a need to develop Water Resources (WR) policies designed to optimize the resource utilization (Link)
- Climate-responsive design: A framework for an energy concept design-decision support tool for architects using principles of climate-responsive design (Link)

VISION 5

VISION STATEMENT

Accelerate investment in sustainable sanitation infrastructure for improved community and environmental health

RELATED CHALLENGES

Challenge 3.1: Lack of a sewerage system and a storm water management plan

VISION DESCRIPTION

In a city like Musanze where only 51.7% of households have access to improved sanitation facilities, with 95% households with access to clean water and where waste disposal and management are lagging behind, an investment in sustainable sanitation infrastructure will be essential in reducing health and environmental risks associated with open defecation and poorly managed wastes disposal. It will also generate health related benefits, improved provision of ecosystem services, energy recovery and a resilient urban community. A sustainable sanitation infrastructure will contribute to optimization of social and health benefits and prevent unintended negative impacts on communities especially from those who are vulnerable to improper wastes disposal and poor sanitation facilities.

To meet the growing demand in the sanitation sector, the city needs to upgrade and standardise the existing sanitation facilities before investing in a sustainable sanitation infrastructure to prevent the exposure to similar challenges. Introducing a sewerage management system in the city could secure adequate waste disposal, integrate faecal sludge management, including the adequate resources recovery. Prior to investment in a sustainable infrastructure, several criteria will have to be considered including the practicability of integrated wastewater collection, faecal sludge collection, transport, treatment, reuse and disposal and the consideration of associated risks. The feasibility of the entire process will have to be carefully considered from the planning and designing phase to development, construction, operation, and monitoring phases.

This vision recognizes a lack of an integrated sanitation management in Musanze city and the lack of updated, related data in the sanitation sector as well. This might challenge the city's ability to implement a sustainable sanitation infrastructure and it will also hinder the city's ability to effectively enforce related policies, regulations and strategies, monitoring, and evaluation. To address the existing gaps, the city will have to develop a sewerage management system which will allow all related stakeholders to understand sanitation scenarios in the city. The sewerage system will be digitized and will have one control station. This emphasizes the need of a well-documented research/survey on the existing sanitation infrastructures as well as the need to amend existing laws and regulations to adhere to sustainable sanitation infrastructure and to attract related investments.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- The need to adequately plan for a decentralised sewerage system
- The need to adequately plan for faecal sludge treatment that will allow a safe treatment facility, safe disposal, and safe wastes collection from septic tanks
- The need to adequately plan for replacing pit latrines with EcoSan or other innovative technologies to prevent shallow groundwater contamination

VISION 5

- The need to improve wastes collection techniques by separating waste bins and clearly marked for various waste types
- The need for awareness raising campaigns on reducing wastes generation from the source
- The need for monitoring landfills including other wastes disposal facilities to ensure their efficiency
- The need to consider environmental protection and conservation of existing resources
- The need for a holistic enforcement mechanism of laws, policies and regulations governing water and sanitation sector
- The need for innovative and resilient sanitation projects that can accelerate the investment from private sectors as additional funds in providing sanitation services
- The need for a proper maintenance of water-related infrastructures
- The need for controlling waterborne diseases

OVERALL VISION RELEVANT ASSETS AND RESOURCES

- Green Growth and Climate Resilience-National Strategy for Climate Change and Low Carbon Development, Pillar 5: Technology, Innovation and Infrastructure (Link)
- National Strategy for Transformation (NST1), in its section III: Social transformation pillar, priority area 5: Moving towards a Modern Rwanda Household, Key strategic intervention 71: Access to sanitation and hygiene will be scaled up to all from 86.2% (IECV5) to 100% and waste management systems will be developed in cities, towns and rural areas. (Link)
- Rwanda Fourth Health Sector Strategic Plan (2018-2024) (Link1, Link2)
- National Guidelines on Health-care of Waste management (Link)
- National Policy and Strategy for Water Supply and Sanitation Services (2010) which recommends sustainable and affordable to safe water supply , sanitation and wastes management services policy and specifies that wastes disposal shall be planned and managed with a view to minimize environmental impact and ensure protection of water resources (Link)
- Rwanda National Integrated Water Supply and Sanitation Master Plans (Link)

SHOCKS AND STRESSES:

- Water quality
- Flooding
- Unemployment
- Environmental and water pollution
- Poverty
- Poor sanitation systems
- Water scarcity

OVERALL CHAMPIONS/STAKEHOLDERS

- **Lead:** Water and Sanitation Corporation (WASAC)
- **Partners:** Musanze district, Rwanda Water Resources Board (RWB), WASH partners, Rwanda Agriculture and Animal Resources Board (RAB), Rwanda Environment management Authority (REMA), Rwanda Meteorology Agency (METEO-RWANDA), Ministry of Health (MOH), Ministry of Education (MINEDUC)
- **Approval:** Ministry of Infrastructure (MININFRA), Ministry of Finance and Economic Planning (MINECOFIN), Ministry of Environment (MOE)

ACTION 1.

5

Short term – Develop improved and sustainable latrine alternatives, to prevent pollution of water bodies in Musanze city

DESCRIPTION

The use of pit latrines and open septic tanks in Musanze city are the available alternatives for wastewater and faecal sludge storage. These wastes are generated from households, commercial buildings, hotels, markets, and schools in Musanze city. The geological nature and high void ratio of soil structure of Musanze make it easy to pollute water bodies through seepages and leakages from untreated wastewater. Therefore, it is from this context that an action of developing an improved and sustainable latrine alternative was called out. The improved sanitation latrine alternatives may consist of flush toilets, EcoSan toilets and pit latrines with solid slabs. These alternatives are considered more improved when ventilated, connected to a sewer system or to a septic system.

The action will contribute to meeting the goal of 100% of the population will have access to improved sanitation systems in Musanze city. For the practical implementation of the action, the city needs to prioritize improved sanitation alternatives depending on a specific area's sanitation demand. The low dense part of the city can opt for improved pit latrines with septic tanks and solid slabs, and improved toilets. This will indeed facilitate onsite treatment as well. The industrial area of the city can opt for treating their own effluent with industry-specific technologies. The urban area of the city, which is highly dense, can opt for flush toilets connected to a waterborne sewer network to be treated at a waste water treatment plant, and this will facilitate off-site treatment. Both on-site and off-site treatments will facilitate the establishment of a proper plan for faecal sludge treatment collected from septic tanks and toilets. Furthermore, the city can opt for a gradual process of replacing pit latrines with improved toilets which can guarantee pollution prevention of shallow ground water of Musanze city and reusing wastes as fertilizers. The replacement of pit latrines with improved toilets will create value for wastes and has a great potential to improve livelihoods and contribute to a circular economy in Musanze city. improved latrines technologies have demonstrated the best hygienic sanitation option that prevents water pollution, fights infections, saves water and promotes zero wastes management.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget
- Community fundraising
- Concessional loans (AFDB, World bank)
- Mobilization of Private sector through Public-private partnership (PPPs) mechanisms.

Policy

- Smart city policy (Link)
- National sanitation policy (RURA, 2016) (Link)
- National Environment and Climate Change Policy (MOE, 2019) (Link)
- National Policy and Strategy for Water Supply and Sanitation Services (MININFRA, 2010) (Link)

Information

- Environmental profile of Rwanda. (Link)
- Rwanda Compendium of Environment Statistics, 2018 (REMA, 2019) (Link)
- Faecal sludge to nutrient-rich compost from public toilets (Rwanda Environment Care, Rwanda, 2012-2014) (Link)
- USAID Isuku Iwacu, Rwanda Rural Sanitation Activity Fiscal year 2020 Quarter reports (Link)

Other assets

- Existing latrine system

5

STAKEHOLDERS

- **Lead:** Musanze district and Ministry of Infrastructure (MININFRA)
- **Partners:** Rwanda Housing Authority (RHA), Water and Sanitation Corporation Ltd (WASAC), Ministry of Environment (MoE), United Nations International Children's Emergency Fund-Rwanda (UNICEF-Rwanda), WASH Partners, Rwanda Water Resources Board (RWB)
- **Approval:** Ministry of Infrastructure (MININFRA), Ministry of Environment (MoE) and Ministry of Finance and Economic Planning

NEXT STEPS

Short term: The short term defined here is from zero to six months and this period will focus on awareness raising. This will be a strategy to bring stakeholders in the process of initiating the improved and sustainable latrine alternatives (e.g: EcoSan). This period will involve:

- Providing the instructions on how the system is used
- Provision of relevant and needed information about why the system is necessary, appropriate, environmentally sound, and needed for the city
- Promotion of the system by educating people on the benefit and costs of the new approach for sustainable sanitation
- Visits to various communities that adopted the system
- Further studies on different aspects of the system for different settings in the area
- Social marketing of the system as a tool for promoting sustainable latrines in private households

Medium term: The medium term defined here is from six months to one year and it will focus on the construction. This period will consist of:

- Selection of sites in the city to implement the system
- Construction works

Long term: The long term defined here is from one to two years which is the real operation of the system and this period will consist of:

- Operationalization of the system
- Link the owners with faecal sludge emptying service providers
- Maintenance plus total ownership by the community

OUTCOME

- Possibilities of groundwater and surface contamination reduced
- Opportunity for circular economy
- Conservation of resources and contribution to the preservation of soil fertility
- Minimum water usage
- Establishment of a collection facility for faecal sludge/wastes

COSTS/FUNDING

The cost that is required to develop improved and sustainable latrine alternatives is bound to lower the costs of urban sanitation. Conventional sewers, treatment plants and sludge disposal arrangements will cost more than improved sustainable latrine alternatives. EcoSan systems for instance require much less investment as they need no water for flushing, no pipelines for the transport of sewage, and no treatment plants and disposal of sludge/wastes.

The cost was roughly estimated between 50 million and 150 million USD to implement the project. The maximum budget was estimated if the improved latrine alternative proposed for the city is the septic tank which is relatively expensive compared to other alternatives. The minimum cost was estimated if fewer alternatives like brick lined latrines or EcoSan are explored and if the community involvement participates in the implementation of the project. Ecological systems are usually cheaper than flush toilets systems and septic systems built on the same standards of quality. The project can be implemented in short term.

CASE STUDIES

Serviced Household Toilets, FSM, and ICT in Antananarivo, Madagascar aims to develop an ICT platform and mobile application to improve the coordination of waste collection logistics and customer service associated to their waterless toilets for households in an urban area of Antananarivo while strengthening linkages between service suppliers and customers. (Link)

ACTION 2.

5

Medium term – Develop an integrated faecal sludge management system to improve management of waste matter and effluents in Musanze city

DESCRIPTION

Increasing access to sanitation facilities and ensuring recycling of wastewater is one the key strategic interventions that the district of Musanze is focusing on as specified in the District Development Strategy (DDS) of 2018-2024. Within Musanze city, wastewater is mostly not treated prior to its discharge into the environment except for a few hotels. The city does not have an integrated faecal sludge management system. Faecal sludge management involves collection, transport, and treatment of faecal sludge from pit latrine, septic tanks, or other on-site sanitation systems.

It is against this background that this action is called out to develop a holistic approach that addresses the whole sanitation service chain, to improvement both waste matter and effluent. This action recognizes that sanitation for all cannot be achieved by managing either wastewater or faecal sludge alone. With an integrated faecal sludge management system, Musanze city will address liquid wastes from Ruhengeri Hospital and ESSA Ruhengeri which is discharged in Kigombe river, resulting in water pollution and disturbance of aquatic biodiversity in Kigombe river. Therefore, the system will assure a systematic way to collect and transport faecal sludge produced in the city of Musanze and put in place a plan for a faecal sludge treatment plant that will treat and safely dispose faecal sludge collected from septic tanks.

This action will build upon the action #1 that will put in place decentralised improved and sustainable latrines alternatives. The integrated faecal sludge management system will manage decentralised latrine alternative systems. This will be done through GIS mapping of existing pit latrines and septic tanks in the city that need emptying services. Once the data base of sanitation facilities is set, the next step will be to connect customers and emptying services provider through a GIS tracking system which will inform where faecal sludge is collected/ dumped. This will ensure a safe disposal for a cleaner and healthier city.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget
- Grants

Policy

- National sanitation policy (Link)
- National Urbanisation Policy (Link)
- National Information and Communication Technology Policy (Link)

Information

- Guideline for faecal sludge management (RURA, October 2020) (Link)
- Water and Sanitation, Sector strategic plan 2018-2024 (Mininfra, May 2018). (Link)
- Musanze city master plan
- Integrated National water supply and sanitation master plan (Link)

Other assets

- Existing shapefiles from ESRI-Rwanda (Link)
- Existing Musanze district Website (Link)

STAKEHOLDERS

- **Lead:** Rwanda Information Society Authority (RISA) and Musanze district
- **Partners:** Ministry of Information and Communication Technology (MINICT), Water and Sanitation Corporation Ltd (WASAC), Rwanda Water Resources Board (RWB), WASH partners, United Nations International Children's Emergency Fund-Rwanda (UNICEF-Rwanda), Rwanda Agriculture and Animal Resources Board (RAB), Rwanda Housing Authority (RHA), Rwanda Environmental Management Authority (REMA), METEO-Rwanda,
- **Approval:** Ministry of Information and Communication Technology (MINICT) and Ministry of Environment (MoE)

5

NEXT STEPS

Short term: The short term defined here is 0 to 1 year period which will focus on preliminary activities of mapping potential sites for faecal sludge emptying and this will include:

- Intensive GIS field mapping
- Analysis of Geometric data
- Understanding the geography of emptying sites
- Quantification of faecal sludge that can be produced per site

Medium term: The medium term defined here is from one to two years and this period will focus on connecting customers with emptying service providers and testing tracking service delivery. This will include:

- Testing of the right technology for tracking service delivery
- Regulating the service delivery patterns
- Complying with emptying standards in close collaboration with competent authority in Rwanda (RSB)
- Establishing faecal sludge collection, emptying and transportation methods
- Regulating charges for emptying
- Regulating and licensing of private emptying providers
- Awareness campaigns
- Sensitization and training of private operators

Long term: The long term defined here is between two to five years and this period will involve the treatment of faecal sludge and final disposal

- Selection and operationalization treatment technology
- Treatment of faecal sludge and resources recovery
- System monitoring and evaluation
- Setting up future plans to improve the system

OUTCOME

- Real time tracking of emptying services
- Health improvement in the city
- Reduced potential for human contact with faecal-borne pathogens
- Reduction of illegal dumping
- Increased revenues

COSTS/FUNDING

Developing an integrated faecal sludge management system is more cost effective because it is based on current and near future demand in sanitation sector and it requires low water supply. This project is taken as a medium project that can take up to five years to implement and can be funded by African development Bank, the government of Rwanda and the beneficiary contributions.

The effective cost for integrated faecal sludge management system is estimated between 12 million USD and 15 million USD. This cost is estimated based on the preliminary works that will have to be conducted, testing the technology that will be used for services delivery and establishing collection, emptying and transportation method for faecal sludge. In addition, part of the cost is linked with awareness raising campaigns, selection, and operationalization of the treatment technology (for Musanze city, constructed wetland is suggested) and system monitoring and evaluation.

CASE STUDIES

SIGeo: integrated Geo-information management: Integrated Geo-information Management of the City of Niteroi provides open access to the city government's Geo-information and fosters closer coordination among various departments. (Link)

ACTION 3.

5

Long term – Establish a decentralized sewage management and treatment facility to enhance water resilience in Musanze city

DESCRIPTION

In order to achieve an inclusive sustainable sanitation infrastructure for improved community and environmental health, there is a need to develop a sewage management and treatment facility that will support in the treatment of collected grey drains and black drains. This will prevent health related hazards from uncontrolled sewerage disposal and pollution of ground water resources. The sewage management and treatment facility will require sewerage delivery at the site from collection site to treatment facility for a proper disposal. To help the city understand its sanitation system, there is a need to integrate the sewage management into Musanze city plans to better understand associated risks, vulnerabilities as well as related environmental health benefits for the community.

The consideration of sewage management and treatment facility into city plans will help the city identify priorities and set defined strategies to address related sanitation risks and vulnerabilities and further align with proposed vision. Furthermore, the City will need strong enforcement mechanisms of existing laws and regulations on sanitation to ensure the achievement of water resilience goals across the sanitation infrastructures within the city of Musanze. To promote the resilience thinking, the city will consider capacity building of local technical staff on proper management of sewage and align it with related existing Sector Strategic Plans (SSPs) and the National Water and Sanitation Master Plan. This action will also take a long time to be implemented and it will require enough time to convince partners and decision makers for investment buy in.

RELEVANT RESOURCES TO THE ACTION

Funding

- Grants
- Concessional loans (AFDB (African Development Bank) and the World bank)
- Private sector involvement through Private Partnership Program as per the guideline in the Official Gazette n°29bis of 16/07/2018. (Link)

Policy

- National sanitation policy, December 2016 (Link)
- National Urbanization Policy, 2015 (Link)
- National Environment and Climate Change Policy (MOE, 2019) (Link)

Information

- Rwanda Urbanization Development Project (RUDP 2) (Link)
- Kigali Central Sewerage project (Link)
- Musanze city master plan
- Manual on sewerage and sewage treatment (Link)
- Guidelines of the Austrian water and waste association (Link)

STAKEHOLDERS

- **Lead:** Water and Sanitation Corporation (WASAC)
- **Partners:** Musanze district, Rwanda Water Resources Board (RWB), WASH partners, Rwanda Agriculture and Animal Resources Board (RAB), Rwanda Environment management Authority (REMA), Rwanda Meteorology Agency (METEO-RWANDA), SNV-Rwanda, UNICEF-Rwanda, RURA and local NGOs
- **Approval:** Ministry of Infrastructure (MININFRA), Ministry of Finance and Economic Planning (MINECOFIN), Ministry of Environment (MOE)

5

NEXT STEPS

Short term – The short term defined here is early beginning of the project not exceeding five years after the project initiation. It will include:

- The Initiation of the project to secure buy in from the key stakeholders
- Data collection: gather all the information that is related to the project in order to define it and present it to stakeholders for further conviction. The data collection can be scaled up to the catchment level to make sure that all stakeholders are satisfied.
- Studies and detailed design: This involve reviewing research, study and understanding the area to be able to develop design.
- Capacity building of local technical staff

Medium term – The medium term defined here is between five to ten years after project initiation.

- Before the construction works, it will be vital to evaluate possible relocation mechanism of community's properties to be affected by the project and this will be done after carefully consulting designs.
- Implementation of 100% of the project will be achieved.

Long term – The long term was defined between 10 to 25 years.

- The public-private partnership for the implementation and management of the project/system
- Operation and maintenance of the facility

OUTCOME

- Sewage management facility is setup to facilitate improved services provision
- The improvement of sanitation services quality and reduction of waterborne disease among the community of Musanze controlled
- Improved groundwater quality
- Opportunities for circular economy
- Job creation during the development and implementation of the action (both skilled and unskilled)

COSTS/FUNDING

The cost of development of a sewage management and treatment facility is estimated to be medium due to its low complexity, but technical skills in establishment of the facility need to be considered. The cost of establishing a sewage management facility is estimated to be medium since it will require skilled personnel in the development and design of the facility and identification of required equipment for the facility to operate. The total cost of the project is estimated to be between 8 and 15 million USD depending on the capacity of the facility that will be proposed after carefully considering the sewage production of the city.

This cost estimation does not include the sewage collection and transportation to the site. The cost will cover the identification for the location of the facility, design, construction, and provision of initial equipment to operate the facility. It was identified by the stakeholders that the national budget cannot afford to develop the system and the funding was proposed to originate from grants and concessional loans from the World Bank or other Development Bank.

CASE STUDIES

- Water and wastewater recycling: Chennai, India. The aim of the project was to secure the industrial water supply in Chennai city through recycling sewage since the municipality usually cut the industrial water supply first whenever a shortage in water supply arises (Link)
- Water and sewage management project in Żory, Poland: the project mainly had the objective to increase sewage system connection rate, improve standards and reduce environmental impact of disposed waste and it also aimed at modernizing a part of the old water network in order to reduce leakages (Link)

VISION 6

VISION STATEMENT

Enhance storm water management for improved water resilience

RELATED CHALLENGES

Challenge 3.1: Lack of Sewerage System and Storm Water Management Plan

VISION DESCRIPTION

This vision is set to promote the development of a storm water management plan which will mimic nature, utilize natural features in the storm water cycle, which will be an asset to the community, and which will function efficiently with little maintenance. The plan will consider the improvement of existing drainage systems within the city and buffer zones and will be correctly delineated. The plan will minimize flood risks through on-site retention, and it will incorporate storm water infrastructure into urban setting. It is essential to manage storm water to considerably minimize threats to flooding, protecting receiving water bodies in the city, and promoting multifunctional use of storm water management systems and development of a sustainable environment.

While aiming for sustainable storm water management for improved water resilience, it is essential to focus on reducing run-offs from the source which will require small scale and localized interventions at household levels and the adapting to innovative storm water management approaches and technologies of water sensitive urban designs and nature-based solutions into the community premises. For an effective storm water management plan implementation, it will be crucial to assemble multi-disciplinary expertise and consult various units with interests or impact on management of drainage systems. This will ensure that a developed plan meets their approval and addresses the community needs.

THE FOLLOWING NEEDS ARE ADDRESSED BY THE VISION

- The need to develop a storm water management plan and align it with 2050 city master plan
- The need to improve drainage systems in the city
- The need to minimize flood risks through on-site run-offs attenuation
- The need for implementation of sustainable storm water management techniques such as permeable paving, detention ponds and infiltration trenches
- The need for adequately planning for green spaces to reduce flood risks from heavy rainstorms
- The need for promoting rainwater harvesting practices on public buildings and households' level buildings
- The need for a sustainable management of groundwater and surface water
- The need for providing additional water source alternatives for high level water users

OVERALL VISION RELEVANT ASSETS AND RESOURCES

- National Strategy for Transformation (NST1) in its section II: Economic transformation pillar, Priority area 7: Sustainable management of natural resources and environment to transition Rwanda towards green economy, Key strategic intervention 48: Develop a project to manage water flows from volcano region and other rivers to mitigate related disasters and improve water resource management. (Link)

VISION 6

- Rwanda Updated Nationally Determined Contributions (NDC), Adaptation measure N0 17 (Link)
- Rwanda Urban Development Project II (RUDP II) in its component 1: Support to the city of Kigali, Sub-component 1a: Integrated urban planning for resilient, inclusive infrastructure delivery, and Sub-component 1b: Evidence-based, sustainable wetland management, flood risk management, and greenhouse gas monitoring.
- Consider also its component 2: Support to secondary cities, Sub-component 2a: Infrastructure and service delivery in secondary cities. (Link)
- Water and Sanitation Sector Strategic Plan (2018-2024) (Link)
- Integrated Water Resources Management (IWRM) policy (Link)
- Water Resources Management Sub-Sector Strategic Plan (2011-2015) (Link)
- Environmental and Social Impact Assessment for Muvumba Multipurpose Dam Project (Link)
- Potential of Rain Water Harvesting in Rwanda- A deep-dive into Best Management Practices of Rain Water Harvesting Systems in Kigali (Link)

SHOCKS AND STRESSES

- Water quality
- Flooding
- Damage of properties and water-related infrastructure
- Water pollution
- Overflowing and formation of scatted stagnant water that contributes to further pollution and public health issues

OVERALL CHAMPIONS/STAKEHOLDERS

- **Lead:** Rwanda Water Resources Board and Musanze district
- **Partners:** Water and Sanitation Corporation (WASAC), WASH partners, Rwanda Agriculture and Animal Resources Board (RAB), Rwanda Environment management Authority (REMA), Rwanda Meteorology Agency (METEO-RWANDA)
- **Approval:** Rwanda Water Resources Board (RWB), Ministry of Infrastructure (MININFRA), Ministry of Finance and Economic Planning (MINECOFIN), Ministry of Environment (MOE)

ACTION 1.

6

Long term – Develop a storm water management plan to enhance water resilience in Musanze city

DESCRIPTION

A lack of storm water management plan in Musanze city has resulted in pressure on the roads drainage systems which were not designed to receive storm water from the vicinity of the city, and this makes the city vulnerable to catastrophic floods. The action to develop a storm water management plan need to be integrated in the city master plan to support adequate planning that will lead to success of storm water management as a whole. Development of storm water management plan will endeavour sketching out where relevant information should be assembled from and how the information should be integrated into the storm water management plan.

In the development process, the city is urged to adopt a multidisciplinary approach from inception to completion and acceptance by the city. This will be important to achieve the objectives in designing an effective storm water management system. The planning stage will consider stakeholders with mandates in managing drainage systems, legal and policy considerations at different levels (national, provincial, district, city), international conventions ratified by the country, incorporation of baseline information (catchment area in which the city resides, related catchment plans, storm water management master plans, and existing reports related to sensitivity of existing wetlands, rivers and ecosystems in the city) into planning stage, site analysis and topography, geology, soil and ground water, climate and hydrology. The storm water management plan will be characterized by drainage systems that convey storm water and allow infiltration to reduce flooding downstream and include bio-swales in the design that will help in conveying of storm sewers.

For water resilience enhancement, the storm water management plan will ensure a proper maintenance of existing drainage systems in the city, construction of new drainage networks and the upgrade of existing storm water networks, building resilient infrastructure including drainage networks for constructed roads and standalone drainage networks in the city neighbourhoods, adoption of nature-based solutions at community and city level, adoption of vegetated drains to allow infiltration, and the adoption of bio-retention swales in Musanze city. To ensure a sustainable implementation of the storm water management plan, the city will invest in proper urban planning of human settlement by allocating people from high-risk zones to safe zones and establishing buffer zones in drainage and storm water networks of Musanze city.

RELEVANT RESOURCES TO THE ACTION

Funding

- Grants
- Concessional loans (AFDB (African Development Bank) and the World bank)
- Private sector involvement through Private Partnership Program as per the guideline in the Official Gazette n°29bis of 16/07/2018. (Link)

Policy

- IWRM Policy (A Handbook for Integrated Water Resources Management in Basins, 2009) (Link)
- National Water Supply Policy, December 2016. (Link)
- National Urbanization Policy, 2015 (Link)
- Development of a storm water management policy (Link1, Link2)

Information

- Rwanda Urbanization Development Project (RUDP II) (Link, Link2)
- World Bank project to introduce NBS in urban areas. (Link)
- Musanze city master plan
- Third National Communication of Climate change (Link)
- Sister Cities of Musanze city information on water management such as Jinhua City in China (Link, Link2)

6

STAKEHOLDERS

- **Lead:** Rwanda Water Resources Board and Musanze district
- **Partners:** Water and Sanitation Corporation (WASAC), WASH partners, Rwanda Agriculture and Animal Resources Board (RAB), Rwanda Environment management Authority (REMA), Rwanda Meteorology Agency (METEO-RWANDA)
- **Approval:** Rwanda Water Resources Board (RWB), Ministry of Infrastructure (MININFRA), Ministry of Finance and Economic Planning (MINECOFIN), Ministry of Environment (MOE)

NEXT STEPS

Short term – Conducting preliminary activities:

- This stage of development of storm water management plan will focus on identifying relevant stakeholders and gaining their commitment then establish action framework and scope and defining city's sub-catchments and required information.
- Identification of the status of the city which will focus on catchment characteristics, condition and practices considering the assessment of values of receiving environment.
- Identification and assessment of land use activities with potential to be damaged by impacts of storm water quantity or quality.

Medium term – Establishing and implementation of prioritization process:

- =This stage will focus on identifying priority issues to manage within the city with consideration of management options and strategies
- =Development of management actions and preparation of implementation plan that will identify estimated costs and funding options, allocate responsibilities and timelines and identification of partnership arrangements to be established with stakeholders.
- =Preparation of draft storm water management plan, stakeholder's review of the plan, finalization of the storm water management plan and its approval by the competent authorities.

Long term – Implementation of the plan:

- Implementation of the recommended actions of the plan considering the adoption of Nature Based Solutions (NBS)
- Performance monitoring and review

OUTCOME

- Reduction of water runoff within the city
- Improved budget coordination in storm water-related spending
- Reduced road and building flooding risks
- Reduced public health/safety and environmental risks from storm water infrastructure
- Reduced water quality issues in receiving water bodies of Musanze district
- Reduced cost of maintenance and upgrading of drainage network of the city
- Increased natural groundwater recharge

COSTS/FUNDING

The cost of developing a storm water management plan will be a medium cost and can be considered as a high cost when it comes to implementing the planned activities. The funding for the development of the storm water management plan can be partly funded by external grants but the cost of implementing storm water infrastructures needs to be identified first in order to determine potential funders. Potential funders for this kind of project can include the World Bank and development banks.

CASE STUDIES

Flood Simulation Modelling; Da Nang, Vietnam: the project aimed at integrating simulated urban flooding under current and future climate and urban development scenarios into the city planning processes to build climate resilience. (Link)

ACTION 2.

6

Short term – Develop a rainwater harvesting strategy to mitigate flood risks in Musanze city

DESCRIPTION

Developing a rainwater harvesting strategy in Musanze city to mitigate flood risks is part of the city's journey towards water resilience. A rainwater harvesting strategy puts in place best practices to reduce run-offs from industrial, commercial, institutional, and public buildings, at the household level and even from steep slopes of Musanze city. Implementing the rainwater harvesting strategy will reduce flood risks and increase water efficiency, reforestation, and terracing initiatives to control soil erosion. The combination of the implementation of both the storm water management plan and the rainwater harvesting strategy will minimize flood risks and improve the quality of discharge and integrate rainwater best practices into water infrastructure and urban settings.

Considering the importance of rainwater harvesting (RWH), the strategic priority actions to be undertaken under the strategy will aim at setting up a policy, legal and institutional framework that proposes an effective legal and policy framework for promotion of RWH and creates appropriate incentives to increase existing RWH activities in the city. The strategy to be developed will contribute to development infrastructure of RWH and storage, equipping public buildings and households with basic RWH systems, harvesting run off water from the road networks and constructing dams, ponds, and irrigation channels that will increase water availability and security.

Musanze city is characterised by abundant rainfalls that makes the city on pressure to promote and adopt a sustainable rainwater harvesting strategy that will include rainwater harvesting promotion activities for all households, institutions and production activities. It will include the development of guidelines and regulations for rain water harvesting including recommendations on appropriate technologies.The strategy will also identify and train local technicians and urban artisans for rolling out the rain, and will organize mobilization and sensitization and demonstration activities for rain water harvesting in all the city neighbourhoods.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget
- Community Contribution
- Mobilization of Private sector through low interest loans.

Policy

- Smart city policy (Link)
- National sanitation policy (RURA, 2016) (Link)
- National water supply policy (RURA, 2016) (Link)
- National Environment and Climate Change Policy (MOE, 2019) (Link)
- National Water Supply Policy Implementation Strategy (MININFRA, 2016) (Link)

Information

- National rainwater harvesting strategy (MINIRENA, 2016). (Link)
- Improving Water Security in Rwanda through Rainwater Harvesting (MOE,2019) (Link)
- Potential of Rainwater Harvesting in Rwanda (Centre for Science and Environment (CSE), 2019) (Link)

Other assets

Existing rooftop and gutters on houses

STAKEHOLDERS

- **Lead:** Musanze district and Ministry of Infrastructure (MININFRA)
- **Partners:** Rwanda Housing Authority (RHA), Water and Sanitation Corporation Ltd (WASAC), Ministry of Environment (MoE), Rwanda Resources Board (RWB), World Vision, United Nations International

for Children's Emergency Fund-Rwanda (UNICEF-Rwanda), WASH partners

- **Approval:** Ministry of Infrastructure (MININFRA), Ministry of Environment (MoE) and Ministry of Finance and Economic Planning (MINECOFIN)

NEXT STEPS

Short term – The short term defined here is from one to two years and this period will focus on introducing and strengthening research on RWH systems. The research will focus on:

- Rainwater harvesting potential for Musanze city,meaning the amount of rainfall that can be collected in Musanze city
- Understanding the layout of the city. This will serve in providing the data/information on where RWH systems can be applied
- Conducting regular surveys on RWH system
- Conducting technical and feasibility studies on RWH applications
- Projections of RWH systems for the future of the city

Medium term – The medium term defined here is from two to three years and this period will focus on development of RWH strategy for the city. This section will focus on:

- Developing RWH strategic action plan
- Developing MIS on RWH interventions
- Awareness raising and capacity building

Long term – The long term defined here is from 3 to 5 years and this period will focus on the implementation of RWH strategy. This will be including:

- Developing RWH strategic action plan
- Developing MIS on RWH interventions
- Awareness raising and capacity building

OUTCOME

- Reduced soil erosion
- Reduce flood risks
- Increased ground water recharge
- Strengthened policies, legal and regulatory framework for improved rain water harvesting coordination and management
- Increased rainwater harvesting infrastructures
- Reduced water consumption in the city
- Enough water for landscape irrigation
- Reduced pollution of water bodies

COSTS/FUNDING

The implementation of rainwater harvesting strategy is a project-based intervention and often in short-term which makes it not difficult to synergize and scale up. Depending on the number of people that will intend to implement rainwater harvesting strategy, the cost may elevate. However, the cost was roughly estimated between 1 million and 10 million USD as minimum and maximum respectively to implement the project. The maximum budget was estimated if the plastic tanks are provided to at least 90% of the households of the city provided that the installation cost is contributed by the community while the minimum budget was estimated considering that some of the household already have tanks in their home.

CASE STUDIES

- Rainwater4Sale project in Lwengo District, Uganda: the project aimed at evaluating the business opportunities for rainwater harvesting system whereby the tank was loaned to local entrepreneurs and selling the water in order to repay them into instalments (Link)
- Metropolitan Atlanta Rapid Transit Authority (MARTA) Atlanta, Georgia: the project aimed at effectively reducing the impacts of stormwater runoff onsite and provides irrigation for the grounds without using potable water. The rainwater is harvested from train stations and they are filtered using a WISY WFF150 filters to be supplied for irrigation (Link)

ACTION 3.

6

Short to medium – Application of Nature Based Solutions (NBS) in informal and formal settlements of Musanze city to build water resilience

DESCRIPTION

To create the right enabling environment in Musanze city that encourages transformation towards sustainable and resilient communities, optimizing resources while protecting and restoring water-related ecosystems in urban areas, nature-based solutions (NBS) application in both informal and formal settlements are proposed as the correct approach to enhance water security. This will be done by improving water availability and water quality while at the same time reducing water-related risks and generating extra social economic and environmental benefits.

Applying NBS in urban settlements of Musanze is of great importance because it will address water availability challenges given that NBS are multi-functional, addressing water availability (scarcity and supply), water quality and risks. This approach will include the management of catchment outside the city that improves supply into urban areas, improved recycling of water within urban water cycles (wastewater reuse trough NBS) and the deployment of green infrastructure within urban boundaries. In addition, application of NBS will offer opportunities to reduce conflicts between sectors over water use through improved system performance (tensions between agriculture water users downstream and mining activities upstream because of siltation of the river).

Solid wastes management has appeared as an issue impacting water quality in Musanze city. This problem can be solved through the application of NBS (green infrastructures) that can contribute to solid wastes collection and the reduction of water pollution at the sources and downstream. One of way of implementing NBS is through green infrastructures, and they provide valuable regulating ecosystem services in respect to global climate regulation by reduction of greenhouse gas concentration through carbon storage and sequestration, water flow maintenance and flood protection. Another implementation of NBS that can be applied is the bioswales which are vegetated, shallow, landscaped depressions designed to capture, treat and infiltrate storm water runoff as it moves downstream. Bioswales are an effective type of green infrastructure facility that can be implemented in Musanze in slowing runoff velocity and cleansing water while recharging the underlying groundwater table.

RELEVANT RESOURCES TO THE ACTION

Funding

- National Budget
- Community contribution
- Mobilization of Private sector through Public-private partnership (PPPs) mechanisms

Policy

- Smart city policy (Link)
- National Environment and Climate Change Policy (MOE, 2019) (Link)
- National Policy and Strategy for Water Supply and Sanitation Services (MININFRA, 2016) (Link)

Information

- A post-pandemic, nature-based tourism, and conservation Recovery Plan for Rwanda (World bank Group, 2021).(Link)
- Smart city master plan (UN Habitat) (Link)
- Governing Smart Cities: Policy Benchmarks for Ethical and Responsible Smart City Development (Link)
- Nature-based flood adaptation measures in informal settlements, Mpazi sub-catchment, city of Kigali, RWANDA (RYWP, 2021).
- Accelerating adaptation through large-scale nature-based solutions (Water Adaptation Community (WAC), 2021) (Link)
- Strategic plan for the environment and natural resources sector 2018 – 2024 (MOE, 2017) (Link)

6

Other assets

Existing permeable pavement at some homes

STAKEHOLDERS

- **Lead:** Musanze district and Ministry of Infrastructure (MININFRA)
- **Partners:** Rwanda Housing Authority (RHA), Water and Sanitation Corporation Ltd (WASAC), Rwanda Transport Development Agency (RTDA), Ministry of Environment (MoE), World Vision, United Nations International for Children's Emergency Fund-Rwanda (UNICEF-Rwanda), WASH Partners, Rwanda Water Resources Board (RWB)
- **Approval:** Ministry of Infrastructure, Ministry of Environment and Ministry of Finance and Economic Planning

NEXT STEPS

Short term – The short term defined here is betweenone to three years and this period will focus on:

- Piloting project of possible NBS.
- Community education and demonstration of the benefits of NBS to their environment.
- Identify suitable NBS to be applied on individual areas.

Medium term –The midterm defined here is between three to five years and this period will focus on:

- Scaling up the NBS application to institutional level.
- Implementation of NBS on a large scale.

Long term –The long term defined here is after five years and this period will focus on:

- Capacity development for technical staff of the city on further application of NBS and continuous update on upcoming alternatives of NBS.

OUTCOME

- Reduced water disaster risks
- Resilient city
- Improved water management
- Long-term food security
- Increased carbon sequestration
- Restored ecosystem
- Natural hydrologic regime maintained

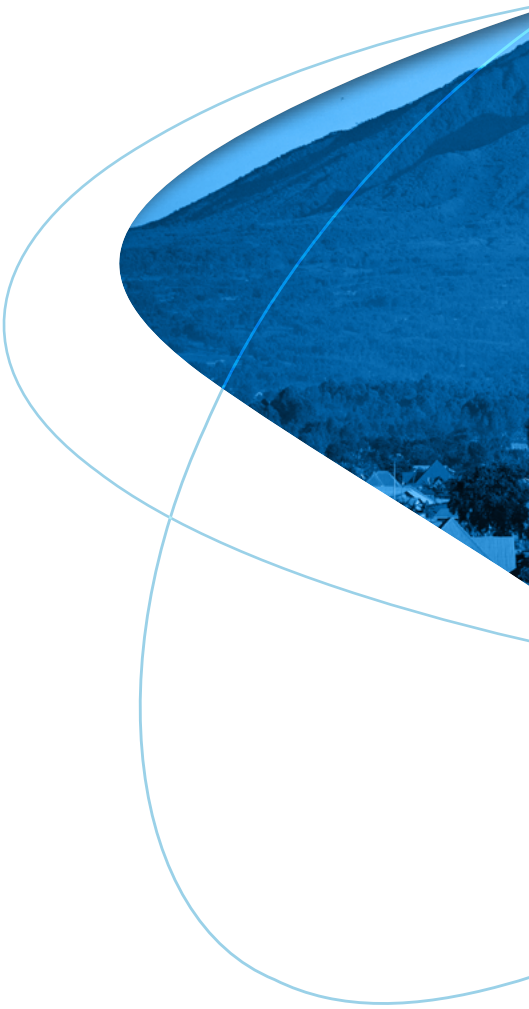
COSTS/FUNDING

The investment in NBS is an opportunity to stimulate the economy by creating jobs in Musanze city. However, it is very crucial to identify how NBS can fit into existing planning and investment decision making process and to identify how these processes need to be adjusted to remove distortion so that NBS can be considered on equal playing field to other options.

The funding for the implementation of NBS can come from government budget, community contributions and from public private partnership. However, the cost was roughly estimated between 1 million and 5 million USD as minimum and maximum respectively to implement the project. The maximum budget was estimated because some NBS can require the relocation of some households while the minimum budget was estimated considering that the community acceptance and ownership might be high hence, they can contribute in the implementation process of the project.

CASE STUDIES

- NBS for greening the urban space: Bari, Italy: The project is aimed at rethinking the urban spaces in a green way in order to improve urban quality, reduce the urban heat island effect and manage storm water (Link)
- Nature-based Solutions on the RISE in Makassar: The pilot project aims to reduce the impact of climate change on marginalized communities by providing localized, water-sensitive interventions that address issues related to sanitation and water management (Link)



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