



The Msimbazi Opportunity

Transforming the Msimbazi Basin into a Beacon of Urban Resilience

Executive Summary



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Client:



President's Office – Regional Administration and Local Government



Financier:



Contractor:



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Acknowledgements

Responding to the call of Vice President of Tanzania, Honourable Samia Suluhu Hassan, to pragmatically address the recurrent flood risk in Dar es Salaam, the Msimbazi Opportunity Plan was developed through a participatory design process, known as a 'Charrette', that was undertaken from January to August 2018. It is the result of the invaluable time and dedication of more than 200 people, from 59 institutions and communities, across 30 working sessions.

This unprecedented approach benefited from, and was championed by, Selemani S. Jafo (MP) Minister of State, President's Office Regional Administration and Local Government and January Y. Makamba (MP) Minister of State, Vice President's Office, Environment and Union Affairs.

The collaboration and consensus building achieved through this process would not have been possible without the sustained efforts of the Dar es Salaam Metropolitan Development Project team within the President's Office for Regional Administration and Local Government, led by Engineer Davis Shemengale.

Through committing to the delivery of a unified solution to one of Dar es Salaam's most pressing challenges, the Charrette brought together stakeholders from the Dar es Salaam Regional Administrative Secretariat, Dar es Salaam City Council, Ilala Municipal Council, Kinondoni Municipal Council, Ubungo Municipal Council, DART, DAWASA, DAWASCO, Ministry of Lands Housing and Human Settlements Development, Ministry of Water and Irrigation, Ministry of Works, National Environmental Management Council, Wami Ruvu Water Basin Authority, Prime Minister Office – Disaster Management Department, TANESCO, TANROADS, Vice President's Office, Ardhi University, Korea Eximbank, Department for International Development, National Land Use Planning Commission, Private Sector Representatives, Tanzania Forest Service, National Housing Corporation, Tanzania Meteorological Agency, Non-Government Organizations, and critically Community Representatives from Hanasif, Idrisa, Mchikichini, Kigogo Kati, Kigogo Mkwajuni, Msimbazi Bondeni, Magomenu-Mapipia, Mikumi, and Suna subwards among others. A full list of participants can be found in Volume C.

A flagship of the Tanzania Urban Resilience Program, the Charrette process was coordinated by Nyariri Nanai (Senior Engineer) of the President's Office for Regional and Local Government, and Eric Dickson (Senior Urban Development & Disaster Risk Management Specialist) and Edward Anderson (Senior Disaster Risk Management & ICT Specialist) of the World Bank.

The Charrette process was facilitated by a consortium of Max van der Sleen (Ecorys), Remco Rolvink (DASUDA), Bas van de Sande (CDR International), and Christina Geoffrey Mandara (WEMA Consult). Detailed review and comments were provided by a World Bank team comprised of Amy Faust (Urban Development & Resilience Consultant), MaryGrace Lugakingira (Urban Planning Consultant), Mussa Natty (Engineer Consultant), Nyambiri Kimacha (Disaster Risk Management Consultant), and Larissa Duma (Urban Ecology, Environment, and Sanitation Consultant).

Special thanks are due to UK aid for their generous funding and support, without which the visionary outcomes of the Charrette process would not have been possible.

Through the collective contributions of such a wide and diverse set of stakeholders, a unique opportunity lies ahead to transform the Msimbazi Basin into a beacon of urban resilience.

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Introduction

This report sets out the Msimbazi Opportunity Plan designed by the Msimbazi stakeholder team over the period January to August 2018. Volume A presents the basin wide Strategy and Management Framework. Volume B describes the Detailed Plan for the Lower Basin. Volume C provides additional information in Appendices. The expectation is that this first Detailed Plan can be realized over a five-year period 2019-2023. Extension further upstream is envisaged for a second and third stage of implementation of the Msimbazi Opportunity Plan.

The Setting

The Msimbazi River and its tributaries flow through the heart of Dar es Salaam, the commercial capital of Tanzania. The city's population growth is one of the fastest in the world and an estimated 70% of urban development is unplanned. The Msimbazi Basin covers an area of 271 square kilometers and is the home of 27% of the city population. In the riverine areas, and especially the Lower Basin and Lower Middle Basin, the city's most severe flooding takes place, putting residents, livelihoods, properties, and critical infrastructure at risk after heavy rainfall.

A number of studies have been undertaken in the Msimbazi Basin which underscore the complexity and interconnected nature of measures needed to improve the situation. In order to develop a comprehensive understanding a participatory design process was initiated by PO-RALG, which was tailor made and based on the "Design Charrette" methodology.

*In the **Upper Basin** low-density peri-urban development is rapidly transforming land use, as farms are converted to residential and other uses. Rainwater absorption is becoming more limited, and the resulting stormwater runoff is draining into the Msimbazi River and tributaries, as is eroded sediment.*

*The **Upper Middle Basin** is urbanized and experiencing rapid densification. Riverbanks in this area are prone to severe erosion.*

*The **Lower Middle Basin** is also urbanized, and most of the area's development is already consolidated with little room for further densification.*

*The **Lower Basin** covers 400 hectares of mainly floodplains covered by a Mangrove forest in the tidal area near the sea outlet, and by wetlands and sandy plains created by sediment deposits after flash floods. Artery roads cross this area and the Dar Area Rapid Transit bus depot is located alongside Jangwani Bridge on Morogoro Road. In this part of the basin unplanned, informal settlements are distributed over the floodplains*

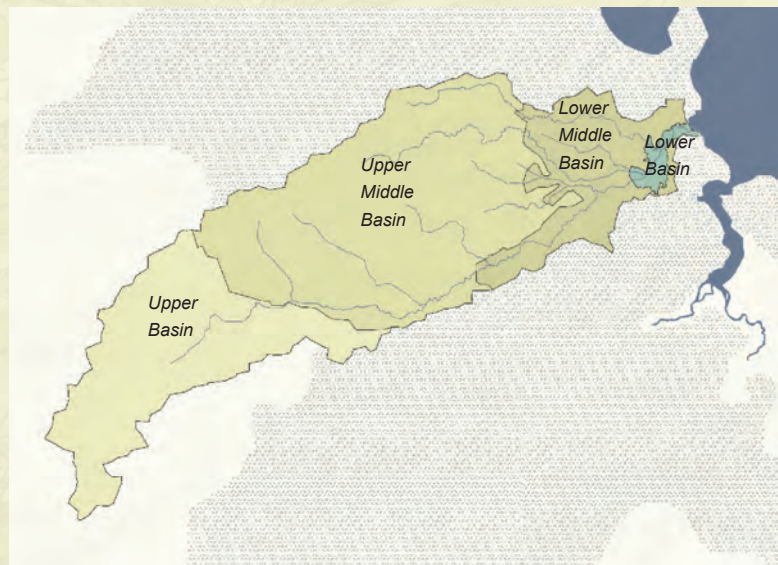



Figure ES-1: Map of the catchment zones

In January 2018 the Vice President of Tanzania Honorable Samia Suluhu convened a meeting on the severe flooding that regularly affects Dar es Salaam. It was concluded that a task force was needed to coordinate various government initiatives and provide guidance for the future with respect to flood protection and environmental restoration. The series of design charrettes organized by PO-RALG provided the starting point for this coordination in the Msimbazi Basin.



In the Msimbazi Charrette process, stakeholders from the highest levels of government to the grassroots of the community, from civil society to private sector, have come together to determine how to best address the multi-faceted challenges posed by the recurrent flooding in the Msimbazi. In less than 9 months, 8 stakeholder workshops and 49 meetings were held which involved more than 150 individuals from 59 institutions. They collected information to understand the complexity of the flood risks and environmental degradation; explored solutions; and designed the Msimbazi Opportunity Plan (MOP) for transforming the Msimbazi Basin in Dar es Salaam into a beacon of urban resilience.

“Charrette” is a French term for a participatory planning process in which representatives from all stakeholder groups including community members, national and local Government, knowledge and education centers, industries, and the relevant professional service organization are assembled in one stakeholder team and are given the task and mandate to design the best possible solutions for a complex problem that affects them all. The stakeholders commit themselves and/or their organizations to the actions designed as part of the solution.

Design Charrette

The underlying data that supported this process included baseline assessments, the development of an elevation and customized flood model, and an analysis of the Msimbazi’s sedimentation dynamics.

This Msimbazi Charrette process thus matched science with local Mtaa level knowledge to gain the insights needed to comprehend the complexity the Msimbazi challenge, and to collectively define appropriate solutions. The Msimbazi stakeholder team developed the MOP as their unity of purpose and delivered the Strategy and Management Framework and the Detailed Plan for the Lower Basin. These documents provide an input for what can become a multi-annual investment program for flood risk protection, environmental restoration and urban development in the Msimbazi Basin.

The Msimbazi Challenge

The Msimbazi Valley is a beautiful, vast greenspace in the center of Dar es Salaam. Historically, the river served as an important water source, and the fertile floodplain provided prime land for agriculture and animal grazing. However, the once-perennial river is now seasonal – the riverbed is almost completely dry for much of the year. During the rainy seasons the river changes its character dramatically. When the rains come the river revives, and when it rains heavily (more than 50mm over 24 hours) in the Msimbazi Basin, flash flood conditions can occur along the river and its many tributaries including the Sinza, Kibangu and Kinyerezi. Within a matter of hours the riverplains inundate with depths up to two meters or more. Severe floods in 2009, 2010, 2011, 2014, 2015, 2017, and 2018 have shown how vulnerable the communities are that have settled in the unplanned and unserviced riverine lands and valley edges. These flood events have both direct and indirect impacts on the city and its residents including: (i) injuries and loss of lives, damage to houses and personal belongings, (ii) interruptions in income earning activities (livelihood losses), (iii) damage to infrastructure assets and interruptions in urban mobility/connectivity, and (iv) damage to ecosystem-services and loss of biodiversity.



Floods

Major flooding occurred in April 2018, affecting thousands of people. The most severe flood recorded was in December 2011, when 10,000 people were displaced from their homes and an estimated 42 fatalities occurred. In the immediate aftermath, 680 of the most affected households were resettled to Mapwepande, 25 kilometers North of Dar es Salaam. Over time a total of 1,007 plots were allocated and 3,400 people were relocated.


Over the last fifty years, urbanization pressure has gradually reduced the water retention capacity in the wider basin and has created various blockages for natural water discharge. The construction of urban infrastructure within the floodplain, coupled with high levels of sedimentation arising from deforestation and erosion, has negatively impacted the ability of the river system to discharge stormwater. Other important functions of the river basin are also negatively affected such as the supply of safe drinking and grey water, and the space and conditions for biodiversity, rich coastal forest and mangrove vegetation. In addition, the locations for settlement along the edges of the river plains has become less safe and healthy. Moreover, the floods damage public and private infrastructure assets including roads and bridges that cross the Msimbazi Basin and are essential for Dar es Salaam as transport corridors. Furthermore, the changes in the nature of the river prevent the use of the plains for growing healthy food for the city population; and previous public, open-access, spaces for sports and leisure activities have turned into polluted swamp land.

With the deterioration of the river's natural equilibrium, the ecosystem services that the Msimbazi Basin provides have similarly declined in quality and function. This has resulted in a now urgent need to proactively implement measures that will support the restoration of this equilibrium, in order to bring to bear significant benefits for the city, and the vulnerable communities living in the Msimbazi valley and Lower Basin.

The governance framework for the Msimbazi Basin is complex, uncoordinated and lacks clear delineations of the responsibilities. This presents a barrier for cross-sectoral coordination, cooperation and communication to cope with these complex challenges.

Drivers of Urban Flood Risk

Human activity linked to urban development and natural resource exploitation are the main causes for the recurrent disasters in the Msimbazi Basin. The flooding events are linked to seven main challenges: (i) Urbanization and deforestation; (ii) Soil erosion and increased sedimentation; (iii) Infrastructure barriers; (iv) Solid waste dumping; (v) Inadequate storm water and sanitation infrastructure; (vi) Climate change effects; and (vii) Vulnerable living environments. The Msimbazi is a highly dynamic river system that is facing immense human and environmental pressures. Its shape and depth change continuously, primarily due to intense erosion upstream, which contributes to heavy sedimentation downstream. Deforestation, sand extraction and uncontrolled development have left exposed soil which is transported by heavy rains, and which is deposited around bridges and in the river's lower stretches. Wetlands that once filtered and absorbed stormwater are shrinking due to competition from expanding urban development, further reducing natural rainwater infiltration. The river is also used as an informal dumping ground for solid waste from communities lacking practical and affordable alternative waste disposal options; rains carry waste downstream, further clogging bridge



culverts. Further, exposure to flooding is higher than it was in the past; there are thousands more residents and far more public infrastructure and other assets than there had been in previous decades, so more is now at stake when flooding occurs.

Due to extreme urbanization pressures all over the Msimbazi Basin, the morphology of the river has become imbalanced and its ecosystem degraded. This has a significant negative impact on Dar es Salaam. The Msimbazi flash floods threaten lives, destroy properties and livelihoods and incapacitate critical infrastructure for connectivity in the city.

Negative Impact of Urbanization

The Risk of Inaction

Without intervention, the flood risks in the coming decades will further increase as a result of continued urbanization pressures and climate change. The current population of Dar es Salaam is estimated at 6 million people. The city is expected to reach megacity size, with more than 10 million people, by 2030. District population data (2011) from the most recent Census (2012) show that 1.2 million people (27% of the city population) lived in the wider Msimbazi catchment. Extrapolation of this data with the current growth rate suggests that the catchment's population is currently close to 1.6 million with 250,000 in the Lower and Lower Middle Basin areas between Selander Bridge and the Nelson Mandela Road. Some 50,000 people are exposed to flood risks caused by river flooding and rain induced flooding due to poor storm water drainage. It is estimated that 8,000 -10,000 households live in areas exposed to river flooding that is considered unsafe and unsuitable for human settlement. Using the population growth projections (3%) of the Bureau of Statistics, the Msimbazi Basin could become the home of 2.5 million people in 2030. That is twice the amount of 2011. If this urban densification takes place without strict land use zoning and enforcement of regulations, it can only reasonably be expected that the relative disaster risk will rise with the frequency and severity of flooding increasing, and the human and economic costs rising in parallel.

Climate change will further compound these risks. Climate change vulnerability and adaptation studies show that the city is already experiencing more concentrated rainfall, heavier flooding, and higher mean temperatures than in previous decades. In the period up to 2050 no significant change in the annual average rainfall is expected, but the intensity of the rainfall and the average temperatures will increase further with longer and more frequent heatwaves. Sea level rise is not a significant factor for the Msimbazi Basin because of its natural elevation.

A Call for Action

The Charrette process has galvanized support from all levels for an integrated course of action that will result in significant benefits for the city. Civil engineering works, such as dredging, will increase the water conveyance capacity of the river. Ecological interventions, such as upstream reforestation, will reduce erosion and sedimentation. Improved land use planning and enforcement will keep people and assets out of harm's way, and some hazardous areas can be reclaimed and made safe for urban development. Nonetheless even with the proposed interventions, most of the valley's lowest-lying lands will remain unsafe for human habitation. In these areas, residents can be resettled according to international best practice, and flood-prone land can be transformed into a wetland park that provides both recreational and ecological value for the city of Dar es Salaam.

Overview
Volume A:
Strategy and
Management
Framework

**Transforming the Msimbazi Basin into
a Beacon of Urban Resilience**



Together, we have redesigned the Msimbazi, as beautiful, green, open city parks that are clean and safe from flood risks and offer prime locations for housing, sports and enjoying nature in the heart of Dar es Salaam.



Figure ES-2: Existing and envisioned Msimbazi River in the Lower Basin

The Msimbazi Opportunity Plan

- i. From a hazardous area for people to the green heart and lungs of the city;
- ii. From a flood hazard area to an iconic city park surrounded by prime real estate for urban development;
- iii. From a liability to an asset for Dar es Salaam.

The lungs of the city

- i. The Pugu-Kazimzumbwi natural forest reserves;
- ii. The wooded areas in the upper & middle valleys alongside the riverbanks; and
- iii. The Mangrove forest and wetlands between Hananasif and Upanga.

Extending the surface area and quality of these eco-system elements will help Dar es Salaam improve its resilience. These interventions will: (i) improve the water retention capacity in the catchment area and help reduce vulnerability to flooding; (ii) increase carbon capture and mitigate climate change; and (iii) help the city adapt to global warming by developing a cool corridor in the city center.

The heart of the city

- i. An iconic city park bordering the business center; and
- ii. Other parks further upstream.

The Lower Basin between Selander Bridge and Kawawa Road becomes the location of a multi-functional city park of 400 hectares with three activity zones: (i) The river zone is a flood plain that caters for large volumes of water during peak flows after heavy rainfall events but in a controlled and non-hazardous way; (ii) The river plain is also a natural reserve of wetlands and mangrove forests, rich in biodiversity; and (iii) The terraced zone in which the first level is used for sports and leisure activities, but can accommodate occasional flooding, while a second terrace and valley edge surrounding the Lower Basin are safe from riverine flood hazard. This is the location of 57 hectares of real estate for mixed urban functions including social housing, social amenities, offices and commercial real estate.

Redesigning the Msimbazi

The stakeholders envisaged four strategies to redesign the Msimbazi: Mitigate, Protect, Transform and Govern. The Mitigate Strategy aims to reduce the flood hazard itself. The Protect Strategy aims to reduce the people, properties and vital infrastructure that are exposed to the flood hazard. The Transform Strategy aims to convert the most flood-prone areas of the river valley into a City Park and redevelop surrounding neighborhoods. The Govern Strategy aims to put in place a planned and coordinated process for urban development and eco-system restoration in the Msimbazi Basin, and thus stop the current uncontrolled urbanization process that results in increased flooding.

4 Strategies, 10 Strategy Components, 48 Interventions



Strategy No 1: Mitigate

The Mitigate Strategy aims to limit the severity of flood hazard and comprises four Strategy Components (SCs) and 19 interventions in the long and short term: SC No 1. Restore the natural ecosystem and make room for the river; SC No 2. Increase water retention and harvest rain water; SC No 3. Control erosion and sedimentation; and SC No 4. Enhance water conveyance capacity.



Strategy No 2: Protect

The Protect Strategy aims to establish location-specific protection of people, livelihoods and assets from flood exposure, and comprises two SC's and 10 interventions: SC No 5. Protect against flooding; and SC No 6. Resettle people and businesses.



Strategy No 3: Transform

The Transform Strategy aims to convert the most flood-prone areas of the river valley into a City Park and redevelop surrounding neighborhoods and comprises three SCs and 15 interventions: SC No 7. Improve Msimbazi river water quality; SC No 8. Improve solid waste management; and SC No 9. Develop City Parks.



Strategy No 4: Govern

The Govern Strategy seeks to put in place a planned and coordinated process of integrated governance and thus stop the current uncontrolled urbanization process that is making the river valleys and basin unsafe and unhealthy for human activity. The Govern Strategy comprises: SC No 10: Good governance for coordination, cooperation, communication and finance.


Ten Strategy Components

Taken together the ten Strategy Components provide the framework for a multi-annual program and action plan for realizing the Msimbazi Opportunity in a phased implementation process.

Next steps: The Way Forward

The short-term time horizon for Stage 1 of the Msimbazi Opportunity Plan is 2023. Over the five-year period between 2019-2023, the Lower Basin from Selander Bridge to the Kawawa Bridge can be transformed from a degraded area where people's lives, assets and infrastructure are highly vulnerable to flood risk, to a newly landscaped city park, where infrastructure assets are safeguarded, people are no longer in harm's way, and new terraced areas provide safe spaces for housing, commercial activities, sports and leisure.

In the medium term, from 2024 to 2031, Stage 2 and Stage 3 of the MOP are planned. Stage 2 covers the Lower Middle Basin between Kawawa Bridge and Nelson Mandela Road; and Stage 3 extends the project into the Middle Basin from Nelson Mandela Road upstream. Working upwards from Selander Bridge through the Stages 1, 2 and 3, the drainage capacity of the



river can be increased by structural engineering works. The three stages all include: sediment removal, deepening and widening the main Msimbazi channel; using the dredged materials for terrace building; removing obstacles from the river plains; and widening bridge openings.

To improve and increase the water infiltration and retention capacity of soils, rehabilitation of the natural ecosystems in the watershed is needed. In combination with a planned and coordinated approach to resilient urban land-use development this will contribute to reducing peak flows and the riverine flood hazards. Essential for this planned outcome are the reforestation and rehabilitation of the Pugu-Kazimzumbwi natural forest reserves, the mangrove forest restoration and expansion, and the rehabilitation and expansion of the fresh and salt water wetlands in the river plains of the Lower Basin.

The long-term time horizon for the Msimbazi Opportunity Plan is 2050. By that time the proposed interventions will have been implemented and their impact fully realized. A new balance in the Msimbazi Basin will have been attained characterized by lower flood risk and effective protection of the urban environment.

An Action Plan for Implementation

The tasks for the newly established Project Implementation Unit are listed under five headings:

- i. Maintain the momentum created by the Charrette process;
- ii. Create the planning and management framework;
- iii. Complete the planning process;
- iv. Coordinate the implementation of Stage 1 interventions; and
- v. Implement the Msimbazi Opportunity Plan.

Priorities

Start the preparations through a Steering Committee and Program Implementation Unit (PIU) to maintain stakeholder commitment and to provide the capacity needed to prepare and implement the MOP; and take steps to establish the Msimbazi Planning Authority (MPA) as an Executive Agency for the Msimbazi Basin. Subsequently the MPA can set up the Msimbazi Area Development Corporation (MADC) to attract private capital for the development of the City Park in the Lower Basin.

Make the 400 hectares of the Lower Basin a Special Investment Zone. The City Park concept offers significant opportunities for private investment. To gain investor confidence and mobilize private investment it is proposed to design the investment conditions together with the private sector, using the “The Msimbazi Opportunity” to market the special investment zone world-wide.

Strategy Components

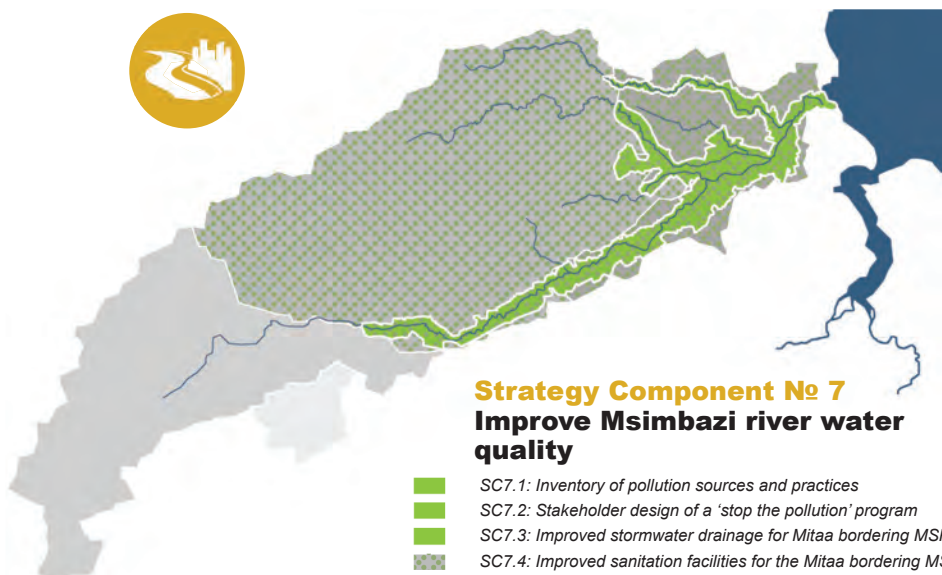
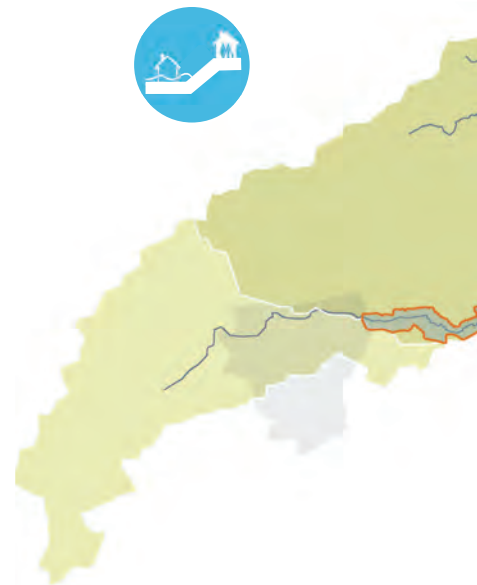
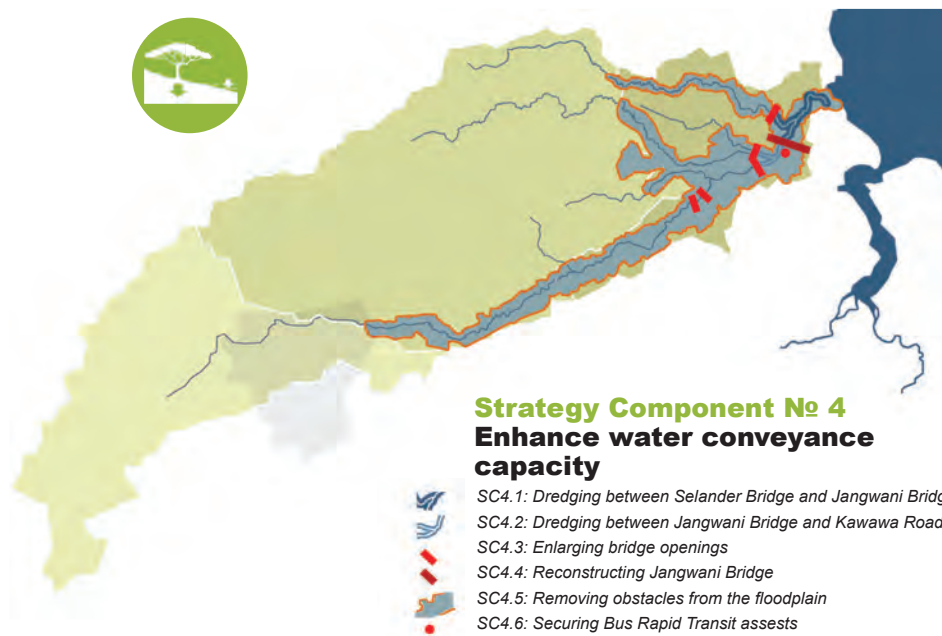
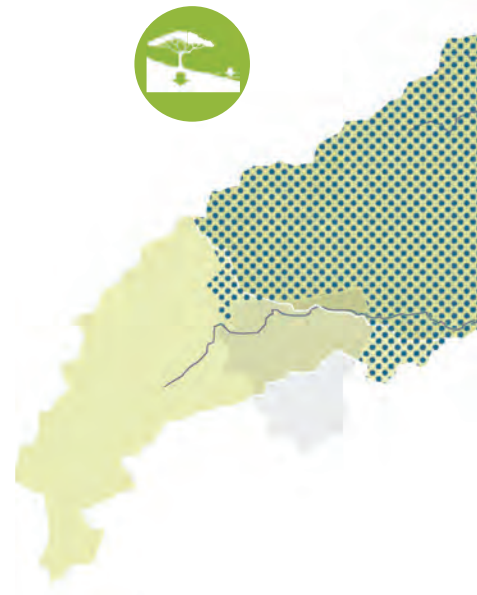
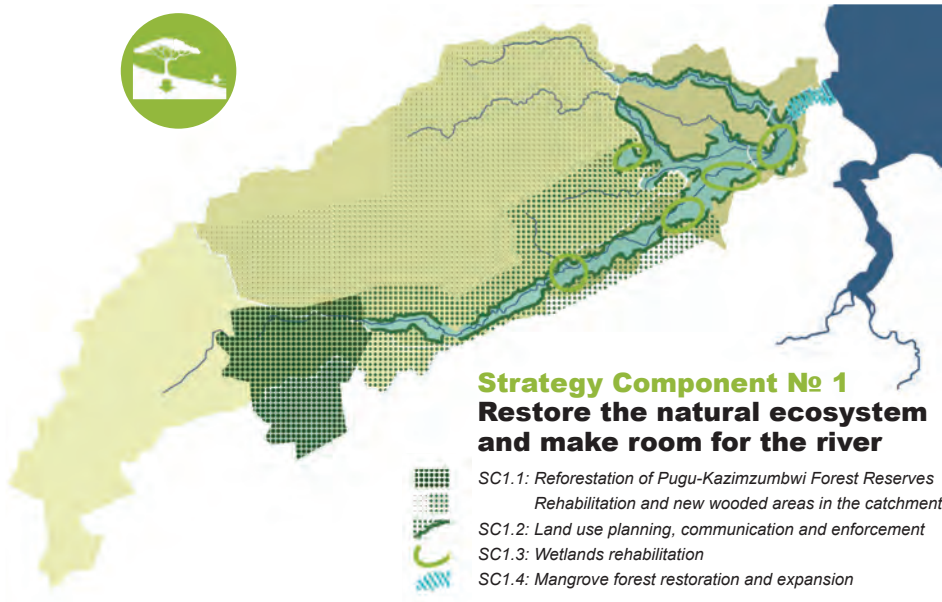
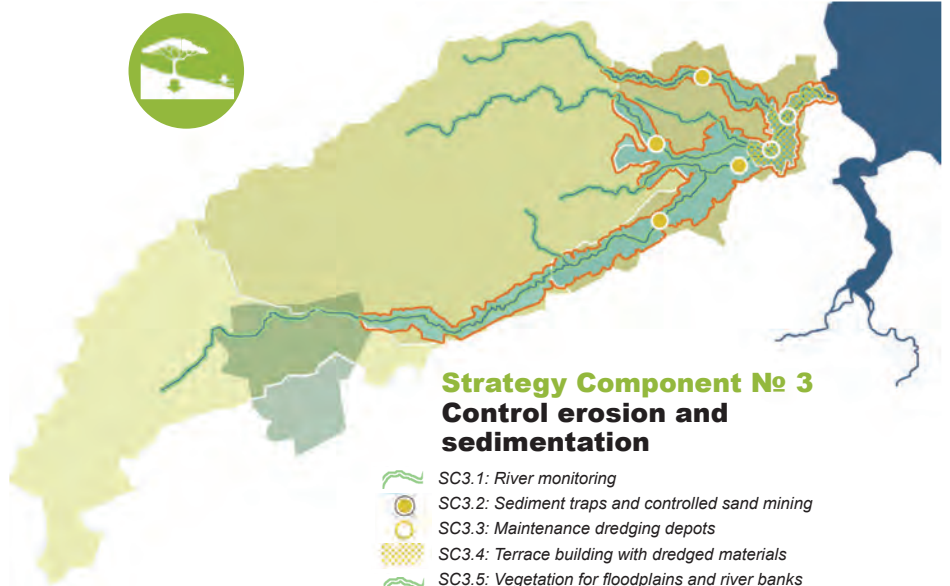


Figure ES-4: Overview of Strategy Components with spatial interventions



Strategy Component No 2 Increase water retention capacity and harvest rain water

- SC2.1 Stormwater retention ponds and reservoirs
- SC2.2 Local rain water harvesting
- SC2.3 Local infiltration and retention



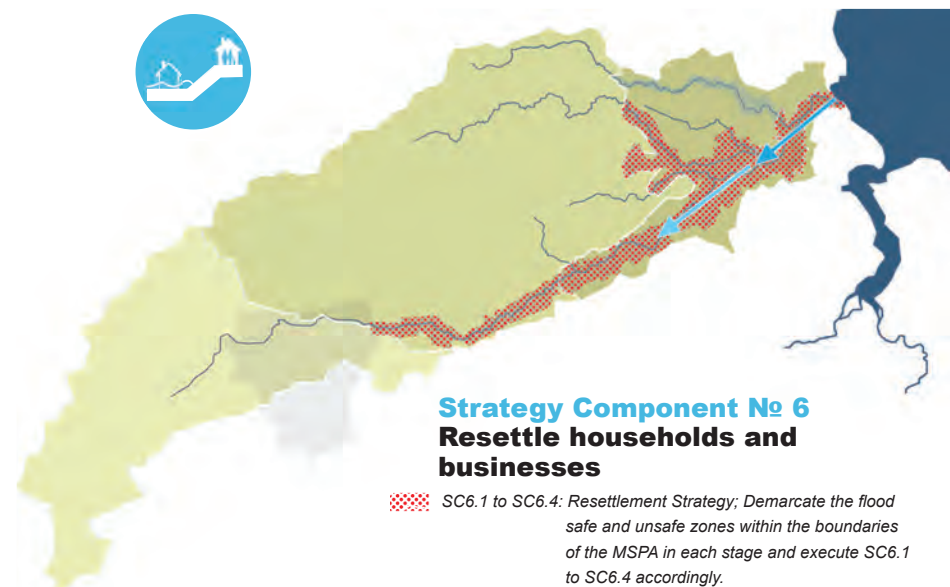
Strategy Component No 3 Control erosion and sedimentation

- SC3.1: River monitoring
- SC3.2: Sediment traps and controlled sand mining
- SC3.3: Maintenance dredging depots
- SC3.4: Terrace building with dredged materials
- SC3.5: Vegetation for floodplains and river banks
- SC3.6: Hazard profiling and zoning



Strategy Component No 5 Protect against flooding

- SC5.1: Reinforcing critical banks against erosion
- SC5.2: Flow guidance by terrace building
- SC5.3: Early Warning System
- SC5.4: Emergency Response Plans
- SC5.5: Relocation of Wastewater Treatment Plant



Strategy Component No 6 Resettle households and businesses

- SC6.1 to SC6.4: Resettlement Strategy; Demarcate the flood safe and unsafe zones within the boundaries of the MSPA in each stage and execute SC6.1 to SC6.4 accordingly.
- SC6.5: Complete the flood model for the next stage from the Lower Basin up to Vingunguti



Strategy Component No 8 Improve solid waste management

- SC8.1: Action plan for solid waste management
- SC8.3: Unblocking of bridges and culverts
- SC8.4: Sanitizing existing illegal dumpsites
- SC8.5: Community awareness raising



Strategy Component No 9 Develop City Parks

- SC9.1: Different Parks along the MSPA:
Flood plain and terraces with public functions
Linear park with smaller parks
- SC9.2: An iconic landscape design for a multi-functional City Park
- SC9.3: Terraced lands for new urban development

**Overview
Volume B:
Detailed Plan
for the Lower
Basin**

River Dynamics and Flood Simulation

Intense rainfall triggers the flooding hazard in the Msimbazi Basin, but the fact that the flood hazard has worsened over the last decade is due to additional factors. A large proportion of the ground surface in the Msimbazi Basin has become impermeable as a result of rapid urbanization, and in the urbanized areas the drainage systems are inadequate. In addition, upstream erosion emerging from deforestation, and unstable river slopes and embankments, leads to high levels of sedimentation in the lower basin where flow velocities reduce and suspended particles settle. The combination of these factors augments the challenge of addressing flood risk in the Msimbazi Basin. Because the riverbed has risen due to the continual deposition of sediment the channel has become increasingly shallow, and under extreme rainfall conditions water is no longer able to efficiently convey to the ocean and this results in more recurrent and extreme flood events.

To better understand the flood hazard affecting the Lower Basin, a customized dynamic numeric hydraulic flood model was developed and simulations were run. Flash floods were simulated by taking into account a large variation in the hydraulic conditions (rainfall bursts) over a relatively short period of time (in the order of hours to a number of days).

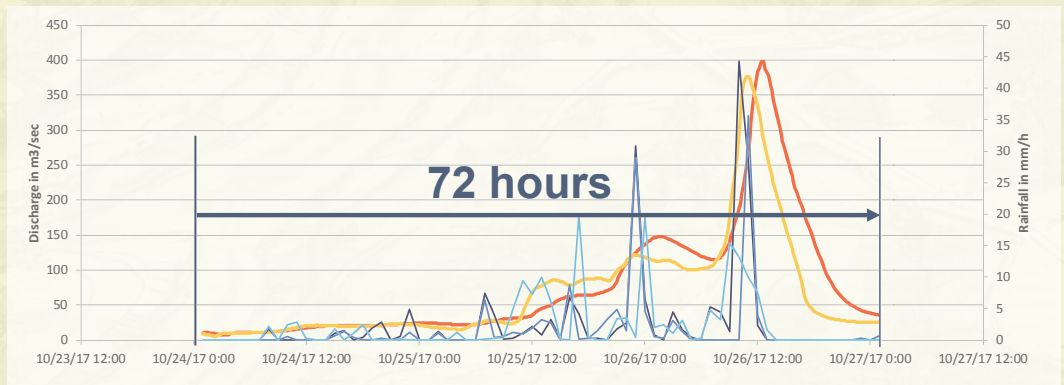


Figure ES-5: Rainfall intensity and river discharge during the October 26 2017 flood event

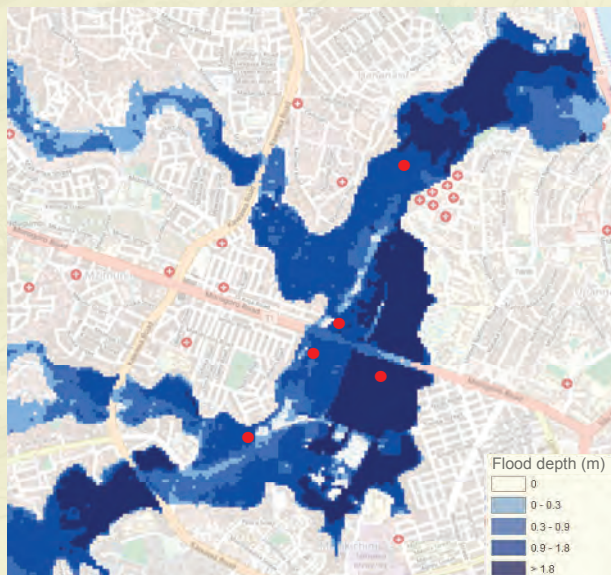


Figure ES-6: Map of flood depth at 60 hours of a T10yr event in existing situation

The modelling results confirmed the following:

- The lowest section in the Detailed Plan area, the section between Selander Bridge and Jangwani Bridge, is inundated first and remains inundated for nearly the entire event; the area is inundated for over 30 hours and has a maximum flood depth that exceeds 1m.
- As peak flooding begins, the section between Jangwani Bridge and Kawawa Road Bridge is inundated as the hydraulic capacity below Jangwani Bridge is exceeded. The backwater effect causes inundation depths of between 1m to 2.5m at the Jangwani playing grounds and causes overflowing of the Jangwani Bridge.
- The section between Jangwani Bridge and Kawawa Road Bridge, and particularly the Jangwani playing grounds remain inundated for a long period due to insufficient drainage capacity in the lowest area of this section, resulting in a bathtub effect. The area remains inundated for over 30 hours with slowly reducing water depths after the peak.

Design principles

Work from downstream to upstream

Based on the Strategy and Management Framework and the flood modelling results a clear overall principle is to start working from downstream, at the Ocean, to upstream, towards Pugu Hills. The Lower Basin is therefore the first area to implement interventions to increase conveyance.

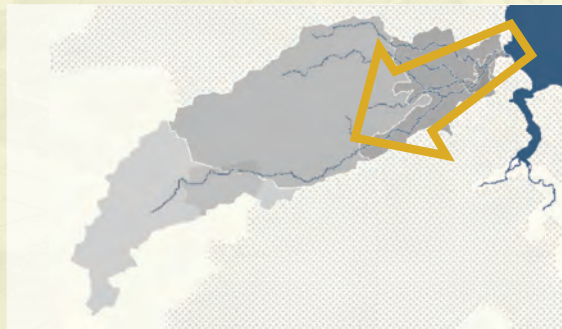


Figure ES-7: Principles on implementing conveyance interventions working from down to upstream

Convey, Guide & Protect, and Use

Three principles are leading in designing the Lower Basin: (i) Focus on conveyance to drain river water from the basin to the ocean as quickly as possible; (ii) Create elevated terraces to guide the water and create higher edges to protect against flooding; and (iii) Create a City Park with functional uses of the terraces and the flood plain.



Figure ES-8: Guiding principles for designing the Lower Basin

A Triple Intervention

The flood modelling shows (see figures below) the potential of a cluster of three major interventions to significantly reduce the duration and inundation depths of the floods that are caused by extreme rain fall events (T1yr – T10yr events). These interventions are: (A) dredging the Msimbazi river from Selander Bridge to Jangwani Bridge to widen and deepen it; (B) raising and widening the Jangwani Bridge; and (C) dredging to widen the river from Jangwani to the confluence with Kibangu River.

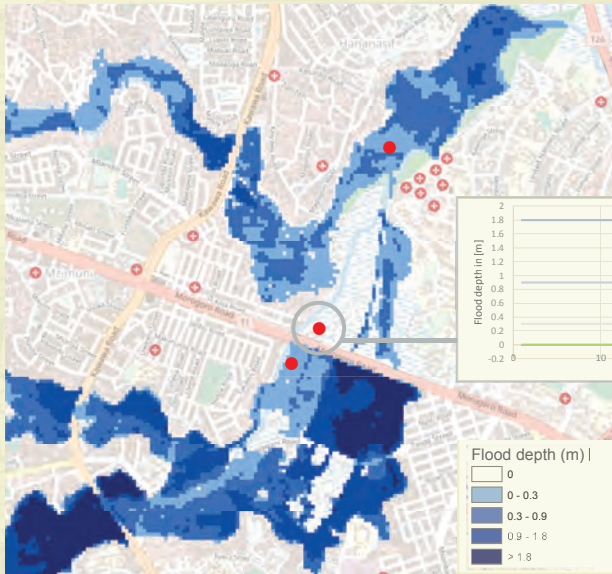


Figure ES-9: Map of flood depth at 60 hours of a T10yr event with interventions A+B+C

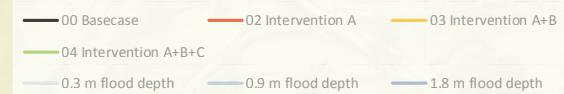
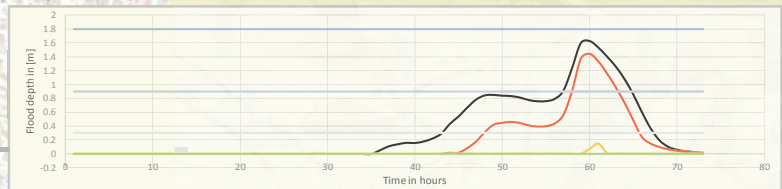


Figure ES-10: Maximum flood depths at location downstream of Jangwani Bridge at Suna

The model, however, also shows that in case of more severe rainfall, such as that experienced in 2011 (classified as a T100yr event), the proposed flood hazard reduction interventions are not sufficient to provide adequate safety levels in the Lower Basin. While significant hazard reductions can be achieved, room for the river to overflow is required to enable planning and design of a safe places for human activities.

Elevated Terraces

To reach the required levels of safety throughout the Lower Basin the use of dredged materials to construct elevated terraces is proposed. These terraces have the function to guide the water during flood events, stimulate the conveyance and will protect (new) urban areas and functions that will be located on safe locations.



Figure ES-11: Concept of the terraces: At location where currently floods occur (a) cut and fill of dredged material from the river channel capital dredging and maintenance is used to build the terraces (b) with safe locations for new urban areas (c).

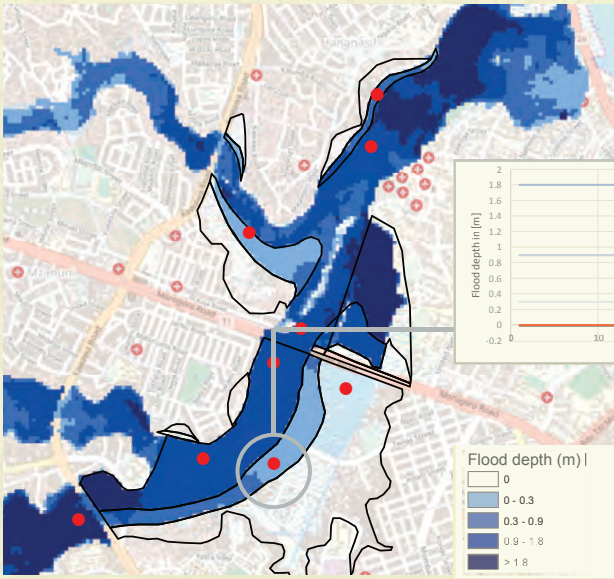


Figure ES-12: Map of flood depth at 60 hours of a T100yr event with interventions A+B+C and Terraces

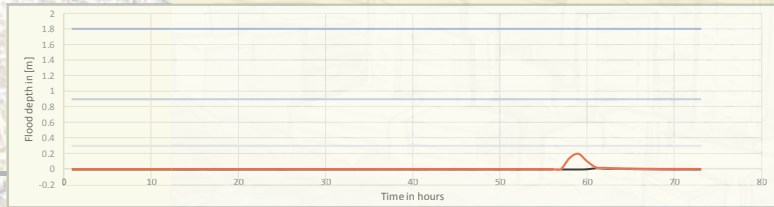


Figure ES-13: Maximum flood depths at location Msimbazi Bondeni first terrace level location

Modelling results of the designed terraces show flood safety of first terrace level during T100yr event, while the proposed second terrace level protects against T100yr floods.

Create a City Park

The Detailed Plan for the Lower Basin is an integral design of the interventions to create a valuable functional urban and public space. This includes a City Park, consisting of wetlands and mangrove forest on the flood plain area and recreational functions at the terrace levels. Here the 'green lung' and the 'heart of the city' come together. The core of the City Park is the central area of the Lower Basin where most functions and activities for people are concentrated.



Figure ES-14: Landuse map

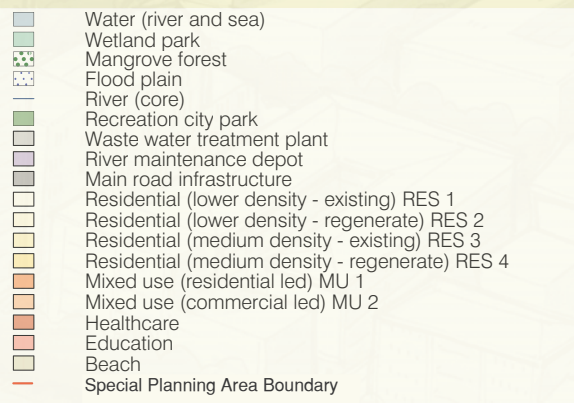




Figure ES-15: Illustrative design map

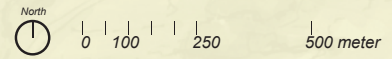



Figure ES-16: Bird's eye view



It is envisioned as an accessible, wide green space that is well connected to the surrounding areas and urban fabric. The second level terrace is much wider than elsewhere in the basin. This additional terraced space will not only provide for protection against floods and guidance of the river water, but also offer a rich selection of desired community and urban functions.

The wider spaces of the Lower Basin are landscaped for public functions of an open and green park, while the land on the edges of the Lower Basin offer potential for urban development on prime real estate. Three urban typologies have been created: Residential development in lower density, residential development in medium density, and mixed-use development in higher densities. These urban development areas have the total capacity of 14,500 units. Part of this total will be available to facilitate the resettlement strategy of the Lower Basin to provide low income housing for people who need to relocate because of flood hazard or construction of terraces. This is estimated at 2,500 units. The remaining 12,000 housing units can be developed for commercial housing for other citizens. Furthermore a mixed-use functionality is appropriate at many of the locations to accommodate commercial, retail and office developments.

Layout designs and development codes for buildings and public space are required for the three typologies identified for the urban development zones. Prior to the roll-out of each new development area, an Urban Development Detailed Precinct Plan must be drawn up for that area and phase. The Detailed Plan sets the guidelines for these developments.

Path Forward

Immediate actions are needed in the following aspects: Resettlement, Channel Opening, Bridge Interventions, Implementation of Terraces, Survey and Monitoring Program.

Resettlement

The number of Project Affected Households (PAHs) and small business that would be directly impacted by the Detailed Plan and would have to resettle is tentatively estimated at 3,000, whom will be eligible for compensation. A specific Resettlement Strategy, including required Livelihood Restoration Programs (LRPs), is to be developed by PO-RALG based on good international practices.

Channel Openings

Establishing enhanced discharge capacity from the Detailed Plan Area to the ocean by means of Intervention A and C is essential to reduce flood hazards in this area (lower flood levels, shorter inundation periods). The fundamental next step is to make detailed designs of these interventions in which channel characteristics like depth, gradient, width, side slopes are verified and optimized.

Jangwani Bridge and DART bus depot

It is strongly advised to construct a new bridge at Jangwani, Morogoro Road. This new bridge design needs to be aligned with the design of the dredging interventions (Interventions A and C) in the overall Detailed Plan. Moreover, the design should look to accommodate a new location for the DART bus depot.

Implementation of terraces

The phased construction of the terraces should be integrated with the capital and maintenance dredging, and excavation works in the channel and the floodplain. Based on the soil balance, the capital dredging and excavation works would provide a large share of the total required fill material for the terraces in the lower section of the Detailed Plan area. The upper section the terraces need to be filled over time, with soil that becomes available through maintenance dredging and captured soil in silt traps.

Required Resources and Projected Revenues

By combining comprehensive drainage improvements with commercial development, the Detailed Plan for the Lower Basin would establish a framework that coordinates investments from various sources, including government, private sector, and development partners to restore the highly-vulnerable flood plain in the middle of the city, and turns this area into a valuable city asset.

The financial requirements are based on the cost breakdown of all interventions in the lower and upper sections of the Lower Basin, however they do not include the Urban Development Areas. For the lower section the costs are approximately USD 55 million, and for the upper section USD 49 million. Other related costs such as reforestation and sediment traps in upper areas, that are essential for sustainability of the Lower Basin investments over the long term, are calculated at approximately USD 10 million. The preliminary estimated total costs therefore amount to approximately USD 114 million.


The preliminary vision for the Lower Basin includes a mix of 12,000 market-rate housing units and 2,500 affordable housing units, resulting in an additional 700,000 m² of additional housing that can be developed across 57 hectares of reclaimed urban land that is resilient to floods.

Preliminary analysis leads to a projected estimate of about USD 900 million in potential revenues in housing development. As the area could also offer space for shops, malls, offices, and parking garages, this is only one part of the expected economic benefits. Based on projected cash flows from different economic activities within the valley, cost recovery on capital expenditure would be reached over a period of 12 year and at an expected Internal Rate of Return of 18 percent.

Implementing the Msimbazi Opportunity Plan

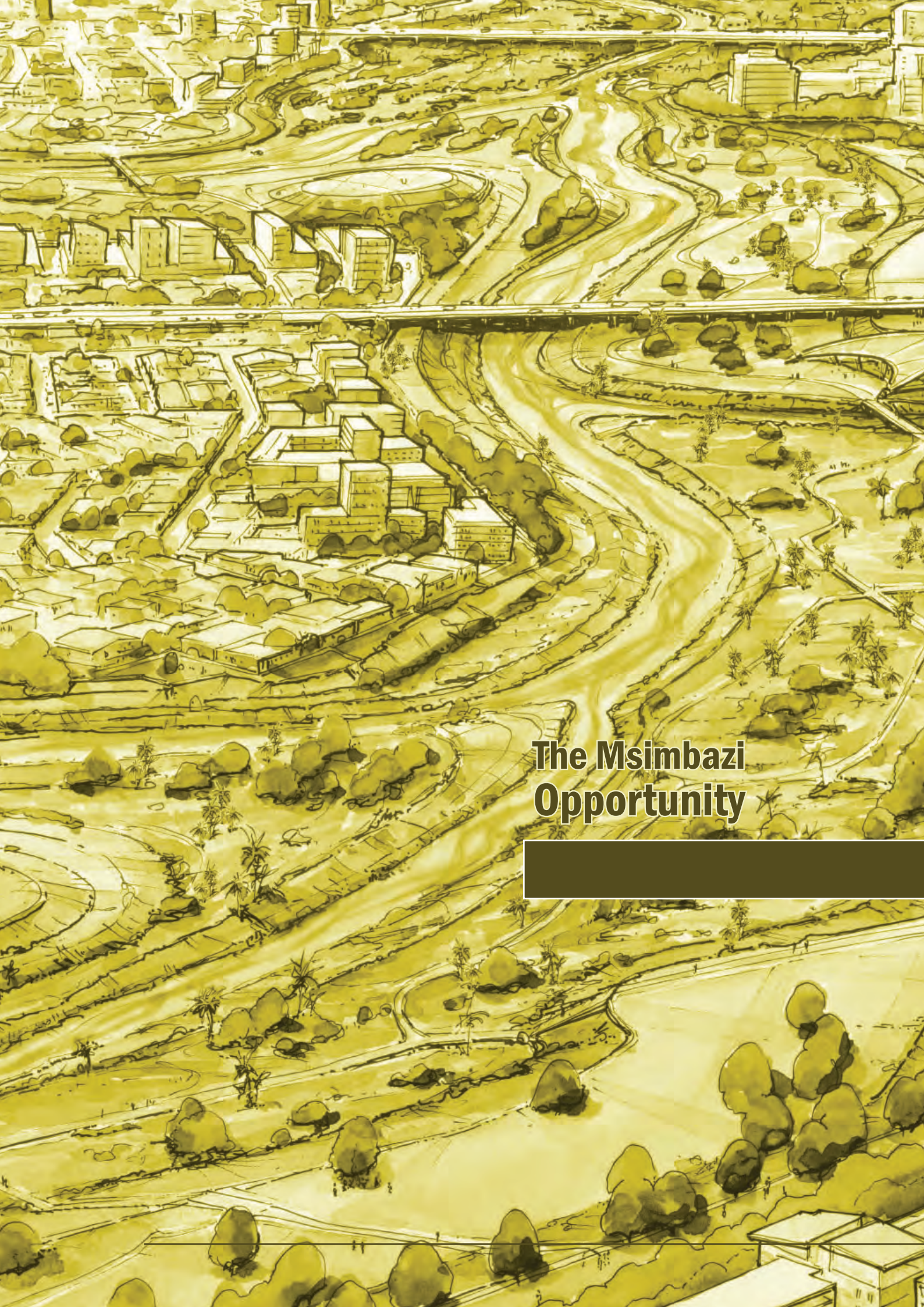
The top priority for moving from enthusiasm towards commitment and plan implementation is to continue the stakeholder and community participation and engagement process now established.

Many participants have been consistent in their attendance of the sessions. They have put in the effort to deliver content and develop knowledge together. It is strongly recommended to use this body of knowledge and to continue to engage this group of Msimbazi Opportunity Ambassadors. They are the best insurance for ownership, quality and purpose of the interventions on the way to fully implementing the plan.



The first steps to move from planning to action were initiated in August 2018. Selemani S. Jafo (MP) Minister of State, President's Office Regional Administration and Local Government and January Y. Makamba (MP) Minister of State, Vice President's Office, Environment and Union Affairs have pledged their support, and PO-RALG is actively engaging with Ministry of Finance to secure initial funding from the World Bank which has indicated its support for the Msimbazi Opportunity Plan.

The momentum is there. Let's get to work. **Tuanze Kazi**



The Msimbazi Opportunity

