2020 Edition

Kigali Master Plan 2050

Master Plan Report

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The Centre of Urban Excellence

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Preface

Project Background

As stated in the 2013 Kigali Master Plan Implementation Report, the first update to the Master Plan shall be undertaken after 5 years from its adoption. This is even more important for a city like Kigali, which is rapidly evolving towards a world-class urban centre, and needs updated and real-time information on the master plan implementation status to promptly identify and apply corrective measures as needed. Surbana Jurong and SMEC have been selected as the ideal candidates for this important task that will shape, once more, the future of Kigali and Rwanda in general.

The core objective of this assignment is to update the 2013 Kigali Master Plan with a new methodological approach based on two key elements:

1. An intense participatory process aimed at deeply involving a large base of stakeholders, capable of providing valued inputs and feedback during the review process.
2. Support this review with new and enhanced information and data coming from additional studies. This represents an unprecedented opportunity to improve the existing Master Plan with new primary and secondary data coming from detailed socio-economic analysis, household and market surveys, and a long-needed citywide transport plan and modelling.

The updated master plan for Kigali, is envisaged to integrate all previous plans and reports and will provide corrective measures and provide updated direction to the growth of the Capital of Rwanda. Surbana Jurong believes that the aim is not just to draft and updated Master Plan for Kigali but sees it as a key opportunity for improving and adjusting Kigali urban development strategies to support the city economic green growth and individuals' well-being, integrate all previous plans, improve local capacity through training and involvement of local planners, and establish a new platform from which the country can position itself as the centre of excellence for innovative and inclusive urban planning in Africa.

Project Commissioning & Objectives

In the beginning of 2018, Surbana Jurong Consultants Pte Ltd and SMEC International, were awarded the "Consulting Services for 2013 Kigali Master Plan Update". Surbana Jurong and SMEC (part of the Surbana Jurong Group) have been working as one team to implement all technical activities required for this master plan update.

The local team in Kigali and team leaders identified for each macro work component (Urban Planning, Infrastructure, Transportation, Environment, Community Engagement and Socio- Economics) are coordinating well between different work streams and also with the local authorities and agencies for regular updates on the master plan.

The specific objectives of the master plan update are as below:

- Collect, integrate and incorporate all new data, plans, projects and regulations elaborated after 2013 Master Plan adoption, including green growth strategies, transport studies elaborated and planned and upcoming developments for Rwanda.
- Integrate baseline studies with primary data collection and update Project Programming with refined forecasts on population, income, employment, services and transport demand.
- Review 2013 Master Plan Implementation Status, assessing the progress of the capital improvement plan and catalytic projects, highlight delays and issues in the implementation, paving the way to the updated Implementation Report
- Integrate a new transportation analysis and modelling into the planning process to further reinforce the Transport Oriented Design approach in 2013 Master Plan
- Involve key stakeholder groups and re-shape the plan to address most critical issues, but without losing track of the overarching Vision. Effectively communicate the project to the community, ensuring ownership of and compliance to the Update Plan.
- Update Nyarugenge CBD Urban Design Plan, incorporating all recent projects and aligning it with market trends.
- Involve City of Kigali technical team in all stages of the project, requesting them to actively contribute in the preparation of draft deliverables (E.g. Interim Master Plan Update)
- Update the entire Master Plan GIS database and coordinate with ESRI for its publication on the new web portal.
- Update the Implementation Plan with with a proposed new Action Plan and a revised Capital Improvement Plan, catalytic projects list and implementation strategies.

Project Organization & Schedule

The planning process elaborated to update the 2013 Master Plan has been developed in 10 months and it had been further organized in six stages, corresponding to key outcomes and deliverables.

Stage 1: Inception
Stage 2: Visioning and Programming Update
Stage 3: Transport Plan Update
Stage 4: Interim Master Plan Update
Stage 5: Final Master Plan Update
Stage 6: Updated Implementation Plan

Parallel to the six stages, there were two sets of activities which was conducted along the entire duration of the project:

1. Participatory process and outreach campaign
2. Training for City of Kigali Technical Team

The current report is part of the Stage 5 and 6 which includes the Updated Final Master Plan and Transport Plan Report includes update on the existing zoning regulations, transportation strategy and infrastructure strategy formulated through engagement with different stakeholders and comments received from CoK. For more details refer to the project Deliverables in the next page.

Project Deliverables

Various reports, corresponding to the various task orders are to be submitted, which include:

Stage 1: Inception

- Inception Report
- Stakeholders mapping and Participatory and Communication Plan
- Socio-Economic Analysis and House Hold Survey Methodology

Stage 2: Visioning and Programming Update

- Implementation Status Report
- Updated Visioning and Programming Report

Stage 3: Transport Plan Update

- Transport Master Plan Report

Stage 4: Interim Master Plan Update

- Report on Comments Collected
- Updated Master Plan Interim Report: Master Plan, Zoning Regulations Report , Infrastructure and Transport Plan for Kigali

Stage 5: Final Master Plan Update

- **Final Master Plan Report with Zoning Plans and Maps**
- **Final Zoning Regulations Report**
- **Nyarugenge CBD Updated Urban Design Report**
- **Gahanga CBD Updated Urban Design Report**
- **Kimironko CBD Updated Urban Design Reportv**

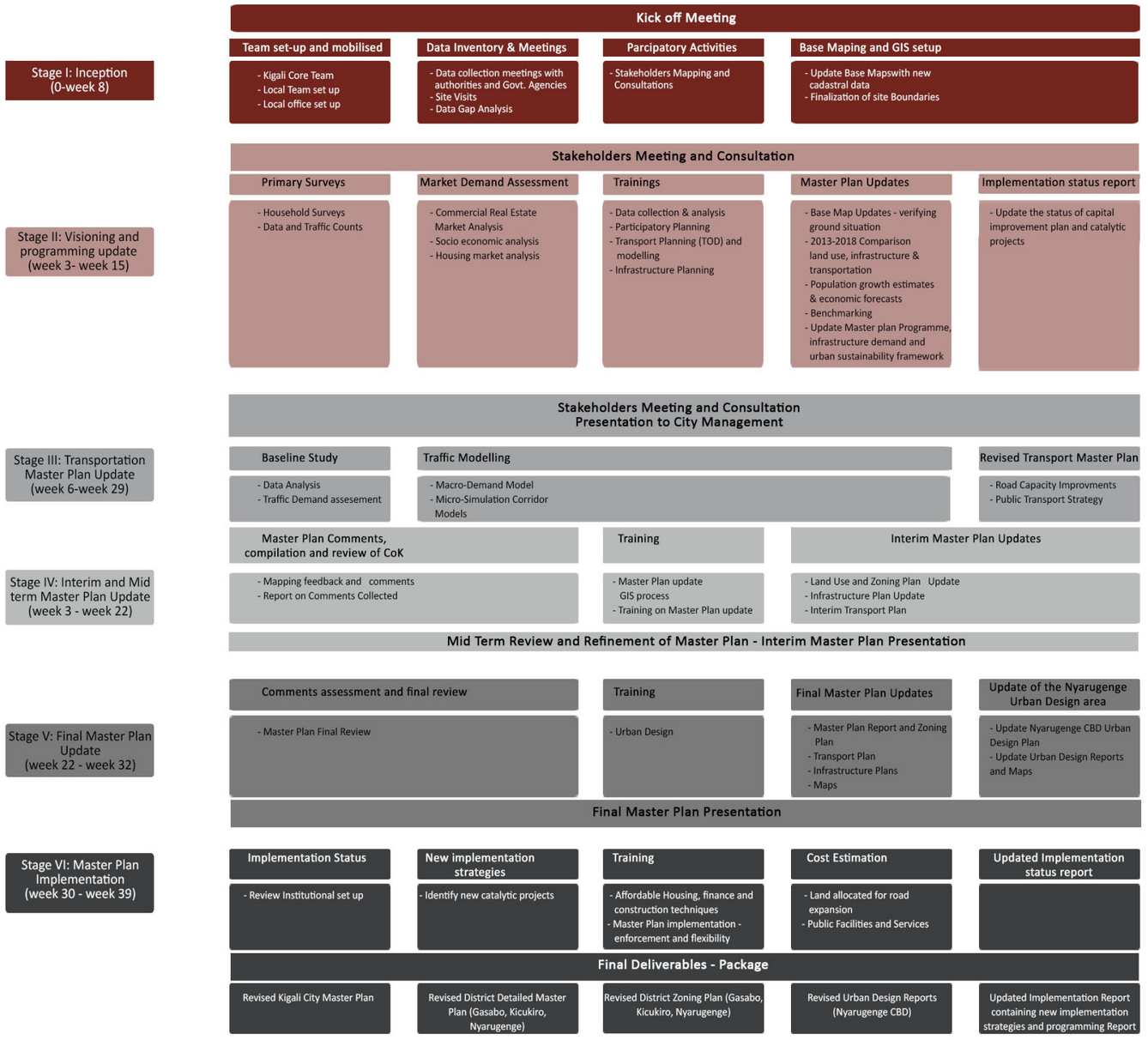
Stage 6: Master Plan Implementation

•For the current stage 5 and 6, the following deliverables are submitted as part of Transport plan and Master plan update.

1. Final Master Plan Report
3. Final Zoning Regulations Report
3.Final Transport Master Plan Report
4. Nyarugenge CBD Updated Urban Design Report
5. Gahanga CBD Updated Urban Design Report
6. Kimironko CBD Updated Urban Design Report
7. Updated Analysis and Vision Report
8. Updated Implementation Plan Report

The Updated Final Master Plan and Transport Plan Report includes update on the existing zoning regulations, transportation strategy and infrastructure strategy formulated through engagement with different stakeholders and comments received from CoK.

The figure illustrates the project process including various stages, schedule and key deliverables of the master plan update.



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Ministry of Environment (MoE)
Ministry of Lands and Forestry (MINILAF)
Rwanda Housing Authority (RHA)
Rwanda Agriculture Board (RAB)
Rwanda Water and Forestry Authority (RWFA)
Local Administrative Entities Development Agency (LODA)
Rwanda Environment Management Authority (REMA)
Rwanda Association of Local Government Authorities (RALGA)
Rwanda Land Management and Use Authority (RLMA)
Rwanda Development Board (RDB)
Rwanda Transport Development Agency (RTDA)
Rwanda Utilities Regulatory Authority (RURA)
Sector Executive Secretaries
Gasabo, Nyarugenge and Kicukiro Districts
Rwanda National Police (RNP)
Rwanda Defence Force (RDF)
Rwanda Women Network
Rwanda Institute of Architects (RIA)
Rwanda Civil Society Platform (RCSP)
Rwanda Green Building Organization (RGBO)
Rwanda – National Climate and Environment Fund (FONERWA)
Rwanda Association of Professional Environmental Practitioners (RAPEP)
Global Green Growth Institute (GGGI)
UN-HABITAT Kigali
Swiss Resource Centre and Consultancies for Development (SKAT)
Strawtec Building Solutions
Private Sector Federation (PSF)
Institute of Policy Analysis and Research (IPAR)
International Growth Centre (IGC)
Water and Sanitation Corporation (WASAC)
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VNG International
World Bank Group
Rwanda Hospitality Association (RHA)
Nyamirambo Women's Center
Institution of National Museums of Rwanda
Youth Engagement in Agriculture Network (YEAN)
Rwanda Youth in Agribusiness Forum (RYAF)

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Executive Summary

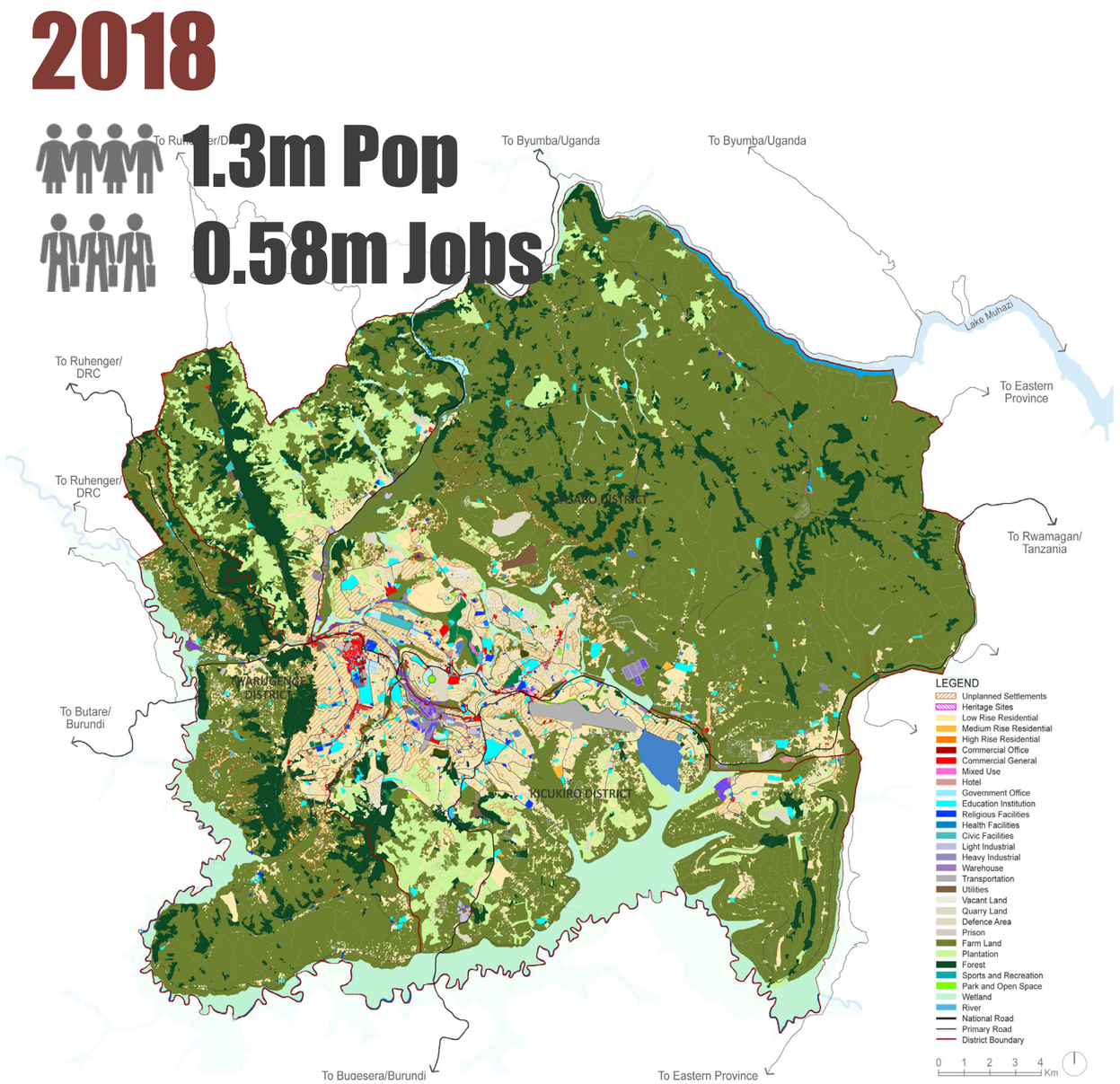
KIGALI CITY MASTER PLAN REVIEW

Kigali is the centre of transformation in Rwanda. The rapidly evolving urban centre requires an updated Master Plan to ensure that the city has the capacity to meet changing demands. In ensuring that the development goals of the Master Plan of the city of Kigali are in line with the overall national strategy, eight themes of development that resonates with the four NUP pillars are proposed for the Master Plan update. The current conditions in 2018 are analysed according to these themes to provide a more holistic review of the Kigali Master Plan 2013 and urbanization challenges that the city faces.

One of the key rationale behind the update of Kigali Master Plan 2013 is to improve the existing Master Plan and make it more inclusive in bringing the people of Kigali and Rwandans in general to the review process. Various participatory tools involving large base of stakeholders including stakeholders meetings, focus groups discussion organised according to the eight themes of development, as well as social media have been employed during the master plan updating process, to collect and share valuable inputs and feedback on the master plan review and aspirations for Kigali city.

UPDATES ON EXISTING LAND USE IN KIGALI CITY

Broad Land Use	Existing Land Use 2013 (sqkm)	Existing Land Use 2018 (sqkm)	% Change
Agriculture	477.55	457.95	- 4.1
Commercial	3.00	3.32	10.6
Industries	4.14	4.25	2.7
Infrastructure	21.25	27.99	32.3
Mixed Use	0.19	0.26	36.5
Nature Area	124.78	123.61	- 0.9
Open Space	1.91	1.81	- 5.5
Public Administrative, Institutional and services	14.07	15.17	7.8
Residential	67.07	80.87	20.6
Special Use	13.26	9.51	- 28.3
Water Bodies	2.73	5.13	87.6
TOTAL	729.86	729.86	



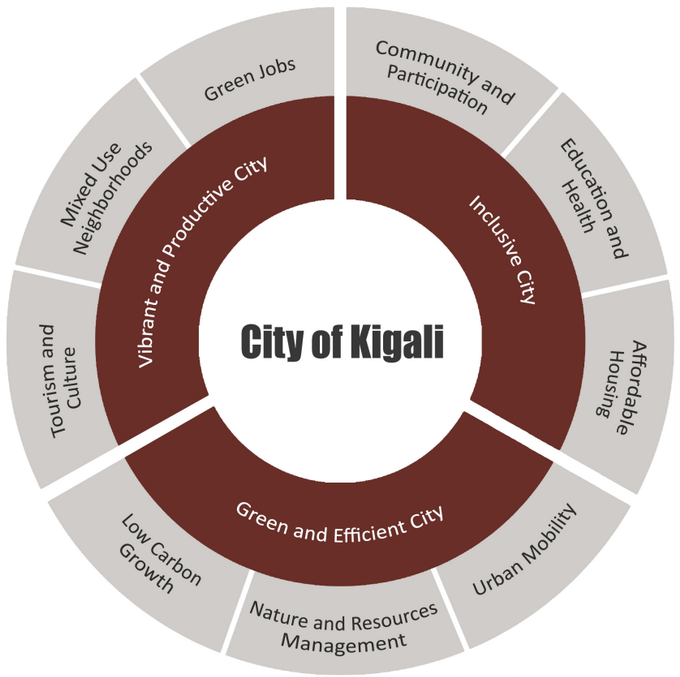
Kigali City Existing Land Use Plan 2018

UPDATED VISION FRAMEWORK

The Urban Sustainability Framework (USF) is updated for Kigali to achieve a greener future and serve as guiding principles for the subsequent planning processes that will ensure the long term sustainability of Kigali. It lays out key dimensions of urban sustainability including governance and integrated planning, economic productivity and sustainability, environment and resource efficiency, low carbon and resilience, and social inclusiveness.

While the updated USF helped to set priorities for the city's vision, multiple stakeholders were also engagement in defining the new vision that represents the aspirations of the upcoming city, following the sustainability path set by the framework.

This new vision expresses its unique local identity and sense of ownership of Kigali city by its citizens to be an inclusive city for all.



Updated Urban Sustainability Framework for City of Kigali

KIGALI VISION 2050

KIGALI Yacu OUR KIGALI!

The Centre of Urban Excellence in Africa

8 GOALS FOR KIGALI

To achieve the long term vision for Kigali, a set of goals covering the 8 themes of development are proposed with key planning strategies and approaches. These key goals will thus guide the review of the physical master plan of Kigali city.

FOUNDING PRINCIPLES

To support the proposed planning process, following unique set of principles have been adopted to guide urban growth, economic growth, land and urban management in Kigali over the coming decades.

Principle One: Kigali Integration in the National and Regional Context

Principle Two: Incremental development

Principle Three: Facilitating Affordable Housing

Principle Four: Detailed Phasing aligned to City Development Strategy

Principle Five: Mixed Use Approach (in all areas, along transport corridors, etc.)

Principle Six: Green Growth (protection vs. development)

Principle Seven: Sustainable and Resilient Infrastructure

Principle Eight: Inclusivity and Equity

PLANNING PRINCIPLES FOR KIGALI CITY

1. Accommodate incremental development:
- Flexible housing options with room for growth
- Ability of households to spend and changing housing demand dictates development

2. Facilitate affordable housing:
- New housing models (like SKAT) to provide for lower rungs of income groups
- Use of local materials, involving local communities in the process, exploring alternative funding models

3. Encourage detailed phasing aligned to city development strategy
- City's growth corresponding to the population and economic growth - phase wise increment

4. Promote mixed use development
- Compact and integrated neighbourhoods with amenities accessbile at a short distance
- Diverse built use at one place
- Combination of varying housing typologies

5. Support green growth (balance protection vs development)
- Sensitive to development impacts on environment
- Caring for eco-fragile and agriculturally fertile land
- Sustainable use of natural resources in the development process

6. Ensure sustainable and resilient infrastructure services
- Weather and climate proof infrastructure provision
- Roads, transit modes, water, sanitation, electricity etc. that is affordable and accessible to all

7. Promote inclusivity and equity
- Attention to vulnerable groups like women, children, poor, old, differently abled etc.
- Inclusive and representative planning

STRATEGIES FOR TRANSFORMATION

1. City of Excellence

- Theme addressed by following key focus areas:

1. Balanced and Sustainable Urban Development;
2. Inclusive Urban Planning and Design;
3. Affordable City;
4. Good Governance; and
5. Quality of life.

- Recommending improved institutional coordination;
- Land management, urban planning and housing management, transport & infrastructure management, environment management plans; and
- Participative implementation of plans and strengthening local governance

2. City of Mixed Use Neighbourhoods

- Ensuring housing affordability;
- Introducing incremental development to ensure flexibility and minimum unused built up spaces that are left unused;
- Mix of several typologies to cater to the needs of various types of families , their spending capacities and personal requirements;
- Encouraging the use of Local materials to encourage cost cutting; and
- Land pooling and consolidation tool to improve grassroots participation in housing process

3. City at Work

- Addressing the issue of excessive work space provision, especially in the CBD;
- Recognising the small scale business requirements of the larger workforce in Kigali and delivering to their needs;
- Integrating works spaces with neighbourhoods and light industries resulting in mixed use Planning Areas;
- Nodes and Corridor strategy where BRT corridors connect to and from CBD and between other important work nodes of Kigali; and
- Integrated industrial park model

4. Green City

- Acknowledging the natural landscape of the city;
- Protecting sensitive ecological areas from urban growth;
- Restoring damaged natural elements like waterbodies;
- Adopting natural resource management system, green building initiatives;
- Forest protection strategies;
- Steep slope protection strategies; and
- Green and blue plan - hierarchy of parks, connectors etc.

5. City on the Move

- Proposal of a road network with a consistent hierarchy
- Access and mobility functions and associated typologies and cross-sections
- Proposal of a public transport strategy, freight management strategy, transport network strategy etc.
- Implementation strategies for an effective transport policy
- Defining roles and responsibilities of the Kigali Transport Authority

6. Efficient City

- Infrastructure provision that is available, accessible and reliable for all income groups;
- Benchmark level coverage of water, sewer drainage services;
- Services as per population projections to strike the right balance between demand and supply; and
- Water source and distribution management that is sustainably executed

7. City for Citizens

- Spatial, social and economic inclusion - the key elements
- Participatory tools embraced and executed for delivering the master plan
- Social infrastructure facilities related to education, health, social support, recreation, culture, interaction and development
- Hierarchy of social infrastructure - national, district, Planning Area and neighbourhood level
- Incorporating facilities into the mixed use neighbourhoods alongside living and working Planning Areas

8. Creative City

- Three key strategic approaches - vibrant city, Tourism and Cultural Development oriented, Heritage valorization
- Means to boost employment and generate increased income
- To support the development and and consolidation of urban centres

POPULATION PROJECTION AND DISTRIBUTION

The IPAR's study on population and housing needs provides an understanding of the housing profile in Kigali. The master plan estimates the quantity of housing required based on IPAR's population projection and understanding of market demand for housing in Kigali. Population Projection in Kigali

According to IPAR, under "high growth scenario", it is estimated that in 2014 Kigali has a population of 1.3million which is projected to grow to 3.8million in 2050. In the "medium growth scenario", Kigali will grow from a population of 1.3million in 2014, to 3.5million in 2050. In the "low growth scenario", Kigali population will grow from 1.3million in 2014 to 3.2miliion in 2050.

Given the migration trend to Kigali, the pressure of urbanization and development on the City and after cross-referencing with other ongoing studies (IGC), the High Growth Scenario with 3.8 million population by 2050 is selected by city.

Following the founding principles, the master plan advocates to develop mixed income, mixed use, higher density residential and affordable housing around employment centres and public transit corridors for integrated development.

The master plan also proposes upgradation and renewal of unplanned settlements around the CBD and fringe centres to accommodate higher density of population currently living in poor urban environment in the heart of the city. This mix of residential areas around the CBD shall bring vibrancy into the city centre. Population is also distributed around the mixed use commercial areas along the proposed BRT network thus connecting different employment and residential areas by public transit across the city.

EMPLOYMENT PROJECTION AND DISTRIBUTION

As per the study by IPAR, the City of Kigali and Rwanda has high potential to develop vibrant services and knowledge based sectors building on major investments that have been undertaken.

The economy of the City of Kigali has experienced positive GDP growth in the last decade averaging 6.5%. To continue growing at the stated growth rate, the city will need to generate proportionate employment for the growing labour force.

The employment forecast for Kigali City indicates creation of a total of 1,760,285 jobs in agro-processing, agriculture, forestry and fishing; mining; manufacturing; services; construction; trade; and transport sectors.

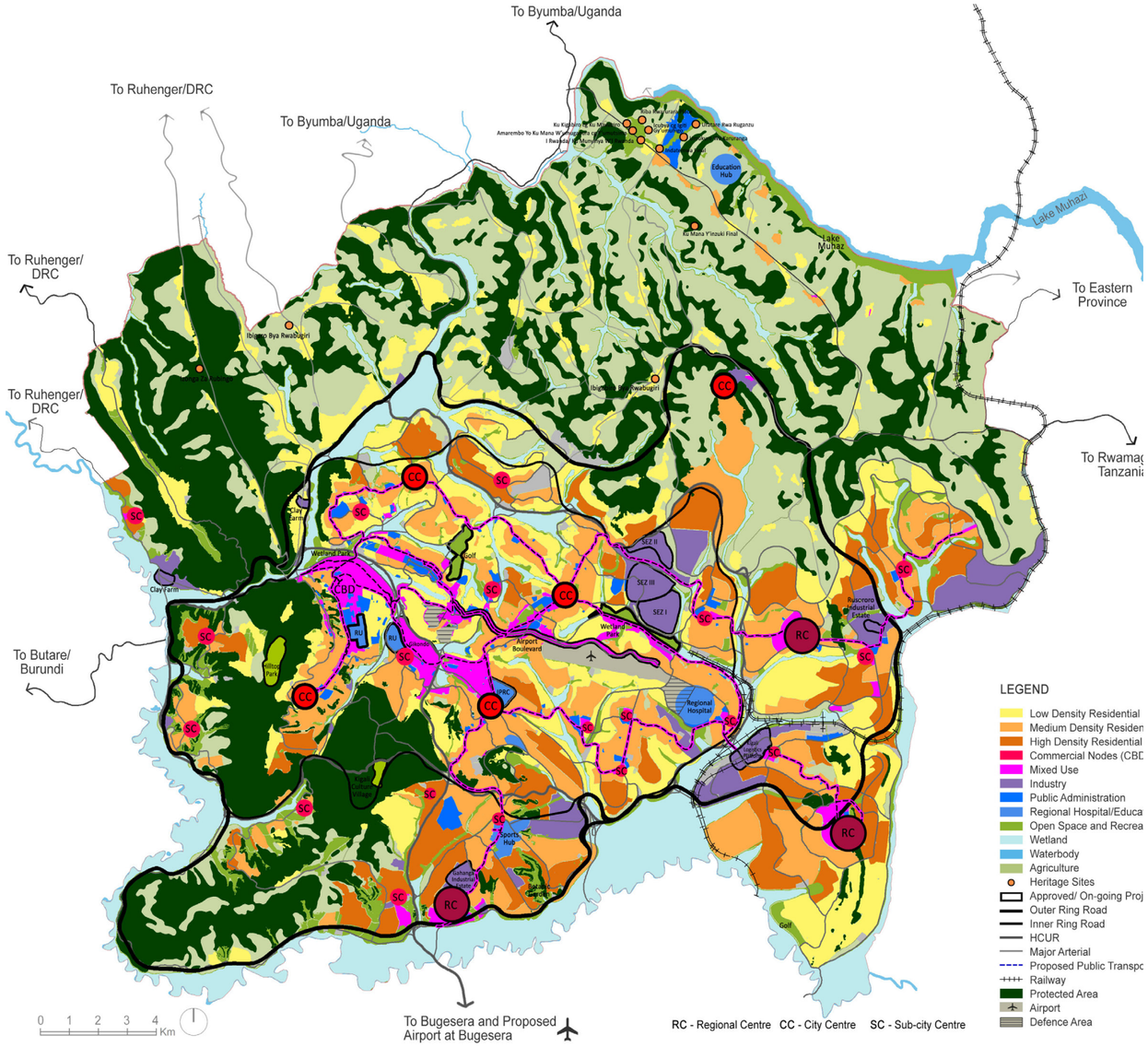
Majority of these jobs are distributed within mixed use commercial districts (CBD, Fringe Centres and Regional Centres) and industrial parks with some employment in residential zones.

Year	IPAR-NISR adjusted projections		
	Low growth Scenario	Medium growth Scenario	High growth Scenario
2012 (Census Year)	1,132,686	1,132,686	1,132,686
2014	1,354,921	1,361,492	1,361,492
2024	1,816,298	1,872,462	1,897,462
2034	2,266,269	2,405,418	2,499,110
2044	2,816,981	3,071,923	3,258,504
2050	**3,224,316**	**3,570,015**	**3,824,708**

Projected population growth scenarios Source: IPAR Study

Sector	2014	2024	2034	2044	2050
Agro-processing, Agriculture, Forestry & Fishing	143,136	168,936	182,046	182,906	175,376
Mining	7,656	10,661	14,257	18,871	22,352
Manufacturing	22,387	40,184	64,703	100,163	128,953
Services	188,780	275,546	379,446	516,783	622,412
Construction	62,463	96,769	140,373	200,326	247,589
Trade	131,769	190,258	259,909	351,296	421,245
Transport	23,779	37,724	55,930	81,292	101,443
Total	**579,969**	**820,078**	**1,096,664**	**1,451,637**	**1,719,369**

Projected employment 2050 Source: IPAR Study



Kigali City Structure Plan 2019-2050

Kigali City Proposed Structure Plan 2019-2050

Following the concept master plan and structure plan 2013, the updated Kigali structure plan 2019-2050 tries to retain the valid proposals and complement missing programmes to show a comprehensive picture for whole Kigali. The overarching strategy for the 2019 Structure Plan is development of "Centres" and "Corridors" within the City of Kigali where the centres are specialised clusters of high value economic activity, major shopping, civic and recreation connected via the economic corridors built along a backbone of transport infrastructure - the proposed public transit (BRT) that link these important economic activities in different centres planned throughout the city. The new structure for the city will have the following key considerations:

- Strengthening and organizing the existing CBD in Nyarugenge;
- Acknowledging four self-sustaining fringe centres with mixed use commercial for peri-urban growth supporting the CBD;
- Establishing four main self-sustaining Regional Centres with mixed use commercial as new growth areas and employment destinations in the sub-urban areas;
- Identified industrial clusters and SEZ to form consolidated and well-connected employment zones for manufacturing, logistics and warehousing;
- Improving connectivity and accessibility via transit corridors, with the proposed Bus Rapid Transport, spreading throughout the city;
- Mixed use residential and commercial zones spread at key locations along public transit corridor creating a well knit and well connected system of housing, jobs and public transport;
- Mixed use and mixed income, high-density, affordable and quality living environments in proximity to employment centres ;
- To redevelop existing unplanned settlements into higher density residential developments;
- To develop clusters of consolidated housing in the rural areas;
- To conserve nature areas such as forests, wetlands and water bodies. Also protect steep slopes (above 30%) in both urban and rural areas; and
- Conserving Kigali's rich nature, heritage and cultural areas;

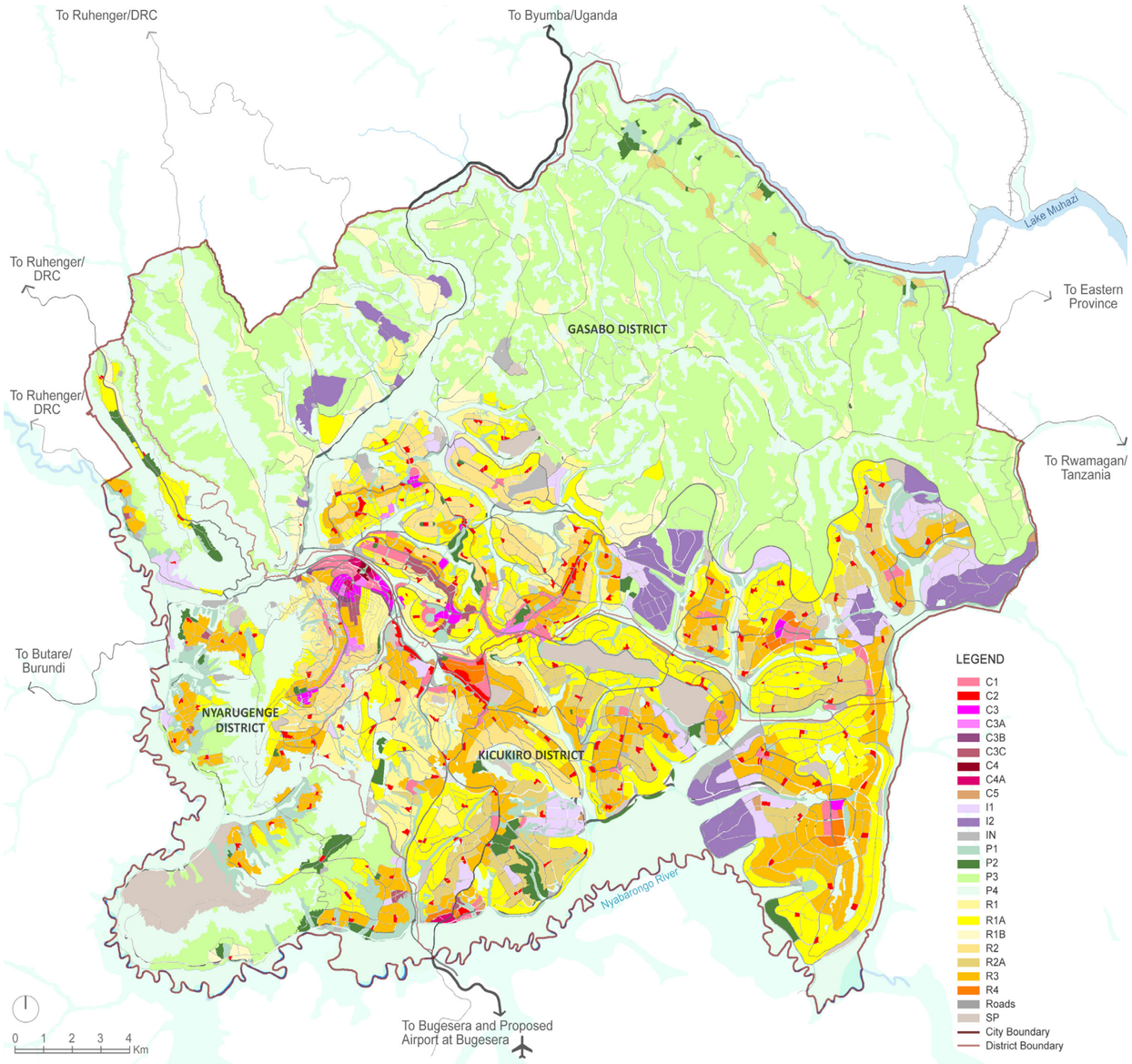
2013 - 2040

5m Pop

2.3m Jobs

Zoning		Area (sqkm)	%
Mixed Use Commercial District	C1	6.2	0.9
Neighbourhood Level Commercial District	C2	5.6	0.8
City Level Commercial District	C3	1.6	0.2
City Level Commercial District	C3A	1.0	0.1
City Level Commercial District	C3B	0.2	0.03
City Level Commercial District	C3C	1.5	0.2
Regional Level Commercial District	C4	0.1	0.02
Regional Level Commercial District	C4A	0.5	0.1
Retail Warehouse District	C5	0.5	0.1
Light Industrial District	I1	12.0	1.6
General Industrial District	I2	16.1	2.2
Infrastructure	IN	6.6	0.9
Passive Recreational District	P1	35.0	4.8
Active Recreational District	P2	7.4	1.0
Agriculture District	P3	192.9	26.4
Protected Area District	P4	191.0	26.2
Single Family Residential District	R1	19.0	2.6
Mixed Single Family Residential District	R1A	60.8	8.3
Rural Residential District	R1B	20.2	2.8
Low Rise Residential District	R2	17.5	2.4
Low Rise Residential District	R2A	21.3	2.9
Medium Rise Residential District	R3	45.5	6.2
High Rise Residential District	R4	1.7	0.2
Road	RD	48.8	6.7
Special Use	SP	16.9	2.3
Total		729.9	100

Source: Kigali MP 2013



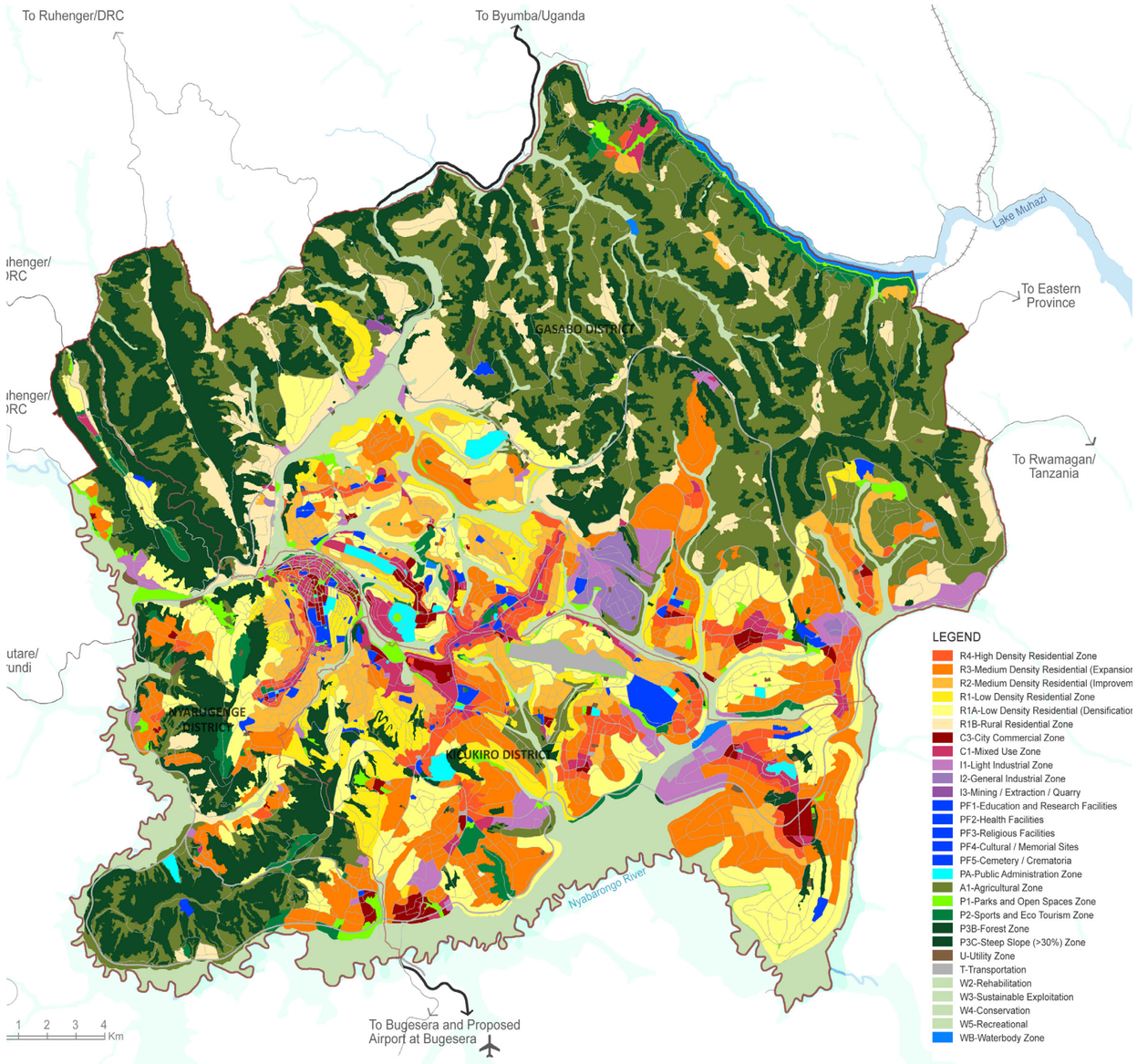
Kigali City Proposed Zoning Plan 2013-2040

2019-2050

3.8m Pop

1.8m Jobs

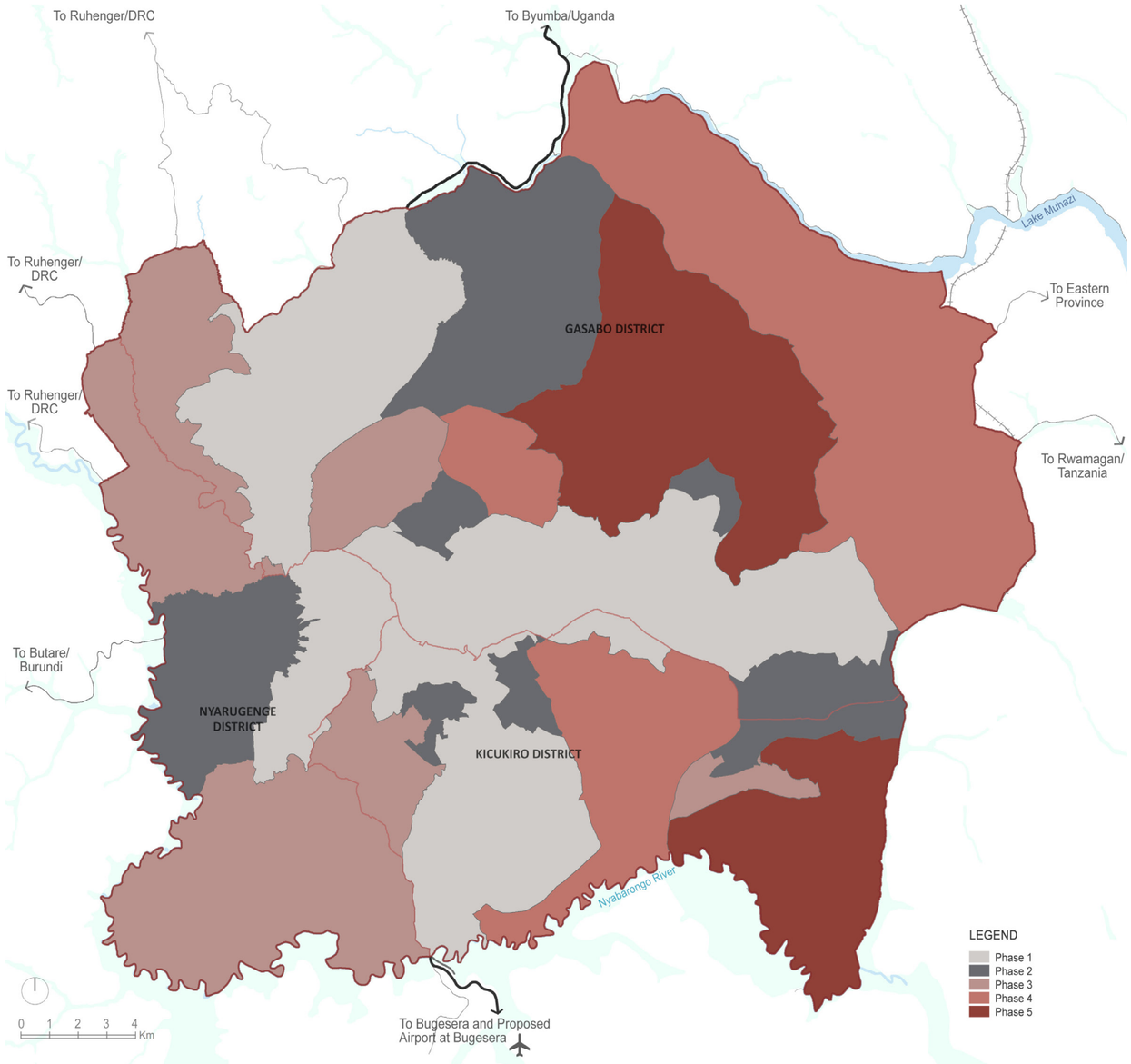
Zoning		Area (sqkm)	%
Agriculture zone	A1	165.5	22.7
Mixed use zone	C1	13.2	1.8
City commercial zone	C3	7.1	1.0
Light industrial zone	I1	13.6	1.9
General industrial zone	I2	4.2	0.6
Mining/ Extraction/Quarry	I3	0.4	0.0
Parks and open spaces zone	P1	10.4	1.4
Sport and Eco tourism zone	P2	11.5	1.6
Forest zone	P3B	87.7	12.0
Steep slopes (> 30%) zone	P3C	53.6	7.3
Public Administration zone	PA	4.4	0.6
Education and research facilities	PF1	2.7	0.4
Health facilities	PF2	2.7	0.4
Religious facilities	PF3	0.5	0.1
Cultural/ memorial sites	PF4	0.1	0.0
Cemetery/ crematoria	PF5	1.8	0.3
Low density residential zone	R1	25.2	3.5
Low density residential densification zone	R1A	60.3	8.3
Rural residential zone	R1B	33.9	4.6
Improvement zone	R2	31.7	4.3
Expansion zone	R3	61.9	8.5
High density residential zone	R4	17.5	2.4
Transportation zone	T	41.9	5.7
Utility zone	U	1.6	0.2
Rehabilitation	W2	12.2	1.7
Sustainable Exploitation	W3	20.4	2.8
Conservation	W4	39.7	5.4
Recreational	W5	1.8	0.2
Waterbody zone	WB	2.2	0.3
Total Area		729.6	100



Kigali City Updated Zoning Plan 2050

Zoning Comparison - Summary

	2013 MP			2019 MP Interim		2019 Final Master Plan		
Zoning	**Area_sqkm**	**Zoning_Nam**	**Sum_Area_Sqkm**	**Zoning_Nam**	**Area_sqkm**	**Zoning_Nam**	**Zoning**	**Area_sqkm**
C1 - Mixed Use Commercial Zone	6.21	**C1**	6.21	**C1**	10.0	C1-Mixed use zone	**C1**	**13.2**
C2 - Neighbourhood Level Commercial Zone	5.57	**C2**	5.57					
C3 - City Level Commercial Zone	1.60	**C3**	4.28	**C3**		C3-City commercial zone	**C3**	**7.1**
C3A - City Level Commercial Zone	0.96	**C3A**						
C3B - City Level Commercial Zone	0.23	**C3B**			5.5			
C3C - City Level Commercial Zone	1.50	**C3C**						
C4 - Regional Level Commercial Zone	0.12	**C4**	0.59	**C4**	1.9			
C4A - Regional Level Commercial Zone	0.46	**C4A**						
C5 - Retail Warehouse Zone	0.46	**C5**	0.46					
I1 - Light Industrial Zone	11.99	**I1**	11.99	**I1**	12.3	I1-Light industrial zone	**I1**	**13.6**
I2 - General Industrial Zone	16.10	**I2**	16.10	**I2**	3.3	I2-General industrial zone	**I2**	**4.2**
I3-Mining/ Extraction/Quarry Zone						I3-Mining/ Extraction/Quarry	**I3**	**0.4**
IN - Infrastructure	6.62	**IN**	6.62	**IN**	3.9	U-Utility zone	**U**	**1.6**
P1 - Passive Recreational Zone	35.02	**P1**	35.02	**P1**	37.7	P1-Parks and open spaces zone	**P1**	**10.4**
P2 - Active Recreational Zone	7.40	**P2**	7.40	**P2**	5.8	P2-Sport and Eco tourism zone	**P2**	**11.5**
P3 - Agriculture Zone	192.91	**P3**	192.91	**P3**	158.7	A1-Agriculture zone	**A1**	**165.5**
						P3B-Forest zone	**P3B**	**87.7**
						P3C-Steep slopes (> 30%) zone	**P3C**	**68.2**
						WB-Waterbody Zone	**P3E**	**2.2**
P4 - Protected Area Zone	191.02	**P4**	191.02	**P4**	235.2	W2 - Rehabilitation	**W2**	**12.2**
						W3 - Sustainable Exploitation	**W3**	**20.4**
						W4 - Conservation	**W4**	**39.7**
						W5 - Recreational	**W5**	**1.8**
						PF1-Education and research facilities	**PF1**	**2.7**
						PF2-Health facilities	**PF2**	**2.7**
						PF3-Religious facilities	**PF3**	**0.5**
						PF4-Cultural/ memorial sites	**PF4**	**0.1**
						PF5-Cemetery/ crematoria	**PF5**	**1.8**
PA- Public Administrative Zone				**PA**	9.2	PA-Public Administration zone	**PA**	**4.4**
R1 - Single Family Residential Zone	18.99	**R1**	18.99	**R1**	21.5	R1-Low density residential zone	**R1**	**25.2**
R1A - Mixed Single Family Residential Zone	60.76	**R1A**	60.76	**R1A**	30.8	R1A-Low density residential densification zone	**R1A**	**60.3**
R1B - Rural Residential Zone	20.23	**R1B**	20.23	**R1B**	24.6	R1B-Rural residential zone	**R1B**	**33.9**
R2 - Low Rise Residential Zone	17.53	**R2**	38.82	**R2**	24.1	R2-Medium density residential - Improvement zone	**R2**	**31.7**
R2A - Low Rise Residential Zone	21.29	**R2A**						
R3 - Medium Rise Residential Zone	45.51	**R3**	45.51	**R3**	18.0	R3-Medium density residential - Expansion zone	**R3**	**61.9**
R4 - High Rise Residential Zone	1.71	**R4**	1.71			R4-High density residential zone	R4	**17.5**
R5-Affordable Housing Zone				**R5**	63.5			
Road	48.83	**RD**	48.83	**RD**	56.5	T-Transportation zone	**T**	**41.9**
SP - Special Use	16.85	**SP**	16.85	**SP**	7.0			
Total	**729.86**		**729.86**		**729.5**			**729.6**



Kigali Master Plan 2019 - Proposed Phasing Plan

Phasing of Development

The phasing plan is a key told for the implementers to prioritise development in a particular area of the City, and source adequate funding to finance the project. It provides the government, community, and donors/financers with rationale to prioritize infrastructure and associated urban services to incrementally develop in a phased manner.

Referring to Kigali Master Plan Zoning Regulations 4.2, phasing regulations can be applied to all zones/areas covered in the Proposed Kigali Zoning Plan 2050. City of Kigali (CoK) shall initiate and carry out the implementation of the master plan according to the phasing plan. Meanwhile, CoK shall prioritize and publicize the 7- Year Development Programme with financial plans. The sequencing of development according to the phasing plan shall require flexibility that is responsive to the market demands. The provision of infrastructure and services planning shall be carried out incrementally and align with 7-year Development Programme. However, each phase shall contain adequate infrastructure and other public facilities to allow the phase to stand on its own without depending on the development of subsequent phases. The prioritization of developmental activities within each phase shall consider, any relocation of people, land management approaches, funding availability, and relevant policies and legislation, that maybe required. The legal agreement and exemption for the phasing plan development shall be referred to the Zoning Regulation report.

Kigali Master Plan is proposed to be demarcated into five phases to allow incremental development in the city in line with the market demand (Figure 1.6). The amount of land allocated for each phase (Table 1.1) is driven by Kigali Broad Land Requirement established to respond to the needs of the projected population and employments in phases. The key factors and considerations for phasing demarcation will include:

1. 7- Year Development Programme;
2. Catalyst Programme and Implementation Projects;
3. Priority areas in redevelopment of unplanned settlements; and
4. Priority areas in development of Sites and Services Areas;

The planning in different phases is elaborated in the following sections.

Land area by phases

Phase	Area (sqkm)	% Completion
Phase1	197.9	27
Phase2	108.4	42
Phase3	142.3	61
Phase4	165.5	84
Phase5	115.5	100
	729.6	100

1

Introduction

1.1 Project Background
1.2 Report Objectives
1.3 Methodology
1.4 Organization of Report

1 Introduction

1.1 Project Background

As stated in the 2013 Kigali Master Plan Implementation Report, the first update to the Master Plan shall be undertaken after 5 years from its adoption. This is even more important for a city like Kigali, which is rapidly evolving towards a world-class urban centre, and needs updated and real-time information on the master plan implementation status to promptly identify and apply corrective measures as needed. Surbana Jurong and SMEC have been selected as the ideal candidate for this important task that will shape, once more, the future of Kigali and Rwanda in general.

Having completed Stages 1,2,3 and 4, the project progresses with the development of Stage 5 and 6 on the Final Master Plan Update. Stage 5 includes Updated Master Plan Final Report which consists of update of the Land Use and Zoning Plans for Kigali City, including Transportation and Infrastructure Plans. This stage of works also include the preparation of a Final Zoning Regulations Report for the entire Kigali City as well as update of Nyarugenge Urban Design Area, Gahanga Urban Design Area and Kimironko Urban Design Areas. Stage 6 includes the updated Implementation plan report which provides the improvement to the framework, elaborate on the priority actions and projects and to define specific roles to be taken by the various stakeholders in an optic of coordinated implementation, monitoring, enforcement and management of the Master Plan.
Presented below is a list of reports due for this project:

Stage 1:

- Inception Report

Stage 2:

- Updated Visioning and Programming Report
- Implementation Status Report

Stage 3:

- Updated Transport Master Plan Report

Stage 4:

- Updated Master Plan Interim Report
- Zoning Regulations Report

Stage 5:

- Final Master Plan Report with Zoning Plans and Maps
- Final Zoning & UD Regulations Report
- Nyarugenge CBD Updated Urban Design Report
- Gahanga CBD Updated Urban Design Report
- Kimironko CBD Updated Urban Design Report

Stage 6:

- Updated Implementation Plan Report

1.2 Report Objectives

This stage is the core of the assignment and consists of several parallel and integrated activities aimed at consolidating all inputs collected in previous stages, with the objective of elaborating a preliminary update of the Master Plan. The review addresses Land Use and Zoning Plans and Regulations, Infrastructure and Transport Networks.

The process was envisioned as a reiterative review exercise where CoK technical team has been involved and collaborated with Planners and Engineers from SJ and SMEC, highlighted critical issues and suggested suitable corrective actions to be incorporated in the plan update.

The objective of this stage was dual, consisting:

- Update the Kigali City Master Plan combining, new data, local feedback and knowledge with SJ-SMEC international experience;
- Involve the CoK staff in an international planning process, exposing them to planning best practices.

1.3 Methodology

Having identified the revised current issues, challenges, vision and preferred development directions, the updated Interim Master Plan for Kigali is developed at this stage.

The methodology and the process in preparation of the updated Interim Master Plan is elaborated below:

Identifying Founding Principles of the Master Plan

In light of the review in the approach taken for the Master Plan update, the underlying principles that will guide the updating of the plan are outlined. These principles are identified integrating the recent national growth directions and issues after the adoption of the 2013 Kigali City Master Plan. They provide the new foundation for the physical planning of the city.

Development of Structure plan 2050

Based on the updated analysis, visioning, socio-economic projections, and implementation status, the Structure Plan of Kigali City from 2013-2040 is reviewed. A land utilization, and urban density distribution strategy for Kigali is developed based on the updated data.

Development of detailed land use Requirement

A detailed land use requirements projected for Kigali City by 2050 for housing and economic activities is developed based on the updated socio-economic study including demographic and economic outlook for Kigali, housing market and need analysis, as well as commercial real estate market analysis.

Development of Kigali Master Plan 2050

Updated land use plans for Kigali City 2050 is developed which focuses on developing detailed strategies for various sectors such as employment, housing, transportation, public transit, public facilities, environment, open paces, and creating unique identity based on the updated information. This to read together with the proposed revised Zoning Plan and Regulations which is detailed out in a separate report.

Public participation & Engagement

Various Stakeholders Meetings, Focused Groups Discussion and Technical Advisory Group Meetings were conducted in parallel during the project stage to engage the communities in data collection, ideas sharing, master plan updating progress, comments and feedback. These comments and inputs collected in the previous stages are incorporated into the making of the revised Master Plan for the City of Kigali.

1.4 Organization of Report

In addition to this chapter, the report consists of other following chapters:

Chapter 2: Envisioning Kigali City 2050

This chapter presents the summary of the changing aspirations and growth potentials of the City of Kigali by 2050, which forms the overarching framework that guides the update of the Kigali City Master Plan. The key outcomes from all the stakeholders engagement, approved proposed vision for Kigali City 2050, as well as the updated Vision Framework with detailed key performance indicators are elaborated.

Chapter 3: Founding principles of the Master Plan

This chapter highlights the key founding principles based on the revised approach

taken in this Master Plan review, which forms the foundation to guide the development of the updated Master Plan. These development principles include the integration of Kigali City in the national context, detailed phasing, incremental development, facilitation of affordable housing, promotion of green growth, mixed use, sustainable and resilient infrastructure, as well as inclusivity and equity.

Chapter 4: Kigali Master Plan from 2013-2040 to 2019-2050

As the detailed Master Plans for the City of Kigali were prepared separately for the three districts previously, this chapter aims to present the consolidated Kigali City Master Plan 2013-2040 including the Concept Plan, Structure Plan, Land Use Plan and Zoning Plan. A summary of these plans are outlined to provide a basis of comparison and review to move forward with the Master Plan update for the period of 2019-2050. The chapter also explains the updated Structure Plan and broad land use requirement for different zones leading to the proposed master plan zoning. .

Chapter 5-12: Updated Master Plan based on the eight development goals

The following chapters organise and present the updated Kigali City Master Plan 2050 according to the revised development goals as first established in the Analysis and Visioning Report in Stage 2 of the project. The proposed detailed strategies leading to the land use plans for each sector including economic, social and demographic growth, employment, nature and environment, housing and public facilities, transportation, utilities and infrastructure, alongside with Master Plan implementation will be updated based on the eight themes: City of Excellence; City of Mixed Neighbourhoods; City at Work; Green City; City on the Move; Efficient City; City for Citizens; and Creative City.

Chapter 13: Master Plan Phasing

The chapter highlights the proposed phasing for the implementation of proposals for the City to focus and prioritise its growth.

2

Envisioning Kigali City 2050

2.1 Proposed Kigali City Vision 2050
2.2 Proposed Vision Framework

2 Envisioning Kigali City 2050

2.1 Proposed Kigali City Vision 2050

As elaborated in the Vision Report of this Master Plan update, a multi stakeholder engagement approach has been adopted as one of the key rationale behind the update of Kigali Master Plan 2013 is to improve the existing Master Plan and make it more inclusive in bringing the people of Kigali and Rwandans in general to the review process.

This approach has also been followed to update the Vision for the city, engaging with stakeholders at multiple platforms and bring out a vision statement that resonates with all its citizens and follows the underline mission and goals set for the master plan when it was first conceived.

KIGALI Yacu!
OUR KIGALI!

The Centre of Urban Excellence in Africa

EIGHT THEMES OF DEVELOPMENT

CITY OF EXCELLENCE

CITY AT WORK

CITY ON THE MOVE

CITY FOR CITIZENS

CITY OF MIXED NEIGHBORHOOD

GREEN CITY

EFFICIENT CITY

CREATIVE CITY

2.2 Proposed Vision Framework Proposed Kigali City Vision 2050

According to the World Bank:

- The Urban Sustainability Framework (USF) is used to support cities to achieve a greener future and serves as a guide for cities seeking to enhance their sustainability;
- It helps in defining a vision with priorities, determining financing, and, finally, monitoring and evaluating their project implementation progress;
- It assists cities to identify their sustainability aspirations and establish how they will finance their implementation plans;

Based on the specific and pressing issues in the city of Kigali, the Urban Sustainability Framework is established to address these aspects by providing guiding principles for the subsequent planning processes that will ensure the long term sustainability of Kigali.
With reference to the reviewed analysis of the existing context of Kigali and growth directions, the following issues are identified that form the basis for Urban Sustainability Framework.

2.2.1 Environmental Issues

- Rapid urbanization and encroachment of nature areas
- Increasing pressure on resources and carbon footprint with urbanization and economic growth

2.2.2 Social Issues

- Large disparity in living conditions between “Rich” & “Poor”
- Increasing urban sprawl with unplanned settlements lacking physical and social infrastructure

2.2.3 Economic Issues

- Pressing need for expanding the skilled workforce
- Need for employment opportunities to cater to the increasing population
- Push for green economic growth

The key strategies and recommendations to tackle the above mentioned issues and the challenges are indicated by Figure 2.1 below and elaborated in Table 2.1.

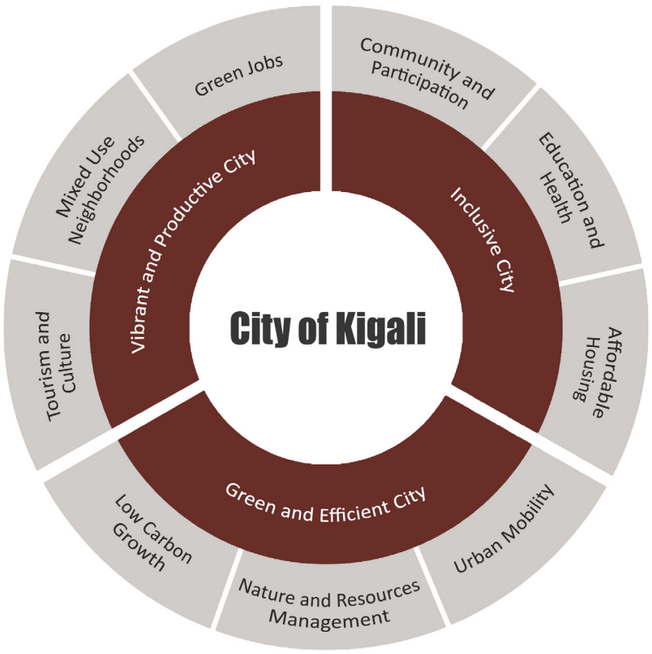


Figure 2.1 Updated Urban Sustainability Framework for City of Kigali

Table 2.1 Updated Urban Sustainability Framework for City of Kigali

Components	Key Issues	Direction	Challenges	Recommendations
ENVIRONMENT Green & Efficient City	Nature areas • Urban areas prone to landslides and flooding • Unplanned developments on steep slopes • Deforestation • Encroachment of wetlands	• Clearance of development in Steep Slopes and Wetlands and acquire land for relocation • Restoration of steep slopes and wetlands • Afforestation	• Implementation mechanism and cost of land acquisition & relocation • Cost for programming and implementation restitution of nature areas	• Conserve all slopes above 30% • Conserve all wetlands • Prepare redevelopment schemes to relocate people from steep slopes and wetlands • Prepare strategies for rehabilitation and for management of slopes, forests and wetlands • Explore possibilities for sustainable exploitation of nature areas for economic gain-creation of green jobs
	Resources & Carbon footprint • Sprawling low rise development • Expanding urban areas • Need for extended infrastructure/ transportation facilities • Increasing pressure on energy and resources • Increasing carbon footprint	• Green Growth development • Compact city development • Sustainable resource management	• Affordability of intensified and densified development • Cost for high capacity transport infrastructure • Efficient use of resources	• Limit urbanization boundaries • Identify potential high density mixed use zones • Reduce sprawling development and hence reduce infrastructure/ transportation cost • Explore possibilities for green mobility and city greening to counter increase in carbon footprint • Explore integrated management system for energy, waste, water etc.
SOCIAL Inclusive city	• Large disparity in quality of living environment between the high and low income groups • Poor living quality in unplanned settlements with lack of physical and social infrastructure	• Inclusive development that considers the needs of all including gender, youth, vulnerable groups • Create Integrated Neighbourhoods • Community Engagement in implementation and local design	• Need for large funding resources • Balancing the needs of various groups of citizens • Brownfield developments • Implementation of integrated neighbourhoods	• Create good affordable housing/ home improvement schemes • Develop integrated neighbourhoods with a mixed of housing, commercial, recreation, transport facilities and employment opportunities • Ensure improved living quality for commoners and minimize the gap in terms of living quality • Conduct regular stakeholders meetings for city and local level project implementation
ECONOMY Vibrant & Productive City	• Lack of well-serviced attractive areas for investment • Need for more employment opportunities for the increased natural and migrant population • Promote green economic growth	• Create dedicated areas for businesses and regional commercial activities • Green jobs creation • Promote tourism development	• Need to make strategic land acquisitions for a well-monitored commercial development • Balanced and complementary development for Kigali city and 6 secondary cities • Attract green economic investments	• Anticipate various investment possibilities in consideration of the latest regional development • Safeguard land for economic expansion at key areas (CBD /commercial center, industrial areas, tourism spots) • Promote green economy investments and green jobs creation • Increase vibrancy and activities, promote tourism with preservation of culture and heritage

2.2.4 Vision Framework

The City of Kigali's vision to become the Centre of Urban Excellence" with its inclusive tagline of Kigali Yacu! Our Kigali! is emphasized through the eight development goals, which addresses the key themes and challenges following the updated analysis of the city
. These goals are elaborated with the key planning approach, strategies and targets that the city is recommended to adopt to realize the vision established.

The detailed strategies and key performance targets for each development goal will be developed in the next stage of Interim Master Plan report.

Table 2.2 Goals and Strategies for City of Excellence

Key themes	Planning Approach & Strategies	Targets & KPIs
Urban Planning **Urban Development**	• Adopt participatory approach in planning and implementation • Implement land consolidation and readjustment models for land acquisition, especially for key public infrastructure/ capital improvement projects • Updates on existing land use and review zoning with socio-economic and real estate market analysis • Introduce alternative zoning models • Introduce incremental development model for flexibility • Introduce transparent yet flexible procedures to update the master plan regularly	• Update of proposed zoning plan and regulations for Kigali Master Plan based on market demand • Development of land consolidation/ land pooling framework • Collect feedback and comments from the stakeholders on the review of the Master Plan
Quality of Life	• Upgrading of unplanned settlement to improve quality of life and urban environment • Review all on-going initiatives for upgradation of informal settlements	• Establish resettlement development model • Provide planned integrated mixed-use neighbourhoods
Governance	• Develop financing models and public-private partnerships • Review of Institutional set-up for better coordination and capacity building • Establish coordinating body for urban development.	• Develop detailed implementation framework and financial models for key catalyst and capital improvement projects • Improve the capacities and the role of CoK one stop center with dedicated units (land consolidation, urban design, Master Plan implementation, community engagement, etc.)

2.2.5 City of Excellence

Table 2.3 Goals and Strategies for City of Integrated Neighbourhoods

Key themes	Planning Approach & Strategies	Targets & KPIs
Affordable city	• Provide quality housing and public facilities • Introduce flexible zoning regulations • Promote low cost, local materials for construction of affordable housing • Provide accessible and quality recreation spaces	• City free of illegal / unplanned areas • Improved and healthy ratio between home ownership and rental housing • 60% affordable housing (CoK and GoR must clearly establish housing affordability indicators, currently there is no criteria to define 'housing affordability' in Rwanda)
Housing & Densities	• Provide integrated developments e.g. industrial with worker housing and social infrastructure • Review proposed FAR for all zones • Set up minimum and maximum guidelines for specific zones	• Review proposed FAR, housing typologies and housing densities
Unplanned Settlements & Economies	• Introduce inclusionary zoning to upgrade unplanned settlements • Promote mixed use, quality affordable housing and public open spaces, services and light industrial opportunities in selected areas	• Establish resettlement / integrated mixed-use neighbourhoods development model • Provide employment opportunities and training of skilled labour
Services at Neighbourhood Level	• Master Plan phasing for provision of quality social infrastructure including health, education and recreation facilities • Review of public facilities provision standards	• Easy access to facilities within 400m walking distance • Minimum green space per capita to be 15sqm (NR)

2.2.6 City at Work

Table 2.4 Goals and Strategies for City at Work

Key themes	Planning Approach & Strategies	Targets & KPIs
Economic Development **Commercial & Retail** **Industries & Construction**	• Create a vibrant business environment • Strengthen economy and provide for regional and local employment opportunities • Promote Kigali as the Tourism Gateway of Central Africa • Introduce flexible zoning regulations • Provide relevant sites to support new key sectors/ economic drivers for economic development • Enhancing productivity of Kigali through agriculture /forestry, construction and manufacturing as key employment sector • Providing micro enterprises with worker dormitories within mixed use affordable housing for live-work integrated neighbourhoods • Review provision of service sector and other employment sectors as per market demand	• Making a modern Regional Financial Hub in Africa • Providing adequate and affordable working spaces for service and industrial sector jobs to cater to the projected sectoral employment • Promote high-value added agriculture and agro-based industries
Productive City	• Develop framework for formalising informal economies • Formalising unplanned settlements when possible • Introduce incremental development approach e.g. for on site upgradation • Enhance skills training and capacity building in the new economic drivers.	• Safeguard land for commercial/ industrial and institution use to create employment opportunities and training of skilled labour • Establish resettlement development model

2.2.7 Green City

Table 2.5 Goals and Strategies for Green City

Key themes	Planning Approach & Strategies	Targets & KPIs
Wet lands and waterbodies	• Development of Integrated Water Resource Management Plan (with Wetland, Water Bodies, Watershed and Stormwater Management Plans and Strategies). • Development of Wetlands and Waterbodies Management Manual • Awareness Campaign and Capacity Building Trainings • Protect wetlands allowing for recreational activities, agriculture and local material extraction in agreement with authorities • Participatory Programs and Action Plans • Promotion of Sustainable Wetlands and Waterbodies Use and Leverage protected natural resources for economic activities • Preservation and Restoration of wetlands and waterbodies encroached upon by human livelihood and urbanization activities • Relocation/resettlement of households inhabiting restricted and hazardous areas including protected wetlands. • Integration of Wetlands, Water Bodies and Natural Drainage Channel Restoration into design and development of green open spaces, urban parks and landscapes, and green city trails/corridors • Promotion of Long-term Phased Reduction of Wetland Cultivation and Increased Upland Agricultural Area (including household kitchen gardens and green roofs)	• Development of Integrated Water Resource Management Plan (with Wetland, Water Bodies, Watershed and Stormwater Management Plans and Strategies). • Development of Wetlands and Waterbodies Management Manual • A citywide Wetland Management Plan • Plan for management of agricultural practices in wetland areas • Zero net-loss of wetlands and waterbodies • 20 m mandatory buffer for wetlands (Organic Law) • 10m mandatory buffer for rivers and 50m buffer for lakes • Restoration of wetlands encroached for urban uses • Protect wetlands allowing for recreational activities, agriculture and local material extraction in agreement with authorities

Key themes	Planning Approach & Strategies	Targets & KPIs
Forestry	• Development of Integrated Forest Management Plan • Development of Forest Management Manual • Awareness Campaign and Capacity Building Trainings on Forest Conservation, Sustainable Forestry and Agro-Forestry Best Management Practices • Participatory Programs and Action Plans for Implementation of natural forest protection and restoration, reforestation and afforestation, forestry and agro-forestry • Preservation and Restoration of natural forest patches and restricted activities in accordance with forest regulations. • Integration of Afforestation (Native and Horticultural Tree planting) into design and development of green open spaces, urban parks, green city trails/corridors, streetscapes, and mass transport corridors. • Protect wetlands and forests allowing for recreational activities, agriculture and local material extraction in agreement with authorities • Leverage protected natural resources for economic activities • Promotion of agroforestry and sustainable forestry favoring native species to restore ecosystem services such as watershed protection, slope protection, and production of timber, fuel wood, fruit, nuts, medicine, etc... • Promotion of Transition to Alternative Energy Sources and Efficient Wood/Charcoal Stoves	• Development of Integrated Forest Management Plan • Development of Forest Management Manual • Development of Participatory Programs and Action Plans • Development of Capacity Building Program • Zero net-loss of existing forests • Reforestation and Afforestation in slopes > 30%
Agriculture	• Development of Urban Agriculture Development Plan • Development of Urban Agriculture Extension Manual • Awareness Campaign and Capacity Building Trainings and promotion of sustainable urban agriculture • Participatory Programs and Action Plans • Preserve fertile agriculture lands and use land consolidation method to increase food productivity • Preservation of net area of agricultural lands • Boosting productivity through agroecological best practices and development of irrigation systems. • Reduced reliance on inorganic fertilizers and pesticides, • Integration of Horticulture into design and development • Promotion of Transition to Wetland to Upland Agriculture	• Development of Integrated Urban Agriculture Management Plan (including Comprehensive management plan for agriculture and agro-forestry along steep slopes) • Development of Urban Agriculture Management Manual • Development of Participatory Programs and Action Plans • Development of Capacity Building Program • Zero Net Loss of Agricultural Areas in the city • Creation of innovative urban agriculture for slopes > 20% • Plan for management of agricultural practises in wetland areas
Steep slopes	• Development of Integrated Slope Management Plan • Development of Slope Management Manual with Best Practices • Awareness Campaign and Capacity Building Trainings on Slope Hazards and Slope Management Best Practices. • Protection and Conservation of Slopes allowing for regulated sustainable use in less fragile areas for recreational activities, agriculture, and local material extraction in agreement with authorities. • Assessment and Mapping of High-Risk Slopes in Kigali to improve landslide disaster risk avoidance and mitigation. • Restricted Development Activities on Steep Slopes in accordance with protection regulations • Reforestation and Implementation of Erosion Control Measures on Steep Slopes • Relocation and Resettlement of Households Inhabiting Restricted (>30% slope) and Hazardous Slopes sites at risk of landslides and flooding	• Development of Integrated Slope Management Plan • Development of Slope Management Manual • Development of Participatory Programs and Action Plans • Development of Capacity Building Program • No development on steep slope (conditional low intensity developments) • Relocation of unplanned communities in areas with >30% slope • Slopes >30%: • Protect steep slopes and eco fragile areas • No development on steep slope (conditional low intensity developments) • Relocation of unplanned communities in steep slopes and restoration / reforestation of slopes above 30% • Afforestation in slopes > 60%: • Mandatory soil stabilization of all slopes (both public areas & private developments) • Creation of innovative urban agriculture for slopes > 20% • Comprehensive management plan for agriculture and agro-forestry along steep slopes • Reforestation to restore former forests • Preserve fertile agriculture through land consolidation method to increase food productivity

Key themes	Planning Approach & Strategies	Targets & KPIs
Steep slopes		• Plan for management of agricultural practices in wetland areas
Green growth and climate change	• Compact and Integrated development • Cluster and inclusionary zoning regulations to create more public open spaces • Include tax exemption and climate financing opportunities as incentives for all energy efficient development • Support existing green standards to encourage green compliance in Kigali • Efficient Use of Resources • Efficient Services and Transport • Economic gain-creation of green jobs • A citywide climate change management plan with projects and guidelines. • Include tax exemption and climate financing opportunities as incentives for all energy efficient development. • Integrating climate and disaster resiliency into planning and design of buildings, infrastructure, and urban services to adapt to and minimize negative impacts from and contribution to climate change and natural disasters.	• Development of Integrated climate and disaster Management Plan • Development of Forest Management Manual • Development of Participatory Programs and Action Plans • Development of Capacity Building Program • Encourage green growth development • Economic gain-creation of green jobs • A citywide climate change management plan with projects and guidelines
Disaster risk reduction and resiliency	• Protect steep slopes and eco fragile areas • Integrate Water Resource and Storm Water Management strategies • Assessment and Mapping of High-Risk Slopes in Kigali to improve landslide disaster risk avoidance and mitigation. • Integrating climate and disaster resiliency into planning and design of buildings, infrastructure, and urban services to adapt to and minimize negative impacts from and contribution to climate change and natural disasters. • Identification and mapping of natural disaster risk and hazard areas (e.g. Flooding, erosion, landslides, earthquakes, and lightning strikes). • Restriction of development and activities in high risk areas. • Relocation of households from high risk/hazardous areas. • Preparation of early warning system. • Preparation of disaster response plans. • Design of resilient infrastructure and services to minimize the impacts and disruptions from common natural disasters.	• Preparation of early warning system. • Preparation of disaster response plans. • Mandatory soil stabilization of all slopes (both public areas & private developments)

2.2.8 City on the Move

Table 2.6 Goals and Strategies for City on the Move

Key themes	Planning Approach & Strategies	Targets & KPIs
Public Transport **Transit-oriented City**	• Develop a high-quality public transport system which provides good coverage, and direct, fast and frequent services. • Develop a supplementary feeder system which works in conjunction with the public transport system, maximizes public transport coverage. • Develop a high-quality public transport system which is easily accessible and segregated from private road-based traffic • Adopt Intelligent Transport Systems (ITS) to enhance service reliability. • Locate road-based public transport stations, stops or interchanges along major arterial roads • Integrate non-road-based public transport services (rail and air transport) with road – based public transport services. • Connect regional centers with public transport services. • Integrate all road-based public transport services. • Develop a strategic approach to providing pedestrian amenities such as trees and street furniture. • Develop a pleasant streetscape especially along the NMT network.	• 80% of urban areas to be within 2km (or 30 min walk) of public transport services. • Public transport services to connect all major regional centers. • 100% of urban areas to be within 500m (or 10 min walk) from the feeder system • Public transport services to connect all major regional centers. • 100% of urban areas to be within 500m (or 10 min walk) from the feeder system. • Adopt ITS technologies for use in public transport service design. • Provision of road-based public transport access points along major arterial roads in regional centers. • Rail and air transport to be within 1km of road-based public transport services. • Public transport services to connect all major regional centers. • Provision of intermodal interchanges at major public transport intersections • Development of an NMT network. • Inclusion of NMT in road hierarchy and cross-sections • Commission of road design manual and guidelines. • Inclusion of NMT in road hierarchy and cross-sections.
Road Network	• Develop a high-quality public transport system which provides good coverage, and direct, fast and frequent services. • Develop a road network that supports the public transport system. • Develop a supplementary feeder system which works in conjunction with the public transport system. • Develop a ring and radial system of highways. • Develop a High Capacity Urban Roads (HCUR) Network. • Provide a Non-Motorised Transport (NMT) network along arterial roads. • Locate logistics hubs on the edge of Kigali • Locate intermodal logistics hubs where necessary • Provide a High Capacity Urban Road (HCUR) around the City for freight. • Develop a road hierarchy and associated mobility and accessibility functions, access management and cross-sections.	• The density of major and minor arterial roads should exceed 2km/sqm in urban areas. • 5% of the road network should be HCUR. • 100% of the major and minor arterial roads should have NMT infrastructure. • Logistics hubs to be located near HCUR on the edge of Kigali. • Intermodal logistics hubs to be located near air and rail links. • Alignment of HCUR to accommodate through movement of freight. • Commission of road design manual and guidelines.

Key themes	Planning Approach & Strategies	Targets & KPIs
Freight Management	• Locate logistics hubs on the edge of Kigali • Locate intermodal logistics hubs where necessary • Provide a High Capacity Urban Road (HCUR) around the City for freight • Reduce warehousing in city-centre and limit freight traffic to off-peak hours (e.g. night)	• Logistics hubs to be located near HCUR on the edge of Kigali. • Intermodal logistics hubs to be located near air and rail links. • Alignment of HCUR to accommodate through-movement of freight.
Green transport plan	• Develop a city-wide NMT network which supports the public transport system. • Develop a Non-Motorised Transport (NMT) network along arterial and collector roads. • Develop a strategic approach to providing pedestrian amenities such as trees and street furniture. • Develop a pleasant streetscape especially along the NMT network.Locate intermodal logistics hubs where necessary • Develop a well-permeating public transport system into the urbanscape of Kigali. • The location of public amenities and facilities to be located within regional centers which are well served by public transport • Develop a well-connected NMT network that utilizes open spaces and the road network • Develop a pedestrian-friendly street design guidance manual for use in residential and urban commercial settings. • Pedestrianize urban core centers where possible.	• Development of an NMT network. • Commission of road design manuals and guidelines. • Inclusion of NMT in road hierarchy and cross-sections. • Develop a hierarchy of demand appropriate public transport modes. • Public transport services to connect all major regional centers. • Reservation of servitudes. • Commission of road design manuals, transport legislation and guidelines. • Commission of a pedestrian project in the center of Kigali.
Effective implementation of transport policy	• Effectively implement the updated Kigali Transport Master Plan 2018 • Authorities, roles and responsibilities clearly defined • Develop a hierarchy of transport plans – policy/strategy, tactical and operational level	• Establish a Transport Authority for Kigali • Develop transport legislative environment • Develop transport governance structure

2.2.9 Efficient City

Table 2.7 Goals and Strategies for Efficient City

Key themes	Planning Approach & Strategies	Targets & KPIs
Water Supply	• Ensure 100% access to safe, reliable, affordable and high quality water supply services • Integrated Urban Water Management (IUWM) practices to be implemented to manage fresh water, waste water and stormwater as components of a basin-wide management plan, to meet the goals of Water Sensitive Urban Design. • Water demand management (WDM) strategies to be implemented including: network modelling, leak detection, setup and management of supply zones, pressure management and water meter assessments • Develop a water master plan for the City of Kigali • Water specific design guidelines and standards should be developed for the City	• In rural/ low density areas community standpipes accessible within 500m • In urban/ high-density areas individual household connections • Consumption in rural/ low-density areas = 80 l/person/day • Consumption in urban/ high-density areas = 120 l/person/day • Develop production and distribution capacity to meet 2050 demand • Rainwater harvesting & water saving devices for all new developments • Water audits & maintenance programmes
Sanitation	• Ensure 100% access to safe, reliable, affordable and high quality sanitation services in both rural and urban areas • Promote hygiene behaviour change for all the people through education programmes • Develop a waste water master plan for the City of Kigali • A waste water department should be established in CoK to manage, monitor and implement the waste water plan • Capacity development programme and maintenance programme to be implemented to train CoK staff on waste water management practices • Pit latrines to be phased out in areas with high water tables to avoid groundwater contamination, and to be replaced with flush-toilets where applicable or EcoSan toilets in areas with no waterborne sewer networks • Waste water specific design guidelines and standards should be developed for the City	• Construction of waterborne sewer network with waste water treatment plant to meet 2050 demand • In rural/ low density areas on site treatment: Pit latrines with solid slabs and septic tanks, or EcoSan toilets • In urban/ high-density areas off site treatment: Flush toilets with connection to waterborne sewer network to be treated at waste water treatment plant • All industries to treat effluent on site
Storm Water	• Develop a stormwater management plan to mitigate impacts on properties, infrastructure, human health and the environment • A stormwater department should be established in CoK to manage, monitor and implement the stormwater plan • Floodlines to be generated with an assessment of establishments in stormwater buffer zones • Stormwater specific design guidelines and standards should be developed for the City • Sustainable and green initiatives, such as rainwater harvesting to be promoted and implemented throughout the city	• All facilities to manage runoff within their properties • Revise local authorities' by -laws to effectively deal with stormwater runoff from all developments • Sustainable stormwater management practices to be implemented: vegetated swales, bioretention swales, constructed wetlands • Minimize flood risk by on-site retention
Solid Waste	• Ensure that all citizens have access to some sort of waste management service in ways that are protective to human health and the environment • Integrated waste management plan should be developed for the City • A waste unit department should be established in CoK to manage, monitor and implement the waste management plan • Public awareness/ education campaigns to be set up to assist with best practices in terms of waste management	• Construction of engineered landfill site that complies with all environmental and regulatory requirements to meet 2050 demand • Construction of transfer stations • In rural/ low density areas on site disposal, including composting of organic waste • In urban/ high-density areas off-site disposal, formal collection service with recycling and discarding at engineered landfill

Key themes	Planning Approach & Strategies	Targets & KPIs
Electricity	• Provide access to electricity to all citizens by grid and off grid means • Plan for contingency and improved quality and reliability of power supply • Reduce feeder length and load • Construct new lines and substations, expanding the power distribution network • Strengthen institutional capacity to service increased number of consumers • Enhance electricity master plan to align with urban plan • Incorporate electricity provision in building control regime • Provide adequate public lighting (roads and community areas)	• Develop power generation plants using abundant sources: hydropower (333 potential sites), solar, geothermal, other renewable sources (countrywide programmes) • Expand electricity transmission grid, with focus on servicing the increased demand of the City • 20% lower energy usage than world average • 20% renewable energy sources • National electrification target seeks 52% of customers to be on the grid with remaining 48% being off the grid. Set appropriate targets for the City. • 100% of customers to have access by 2020 (according to national electrification planning) • 100% access to high quality power supply by 2050
Fibre	• ICT infrastructure to enable “smart” services for the city • Provide connection to all citizens	• 100% connection by 2050 • Fibre ring main to pick up key locations: public sector (health care, educational institutions, government offices, safety and security), business locations, residential areas, peri-urban areas • Construction of data centres as the hosting environment for smart applications and platforms • Construction of network operations center (NOC) to manage day-to-day operations

2.2.10 City of Citizens

Table 2.8 Goals and Strategies for City of Citizens

Key themes	Planning Approach & Strategies	Targets & KPIs
Inclusive City	• Promote integrated, affordable development with access to social infrastructure for all • Develop mixed use, mixed income development through alternative zoning • Promote participatory planning/ bottom up approach • Support upgradation of unplanned settlement to provide quality living environment and affordable housing and infrastructure	• Establish resettlement development model to enable access to basic infrastucture for all • Easy access to facilities within 500m walking distance • Minimum green space per capita to be 15 sqm (NR) • Community design for locally based plans
Education	• Provide education facilities base on population catchment and densities by city, district, sector and cell levels to ensure easy accessibility	• Review minimum provision standards based on UPC and LUP and Kigali Master Plan 2013
Health	• Provide health facilities base on population catchment and densities by city, district, sector and cell levels to ensure easy accessibility	• Review minimum provision standards based on UPC and LUP and Kigali Master Plan 2013
Disabled people & Disadvantaged Groups	• Urban design guidelines to include universal design and barrier free environment	• To emphasize on barrier free designs for a minimum of 20% of the new developments • Introduce Incentives on zoning for housing with barrier free environment and imposing a percentage of accessible housing

2.2.11 Creative City

Table 2.9 Goals and Strategies for Creative City

Key themes	Planning Approach & Strategies	Targets & KPIs
Tourism & Culture	• Review and incorporate sites for tourism and suggest related economic activities • Support balanced development of natural resources for economic activities • Improve and extend ICT accessibility and connectivity to promote/ enhance digital marketing, online MICE conferences etc • Create more public open spaces to showcase cultural and tourist activities	• Enabling environment to double tourist arrival in Kigali by 2025 (as per the Sustainable Tourism Development Masterplan for Rwanda) • Develop at least 1 regional tourism destination in each district
Vibrant City	• Identify key nodes for mixed uses and entertainment activities • Improve accessibility to mixed use nodes • Encourage activity generating land uses to create a 24 hour city where people live-work-play-create	• Provide key areas in CBD as mixed use and entertainment precincts along main transit corridors • Develop urban design guidelines on key precincts to guide development of a vibrant and attractive environment
Heritage	• Including heritage sites in Master Plan • Provide guidance on further studies on mapping of heritage sites for preservation and tourism	• Develop three special precincts or heritage precincts in Kigali • Preservation of all historic and culturally important sites in master plan • Draft Heritage Promotion Strategy

3

Founding Principles of the Master Plan

3.1. Kigali Integration in the National and Regional Context
3.2. Incremental development
3.3. Facilitating affordable Housing
3.4. Detailed Phasing aligned to City Development Strategy
3.5. Mixed Use Approach
3.6. Green Growth
3.7. Sustainable and Resilient Infrastructure
3.8. Inclusivity and Equity

3 Founding Principles of the Master Plan

"A city should be built to give its inhabitants security and happiness." - Aristotle

Locations and status of the cities become critical factors in creating vision for cities. The City of Kigali is more than just another location or dwelling place, more than just a place where people live, work, grow, retire and then pass away. It is the landmark and the image of a nation that has influence on the trends beyond its borders. It is the seat of decision-making that affects the lives and livelihoods and the future of the citizens, and gives meaning to the very idea of Rwanda.

Countries all over the world are rapidly urbanizing and grappling with the challenges that urbanization poses. According to the UN report, 68% of the world's population is projected to live in urban areas by 2050, and more than half of the world's population growth will be in Africa by 2050. This is a serious indication that African countries can no longer be satisfied with business as usual approach in urban planning and implementation.

Therefore, the Master Plan for Kigali must be formulated on strong principles and foundation that can satisfy the needs of all people today and the future generations, and plan a better future, not just for the citizens of the capital, but for the entire country. The intent of the Master Plan is to engage all stakeholders to create a sustainable, safe, inclusive and efficient community where the life and vitality can be enjoyed by all its residents and visitors alike.

The planning process proposed for the Master Plan of Kigali is designed to be:

- **Innovative**, introducing most recent and effective planning approaches to Kigali in all aspects of the final Plan;
- Centred on **rigorous needs assessment** based on Primary and Secondary Data Collection, Stakeholders and Community Representatives engagement, in depth analysis;
- Focused on establishing **integration and synergies** with Public Institutions, Private Sectors, International Organizations, Consultants through a continued interaction and collaboration;
- **Inclusive** by addressing citizens needs with respect to access to housing, working spaces, public facilities and transport solutions;
- Built around a **Transport Oriented Development** approach, focusing on mixed used development along main transportation corridors and focused on **Sustainable Infrastructure Development**; and
- I**mplementable**, by having implementation as key objective from the beginning of the planning process

To support the proposed planning process, following unique set of principles have been adopted to guide urban growth, economic growth, land and urban management in Kigali over the coming decades.

Principle One: Kigali Integration in the National and Regional Context

Principle Two: Incremental development

Principle Three: Facilitating Affordable Housing

Principle Four: Detailed Phasing aligned to City Development Strategy

Principle Five: Mixed Use Approach (in all areas, along transport corridors, etc)

Principle Six: Green Growth (protection vs. development)

Principle Seven: Sustainable and Resilient Infrastructure

Principle Eight: Inclusivity and Equity

These eight principles have been further elaborated in the chapter ahead.

3.1 Kigali Integration in the National and Regional Context and Review of NLUMP

The first founding principle of this Master Plan is Kigali Integration in the National and Regional Context, which positions Kigali as an integrated part of the nation as well as the regional community at large. Kigali city is envisaged to grow in alignment with national directions that promotes balanced economic and physical development, in harmony, and complementing the needs and requirements of other cities and the region. As the capital city, Kigali will continue to play a leading role and grow

Planning Principles at a glance

Accomodate incremental development
- Flexible housing options with room for growth
- Ability of households to spend and changing housing demand dictates development

Facilitate affordable housing
- New housing models (like SKAT) to provide for lower rungs of income groups
- Use of local materials, involving local communities in the process, exploring alternative funding models

Encourage detailed phasing aligned to city development strategy
- City's growth corresponding to the population and economic growth - phase wise increment

Promote mixed use development
- Compact and integrated neighbourhoods with amenities accessible at a short distance
- Diverse built use at one place
- Combination of varying housing typologies

Support green growth (balance protection vs development)
- Sensitive to development impacts on environment
- Caring for eco-fragile and agriculturally fertile land
- Sustainable use of natural resources in the development process

Ensure sustainable and resilient infrastructure services
- Weather and climate proof infrastructure provision
- Roads, transit modes, water, sanitation, electricity etc. that is affordable and accessible to all

Promote inclusivity and equity
- Attention to vulnerable groups like women, children, poor, old, differently abled etc.
- Inclusive and representative planning

Box 1: Scenario of Kigali in the National and Regional Context

Kigali city is surrounded by 27 Districts including 6 Secondary Cities (Huye, Muhanga, Nyagatare, Rubavu, Musanze and Rusizi). To promote more balanced urban growth and management, these 6 cities were selected as emerging secondary economic poles of growth while keeping the leading role of Kigali as the Regional Hub that will attract international investments to Kigali through improved connectivity, competitiveness, market expansion and enhancement of value chains.

In the regional context, Rwanda is bordered by Uganda, Tanzania, Burundi and the Democratic Republic of the Congo and it is envisioned as a Continental Hub for Africa. Kigali and Rwanda are envisioned to be positioned as world class destinations and major tourism and regional conference hubs for Central and Eastern Africa. Rwanda aims to accelerate MICE tourism growth by attracting big events and conferences and developing cultural and religious tourism.

Connections

Kigali is in the central region of Rwanda, which places it in a good position as a stopping centre for freight travelling between international borders. Kigali is globally connected by the existing Kigali International Airport which is situated in the heart of the City along the east-west national highway. This highway connects Kigali to the neighbouring towns of Rwamagana in east, and Muhanga (Gitarama) in west, and to the other larger towns of Kibuye, Nyanza and Huye (Butare) in Rwanda.

The northern highways connect Kigali to Byumba in the north and the tourist destination-Ruhengiri in the north east and Gisenyi in the far-east. The regional Northern Corridor comprises of the inter-country highway and connects Kigali City to Kampala, Nairobi and Mombasa. The Central Highway corridor connects Kigali to Dar-es-Salaam and Bujumbura.

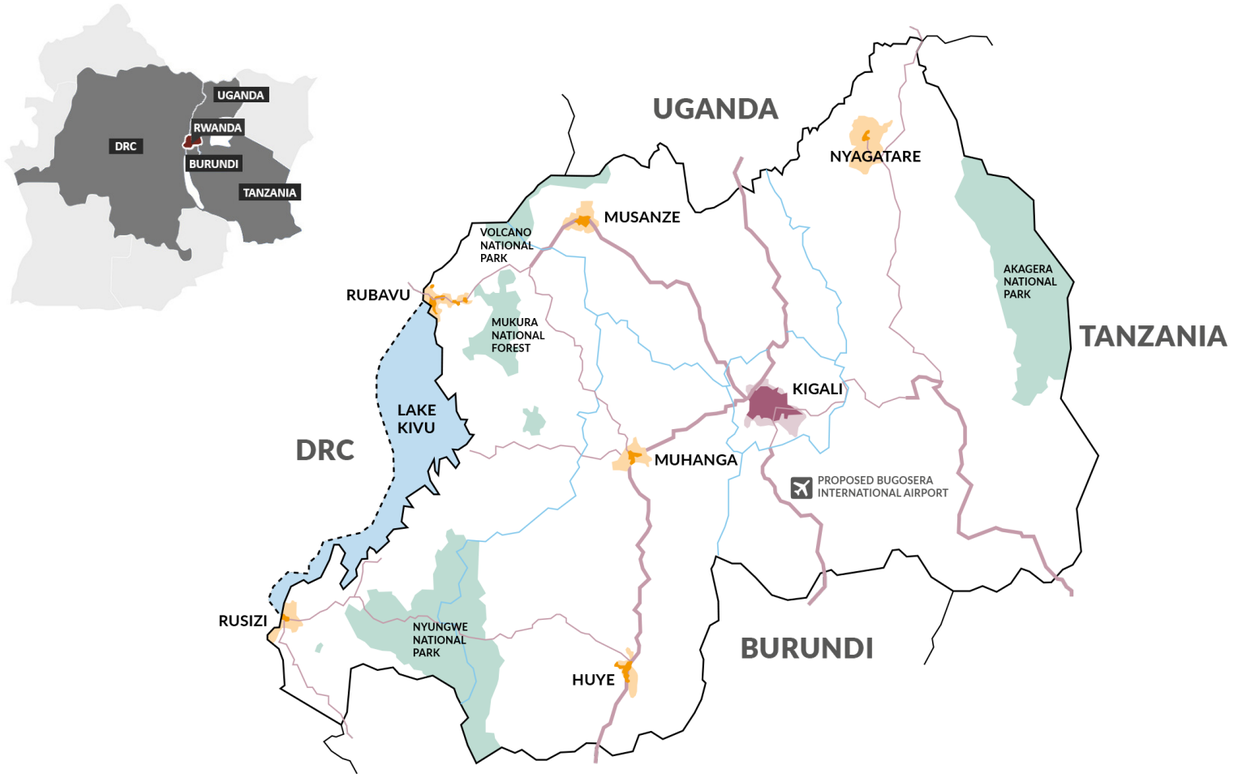


Figure 3.1 Regional Context for the City of Kigali
(Source: https://www.worldatlas.com/airports/rw/kigali-kgl.html)

as the Regional Hub for Rwanda and a Continental Hub for Africa.

Cities and regions do not and cannot exist independent of each other, rather they are interconnected and have effects on one another. As indicated by the *Principles of Intelligent Urbanism*, cities and regions are tied by the physical and environmental systems, such as watersheds, aquifer systems, forests, fauna and avifauna habitats that are connected by natural corridors and other natural systems that operate and exerts influence across the entire region. Also, economic/social infrastructure such as, roads, irrigation channels, hydro facilities etc. connect cities and regions, and should follow the same national standards for consistency and uniformity. It is crucial to conceptualize urbanization/development as part of a larger economic, social, and geographical setting such as the region. Likewise, we should think of the region as an integral part of the city and that planning of the city entails keeping larger picture of its hinterland as a holistic process/approach.

As the city and its growth and development exert influence over its

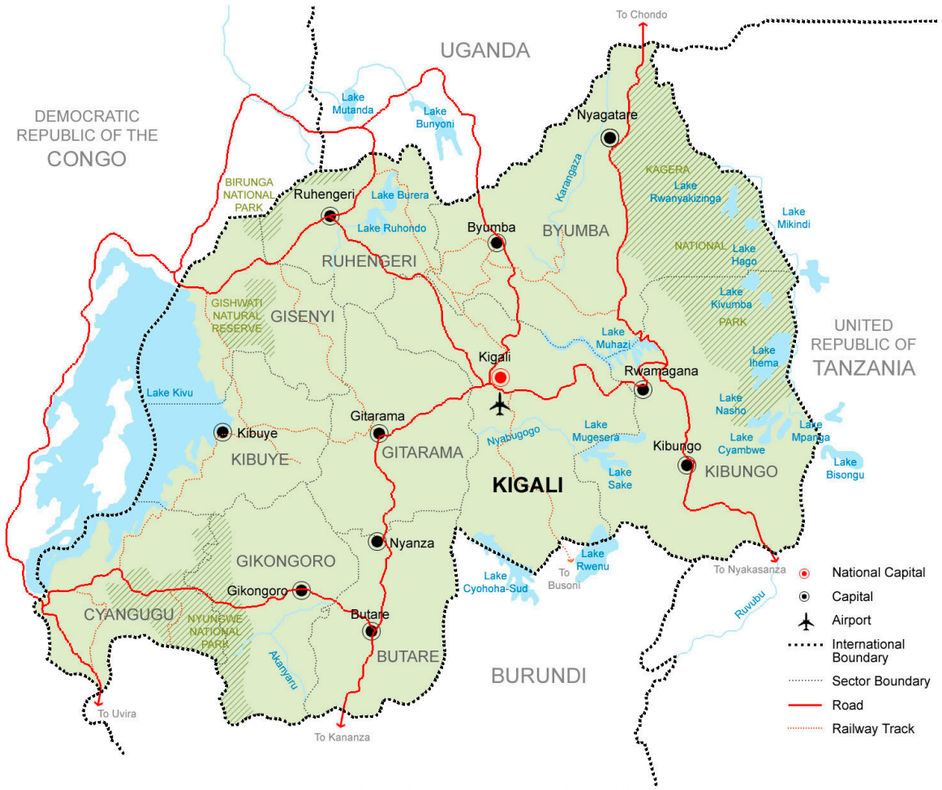


Figure 3.2 Regional connectivity to strengthen potential regional intgration of the city of Kigali (Source: CoK official website)

immediate and regional surrounds, it can accelerate or deteriorate development in the hinterland that supplies important products/raw materials, food, workers, and environmental safeguards. Where there are barriers for integration, it can hinder holistic development in terms of the efficiency, safety and overall effectiveness.

If we do not recognize the growth and wholeness of the city and its country as a regional phenomenon, then cities will turn haphazard in their development and ruthlessly exploit their surrounds without any respect on the growth of the whole. There is always a spread of population from the city into the region, and that population in the region moves into the city for work, shopping, entertainment, health care and education.

Socially, the city boundaries expand beyond their political boundary to serve those living within the catchment area from which workers commute into the city daily. Economically it works like a trade/commerce zone from which people choose to visit one city, or another, for supply of goods and materials, entertainment etc. When cities and regions are in harmony, they bring improved standards of living, greater security within the country, and can even contribute to the progress of the surrounding regions through an integrated approach that realizes greater economic and social development. National and regional integration promotes trade and market expansion through better allocation of resources across the region and accelerate economic growth. Therefore, it is essential that cities and regions are not seen as individuals, but in a comprehensive approach for sound social and economic development.

Box 1 eleborates on the scenario of Kigali in the National and Regional Context.

Strategies

Kigali is in the central region of Rwanda, which places it in a good position as a stopping centre for freight and people travelling between cities and international borders. The Master Plan supports a holistic view to city planning and proposes the following broad approaches/strategies for national and regional integration.

Comprehensive approach - for balanced development and in harmony within cities and region:

- Promote synergistic developments between secondary cities and complementary growth to support Kigali City. This includes taking into consideration the role and vision for each city and how the dynamics play between secondary cities and Kigali to grow in harmony and in support of each other; and

- Promote regional integration through synergistic developments within the country and the region as is the ongoing discussion with various stakeholders for the **NLUMP (National Land Use Master Plan)** review exercise where we collaborate and are in constant dialogue to stay inline with local authorities and relevant parties envisioning the city's future. This includes positioning Kigali and Rwanda as a world class destination and major tourism and regional conference hub for Central and Eastern Africa. It also promotes cross-regional markets and services, attraction of foreign direct investments, expansion of trade and investments to enable deeper national and regional economic integration.

3.2 Incremental Development

As the number of city dwellers soars, it overwhelms the ecosystems and places incredible pressure on the capacity of Governments to provide essential infrastructure and services. Therefore, this second founding principle of Incremental Development proposes the city and specially housing to grow in an incremental manner, responding to local conditions, desires, aspirations and financial capabilities of the cities and communities.

Incremental development provides an opportunity to regulate ongoing unplanned development processes and ensure efficient provision of infrastructure and service delivery and rational land use. It could also shape the urban areas as per priorities developed for the entire city and reduce urban sprawl in favour of densification and compact development.
The land-use patterns change over time due to the market and socio-economic changes and growing

demand to accommodate more people. However, the majority of developing countries cannot keep pace with the rapid changes and face challenges to implement development projects, involving major land assembly and high upfront costs. These large projects are generally driven by finance and as per the needs of the investors and the authorities, as opposed to what the community/individuals may need.
Incremental development encourages smaller projects that are planned and implemented as per the needs and willingness of the communities, and when implemented consistently over time, they contribute in creating vibrant and livable neighbourhoods.

In rapidly urbanizing countries, governments are grappling to fill the backlog of housing and other infrastructure requirements of the growing population. When cities do not have adequate resources to provide basic infrastructure, or to cater to the housing needs of its low-income dwellers, these inhabitants demonstrate their own ability to house themselves and their extended family. They use their own labour, knowledge and materials for the construction of their home as they cannot afford to legally contain themselves in the formal housing market. However, not all households that start to build or renovate can succeed and they need support from local and national governments to complete their construction.

Therefore, by supporting and engaging these inhabitants and improving the production and management of their dwellings, it will be easier to get a larger number of legally built, affordable, safe and healthy dwellings and neighbourhoods.
Incremental housing is constructed in stages as per the financial situation to incrementally achieve the required FAR and density as per the zoning requirements. There have been some outstanding examples of incremental housing where "half of a whole house" is constructed in a well-located area. Over time, market demand or their economic growth forces the beneficiaries to transform and complete the house as per their own preferences and investment capacity (Figure 3.4 and 3.5 illustrate concept of demand based incremental development.

In this process, government generally provides for expensive and fundamental components of the house and cheaper components are left to the beneficiaries to create.

Location plays a critical role in housing settlements and it is important to understand the characteristics of housing demand, including the real preferences of recipients. People are often happy and willing to trade-off housing quality for better access to jobs. The incremental approach takes the "public interests" and "voices" into consideration and provides for a process that is bottom -up and inclusive.
Box 2 elaborates on the development challenges in Kigali.

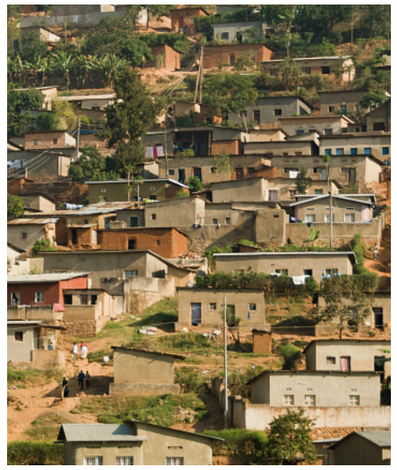


Figure 3.3 Increasing unplanned settlements in the city of Kigali with lack of basic infrastructure and poor urban environment

Strategies

Incremental development encourages the engagement of communities to shape and affect their environments and the incremental development process offers them the opportunity to be the actors of making place, which are otherwise lost in large scale projects. The Master Plan proposes the following broad facilitating strategies for incremental development.

Box 2: Development challenges in Kigali

More than 60% of Kigali's population live in unplanned settlements and they lack access to integrated infrastructure including safe water, proper sanitation, electricity, health services, waste management and proper roads. There is large disparity in quality of living environment between different income brackets.

There is a lack of government owned land and adequate funds to cater for the needs of its growing population. This has created a major issue in Kigali as the city is not able to implement the proposals of the Master Plan as it doesn't have funds to assemble land, which is the key aspect of development.

Owing to its topography and eco-fragile landscapes, Kigali has scarce developable land to accommodate the growing and diverse population.

It was highlighted during the Focused Group Discussions (FGD) and Technical Advisory Group meetings (TAG) that one of the critical issues identified from the previous Master Plan is in the development model and lack of flexibility in the implementation of the proposed zoning plan. The proposed zoning regulations for each land use are extensive and rigid, which has led to difficulties in implementation.

The lack of public participation and engagement of the stakeholders in the planning process proved challenging for implementation as the public reflected their lack of understanding of the Master
Plan 2013 and zoning system.

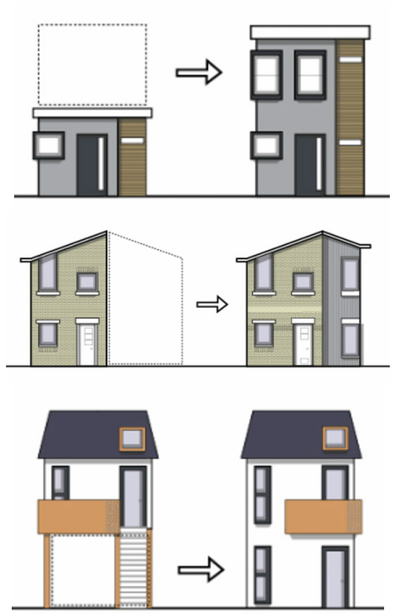


Figure 3.4 Concept of incremental development
(Source: https://moduledesign.weebly.com/incremental-housing.html)

- **Land pooling and consolidation** - Promote land pooling method to assemble land to provide basic infrastructure and open spaces, and then provide serviced land for incremental development(Figure 3.6);

- **Flexible zoning regulations** - Introduce flexible zoning regulations that allows incremental development:

1. On-site incremental upgrading, where feasible, to provide a quality living environment,affordable housing and infrastructure upgrades; and

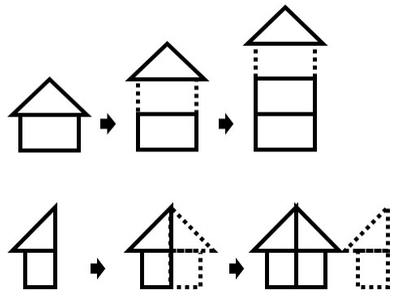


Figure 3.5 Demand based on-site incremental development

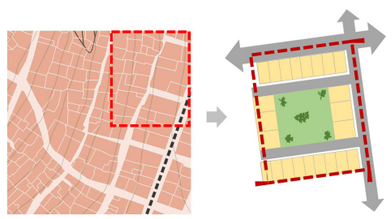


Figure 3.6 Land pooling and consolidation to improve access to infrastructure and public open spaces

2. Incremental densification of the urban renewal areas in alignment with the current market demand - through alternative and flexible zoning approaches such as Inclusionary Zoning, Overlay Zoning, Incentive Zoning etc. to make it possible to implement proposed redevelopment projects including integrated neighbourhoods and affordable housing projects (Figure 3.7)

- **Promote participatory planning/ bottom up approach** for an inclusive and equitable planning and development

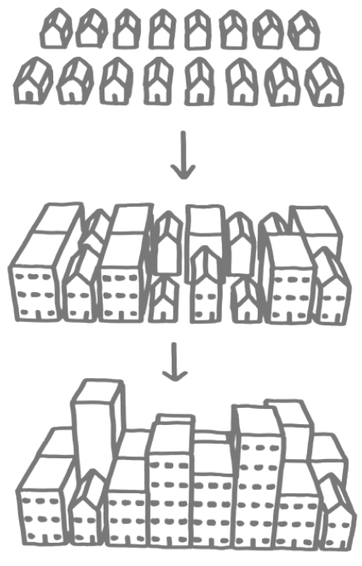


Figure 3.7 Incremental densification through flexible zoning regulations

3.3 Facilitating affordable Housing

Facilitating affordable housing is a central focus for the Rwandan Government as the country and specially Kigali City faces major backlog in providing for its low income and disadvantaged dwellers. However, before delving into the planning and implementation, CoK and GoR must establish the definition of what affordable housing means in the Rwandan context based on certain indicators and benchmarks. Facilitating affordable housing principle promotes to create a variety of housing possibilities, which respond to a range of household structures and situations. It recognizes that households transform through the years pertaining to growth of family members, socio-economic changes etc., requiring a variety of housing that responds to communities needs and capabilities.

The housing sector plays an important role for family and its economic growth. As a rule of thumb, housing is usually considered affordable if it costs less than 30% of one's gross household income *(as per NSW Government definition of affordability)*. However, with rising demands of the growing population in developing nations, which doesn't match the supply, housing costs exceed way beyond the 30% margin. These growing populations with no ability to afford formal housing, demonstrate their own abilities to accommodate themselves, giving rise to unplanned settlements, challenging the very core of sustainability and safety. These unplanned settlements represent a universal phenomenon, which many countries suffer from worldwide and Rwanda is no exception, especially the City of Kigali. It is one of the major phenomena accompanying rapid urbanization processes worldwide. People move to the cities with many dreams and hopes, including the hope of getting better opportunities and income. When they find there is no available affordable formal housing or it is in short supply, they have no choice but to settle in inadequate conditions to make some savings.

Land use and zoning regulations have profound significance on the supply of affordable housing in the cities. Lack of adequate government land for urban development impedes development particularly in terms of providing social spaces and infrastructure including low-income housing. Private ownership of land and scarcity of adequate developable land leads to escalating land prices, overcrowding of existing neighbourhoods, and illegal encroachment of steep slopes and wetlands. Without innovative approaches to facilitating adequate affordable housing, this trend cannot be reversed giving rise to more and more unplanned settlements and sprawling inefficient and unsustainable development.

Most affordable housing supply across the world have been possible due to government facilitation and subsidy with some exceptions from other sources, especially in terms of financial support. However, with rapidly urbanizing countries, governments are grappling to provide adequate housing and infrastructure to the growing population and thus do not have adequate resources (both land and finance) to build or facilitate subsidised and completed dwellings to house its low-income households. It is essential to create conditions that would facilitate development through enabling zoning regulations, policies and institutional set up and various financial mechanisms to support such development. Exploring and encouraging the use of local building materials in the construction of affordable homes is key, as one of the major costs for housing goes on building materials which constitutes the largest input to housing construction. Therefore, it is critical to look for

Box 3: Affordability scenario in Kigali

Affordability is a key issue in Kigali. The city lacks adequate affordable housing and over 60% of the households in City of Kigali reside in unplanned housing structures, many of which are in fragile ecosystems and hazardous areas where land is cheap such as steep slopes and wetland areas. These settlements also lack access to integrated infrastructure including safe water, proper sanitation, electricity, health services, waste management and proper roads.

Among the lowest income quantile households that rent, they allocate 88% of their incomes to rent.

There is a short supply of local, cost effective materials for construction of affordable housing in Kigali. The local authorities are trying different affordable housing models and techniques to increase the supply of affordable housing to meet the shortage and the future demand.

The authorities are trying to supply some affordable housing to the growing population. However, shortage of affordable housing options close to the existing economic activities resulted in the need to travel long distances to work, making people opt to live in unplanned settlements, closer to their work. Further, there is lack of worker housing and social infrastructure around industrial areas and new employment centres in Kigali.

The high land prices in the city along with rapid growth of population in Kigali with migrants seeking for economic opportunities have led to urban sprawl and development of large and congested unplanned settlements across the city and especially in the fringe areas.

Figure 3.8 Unplanned housing occupying disaster prone areas

Figure 3.9 SKAT Model Pilot Project for affordable housing - construction using local materials

Figure 3.10 Affordable housing estates in Kinyinya, Kigali

alternative approaches and strategies to facilitate affordable housing for planned and sustainable growth.

Box 3 elaborates on the affordability scenario in the city of Kigali.

Strategies

The master plan proposes the following broad approaches/ strategies to facilitate affordable housing in Kigali. These strategies would need 3 major enabling factors to be able to facilitate affordable housing supply – Community participatory approach, Workable financial model/PPP partnerships and enabling institutional set up and policies for better coordination and implementation.

- **Land Pooling and land consolidation** – Assemble land and unlock land potential through land pooling to promote integrated mixed-use, mixed income development;

- **Flexible zoning regulations** – Introduce inclusionary, overlay zoning and incentive zoning in selected areas for upgrading of unplanned housing and for urban renewal projects, to promote incremental housing and provide quantum for affordable housing/ social infrastructure;

- **Promote local materials for construction** – Materials such as clay are low cost, and their extraction with proper restoration measures can ensure quick production of affordable housing in Kigali; and

- **Compact mixed-use development** - Reduce amount of areas dedicated to single family houses and push for higher density mixed use development to achieve integrated and inclusive neighbourhoods

3.4 Detailed Phasing aligned to City Development Strategy

Detailed Phasing is essential in urban development because it gives the government, community and donors/ financers indications and rationale of how infrastructure and associated urban services will be developed over a period of time in a phased manner. The provision of infrastructure and services planning in different phases is crucial to achieve the vison of the cities. The principle of phasing also provides government agencies/municipalities to prioritise development of a particular area of a city and source adequate funding to finance the project. Such a method will be of paramount importance especially in developing countries which largely depend on external funding or foreign aid to implement such projects. Therefore, this principle promotes preparation of detailed phasing of developmental activities and financial planning disbursement that is in alignment to the City Development Strategy.

Development phasing describes the components required to be developed either at once or in an incremental way, followed by key decisions to be made at an early stage, and identifies key areas of development in response to future requirements. Often urban

development projects are rushed due to pressure/constraints in timeline or they are delayed due to constraints in available resources for one component before another sequence can commence. This leads to supply and capacity gaps which impacts the growth and living standards of the communities. To avoid such impacts on the viability of projects, prioritization and detailed phasing of both projects and finances are critical to align with the growth of the city. The master plan phasing should be planned around the potential to deliver quality infrastructure including health, education and recreation facilities. It should also consider any relocation of people, land management, funding availability, and relevant planning processes and legislation. As per the requirements, each phase can be either implemented consecutively or in parallel to each other. However, this arrangement will need better coordination amongst various actors/ stakeholders.

Prioritization and phasing should be based on the growth potential as per projected populations, employment, and market demand assessments. Phasing that is proposed without taking into consideration community's needs, market requirements and financial capabilities, is bound to fail due to the mismatch with the priorities and capabilities for implementation. The master plan preparation should support advanced planning to accommodate growth in an orderly manner to avoid sprawl and unplanned settlements.
Each phase of development should have a specific timeframe for the development process as per the priority and availability of resources, and designed to release optimum resources to unlock the next phase of development, until total implementation is achieved.

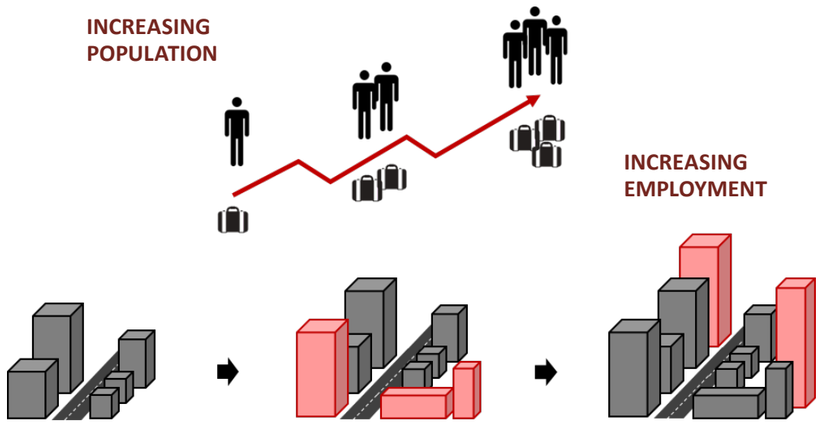


Figure 3.11 Incremental city development strategy - phasing strategies- city development to follow the increase in demand with increase in population and employment

Box 4 eleborates on the implementation challenges in Kigali.

Strategies

The Master Plan supports realistic and detailed phasing as per the priorities, resource capabilities and market opportunities the city presents. The following are broad strategies to guide the detailed phasing of Master Plan.

- **Time frame** - Master Plan phasing to follow 7-year Government programme timeframe - This is to better align with Government priorities and budget allocations for smooth implementation;
- **Phasing mechanism** to consult 7 Year Government programme – It is essential to refer to 7 Year Government Programme as it is an implementation instrument and it highlights priority areas and key strategic interventions to achieve the goals;
- **Implementation to be in sync with Phasing boundaries** - The implementation plan that is designed in sync with the phasing boundaries allow for a balanced and compact development, and in line with the expected city's growth, it will help manage growth and control sprawl. It will also make the plan understandable thereby reducing pressure on haphazard and untimely implementation requests; and

- **Introduce incremental development model** within phased development for flexibility in construction completion as per resource availability and requirement

Box 4: Implementation Challenges in Kigali

Often development in Kigali doesn't meet the desired expectations when zoning regulations require micro management such as several clearances from multiple authorities and there are financial shortfalls to develop as per the prescribed regulations.

One of the critical issues identified from the previous Master Plan was in its implementation model as the implementation was not related to phasing. Three stages of development phasing were proposed (short term, medium term and long term) for progressive development, but the implementation couldn't match with phasing due to financial constraints and zoning restrictions.

The socio-economic conditions of Kigali City have changed over the last 5 years and it is found that the proposed zonings are not reflecting the existing conditions, impeding implementation process.

Although some of the owners within the industrial area were ready to build on their plots, they couldn't get "no objection" for development, as MINICOM was not yet ready to provide basic services/ infrastructure to the industrial area. These kinds of issues block development without prioritization and phasing.

There is a lack of understanding for the proposed zoning and lack of flexibility in implementation giving rise to urban sprawl into the fringe areas.

3.5 Mixed Use Approach

Mixed use is the fifth principle that is proposed to create vibrant locations that are physically, functionally and socially integrated with mix of use and mix of income, supported by efficient public transport. Mixed-use development blends various types of residential, commercial, cultural, entertainment/ public facilities, and light industrial uses. As a Capital City that is experiencing unprecedented urbanization and population growth and a shift in lifestyle preferences, Kigali showcases itself as a prime location to support mixed use development. Further, the national policies, strategies and various meetings also advocate replacing the current low-rise unplanned settlements into mixed-use development that caters for affordable multi-family housing.

Communities are accepting mixed use and mixed income neighbourhoods because of their potential to reduce car dependency and support public transit, manage urban sprawl, accomodate open spaces, promote economic development, reduce the expense of providing and maintaining for infrastructure etc in comparison to low density neighbourhoods. Due to rapid urbanization and increasing numbers of cars on streets causing congestion, loss of time and pollution, an increasing number of people now prefer to stay in locations which are closer to work places, schools, clinics, shopping centers, entertainment/ recreation destinations, and light industrial neighbourhoods with worker housing and social infrastructure, and shortest commuting time. It is said that people are even ready to trade-off with housing quality for a location close to their workplace. Thus, mixed use developments are enabling compact neighbourhoods that allow for people to live, work, play and shop in one place, which may also become a destination for people from other neighbourhoods.

Mixed use developments become inclusive places when there is a mix of housing typologies catering to a range of family sizes and people with different incomes /ethnic groups/ religions/ cultures etc. are provided. This has the potential to reduce disparity and social segregation between different groups. Therefore, it is essential to create mixed use mixed income neighbourhood which would become an integral part of the urban fabric, enabling affordable housing to be retained with higher income housing for inclusiveness.

Mixed-use has gained popularity with its flexible combination of uses as it allows for both horizontal and vertical combination of uses. In the horizontal mixed-use development, the mixed-use zone consists of a range of integrated single use buildings at walkable distance within the same development project area. In the vertical mixed-use development, different uses are combined within the same building with public spaces/domains on the lower floors for ease of access and private spaces such as residential, office spaces on the upper floors for privacy and quiet atmosphere. There can also be a combination of vertical and horizontal mixed use in an area and at a walkable distance.

Box 5 eleborates on the zoning challenges in Kigali.

Strategies

A good part of Kigali is currently occupied by unplanned settlements and low density urban areas which presents as an opportunity to develop Mixed Use and inclusive neighbourhoods. The master plan proposes mixed use mixed income integrated development through the following broad strategies.

Integrated and Inclusive Development

- **Compact** - Promote compact development for live-work -play in one place with efficient use of land and infrastructure. It can also include microlight industries with worker accommodation within mixed use affordable housing for live-work integrated neighbourhoods;
- **Vibrant** - Promote vibrant mixed use mixed income neighbourhood for strong neighbourhood character and bonding with a sense of place which are well used and appreciated by the residents and visitors;
- **Variety of housing types** - Promote variety of housing types and density including affordable housing that caters for low income group, senior citizens and people with disabilities;
- **Accessible** - Promote accessible and safe neighbourhoods for all ages and abilities with a comprehensive and strategic road network, good pedestrian linkages and well connected public transport

Box 5: Zoning challenges in Kigali

With 60% of its households residing in unplanned settlements, there are underutilized areas in Kigali, which does not match with the requirements of 2013 Master Plan zoning. The low-density development and lack of flexibility in implementation gave rise to urban sprawl into the fringe areas.

The socio-economic conditions of Kigali City have changed over the last 5 years and it is found that the proposed zonings are not reflecting the existing conditions.

The implementation of mixed use integrated neighbourhoods as per the 2013 Master Plan and zoning regulations, have been challenging due to the lack of government land and inadequate funds to assemble land for the provision of integrated social and public facilities such as open spaces, affordable housing.

The 2013 zoning regulations only provide a maximum density limit regulation for each land use, and existing conditions do not support the densities that the zoning regulations proposed. The CBD is not able to achieve the proposed skyline based on upper limits of zoning guidelines.

The proposed zoning regulations for each land use are extensive and rigid, which has led to difficulties in implementation.

MINICOM expressed lack of affordable housing and social infrastructure for workers close to the planned industrial areas – KSEZ and other industrial parks. People are forced to travel longer distances to work in these areas as there is lack of housing and social infrastructure around these industrial clusters. While the Master Plan 2013 suggests the development of integrated industrial parks, the city has been facing many challenges related to implementation that impacts the overall quality of urban environment for workers within these industrial areas.

3.6 Green Growth

The sixth founding principle of this Master Plan is Green Growth, which promotes a city designed with consideration for environmental, ecological impacts and well-being of citizens. It is to judiciously harness the benefits of ecological systems while protecting and nurturing them for future generations.

This principle of green growth is in alignment with the national direction [through the Global Green Growth Institute (GGGI)] that refers to "promoting growth that is compatible with protecting the environment; reducing carbon and other unwanted emissions; improving the rational use of natural resources; dealing with climate change; securing access to clean energy and water; and simultaneously targeting poverty reduction, job creation, and social inclusion".

There is always a critical balance we need to maintain in planning for growth. To promote and maintain sustainability, there must be a balance between nature and human intervention *(Principles of Intelligent Urbanism)*. At the midst of rapid urbanization to accommodate the growing population and expanding economic opportunities, environmental aspects are often undermined. All players of the society must understand the difference between exploiting and utilizing nature. It is important to understand that there is a certain level of human intervention, up to which the resources that are consumed gets replaced through nature's own replenishing cycles, creating an equilibrium. So long as nature can recharge each cycle; the habitat of fauna and avifauna are safe; biomass maintains its own ecological balance; and there is no erosion and flooding of wetlands and the forest coverage is maintained, it is assured that we are only utilizing nature. However, there is a delicate line that we tend to cross when we take from nature and we get to a point of no return. At that point of no return, utilization of natural resources will outpace the ability of the eco-system to replenish itself. When the soil is eroded faster than it can be replaced; when the forest is cut down faster than it can be replaced; river silts up faster than the natural currents can wash it clean, we have destroyed the natural balance. From there on degradation accelerates and environmental issues such as deforestation, erosion, floods, and landslides incessantly increases. Land degradation takes place due to widespread land clearance and over cultivation. Heavy soil erosion reduces soil fertility and depletes rivers and wetland habitats.

Figure 3.12 Integrated and inclusive development

It is not always the eco fragile areas that need protection but also our sources of food that feeds the population. Government and Planners alike always have a dilemma over the land which is required for development as well as for agriculture. It is pertinent to maintain a balance between the fertile agricultural lands that need to be protected versus developable land that is needed to accommodate the growing population, to protect and nurture for future generations.

Box 6 elaborates on the environmental challenges in Kigali.

Strategies

Box 6: Environmental challenges in Kigali

Kigali City is built on hilly landscape sprawling across ridges and wetlands with an altitude varying between 1300-2100m. As per the Rwanda National Land Use Development Master Plan, Kigali City land area falls under medium to high risk soil erosion zone and soil present on more than 5% slope is susceptible to heavy erosion.

A Significant Percentage of the entire Kigali city land area is occupied by steep slopes of more than 30%. Some of the slopes are located within city area and inappropriate developments including unplanned settlements on steep slopes has caused extensive soil erosion in some areas.

Rapid deforestation due to cultivation and urbanization has led to the serious destruction of biodiversity, leading to relatively low concentration of fauna in Kigali.

Kigali has a good amount of clayey soil and since it is an affordable local building material, it is in big demand for affordable housing construction. However, exploitation may cause environmental pollution, especially in the case of wetland sourced clay as the wetland buffer zones are key sites for extracting clay for brick manufacturing.

Agriculture is the backbone for sustained economic growth in Rwanda. In Kigali, the total agricultural land (consisting of general farmland and plantation areas) is approximately 63% as captured in Master Plan 2013, and in 2018. However, high population density on the limited land resource has led to land fragmentation and reduction of farm sizes, as well as encroachment of agricultural land. Further, intensive and over cultivation of land without restoration of soil nutrients, lack of appropriate farming practice has led to land degradation. There is a need to preserve agriculture land as much as possible, strengthen and develop sustainable land management systems to ensure food security.

Figure 3.13 Environmentally sensitive areas in Kigali

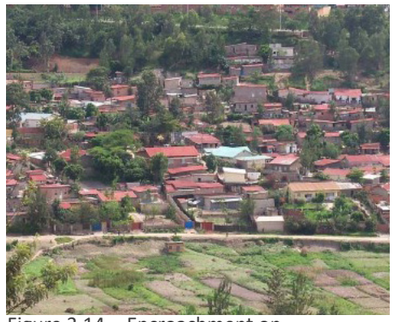


Figure 3.14 Encroachment on environmentally sensitive slopes and wetlands

The Master Plan supports mainstreaming green growth and proposes bringing balance in nature and development through the following broad strategies and approaches.

- **Protect** steep slopes, wetlands and eco fragile areas to reduce disaster risks from changing weather events caused by climate change and preserve fertile agriculture lands for food security through:

1. Relocation of people from steep slopes and wetlands to safer locations for rehabilitation and for management of slopes, forests and wetlands. Proper redevelopment schemes will have to be prepared to relocate settlements;
2. Prioritize relocation based on actual risk assessment;
3. Promotion of land consolidation method to increase food productivity; and
4. Conservation of natural resources through water recycling and energy efficient projects;

- **Utilize** natural resources sustainably to increase resource efficiency and leverage protected natural resources for economic gain through:

1. Promotion of compact, integrated and inclusive development; and
2. Creation of green jobs through eco-tourism, passive recreation;

- **Restore** natural resources that are used or destroyed by disasters through:

1. Restoration of steep slopes through afforestation and bioengineering techniques;
2. Restoration of wetlands encroached by urban uses and create a balance between wetland protection and use of wetlands for economic development; and
3. Restoration of natural habitats following remedial activities

3.7 Sustainable and Resilient Infrastructure

This seventh principle of Sustainable and Resilient Infrastructure advocates

Figure 3.15 Focus on green growth

to create an inclusive city that promotes and provides resilient and sustainable infrastructure across entire city and beyond. For communities and businesses to operate and thrive, and to respond to societal needs, reliable and efficient infrastructure is essential. This principle aligns with Rwanda's green growth strategies for sustainable development and its vision "to be developed as climate resilient, low carbon economy by 2050".

Protecting infrastructure from climate related impacts such as floods, landslides and erosion is essential as cities and communities rely on a range of infrastructure for their safety, health and prosperity. Infrastructure networks such as roads, transit, water, sanitation, electricity, and ICT networks are the lifelines of communities, providing critical services continuously for households, social sectors and commercial/ businesses.

In this fast urbanizing world, growing population and incessant disasters and calamities cause pressure on land, water, food and energy resources, eventually depleting these resources if not addressed promptly. Sustainable infrastructure that is resilient to hazards is becoming critical, especially in developing countries where natural and other disasters cause disproportionate damages and impede development efforts.

Amidst the increased frequency and severity of extreme weather events, socio-economic development becomes uncertain and the issue of sustainability and resiliency is impossible to ignore. Hence, it only becomes imperative that cities place importance on the provision of inclusive, sustainable and resilient infrastructure. Building climate-resilient and sustainable infrastructure helps ensure the delivery of development and economic benefits over the long term. Investments in infrastructure help to promote better living environments, uplift living standards and make communities more resilient to climate change. However, infrastructure costs are huge as they are generally designed for long life spans and they take a long time for implementation. Also, with increasing complexity and interconnectedness between various infrastructure networks/systems, it requires well-coordinated and long-term efforts to provide, maintain and sustain these systems. Therefore, it is essential to have sustainable and resilient systems, while also maximizing return on investment.

While infrastructure requires large investments, there are social and economic benefits, as it helps bring jobs to the communities at the implementation/construction stage and at the operation and maintenance stage. Subsequently, sustainable and reliant infrastructure attracts businesses/investments thereby creating jobs for the economic growth of the communities.

It is generally the role of governments to plan, regulate and finance the bulk infrastructure of cities. However, with ever growing population and pressure to accommodate and provide for this expanding population, it's become harder for governments to mobilize adequate capital. Further to this, increasing access to long-term capital at adequate rates to support investments in sustainable infrastructure, will require enhanced participation from private actors (UN General Assembly, 2015: Bielenberg et al., 2016: Fay et al., 2017). Therefore, the way forward will be to plan and create financing mechanisms, through participatory and coordinated approaches, with key stakeholders, to deliver sustainable infrastructure.

Box 7 elaborates on the current infrastructure scenario in Kigali.

Strategies

Cities become smarter through a series of stages that enable them to become sustainable and resilient. The Master Plan proposes the following broad strategies towards sustainable and resilient infrastructure.

Box 7: Infrastructure Scenario in Kigali

Although the consumption of energy and water usage are quite low in Kigali, the city faces extreme inadequacies in terms of making provisions for these infrastructures. Hence, there is unequal distribution of infrastructure across the city making the system inefficient and expensive.

Expanding urban areas with sprawling low-rise development make it more and more challenging, inefficient and expensive with the need for extended infrastructure and transportation facilities. Existing Infrastructure systems are susceptible to failure, being relied on by ever-expanding user population.

Growing population and climate change issues are increasing pressure on energy and resources and thereby increasing carbon footprint.

The transmission network is still challenged being isolated from neighbouring countries' networks, lack of redundancy options at substations and generation plants and technical losses.

Transport in Kigali is still in rudimentary stages and there is a great need for enhanced mobility. Although the private vehicle ownership is still in lower limits due to lower income levels, with increasing low rise sprawl, there will soon be huge traffic impacts.

One of the major issues that has been highlighted across all service sectors is the need for integrated planning. Due to the extreme topography and the limited developable space in Kigali, it is crucial that corridors are secured to make provision for all possible future services.

Figure 3.16 Infrastrcuture in Kigali

Figure 3.17 Sustainable and resilient city infrastructure

- **Integrated Planning through coordinated actions**

1. Reduce sprawling development and hence reduce infrastructure/ transportation costs;
2. Explore integrated management system for energy, waste, water etc.;
3. Improve and plan infrastructure towards equal development of the city;
4. Develop a Water Master Plan for the City of Kigali;and
5. Integrate Rail and Air Transport with the Road Network

- **Sustainable Resource Management**

1. Adopt sustainable rainwater harvesting;
2. Improve water supply network in city ensuring minimum leakage and water loss;
3. Provide sanitation coverage for the entire city by developing safe well-regulated and affordable off-site sanitation services for densely populated areas;
4. Ensure efficient solid waste collection and management; and
5. Develop a transport network that supports sustainable mass transit systems

- **Green Initiatives**

1. Affordable and sustainable public transport system- Develop a well-connected high-quality mass transit system which provides good coverage, fast and frequent services;
2. Develop a city-wide NMT network which includes cycling and connectivity; and
3. Encourage efficient technologies for reduction in energy use

3.8 Inclusivity and Equity

A city that listens and caters for housing and other social needs of its citizens including disadvantaged populations, vulnerable and differently able citizens, is an inclusive and equitable city.

The principle of Inclusivity and Equity promotes a city in which people from all walks of life, regardless of their income, gender, ability, colour or religion, can live and grow together and in harmony. In today's world where different forms of discrimination and disparity have created places that don't work for everyone, equity and inclusion in planning and development process has become imperative.

One of the key approaches taken is to make the updated master plan be inclusive to the disadvantaged and disabled group and enable them to feel safe and within universal access of housing, basic amenities, social and physical infrastructure, information and technology.

Due to the lack of affordable and serviced land in locations that are closer and have easy access to income generating opportunities, the urban poor resorts to unplanned settlements with inadequate services. The lack of equal opportunities, rights and access for the disadvantaged societies cause turmoil due to incidents of crime and violence with growing inequities in terms of resources, access, and control. These issues grow out of proportion and become more difficult to resolve if not addressed promptly. Without proper attention to planning, it will become

Box 9: Inclusivity and Equity Scenario in Kigali

There is large disparity in quality of living environment between different income brackets. The situation of massive populations living in unplanned settlements and a small percentage of people living in trendy apartments/ villas/bungalows makes the income gap obvious.

The few affordable housing (as might be defined by CoK and/or GoR based on the context and indicators chosen) projects that are being developed in Kigali are located far away from people's work places making it inconvenient, time consuming and more expensive to commute.

Kigali City is short of government owned land. Almost all the land in Kigali is owned by private people making the land inaccessible and challenging for implementation of many development projects in affordable housing. The government also lacks adequate funds to create land banks for sale or development.

The lack of a participatory approach led to people not understanding the master plan. Stakeholders requested to ensure the plan is socially inclusive, that the citizens can make informed decisions and that the local government is following continued communication at grassroots level.

There is an imbalance in the distribution of health centres throughout the city and health centres suffer from congestion and overcrowding

The city lacks open space in the existing commercial districts and unplanned settlements. Land sub-division, private ownership and lack of public engagement to create new public open spaces within these overcrowded unplanned settlements have been some of the major challenges faced by the city in developing public open spaces.

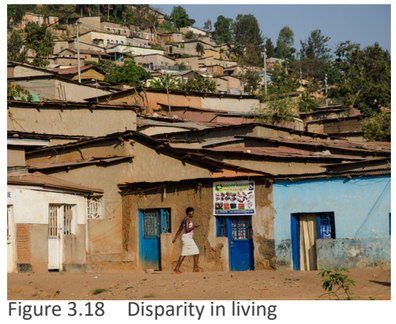


Figure 3.18 Disparity in living environments in Kigali

increasingly difficult to reach the disadvantaged who remain excluded by various circumstances, and market-resistant impediments.

For any city, it will be of paramount importance to examine if it is an inclusive city. The city is not inclusive and equitable where vulnerable groups such as women, children, poor, people with disabilities, and senior citizens face barriers when accessing housing, health, employment, education, and where people live in unplanned settlements and lack access to or have inadequate access to services. This inequity costs cities socially and financially with more chaos, insecurity, and more and more

Figure 3.19 Planning aspects of an inclusive and equitable city

unplanned settlements and many other issues.

Inclusion and equity create more sustainable cities with people getting the right to fully participate in every aspect of social, economic, political, and cultural life and voice their concerns and ideas to create thriving neighbourhoods and communities.

Women's organization in Rwanda has brought attention to the challenges faced by women/girls and the ways in which they experience the city. Cities can respond better to the aspirations of everyone if gender and other social inequities are addressed through an inclusive and equitable approach.

In an inclusive society, we should be able to create opportunities for inclusion of special needs population. Inclusive services help reach and impact more lives, and save money. Many cities set aside funds to cater to such populations through the establishment of affordable and special needs housing funds, housing trusts funds etc. Besides, tools such as inclusionary zoning helps achieve affordable housing goals.

The planning and implementation become more equitable through meaningful participation and engagement of people representing different groups and better strategies can be worked out with deeper understanding of their needs. Engaging communities in planning, design and development bring richness in the process as they often have rich knowledge and experience about the type of environment in which they live. When they feel their opinions are being valued, things work well to make lasting changes and fosters ownership and responsibility towards a healthy society.

Box 9 elaborates on the inclusivity and equity scenario in Kigali.

Strategies

As countries are rapidly going through socio-economic changes, urban growth has become increasingly unequal with increasing disparity and growing unaffordability. The Master Plan aims to promote and create an Inclusive and Equitable city through the following broad strategies.

Affordable

- Promote integrated, affordable development with access to social infrastructure for all;
- Develop mixed use, mixed income development through alternative and

inclusionary zoning; and

- Support upgrading of unplanned settlement to provide quality living environment and affordable housing and infrastructure

Participatory

- Promote participatory community engagement and bottom up approach in planning and design to include their views, needs and aspirations

Accessible

- Provide schools, health centres, community centres, open spaces etc. at walking distance for everyone to have easy and equal access to these social facilities;

- Promote safe, affordable and inclusive mobility - It is fundamental for equitable access and inclusion of people from all spheres of life; and

- Urban design guidelines to include universal design and barrier free environment for people with disabilities. Making cities safe and accessible makes it enjoyable not only for people with special needs but for everyone

Opportunities

- Create good jobs and economic opportunities giving equal opportunities and rights for all residents, including the most marginalized to enjoy the benefits of economic growth; and

- Support provision of affordable and serviced land in locations that have shorter commuting distance and easy access to work places/income earning opportunities

4

Kigali Master Plan from 2013-2040 to 2019-2050

4.1 Concept Plan
4.2 Population & Employment Distribution
4.3 Structure Plan
4.4 Broad Land Use Requirement
4.5 Zoning Plan
4.6 Flexible Zoning Plan

4 Kigali Master Plan from 2013-2040 to 2019-2050

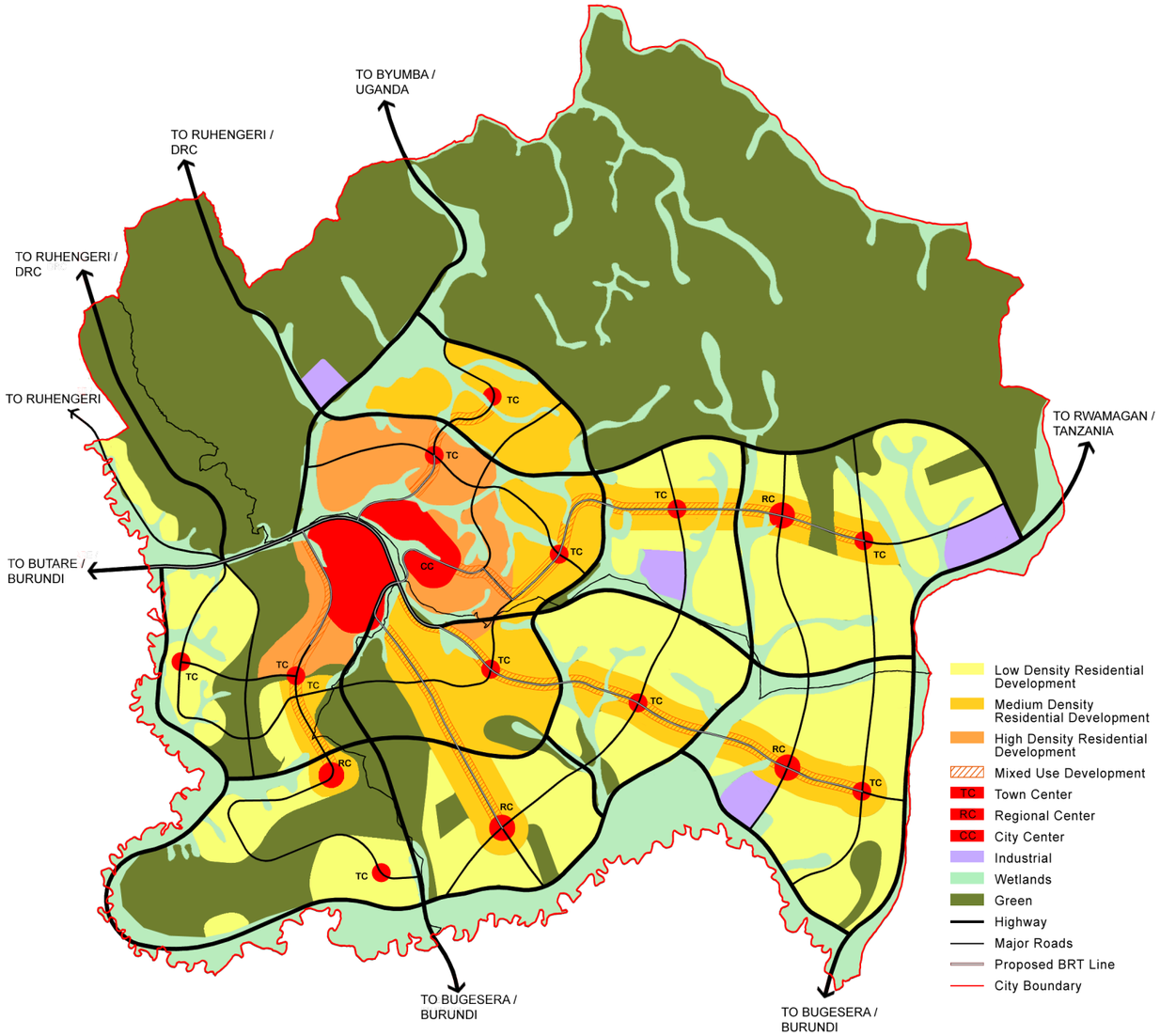


Figure 4.1 Kigali Master Plan 2013 - Proposed Concept Plan

The Detailed Master Plans of the City of Kigali were done separately for the three districts: Nyarugenge (2009), Gasabo and Kicukiro (2013) respectively. In this Kigali Master Plan Review, it is intended to consolidate the plans of the three districts into one Kigali City Master Plan. Thus, to ensure consistency and coherence, the three plans are integrated for the purpose of this review. From concept, structure, land use and zoning plans, this chapter summarizes and evaluates the Kigali City Master Plan 2013 with a planning horizon from 2013-2040, that formed the basis for progressing with Master Plan update from 2019-2050.

4.1 Concept Plan

In preparation of the concept plan of Kigali City in 2013, the key considerations for the development of Kigali City Master plan were:

- Establishing a range of employment centers in Kigali;
- Creating affordable and quality living environments in Kigali;
- To develop a compact, vibrant & transit-oriented city;
- Managing and improving the environment and infrastructure;
- To preserve urban heritage & enhance public greens; and
- To consolidate and reserve land for future needs

Guided by these broad principles, the City Master plan for Kigali was updated. The selected concept for Kigali was the Radial City Structure which promotes transit oriented development corridors and development of comprehensive new Planning Areas along it. This plan focuses on linking the development corridors radiating out from the CBD and connecting the various areas of Kigali to the city centre. The key features of the proposal are highlight as follows:.

New Development Corridors

The concept plan focuses on the new developments in the green field areas, while intensifying the inner city area surrounding the CBD. The key development corridors are planned to connect key features of the city as well as the proposed employment nodes, with the residential areas for the projected population distributed along these development corridors.

Development of new Regional Nodes

The concept plan defined several new growth areas and self sustainable nodes along the development corridors that are proposed to be well integrated to the proposed transit. These regional nodes are the key employment destinations in the city offsetting the pressure form the CBD. They cater to a larger catchment area and include regional level facilities and commercial activities.

Planning Areas integrated with transit corridors

The transit corridor forms an integral component of the transportation plan. It links the various residential and employment centres in Kigali and makes travelling from one part of the city to another a seamless experience. The concept plan envisions high density development by developing new Planning Areas, urban centres and growth nodes along these corridors.

Better Regional Connectivity

The concept plan focuses on improved regional connectivity for the city of Kigali. A network of proposed expressways link the various districts of Kigali. A radial road network with well spaced highways caters to smooth city travel and fast connections within the city and better linkage to the new airport at Bugesera. The ring road also provides alternate bypass to heavy good vehicles travelling across the country. The proposed trans-national rail line to the SEZ will further strengthen the logistics role of the SEZ and allow future passenger rail service linkage from the city to the Bugesera.

Since the launch of the Kigali City Master Plan and Zoning Plan in 2013, the planning concept of the Master Plan has been widely understood and accepted by the authorities and public stakeholders, and implementation of key projects are ongoing. The key principles taken into consideration into the concept plan remains applicable to the current context. The implementation of the Kigali Master Plan in the last five (5) years also aligned to the green growth principles that are encouraged in this Master Plan Review. Respecting the physical ground conditions of the city, it is hence acknowledged that the city will continue to adopt the radial structure for its development growth. However, the hierarchy and scale of urban centres may be reviewed according to the updated socio-economic projections for the city till 2050.

4.2 Population & Employment Distribution

4.2.1 Population and Employment Projection 2013 -2040

In Kigali Master Plan 2013, as per former population estimates, the City's population was estimated to reach 4.2 million by 2014 and 5 million by Year X.

This projected population are proposed to be distributed within self-sufficient integrated Planning Areas in existing and new growth areas planned in the city, connected and served by public transit corridor. Affordable housing is the form of medium density developments are proposed close to the main transit corridor inside the Planning Areas so that majority of the population lives in close proximity to the mass rapid transit and has quick access to local jobs and public facilities.

Under this distribution, 95% of the projected population is to be redistributed within the City Centre and 24 urban Planning Areas in city fringe and suburban areas. The remaining population is expected to be distributed in the rural sectors of Kigali.

On the other hand, the socio-economic study projected that the labor participation in the City will be 46%. This requires City to ensure 2.3 million jobs in long term future.

Kigali Master Plan 2013 proposed to cater for projected job requirements through strengthening and organizing the existing CBD in Nyarugenge and establishment of new employment nodes around the city in proximity to the proposed Planning Areas.

4.2.2 Population and Employment Projection 2019-2050

SJ-SMEC is partnering with Institute of Policy Analysis and Research (IPAR) to update existing socio-economic data and projections as well as to draft two additional studies: Affordable Housing Market Study and Commercial Real Estate Market Analysis. Additionally, International Growth Centre (IGC) prepared the study of Housing Need in Kigali aiming to estimate the quantity of housing required and to contribute to an understanding of market demand for housing in Kigali. IPAR has been working with IGC to align their studies for population projections for Kigali. These studies review the viability of Kigali from the previous 5 million population targets and suggest revised population and employment projections, based on current and future market and demographics trends, which is used as a guide for this round of master plan update.

According to IPAR studies, in the medium population growth scenario, the resident population of Kigali City will reach about 3.5 million by 2050. In the high population growth scenario, the resident population has been projected to reach about 3.8 million people by 2050 while the low growth scenario projects a resident population of 3.2 million people by 2050 (Table 4.1)

Given the migration trend to Kigali, the pressure of urbanization and development on the City and after

Table 4.1 IPAR-NISR adjusted projections

Year	IPAR-NISR adjusted projections		
	Low growth Scenario	Medium growth Scenario	High growth Scenario
2012(Census year)	1,132,686	1,132,686	1,132,686
2014	1,354,921	1,361,492	1,361,492
2024	1,816,298	1,872,462	1,897,462
2034	2,266,269	2,405,418	2,499,110
2044	2,816,981	3,071,923	3,258,504
2050	3,224,316	3,570,015	3,824,708

Source: IPAR Study

Employment Trends

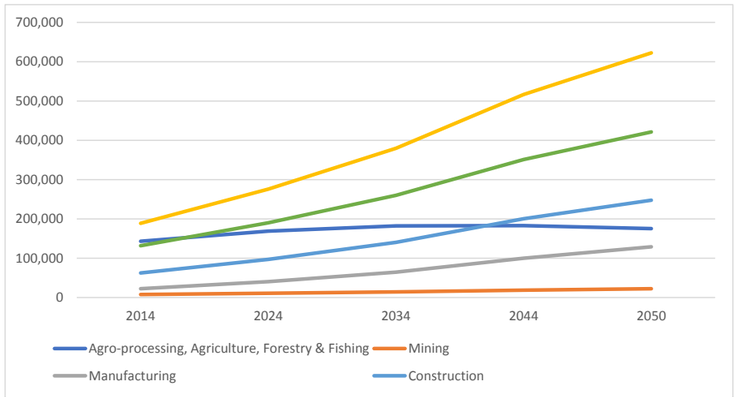


Figure 4.2 Kigali employment trends and projections Source: IPAR Study

Table 4.2 Employment Projections 2050

Sector	2014	2024	2034	2044	2050
Agro-processing, Agriculture, Forestry & Fishing	143,136	168,936	182,046	182,906	175,376
Mining	7,656	10,661	14,257	18,871	22,352
Manufacturing	22,387	40,184	64,703	100,163	128,953
Services	188,780	275,546	379,446	516,783	622,412
Construction	62,463	96,769	140,373	200,326	247,589
Trade	131,769	190,258	259,909	351,296	421,245
Transport	23,779	37,724	55,930	81,292	101,443
Total	**579,969**	**820,078**	**1,096,664**	**1,451,637**	**1,719,369**

Source: IPAR Study

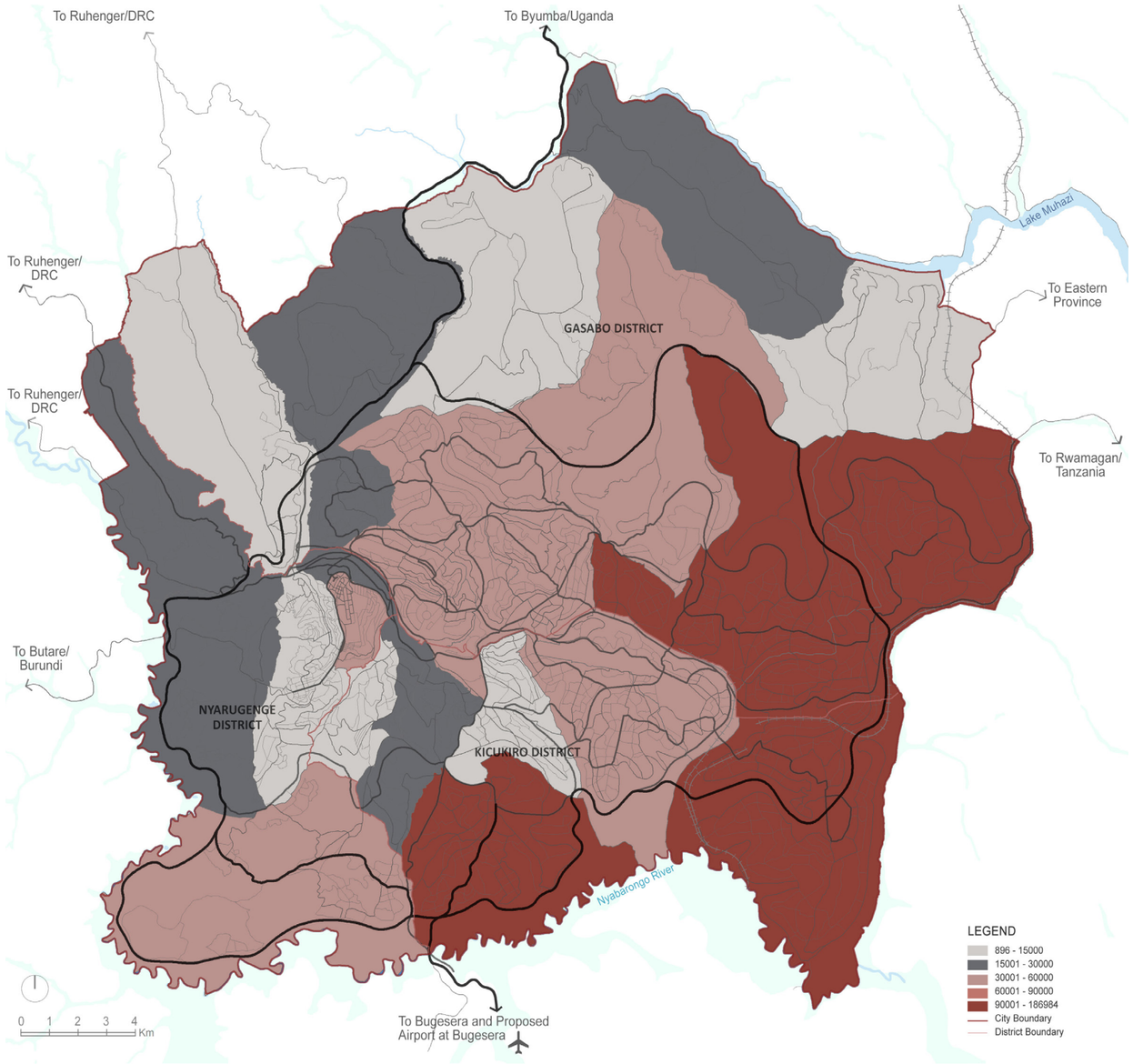


Figure 4.3 Kigali Employment Projection & Distribution 2019-2050

cross-referencing with other ongoing studies (IGC), the High Growth Scenario with 3.8 million population by 2050 is selected by city.

According to IPAR, the City of Kigali and Rwanda has high potential to develop vibrant services and knowledge based sectors building on major investments that have been undertaken.

The employment forecast for Kigali City indicates creation of a total jobs in agro-processing, agriculture, forestry and fishing, mining, manufacturing, services, construction, trade and transport sectors.

4.2.3 Population and Employment Distribution 2019-2050

The establishment of workplace decides where people go to work; an extended and connected traffic network out of workplaces guide how people can move around; and finally, an adjacent and affordable housing estate with integrated social facilities provide space for people to settle and entertain.

Employment Distribution

The principal strategy to distribute employment across Kigali is based on clustering where different types of industries are agregated into clusters which shall form the main employment centres within the city of Kigali. Located along the public transit corridor, these employment centres are planned as self-sustaining, integrated industrial areas and mixed use commercial areas provided with public facilities, social infrastructure and worker housing. This shall have multipal benefits:

- Control pollution by regularizing heavy industry locations and providing collective waste management;
- Making better use of existing and planned infrastructure; and
- Encouraging collaboration, healthy competition and innovation amongst businesses from clustering

Analysing the existing employment centres and proposed industrial areas approved by the city of Kigali, following areas are proposed as the main employment centres within the City. These include the CBD and other regional centres planned in the sub-urban areas to distribute employment in different locations based on expected demand from different employment sectors. Figure 4.3. illustrates employment distribution in Kigali proposed in the Master Plan 2050.

- The Central Business District in Nyarugenge District;
- The Civic and Commercial Centre at Kigali Business Centre (KBC);
- Kimironko City Centre - Mixed use Commercial Centre;
- Kicukiro City Centre - Mixed use Commercial Centre;
- Upcoming City Centres at Nyakabanda and Kinyinya - Mixed use Commercial Centre;
- The Kigali Special Economic Zone (SEZ) located in Nyandungu where phase 1 and 2 have been completed and phase 3 is waiting for implementation;
- Ndera mixed use regional centre - existing and expanding light industrial area;
- Masaka mixed use regional centre-

Kigali logistics platform (KPL) in Masaka where industrial parks and logistics warehouses will be established following the international rail networks - Isaka-Kigali Rail and Kagitumba-Kigali Rail;

- Rusororo Industrial Estate at the east edge served by Kagitumba-Kigali railway;
- Gahanga Industrial and mixed use regional centre - Gahanga Light Industry and agro-processing park which is well connected with proposed Bugesera International Airport road; and
- New Regional Centre has been proposed in Bumgogo to support logistics and frieght movement in and out of the Kigali via proposed 80km ring-road in Kigali City (KRR)

These newly-formed employment centres that have evolved from existing commercial and industrial clusters will provide different scales and cost range of commercial and industrial solutions, following current and expected market dynamics. An established public transport corridor will expand from these employment centres to connect these high value economic activity areas, that are major shopping, civic and recreation destinations, across the city.

The projected employment sectors from IPAR studies are combined or re-categorised to form industrial clusters to be planned under different industrial and commercial mixed use zones in the master plan. TTable 4.3 provides details of these industrial categories and projected employment for these sectors. 13% of total employment in Kigali is generated by manufacturing and transport sectors. 61% of Employment in services and trade are conglomerated in city centres and regional centres, and also within the mixed use commerical corridors along the public transit networks. The rest of 26% jobs in agro-processing, agriculture, forestry, fishing, construction, mining and quarrying are spread in sub-urban and rural areas.

Table 4.3 Categorising IPAR 2050 Employment Projections into Industrial Types

Industrial Types	Employment Estimate (IPar Study)	Percent
Agro-processing, Agriculture, Forestry & Fishing	175,376	10.20%
Mining	22,352	1.30%
Manufacturing	128,953	7.50%
Services	622,412	36.20%
Construction	247,589	14.40%
Trade	421,245	24.50%
Transport	101,443	5.90%
Total Employment	1,719,369	100.00%

Source: IPAR Study

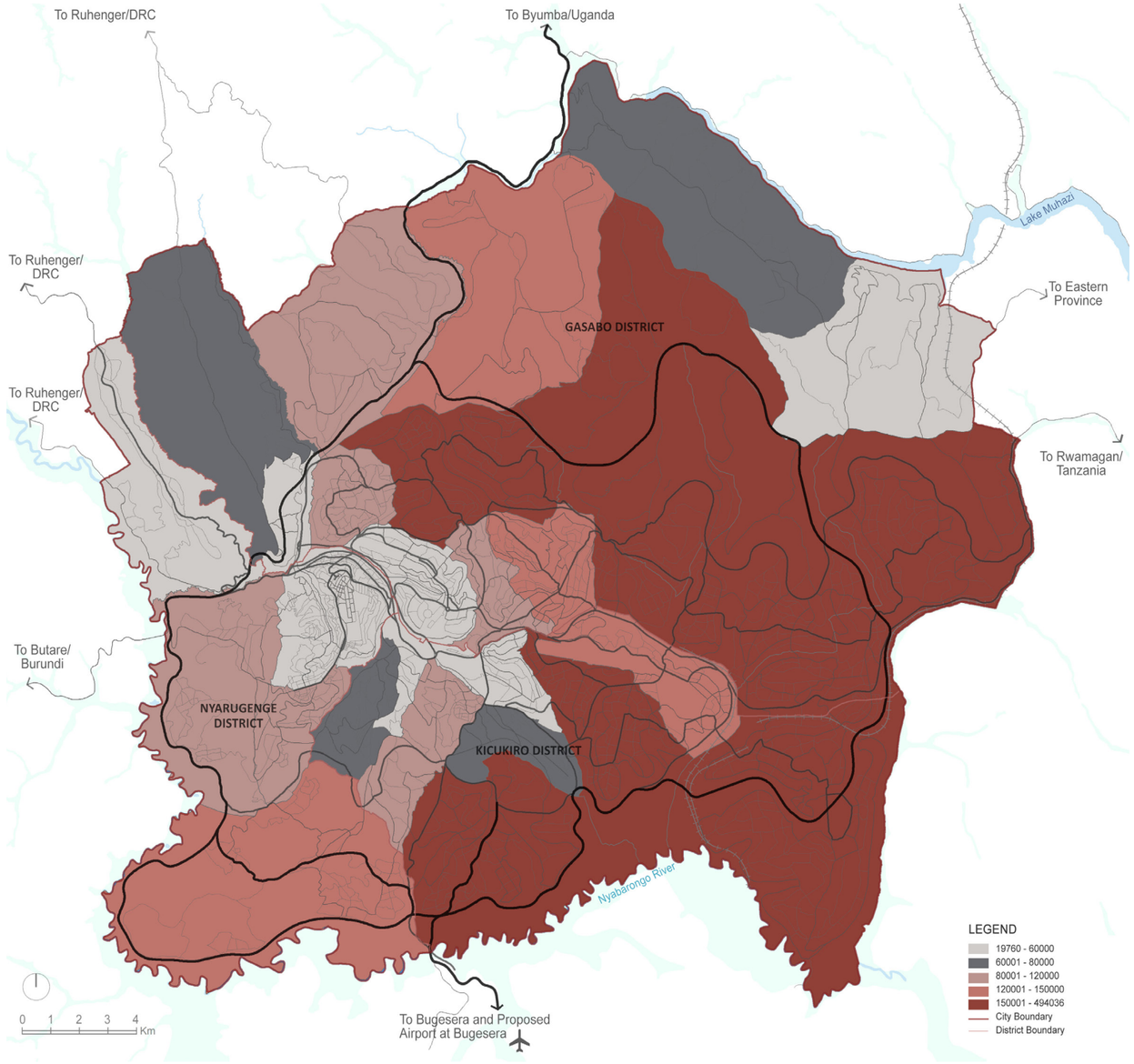


Figure 4.4 Kigali Population distribution 2019-2050

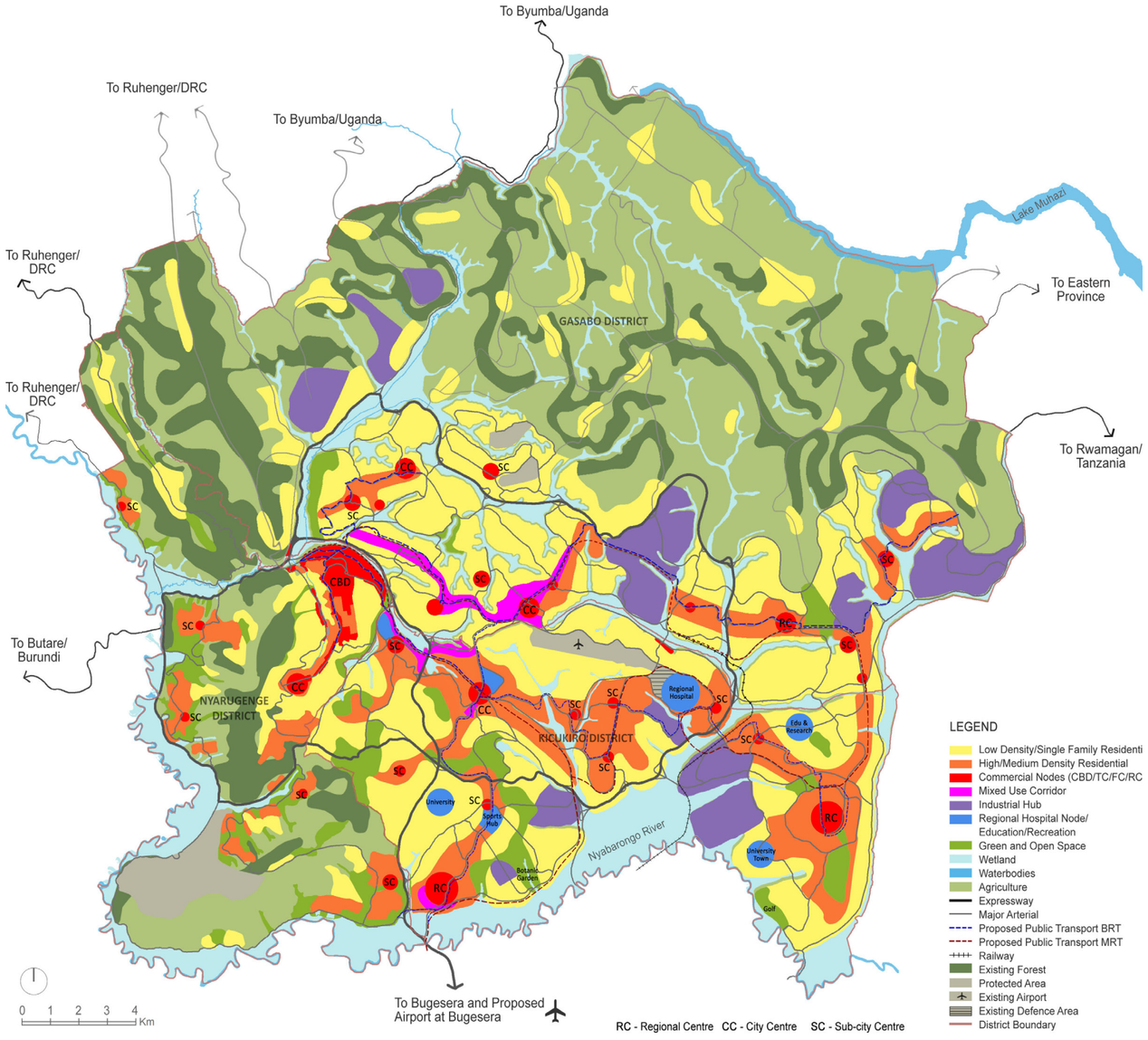


Figure 4.5 Kigali City Proposed Structure Plan 2013-2040

Population Distribution

With well-established employment centres and extensive public transport corridors, and following the founding principle of integrated, mixed use development the master plan advocates to develop integrated industrial areas with affordable housing, social infrastructure and green open spaces for people in Kigali to have a "work-travel-live-play" communities.

Taking the fact that city is moving towards promotion of densification through land pooling and incentives, residential zones accommodating higher densities, suitable for different income groups including affordable housing have been planned in proximity to public transport corridors and employment centres. Meanwhile, following the founding principle of encouraging mix of uses in all areas, these residential areas are planned as mixed use zones allowing a vast variety of income generating activities and public facilities. Thus, mixed income, mixed use, higher density residential and affordable housing are planned around employment centres and public transit corridors for integrated development.

The master plan proposes upgradation and renewal of unplanned settlements around the CBD and City Centres to accommodate higher density of population currently living in poor urban environment in the heart of the city. This mix of residential areas around the CBD shall bring vibrancy into the city centre. Population is also distributed around the mixed use commercial areas along the proposed BRT network thus connecting different employment and residential areas by public transit across the city.

As the city expands in future, the increasing population in Kigali is proposed to be housed around regional centres in sub-urban areas including Kinyinya, Bumbogo, Kimironko, Ndera, Rusororo, Masaka, Kanombe, and Gahanga.

Figure 4.4. illustrates population distribution in Kigali proposed in the Master Plan 2050.

4.3 Structure Plan

4.3.1 Kigali City Proposed Structure Plan 2013-2040

Further developing from the Radial Concept Plan, there was no one Structure Plan for the City of Kigali as the Master Plans for the three districts were developed separately. Thus, in the attempt to unify the plans of the districts in this Master Plan update, the individual plans are integrated to illustrate the overall Structure Plan for Kigali City as shown in Figure 4.5.

The Structure Plan will form the basis for the development of the updated Master Plan, which includes the proposed Zoning, Transportation and Infrastructure Plans.

The rationale of the planning structure and main programmes for each district are explained as follows.

Nyarugenge District

In the Kigali City Master Plan 2013, the Nyarugenge District was positioned as the "Green Financial Hub and Vibrant Growth Centre", based on its potential being the home to the CBD of the city.

The Proposed Structure Plan for Nyarugenge District established the structure of the development areas and location of the key activities within the District. The key proposals included:

- Establishment of an efficient highway grid system ensuring the long-term regional connectivity and internal linkages;
- Redevelopment of Muhima Sector as the new Central Business District of Kigali City;
- Development of a CBD core extending from the Centre Ville Roundabout down into the wetlands;
- Development of a new District Centre at the junction of Nyamirambo and Mageragere Sectors;
- Redevelopment of the existing commercial and civic node at the north of Nyamirambo into a Regional Centre for the District;
- Redevelopment of the existing dense and unplanned housing areas near the CBD into high-density medium rise residential areas;
- Development of the under developed areas in the sub-urban sectors into Umudugudu and eventually into comprehensive residential Planning Areas complete with retail, public and civic facilities as well as supporting employment generating industrial and commercial activities;
- Creation of local employment opportunities through development of town centres and industrial estates;
- Utilization of unbuildable areas of the District for agricultural activities;
- Conservation of existing forest and wetlands. Afforestation in very steep areas; and
- Utilization of the wetlands and nature areas for tourism development as well as for integration into the Planning Areas as recreational destinations

Gasabo District

Gasabo was been identified as Rwanda's Administrative Centre to play the role of a "Diverse Employment Hub and Cultural Heartland of Kigali"

Guided by the key strategies for transformation a structure plan was proposed for the Gasabo District. The key features of the structure plan are as follows:

- To expand and strengthen the City Centre by allowing high density commercial and vibrant mixed use developments supporting existing administrative areas;
- To introduce regional level commercial developments in fringe and suburban areas, to provide well distributed employment centres;
- To safeguard land for consolidated Industrial Estates at strategic locations;
- To establish an efficient highway grid and arterial system which ensures long-term regional and local connectivity and to ensure smooth flow of traffic;
- To redevelop existing unplanned settlements into higher density residential developments;
- To develop five new, compact suburban Planning Areas with integrated facilities and light industries;
- To develop small clusters of consolidated housing in the rural areas;
- To conserve nature areas such as forests, wetlands and water bodies. Also protect steep slopes (above 20%) in both urban and rural areas;
- To protect and promote key sites of cultural and historic importance;
- To introduce a variety of iconic regional recreation and tourism destinations, the key attractions in Kigali;
- To provide land for value added farming in un-buildable areas so as to ensure continuity of agricultural identity and heritage; and
- To develop key infrastructure like BRT and MRT and to integrate them with commercial and residential developments.

Kicukiro District

The development focus of Kicukiro District was set to become the 'Knowledge Hub and Green Gateway of Kigali".

Guided by the broad principles, that were set by the Conceptual Plan for Kigali city, the following strategies were proposed for the transformation of Kicukiro District:

- To establish a unique gateway commercial hub to Kigali with a wide variety of mixed used developments along growth corridors - The proposal focused on new developments in the green field areas, whilst intensifying the inner city area surrounding the CBD. The development corridor would connect existing key features of the city with the new commercial and industrial employment nodes. This includes two new 'Regional Centres' at Gahanga and Masaka sectors respectively and a 'City Centres' at Kicukiro sector. These Regional Centres were planned to cater to a larger catchment area providing regional level facilities. They would also be key employment destinations in the city offsetting the development pressure from the CBD area;

- To create distinct identity by developing knowledge, sports and innovation centric growth centres - The relatively higher number of Educational Institutes in Kicukiro District gives it an ideal platform to promote the district as the City's knowledge hub with additional facilities like Regional level Sports stadium and Research cum Innovation centres. Two new University Towns are proposed in Gahanga and Masaka sector respectively. The approved Indoor and Outdoor Stadium projects are integrated in the District's Master Plan;

- To conserve scenic wetlands and nature areas, and promote them through value added recreational uses - The proposed Environmental Green and Blue Plan connects the various existing nature areas through a continuous pedestrian and bicycling network along the wetland buffer zone. Numerous parks in different hierarchy providing both active and passive recreational spaces for residents are proposed within each Planning Area. These parks are planned as nature parks, wetland parks and edge parks depending of their location, environmental condition and topography. Regional Level parks like the flower valley, Botanical garden and Biodiversity park are proposed in key areas;

- To develop new comprehensive integrated Planning Areas and promote regeneration of existing areas with quality living environments - The Detailed Master Plan proposed restructuring the District into eleven (11) self-sufficient Planning Areas. Unplanned areas within the district are proposed to rehabilitate and regenerate to create a 'Slum Free' Kigali by 2040. The existing residential developments are reorganized to provide access to adequate public facilities and infrastructure. Masaka town and parts of Kanombe sector are rehabilitated to medium residential developments. New medium and high density residential neighbourhoods are proposed along the key transit corridors;

- To integrate all developments with a well planned transport network, and create walkable neighbourhoods by promoting non-motorized transit - A radial road network with well spaced highways was proposed to cater to smooth city travel and fast connections within the district and better linkage to the new airport at Bugesera. The proposed trans-national rail line through the District will further strengthen the District's Industrial and logistics

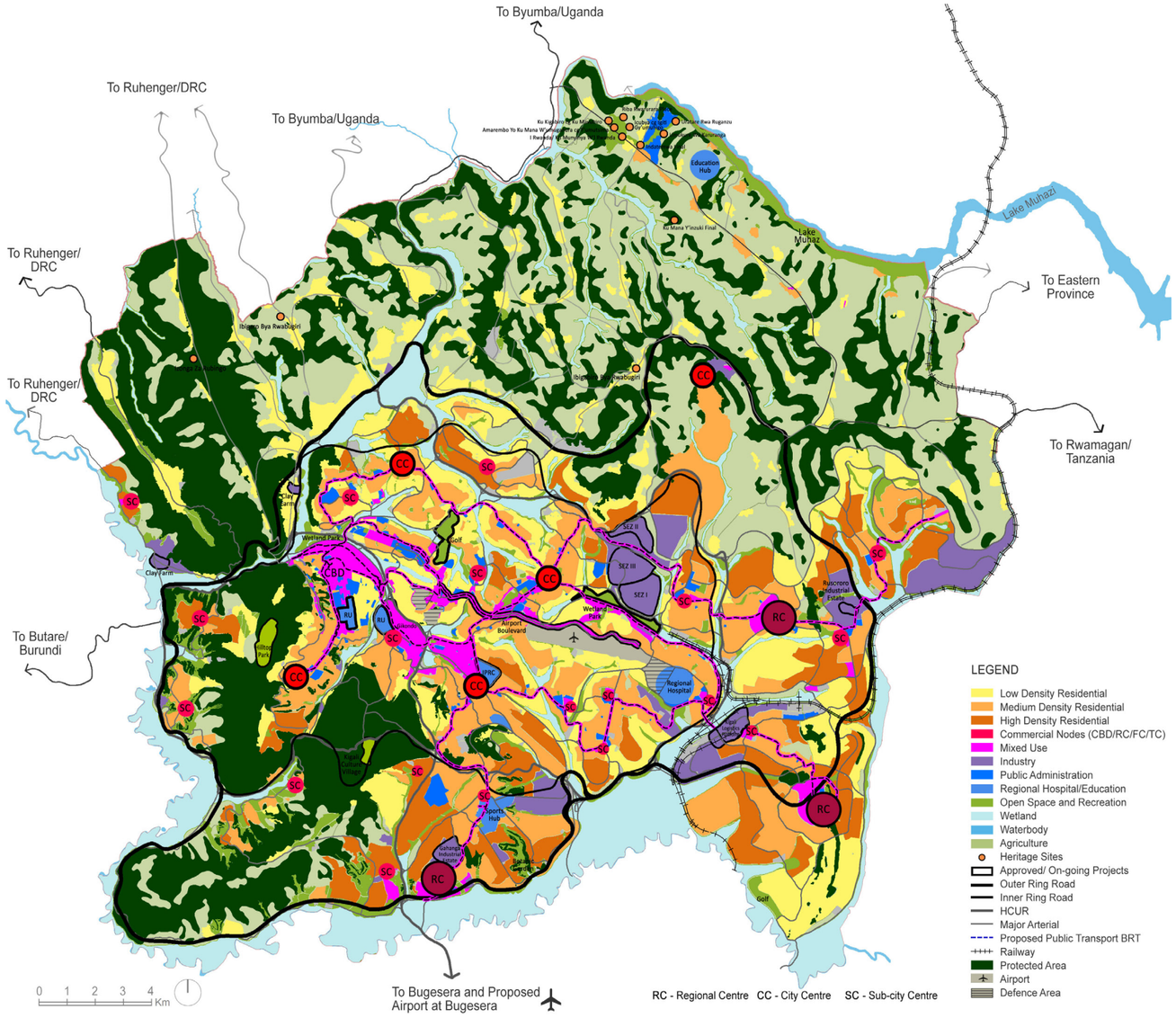


Figure 4.6 Kigali City Proposed Structure Plan 2019-2050

sector. The proposed transit corridor forms an integral component of the transportation and Land Use Plan. It links the various Planning Areas in Kicukiro and high density development is proposed along these corridors. The transit corridors ws planned to have Bus Rapid Transit with transit stops distributed at regular intervals. However, in the future once enough population catchment was achieved, high capacity MRT corridor was proposed.

4.3.2 Kigali City Proposed Structure Plan 2019-2050

Moving forward, working from the individual theme and strategies made for three districts in 2013, the 2019-2050 Kigali Structure Plan try's to retain the valid proposals and complement missing programmes to show a comprehensive picture for whole Kigali. The new structure for the city will have the following key considerations:

- Strengthening and organizing the existing CBD in Nyarugenge;
- Acknowledging four self-sustaining City Centres with mixed use commerical for peri-urban growth supporting the CBD;
- Establishing four main self-sustaining Regional Centres with mixed use commerical as new growth areas and employmenr destinations in the sub-urban areas;
- Identified industrial clusters and SEZ to form consolidated and well-connected employment zones for manufacturing, logistics and warehousing;
- Improving connectivity and accessibility via transit corridors, with the proposed Bus Rapid Transport, spreading throughout the city;
- Mixed use residential and commercial zones spread at key locations along public transit corridor creating a well knit and well connected system of housing, jobs and public transport;
- Mixed use and mixed income, high-density, affordable and quality living environments in proximity to employment centres ;
- To redevelop existing unplanned settlements into higher density residential developments;
- To develop clusters of consolidated housing in the rural areas;
- To conserve nature areas such as forests, wetlands and water bodies. Also protect steep slopes (above 30%) in both urban and rural areas; and
- Conserving Kigali's rich nature, heritage and cultural areas;

Figure 4.6 illustrates the proposed structure plan for master plan update 2019-2050.

Centres and Corridor

The overarching strategy for the 2019 Structure Plan is development of "Centres" and "Corridors" within the City of Kigali where:

The centres are specialised clusters of high value economic activity, major shopping, civic and recreation connected via the economic corridors built along a backbone of transport infrastructure - the proposed public transit (BRT) that link these important economic activities in different centres planned throughout the city;

While the **centre of businesses**

benefit from clustering, encouraging collaboration, healthy competition and innovation amongst businesses, the **corridors** ensure improved access to retail, office, health, education, leisure, entertainment and cultural facilities and community and personal services;

While the **mixed use centres** create vibrant places and vibrant economies enabling people to carry out a number of activities in one location, the **corridors** make better use of existing and planned infrastructure such as public transit, promoting the use of sustainable urban transport within the city and creating healthier communities by giving more people the option of taking public transport, walking and cycling to reach the urban centres.

The "Centres" of Kigali that are also the important employment destinations proposed within the city:

- The Central Business District in Nyarugenge District;
- The Civic and Commercial Centre at Kigali Business Centre (KBC);
- The Kimironko Mixed use Commercial Centre;
- The Industrial and Mixed Use Regional Centres – Special Economic Zone, Ndera and Rusororo industrial and mixed use regional centre , Masaka Industrial estate and mixed use regional centre, Gahanga Industrial and mixed use regional centre
- The mixed use commercial planned at four City Centres in Kinyinya, Kimironko, Kicukiro and Nyamirambo

As part of the corridor strategy, the master plan update shall address upgradation and renewal of areas that are unplanned, run down or have significant underutilised infrastructure as part of the TOD strategy along the proposed BRT corridors. The corridors strategy shall upgrade and improve the mixed use commercial or industrial activity along busy roads. Below are some of the critical economic corridors within the city of Kigali:

- BRT corridor connecting CBD to KBC;
- Airport Boulevard connecting KBC to current Kigali International Airport;
- BRT corridor connecting KBC to Kimironko mixed use commercial City Centres ; and
- BRT Corridor connecting Kicukiro City Centre to Gahanga Regional Centre and further connecting to the new Airport at Bugesera;

By integrating the "centres" with the "corridors", the structure can bring both economic and social benefits desired in the city of Kigali.

4.4 Broad Land Requirements

Broad land requirements are established to respond to the needs of the projected population and employments for 2050.

4.4.1 Broad Land Requirements for Housing

Affordability

Housing affordability, is the most pressing issue in Kigali. According to Household survey conducted by IPAR, 58% of Kigali population earns less than 100,000 RWF (Table 4.4). Among the households that rent, within the lowest income quantile, they allocated 88% of their incomes to rent, whereas those in the highest income quantile, they averagely allocate 20% of their income to rent (Table 4.5). Among households with property in the city of Kigali, the value of their residential properties (including land and houses) ranges between 10million RWF and 400million RWF. In comparison to their income streams, the lowest quantile requires approximately 24 years to purchase the same property, while those in the highest quantile require 16 years to purchase the current properties they own (Table 4.6). As a result of low household income compounded with relatively high cost of living, the vast majority of Kigali's population live in unplanned settlements occupying large areas around the city CBD.

The different housing typologies including their purchase (construction costs including the cost of land) and rent cost are matched onto the income categories to determine which households can afford the different housing typologies. The key findings indicate that households who earn less than 40,000 Rwf can only afford to purchase rudimentary shelter only if they own the land on which their house will be located. These households can only afford to rent a small space which is below 30sqm when the shelter is rudimentary. Households that earn less than 40,000Rwf can neither afford to rent or purchase better housing typologies including low cost brick SKAT houses, bungalows and apartments. This implies that social housing will be required as a policy option if these households are to benefit from decent affordable housing.

Table 4.4 Households Income and Available Monthly Budget

Income Ranges (RWF)	Households %	Household No.	Population	Avg. Available Monthly payment for housing
0 -40,000	**30%**	77,348	386,739	< 14,000
41,000 -100,000	**28%**	71,808	359,040	42,000
100,001-250,000	21%	53,873	269,367	97,000
250,001 -500,000	14%	35,731	178,654	230,000
Above 500,001	9%	22,643	113,217	> 470,220
Total	**100%**	**261,057**	**1,305,286**	

Source: IPAR Study

Table 4.5 Affordability Ratio (Proportion of Renting to Monthly Household Income)

Income Quantile	Median Income	Median Rent	Affordability Ratio
1(25%)	20,000	17,500	0.88
2(50%)	70,000	30,000	0.43
3(75%)	170,000	50,000	0.29
4(100%)	500,000	100,000	0.20

Source: IPAR Study

Table 4.6 Affordability Ratio (Proportion of Property Value to Annual Household Income)

Quantile	Median Annual Income	Median Property Value Rent	Affordability ratio (Years Needed to construct a house)
1(25%)	420,000	10,000,000	23.81
2(50%)	1,200,000	25,000,000	20.83
3(75%)	2,640,000	50,000,000	18.94
4(100%)	25,000,000	400,000,000	16.00

Source: IPAR Study

Households that earn between 40,001 and 100,000 Rwf can afford to purchase and rent rudimentary shelter but can neither afford to rent or purchase other better housing typologies including apartments, bungalows and low cost brick houses. Again, social housing would be a viable housing policy option for this class of households.

Households earning between 100,001 and 250,000Rwf monthly can afford to rent and purchase low cost SKAT type housing and medium house bungalows. Households earning between 250,001Rwf and 500,000Rwf are the ones that can afford to rent or purchase medium quality bangalows and can be targeted by mortgage and low cost affordable housing loans.

Table 4.7 Currently Affordable Typologies

	Shelter (Rudimentary)		Semi Temporary House (Mud or Concrete Bricks, Metal Roofing)		Low Cost Brick Row Housing (SKAT type) - Row Housing		Medium Quality Bungalow		Villa		High Quality G+3 Apartment		High Quality G+7 Apartment	
Income Ranges (RWF)	Pur-chase	Rent	Pur-chase	Rent	Pur-chase	Rent	Pur-chase	Rent	Pur-chase	Rent	Pur-chase	Rent	Pur-chase	Rent
0 - 40,000	Only if Owning land	Yes, Small DU below 30 sqm.	no	no	no	no	no	no	no	no	no	no	no	no
41,000-100,000	yes	yes	Only if Owning land	yes	no	no	no	no	no	no	no	no	no	no
100,001-250,000	yes	yes	yes	yes	yes	yes	no	no	no	no	no	no	no	no
250,001-500,000					yes	yes	yes	yes	no	no	yes	yes	no	no
Above 500,001							yes	yes	yes	yes	yes	yes	yes	yes

Source: IPAR Study

Table 4.8 IPAR's Population and Household Size Projection

	2018	2018-2024	2024-2031	2031-2038	2038-2045	2045-2050
ipar population	1,590,299	1,897,223	2,291,345	2,745,831	3,343,950	3,824,708
Projected household size	5	4.8	4.6	4.4	4.2	4
total du	318,060	395,255	498,118	624,052	796,179	956,177

Source: IPAR Study

Table 4.9 Additional Housing Needs by Phase

Income Ranges (RWF)	%	2018	2018-2024	2024-2031	2031-2038	2038-2045	2045-2050
0 - 40,000	30%	59,460	57,169	27,985	37,313	50,999	47,405
41,000-100,000	28%	33,415	61,929	25,981	34,640	47,346	44,010
100,001-250,000	21%	19,235	42,954	19,492	25,988	35,521	33,018
250,001-500,000	14%	4,331	21,001	12,928	17,237	23,559	21,899
Above 500,001	9%	475	6,751	8,193	10,923	14,930	13,878
Total	100%	116,916	189,804	94,579	126,101	172,354	158,943

Source: IPAR Study

Lastly households that earn over 500000Rwf per month are the only ones that can afford to rent or purchase an average quality apartment. Table 4.7 provides details of the current affordable typologies in Kigali.
In conclusion, 58% of population or about 150,000 households (income level below 100,000Rwf), according to this analysis, would not be able to afford even the cheaper formal SKAT housing type. Therefore, it is necessary for master plan to allow for medium-density self-construction – incremental development to be built by individuals over time. Beyond that, subsidy should be granted for those households.

Housing Needs

According to IPAR's study of 2012 census, EICV3, EICV4, household survey of 2018 and its key assumption for the average household sizes by phases (Table 4.8), the housing needs have been projected by phasing and individual income ranges shown in Table 4.9. In summary, approximate 859,000 new dwelling unites need to be constructed by 2050, in other words, there will be average 27,000 houses required per year till 2050.

Housing Share by Zoning Types

Due to chaging demographic trends in Rwanda impacting also the City of Kigali, population for the city in 2050 is projected to be 3.8million. This may be lower than the earlier projected population of 4.2million by 2040 but higher density, mixed use, mixed income living needs to be adopted by the city to combat the primary issues of urban sprawl, increasing unplanned settlements and lack of quality urban environment and affordable housing that are impacting the overall economic growth of the city. The current low density areas will require to be densified. The average urban density in Kigali is proposed to be 14000 p/km2. Broad land use for housing in Kigali is calculated as per residential zoning types based on proposed housing densities.
Referring to the Kigali Zoning Regulations, 11 zones (including 2 overlay zones) with residential mixed use focus have been established to align with city's density requirement and accommodate this 3.8million population by 2050.

Low density zones:

- R1: Low Density Residential Zone with net density 15 du/ha
- R1A: Low density Residential Densification Zone(R1A) with net density 30 du/ha
- R1B: Rural Residential Zone with net density 70 du/ha

Medium to high density zones:

- R2: Medium Density Residential - Improvement Zone with net density 100 du/ha
- R3: Medium Density Residential - Expansion Zone with net density 90 du/ha
- R4 : High Density Residential Zone with net density 120 du/ha
- C1: Mixed Use Zone with 70% residential and net density 110 du/ha
- O-C2 : Neighbourhood Commercial Overlay with 70% residential and net density 90 du/ha
- C3: City Commercial Zone with 60% residential and net density 100 du/ha

Broad Land Requirement for Residential Zones

Table 4.10 provides broad residential land requirements for the proposed housing composition based on the affordability study from IPAR[1].

In order to meet the housing demands by different income ranges, residential zones with suitable densities and functions have been provided to fit the context, and thus a series of housing

1 Please note the residential components of overlays O-C2 and O-R4 have been added to other residential mixed use zones as these overlays will superinpose the base zoning.

share have been computed to meet the overall demand. Current large areas of low density residential land will be reduced to 15% of the total area allocated for residential mixed use in zoning, while the remaining 85% of this land will be utilised for medium to high density residential mixed use for a more compact development.

Calculated by projected gross density for individual zones, IPAR's 956,177 dwelling units by 2050 will be distributed on a total number of 18,169 ha of gross residential land. Detailed distribution for different zones is illustrated in later chapters.

4.4.2 Broad Land Requirements for Commercial Mixed Use zones

Kigali's GDP is projected to be RWF 29,739 billion, witnessing an average growth rate of 6.5% per annum. The total workforce of Kigali in 2050 is estimated to be 1.72 million. The employment in the services sector (Retail Trade, Commercial Services and Micro- light industrial) is estimated to be 980,356 by 2050.

To provide the variety of spaces needed for the services sector a broad land use for the commercial facilities is required. The commercial facilities are generally proposed to be integrated with the regional center, city centers, town/ community centers, and neighborhood centers. The following zones are proposed for commercial mixed use in updated zoning plan for Kigali.

- C1: Mixed Use Zone with 30% Commercial
- O-C2 : Neighbourhood Commercial Overlay with 30% Commercial
- C3: City Commercial Zone with 40% Commercial

Table 4.10 provides broad land requirements for commercial mixed use based on the projected employment demand from IPAR.

The provision of total commercial space in Kigali is derived from IPAR's employment projection in the services sector with commercial space distribution in different employment nodes (by hierarchy of commercial space) guided by IPAR's Commercial Real Estate Study.

In Kigali 2013 Master Plan, city proposed 40% share of total commercial space to CBD, 20% share was distributed to regional centres, 20% share to various town and City Centres, and the remaining 20% was distributed to commercial spaces within neighbourhood centre and other commercial.

Suggested by IPAR's Commercial Real Estate Study, larger commercial building with extra facilities (parking, etc.) become more expensive and have less appeal for the majority of the local businesses. The majority of businesses in Kigali are small in size and financial capacity. While there has been an oversupply of Grade A buildings in key employment nodes proposed in the 2013 Master Plan, they have a very low occupancy rate and high take-up time due to high

Table 4.10 Broad Residential Land Requirements: Housing Composition 2050

Zone	Housing Share	Density Share	Projected DU	Net density (du/ha)	Gross Density (du/ha)	Residential Land (ha)	mixed use residential split
R1	2.6%	29% Low density	25,522	15	10	2,552.85	100%
R1A	11.9%		117,457	30	20	5,872.95	100%
R1B	14.2%		140,333	70	40	3,508.35	100%
R2	17.9%	71% medium to High density	176,454	100	60	2,940.92	95%
R3	29.6%		291,895	90	50	5,838.10	95%
R4	13.5%		133,210	120	80	1,665.16	95%
C1	7.1%		69,757	110	77	905.96	70%
C3	3.1%		31,022	100	70	443.26	60%
TOTAL	100.0%		985,650			23,727.54	
Total	**100%**		**956,177**			**18169.02**	

Table 4.11 Broad Land Requirements: Commercial Composition 2050

Zone	Types	Share	Employment	sqm per employment	Commercial GFA (sqm)	FAR	Commercial Land (ha)
C1	Mixed Use Commercial	30.35%	289,909	15		6,212,269.92	1.6
C3	CBD, Town Level	34.65%	330,967	15		7,092,203.87	2.4
O-C2 OVERLAY,MIXED USE RESIDENTIAL IN R2,R3, & R4	Neighbourhood Level	35.00%	334,335	15		7,431,728.33	1.4
TOTAL		100.00%	955,211			20,736,202.12	

Table 4.12 Broad Land Requirements: Industrial Composition 2050

Zone	Types	Employment	sqm per employment	Commercial GFA (sqm)	FAR	Commercial Land (ha)
I1	Light industrial zone	246,183	46.4		13,438,637	1
I2	General industrial zone	44,169	40		2,078,615	0.5
I3	Mining/ Extraction/Quarry	3,740	40		176,038	0.5
TOTAL		294,092			15,693,290	
Total		246,788		13,484,061		1493.02

Table 4.13 Broad Land Requirements: Tourism Composition 2050

	Hotel				
Provision Standard (m2/person)	0.1				
Commercial Floor Area (mill m2)	0.38				
Space distribution	%	GFA (m2)	Rooms*	FAR	Land Area (ha)
CBD	40%	152,000	2533	2	7.6
Regional Centre	15%	57,000	950	2.4	2.375
Town Centre	15%	57,000	950	2	2.85
Neighbourhood and Others Commercial	30%	114,000	1900	1.6	7.125
Total	100%	380,000	6333		
* based on avg 60 m2/room					

construction cost and higher rents in premium locations. Small and medium entrepreneurs find it hard to find quality affordable locations in proximity of the neighbourhoods. Considering this situation, the emphasis of the master plan is to facilitate access to the market of small and micro enterprises and provide different scales and cost range of commercial and industrial solutions. In the master plan update, the share of commercial space within neighbourhoods and town centres have been increased to 50%., reducing some share of commercial space from CBD and regional commercial areas.

Meanwhile the standard of commercial space provision is based on international benchmarks. A total commercial space of 15sqm per person is proposed for services sector jobs in Kigali. Broad commercial land requirement for projected demand is explained in Table 4.11.

4.4.3 Broad Land Requirements for Industry

The employment in the industrial sector is projected to be 294,092 by 2050. The light industry ill have 84% share of this industrial employment, while the General industries will take up 15%. mining, Extraction and Quarry jobs will take 1 % of the industrial employment share.

Following are the main industrial zones proposed in Kigali.

The industrial facilities standards for Kigali is based on international benchmarks. An average Planning Standard of 46 sqm per person is provided for the light industry and 40 sqm per person for the general Industries sector. Similarly, 40sqm per person is provided for the mining, quarry and extraction sector. Broad industrial land requirement for the expected demand is explained in Table 4.12.

4.4.4 Broad Land Requirements for Tourist Facilities

The Sustainable Tourism Development Plan proposes 4000 rooms in Kigali by 2020. With the increased inflow of international as well as local tourism, Kigali will require more hotel rooms by 2050. Broad land requirement for tourism facilities for the expected demand is explained in Table 4.13.

4.4.5 Broad Land Requirements for Public Facilities

Basing on the comparative study of planning standards applied in South Africa and Singapore, the public facilities standards have been established in Kigali Master Plan 2013. According to the discussion with Focus Group and various government councilors, the standards made in 2013 will continue in force during the 2018 Kigali master plan review. Standards were calculated based on the relationship between hierarchy of spaces and the proposed population served. The broad land requirements for public facilities are presented in Table 4.14.

4.4.6 Broad Land Requirements for Roads & Infrastructure

The standard for the provision of roads and infrastructure in Kigali is proposed at 18% of total urban area in 2013. The 2019 Master Plan Update will maintain the necessary reserve made in 2013 while incorporate new projects including the Kigali Ring Road and some key infrastructure projects waiting to be implemented. The proposed roads and infrastructure in Kigali is around 20% of total urban area in 2019.

4.4.7 Broad Land Requirements for Recreational Spaces

Open Spaces includes sports and recreation areas, and urban parks and open spaces. Provision of 4sqm per person of open space in urban areas is proposed for Kigali. which is exclusive of wetlands, nature areas etc.

4.4.8 Broad Land Requirements for Special Uses

Special Uses incorporates defence areas, quarry land, prisons, graveyards and special strategic vacant land. In the broad land use, 3-4% of urban land is provided for Special Uses.

4.5 Zoning Plan

With the proposed Structure Plan and broad land requirement based on all socio-economic studies, the Zoning Plan for Kigali City was further updated Zoning regulates the types of uses, the development intensity, the setting and height of buildings on any plot. As such, it serves as an effective planning tool to guide development in a logical and orderly fashion. The Zoning Plan is meant to provide landowners and developers with a clear picture of what can and cannot be developed on any particular plot.

4.5.1 Kigali Proposed Zoning Plan 2013-2040

3 separate Zoning Regulations for each district were prepared for the City of Kigali in 2013. The objectives of the Zoning Regulations is to provide a clear mechanism for the implementation of the Nyarugenge, Gasabo and Kicukiro Districts Master Plan and to direct public and private sector development to follow a clear set of development objectives, definitions and regulations that reflect the vision and concept proposed in the Master Plan.

The objectives, definitions and regulations ensure that development

Table 4.14 Public Facilities Standards

Type		Proposed for Kigali
Commercial	Neighborhood Centre	1 per neighborhood; 1.2 ha site.
	Sub-City Centre	1 per Planning area ; 12.0 ha site.
	Regional Centre	1 per 0.5 million, 50 ha site.
Educational Facilities	Primary School	1 per neighborhood (15,000-20000 population). 1.5 ha site.
	Secondary School	1 per 20,000 - 25,000 population. 2.4 ha site.
	Primary + Secondary School (Combined)	2.8 ha site. (Based on existing school sites)
	Vocational / ICT Institute	1 per Planning area . 2.0 ha site
	Higher Education Institute	1 per 500,000 population. 6.0 ha site
Socio-Cultural Facilities	Community Hall*	1 per Neighbourhood. 0.5 ha site.
	Regional Library	1 per 500,000 population. 0.5 ha site.
	Religious Facility	1 per neighborhood (15,000- 20000 population). 0.5 ha site.
	Cemeteries Crematorium	1 10 ha site per 200,000-250,000 population 1 per 150,000 population; 2 ha site
	Museums/ Cultural Centre etc.	1 per Planning Area. 1.5 ha site.
Health Facilites	Health Clinic *	1 per neighborhood (15,000-20000 population). 0.5 ha site.
	Polyclinic	1 per Planning Area. 5.0 ha site. Max travel time of 30 mins.
	Regional Hospital	1 per 500,000 population. 5.0 ha site
Parks & Open Spaces	Neighborhood Park	1 per neighborhood (15,000-20000 population). 1.0 ha site
	Sub-City Park	1 per Planning Area. 6.0 ha site
	Sports Field	1 per Planning Area . 1.5 ha site. (Near to schools or community centres or combine with parks.)
Sports & Recreation	Sports Centre (with swimming pool and stadium)	1 for every 500,000 population. 6.0 ha site.
Civic facilities	Fire Station	5 minutes response time. 0.5 ha site.
	Government/ Municipal Offices	1 Sector office per Sector. 1 District office per District.
*(as part of neighborhood centre)		

Source: Kigali MP 2013

is carried out to achieve a logical, attractive and livable development pattern in the city, safeguard privacy and amenities, and provide opportunities for growth, with enough flexibility to respond to changing business needs and development trends. The regulations place an emphasis on encouraging sustainable development and design in order to achieve a quality and sustainable living environment.

The Kigali Zoning Plan 2013 and its detailed categories with land area distribution have been shown in Figure 4.77 and Table 4.15.

Since the adoption of the Kigali City Master Plan 2013, the city has been facing some challenges regarding the complexity and inflexibility of implementation for the zoning regulations suggested in the 2013 Master Plan. These were shared in various stakeholder consultations conducted during the master plan review to guide the updation of the Master Plan. Hence in conjunction with unifying the separate District Master Plans for this Master Plan update, it is also the intention to review the zoning regulations to make it easier for the city to follow the proposed regulations and implement the Master Plan.

The strategies proposed in Master Plan 2013 are largely relevant and will continue to form the broad guiding principles of the Master Plan update with added focus on affordability and Implementation of the revised master plan. The quantum of the detailed zoning components will be updated according to the revised socio-economic projections and market demand envisaged for the city.

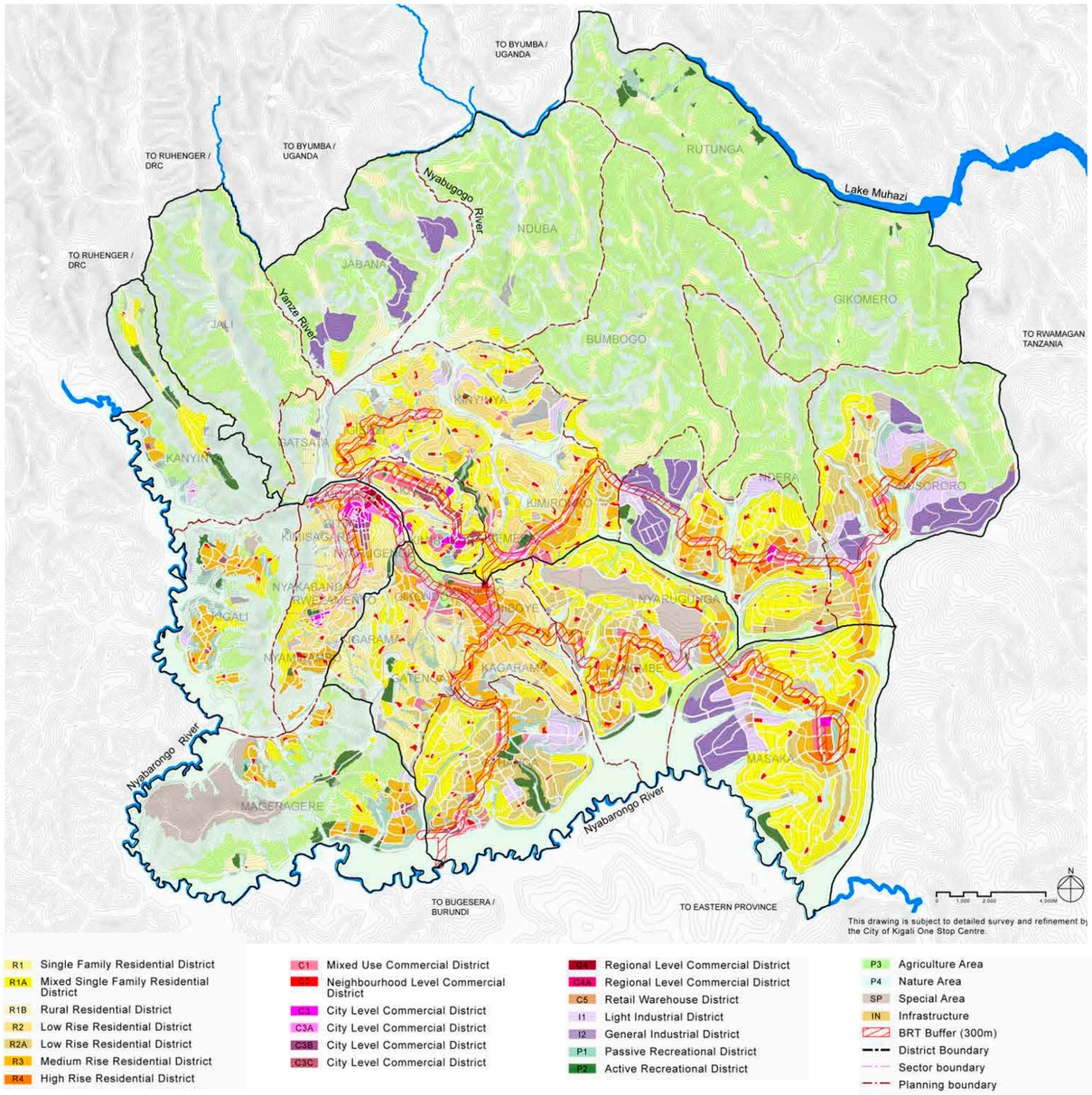


Figure 4.7 Kigali Master Plan 2013 - Proposed Zoning Plan

Table 4.15 Proposed Kigali Zoning 2013 Summary

Zoning		Area (sqkm)	%
Mixed Use Commercial District	C1	6.2	0.9
Neighbourhood Level Commercial District	C2	5.6	0.8
City Level Commercial District	C3	1.6	0.2
City Level Commercial District	C3A	1	0.1
City Level Commercial District	C3B	0.2	0.03
City Level Commercial District	C3C	1.5	0.2
Regional Level Commercial District	C4	0.1	0.02
Regional Level Commercial District	C4A	0.5	0.1
Retail Warehouse District	C5	0.5	0.1
Light Industrial District	I1	12	1.6
General Industrial District	I2	16.1	2.2
Infrastructure	IN	6.6	0.9
Passive Recreational District	P1	35	4.8
Active Recreational District	P2	7.4	1
Agriculture District	P3	192.9	26.4
Protected Area District	P4	191	26.2
Single Family Residential District	R1	19	2.6
Mixed Single Family Residential	R1A	60.8	8.3
Rural Residential District	R1B	20.2	2.8
Low Rise Residential District	R2	17.5	2.4
Low Rise Residential District	R2A	21.3	2.9
Medium Rise Residential District	R3	45.5	6.2
High Rise Residential District	R4	1.7	0.2
Road	RD	48.8	6.7
Special Use	SP	16.9	2.3
		729.9	**100**

Source: Kigali MP 2013

Table 4.16 Proposed Kigali Zoning 2019 Summary

ZONING		AREA (SQKM)	%
Agriculture zone	A1	165.5	22.7
Mixed use zone	C1	13.2	1.8
City commercial zone	C3	7.1	1.0
Light industrial zone	I1	13.6	1.9
General industrial zone	I2	4.2	0.6
Mining/ Extraction/Quarry	I3	0.4	0.0
Parks and open spaces zone	P1	10.4	1.4
Sport and Eco tourism zone	P2	11.5	1.6
Forest zone	P3B	87.7	12.0
Steep slopes (> 30%) zone	P3C	53.6	7.3
Public Administration zone	PA	4.4	0.6
Education and research facilities	PF1	2.7	0.4
Health facilities	PF2	2.7	0.4
Religious facilities	PF3	0.5	0.1
Cultural/ memorial sites	PF4	0.1	0.0
Cemetery/ crematoria	PF5	1.8	0.3
Low density residential zone	R1	25.2	3.5
Low density residential densification zone	R1A	60.3	8.3
Rural residential zone	R1B	33.9	4.6
Improvement zone	R2	31.7	4.3
Expansion zone	R3	61.9	8.5
High density residential zone	R4	17.5	2.4
Transportation zone	T	41.9	5.7
Utility zone	U	1.6	0.2
Rehabilitation	W2	12.2	1.7
Sustainable Exploitation	W3	20.4	2.8
Conservation	W4	39.7	5.4
Recreational	W5	1.8	0.2
Waterbody zone	WB	2.2	0.3
Total Area		729.6	100

Other than the zoning listed in the table, there are three more overlay zones being specified here:

- Public Facility Overlay
- Forest Restoration Overlay
- Heritage Overlay

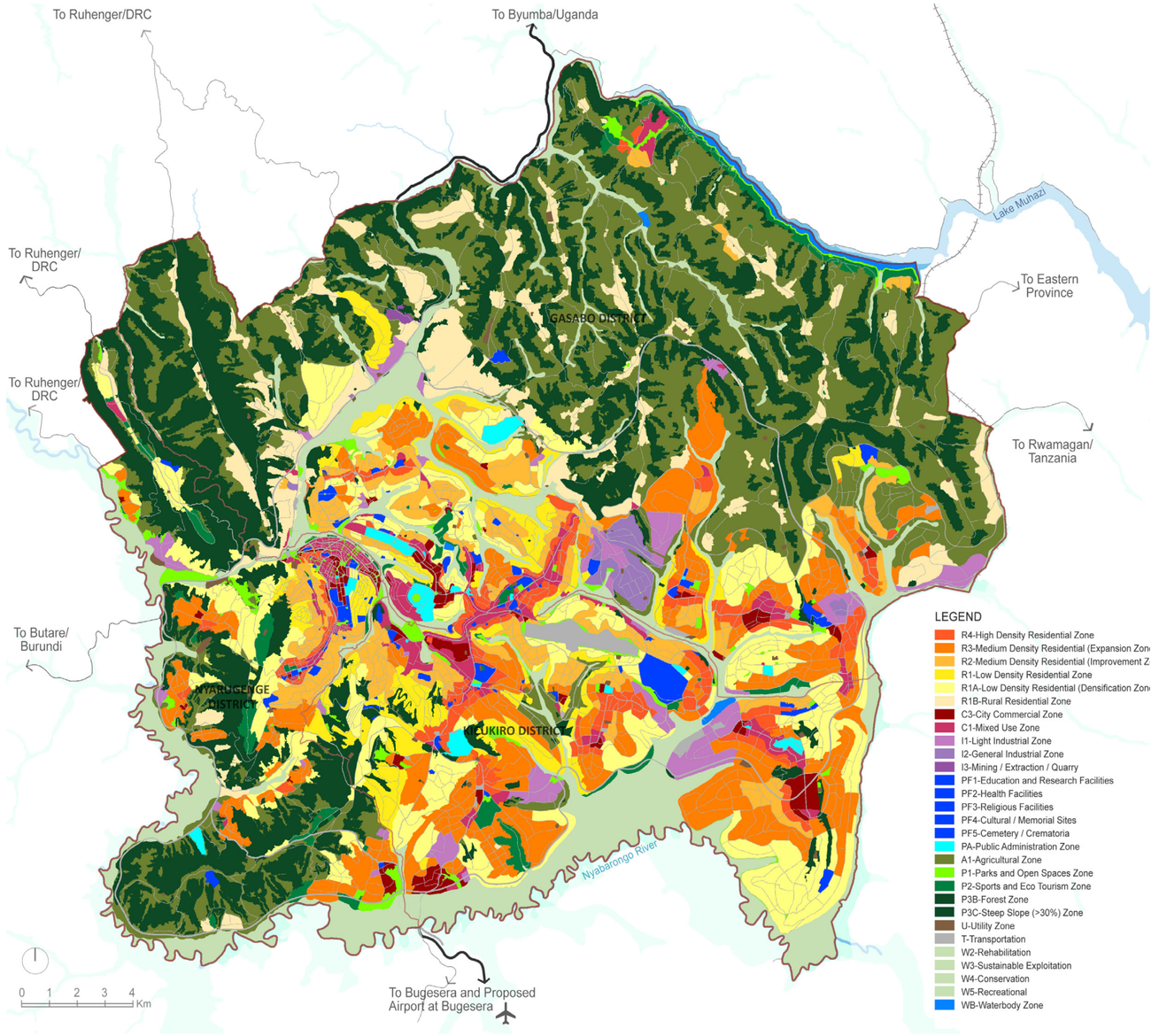


Figure 4.8 Kigali Master Plan 2019 - Proposed Zoning Plan

4.5.2 Kigali Proposed Zoning Plan 2019-2050

CConsidering the changes in population and employment of Kigali (3.8million projected population and 1.72 million projected employment by 2050), studying the affordability and housing needs from socio-economic studies and commercial real estate trends from commercial real estate studies from IPAR and after rounds of discussion through TAG and Focused Group meetings, the Master plan zoning suggests several key changes while updating Zoning Plan from 2013 towards 2019 (Table 4.17).

One of the key changes are on the zoning regulations with similar and correlating operations established in 2013. The following similar and correlating zones are proposed to be combined into one type of zoning for ease of implementation and understanding.:

• C3, C3A, C3B, C3C in 2013 Zoning Plan are updated to C3: City Commercial Zone in 2019;

• C4, C4A in 2013 Zoning Plan are updated to form Incentive Zoning Overlay that seeks to densify not only key commercially valuable areas of the City, but also those areas along BRT and major Transit Corridors and Nodes, along specific sections of wetlands dedicated to recreational uses or in proximity of landmarks, and any other areas, that the market demands, for extra floor space and height;

• C5 Retail Warehouse District from 2013 Zoning Plan are added to I1 zone in 2019 to allow development of retail warehouse within Light Industrial Zone;

• R2, R2A in 2013 Zoning Plan are updated as R2-Medium density residential - Improvement Zone in 2019, for upgradation of unplanned settlements or redevelopment of urban renewal areas, wherever feasible in the brown field sites.

Further, owing to the need for a comprehensive zoning that allows for more clarity in implementation, and as per the latest development and zoning discussions with the RULMA, the final agreed zoning classification become more elaborated, as compared to the 2013 Zoning Plan. The new set of agreed zoning classification brought about inclusion/ diversification of many new zones. There are few new zones added to the 2019 Zoning Plan. It is envisaged that these new elaborate set of zones (specially for eco fragile areas) will further assist the CoK and the stakeholders in emphasizing on the green growth approach for climate change mitigation and sustainability, which is at the core of Master Plan update.:

- P3 in 2013 Zoning Plan has been updated to A1: Agriculture Zone in the 2019 Zoning Plan;
- P4 - Protected Area Zone in 2013 Zoning is elaborated and updated in the 2019 zoning plan as follows.:
- P3B-Forest zone
- P3C-Steep slopes (> 30%) zone
- WB-Waterbodies
- W – Wetlands Zone which the Kigali City Wetland Master Plan has further subdivided into:

1. W1 - Buffer Zone
2. W2 - Rehabilitation Zone
3. W3 - Sustainable Exploitation Zone
4. W4 - Conservation Zone
5. W5 – Recreational Zone

• PA is zone for Public Administrative and Services has been introduced following the Urban Planning Code and Land Use Planning Guidelines of Rwanda. This zone is designated for public administration and facilities and shall only apply to lands owned by governmental agencies for public use or benefit. It applies to lands identified on zoning map as national level, city level, district level public facilities and to other publicly owned properties as listed in the Zoning Regulations;

• Public Facilities (PF) is introduced to clearly help identify each category of public facilities provided for the community. It is divided into the following zones:

1. PF1 - Public Facilities Zone-Education and Research
2. PF2 - Public Facilities Zone -Health
3. PF3 - Public Facilities Zone -Religious
4. PF4 - Public Facilities Zone-Cultural/ Memorial
5. PF5 - Cemetery/Crematoria

This clarity in categorization seeks to facilitate basic and essential support services required by the community, based on the demand and population, at the City, Planning area and Neighbourhood level.

According to the increasing housing demands for lower income ranges in Kigali, the city needs to work towards supplying affordable housing, or facilitate the residents to build their own units on serviced lands they may own in an affordable way, or, encourage the developers in providing affordable housing through cross subsidization. R3 zone has specially addressed this aspect in the Master Plan Update by allowing for intensification and redevelopment of peri-urban and green field areas through extensive housing strategies to provide variety of housing solutions, including development of low-cost incremental housing. The variety of housing solutions ensures mix of use and income for an inclusive development. The sites for these intense housing solutions has been selected based on their proximity to public transport corridors for a comfortable and well-connected live-work-play environment.

The city is also working towards reducing land dedicated to single family housing and promoting densification through incentives to modify building typologies and densities. Most of low density residential district R1, R1A, R1B, R2, R2A in 2013 Zoning Plan have been revised significantly and converted to medium and high-density zones R2, R3, R4 in 2019 Zoning Plan. All these zones, including R1, R1A and R1B zones allow mixed use development, opening a vast variety of income generating activities and public facilities within the neighbourhoods.

For the City of Kigali to apply more flexibility and discretion to protect certain areas, as well as to encourage or discourage certain types of development, overlay zoning has been re-emphasized by the 2019 Zoning Plan, through a variety of additional overlays. These overlays allow to take the development direction, based on market forces and land sensitivity. In total there are Thirteen (13) overlays included, as listed below:

- Neighbourhood-level Mixed Use – O-C2 Overlay (Refer Section 6.2.2)
- Public Facilities Overlay
- Incentive Zoning Overlay
- Land Assembly Overlay
- Land Sub-Division Overlay
- Urban Design Overlay
- Airport Restriction Areas Overlay
- Nature Restoration Overlay
- Slope (30-50%) Overlay
- Tourism Promotion Overlay Heritage Conservation and Promotion Overlay
- Mining Concession Overlay
- Buffers Overlay
- Natural Disaster Risk Overlay

While some of these overlays will be discussed further in the later section: Flexible Zoning Plan, a detailed picture on all the overlays and their regulations are stipulated in the Zoning Regulations, which forms an integral part of this Master Plan Report.

Table 4.17 Zoning Comparison - Summary

	2013 MP			2019 MP Interim		2019 Final Master Plan		
Zoning	**Area_sqkm**	**Zoning_Nam**	**Sum_Area_Sqkm**	**Zoning_Nam**	**Area_sqkm**	**Zoning_Nam**	**Zoning**	**Area_sqkm**
C1 - Mixed Use Commercial Zone	6.21	**C1**	6.21	**C1**	10.0	C1-Mixed use zone	**C1**	**13.2**
C2 - Neighbourhood Level Commercial Zone	5.57	**C2**	5.57					
C3 - City Level Commercial Zone	1.60	**C3**	4.28	**C3**		C3-City commercial zone	**C3**	**7.1**
C3A - City Level Commercial Zone	0.96	**C3A**						
C3B - City Level Commercial Zone	0.23	**C3B**			5.5			
C3C - City Level Commercial Zone	1.50	**C3C**						
C4 - Regional Level Commercial Zone	0.12	**C4**	0.59	**C4**	1.9			
C4A - Regional Level Commercial Zone	0.46	**C4A**						
C5 - Retail Warehouse Zone	0.46	**C5**	0.46					
I1 - Light Industrial Zone	11.99	**I1**	11.99	**I1**	12.3	I1-Light industrial zone	**I1**	**13.6**
I2 - General Industrial Zone	16.10	**I2**	16.10	**I2**	3.3	I2-General industrial zone	**I2**	**4.2**
I3-Mining/ Extraction/Quarry Zone						I3-Mining/ Extraction/Quarry	**I3**	**0.4**
IN - Infrastructure	6.62	**IN**	6.62	**IN**	3.9	U-Utility zone	**U**	**1.6**
P1 - Passive Recreational Zone	35.02	**P1**	35.02	**P1**	37.7	P1-Parks and open spaces zone	**P1**	**10.4**
P2 - Active Recreational Zone	7.40	**P2**	7.40	**P2**	5.8	P2-Sport and Eco tourism zone	**P2**	**11.5**
P3 - Agriculture Zone	192.91	**P3**	192.91	**P3**	158.7	A1-Agriculture zone	**A1**	**165.5**
						P3B-Forest zone	**P3B**	**87.7**
						P3C-Steep slopes (> 30%) zone	**P3C**	**68.2**
						WB-Waterbody Zone	**P3E**	**2.2**
P4 - Protected Area Zone	191.02	**P4**	191.02	**P4**	235.2	W2 - Rehabilitation	**W2**	**12.2**
						W3 - Sustainable Exploitation	**W3**	**20.4**
						W4 - Conservation	**W4**	**39.7**
						W5 - Recreational	**W5**	**1.8**
						PF1-Education and research facilities	**PF1**	**2.7**
						PF2-Health facilities	**PF2**	**2.7**
						PF3-Religious facilities	**PF3**	**0.5**
						PF4-Cultural/ memorial sites	**PF4**	**0.1**
						PF5-Cemetery/ crematoria	**PF5**	**1.8**
PA- Public Administrative Zone				**PA**	9.2	PA-Public Administration zone	**PA**	**4.4**
R1 - Single Family Residential Zone	18.99	**R1**	18.99	**R1**	21.5	R1-Low density residential zone	**R1**	**25.2**
R1A - Mixed Single Family Residential Zone	60.76	**R1A**	60.76	**R1A**	30.8	R1A-Low density residential densification zone	**R1A**	**60.3**
R1B - Rural Residential Zone	20.23	**R1B**	20.23	**R1B**	24.6	R1B-Rural residential zone	**R1B**	**33.9**
R2 - Low Rise Residential Zone	17.53	**R2**	38.82	**R2**	24.1	R2-Medium density residential - Improvement zone	**R2**	**31.7**
R2A - Low Rise Residential Zone	21.29	**R2A**						
R3 - Medium Rise Residential Zone	45.51	**R3**	45.51	**R3**	18.0	R3-Medium density residential - Expansion zone	**R3**	**61.9**
R4 - High Rise Residential Zone	1.71	**R4**	1.71			R4-High density residential zone	R4	**17.5**
R5-Affordable Housing Zone				**R5**	63.5			
Road	48.83	**RD**	48.83	**RD**	56.5	T-Transportation zone	**T**	**41.9**
SP - Special Use	16.85	**SP**	16.85	**SP**	7.0			
Total	**729.86**		**729.86**		**729.5**			**729.6**

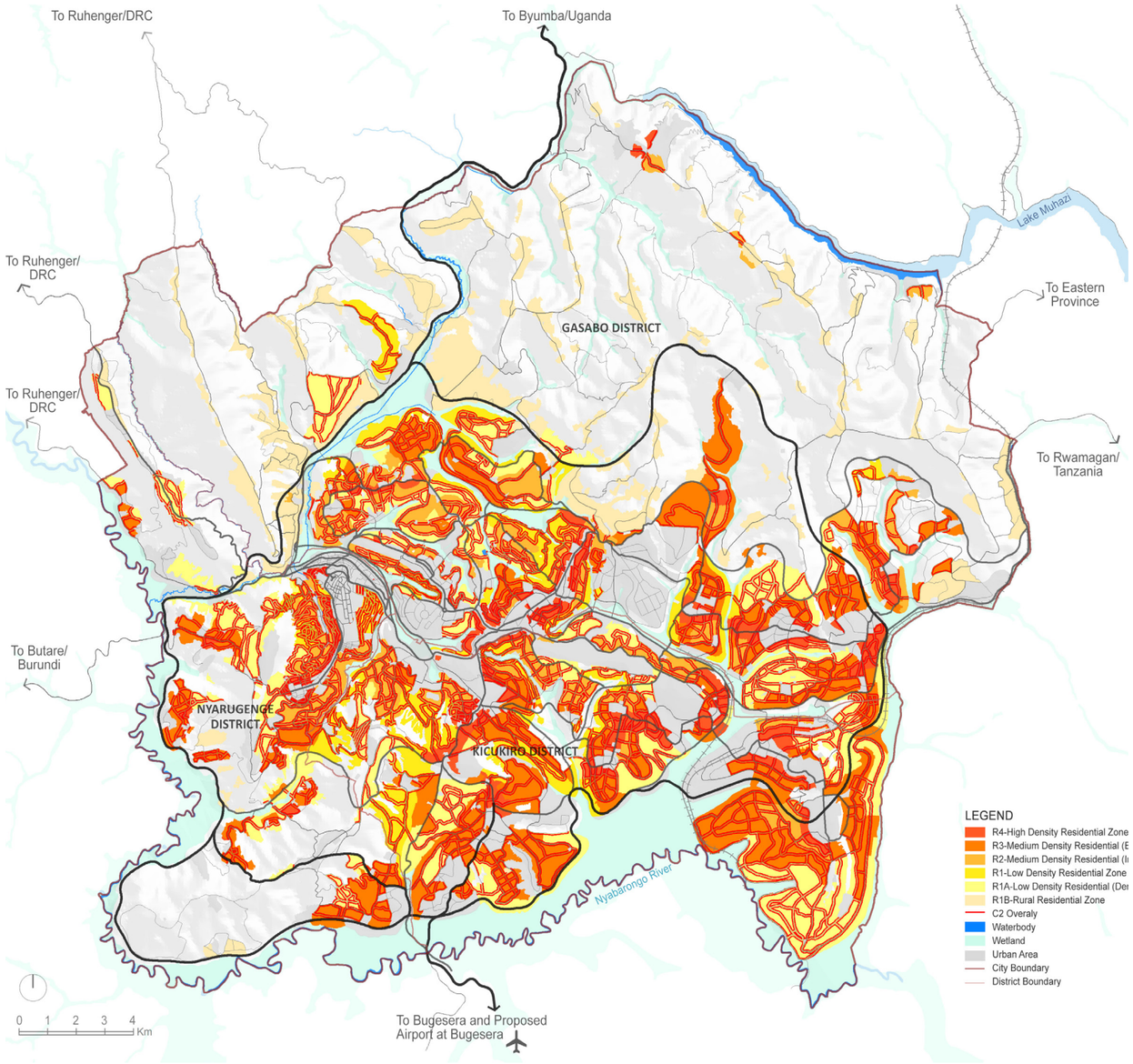


Figure 4.9 Kigali Master Plan 2019 - Proposed O - C2 Zone

4.6 Flexible Zoning Plan

Kigali 2019 Zoning Plan features flexible and adaptive characteristics in terms of regulation and implementation. These characteristics are reflected through various zoning and planning strategies to build an inclusive, sustainable, equitable, integrated and mixed-use city:

- Overlay Zoning;
- Incremental Development;

4.6.1 Overlay Zoning

Overlay Zoning is a mechanism used by urban development authorities to provide flexibility to a land use zone so that it can take a development direction based on market forces. It can be also used for preservation or development of eco-sensitive areas like wetlands, heritage zones etc. or in areas whose future development direction is unpredictable.

Overlay Zones are superimposed over the established zoning and can be used to impose supplement restrictions, permit or disallow various forms of density as well as provide bonuses and incentives to achieve the desired planning intent for that particular area. It helps the urban development authorities to give options to property owners and directs them in making informed decisions based on allowable uses and character/profile of their land parcel. This helps delegate decision making instead of taking a case-by-case basis approach.

Within the 2019 Zoning Regulations, there are various zoning overlays proposed on top of the base zones to provide more discretion and flexibility by allowing the City to protect certain areas as well as encourage or discourage certain types of development.

These overlay zones are one of the key difference in approach adopted for updating the Kigali Master Plan. While these provide the desired flexibility for city development, the implementation of these overlays, like for any other zoning regulation has to be well monitored by the city authorities through continuous engagement with the stakeholders, to achieve the desired city characteristics.

While the zoning regulations provides complete list of Overlay Zones applying restrictive and flexible zoning regulations on the zoning plan , the following overlays, among others, proposed in the Kigali 2019 Zoning Plan promote this planning flexibility encouraged in the master plan update.

The following list the categories of overlays applied in zoning:.

1. Neighbourhood-level Mixed Use – O-C2 Overlay
2. Public Facilities Overlay
3. Incentive Zone Overlay
4. Land Assembly Overlay

O-C2: Neighbourhood Level Mixed Use Commercial Overlay

The Neighbourhood Commercial Zone Overlay (O-C2) within residential zones creates attractive establishments and such developments along minor arterial and collector roads allow for compact

and active mixed-use developments with a commercial frontage.

The intent of this overlay is to maintain and enhance the vitality of neighbourhood, provide compatible services near one another, and allow diverse uses, based on the demand. This integrated and compact development pattern of neighbourhood creates a walkable and transit-friendly environment. The C2 Overlay also allows for small-scale, affordable commercial solutions at the neighbourhood level.

The location and size of these neighbourhood level commercial uses within residential areas are dictated by market demand based on the residential population and needs of the residents. Thus, to promote a vibrant neighbourhood environment within the city of Kigali, the neighbourhood level mixed use commercials are suggested as an overlay to provide the flexibility for these commercial uses to follow market demand and retail trends as the city evolves.

These mixed use zones are likely to work best along main streets which carries most traffic within the neighborhoods. This has been used as a guiding principle for the overlay and 30-metre buffer from the minor arterial and collector roads passing through the residential zones have been marked in the overlay that should allow commercial mixed use to be planned in the neighbourhoods.

Figure 4.119 illustrates O-C2 neighbourhood level commercial mixed use overlay.
The listed uses that are allowed within this overlay:

- Commercial and retail;
- Offices;

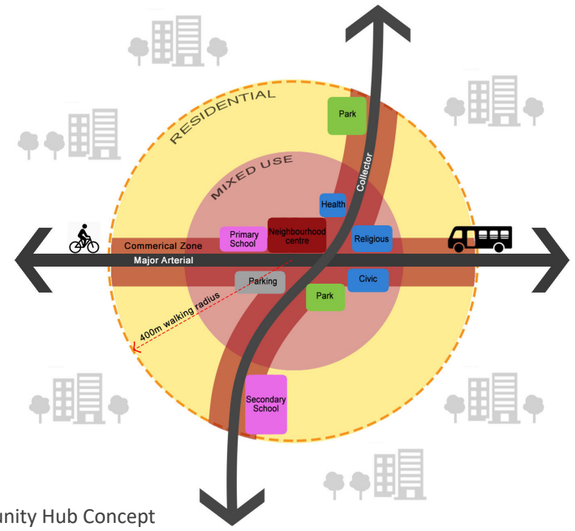


Figure 4.11 Community Hub Concept

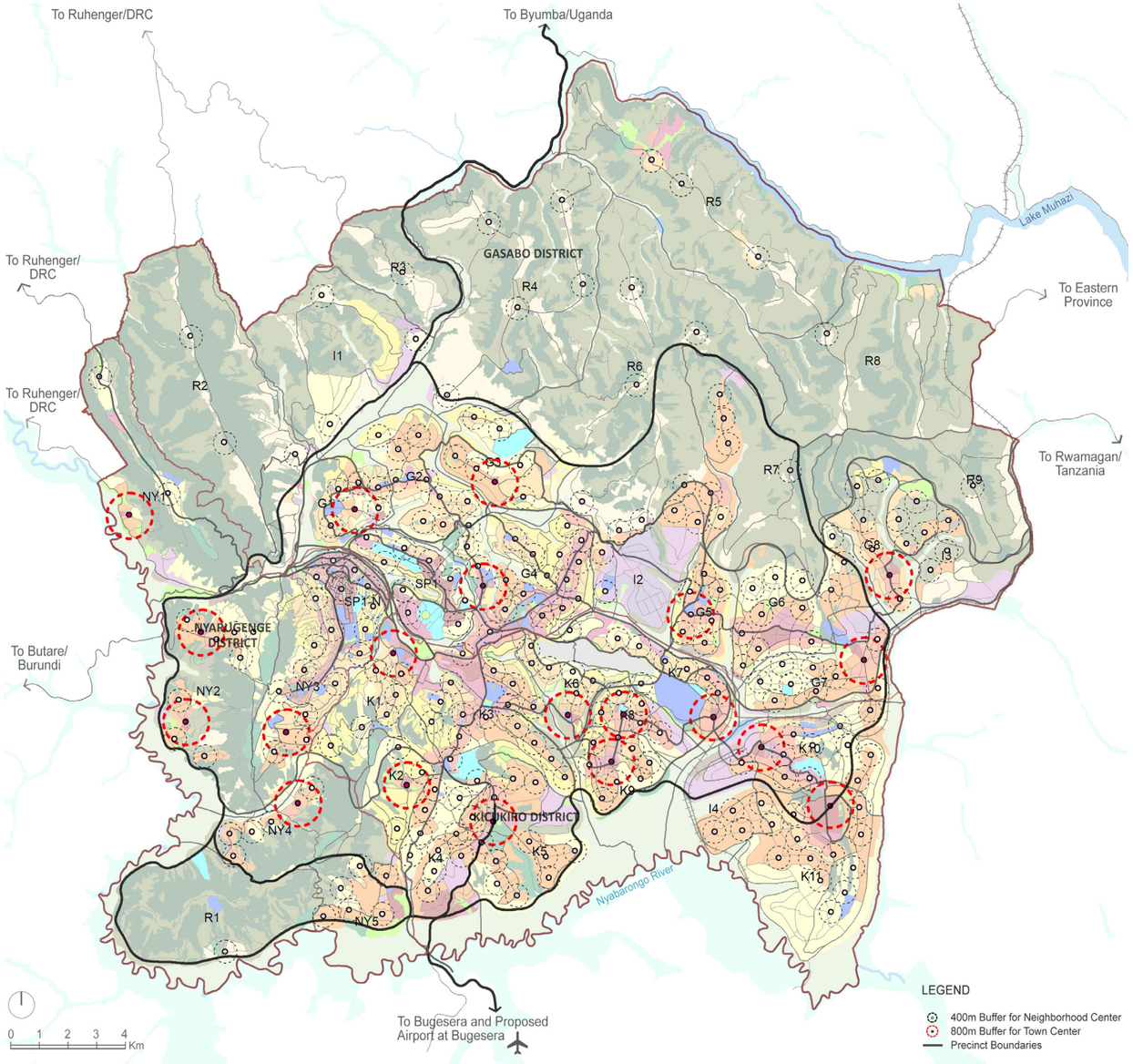


Figure 4.10 Kigali Master Plan 2019 - Proposed Public Facility Overlay

- Hotels;
- Micro-enterprise; and
- Co-working spaces

This arrangement helps to provide different scales and cost range of commercial areas that are good for residential areas, following current and expected market dynamics. It also facilitates access to the market of small and micro-enterprises, promoting the creation of more formal jobs near living places. In terms of physical planning, it creates an active and mixed-use street front where most of shops are located to generate economic activities..

Public Facility Overlay

The Public Facilities overlay is established to provide for a range of public facilities, that are required by the community at neighbourhood, planning area and at city level. These facilities provide basic services and essential support services for the community. They are generally not identified within any specific zone, due to the need to locate in areas that best serve the community and based on population and demand.

The Public Facilities Overlay covers all uses that are stipulated under the zoning regulations of the Public Facilities Zone (PF), which are sub-divided into the following categories:

- PF1 - Public Facilities Zone-Education and Research
- PF2 - Public Facilities Zone -Health
- PF3 - Public Facilities Zone -Religious
- PF4 - Public Facilities Zone-Cultural/ Memorial
- PF5 - Cemetery/Crematoria

The Public Facilities Overlay is established, not as a prescriptive regulation but rather it is to serve as an indication for City of Kigali - One Stop Centre, in identifying most suitable and optimal location of Public Facilities, based on proposed land use distribution and population density. Exact location of Public Facilities will be identified in Land Subdivision Plans following the standards prescribed under this Overlay Regulations. The locations of respective public facilities, once identified, shall then form a part of the zoning map and actual zoning regulations stipulated under section 6.4.1 of the zoning regulations. The overlay provides for an inclusive and integrated development by requiring all neighbourhood level facilities to be distributed within the established Public Facility Zone and/or within 400m walking radius in residential and mixed-use neighbourhoods, based on population and demand. Town centres will have larger serving radius of 800m walking radius.

Figure 4.10 illustrates neighbourhood level and planning level public facilities overlay. The location of existing neighbourhood centres and public facilities (schools, health centres etc.) from the existing land use plan 2018, along with the overall densities and population of different Planning Areas as updated from the Master Plan 2013, have been used as a guiding principle for the overlay to allow community facilities to be planned within the neighbourhoods.

The Local Area Plans for different neighbourhoods may use this overlay to provide public facilities in addition to the existing facilities as per the requirement based on the population demands of the neighbourhood. These facilities may be planned together to create a cluster of facilities for each neighbourhood, like a “community hub” with mixed use commercials along the main streets of the neighbourhoods. Figure 4.11 illustrates idea of Community Hub for a typical 400-metre walking radius within any neighbourhood.

Incentive Zoning Overlay

Incentive Zoning Overlay is established to help create high-density mixed-use, mixed-income developments, as per demand in various locations of the city. It also intends to facilitate and help identifying receiving areas as an opportunity to implement Transfer of Development Rights (TDR) in the future. It works as a special tool that can permit developers to build additional Floor Area or Height than normally allowed by the base zones, in exchange of benefits for the community such as Public Facilities, Open Spaces, Affordable Dwelling Units or any other publicly available amenity, on-site or off-site (Affordable Dwelling Units solutions shall be provided on-site only).

Incentive Zoning Overlay is applicable to the following cases:

a) Key highly commercially valuable areas of the City of Kigali where demand for extra height and floor space is required or to ensure the establishment of a CBD-like kind of development characterised by tall and iconic buildings.

b) Along BRT and major Transit Corridors and Nodes, to capitalise on the increased land and property value generated and allow for higher densities in close proximity to the infrastructure.

c) Along specific sections of wetlands dedicated to recreational uses or in close proximity of valuable landscapes or landmarks, to capitalise on the increased land and property values.

d) In other areas of the City of Kigali, depending on CoK OSC assessment based on demand, market interest and specific opportunities. In such case, Incentive Zoning Overlay shall be updated accordingly by CoK-OSC.

The application for this incentive zoning mechanism can only be evaluated when the developer submits the Urban Design for the entire block to demonstrate there will be no disturbance/disruption to the area. The development of such additional floor area or height will only be allowed where there is adequate infrastructure provision and the location of such developments is not inconsistent with the accessibility and safety of people residing or working in the area.

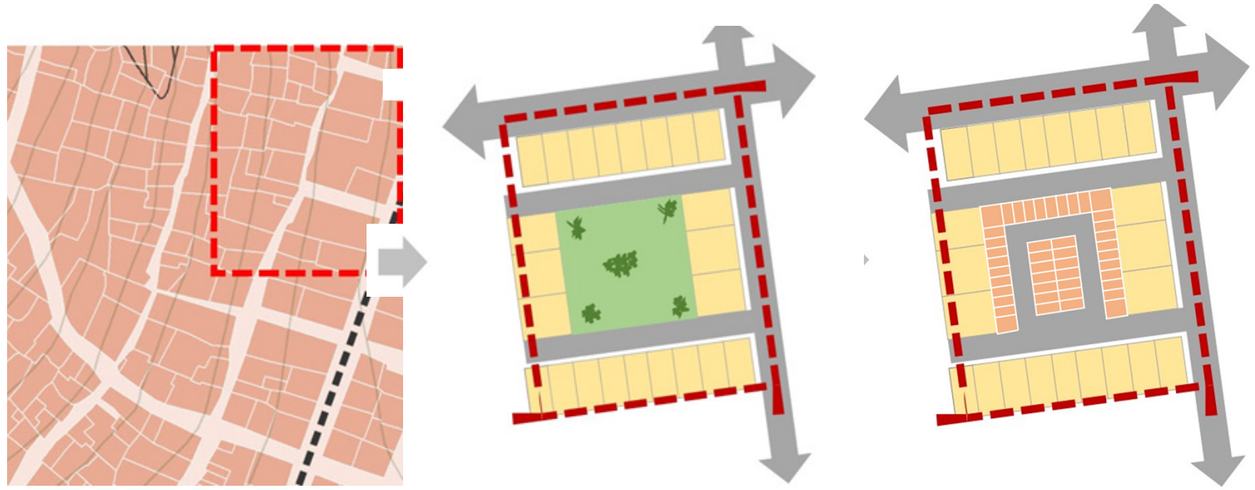


Figure 4.12 Land consolidation and readjustment for shared public facilities - public open space (a) and community carparking (b)

LAND ASSEMBLY OVERLAY

Owing to the well-known fact on the lack of government owned-land to provide for even the basic urban infrastructure such as roads, utilities and other public facilities and open recreational spaces. It is recommended that CoK should take the lead to assemble land for development through a participatory land readjustment or assisted land pooling approach, where feasible. These approaches shall help achieve desired planning and development outcome for a particular area, ensure minimum cost implications to the City and make the land owners partners in the development process.

Participatory land readjustment/ Land Pooling approach involve pooling all land parcels of the project area and planning as one unit. A proportion of the original land holding gets redistributed to the original landowners after deducting agreed proportion/percentage of land required for roads and other required infrastructure, public open spaces, reserve land etc. With this approach, each landowner get back a plot that is smaller than the original area, but with enhanced value as a serviced plot. This involves pooling all land parcels of the project area and planning as one unit. 30-40% of total land is used for common infrastructure, community parking and public open spaces where all land owners contribute for these shared public facilities (Figure 4.12).

While the Land Assembly Overlay is established not as a prescriptive regulation, it serves as indication for City One Stop Centre in identifying parts of the City that require particular attention when issuing construction permits or evaluating development proposals.

The approach explained in the overlay can apply to the following areas:

- Areas of urban expansion/green field sites.
- Redevelopment /renewal of prime areas e.g. along BRT corridor located near City centre.
- Unplanned settlements or areas deprived of development due to the lack of basic physical and social infrastructures like road, drainage etc.

As per Fig 4.13 (Implementation Analysis for Land Consolidation), 160 .20 sqm of land parcels in Kigali are without direct access from existing roads. These will be ideal areas for land consolidation and participatory land readjustment where government can prioritize to provide pilot projects through land readjustment process

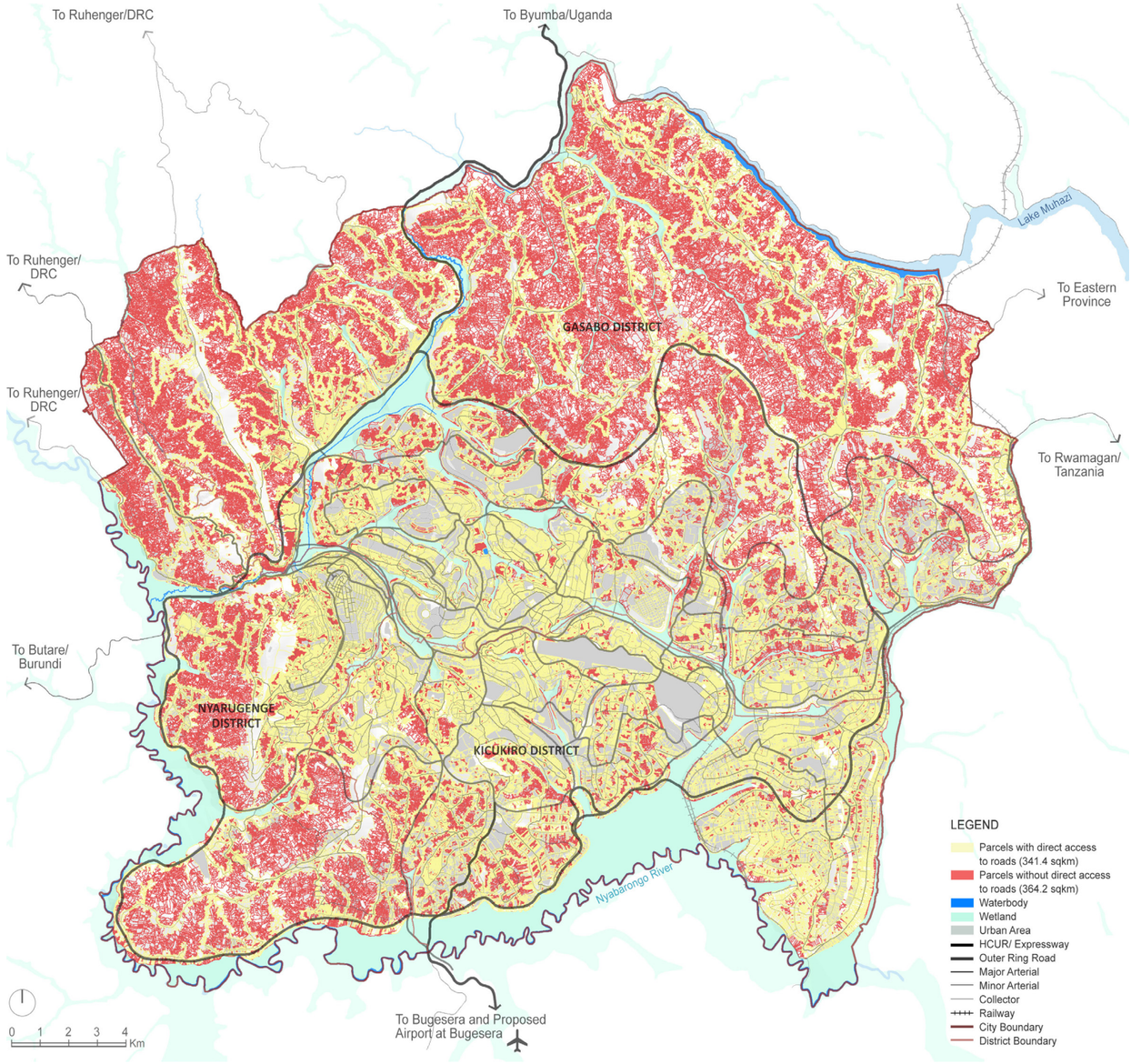


Figure 4.13 Implementation Analysis for Land Assembly

4.6.2 Incremental Development

Incremental development has potential to be a flexible and spontaneous tool for application of Kigali Master plan, where a long-term master plan pushes for large-scale changes but starts with small-scale steps. It is a development based on staging strategy in which some or parts of the infrastructure and building are developed and occupied or delivered to the users, before the building or the development is completed in its entirety, based on the

requirements and financial capacity of the stakeholders. The implementation of that long-term plan is conducted incrementally at all scales, the district, neighbourhood, parcel and even the building level.

Figure 4.14, 4.15 and 4.16 illustrate incremental development at Planning Area level, parcel and building level respectively. The flexible zoning plan facilitates vertical and horizontal incremental development, allowing phased construction of mixed use, residential or commercial buildings. Applying incremental development on zoning can have the following benefits for the developers and land owners:

Figure 4.14 Incremental development at Planning Area level

Figure 4.15 Incremental development at Parcel level

Figure 4.16 IIncremental development at Building level

- **Reduce up-front capital costs:** A residential project's master plan will be laid and phased within 2-4 planned phases depending on the size, target market and housing demand. Developer would only raise funds for the construction for the housing and necessary infrastructure of the first phase, which is a stable management of cash flow and budgeting;

- **Flexible development in subsequent** phases: Based on sale and profits of the previous phase, decision will be taken for how swiftly subsequent phases will begin construction. Meanwhile, key streets and infrastructure are oriented for easy extension to accommodate greater development in subsequent years;

- **Maximize occupancy capacity:** Most space in the residential or commercial project, where demands are low, tends to be vacant whereby money has been spent for the construction costs. Developing a model for incremental development can effectively help to maximize the occupancy capacity and save costs for unnecessary idle space;

- **Opportune feedback from public participation:** Data from built projects — from energy consumption and resident safety to transit use and community involvement — informs feedback mechanisms for iterative change and future development decisions, creating a process of on-going improvement through feedback cycles

5

City of Excellence

5.1. Proposed Kigali Master Plan 2050
5.2. Need for Improved Institutional Coordination
5.3. Towards a Participative Implementation and strengthening of Local Governance

5 City of Excellence

5.1 Introduction

To achieve the holistic vision of the City to become the "Centre of Urban Excellence" and to position itself as a regional leader in city management, it is fundamental for the planning approach, strategies and targets recommended by all eight themes of development (Fig 5.1), to work in sync with each other and with good coordination. The City of Excellence as the primary and overarching theme of development[1] that would drive the overall development and execution of the Master Plan, strives to create a city that attracts people to live, work, visit, learn from and replicate. It envisions a city that is smart, with vibrant economy, environmentally sensitive, well connected, and participatory and inclusive in its urban planning and management functions.

As Kigali City is rapidly urbanizing, and with the changing dynamics of population, demand, lifestyles and socio-economic conditions of its residents, an integrated and inclusive urban planning, improvement in urban management, governance, institutional framework, and participatory decision-making form central elements to achieve sustainable economic growth and social well-being. Tapping upon the existing strengths in good governance and city management, and as one of Africa's fastest urbanizing economies, Kigali proves to have the potential capability to be positioned as a City of Excellence in leading urbanization in Rwanda and in the Region.

1 Chapter 2: Envisioning Kigali City 2050

The City of Excellence theme is therefore targeted at improving the overall urban development management while promoting an inclusive implementation of the Master Plan. The proposed Master Plan is formulated with the aim of making the planning and urbanization process in Kigali, integrated, green, and resilient, for a vibrant, liveable, safe, and integrated City, that is well connected to essential facilities and social services, including work places. Institutional and governance improvements are at the centre of the "City of Excellence" goal, as they represent the key enabling factors of an integrated and sustainable management of the ongoing urbanisation process.

5.2 Kigali Master Plan in the National and International Urbanisation Management Framework

The strategic directions provided by all relevant national strategies, plans and polices, form an integral part of the Master Plan formulation process. To understand government priorities, challenges and directions on urban development, the following strategic documents, guiding sustainable urbanization of Rwanda, have been reviewed. Significantly, there have been several policy updates since the development of Kigali Master Plan in 2013. It was thus important to understand and take into consideration these recent updates to locate the review exercise in this improved institutional framework. Salient points captured from the review (explained in detail in the Analysis and Visioning Report) were considered appropriately

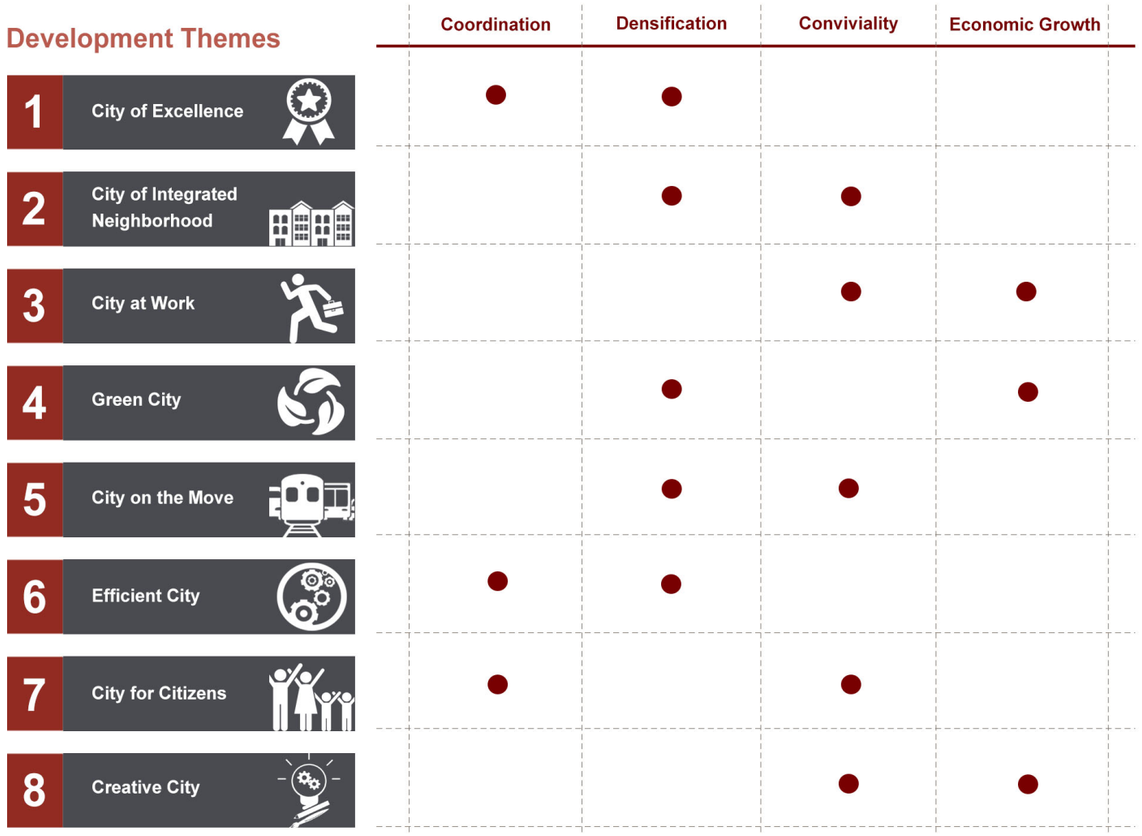


Figure 5.1 Development Themes for the City of Kigali

for the update of Kigali City Master Plan. Listed below are some of the most critical national directives that guided and formed the underlying basis for the Master Plan update:

Vision 2050 - highlights the importance of a rapid and well managed urbanization to achieve Rwanda's aspirations for Growth that can help "elevate Rwanda beyond high income to high living standards by the middle of the century". **Rwanda National Urbanization Policy (2015)** - addresses all aspects of cross sectoral actions in urban development and governance for sustainable development, through its overarching four pillars of Coordination, Densification, Conviviality and Economic Growth.

7 years Government Programme National Strategy for Transformation (NST 1) 2017- 2024- an implementation instrument elaborates on the objectives, priority areas for 7 years and key strategic interventions to achieve the goals.

Green Growth and Climate Resilience National Strategy for Climate Change and Low Carbon Development (2011)

– highlights Rwanda's vision, guiding principles and strategies for green growth and climate resilience and to mainstream climate change into all sectors; and guide national policy and planning in an Integrated way.

National Human Settlement Policy (2009) - outlines the policy principles, objectives, strategies and programmes for a sustainable human settlement in Rwanda.

National Housing Policy (2015)- outlines vision and principles assumed and pursued by the government in supporting housing development, to ensure decent housing to all Rwandans.

National Informal Urban Settlement Upgrading Strategy (2017) - guides the implementation of countrywide informal urban settlement upgrading in Rwanda.

City-wide unplanned and underserviced settlements upgrading strategy for Kigali, Rwanda (2018) - identifies categories of informal settlement in defining a citywide strategy to upgrade underserviced and unplanned settlements in Kigali, to achieve positive socio-economic impacts and counter-balance segregation trends.

Sustainable Tourism Master Plan (2015) - includes plans, policies and strategies to make Rwanda a major international tourist destination and regional conference hub for Central and Eastern Africa.

SMART Rwanda 2020 Master Plan (2015) - recognizes ICT as one of the key drivers for economic growth in Rwanda. It aims to help improve citizens' quality of life while also developing capability of the private sector key industries to achieve a sustainable socio-economic growth.

National Roadmap for Green Secondary City Development (2015) - guides planning of the six secondary cities to ensure balanced urban growth by encouraging the emergence of secondary economic growth poles, while keeping the leading role of Kigali.

Rwanda National Land Use Planning Guidelines (NLUPG) - guides efficient land use and management to standardize land use plans preparation and development in Rwanda.

Urban Planning Code (UPC) - A guide for the preparation and implementation of physical plans that includes principles for sustainable human settlement and management of urban land.

City Development Strategy (CDS) - a six-year Development Strategy structured through three pillars (Economic, Social and Governance Transformation) and 6 goals, is developed with an inclusive and participatory approach to help coordinate investments and achieve the "Seven Years Government Program" starting from 2017/18 through to 2024.

City Integrated Development Strategy (IDS) – a six-year strategic plan that is envisioned to guide all the development operations of the City of Kigali between 2018 and 2024, considering all District Development Strategies and Local Economic Development Strategies, and

Figure 5.2 Sustainable Development Goals (set by the United Nations General Assembly in 2015)

aligning with all national development policies. It aims to define the City's vision and goals, through an integrated approach, and align the programmes of the City to a new strategic direction.

National Land Use and Development Master Plan (NLUDMP) – tAs per NLUDMP, Urbanization will continue to rapidly change with new growth poles projected to emerge besides the already planned six secondary cities and Kigali city. The Urban population is projected at 7.5M on the coverage area of 897 km2 by 2035 and 15.4M (70%), spreading on 1470 km2 by 2050. Kigali is planned for a population of 3.8M to harmonize with the NLUDMP.

Furthermore, Kigali Master Plan 2050 is developed following the United Nations Sustainable Development Goals (SDGs), for making cities and human settlements inclusive, safe, resilient and sustainable and the New Urban Agenda of UN-HABITAT. It also followed other international and regional accords and builds on evaluating and adapting international standards and taking inspiration from global best practices (Figure 5.2).

5.3 Proposed Kigali Master Plan 2019 -2050

A city that is well-functioning, well-connected and has a good pool of workers becomes easily accessible and productive and attracts investors,

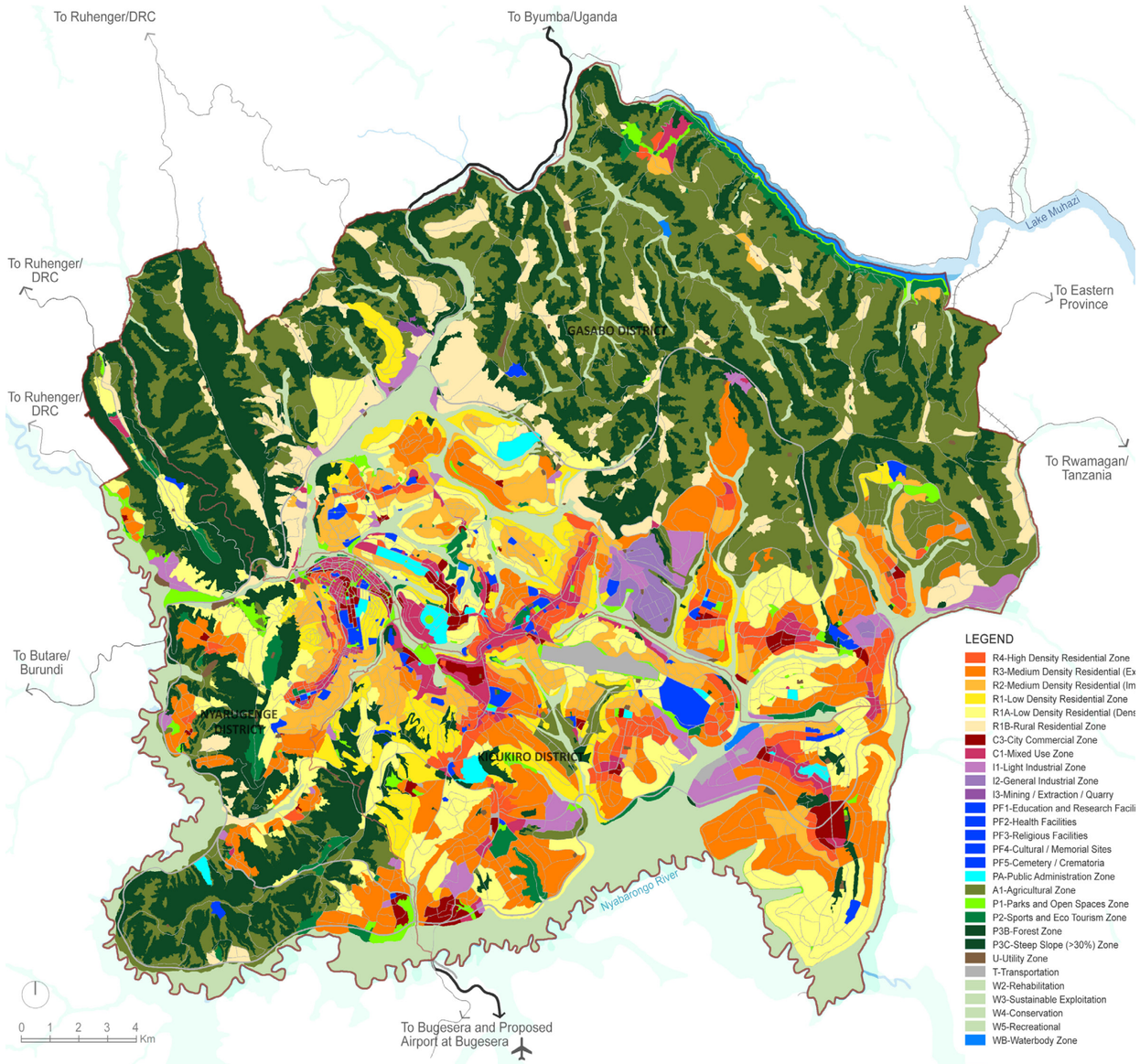


Figure 5.3 Kigali Master Plan 2019-2050 - Proposed Zoning Plan

facilitating economic growth. The agglomeration that the urbanization brings is therefore envisaged to bring economic prosperity through its concentration of labour force. In line with this, the Vision 2050 also highlights that rapid and well-managed urbanization is essential for Rwanda to realize its aspirations for growth and thus recognizes urbanization as a key driver of economic growth to achieve its vision of middle income status by 2035 and high-income status by 2050. To reap the economic and social benefits of its policy to rapidly urbanize, the formulation of a robust Master Plan is essential as an integral tool for developing a thriving, integrated and well-managed city, that aligns its ambitions to the national directives and objectives. Therefore, Master Plan 2050 is formulated as a critical urban development and management tool to:

- Organise and coordinate the urban land uses to promote economic development, and direct the development in relation to its social and economic characteristics based on comprehensive analysis and studies on the present and the future growth potentials;
- Control developments and direct growth through its zoning regulations,
- Guide growth and changes in response to the national directives, ongoing trends and best practices, keeping in view the rapidly changing dynamics and the need for a continual review;
- Propose strategies for value creation and recommend financing and development mechanisms.
- Evaluate governance structure and propose Institutional and regulatory framework changes for effective coordination and resource allocations within various sectors involved in the development process.
- Contribute to the social and economic development of the city in a planned and sustainable manner to improve the quality of life of the communities.

The Master Plan proposals are based on eight themes of development (as shown earlier in Figure 5.1) that resonates with the relevant national and international directives and plans, as explained earlier. The eight development themes, including City of Excellence, formed the basis to structure the focused group discussions, existing context analysis, development goals as well as the proposals in the Master Plan 2050. The key issues and challenges facing the city of Kigali in its urban development and in previous master plan implementation were analyzed for understanding and enhancement in the review process, leading to the drafting of Master Plan 2050. Through a concerted effort in trying to better coordinate and understand the needs and aspirations of the stakeholders through various forums, the Master Plan 2050 is built on the foundations and strategies of inclusivity and equity, that encompasses every other principle in planning.

Kigali Master Plan represents both a strategic and detailed level physical planning tool which, if properly implemented in close coordination with relevant stakeholders and partners, could unlock all the potential that urbanization processes bring with them and, at the same time, generate positive impacts on local communities. For the

Master Plan to accomplish this mission it is imperative to understand currently available urbanization management tools and identify critical missing elements that, in concert, would effectively guide urban development in a sustainable and equitable way.

5.4 City of Excellence - Key Focus Areas

The development theme of City of Excellence for Kigali emphasizes on the following key focus areas to achieve good and integrated urban development management

- Balanced and Sustainable Urban Development;
- Inclusive Urban Planning and Design;
- Affordable City;
- Good Governance; and
- Quality of life.

5.4.1 Balanced and Sustainable Urban Development

Rwanda's urban system is dominated by Kigali, both demographically and economically[2] . Through various national development strategies, it is evident that there is a huge emphasis placed on the nation's capital city as a regional hub for East Africa, and therefore on the intense efforts being made towards a planned urban development. The strategy that the Government of Rwanda is implementing, aimed to decentralise growth towards other urban nodes in the country will hopefully produce its more evident results in the near future but, for several years to come, Kigali will remain the centre of economic development in the Country.

As per the WB report (Reshaping Urbanization in Rwanda), there is sustained and huge investments on infrastructure being made in Kigali, towards a planned development. Despite the Government making every effort to establish an urban framework to accommodate and manage the growth in a sustainable manner, there is still around 66%[3] of the population living in unplanned settlements.

Some of the key urbanization challenges faced by Kigali City include:

- Obstacles in land acquisition to establish a sustainable land banking mechanism and deficiencies in land management, undermining the efficacy of the urbanization process.
- The lack of government-owned land in Kigali, to enable development of infrastructure and integrated projects, disrupts implementation to happen as per the proposed Master Plan.
- The increasingly high land prices and frequent land speculation often force residents to move to the city fringe. For the same reason, a large percentage of most recent migration towards Kigali, is settling in the neighbouring districts[4] . This phenomenon is rapidly urbanizing the areas immediately outside the city boundary, giving rise to unsustainable urban sprawl.
- The design of incentives for development of truly affordable housing are at an embryonic stage and a still unclear legal framework and limited management capacities to carry out land pooling/consolidation to assemble land are affecting the capacity to address the increasing demand for housing and services in the City.

An integrated and inclusive approach to urban planning and development is key for developing resilient systems, successful implementation, and for the economic growth of the cities[5] . Urbanization is envisaged to promote economic growth. However, some studies have shown that urbanization does not always automatically promote economic development in the cities[6] due to unmanaged growth and congestion, leading to failure of the cities, as engines of growth. Cities that are well-managed found that agglomeration did promote economic growth, with conducive institutional setting, supportive policies, and infrastructure investments. Therefore, it is essential to develop well-managed resilient systems to mitigate any negative impacts that may result from increased population density.

The Rwanda National Urbanization Policy also highlights the significance of a well-managed urban development and its dependency on the functionality of the public administration or governance, continuous engagement and participation of the communities, capable human resource, good coordination amongst institutions and effective application of social, economic and environmental tools.

The Master Plan 2050 anticipates and guides the urban development in Kigali in terms of allocation and protection of land and natural resources, regulation of physical development and the provision of well-dimensioned, resilient infrastructure. Whilst the Master Plan can effectively provide guidance on physical development strategies designed basing on up-to-date socio-economic indicators, several upstream and downstream tools are still required to achieve a virtuous urbanisation process. Therefore, it is fundamental to introduce Multi-level governance platforms from the planning to the implementation stages of the Master Plan at both local and city levels to achieve the ambitious objectives of creating an integrated, inclusive, vibrant, productive, affordable, green, and efficient city. A participatory approach is inevitable for sustainable urban development and management, towards establishing excellence.

5.4.2 Inclusive Urban Planning and Design

For a city to aspire at excellence inclusive urban planning is fundamental. It takes a holistic and cohesive approach, towards all dimensions of inequalities that exist within urban areas and take into consideration varied situations and environments that exist within an urban fabric and ensures that planned interventions are targeted at those who will be benefitting from them[7].

The Master Plan 2050 envisions to create liveable and resilient city for its inhabitants, attractive to investors through inclusive and integrated urban planning, for coherent development. It therefore suggests the strengthening of a participatory approach in planning and development of all plans including, Local Urban Development Plans, Urban Design Plans, and Land readjustment/ consolidation projects, towards inclusive planning and development.

The Master Plan promotes a well-planned City with efficient organisation and use of urban spaces and encourages prudent use of land and its natural resources to build sustainable communities. With the growing population and current situation of private hold on land and inadequate provision of infrastructure and services, the Master Plan proposes inclusive and participatory land mobilization strategies and provision of good urban infrastructure and services for the city to be productive and economically sustainable. It proposes to guide investments on priority development such as Mass Transit Corridors for Transport Oriented Development to capture the benefits of growth and productivity, invest in integrated social and economic development, and reduce environmental risks and carbon

2 Urbanization and the Evolution of Rwanda's Urban Landscape December 2017 RESHAPING URBANIZATIONIN RWANDA

3 Urbanization and the Evolution of Rwanda's Urban Landscape December 2017 RESHAPING URBANIZATIONIN RWANDA

4 Refer to immigration trends analysis in the socio- economic section of this report.

5 City of Kigali Integrated Development Strategy (2018-2024)

6 Ivan Turok and Gordon McGranahan. Urbanization and economic growth: the arguments and evidence for Africa and Asia

7 SAMSET. Inclusive Urban Planning - Promoting Equality and Inclusivity in Urban Planning Practices

emissions, towards a sustainable development.

The 2019 review of the 2013 Zoning Plan and Regulations seeks for alternative zoning models, incremental development, and flexibility for inclusive and equitable development. The new proposed zones are supported by a comprehensive set of data collected, focused researches and socio-economic and real estate market analysis. Stakeholders' consultations and interactions with international organizations and consultants operating in a variety of sectors[8], allowed to collect valuable feedback and insights, aligning the Master Plan with international best practices and ongoing projects as well as ensuring coordination with the broader context.

The updated Urban Design for Kigali CBD reflects this approach and aims at maximizing the capacity of the City of Kigali to implement the Urban Design plan in partnership with local owners, focusing on a more sustainable and incremental approach.

It is envisioned that with reforms and renewed strategies and approaches explained in detail under each development theme, the master plan would become successful in meeting its objectives and enable the citizens in meeting their aspirations. The urban planning and development time horizons are proposed to be integrated with the Seven Year planning cycle as well as with the annual budget cycle of the City of Kigali so that the proposal will find reflection in the City Integrated Development Strategy. The implementation of the Master Plan needs to be well-linked to the mobilization of land, financing, incentives, and land administration to become more realistic.

5.4.3 Affordable City

The city of excellence should be a destination where there is a range of choices for everyone as per their income, ability and skills. As the majority of Kigali population fall in the lower income bracket, the Master Plan 2050 seeks to create a destination that is welcoming, comfortable, safe, and affordable for every group of the society.

The City of Kigali faces acute shortage of truly affordable housing options close to the existing economic activities, resulting in the need to travel long distances to work. Intertwined closely with the issue on affordability, the chronic limitations to the quality of life within the unplanned settlements is another challenge that needs to be overcome. A majority of the population in Kigali are living in unplanned areas, many of which are in fragile ecosystems and hazardous areas where land is cheap, such as steep slopes and wetland areas. These settlements also lack access to integrated infrastructure including safe water, proper sanitation, electricity, health services, waste management and proper roads.

Even with concerted effort by the Government to provide affordable housing to accommodate the growing population, the gap between the supply and demand is still substantial. Land, being the major resource required for any development, is mostly under the ownership of private individuals and, therefore, in short supply for the provision of affordable housing and other social infrastructure. A slow land-banking process is struggling to achieve minimal critical mass and, even in the cases where housing projects are implemented with affordability as objective, the financing and implementation models applied, prevent the majority of the population to access the housing solutions produced with these interventions.

As per international standards, housing is considered affordable if rentals are no more than 30%[9] of the household income. In Kigali, among the lowest income quantile households that rent, they allocate a much larger portion of their incomes to rent. Since the low-income segments of the population mainly depend on informal economy, they are virtually excluded from formal housing finance mechanisms, such as mortgages, and are often pushed in the outskirts of the city where development controls are more relaxed, and land is made available for temporary informal constructions. This is confirmed by the IGC study "Housing need in Kigali " where it is clearly shown that home ownership remains a challenge as there is a requirement for a down payment of at least 20% for mortgages, which is an extremely high demanding requirement for lower quintile households and, therefore, these mortgages may only be suitable for those above certain income levels and with a formal employment. . This indicates that other mechanisms such as rent-to-own or other financing mechanisms will have to be explored for those households in the lower quintiles who are not likely to be engaged in formal mortgage agreements. For such people with low and unstable income, rental housing might be a more accessible opportunity due to the potential modularity and flexibility of the supply focused on rental market. One of the provisions put in place by the Master Plan is the promotion of accessory residential units which can be implemented by individuals on small scale. If on one side this would generate source of additional income for property owners, on the other side can potentially drastically increase the supply of cheap -yet formal- housing solutions.

In keeping the affordability factor as one of the key focus areas, the Master Plan proposes various strategies for implementation, such as participatory land pooling/consolidation as a win-win for all stakeholders, flexible zoning regulations that highlights on i) Integrated and mixed-use, mixed-income developments that promote the creation of a sufficient rental stock through urban renewal, upgradation of unplanned settlements and sites and services provision in greenfield sites; ii) provision of affordable housing through Inclusionary Zoning; iii) Bonus density and other incentives for the developers in exchange for provision of various public facilities; and iv) provision for Incremental development as per the financial capabilities and requirements of individual developers of government agencies. Further, most of the low density residential districts in 2013 Zoning Plan are revised significantly and medium density residential zones are promoted instead, allowing mixed-use with a variety of housing solutions (including row houses, multifamily units, accessory residential units for rental purposes), income generating activities and public facilities. The Master plan also allows for a sustainable utilization of the clay-extraction sites to produce low-cost local materials to reduce construction costs.

While all the above strategies are detailed under each development theme and in the zoning regulations, the success of the Master Plan implementation will depend on adequate supply of land for its use and provision of infrastructure. and services. It becomes fundamental for establishment of enabling ad-hoc policies, and institutional framework, as outlined under each development theme and innovative financing mechanisms to effectively implement the affordable aspirations of the Master Plan. It suggests taking a holistic view of infrastructure (physical, social, and environmental) needs and priorities and recommend projects that enables government investments to be targeted at those needs that are of greatest economic benefit to the city and can also provide opportunities to the private sector to contribute towards

8 During the drafting of the Kigali Master Plan, fruitful collaborations where established with several research institutions (IGC, University of Stuttgart, IPAR), international partners (UNHABITAT, GGGI, IRDP, WORLD BANK, DFID, JICA, VNG, among others) and parallel studies (Agricultural Suitability Analysis, Water Supply Strategy, BRT Feasibility Study, Ring Road Feasibility Study, etc.)

9 IGC. Housing need in Kigali. July 2019

investments in projects. This in turn can bring affordability through PPP and cross- subsidization.

The Inclusionary Zoning practices, with the objective of facilitating the creation of affordable housing stock in an optic ofmixed-income development, will need more in-depth analysis and ad-hoc policies should be established to effectively implement this tool as downstream policies to the Master Plan.

5.4.4 Good Governance

A strong and capable local government is considered key to ensure inclusive and sustainable development, facilitating governance systems that promote transparent decision-making and multi-stakeholder involvement. When we plan for transformation of cities in terms of social, economic, and physical aspects, it is critical for the human and administrative capacities to keep pace as urban governance and management require greater capacity at all levels of government and for all involved in the process. Therefore, capacity building for urban governance and management in the areas of urban planning, development regulations, urban management, and stakeholder engagement are essential.

The urban growth in Kigali City is being guided by a well-developed policy and legal framework, and many reforms have been made in the governance/ institutional setup in the recent years, towards good governance. The Master Plan proposes to build on the reforms and encourage the CoK to work towards a well-coordinated and sustainable implementation of the Plan. Further, it proposes to strengthen institutional framework for urban management to ensure integrated and effective coordination in planning and implementation and to ensure participatory and bottom-up approach, not only in the planning and designing phase, but also during the implementation phase. A more participatory approach in the CoK's functions will prove viable in increasing partnerships with communities, non-governmental agencies, and the private sector, for sound development.

E-Governance has become critical in today's urban management and the City of Kigali is striving towards becoming a Smart city. As of today, several e-government platforms are already operating in Kigali and in Rwanda: Irembo services give access to many government services and information. Kigali Master Plan is accessible online since 2013 and Online construction permitting system (CPMIS) is operational and has been improved in 2015. It is planned that in coming years these two systems will be integrated with Land Administration Information System. As ICT is recognized by the Government as one of the key drivers of economy in Rwanda, the Master Plan proposes to effectively expand its use of modern technology through enhancement of ICT Infrastructure and capabilities, to further enhance e-governance for improvement in quality of life, urban management and enhancing energy and natural resources sustainability.

5.4.5 Quality of Life

While some people find joy in cities because of the accomplishments and the scenic beauty the cities provide, others enjoy the sense of community, inclusiveness it provides and social wellbeing. The Master Plan 2050 seeks to promote sense of community and wellbeing, economic growth, resilient systems and aesthetics, to enhance the overall experience of Kigali city as a city of excellence. It envisions to be a kind of destination that is safe and inclusive, where investors would like to park their investments as preferred destination for Foreign Direct Investments (FDI).

Most of city dwellers face acute shortage of basic infrastructure and facilities entailing unhealthy, unhygienic situation, disaster risks from floods, landslides and earthquake, undermining community well-being. Therefore, quality of life is a key component of the Master Plan 2050. It is proposed to be enhanced through creation of safe neighborhoods, provision of quality services and facilities creation of inclusive, integrated and walkable mixed-use, mixed-income neighborhoods (allowing for Home Occupation and Micro-Enterprise economic activities and social infrastructure), connected by an efficient Public Transport System, with special attention to the lower income groups, promoting safety for children, inclusion and empowerment for elders and people with disabilities. The Master Plan 2050 proposes upgrading unplanned settlements and implementing various development strategies and housing and rental solutions to specially provide affordable housing to the communities. It emphasizes on the creation of accessible and quality recreational spaces through land pooling/consolidation approaches and replacement of on-site parking requirements with cluster parking approach and a component of on-street parking when possible.

However, for urbanization to go together with the economic prosperity, and enhanced quality of life, it is essential for the City of Kigali to take a proactive role in continuously striving to engage and understand the needs and challenges of all stakeholders, including new businesses and developers, and facilitate them accordingly. It is equally critical for the City to find innovative ways to enhance its Municipal Finance, to enable effective implementation of proposed incentive and inclusionary zoning provisions, value capture mechanisms, provision of subsidy, amongst others, for sustainable and enhanced quality of life.

5.5 Improved Institutional Framework and Coordination for Urban Management

Urban management policies and practices have impact on social wellbeing, thus it is important to understand that urban management systems in place are adequate for implementing, monitoring and evaluating the provisions of infrastructure and services, and that every effort is made to help people make informed choices. The Analysis and Visioning Report analyses the institutional framework and governance involved in urban development in Kigali. It was noted that since the Kigali Master Plan 2013, much progress and reforms have been made in the governance of Rwanda to improve the delivery of services and management of urban development. One key initiative was the establishment of Single Project Implementation Units (SPIU) across various ministries, which allows for the grouping of all the different project implementation units within a ministry under one single umbrella. This helps to better coordinate work, retain staff expertise and reduce duplication of work.

Becoming a City of Excellence requires collaboration from a wide range of institutional and individual stakeholders, bolstered by increased awareness and participatory action by the residents and visitors of Kigali. As the process of urbanization is a multifaceted interaction between people, institutional frameworks, governance and the environment, it is of paramount importance to institutionalize multi-level coordination mechanisms (involving national and local governments) to support policy formulation and coordinated interventions, for effective, transparent, and efficient urban management. The underlying challenge in Kigali towards the implementation of the Master Plan is identified to be the lack of coordination and effective communication among institutions and agencies. The lack of technical capacity also remains one of the most important causes of uncertainty for the successful implementation of the activities. A more coordinated approach must be taken to manage the various development processes.

The Master Plan emphasizes on the National Urbanization Policy pillars of coordination and densification to achieve good and integrated urban development and management. Continued promotion of public engagement in decision-making has become most critical in urban planning and development. The Master Plan proposes community engagement, to ensure continued interaction with all the relevant stakeholders in assessing the performance and realization of the Master Plan and to take corrective measures where required for enhancing the implementation and preparation of new plans and projects. It is equally critical to also ensure the integration / coordination of different urban sectors to guarantee the success of the Master Plan. In Kigali, although the master plan implementation is driven by the CoK One-Stop Centre, the success of Master Plan is dependent on the effective cooperation and coordination amongst all the relevant public agencies, private sectors, NGO's CSO's and other development partners.

To ensure that the Master Plan is implemented as intended, institutional capacity and coordination efforts amongst agencies play an important role to push for a coordinated urban development and to truly uplift the socio-economic conditions and quality of living in Kigali. There needs to be continuous coordination across units, and centralised data sharing on all development activities, to avoid duplication and abortive jobs. During the Master Plan review process, a Technical Advisory Group (TAG) composed of high level national and international stakeholders has been established to ensure guidance and ownership of key actors towards the Master Planning process and to support synergy and coordination in enforcing smooth implementation of the plan. The Master Plan proposes that the TAG should be consolidated in the long term, as a permanent decision-making platform, to ensure local and national coordination in the enforcement and implementation of the Kigali Master Plan and its future update, in coordination with Secondary Cities Master Plan. In the long term. It is envisaged that the TAG will monitor and guide the urbanization of the country at a strategic level, to improve the national urban management.

With the change in urban development strategies and implementation modalities for Kigali, brought by the review process, and with the additional role as the central authority for planning and implementation, the Kigali One Stop Center is proposed to become more central in City development by widening its role and expertise with additional units. Further, the City of Kigali needs to equip itself with a new set of policies, plans and professional skills to be able to implement the plan in the most effective way. All changes/proposals in the Kigali City institutional framework, governance and management of the master plan will be detailed in the Implementation Plan of this Master Plan.

The Master Plan 2050 collected all available sectoral plans and strategies from all sectors. Such proposals became part of the Implementation Plan that guides a phased implementation of the Plan. While first phase is fully aligned with current sectoral programmes, further effort should be put in ensuring that future programmes are conceived and agreed in coordination with the Plan.

5.6 Towards a Participative Implementation and strengthening of Local Governance

"Cities have the ability of providing something for everybody, only because and only when they are created by everybody"- Jane Jacobs

The sustainability and effectiveness of any development project depends on the support of its communities. Therefore, transparent decision-making, well-coordinated stakeholder consultations and empowerment of citizens, must be integrated into city planning and development processes.

The lack of public participation and engagement of the stakeholders in the planning process was one of the key issue identified by the stakeholders during the stakeholder's meetings. It was reflected by the public that they lack understanding of the Master Plan 2013 and zoning system as it lacked involvement and engagement of public during the planning process. This led to challenges in the implementation of the Master Plan.

The Master Plan 2050 preparation initiated the establishment of a multi stakeholder's decision-making process, to ensure that plan is socially inclusive and that the citizens and stakeholders can make informed decisions. These included organization of stakeholder's meetings, thematic focused groups discussions (FGDs), Technical Advisory Group (TAG) meetings and collecting comments through other forums such as social media and digital platform. There have been more than 100 meetings conducted, to which stakeholder meetings, TAGs, FDGs, Districts and Sectors meetings and workshops, to find a common ground towards a sustainable and inclusive urban development shall be added.

This Master Plan 2050 re-emphasizes on promoting bottom-up participatory process for involvement and engagement of all stakeholders for creation of inclusive and equitable Plan. Master Plan proposes to set up a structured Participatory approach in the CoK Urban Planning process and strengthen the implementation of an integrated Institutional and Governance Framework, by establishing the TAG, as a multi-level steering committee in charge of monitoring and coordination of strategic planning at national level. Public Participation and access to information need to be internalized in the CoK management for plan preparation and implementation and details will be provided in the Implementation Plan.

Furthermore, the Master Plan recommends establishing participatory monitoring and evaluation mechanisms, to ensure a multi-level stakeholders engagement in monitoring and evaluating the implementation process, the performance, and the interim results. This process allows taking and identifying corrective actions and is one of many approaches to ensure that the implementation of the Master Plan leads to the expected outcomes. Participatory Monitoring and Evaluation Mechanisms will be detailed in the Implementation Plan of this Master Plan.

Participative Planning is recommended to design and implement Local Urban Development Plans and Urban Designs and Land Subdivision Plans. Since planning and development is about optimum utilization of land and resources and to the best advantage of the local communities living in the area, they play critical role in the development process. The success or the failure of planning proposals are dependent on the community (both stakeholders and the beneficiaries). The involvement of the community right from the initiation to the implementation stage (from consultation through to capacity building) and to understand their needs and aspirations, from their perspective, are essential for a strong foundation for success. In a city like Kigali, where there is lack of government land and developable land is scarce, approaches such as land pooling/consolidation are inevitable in the development process, be it on green field sites or redevelopment sites. In such a situation, participatory and inclusive planning and development would be critical. These processes often take long time and effort to gain trust and buy-in from the stakeholders. However, with its city of excellence motive, the city will develop in an inclusive and equitable manner, fostering good governance.

6

City of Mixed Use Neighbourhoods

6.1. Introduction
6.2. Population Projection and Distribution
6.3. Residential Plan

6 City of Mixed Use Neighborhoods

6.1 Introduction

Kigali, as a capital city that is experiencing unprecedented urbanization and population growth along with a shift in lifestyle preferences, showcases itself as a prime location to support mixed use development. Further, the national policies, strategies and various meetings also advocate replacing the current low-rise unplanned settlements into medium and high-density mixed-use development that caters for affordable multi-family housing.

As one of the development goals for Kigali, the city of mixed use neighborhoods promotes development with quality affordable housing and public open spaces and facilities. Such neighbourhoods create vibrant locations that are physically, functionally and socially integrated, walkable and supported by efficient public transport. They blend various types of residential, commercial, cultural, entertainment/ public facilities, and micro-enterprise industrial uses at one confluence.

Communities are embracing the idea of mixed use and mixed income because of its potential to reduce car dependence and support public transit, manage sprawl, preserve open space, promote economic development, reduce the expense of providing and maintaining infrastructure in low density environments. Owing to rapid urbanization and increasing number of cars on streets causing congestion, loss of time and pollution, increasing number of people now prefer to stay in locations which are closer to work places, schools, clinics, shopping centers, entertainment/ recreation districts, and light industrial neighbourhoods with worker housing and social infrastructure availability that are at a distance of short commute time.

Therefore, mixed use developments are proposed in this Master Plan to be planned as compact neighborhoods that allows for people to live, work, play and shop in one place, which may also become a destination for people from other neighborhoods. Mixed income, mixed use residential zones are planned with higher density residential and affordable housing around employment centres and industrial zones for mixed use development.

6.1.1 Housing Affordability

The housing sector plays an important role for family and its economic growth. However, affordability is of a key issue in Kigali. The existing residential sector in Kigali is facing three major challenges:

1. Lack of quality affordable housing;
2. Low denisty urban settlement;
3. Underserviced and unplanned settlements; and
4. Lack of public open spaces and social infrastructure within residential areas

As stated earlier, the city lacks adequate affordable housing and over 60% of the households in City of Kigali reside in unplanned housing structures, many of which are in fragile ecosystems and hazardous areas. These settlements also lack access to integrated infrastructure including safe water, proper sanitation, electricity, health and education services, waste management, public open spaces, proper roads and other social infrastructure.

With rising housing demands of the growing population, which doesn't match the supply, housing costs exceed beyond the reach of the majority population in Kigali. Some of the lowest income households that rent thier housing in Kigali allocate 88% of their incomes to paying rent. This stops them from being able to afford decent formal housing, and hence they are subject to desperate measures to accommodate themselves, giving rise to unplanned settlements, challenging the ideologies of sustainability and safety. Inadequate public land and scarcity of developable land has led to a city that is not able to keep pace with the rapid changes in the urban fabric and it now faces challenges to implement large scale projects, that involves major land assembly and high upfront costs. Although the authorities are trying to supply some affordable housing to the growing population, there is still a shortfall in supply stock that are ideal i.e close to existing economic activities and work places. This results in the need to travel long distances to work, often forcing people to ultimately live in unplanned settlements, closer to their workplaces.

6.1.2 Master Plan Strategies for Mixed use Neighbourhood and Affordability in Housing

This master plan proposes several strategies that can contribute towards housing affordability and development of mixed use nighnourhoods:

Mixed-use

The master plan zoning promotes mixed-use development which will encourage integrated, compact and affordable developments. The proposal is to reduce areas dedicated to single family houses and push for increase in higher density mixed-use, mixed income development. In line with this strategy, most of the commercial zones such as C1 and C3. Residential zones such as R2, R3, R4 have been proposed as mixed-use zones to encourage live-work-play environment also include R1, R1A and R1B allows for mixed use whereever allowed by the C2 overlay and public facilities overlay, that are walkable and are connected to transit corridor.

Incremental development

There have been feedbacks regarding the lack of flexibility in implementation of the 2013 Master Plan with its restrictive zoning regulations, giving rise to urban sprawl into the fringe areas. The major challenges faced in the implementation of the master plan is the lack of financial capacity of the implementers in providing infrastructure and of the land owners to develop as per the zoning requirements. Analysing this mismatch of capability with the zoning requirements this Master Plan proposes to introduce incremental development for flexibility in construction completion as per availability of resource and requirement.

Typology

As typology of the structure has major effect on the affordability of housing, the master plan proposes compact typologies such as row houses, medium -rise and high density apartments. With scarcity of developable land in Rwanda and Kigali, single family houses are no longer viable to accommodate the growing population. Therefore, the master plan proposes zones such as R2, R3 and R4 to encourage compact and affordable development. Commercial mixed-use zones (C1, C3) are also expected to cater for a certain amount of affordable housing through inclusionary zoning and incentive zoning practices.

Construction Material

One of the major costs for housing goes on building materials as it constitutes the largest input to housing construction. Therefore, it is critical to explore and encourage the use of local materials to produce affordable homes.

The materials such as clay are low cost, and they are in abundance in Rwanda and in Kigali. However, their extraction without proper restoration would pose environmental issues. Therefore, this Master Plan proposes for proper assessment and restoration measures to reduce impact on environment and in the meantime also ensure quick production of affordable housing in Kigali.

Land Pooling and Land Consolidation

Land pooling or readjustment is a land management tool for promoting efficient, sustainable and equitable land development by consolidating small

land parcels into a large land parcel for planned subdivision into serviced building plots with shared public open spaces and social infrastructure. It is an important tool for the implementation of the master plan where communities can be planned with highest participation. The master plan proposes land pooling and land consolidation, where feasible to assemble land to help promote integrated mixed-use, mixed income development.

6.2 Population Projection and Distribution

The IPAR's study on population and housing needs provides an understanding of the housing profile in Kigali. The master plan estimates the quantity of housing required based on IPAR's population projection and understanding of market demand for housing in Kigali. Population Projection in Kigali

According to IPAR, under "high growth scenario", it is estimated that in 2018 Kigali has a population of 1.5million which is projected to grow to 3.8million in 2050. In the "medium growth scenario", Kigali will grow from a population of 1.5million in 2018, to 3.5million in 2050. In the "low growth scenario", Kigali population will grow from 1.5million in 2018 to 3.1miliion in 2050. Figure 6.1 and Table 6.1 indicate the projected population growth scenarios from IPAR study.

Households Income and Available Monthly Budget

The household survey conducted by IPAR. co-financed by IGC looked into the households' housing. IGC also provided technical expertise for the review of this and Real Estate study. According to the household income of the population to understand the population's payment capability for survey data (Table 6.2), 58% of Kigali Population earns less than 100.000 RWF per month.

Additional Housing Need in Kigali

The Table 6.3 indicates that Kigali would require approximately 859,000 new dwelling units (DUs) by 2050 i.e. an average of 27,000 DUs/year. The phasing plan is prepared for 7-year cycle, to coincide with the 7 Year Government's Programme, for ease of implementation and allocation of resources. The affordable housing demand in Phase 1 (2018-2024) accounts ~ 72,000 DUs in Phase 3 (2031-2038), ~ 98,400 DUs in Phase 4 (2038-2045) and ~ 91,500 DUs in Phase 5 (2045-2050).

Phasing Plan for Housing

As per phasing plan, 376,625 DUs are proposed to be created in Phase 1 (2018-2024) catering for a population of 1,506,500. Phase 2 will provide 180,218 DUs, catering for a population of 720,872, Phase 3 will provide 100,125 DUs catering for a population of 400,500, Phase 4 will create 180,472 DUs for a population of 721,888 and Phase 5 will provide 152,979 DUs, for 611,976 people (Table 6.4).

6.3 Residential Plan

Kigali's residential areas are spread over 17 urban sectors which include Gatsata, Gisozi, Remera Kimironko and part of Kinyinya in the Gasabo District; Gikondo, Kicukiro, Niboye, Kagarama and northern parts of Kigarama, Kanombe and Nyarugunga sectors in Kicukiro District; and Gitega, Kimisagara, Nyakabanda, Rwezamenyo and parts of Nyamirambo sector in Nyarugenge District.

Newer residential areas for apartments and single-family housing in urban areas are largely focused in Gasabo district in Kinyinya, Gisozi and parts of Ndera and Rusororo sectors along the EW regional road. A few approved projects for affordable housing are proposed in Kanombe, Masaka, and northern Kinyinya.

There is a trend of building low and medium density single family housing in Kigali. However, the current trend of low and medium density developments is not sustainable in the long run and requires suitable density management strategies to promote a compact living environment. Majority of land with higher density potential is occupied by low and medium density developments.

According to the national policies and strategies prepared by international agencies like UN HABITAT, Skat consultants etc. working in Kigali, replacing current low-rise unplanned settlements into high-density mixed-used buildings (e.g. residential with commercial on the ground floor) and high-density affordable multi-family housing has been the common proposal in different cases. Therefore, after analysis of the current situation, comments from various TAGs, FGDs

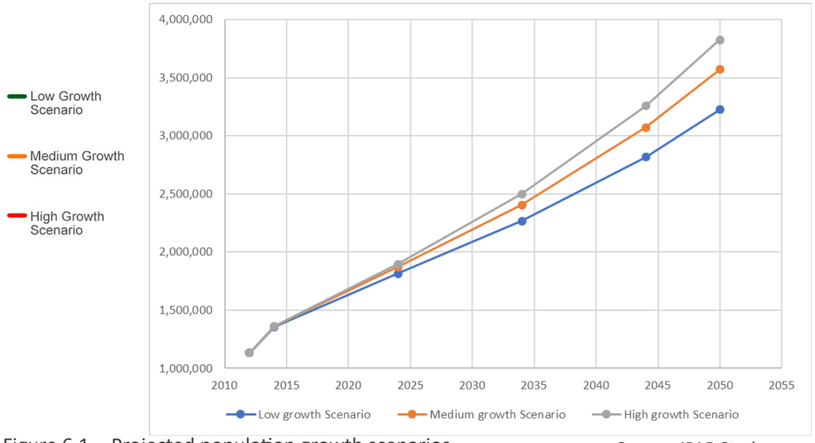


Figure 6.1 Projected population growth scenarios

Source: IPAR Study

Table 6.1 Projected population growth scenarios

Year	IPAR-NISR adjusted projections		
	Low growth Scenario	Medium growth Scenario	High growth Scenario
2012 (Census Year)	1,132,686	1,132,686	1,132,686
2014	1,354,921	1,361,492	1,361,492
2024	1,816,298	1,872,462	1,897,462
2034	2,266,269	2,405,418	2,499,110
2044	2,816,981	3,071,923	3,258,504
2050	**3,224,316**	**3,570,015**	**3,824,708**

Source: IPAR Study

Table 6.2 Households income and average available monthly budget for Housing

Income ranges (RWF)	Households	Household no.	Population	Average available monthly payment for housing
0-40,000	**30%**	77,348	386,739	**<14,000**
40,001-100,000	**28%**	71,808	359,040	**42,000**
100,001-250,000	21%	53,873	269,367	**97,000**
250,001-500,000	14%	35,731	178,654	**230,000**
Above 500,001	9%	22,643	113,217	**>470,220**
Total	100%	261,057	1,305,286	

Source: IPAR Study and Surbana Jurong collaboration

Table 6.3 Additional housing need in Kigali

INCOME RANGES (RWF)	HOUSEHOLDS %	2018	2018-2024	2024-2031	2031-2038	2038-2045	2045-2050
0-40.000	30%	59,460	57,169	27,985	37,313	50,999	47,405
41.000-100.000	28%	33,415	61,929	25,981	34,640	47,346	44,010
100.001-250.000	21%	19,235	42,954	19,492	25,988	35,521	33,018
250.001-500.000	14%	4,331	21,001	12,928	17,237	23,559	21,899
Above 500.001	9%	475	6,751	8,193	10,923	14,930	13,878
Total	100%	116,916	189,804	94,579	126,101	172,354	158,943
TOTAL NEW DU REQUIRED BY 2050: ~859,000 - AVERAGE 27,000/ YEAR							

Source: IPAR Study and Surbana Jurong collaboration

Table 6.4 Phase wise housing Demand for the city of Kigali

PHASES	DWELLING UNITS (DUs)	POPULATION	AREA SQ. KM.
Phase 1 (Year 2018-2024)	408992	1635968	197.9
Phase 2 (Year 2024-2031)	151901	607604	108.4
Phase 3 (Year 2031-2038)	110745	442980	142.2
Phase 4 (Year 2038-2045)	172689	690756	165.5
Phase 5 (Year 2045-2050)	141323	565292	115.4
Total	**985,650**	**3,942,600**	**729.4**

Source: IPAR Study

and other forums, the master plan has reviewed zoning regulations including proposed densities and FAR for different zones proposed in Kigali to meet the overall housing and employment demand in the city.

Hence, the development in Kigali are proposed to be intensified with reduction in single family homes and push for higher densities through compact, mixed-use, mixed income developments supported with integrated public facilities.

6.3.1 Kigali Master Plan 2019-2050 - Proposed Residential Mixed Use Plan

The proposed residential mixed-use plan for Kigali builds on its current situation and strategies to achieve higher densities to meet the expected demand and redistribute those in the existing and new growth areas. The residential mixed-use plan intends to provide integrated neighborhoods with public facilities and range of housing typologies (single-family, low rise apartments, rowhouses, town houses, medium rise apartments and sites and services areas for affordable housing) to cater for all family sizes and all levels of incomes.

The residential zones are proposed to be developed as mixed use, mixed income residential with overlay zones of commercial, retail and micro-enterprises to introduce vibrancy and inclusivity in the residential neighbourhoods. The residential zones are proposed close to the major employment centres to provide housing options for workers close to their offices, workshops and other places of employment. Majority of these residential zones (R1, R1A, R1B, R2, R3, R4) are proposed to be served by public transit corridor. These transit corridors will become the main spine of these developments.

The master plan is centered on affordability and implementation. The key focus and strategies to achieve higher density, mixed use neighborhoods, and quality affordable housing and public spaces for the proposed 3.8 million population in Year 2050 are:

- Rehabilitation and regeneration of unplanned areas in Kigali to create well planned and inclusive Kigali;
- Creating integrated and affordable mixed-use housing developments;
- Creating neighborhoods that are walkable and well connected by BRT with easy access to quality, affordable facilities;
- Reduction of zones dedicated to single family housing, promotion of densification with incentives to modify building typologies and densities;
- Facilitate vertical and horizontal incremental development, allowing phased construction of mixed use, residential or commercial buildings;
- Promote redevelopment in high land value areas where land pooling approach will be effective due to cross financing mechanism;
- Implement extensive site & servicing approach to accommodate low income earners. Sites have been selected for their proximity to the public transport corridors. Areas will be mixed use zones allowing a vast variety of income generating activities and public facilities;
- Design flexible and adaptive guidelines, allowing incremental low-cost construction, in respect of minimum design guidelines;
- Promote and incentivize land pooling as a main implementation tool for providing affordable housing solutions; and
- Establish social and income mix in all parts of the city to ensure social cohesion in current population and future generations

Residential Zones

Table 6.5 presents the residential zone distribution for different residential categories proposed in Kigali. 182 sqkm,

Table 6.5 Residential zone distribution in Kigali

ZONING	DESCRIPTION	AREA (SQKM)	%
R1	Single Family Residential Zone	25.5	11.13%
R1A	Mixed Single Family Residential Zone	58.7	25.62%
R1B	Rural Residential Zone	35.1	15.30%
R2	Low Rise Residential Zone	31.0	13.50%
R3	Medium Rise Residential Zone	61.5	26.81%
R4	High Rise Mixed Use Residential Zone	17.5	7.64%
	Total	182.44	100

Table 6.6 Zoning parameters for residential zones in Kigali

Zone	Zoning Parameters	
R1	FAR	0.5
	Maximum Plot Size	500m²
	Net Density	10-15 Du/ha
	Typology	Low Density Residential
	Development Strategies	Single Plot
R1A	FAR	1
	Maximum Plot Size	300m²
	Net Density	20-30 Du/ha
	Typology	Low density Residential Densification
	Development Strategies	Single Plot, land consolidation
R1B	FAR	1.2
	Maximum Plot Size	100m²
	Net Density	40-70 Du/ha
	Typology	Rural Residential
	Development Strategies	Single Plot, land consolidation
R2	FAR	1.4
	Maximum Plot Size	120m²
	Net Density	70-100 Du/ha
	Typology	Medium Density Residential - Improvement
	Development Strategies	Redevelopment and land consolidation
R3	FAR	1.2
	Maximum Plot Size	100m2 - Single Family, 150m2 - Row housing
	Net Density	70-100 Du/ha
	Typology	Medium Density Residential - Expansion
	Development Strategies	Land consolidation
R4	FAR	1.8
	Minimum Plot Size	750 m2
	Net Density	80-120 Du/ha
	Typology	High Density Residential
	Development Strategies	Land consolidation

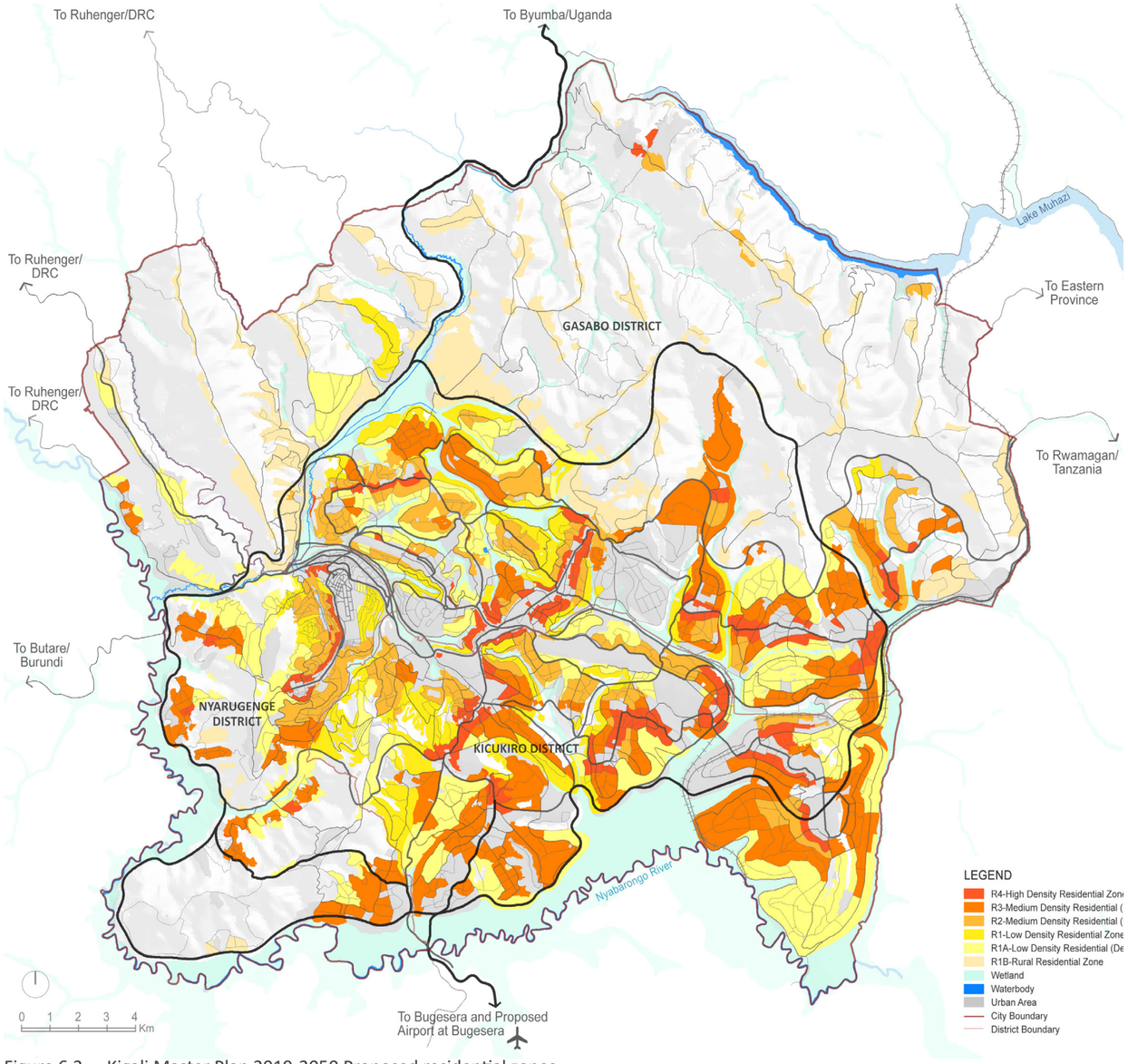


Figure 6.2 Kigali Master Plan 2019-2050 Proposed residential zones

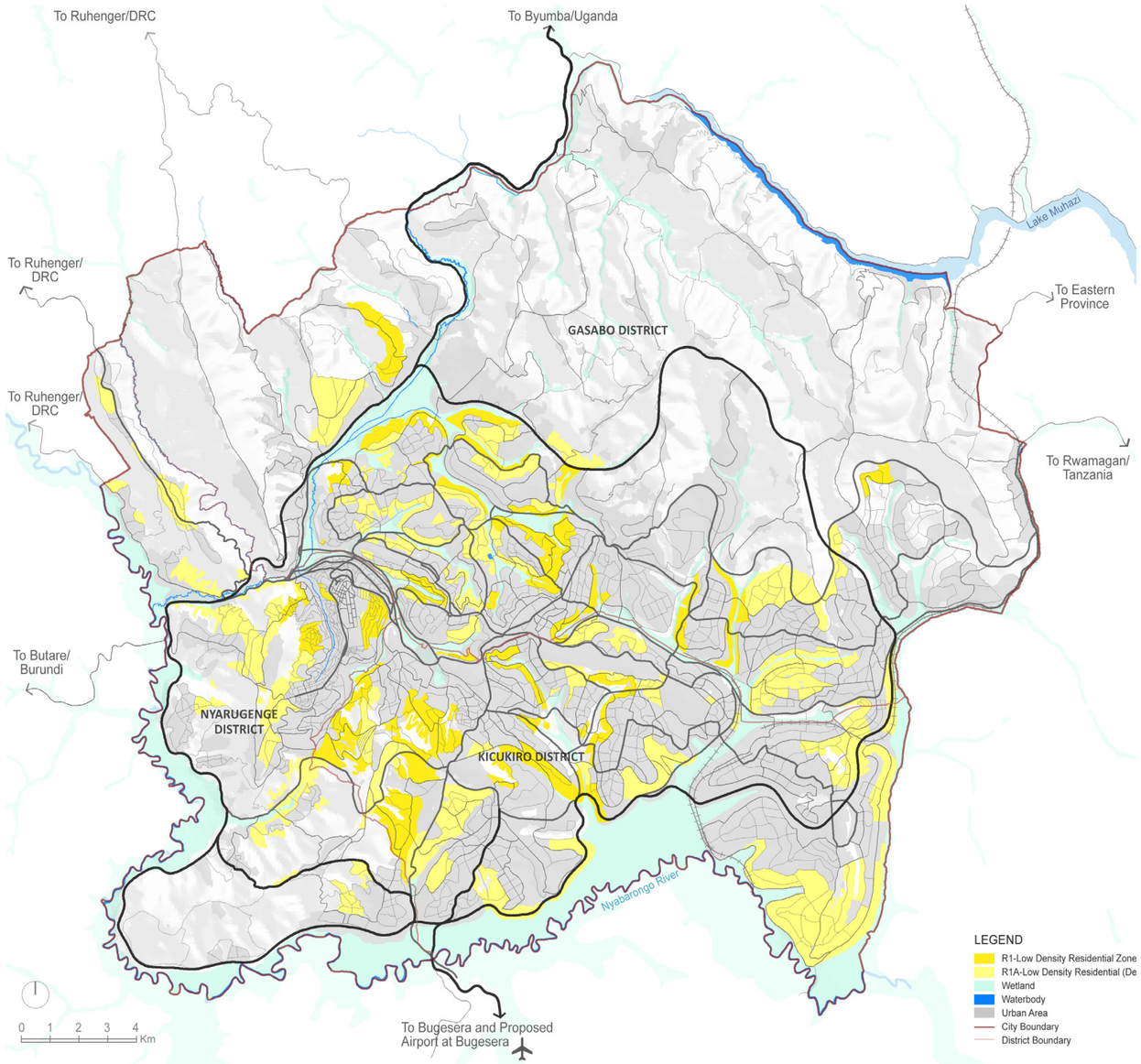


Figure 6.3 Kigali Master Plan 2019-2050 - Proposed Residential R1 & R1A

25 percent of the overall land in the city of Kigali is dedicated to residential zoning. The master plan ensures provision for different residential categories such as single family and villas, townhouses, rowhouses, low rise apartments, medium rise apartments, site & services, affordable housing to address housing needs of income groups based on the projected demands from the housing study. The following are various residential zoning categories and sub-categories proposed for Kigali City in the updated zoning plan:

- Low density residential zone(R1) for single-family low rise housing
- Low density residential densification zone (R1A) for single-family townhouses in single family densification area
- Rural Residential Zone (R1B) for compact rural housing
- Medium Density Residential - Improvement Zone (R2) for single-family row houses and multi-family Low rise apartments
- Medium density residential Expansion zone (R3) for low cost incremental housing
- High Rise Residential Zone (R4) for high density apartments and mixed use

Figure 6.2 illustrates the various residential zones proposed within the city of Kigali. Table 6.6 presents zoning parameters for different residential zones in Kigali.

Mixed use and Public Facilities Overlays

The planned residential zones promote mixed-use environment as one of the key development strategy that offers live-work spaces that blends residential, commercial, cultural, institutional, and entertainment uses, where these functions are physically and functionally integrated within walking radius with pedestrian connections.

This vibrant living environment is thus more conducive to walking and public safety. Different overlay zones of neighbourhood commercial and public facilities are induced in the residential zones to create this mixed-use, vibrant environment for residents.

- **Neighbourhood Commercial (O-C2) -** Overlay of 30 m buffer along collector roads and minor arterials within residential neighbourhoods that allow for commercial, retail, micro-enterprise uses to be planned within these residential neighbourhoods; and
- **Neighbourhood Level Public Facilities**

The Overlay allows for the provision of public facilities within a 400m walking radius in the residential neighborhood, based on population and demand.. The public facilities may include neighbourhood centre, neighbourhood park, primary school, health centre,

religious facilities, civic offices and other additional facilities

These overlays provide provisional location of neighbourhood facilities with residential zones based on the current population projections and demand estimated for public facilities based on planning standards (refer flexible zoning section 4.5 of the report, Chapter 4).

As discussed in the flexible zoning section of this report, these overlays provide flexibility in planning and allow neighbourhoods to provide these public facilites and commercial establishments following market trends, growth in population and overall demand at different locations within the neighbourhood. The neighbourhood character is thus allowed to grow and change over time adopting to the changing needs of the residents.

Following section provides details of different residential zones provided in Kigali.

Low density residential zone & Low density residential densification zone(R1 &R1A)

Figure 6.3 illustrates residential zones R1 and R1A proposed within the city of Kigali. It is realized that the current trend of developments is quite low in density and with such low urban densities it will not be possible to meet the City's future urban land demand. Hence, the developments in Kigali are proposed to be intensified with reduction in single family homes and push for higher densities through compact developments and supported with integrated public facilities. Low rise residential developments including single family houses, low rise apartment, townhouses, terrace houses are included in zones R1 (Low density residential zone, and R1A (Low density residential densification zone). R1 also has the flexibility of mixed used development as conditional uses falling under Public facilities overlay and Commercial overlay.

Around 34% of the residential land in Kigali is proposed to develop as low rise residential areas with an average net density of 15DU/ha for R1 and 30DU/ha for R1A. It comprises of 14.5% of the population share (2.6 % R1 and 12% R1A).

These residential zones are intended to provide for communities targeting for high-end single-family dwellings and town houses. They are proposed to have maximum lot sizes of 500sqm and 300sqm for R1 and R1A respectively.

The total area covered by R1 zone in the city is 25.5 sq km envisaged to spread all over Kigali in proximity to nature areas like wetland greens and other city green networks providing quality living environment around these high end housing. The total area covered by R1A zone is 58.73 sq km.

Proposed Residential Zone R1B

Another essential aspect of Kigali master plan is rural housing. Currently, the rural housing in Kigali is spread all over the agriculture areas, and due to lack of zoning regulations, this

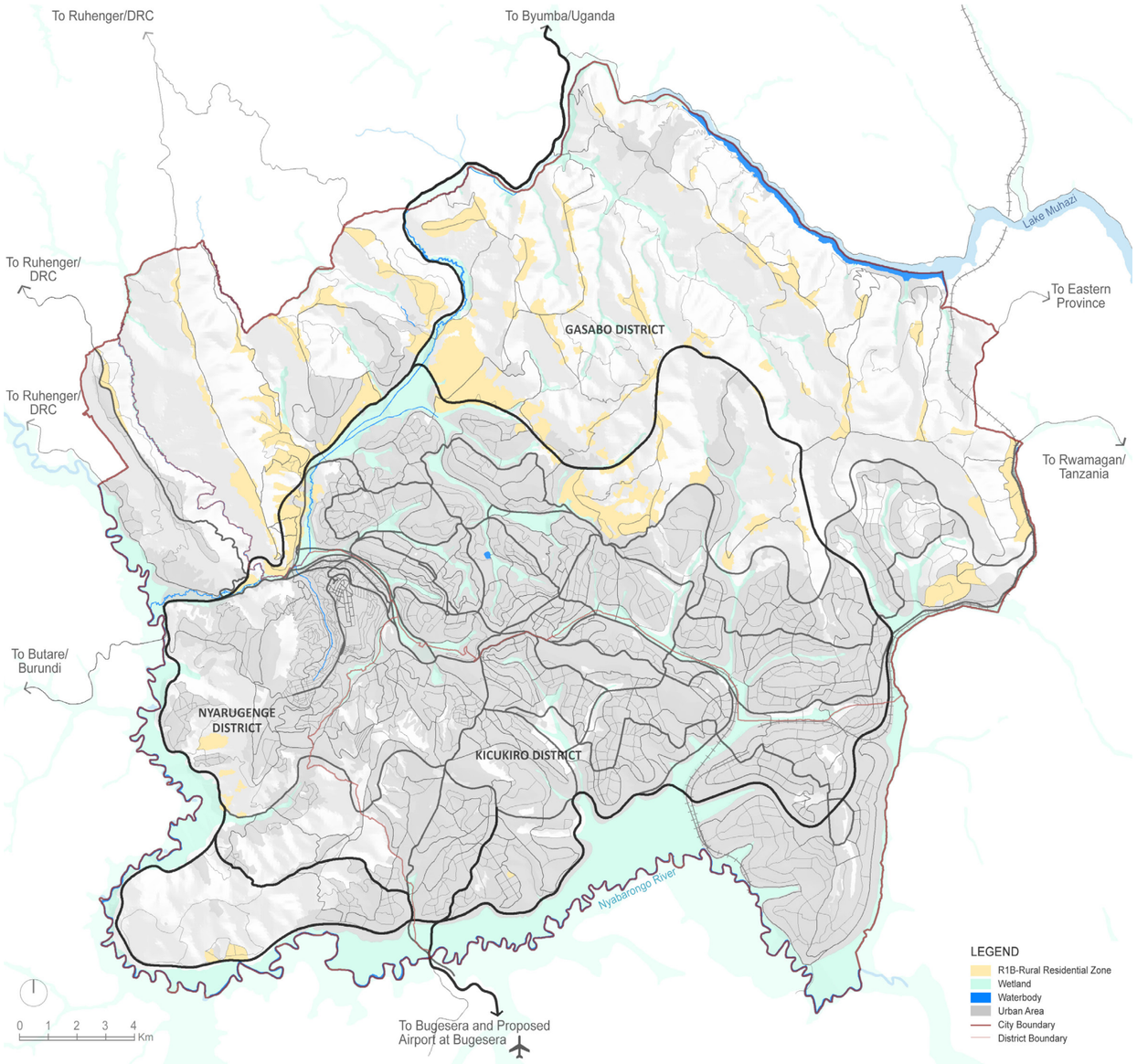


Figure 6.4 Kigali Master Plan 2019-2050 Proposed rural residential zone R1B

Figure 6.5 Kigali Model Village housing

https://thisisafrica.me/model-villages-poor-rwanda/

Figure 6.6 Kigali Master Plan 2019-2050 Proposed rural residential zone R1B

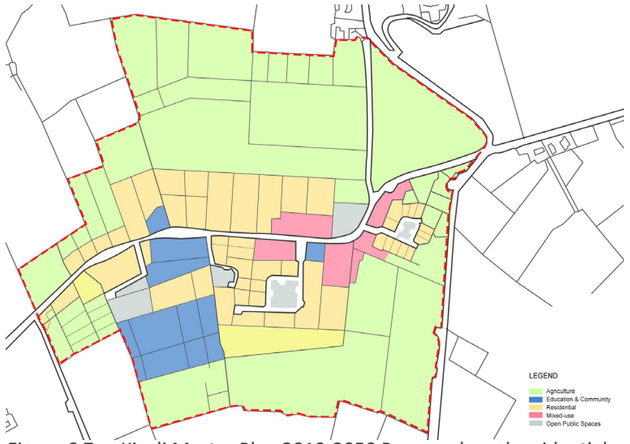


Figure 6.7 Kigali Master Plan 2019-2050 Proposed rural residential zone R1B

housing is spreading further making it difficult for the public authorities to build infrastructure to reach these far, spread out individual houses. R1B (Rural Residential Zone) is a residential zone offering low rise compact developments in the rural areas. These are also inline with country's plan to develop 'modern villages' where government is building cluster of houses agricultural land is proposed to be consolidated housing in agricultural rural areas equipped with necessary public facilities (Figure 6.5). R1B also has the flexibility of mixed used development as conditional uses falling under Public facilities overlay and Commercial overlay.

Government can build homes for indigent people living in high-risk zones and other residents with financial capacity can build their own homes there too. Dubbed 'model villages', the modern settlement sites will be absolutely connected to essential infrastructure like roads, water, electricity, schools, health posts, and local markets. Rwandans need to liberate themselves from inappropriate habitat. They need to understand that living in village settlement sites (imidugudu) helps to scale up access to infrastructure. Building model villages will help in efforts to use the country's scarce land resources more efficiently through land consolidation for higher yields from arable land, while also championing improved housing, officials said.

Figure 6.4 illustrates residential zones R1B proposed within the city of Kigali. 14 % of the residential land in Kigali is proposed to develop as rural residential areas. It comprises of 14.2% of the population share.

These residential zones are intended to provide for communities targeting development of compact houses in rural area. They are proposed to have minimum lot sizes 100sqm to accommodate net dwelling units of 70DU/ha.

The total area covered by R1B zone in the city is 35.08 sqkm envisaged to spread all across the rural areas in proximity to the agricultural zones.

Implementation Mechanism for Rural Residential Zones (R1B)

The Master Plan document suggests participatory land readjustment as one of the primary tools for implementation of R1B residential zone in rural areas of Kigali. Community-based agricultural land consolidation shall form an essential aspect of rural restructuring in Kigali.

In the rural areas of Kigali, there are multiple parcels owned by multiple owners, and small farms are often awkwardly shaped for agricultural purposes. Further, the houses are far apart, away from main roads making it challenging to provide physical and social infrastructure (Figure 6.6). In such situations, land pooling and consolidation process (which is already practiced in Kigali for agricultural land consolidation) presents as the best way forward to bring the community together to improve rural livelihoods and agricultural production, and to improve social conditions by increased access to social services, water and

sanitation.

The rural residential areas comprising of R1B zones, are proposed to be developed as clusters after land consolidation, along main road for improved accessibility

These shall enable consolidation of fertile agricultural land for optimizing agricultural production and promoting sustainable agricultural practices. These shall also help in the consolidation of irregular shaped development parcels for integrated development and improved social conditions by increased access to social services, water and sanitation, open spaces etc. (Figure 6.7)

Medium Density Residential - Improvement Zone Zone R2

The R2 residential zone (Rowhouses and Low Rise Apartments) are essentially planned for upgradation of unplanned settlements or redevelopment of the urban renewal areas, wherever feasible, to provide quality living environment and affordable housing and infrastructure upgrade.

Among other areas, R2 zoning also applies to various unplanned settlements in Kigali that are spreading in different areas due to lack of quality affordable housing.

More than 60% of Kigali's population live in unplanned settlements that lack access to integrated infrastructure including safe water, proper sanitation, electricity, health services, waste management and proper roads. Due to multiple private land ownership and lack of funding for affordable housing, Kigali is facing the challenge to cater to the needs of its growing population and keep pace to fill the backlog of housing and other infrastructure requirements for this population. This has resulted in further growth of these unplanned settlements in proximity to the main transit corridors and activity areas like the CBD where they can have quick access to local jobs and public facilities. The population living in these settlements have no option but to use their own knowledge, labour, and materials for the construction of their home, as they cannot afford to contain themselves in the formal housing market.

Redeveloping unplanned settlements and facilitating affordable housing has been a central focus for the Rwandan Government. In defining a citywide strategy to upgrade unplanned settlements in Kigali, City-wide unplanned and underserviced settlements upgrading strategy for Kigali, Rwanda (2018), supported by UNHABITAT, identified seven (7) categories of unplanned settlement based on location, associated environmental risks and area size/ density. The seven categories are:

1. Uphill sloped settlements (UP) (19%);
2. Downhill settlements (DWN) (11%);
3. Inaccessible areas (IN) (13%);
4. Small-pocket settlements (SMP) (2%);
5. Central overcrowded areas (34%);
6. Peri-urban areas (PERI)(9%); and
7. Settlements located in high risk areas (highly steep slopes and flood prone) (HRZ) (13%)

In accordance with this, many people

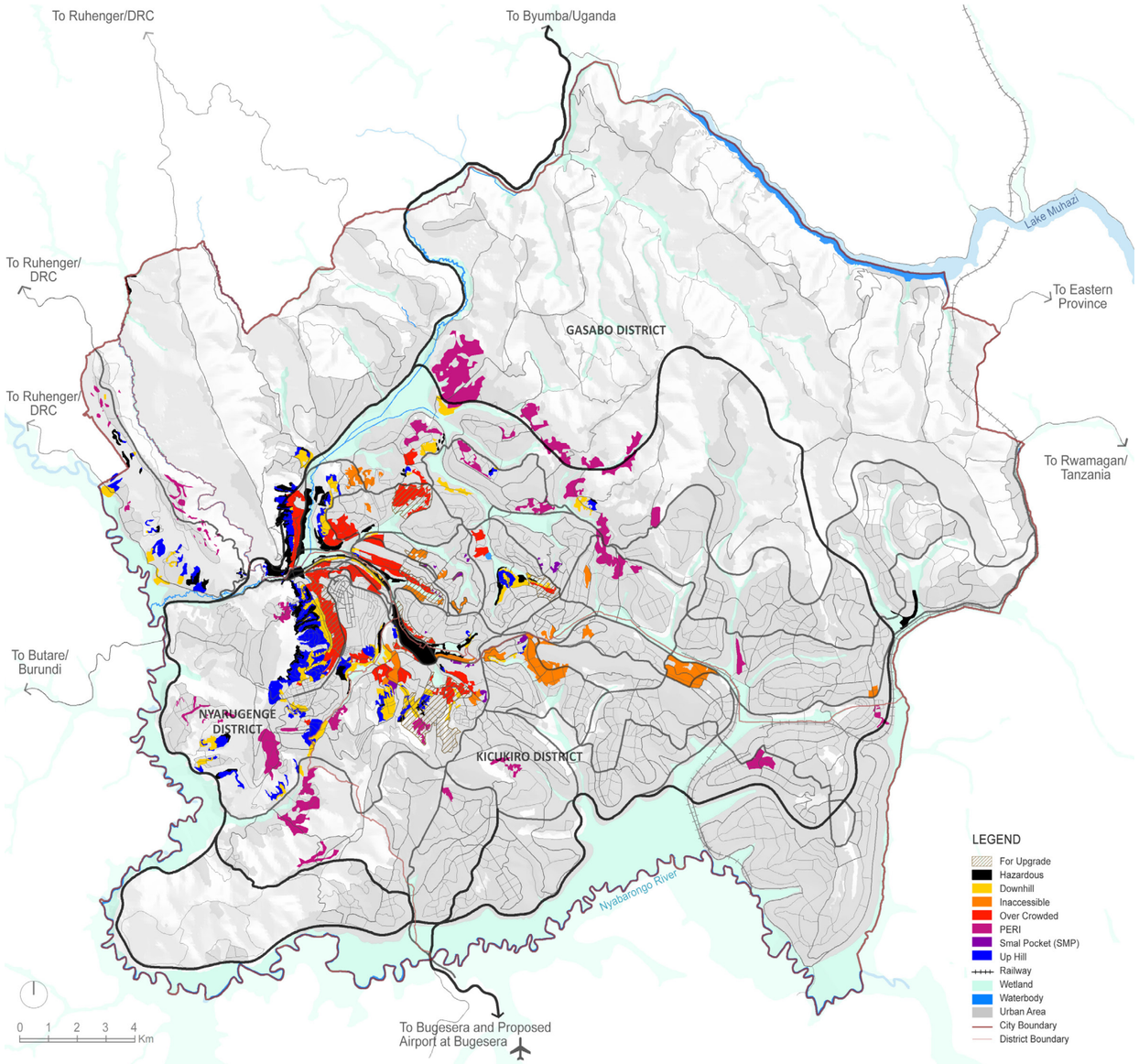


Figure 6.8 Kigali Master Plan 2019-2050 - Unplanned Settlements

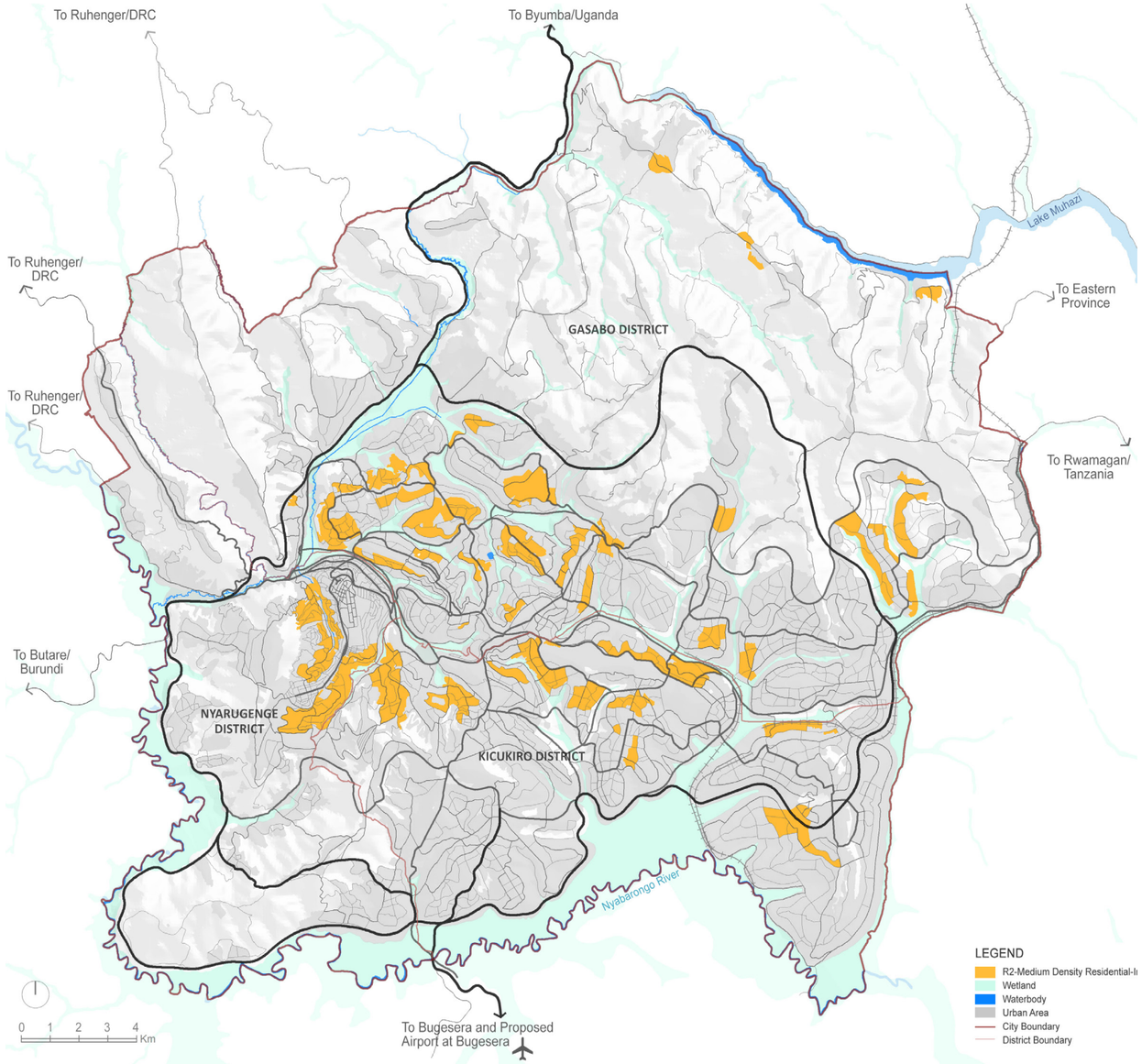


Figure 6.9 Kigali Master Plan 2019-2050 - Proposed Residential R2

Figure 6.10 Pilot project using SKAT model for redevelopment of unplanned settlement in Kigali

have already been relocated from hazardous and eco fragile areas. The Master Plan update has taken these categories into consideration while proposing and updating the 2013 zoning plan.

Figure 6.8 illustrates the unplanned settlements within Kigali as per the seven categories listed above. 5% of the overall land in Kigali, approximately 40 sq km, is covered by unplanned settlements in Kigali. Most of the R2 zones are located in these settlement areas. Considering government's initiative to improve living conditions of the people in these unplanned settlements and to better utilize the developable land for creating integrated and affordable neighborhoods, and provide adequate infrastructure and public facilities, the Master Plan proposes two approaches for unplanned settlement: upgradation in short term or redevelopment through land assembly process in long term.

Currently the City is working with various experts to develop models for affordable low cost housing that is implementable at a larger scale. One such model is the SKAT model developed by SKAT Consulting ltd , working closely with City of Kigali (COK) for a pilot project for redevelopment of unplanned settlement in Kigali. Similar ideas can be incorporated in the participatory low cost housing projects by involving local communities where their role is to contribute land. This is followed by the role of architectural consultants in partnership with the government to build resilient units made up of local, inexpensive materials that can stand natural calamity, impacts of landslides, earthquakes and floods. It is suggested to follow similar typologies for R2 zone to achieve low rise, high density, affordable development.

The R2 zone is proposed to have maximum lot size of 200sqm with a net density of 100DU/ ha. The government will need to drive initiatives for land consolidation, (where feasible), promote incremental development, and provide incentives to developers for constructing affordable housing.

The total area covered by R2 zone is 30.96 sq km. 12.4 % of the residential land in Kigali is proposed to develop as R2 residential areas. It comprises of 17.9% of the population share. Figure 6.9 illustrates R2 residential zone proposed in the city of Kigali.

Medium Density Residential - Expansion Zone (R3)

Due to the lack of adequate affordable housing and with an aim to fill the housing backlog of the city, Rwanda Housing Authority (RHA) is faced with the responsibility to enact low cost Housing Plans. In conformity with the National Policies, Rwanda Housing Authority (RHA) has enacted low cost Housing Plans for improving the existing housing deficit (Figure 6.13 and 6.14).

The current locations for the low cost incremental Housing Projects are away from urban area and decentralized in the city fringes and sub-urban areas. This Master Plan proposed to bring these affordable housing areas closer to the city to refrain from urban sprawl. It is therefore planned to develop these affordable housing sites are R3 medium density low cost zones that can be developed as mixed use integrated development and close to transport corridors for ease of accessibility.

To facilitate and accommodate low income earners in the city, the Master Plan proposed R3 residential zone which can be planned and implemented as a kind of Low cost incremental zone for provision of affordable housing. This zone is mainly located on greenfield sites for ease of development and close to transport corridors for ease of accessibility.

The unplanned settlements currently falling on hazardous areas where people live at a high risk and the character of terrain are steep slopes or in flood-prone regions, the inhabitants from these areas may also be relocated and resettled in these sites forming the R3 zones.

These low cost incremental sites implemented through participatory land readjustment strategy, provide serviced sites with appropriate infrastructure to attract people to build their own homes and live in small clusters with shared community facilities like public open spaces and parking. The R3 zones are also planned to be developed as mixed-use zones allowing a vast variety of income generating activities and public facilities.

This zone has the highest projected demand for housing in the city, thus the largest share of population and dwelling units. The total area covered by R3 zone is approximately 61.46 sq km, 8..4% of the total land area in the city. It is envisaged to comprise of 29.6% of the

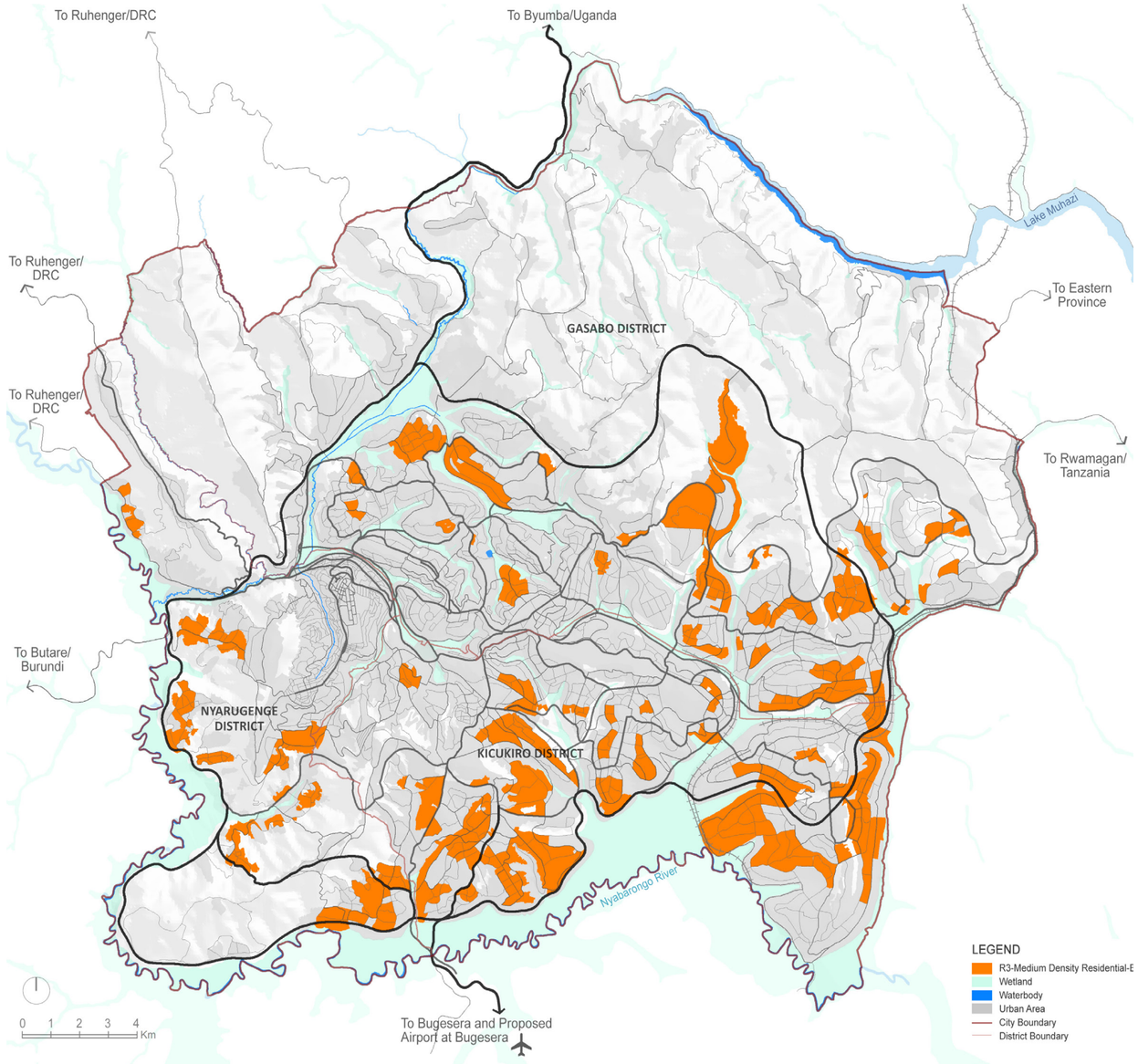


Figure 6.11 Kigali Master Plan 2019-2050 - Proposed Residential Zone R4

population share. The zone is proposed to have maximum lot size of 100sqm with a net density of 70-100Du/ha. Figure 6.14 illustrates residential zone R5 proposed within the city of Kigali.

The Master Plan provides various strategies to develop R3 residential zone such as promoting land pooling and consolidation to plan the areas with the required infrastructure and public facilities and allow incremental development of housing, commercial and mixed-use buildings following the investment capacity of investors and developers, but in respect of clear guidelines.

6.3.2 Particiatory planning and design for upgrading settlements

Implementing Mix-Used Neighbourhoods strategy requires intensive involvement of the residents in a structured and organized manner, especially in unplanned settlement upgrading and site and services projects. As is well known, upgrading plans are better, stronger and more sustainable if local people have been involved in the process. Put stakeholders at the centre of planning development projects is a winning component to succeed in the process and implementation phase.

The meaningful participation of all stakeholders, landowners, tenants, unplanned residents, the municipal authorities, land professionals and community organizations – in planning and making decisions, should avoid the imposition of decisions on local

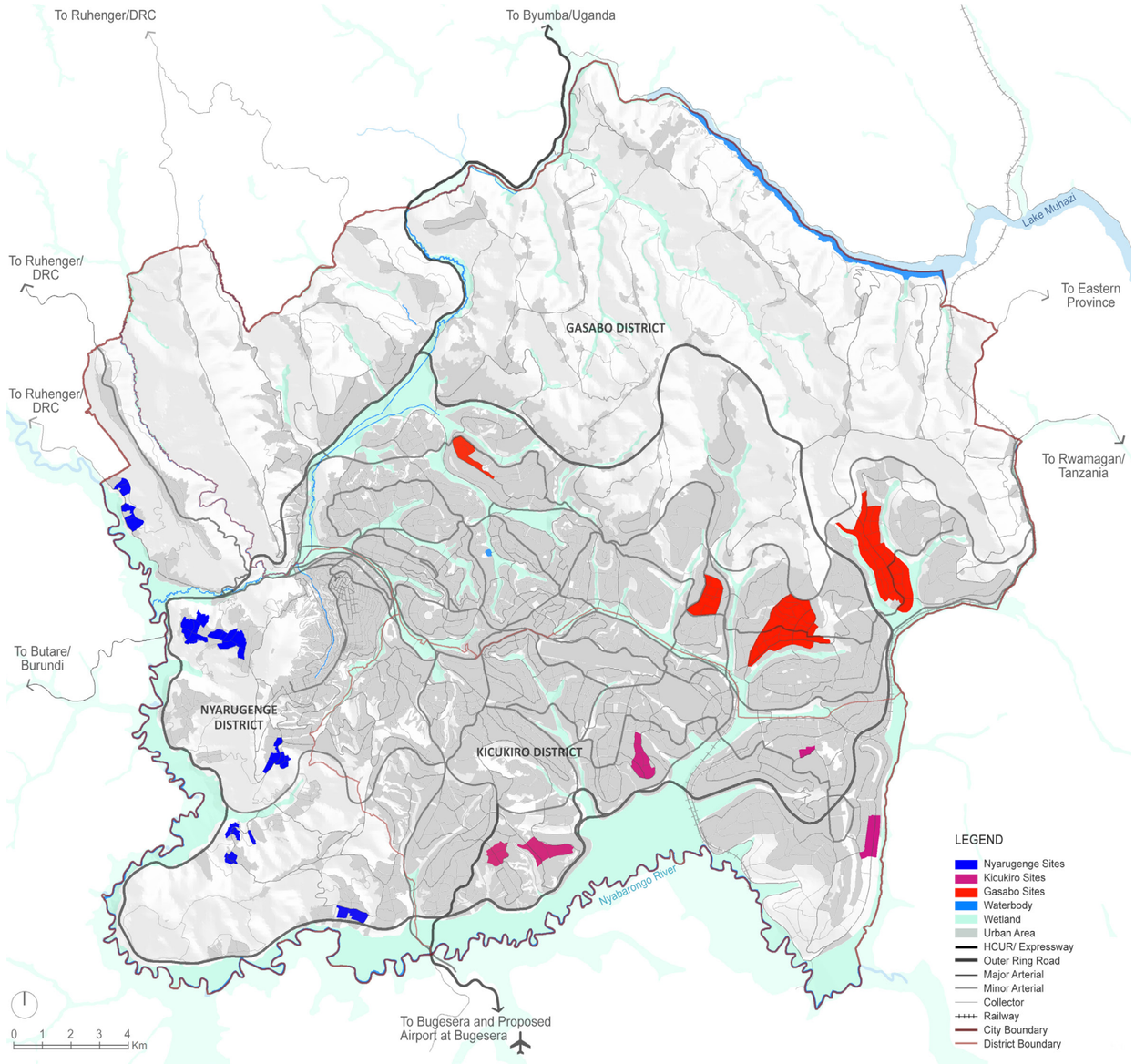


Figure 6.12 Kigali Master Plan 2019-2050 - Proposed Residential R3

communities and strengthen a bottom-up approach. The process needs to be inclusive and ensures that disadvantaged also benefit. It aims to achieve consensus among all stakeholders and avoid forcible removals or evictions.

The participatory approach needs to be implemented in all phases of the process, from the initiation stage, when presentation of the projects objective and expected results, discussion and agreement on the process' stages and selection of representatives of the Community need to be conducted. The following stage required collecting data and information of the site, stakeholders mapping, participatory recognition of the plots and context analysis. At this stage, the involvement of local people in gathering information about the community and its members it is critical to avoid mistakes and misunderstanding. During development of draft plan the stakeholders are involved throughout planning process in a continuous and reiterative series of consultations meetings. Participatory design allows preparing realistic alternatives to show to the stakeholders and collect comments and suggestions to adjust the plan, before its final version. Several meetings and discussions may be necessary before the plan is approved by the City Council and stakeholders.

It is foreseen that collaboration from residents should be fostered also during implementation phase. Contribution and participation of citizens in realizing infrastructure works, housing upgrading or public and open space facilities it desirable, allowing a smooth and quick implementation of the upgrading and site and services plans.

Engagement of residents from the early stage will develop a strong sense of ownership to project and plan, avoid –or help to solve- conflicts and forced decisions, build cohesive and organized community, shaping sustainable and

Figure 6.13 One of the affordable housing estates being developed in Kinyinya Kigali http://www.hope-mag.com/index.php?com=news&option=read&ca=6&a=1917

inclusive City.

Proposed Residential Zone R4

It is essential to provide higher density residential development in the city centre and along the transit corridors to provide homes close to the major job centres of the City and for a vibrant and integrated live-work-play environment.

The Master Plan envisages integrated transit-oriented development with variety of housing choices and easy access to quality, affordable facilities in these areas. Therefore, medium rise apartments are proposed mainly along BRT corridor and other areas with potential for higher density development. The total area covered by R4 zone is 17.52 sq km, 2.4% of the total land area in Kigali is envisaged to comprise of 13.5% of the population share.

The zone is proposed to have minimum lot size of 750sqm with a net density of 120Du/ha. Figure 6.11 illustrates residential zones R3 proposed within the city of Kigali.

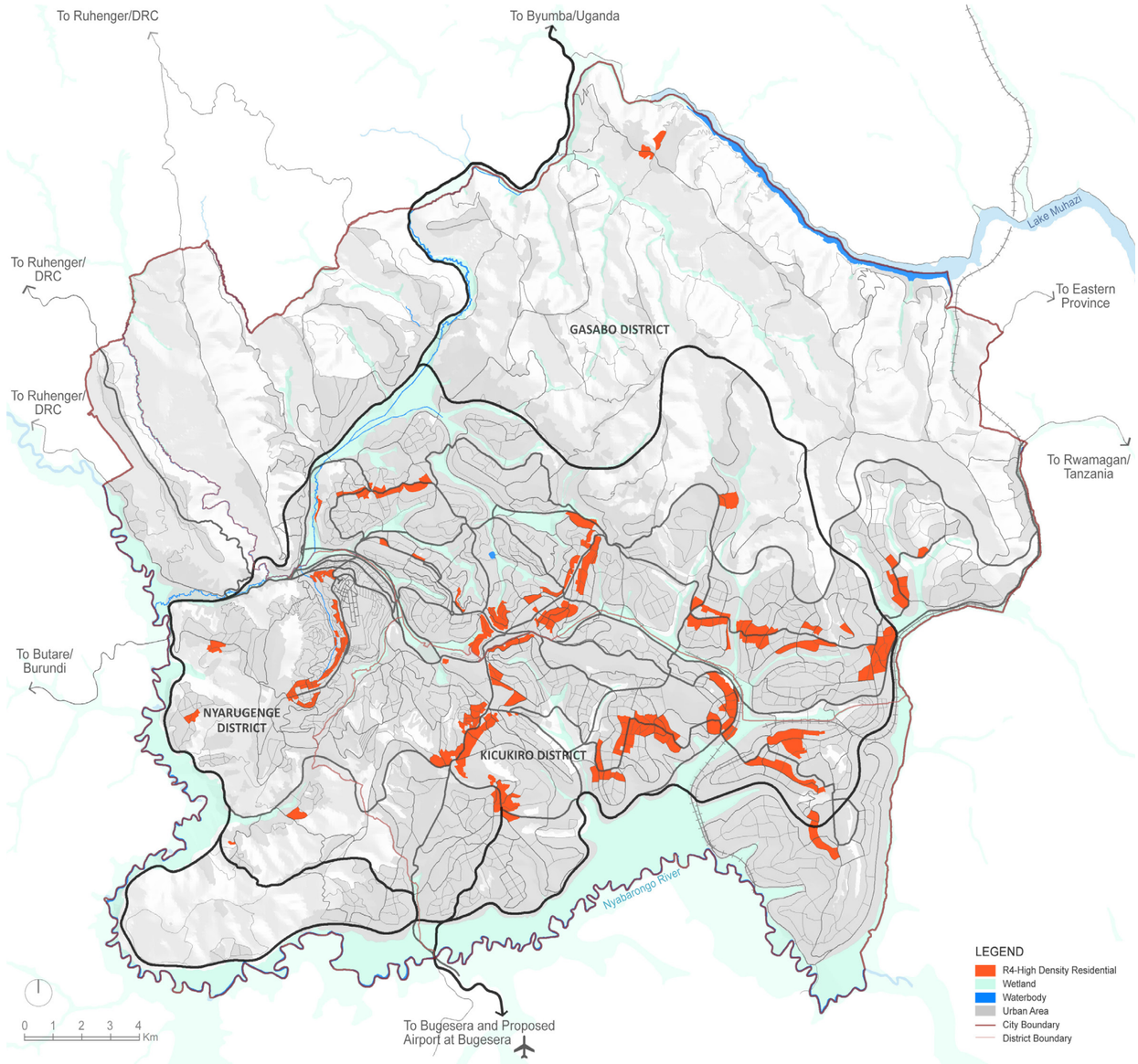


Figure 6.14 Proposed Low cost projects by RHA

7

City at Work

7.1 Introduction
7.2 Commercial Plan
7.3 Industrial Plan

7 City at Work

7.1 Introduction

Economic development is critical for a city that is striving for urban excellence and prosperity with good jobs opportunities and income growth. City at work is one amongst the eight (8) goals of development for the City of Kigali.

A socio-economic study supported by a household survey conducted on a sample of about 4000 HH of the existing context in Rwanda and Kigali was conducted to understand the existing economic and population trends, which serves as the basis for review of socio-economic projections guiding the update of the Kigali City Master Plan 2013.

The major economic generators in the recent years has been through investments on Meetings, Conferences and Exhibitions (MICE) sector. MICE tourism is one of the major drivers of economic growth and as a part of MICE strategy, Kigali City has made investments in infrastructures such as the Kigali Convention Centre, improvements of the airport at Kanombe, investments in the national fleet with increase in the number of destinations for Rwanda Air, investments in hotels, and support on the value chain of the conference tourism through private sector involvement (IPAR Socioeconomic Report).

The Master Plan proposes major employment distribution within mixed use commercial districts (CBD, Fringe Centres & Regional Centres) and industrial parks (I1,I2&I3), planned as nodes along the BRT corridor.

Higher density mixed use residential and commercial are planned at regional and fringe centres for larger employment and housing ratio to control urban sprawl. The mixed use commercial zones including Industrial nodes are proposed to be planned as integrated zones with affordable housing, social infrastructure and green open spaces. Similarly, the Master Plan is planned to include micro-light enterprise uses within the residential mixed use zones (R1,R2,R3). This is to increase the creation of more formal jobs in the market and to bring work closer to homes, thereby limiting the time and resources required for travels to work. This will also promote women into the workforce, with work place in proximity to home.

7.1.1 Employment Projection and Distribution

As per the study by IPAR (Institute of Policy Analysis and Research) Rwanda, the City of Kigali and Rwanda has high potential to develop vibrant services and knowledge based sectors building on major investments that have been undertaken.

Economic Projections

The economy of the City of Kigali has experienced positive GDP growth in the last decade averaging 6.5%. Among the three districts, Kicukiro district is the biggest in terms of GDP accounting for 42% of the total GDP, followed by Gasabo (35%) and Nyarugenge (23%). The city is projected to continue growing between 6.5% and 10% for the next three decades pertaining to enormous investments taking place especially in the service and manufacturing sector (Figure 7.1). To continue growing at the stated growth rate, the city will need to generate proportionate employment for the growing labour force.

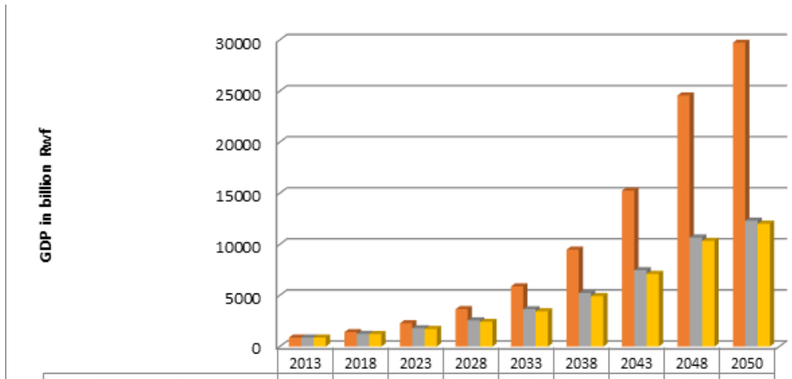
Employment Projections

The employment forecast (Table 7.1 and Figure 7.2) for Kigali City indicates creation of a total of 1,719,369 jobs in agro-processing, agriculture, forestry and fishing; mining; manufacturing; services; construction; trade; and transport sectors.

Majority of these jobs are distributed within mixed use commercial districts (CBD, Fringe Centres and Regional Centres) and industrial parks (I1,I2 & I3), with some employment in residential zones.

7.2 Commercial Plan

Kigali market has been witnessing accelerating increase in commercial office space over the last five (5) years, changing the Kigali skyline, with developments such as M-peace plaza, Kigali city tower and Kigali heights among others. Additional 70,000 sqm of commercial area is in the pipeline for the next two years according to Knight Frank Africa report 2017. Despite the government initiatives and potential demand for commercial office and retail in coming years, the city of Kigali faces a tough challenge towards growth of its commercial sector especially in the CBD area. The oversupply of commercial



Source: IPAR Study

Figure 7.1 Kigali GDP growth projections

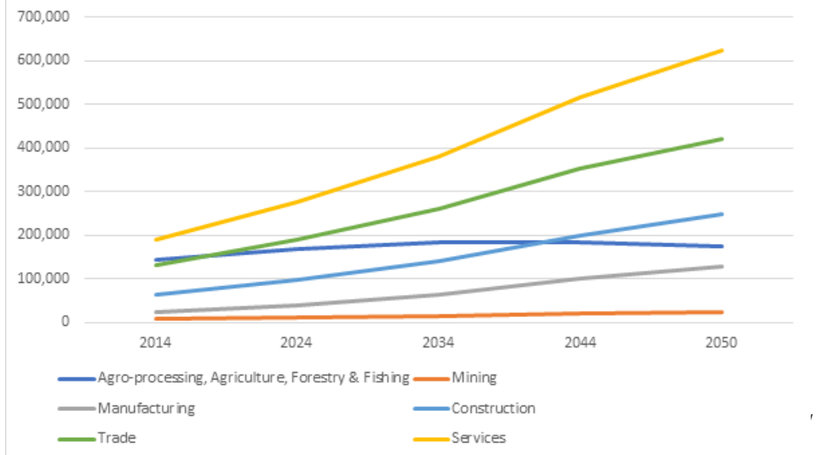


Table 7.1 Employment Projections 2050

Sector	2014	2024	2034	2044	2050
Agro-processing, Agriculture, Forestry & Fishing	143,136	168,936	182,046	182,906	175,376
Mining	7,656	10,661	14,257	18,871	22,352
Manufacturing	22,387	40,184	64,703	100,163	128,953
Services	188,780	275,546	379,446	516,783	622,412
Construction	62,463	96,769	140,373	200,326	247,589
Trade	131,769	190,258	259,909	351,296	421,245
Transport	23,779	37,724	55,930	81,292	101,443
Total	**579,969**	**820,078**	**1,096,664**	**1,451,637**	**1,719,369**

Source: IPAR Study

office in CDB without current market demand, high cost of land in city centre and high construction cost has slowed the commercial developments in the city centre. A high rate of the current office spaces are vacant, as high land price and rental fees force tenants to choose alternative locations for business away from the CBD. Figure 7.3 indicates higher percentage of buildings in CBD than Kimironco Fringe Centre with occupancy below 50%.

As per IPAR's study, the majority of businesses that rent commercial buildings within the city of Kigali are small and medium in nature. These are sometimes not able to afford high rents charged by Grade A buildings in prime areas within the city of Kigali. This is one of the major issues highlighted in the study from demand side. Figure 7.4 indicates CBD in Nyarungenge with highest average rental cost per square meter amongst all commercial nodes.

Zoning regulations in Kigali City have had a significant impact on commercial real estate, notably rents. Ineffective building design not meeting tenants' expectations (quality, flexibility, cost per sqm), high construction costs, loan interest rates and mortgage rates in dedicated employment centres and commercial zones, affect the overall rents and hence commercial real estate demands, as per the IPAR study sample survey, making Kigali unaffordable for local population owning local, small scale businesses.

Following are some critical issues highlighted in the commercial real estate market in IPAR's study

Supply related issues

- New Commercial buildings are mostly designed to accommodate high-end demand, limiting supply for new entrepreneurs, SMIs;
- Small and medium sized businesses require spaces in integrated or mixed use neighborhoods – Grade A office spaces demanding high rents in concentrated areas are not relevant;
- Large commercial buildings with high end amenities are expensive and not in high demand; and
- Regulatory rigidity / lack of accurate regulatory knowledge, complicating approval process

Demand Related Issues

- Limited dimension of businesses in Kigali, requiring cheaper, more scalable design; and
- Flexible arrangements (like pooling of resources for favorable loan terms to aid small businesses) are missing

The Master Plan, according to the urban design reviews, envisions the CBD (located in Muhima and Nyarugenge) to be revitalized as a "vibrant new growth area" allowing for high-rise, large offices and mixed-use developments.

Supply Related Recommendations

Following are the supply related recommendations on commercial real estate market:

- Detailed target market research for multiple affordable vs high end quality;
- Flexible pricing to make commercial real estate affordable;
- Co-working or shared space models required so that SMEs can share the rental burden at prime locations;
- Builders must opt for affordable and local materials and technology to incur low costs, recover investments and charge cheaper rental rates; and
- Buildings must reflect local context and sentiments rather than being replicas of buildings from other countries

Demand Related Recommendations

- Organized and quicker permit clearance system required;
- Incremental construction model for builders based on their financial capacity; and
- Close attention to clients' design requirement based on their capacity and need

Working with the above recommendations from the Commercial Real Estate study, Kigali Master plan is updated following the key strategies given below:

- Provide different scales and cost range of commercial and industrial solutions, following current and expected market dynamics;
- Facilitate access to the market of small and micro-enterprises, currently the majority in Kigali and in the Country, promoting the creation of more formal jobs;
- Allow incremental development of commercial and mixed use buildings following the investment capacity of investors and developers but in respect of clear guidelines;
- Encouraging mix of uses in all areas to promote a 24h city;
- Provide integrated enterprise zones with affordable housing and social infrastructure and green open spaces; and
- Infrastructure to share like parking and public open spaces planned within commercial and industrial zones

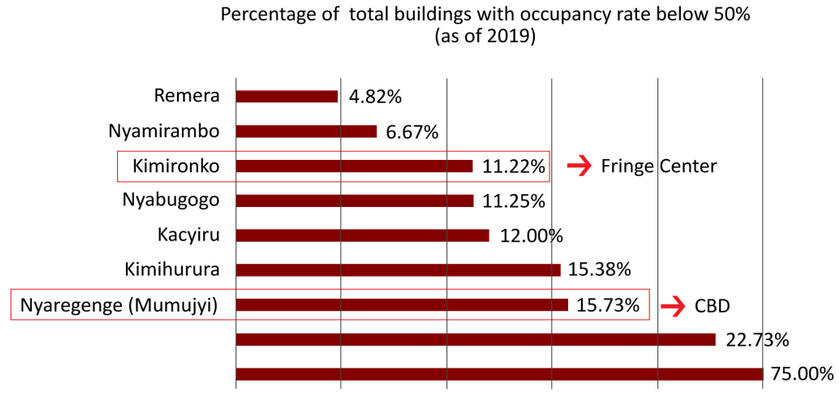


Figure 7.4 Percentage of total buildings with occupancy rate below 50% as of 2019

Source: IPAR Study

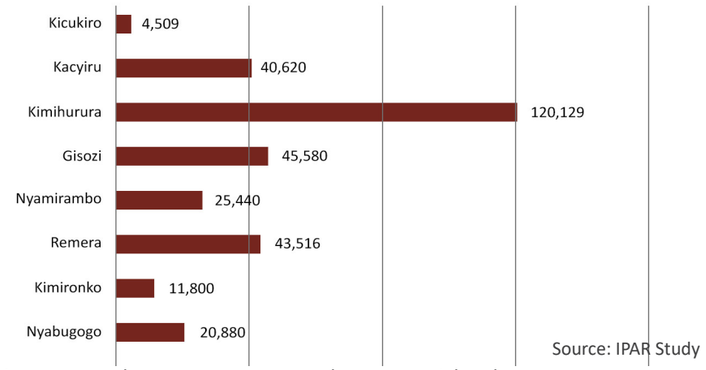


Figure 7.3 Average rental cost per square meter by commercial nodes

Source: IPAR Study

Recommendations suggested by real estate developers and property owners

- CoK should fasten on the issuing process of the permits for construction or renovations to commercial developers. This would improve on the quality of most buildings in the city. The government authorities should also improve on the construction inspection process. They should inspect and evaluate the construction process progressively "they should not wait for the whole building to be finished and then ask for durability standards"

- Reduce on the high taxes levied on traders. The authorities should help traders by reducing and regulate the many taxes levied on their businesses so that they could be able to get enough returns to pay rent and meet their family basic needs for survival. Business people find it hard to even raise rent for on the commercial houses and most of them are kicked out of business just in few months' dues to high taxes and low rates of customers. "At times the tenants default us and even others go with their rent arrears as they leave the buildings" some landlords complained

- CoK should give some tax incentives or holidays to local commercial developers. They should be making projections of about to ten years when designing and setting taxing and renting policies which destabilize the investors. Let the authority give a grace period before taxing a new commercial building. This would enable investors to make profits and bring up more buildings. They further said that the authorities can introduce a taxing policy based on percentages. For example, they should tax only 50% of returns in profits and leave the remaining 50% to the developers for financing and maintaining the commercial buildings.

- The government should not concentrate commercial and public facilities in specific areas like the city centre. In every zoned area for residential and commercial development, the government should be recommending developers to establish services like health clinics that would save residents from necessarily making long distances in search for those services

- The government should consider its expropriation, resettlement and compensation policies. People with plots and old houses which they cannot develop, in places deemed for commercial development and are on government's development priority interests, should be well explained to them on how they can be expropriated and compensated for their land in case of commercial development. If people are to be given rooms as a compensation for their land, it should be better too for them at least an additional commercial room on the building to rent out and collect money for survival

- The government should consider peoples' financial potentials before levying taxes on them. The government should survey to identify how much business people can afford to pay in taxes and how much money the commercial developers have to develop their lands before prioritizing certain commercial building developments in certain areas

- CoK should put more emphasis in research through Private-Public Partnership (PPP). The commercial developers do extensive market surveys for their projects, so they would share their information finding with the government to act as a bench mark for the government decision making on policies and regulations

- The government should revise ways through which it can subsids on the commercial real estate developers. The government should provide incentives like subsidizing on buying or giving out land to mega commercial developers to attract more investments hence convincing the developers to lower the prices for the customers and boosting the market. More still the government can give incentives to developers like giving out land cheaply to subsidise on the commercial construction costs because high construction costs influences high rents charges as the developers wish to return on their investments

- Most importantly the government should sensitize the masses about the use and importance of real estate development in the city. Informing the public about why certain projects are done. This would save the targeted buyers from the ignorance of need for commercial development

- Specific Recommendations Suggested from Hotels and Hospitality services

- RDB- should promote tourism by maintaining stable taxes on hotels so that they keep stable prices, the continuous increase in taxes causes the hotel price charges to fluctuate hence at times scaring away potential customers.

- Rwanda should maximise the EAC friendships in promoting tourism to include the sharing of surplus animals in the game parks from amongst other member countries. For example in other countries' game parks when they want to reduce or maintain a given number of a particular animal breed say lions, they kill some off, it would be a good idea therefore if countries can exchange or share the excess numbers with the member country that has few animals of that particular breed/type.

- The city authorities and the country at large should think of the changing or improving on the tourist attractions we market, for time they have been marketing the Genocide memorial cites, but with time they will be attracting less tourists, so the government should consider creating animal centres in the city suburbs like snake zoos among others to attract more tourists to the city because there no such things in Kigali city centre

- RDB should be considering on how to engage the tourist travel agencies because they are fundamental in promoting tourism in the country. The government ought to engage them and they share with them the information they receive from the tourists from their websites, this would help the tourism sector to improve on their services. Research is needed on these institutions to identify the information shared and the room for improvements

- Government should reduce or even exempt taxes on the sports facilities that are imported into the country in a way of promoting sporting services in the country and enabling most recreation centres to charge low prices on sports activities.

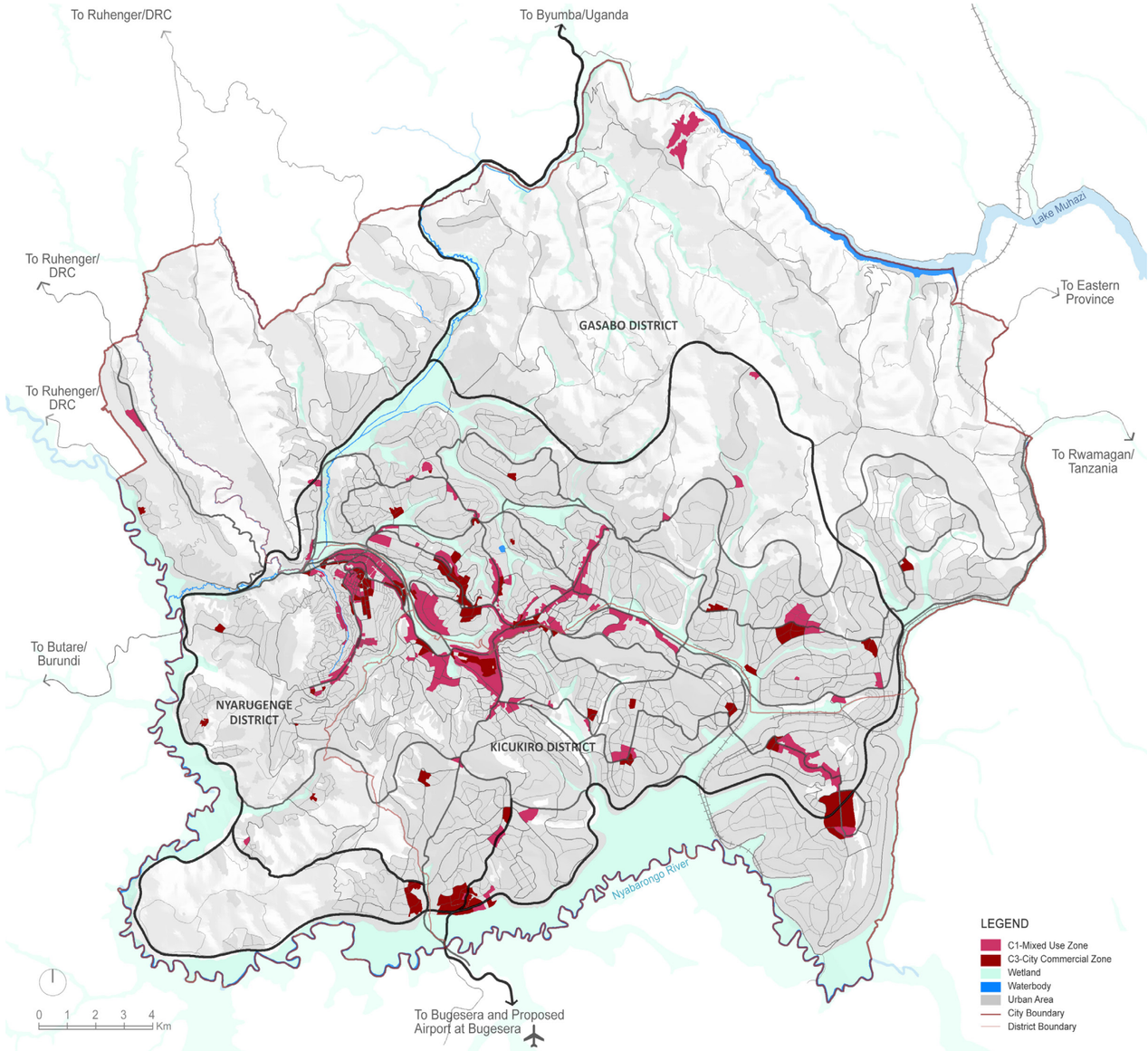


Figure 7.5 Kigali Master Plan 2019-2050 Proposed Commercial Mixed-Use Plan

Table 7.2 Proposed Mixed use commercial zones

Zone	Zoning Parameters	
C1	FAR	1.6
	Minimum Plot Size	500m2
	Net Density	110 Du/ha
	Mixed Use Share	Residential 70% Commercial 30%
C3	FAR	2.4
	Minimum Plot Size	1000m2
	Net Density	100 Du/ha
	Mixed Use Share	Residential 60% Commercial 40%
R2 R3 R4	Mixed Use Share	Residential 95% Commercial 5%

Table 7.3 Proposed commercial mixed use zone distribution in Kigali

Zoning	Description	Area (Sqkm)	%
C1	C1-Mixed use zone	12.9	64
C3	C3-City commercial zone	7.4	36
	Total	20.3	100

7.2.1 Kigali Master Plan 2019-2050 - Proposed Commercial Mixed-Use Plan

Kigali city is well positioned to be a major business and service hub and this Master Plan has incorporated all on-going projects and investments that are undertaken for the City of Kigali.

As per the socio-demographic studies indicate the service sector and retail trade will have 622,412 and 421,245 jobs respectively by 2050. The retail trade and services sector will represent 60% share of employment in Kigali and proposed Commercial Mixed Use Plan addresses the strategic distribution of these jobs in Kigali. It is planned to create a hierarchy of commercial centres such as CBD, Regional Centres, Fringe Centres and other Commercial, distributed across the city to bring jobs close to homes.

The zoning regulations including proposed FAR for all zones in the commercial areas have been reviewed as per the current situation. Suggestions and comments from various TAGs, FGDs and other forums to optimally cater for the employment demand of the city. One of the key updates in the commercial zones from Kigali Master Plan 2013 is proposal for all commercial developments in Kigali to be mixed use to a promote a vibrant and 24h city. This is one of the key difference in approach adopted for updating the Kigali Master Plan.

The commercial zones C1 (Mixed Use Commercial Zone) and C3 (City Level Mixed Use Commercial Zone) are proposed to be developed as mixed use zones with residential and commercial mix for vibrancy, integrated live-work-play environment and inclusivity. These mixed use centres shall support local businesses and micro-enterprise enabling people to carry out a number of activities in one location.

Incentive Zoning Overlay is introduced at Regional level that seeks to densify not only key commercially valuable areas of the City, but also those areas along BRT and major Transit Corridors and Nodes, along specific sections of wetlands dedicated to recreational uses or in proximity of landmarks, and any other areas, that the market demands, for extra floor space and height.

All these commercial zones are planned to be served by public transit corridor. The Master Plan proposes corridors strategy that shall upgrade and improve the mixed use commercial and industrial activity along busy roads. Below are some of the major economic corridors within the city of Kigali:

- BRT corridor connecting CBD to KBC;
- Airport Boulevard connecting KBC to current Kigali International Airport;
- BRT corridor connecting KBC to Kimironko mixed use commercial Fringe Centre; and
- BRT Corridor connecting Kicukiro Fringe Centre to Gahanga Regional Centre and further connecting to the new Airport at Bugesera;

The Commercial Mixed Use Plan proposes to provide 20 sqkm of commercial mixed use space in total which amounts to 2.8 % of total land.

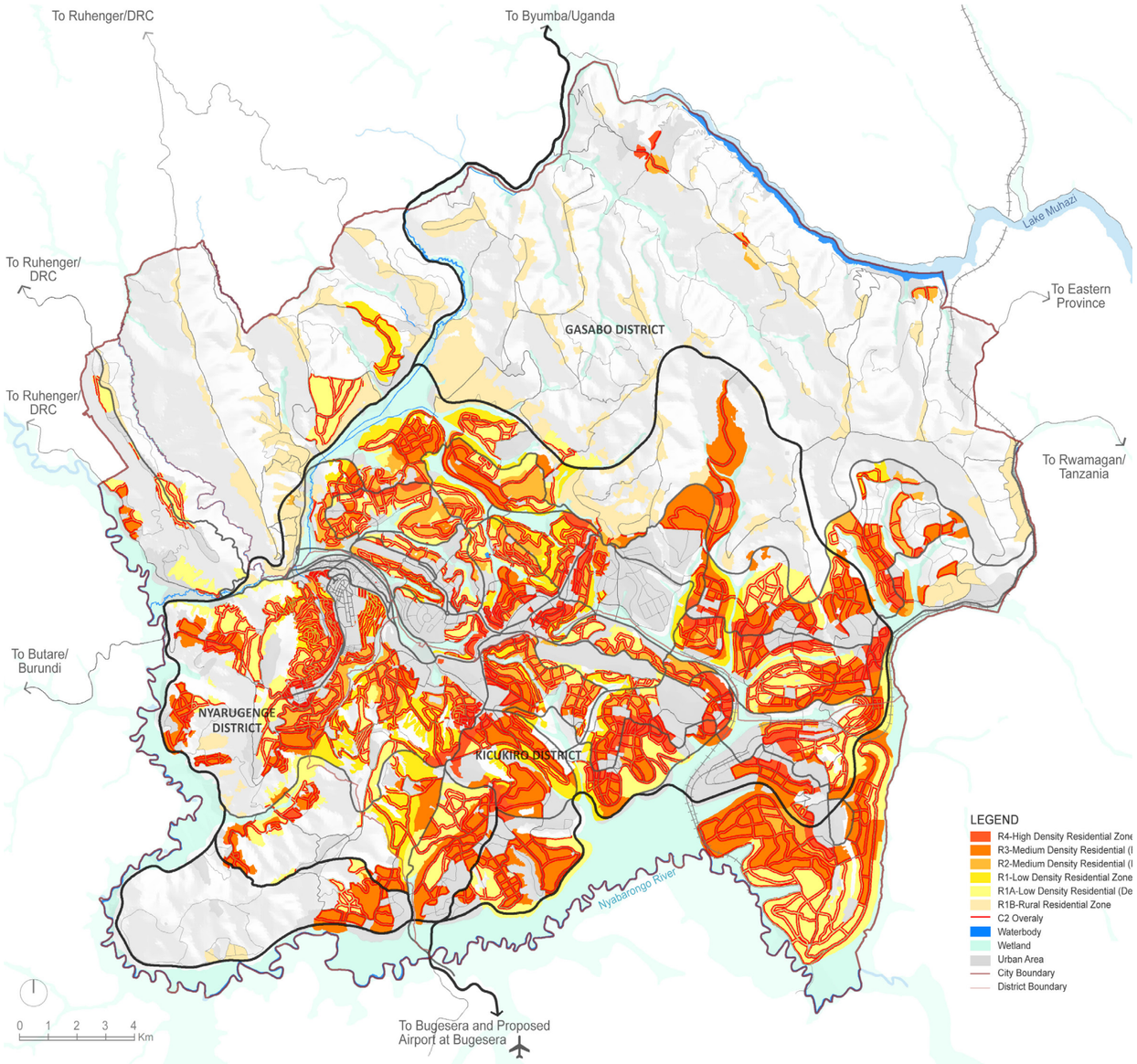


Figure 7.6 Kigali Master Plan 2019 - Proposed O - C2 Zone

63.5% of the commercial mixed use areas in Kigali is proposed to be developed as C1 (Mixed Use Commercial Zone).

36.5% of the commercial mixed use areas in Kigali is proposed to be developed as C3 (City Level Mixed use Commercial Zone).

O-C2: NEIGHBOURHOOD COMMERCIAL ZONE OVERLAY

AThe Neighbourhood Commercial Zone Overlay (O-C2) within residential zones creates attractive establishments and such developments along minor arterial and collector roads allow for compact and active mixed-use developments with a commercial frontage.

The intent of this overlay is to maintain and enhance the vitality of neighbourhood, provide compatible services near one another, and allow diverse uses, based on the demand. This integrated and compact development pattern of neighbourhood creates a walkable and transit-friendly environment. The C2 Overlay also allows for small-scale, affordable commercial solutions at the neighbourhood level.

The location and size of these neighbourhood level commercial uses within residential areas are dictated by market demand based on the residential population and needs of the residents. Thus, to promote a vibrant neighbourhood environment within the city of Kigali, the neighbourhood level mixed use commercials are suggested as an overlay to provide the flexibility for these commercial uses to follow market demand and retail trends as the city evolves.

These mixed-use zones are likely to work best along main streets which carries most traffic within the neighborhoods. This has been used as a guiding principle for the overlay and 30-metre buffer from the minor arterial and collector roads passing through the residential zones have been marked in the overlay that should allow commercial mixed use to be planned in the neighbourhoods.

7.3 Industrial Plan

According to the existing Industrial distribution in Kigali, the Kigali Special Economic Zone (SEZ) located in Nyandungu, has been designated and developed to accommodate small- and large-scale industries including: heavy and light manufacturing industries, large scale users industrial plants, wholesalers, chemical, pharmacy and plastics, warehousing, tourism and service industry and telecommunications. The KSEZ was created through the merger of the former Kigali Free Trade Zone and the Kigali Industrial Park projects. It has been growing with more industries relocating in the SEZ from the industrial park of Gikondo, the largest clusters of heavy polluting industries and warehouses in the heart of the city sitting on and along the wetland protected area.

The Gahanga Regional Centre proposed in the 2013 Master Plan, which is well connected with the city centre as well as the proposed Bugesera International Airport, has also developed as one of the key growth nodes in suburban Kigali. Other major industrial nodes in Kigali are Kanyinya industrial area, Gatsata industrial area and Kigali logistics platform.

Other than the key industrial sites planned in the city, some industrial clusters are also scattered along the Kigali-Gatuna Road in Gatsata, Gasabo district. These include heavy industries for petroleum storage, chemical and clay farm, light industries and warehouses. Some new warehousing facilities have also been established in the proposed light industrial zone of Kanyinya in Nyarugenge district.

There have been suggestions from stakeholders including concerns raised by MINICOM regarding lack of affordable housing and social infrastructure for workers close to the planned industrial areas – KSEZ and other industrial parks. People are forced to travel longer distances to work in these areas as there is lack of housing and social infrastructure around these industrial clusters. While the master plan 2013 suggested the development of integrated industrial parks with worker housing and social infrastructure, according to RDB and MINICOM who are in charge of SEZ and business parks, the city has been facing many challenges related to implementation that impacts the overall quality of urban environment for workers within these industrial areas. The current master plan proposes strategies to address these issues of planning and implementation to create safe 'live-work-play' environment within the industrial estates. It is essential to have industrial areas evenly distributed across the urbanized area of Kigali, so as to ensure availability of jobs near homes.

The Master Plan proposes low impact industrial uses and integrated industrial development in all industrial areas creating a safe 'live-work-play' environment with self-contained industrial parks with housing and social infrastructure within the industrial estates, avoiding long travel time and resources for workers.

The Master Plan proposes to safeguard land for dedicated and consolidated industrial estates for both light and general Industrial uses. Different types of industries are aggregated into clusters with public facilities, social infrastructure and worker housing. This approach provides the following benefits:

- Control pollution by regularizing heavy industry locations and providing collective waste management;
- Making better use of existing and planned infrastructure;
- Encouraging collaboration, healthy competition and innovation amongst businesses from clustering; and
- Creating self-sustaining, integrated industrial areas

As per the socio-demographic projections the industrial sector will have 28,953 Jobs by 2050. The industrial sector will represent 7% share of employment in Kigali and proposed Industrial Plan addresses the strategic distribution of these jobs in Kigali.

17.9 Sq.km of Industrial space in total which amounts to 2.45% of total land, and provide working space for 294,092 people

Most of these industrial clusters are located along the public transit corridor for easy connectivity and access. Industrial areas and warehousing are also proposed adjacent to freight railway infrastructure for better logistics access and connectivity. However, the siting of the industrial areas are also based on key criteria such as pollution (air, noise), size of the industry, proximity to environmental sensitive areas etc. Heavy industries which create more pollution (air, noise etc.) are proposed to be located far from residential areas. The light industries which create lesser pollution are proposed to be closer to residential areas with micro/clean industries located within residential neighborhoods.

The Master Plan proposes the warehousing and wholesaling to be located at the edge of the city considering the amount of traffic they generate. However, smaller transfer stations can be located in more central areas.

It is planned for micro/small scales activities requiring small capital, that are essential for the neighborhood, to be located within the residential and mixed use zones, provided they are compatible with residential uses and the activities does not affect the residents.

Light Industries characteristically have low environmental impact than those associated with heavy industries and hence are usually located closer to residential areas. Besides the major industrial areas, micro-enterprise

Table 7.4 Proposed Industrial use zone distribution in Kigali

Zoning	Description	Area (Sqkm)	%
I1	Light industrial zone	13.4	75
I2	General industrial zone	4.2	23
I3	Mining/ Extraction/Quarry	0.4	2
	Total	**15.58**	**100**

industries serving the surrounding population such as printing companies, light building services, storage and retail warehouses, and other small clusters of SMEs etc. are planned to be also located within all the mixed use residential zones (R2, R3), providing jobs closer to homes.

The Master Plan proposes having an integrated industrial park model i.e. to create an industrial city with a complete environment which will give a certain quality of life to workers. This model will improve working efficiency and increase productivity.

4.2 sq km is proposed to be planned for general industries which will provide employment for 44,169 people by 2050.

13.4 sq km of land is proposed to be planned for light industries which will provide employment for 246,183 people by 2050.

It was mentioned in the Focus Group Discussion held on 11/12/2018, that MINICOM will look for potential investors to develop and manage industrial parks and that the Public Private Partnership model will be used to develop industrial zones.

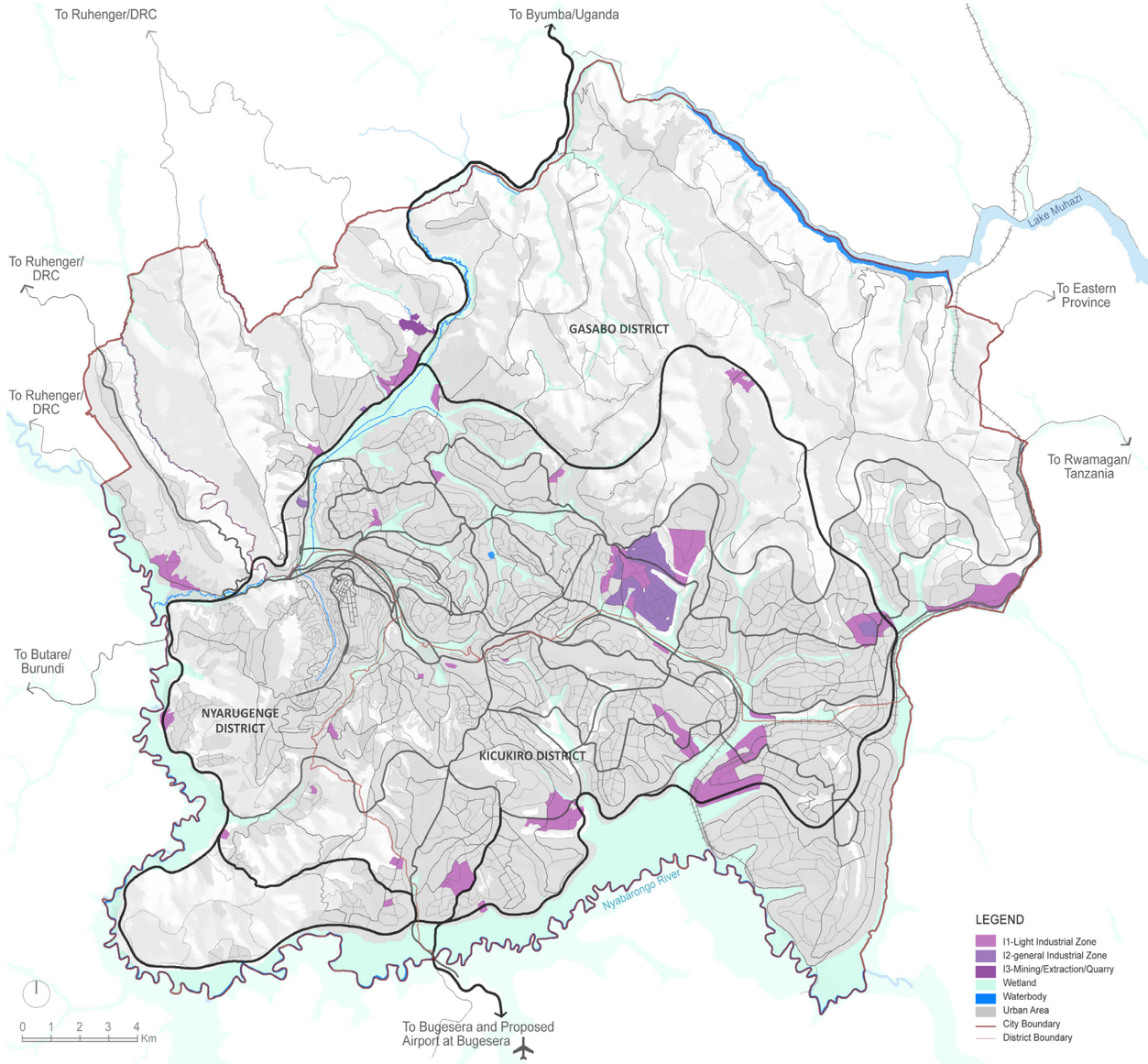


Figure 7.7 Kigali Master Plan 2019-2050 - Proposed Industrial Use Plan

8

Green City

8.1. Introduction and Description of Green Growth and a Green City
8.2. Existing Green Growth Initiatives
8.3. Review of 2013 Master Plan Green Growth Plans & Strategies
8.4. Green Growth Vision, Approach and Strategies
8.5. Green Growth Strategies
8.6. Environmental Management Strategy Plan
8.7. Wetlands and Waterbodies Management Plan
8.8. Forest and Biodiversity Plan
8.9. Agriculture Management Plan
8.10. Steep Slope Protection Plan
8.11. Climate Change and Disaster Resiliency
8.12. Green and Blue Plan

8 Green City

8.1 Introduction and Description of Green Growth and a Green City

Sustainable Cities and Communities is a one of the goals (no. 11) of the Sustainable Development Goals (SDGs) to be achieved by all nations in the world by 2030. The Green City development theme for Kigali Master Plan 2050 arises from the Rwanda's national green growth and climate resilience strategy.[1] The concept of Green Growth and a Green City underlying the environmental and natural resource plans in this update of Kigali City's master plan are based on the well-articulated definitions for Green Growth and Green Cities presented by the Rwanda Ministry of the Infrastructure (MININFRA) and the Global Green Growth Institute (GGGI) in the National Roadmap for Green Secondary City Development[2] (NR 2015).

In the NR 2015 Green Growth is defined as:

"Green growth….is growth that is compatible with protecting the environment, reducing carbon and other unwanted emissions, improving the rational use of natural resources, dealing with climate change, securing access to clean energy and water, and simultaneously targeting poverty reduction, job creation, and social inclusion."

Green Growth is further described in the NR 2015 as encompassing greener technologies and industries, ongoing environmental protection and preservation efforts that enhance development, environmental and social impact assessments (ESIAs), resource efficiency, and cleaner production. Green growth, which may be pursued along different paths and strategies based on the aspirations and context of each country, provides increasing economic opportunities, while mitigating environmental pressures.

A Green City is defined in NR 2015 as:

"A green city is a city designed with consideration of environmental and ecological impact, inhabited by people dedicated to minimization of required inputs of energy, water, and waste output of heat, air pollution, and water pollution. A green city is inclusive and enhances the well-being of citizens and society through integrated urban planning and management, harnessing the benefits of ecological systems, while protecting and nurturing them for future generations. Green Cities strive to function harmoniously with natural systems. They value their own ecological assets, as well as the regional and global ecosystems on which all people depend. To address climate change, a green city decouples economic growth from the use of fossil fuel resources by shifting society and the economy toward consumption that relies on renewable energy, energy efficiency, and green transportation."

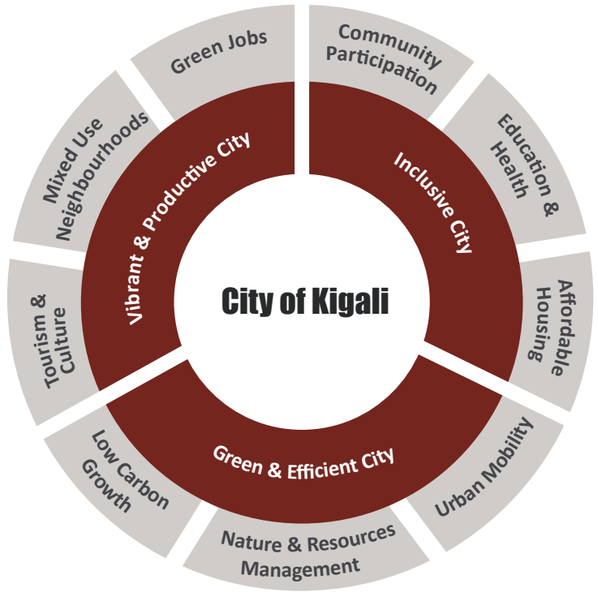


Figure 8.1 Updated Urban Sustainability Framework for City of Kigali

Green Growth is further described in the NR 2015 as encompassing greener technologies and industries, ongoing environmental protection and preservation efforts that enhance development, environmental and social impact assessments (ESIAs), resource efficiency, and cleaner production.

The approach to planning for a green city characterized by green growth is further guided by the principles of the Updated Urban Sustainability Framework[3] proposed for Kigali City in response to the environmental, social and economic issues faced by the city and the Vision for Kigali and Rwanda for 2050.

Green growth concepts and strategies are presented under the Green City development goal, and also integrated into the seven (7) other development goals agreed upon for the updated Kigali Master Plan.

1 Government of Rwanda . 2011. Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development. Kigali, Rwanda. November 2011

2 Government of Rwanda and GGGI (2015). National Roadmap for Green Secondary City Development. Kigali

3 Surbana Jurong 2018. Kigali Master Plan Review: Analysis & Visioning Report, Nov 2018

Table 8.1 Green growth considerations integrated into the Eight Development Goals of the Updated Kigali Master Plan

Development Goal	Key Theme	Green Growth Consideration
City of Excellence	Urban Planning and Urban Development	Participatory planning and implementation for green growth, land consolidation and readjustment for restoration and preservation of natural ecosystems and minimization of natural hazards.
	Quality of Life	Integrated mixed-use neighborhoods with green space (min. 15sqm per capita), resilient infrastructure, efficient natural resource use and reduced pollution and waste.
	Governance	Financing of green growth projects, improved coordination and capacity building for green growth and integrated environmental management, recommend development of plans and handbooks for integrated environmental and natural resource management.
City of Integrated Neighborhoods	Affordable City	Sustainable use of locally sourced building materials, development of accessible parks and green spaces for recreational use.
	Housing & Densities	Compact integrated communities for efficient resource use and promotion of greener modes of transport.
	Informal Settlements & Economies	Resettlement for restoration of protected or hazardous natural area and upgrade of informal settlements with access to public green space, enhanced climate change and disaster resilience, improved environmental health.
	Services at Neighborhood Levels	Access to basic services important for well-being and environmental health, climate resilient service provision, access to green space (min. 15sqm/capita).
City at Work	Economic Development, Commercial & Retail, Industries & Construction	Promote green economy with green jobs, sustainable use of natural resources and ecosystems, development of eco-tourism and green industries, development of value-added agriculture and agro-processing.
	Productive City	Framework for formalizing informal economic activity which facilitates adoption of green technologies and enforcement of environmental regulation.
Green City	Natural Resource Protection	Natural resource preservation, restoration, conservation and sustainable use.
	Agriculture & Forestry	Preservation and enhancement of sustainable agriculture, preservation and expansion of sustainable forestry and agro-forestry, creation of neighborhood parks and other public spaces with trees.
	Green Growth & Climate Change	Green growth for sustainable development, reduction in greenhouse gas emission, resiliency to impacts of climate change.
	Disaster Risk Reduction & Resiliency	Disaster risk reduction, resiliency to natural disasters (including those associated with climate change), protection of steep slopes, restoration of important and fragile ecosystems, integrated environmental management plans.
City on the Move	Public Transport Transit-Oriented City	Development of a transit-oriented city with more sustainable transport modes such as mass public transport and non-motorized transport.
	Road Network	Development of streetscapes with trees and green spaces, development of road network favoring mass transit and non-motorized transport.
	Freight Management	Promote adoption of green technologies and cleaner transport modes in freight and logistics industrial sector.
	Green Transport	City-wide non-motorized green transport network, design to include amenities and infrastructure for cycling and pedestrians, development of streetscapes with greenery/trees, provision of amenities to encourage mass transport.
Efficient City	Water Supply	Water resource conservation, integrated water resource management, environmental health.
	Sanitation	Pollution control, environmental health.
	Storm Water	Watershed management, flood management, and pollution control, environmental health.
	Solid Waste	Resource conservation (reduce, reuse, repurpose, recycle), pollution control, environmental health.
	Electricity	Energy resource conservation, renewable energy production, pollution control, reduction in greenhouse gas emissions.
	Fibre	Green technologies for monitoring environmental issues, access to information for sustainable resource management and green growth.
City for Citizens	Inclusive City	Promote integrated mixed use and mixed income development with access to green spaces, green transport, resettlement and upgrading of informal settlements for restoration of protected and hazardous areas, and improvement of access to reliable and resilient services important for environmental health.
	Education	Integration of green building, green spaces, and resilient efficient services for education facilities, awareness and capacity building on environmental issues and green growth policies.
	Health	Integration of green building, green spaces, and resilient efficient services for health facilities, awareness and capacity building on environmental issues and green growth policies; improvement of environmental health through plans for resilient infrastructure and services and pollution control.
	Disabled People & Disadvantaged Groups	Access to resilient infrastructure and services and green spaces.
Creative City	Tourism & Culture	Promotion of eco-tourism, restoration and conservation of natural ecosystems for eco-tourism and recreational use, creation of public open/green spaces for recreational and cultural activities.
	Vibrant City	Mixed use development and public spaces conducive to a vibrant community life in the city.
	Heritage	Preservation of historical places including natural features and ecosystems.

Kigali Environmental Profile

Natural Landscape

The City of Kigali is situated at altitude range of 1300-2100 masl in a landscape characterized by hills with rivers and wetlands in the valleys below. These features combined with a mild climate contribute to the natural beauty of Kigali City and its attractiveness to residents and visitors. The steeply slope hills are covered by forest and farmland and the wetland and river floodplains are largely under agricultural use, though there is noticeable encroachment from urban development extending up some slopes and down into the wetlands. Preservation, restoration and sustainable use of these defining environmental features of Kigali, that is the sloped upland, forest and wetland ecosystems, and agricultural land have been identified as priorities for pursuing green growth and earning green city status. These green growth strategies are complemented by those environmental protection and enhancement strategies integrated into the other development goal plans, towards Kigali becoming more holistically a green city.

Environmental issues and challenges

The environmental issues and challenges faced in Kigali are similar to those observed in urban centers across Rwanda and much of the East Africa region including: land degradation, deforestation, dependence on biomass as cooking fuel, soil erosion and siltation, water pollution, air pollution (including indoors), polluting transport system, degraded natural ecosystems, lack of green construction of housing and infrastructure, poor waste management, electronic waste, hazardous chemicals and materials waste, and limited coordination in environmental governance.[1,2] The growing impact of climate change is another environmental concern, as over the past decades Rwanda has experienced climate change with a 0.35°C increase in annual mean temperature per decade since 1970 and changes in rainfall[3], where intense rain events can be a cause of natural hazards including flooding and landslides.

Among the more pronounced and widespread environmental challenges facing the natural environment in Kigali are the following:

- Urbanization and subsistence farming extending into naturally vegetated and forested areas leading to de-vegetation, biodiversity loss, topsoil erosion, and hydrological and water quality impacts downstream. Greenhouse gases are released from related activities such as burning of vegetation to clear areas for cultivation (releasing carbon dioxide), and cattle and rice fields both releasing methane;

- Alteration (e.g. drainage and filling) of wetland and river floodplains for settlement, cultivation, and grazing, leading to loss of wetland area, degradation of existing wetlands, and loss of valuable wetland services. Wetland and river flood plains naturally experience flooding and thus any people, livestock, crops, and structures within those areas at a high risk of being directly impacted by flooding;

- Increase in impervious surfaces, reduction in forest cover, and alternation of natural drainage areas of the watersheds of the City, leading to flooding and landslide and sanitation risks, soil erosion and sediment transport, and changes to the hydrology central to healthy river and wetland ecosystem functioning;

- Steeply (>30%) sloped land with a medium to high-risk of erosion occupies about 7% of the total land area of Kigali. These slopes present a landslide and stormwater flooding hazard to people residing or undertaking activities on or immediately below such slopes, as well as risk of damage to structures or infrastructure on or below the slopes. The risk is compounded by any deforestation, cultivation or urbanization activities which may take place on or upstream of the slopes; and

- Human consumption, construction, and industrial activities leading to intensive natural resource extraction and polluting waste products release with local, regional and global impacts. Impacts include:

    1. Mining of clay, sand, and rock for construction materials, impacting rivers and wetlands;

    2. Harvesting of trees for construction and firewood and charcoal production, degrading naturally vegetated ecosystems;

    3. Burning of wood and charcoal as a cooking/heating fuel source, causing indoor and outdoor air pollution and release of greenhouse gases;

    4. Combustion of fossil fuels in transport, power generation, and fossil fuel powered industrial systems, releasing air pollution and greenhouse gases and noise pollution; and

    5. Solid and liquid waste disposal leading to untidy and hazardous spaces, soil and water pollution, air pollution (from burned waste and gas emissions), and health hazards to humans, animals and natural ecosystems

Environmental management

Diverse efforts are undertaken by the City, non-governmental and community organizations and private companies and citizens to tackles these and other environmental issues and challenges.

A legal and regulatory framework has progressively been established, along with the institutional framework to enforce the regulations and plan and implement programmes and projects for environmental protection and restoration. Kigali Master Plan 2013 provided a description of these and proposed various strategies and catalytic projects for addressing environmental issues and challenges. Changes and progress have been made in the evolution of the regulatory and institutional framework in the years since the 2013 Master Plan was prepared, complemented by growing collaborative efforts to implement environmental initiatives. However, for various reasons (particularly financial and human resource constraints) many of the recommended strategies and catalytic projects have yet to materialize.

Many of those environmental management elements of the Master Plan 2013 are still valid and important for addressing Kigali's environmental issues and will be retained in this Updated Master Plan 2050, while some additional strategies will be introduced in an attempt to create a more conducive framework for sustainable actions towards protecting the City's environment and fostering green growth.

1 Rwanda Ministry of Environment. 2018 DRAFT. National Environment and Climate Change Policy. Draft Report. Accessed 04 March 2019. http://www.environment.gov.rw/fileadmin/Environment_Subsector/Laws__Policies_and_Programmes/Useful_documents/Final_Draft_Environment_and_Climate_Change_Policy.pdf

2 REMA 2013. Kigali State of Environment and Outlook Report 2013. Rwanda Environment Management Authority. P.O. Box 7436 Kigali, Rwanda.

3 Government of Rwanda (GoR), 2011. Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development. Kigali, Rwanda

8.2 Existing Green Growth Initiatives

Numerous green growth initiatives have been introduced in Rwanda since the launch of the Kigali Master Plan in 2013. Among these initiatives are green initiatives started by GGGI, the leading institution in promoting green growth in Rwanda. These include:

- Enhancement of green growth of secondary cities aimed at reducing the pressure of urbanization of the Capital City;
- Institutional capacity building on green growth and urbanization;
- Support in leveraging green growth financing; and
- Integrated Planning and Data Management

Ongoing efforts and projects in the pipeline for improving the urban natural environment by GGGI and other institutions include:

- Proposed master plan development for Lake Muhazi eco-tourism project;
- Initiatives to establish a wetlands master plan;
- Inventory of illegal activities in all urban wetlands (mapping, identification, photos). Monitoring system to be designed;
- Monitoring of urban wetlands using drones and establish drone-based imagery-orthophotos of wetlands and their buffer zones;
- Development of the 130 ha Nyandungu Urban Wetland Eco-tourism Park, which will restore and conserve wetland ecosystems and biodiversity while also serving as a recreational park;
- Ecosystem Rehabilitation focusing on Urban wetlands (Nyandungu and Kimicanga);
- Proposed waterfront development along Muhima wetland around the CBD;
- Detailed Sub- Catchment Management Plans for Gikondo and Nyabugogo Wetland Systems;
- Terracing and increased reforestations for protection of steep slopes and prevent landslides, erosion and flooding;
- Development of a Pedestrian Street (Car Free Zone) along a section of KN4 Avenue, adjacent to City Hall;
- Beautification and maintenance of existing green urban spaces and pedestrian corridors; and
- Umuganda (community service) street clean ups, reforestation and erosion control, and protection of river banks. Umuganda is a community service day that occurs for three hours on the last Saturday of every month in Rwanda. It was institutionalized with the passing of Organic Law Number 53/2007 governing community works and later with Prime Ministerial Order Number 5803

8.3 Review of 2013 Master Plan Green Growth Plans & Strategies

The Kigali City Master Plan released in 2013 effectively integrates green growth considerations and strategies into the proposed land uses and zoning, neighborhood and city layout, infrastructure and services plans, transportation master plan, and natural areas conservation. Many of the

Table 8.2 Goals and Strategies towards achieving the Green City development goal

Issue	Strategies	
	Master Plan 2013	Master Plan 2050
Existing Forest	Protected areas, Zero net loss of existing forests and biodiversity areas; Slope restoration	Protect forests allowing for recreational activities, agriculture and local material extraction in agreement with authorities. Zero net-loss of existing forests
Afforestation & No Development Zone	Slopes>40% Appropriate slope management and protection; use of native plants for afforestation	Slopes>30% Protects steep slopes and eco fragile areas No development on steep slope (conditional low intensity developments) Relocation of unplanned communities in steep slopes and restoration / reforestation of slopes above 30% Afforestation in slopes > 60%
Conditional Use (Urban Area)	Slopes 40% to 20% Use subjected to EIA, appropriate slope management and protection strategy	Slopes>30% to 20% Mandatory soil stabilization of all slopes (both public areas & private developments)
Farming & Forestry/ Conditional Use (Rural Area	Slopes 40% to 20% Suitable farming & forestry along the slopes Conditional use subjected to EIA, appropriate slope management and protection strategy	Slopes>30% to 20% Creation of innovative urban agriculture for slopes > 20% Comprehensive management plan for agriculture and agro-forestry along steep slopes Reforestation to restore former forests
Developable Area (Rural Area)	Slopes <20% • Land consolidation and agricultural modernization	Slopes <20% • Preserve fertile agriculture lands and use land consolidation method to increase food productivity • Plan for management of agricultural practices in wetland areas
Natural Drainage Channels	• Protection of existing drainage lines and implementation of 20m to 50m buffer from the development.	• City-Wide Watershed and Storm Water Management Plan • Incorporate Integrated Water Resource and Storm Water Management Strategies • City-Wide Flood Management Plan
Wetlands	• 20m buffer to the wetland boundary established by REMA, • Zero loss of existing wetlands	• 20m mandatory buffer for all wetlands (Organic Law) • Zero net-loss of existing wetlands • Restoration of wetlands encroached for urban uses • Protect wetlands allowing for recreational activities, agriculture and local material extraction in agreement with authorities • Kigali Wetland Management Plan • Plan for management of agricultural practices in wetland areas
Rivers & Lakes	• 10m mandatory buffer for rivers • 50m buffer to the lake boundary established by REMA.	• 100% conservation of all water bodies • 10m mandatory buffer for rivers • 50m mandatory buffer for lakes (Organic Law)
Parks & Public Open Spaces	• Existing scattered patches of nature areas to be developed as city & community level nature parks	• Cluster and inclusionary zoning regulations to create more public open spaces • Establishment of networks of parks and natural areas across the City and neighborhood nature parks
Disaster Risk Reduction & Resiliency		• City-Wide Flood Management Plan • City-Wide Watershed and Stormwater Management Plan (including Slope Management Plans)
Climate Change		• A citywide climate change management plan with projects and guidelines • Tax exemption and climate financing opportunities as incentives for all energy efficient development

Table 8.3 Overview of the Environment components of the Updated Urban Sustainability Framework for Kigali City

Components	Key Issues	Direction	Challenges	Recommendations
ENVIRONMENT: GREEN AND EFFICIENT CITY	NATURE AREAS: • Urban areas prone to land slides and flooding • Unplanned developments on steep slope • Deforestation • Encroachment of wetlands	• Clearance of cevelopment in Steep Slopes wetlands and acquire land for relocation • Restoration of steep slopes and wetlands • Afforestation	• Implementation mechanism and cost of land acquisition & relocation • Cost for programming and implementation restitution of nature areas	• Conserve all slopes above 30% • Conserve all wetlands • Prepare redevelopment schemes to relocate people from steep slopes and wetlands • Prepare strategies for rehabilitation and for management of slopes, forests and wetlands • Explore possibilities for sustainable exploitation of nature areas for economic gain-creation of green jobs
	RESOURCES & CARBON FOOTPRINT: • Sprawling low rise development • Expanding Urban areas • Need for extended inrstructure/ transportation facilities • Increasing pressure on energy and resources • Increasing carbon footprint	• Green growth development • Compact city development • Sustainable resource management	• Affordability of instensified and densified development • Cost for high capacity transport infrastructure • Efficient use of resources	• Limit urbanization boundaries • Identify potential high-density mixed-use zones • Reduce sprawling development and hence reduce infrastructure/ transportation cost • Explore possibilities for green mobility and city greening to counter increase in carbon footprint • Explore integrated management system for energy, waste, water etc.

greening growth plans and strategies from the 2013 Master Plan remain relevant and can be retained and integrated into plans and strategies for the new themes of development of the Updated Master Plan (2019). In the five (5) years since the 2013 Master Plan went into effect, there has been continued population growth and land use changes in the City of Kigali as well as introduction of new policies and regulations by the Government, which together with the extension of the planning timeframe to 2050, necessitate updating and realignment of some green growth plans and strategies in the Updated Master Plan. Comments[4] collected from diverse sources during the review of the 2013 Master brought attention to the need for: green/ natural open public spaces at the neighborhood level; improvement of conditions in unplanned settlements; preservation of agricultural land and limiting urban sprawl; protection, restoration and recreational use of wetland and waterbodies, use of wetlands for agriculture and clay extraction; and adaptability to climate change. The Updated Master Plan will take into consideration these comments and introduce additional strategies for management of natural resources and ecosystems in the city landscape, as well as consideration of resilience to climate change and natural disasters in infrastructure, services and land use plans.

A key reason for updating the Kigali Master Plan 2013 is to incorporate more stakeholders into the process of reviewing, shaping and implementing the city's Master Plan. Participatory planning and implementation are crucial for successful progress and achievement of the green growth plans and strategies for Kigali. Systematic effort has been made to integrate such enhanced stakeholder input into the development of this Updated Master Plan and in the strategies proposed for achievement of the development goals collectively identified and selected for Kigali City.

4 Kigali Master Plan Review: Comments Collected, Nov 2018

The Analysis & Visioning Report introduced the main focal areas, planning approaches and strategies for achieving the City's development goals, including the goal for Kigali to function as a Green City (See Table 8.3)

8.4 Green Growth Vision, Approach and Strategies

This section presents the Vision, Approach and Strategies for green growth to be integrated in Updated Kigali City Master Plan 2050, based on situation analysis, proposed MP (land use and infrastructure), policy framework, GGGI recommendations, and stakeholder/focus group input/ comments.

Comparative analysis of the current land use in Kigali with land use at the time of preparation of the 2013 Master Plan indicates a negative trend in terms of the land area under natural or green spaces (including agricultural area), except for water bodies area which increased.[5] Observed continued encroachment of natural areas, increased pressure on natural resources and a growing carbon footprint, are associated with rapid urbanization and economic and population growth in Kigali. These environmental and natural resource issues are a basis for the Environment component of the updated urban sustainability framework proposed for the City as presented in the Analysis and Visioning Report (see Table 8.4).

5 Surbana Jurong. 2018. Kigali Master Plan Review: Analysis & Visioning Report, November 2018

The areas under protected zones like forests and wetlands, wetland buffers, nature restoration projects, slopes above 30% have been updated in MP 2050 (Figure 8.2).

The issues and broad strategies identified as the focus of efforts towards Kigali becoming a Green City include:

- Protection and Conservation of Slopes, Wetlands and Forests, allowing for regulated sustainable use in less fragile areas for recreational activities, agriculture, and local material extraction in agreement with authorities;
- Restoration of wetlands, waterbodies and forests encroached upon by human livelihood and urbanization activities and relocation/resettlement of households inhabiting restricted and hazardous areas;
- Preservation of net area of agricultural lands, while boosting productivity through agro-ecological best practices, reduced reliance on inorganic fertilizers and pesticides, and development of irrigation systems;
- Promotion of agroforestry and sustainable forestry favoring native species to restore ecosystem services such as watershed protection, slope protection, and production of timber, fuel wood, fruit, nuts, medicine, etc.;
- Leveraging natural resources for green economic activities including: creation of wetland parks, recreational parks, green hiking and biking trails, and sustainable harvesting of forest and wetland resources; and

32.25% of the land in Kigali City falls under protected zone (P4). Figure 8.2 shows protected areas under different categories.

Table 8.4 Development Constraints and Protected Areas

Zone	Constraints/ Protected Areas	Area (Sq.km)
P3B	Existing Forests	71.1
P3C	Above 30% slope	42.1
P3C	Existing Maintained Forests (Gentle Slopes)	10.0
P3C	Existing Maintained Forests (Steep Slopes)	29.5
WB	Waterbodies Zone	2.0
W	Wetland	75.1
	Wetland Buffer	2.7
		232.5

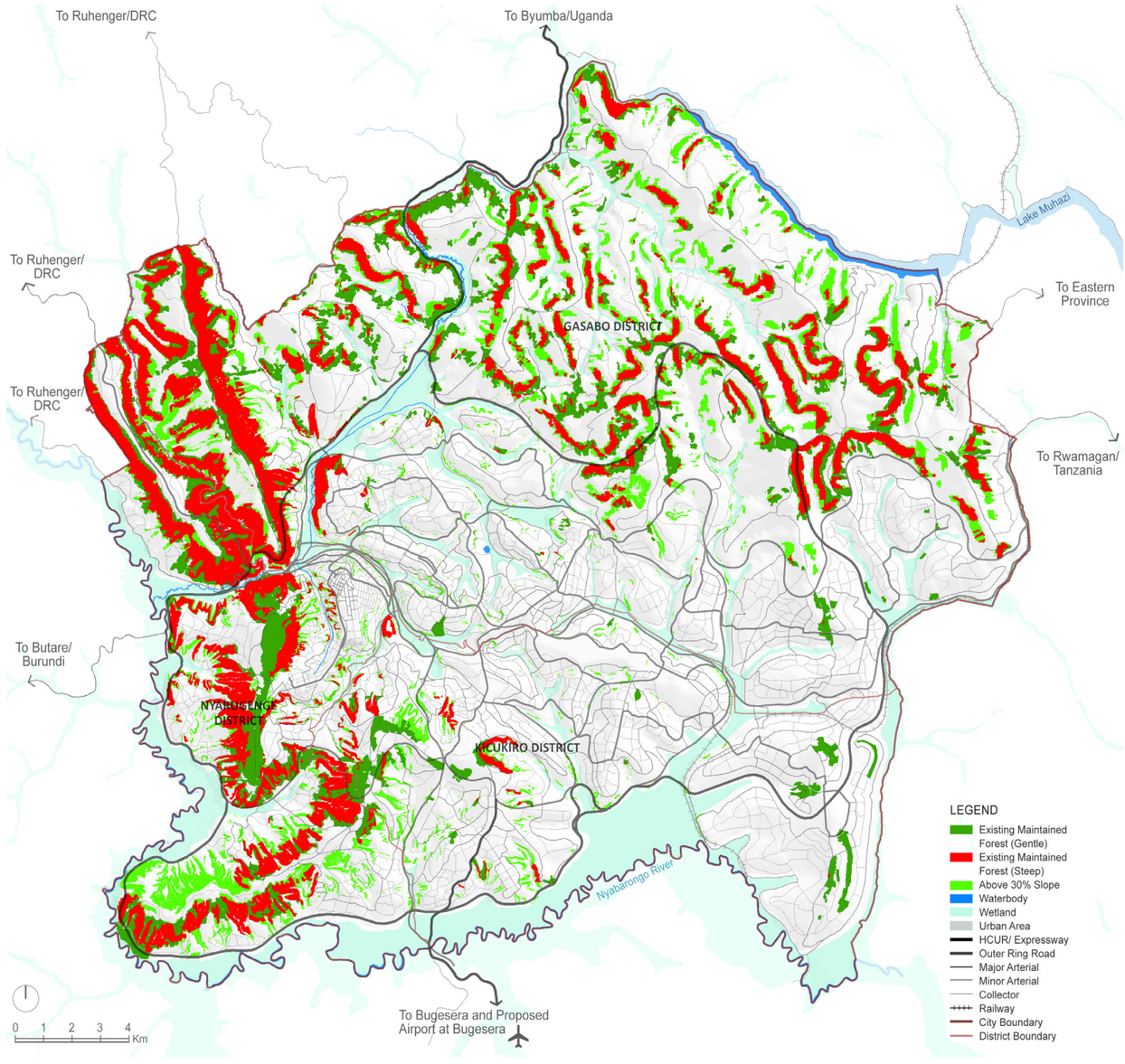


Figure 8.2 Protected zones and land under development constraints in Kigali

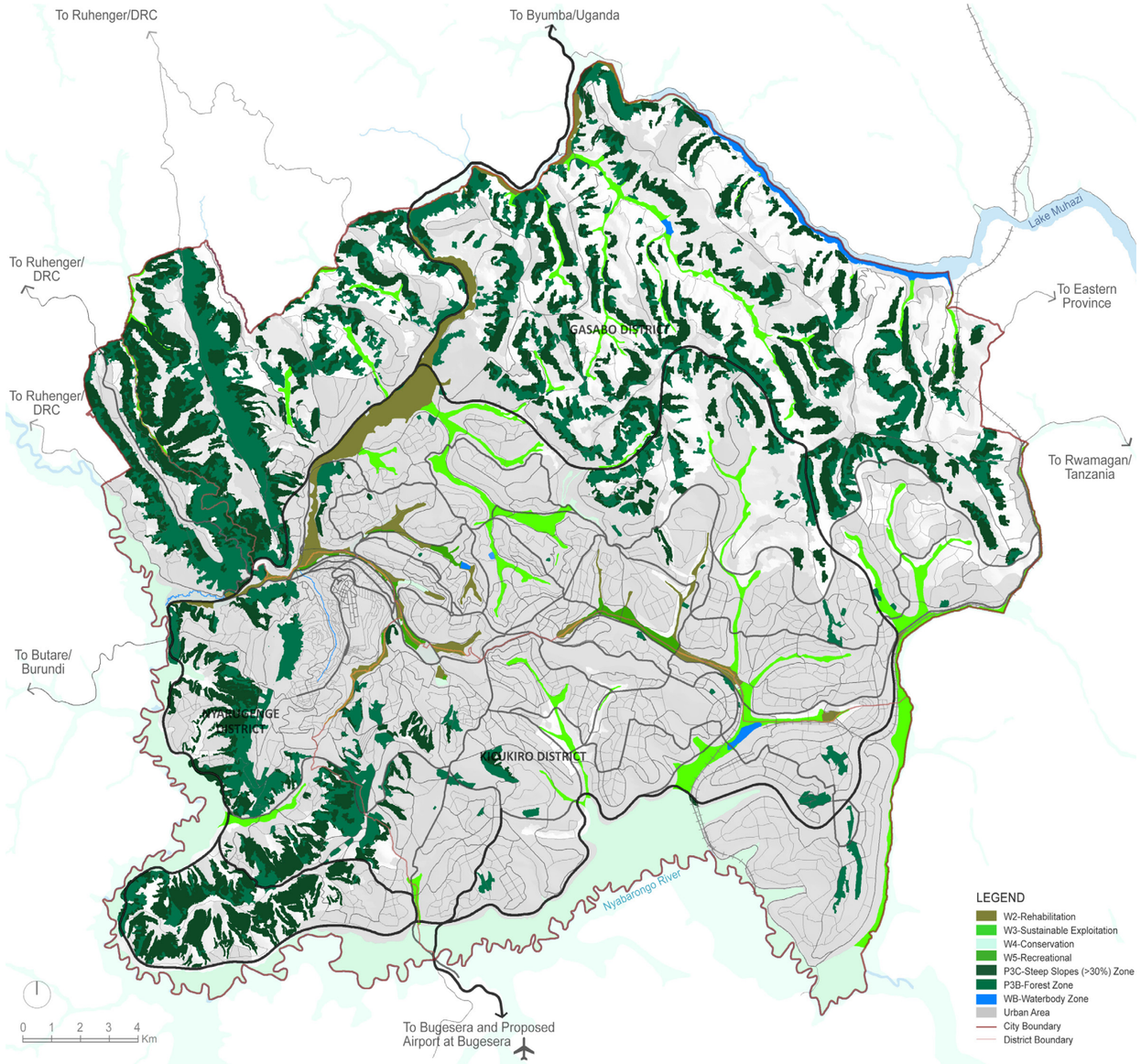


Figure 8.3 Protected zones and land under development constraints in Kigali

- Planning for compact and integrated development with green transport, efficient services, green buildings, resilient infrastructure, and inclusionary zoning and design regulations for improved livelihoods and universal access. Development of integrated environmental management plans including: Integrated Water Resource Management Plan (with Watershed Plans/Strategies and Stormwater Management Plans/Strategies)

The following sections elaborate on these proposed approaches and strategies intended to guide and structure progress towards achieving the Green City development goal for Kigali.

8.5 Green Growth Strategies

Green growth in Kigali City towards becoming a Green City requires collaboration from a wide range of institutional and individual stakeholders, bolstered by increased awareness and participatory action by the residents and visitors of Kigali. A participatory approach is fundamental for sustainable resource use and environmental management towards establishing a green economy while also preserving natural ecosystems and their functions and services. The environmental and natural resources affect and are impacted by all facets of urban life and economy, thus green growth initiatives and strategies must be integrated into all eight (8) development goals agreed upon for the Updated Kigali Master Plan.

The Master Plan includes strategies for green growth relevant to each respective development goal, including the following:

- **Sustainable Management of natural resources:** Preservation, restoration, conservation and sustainable use of natural resources in the city, including: land conservation (slope management and management of impacts on sensitive areas); soil conservation (erosion control); water resource management (watershed protection, water conservation and stormwater management); wetlands and waterbodies conservation, restoration and sustainable use; forest conservation; reforestation, and sustainable use; and air quality protection.

- **Green City / Green Neighborhoods:** Design compact, inclusive, mixed-use neighborhoods, with green buildings and green infrastructure and services including green transportation, efficient services, climate and disaster resilient infrastructure and services, green open spaces for recreation, and opportunities for green economic activities and jobs;

- **Green Building:** Finalization and adoption of local green building certification system and enforcement of green building regulations. Capacity building of construction sector experts on green building best practices and achieving regulatory requirements;

- **Green Transport Design and Plans:** Promoting mass transportation, non-motorized transport, pedestrianization of the city, development of network of green trails, planting of trees as part of streetscaping, and low-impact access-friendly transport infrastructure with permeable pavement and stormwater drainage system integrated swales, and constructed wetlands;

- **Efficient and Sustainable Services:** Improved access to safe water, sanitation, waste management, energy and ICT services. Conservation of water and energy use and waste production to 20% below international norm;

- **Climate and Disaster Resilient Infrastructure and Services:** Integrating climate and disaster resiliency into planning and design of buildings, infrastructure, and urban services to adapt to and minimize negative impacts from and contribution to climate change and natural disasters. Identification and mapping of natural disaster risk and hazard areas (e.g. flooding, erosion, landslides, earthquakes, and lightning strikes), restriction of development and activities in high risk areas, relocation of households from high risk/hazardous areas (e.g. flooding, erosion, landslides, earthquakes, and lightning strikes), restriction of development and activities in high risk areas, relocation of households from high risk/hazardous areas, preparation of early warning system, preparation of disaster response plans, and design of resilient infrastructure and services to minimize the impacts and disruptions from common natural disasters; and

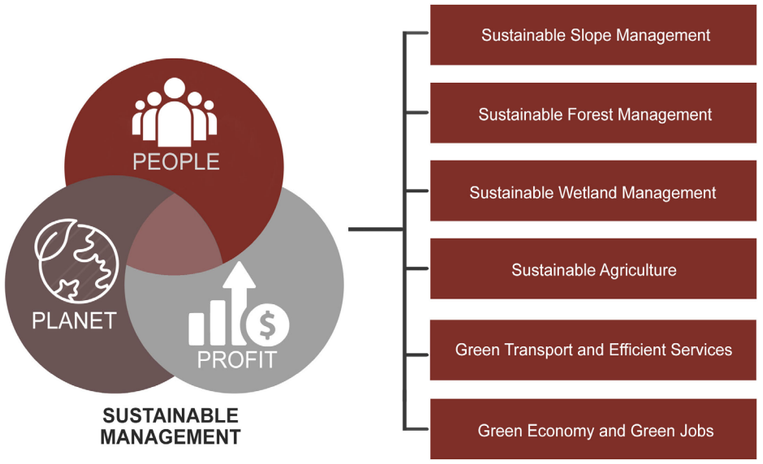


Figure 8.4 Sustainable Management of Resources

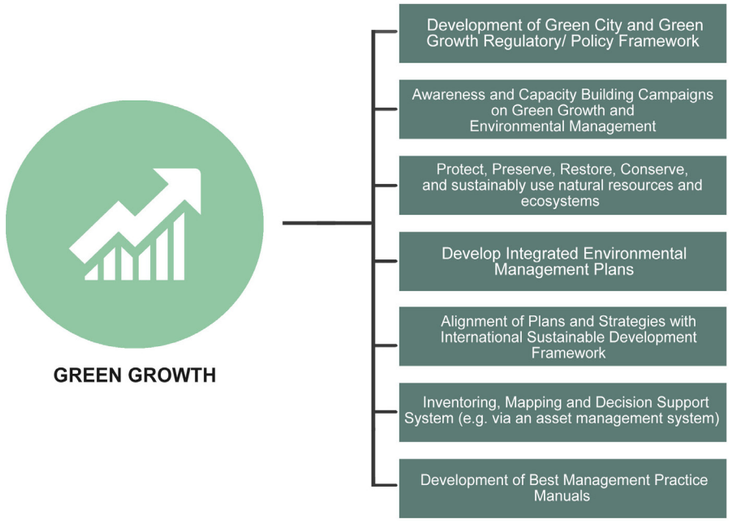


Figure 8.5 General strategy framework for realization of sustainable green growth in accordance with the Master Plan

- **Green Economy and Green Jobs:** Development of industry, services, eco-tourism, agriculture, and jobs promoting sustainable, least-impactful, low-carbon, ecosystem protecting, resource conservation and waste/pollution reduction and recycling technologies and practices

8.6 Environmental Management Strategy Plan

Environmental management in an urban context addresses the preservation, restoration, conservation and sustainable use of natural resources, natural ecosystems, and man-made urban environments, towards achieving sustainable green growth beneficial to the environment, community and economy. The environmental management strategies and recommendations presented here are intended to guide land use decision-making during planning and implementation of Master Plan 2050. Protected and sensitive ecosystems (e.g. steep slopes), wetlands and water bodies, forested land, agricultural lands, and natural and designed open green spaces form an overlay influencing and structuring the zoning and development guidelines of the Master Plan Environmental considerations form an important part of the requirements during the development approval process for land in the city.

KEY GOALS FOR NATURAL ENVIRONMENTAL MANAGEMENT AS DESCRIBED IN MASTER PLAN 2013

- Manage abundant wetlands and water bodies
- Improve farming and forestry
- Conserve diminishing forests and biodiversity
- Protect steep slopes and watershed areas
- Protect open spaces and allow access to natural amenities
- Integrate natural landscapes with the urban landscapes

8.6.1 Environmental Management Goals

The main goals being pursued through the environmental management plans of Master Plan 2050 are:

- Natural resource preservation, restoration, conservation and sustainable;
- Preservation, restoration, conservation and sustainable use of wetlands and water bodies, and protection of watersheds;
- Preservation and expansion of sustainable forestry and agro-forestry;
- Preservation and enhancement of sustainable agriculture;
- Protection of steep slopes, restoration of important and fragile ecosystems;
- Integration of natural areas into the urban landscape through creation of parks and other public spaces with trees and natural vegetation;
- Green growth for sustainable development, reduction in greenhouse gas emission, resiliency to impacts of climate change; and
- Disaster risk reduction, resiliency to natural disasters (including those associated with climate change)

8.6.2 Environmental Management Strategies Framework

The following general approaches and strategies are recommended to structure the Environmental Management Plans described in the following sections:

- **Development of Green City and Green Growth Regulatory/Policy Framework** with clearly defined institutional responsibilities, inter-institutional collaboration, and participatory action;

- **Awareness and Capacity Building Campaigns** on green growth and environmental management to promote public awareness and technical and administrative Capacity Building of City of Kigali and other institutional staff;

- **Protect, Preserve, Restore, Conserve and Sustainably Use** natural resources and ecosystems to sustain ecosystem services, grow the economy, provide livelihoods, and foster climate and disaster resilience;

- **Develop Integrated Environmental Management Plans** to promote best practices and facilitate inter-institutional collaboration and participatory action by all stakeholders, including community members;

- **Alignment of Plans and Strategies with international Sustainable Development Framework**, including Sustainable Development Goals (SDGs), New Urban Agenda, and Paris Agreement;

- **Inventorying, Mapping and Decision Support Systems** (e.g. via an asset management system) to promote transparent and integrated decision-making and management actions by the City and all other stakeholders; and

- **Development of Best Management Practices Manuals** for sustainable natural resources management, environmental protection, green design, green infrastructure and efficient services. Wetlands & Waterbodies Management Plan

8.7 Wetlands and Waterbodies Management Plan

8.7.1 Waterbodies and Watersheds

Kigali is surrounded and traversed several streams, rivers and lakes and can be delineated into twenty-five (25) watershed areas which drain into those waterbodies. Lake Muhazi lies along the border of the City northeast of Gasabo District. Nyabarongo River borders Nyarugenge and Kicukiro Districts along the south western edge of the City and is the river to which most of the city's other rivers and streams are tributaries and which in turn flows to Lake Rweru and is part of the Nile River Basin. The Yanze, Kibumba, Rwazangoro and Ruganwa rivers all drain into Nyabugogo River, which flows into the Nyabarongo River to the west of the City.

These water bodies provide valuable supplies of water, drain stormwater, and contribute to the physical beauty and character of the City. There are a number of issues and challenges though, including turbid waters of Nyabarongo River due to high sediment load from soil erosion in the catchments and other polluting content inflowing from sewage and stormwater runoff. Agricultural areas are a source of sediment, pesticides and chemical fertilizers which further degrade the water quality of waterbodies in the city. Urban development and landcover change are increasing the impervious surfaces in Kigali's catchments, leading to increased stormwater runoff and localized flooding. This compounds the already existent challenge of flash flooding and landslide risks associated with the hilly topography and steep slopes of the city. Flood risks are high in the valley and wetland areas of the city to which the catchments drain, including along the Nyabugogo, Gikondo, and Nyabarongo Rivers. Preservation and restoration of the natural drainage channels across the catchments in Kigali is an important strategy for managing flooding, especially in the absence of developed stormwater drainage infrastructure in much of the City.

8.7.2 Water Bodies and Watershed Conservation Efforts

Rwanda's environmental regulations stipulate that buffers should be maintained and protected along the periphery of waterbodies, with 10m buffers for rivers, 20m buffers for wetlands and 50m buffers for lakes, however no guidelines are provided for the management of catchments (also known as watersheds) which drain into these waterbodies. In October 2015,

MINIRENA-RNRA published Rwanda National Water Resources Master Plan (RNWRMP) and which includes catchment plans (up to 200) for nine catchments in Rwanda, including Lower Nyabarongo River within which the City of Kigali lies. The RNWRMP calls for more detailed and localized resources and demand investigation building upon the nine catchment Master Plans included in the RNWRMP. Planning of resources protection and resources development is only possible at the catchment level, yet there are currently no institutional entities in Rwanda that manage water resources or otherwise operate at the catchment level. The RNWRMP proposes for the establishment of Catchment Committees and Catchment Water Management Offices at the catchment level (Figure 8.6)[6]. These new catchment scale institutions would allow for more effective resource management in the catchment encompassing Kigali City. MINIRENA intends to establish an authority specifically for integrated water resource management (IWRM) to provide a detailed planning and management framework for catchments and waterbodies. Rwanda Environmental Management Authority (REMA) is also developing programs for rehabilitation of rivers and lakeshores.

Nyabarongo River Basin initiatives are being implemented by Rwanda Water and Forestry Authority (RWFA) in conjunction with Water for Growth to protect Nyabarongo river catchments through promoting terracing of slopes, agro-forestry, afforestation and sustainable mining within the catchments of the River Basin. Nyabugogo Catchments in Kigali are among the demonstration catchments where Water for Growth Rwanda is piloting development of a governance framework, develop land and water management solutions program.[7]

8.7.3 Recommended WaterBodies and Watersheds Management Actions

Water Bodies and Watershed Management Actions[8]

Flood management

- Reduce exposure to flood risk by avoiding hazardous, uneconomic or unwise use of floodplains, thereby protecting life, property and community infrastructure;
- Identify flood plain boundaries based on the 100 years flood data. These flood zones can be further divided into high, medium and low risk zone

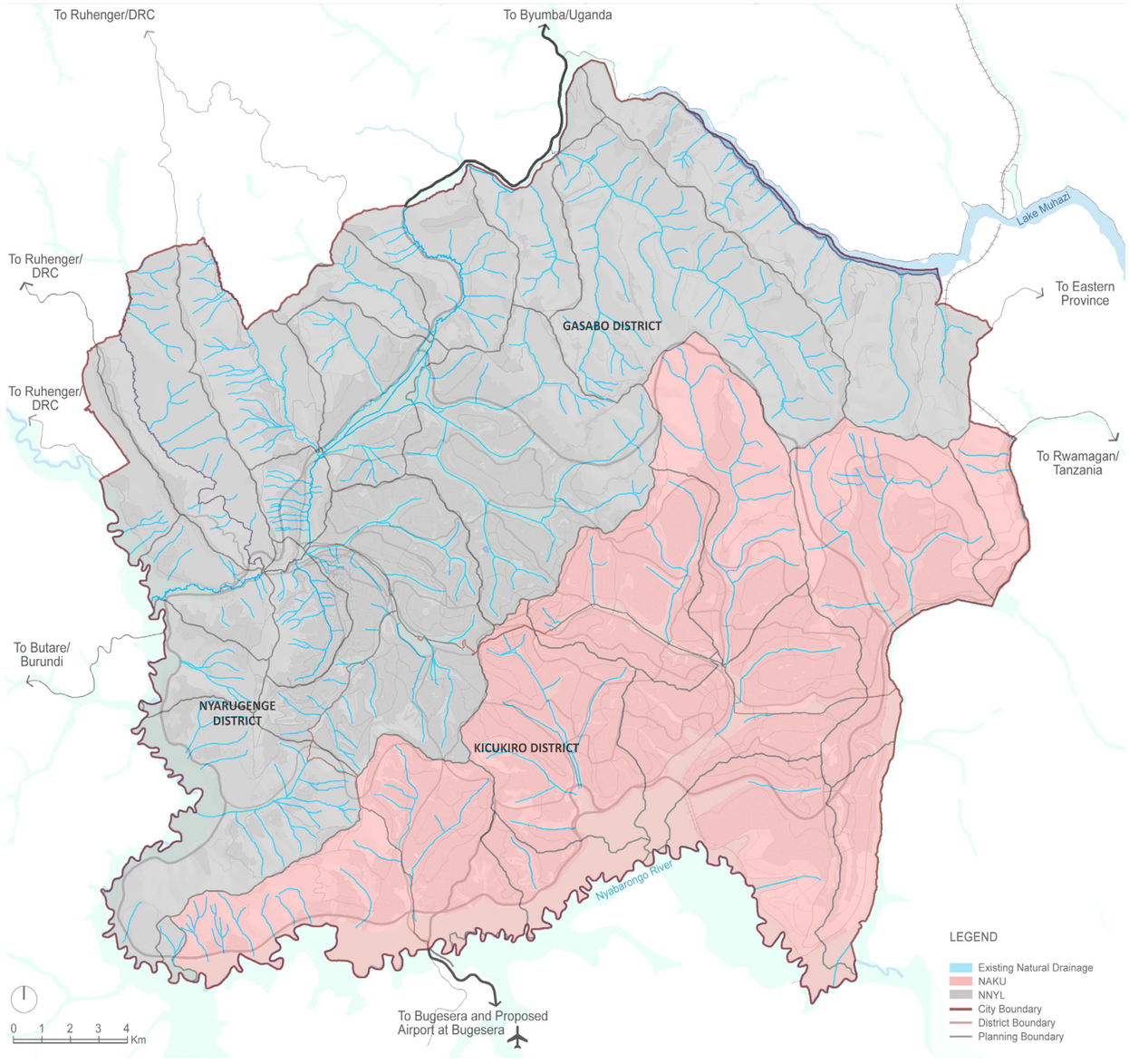


Figure 8.6 Watersheds in the City of Kigali

6 MINIRENA-RNRA. 2015. Rwanda National Water Resources Master Plan. Ministry of Environment and Natural Resources (MINIRENA) – Rwanda Natural Resources Authority (RNRA)- October 2015. Accessed online: 18 March 2019. https://waterportal.rwfa.rw/sites/default/files/2017-09/Rwanda%20National%20Water%20Resources%20Master%20Plan.pdf

7 Nkurunziza, M. 2018. Government, partners re-commit to protect Nyabarongo river catchments. The Inspirer. March 18, 2018. Accessed online: 17 March 2019. http://rwandainspirer.com/2018/03/18/government-partners-re-commit-to-protect-nyabarongo-river-catchments/

8 Includes management actions from Kigali Master Plan 2013

established by 20yr, 50yr and 100yr flood line. Based on this permissible extent, nature of Landuse and floodplain management guidelines can be established;
- Protect the natural flood carrying capacity of watercourses and wetlands;
- Propose interconnected stormwater network which detains, spreads slow down and cleans the flow before it finally discharged into water bodies;
- Conserve natural drainage channels for stormwater flow; and
- Combine storm water detention facilities with open spaces, parks, sports fields or other public recreational facilities that have minimal building developments

Water quality management

- Manage and treat stormwater flow before it is finally discharged into waterways and wetlands and promote onsite recharge and infiltration of the rainwater;
- Control non-point source pollution from the watershed source like urban land uses, agricultural activities and forest practices;
- Strictly implement 10m environmental buffer for rivers, 20m buffer for wetlands and 50m for lakes as per Organic Law. Use natural vegetation along these buffers;
- Redefine landuse, wherever both surface water and groundwater resources are being impacted due to activities along the waterways and landfill like Gikondo Industrial District;
- Set up Sewage Treatment Plants along the waterways for treating the diverted sewage flowing into the waterways through open drains and divert them for treatment; and
- Ensure new development and redevelopment, address stormwater quality, quantity, reuse and infiltration

Natural drainage channels management

- Integration of natural drainage channels into the urban landscape and citywide green network;
- Protect existing natural drainage channels and propose implementation of a 20m buffer from the development activities, similar to the buffer requirement for wetlands;
- Allow conditional uses along watershed and around natural drainage channels but efforts should be made to avoid any adverse impacts on these areas;
- Conserve existing riparian corridors and introduce new riparian corridors along the restored natural drainage channels; and
- Use native vegetation along the riparian corridor to control flow of water, reduce erosion and trap pollutants from the catchment

8.7.4 Wetlands

Wetlands cover approximately 10.6% (compared to 14% in 2013) of the land area of the City of Kigali, occurring primarily along the low-lying valleys and floodplains of the rivers flowing through the city landscape. Wetlands in Kigali are classified as Central Plateau Swamps (based on REMA's 2008 wetland inventory and classification system). The wetlands have mineralized soil substrate with dominant vegetation, when not cultivated, being Polygonum pulchrum, Cyperus papyrus, Commelina

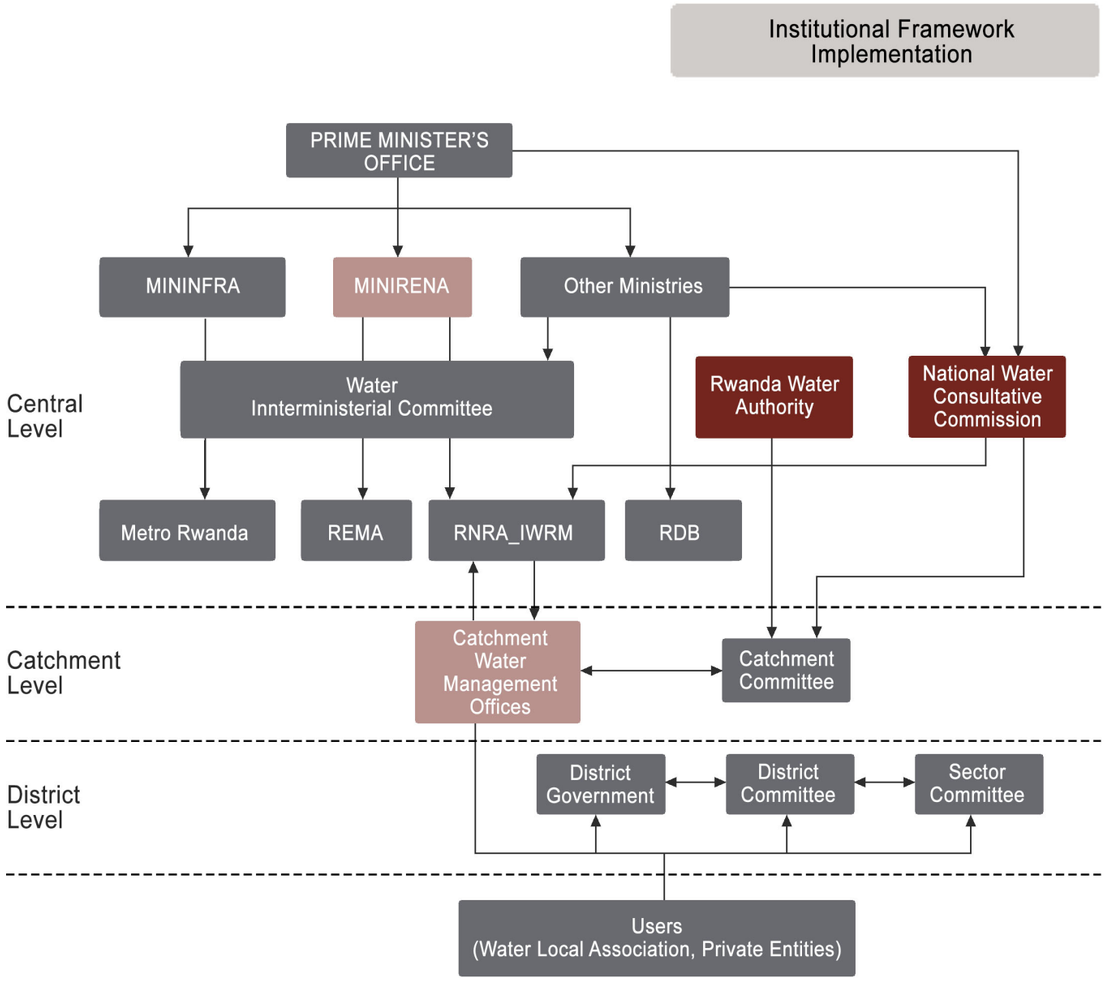


Figure 8.7 Institutions involved in water resource management and development in Rwanda, including Catchment Water Committees proposed by MINIRENA

diffusa, Cynodon dactylon, Eicchornia crasipes, and Pennisetum purpureum. The wetland play an important role in improving water quality, flood attenuation, reducing soil erosion, providing habitat for diverse species of flora and fauna, moderating climate conditions, contributing to the City's aesthetics, and providing opportunities for economic, recreational, educational and research activities.

In Kigali wetlands are used extensively for agriculture and in some sites for extraction of sand and clay which are important building materials. The wetlands in Kigali, however, are threatened and impacted by urbanization, agricultural and industrial activities including cultivation in wetlands, pollution from fertilizers and pesticides, grazing by livestock, mining of clay and sand, encroachment and pollution from industries, encroachment and pollution from human settlements. Over half of the wetlands in Kigali are degraded and have lost ecological functions and over 2078 establishments are identified as encroaching on the city's wetlands.[9]

Wetland conservation efforts

Wetlands are projected in Rwanda under the Organic Law. REMA is designated as the institution responsible for enforcement of wetland regulations and thus any planned development activity encroaching upon or impacting wetlands must be approved and coordinated with REMA.

9 World Wetland Day: Rwandans urged to wisely use urban wetlands, REMA 2018

Through Prime Ministers Order No.006 of 13/02/2017 12 four wetlands within Kigali City are to be designated as wetlands of international importance under the RAMSAR Convention. The Ramsar Site wetlands would include: Kitagurizwa Wetland (Within Gasabo and Kicukiro districts), Rugende- Isumo Wetland (Within Gasabo and Kicukiro districts), Nyabarongo- Aval Wetland (Within Nyarugenge and Kicukiro districts) and Nyabarongo- Amont Wetland (Within Nyarugenge district).

Strategies are proposed in below to guide and facilitate preservation and sustainable management of the wetlands to ensure the wetlands and the benefits from the diverse services provided by the wetlands are restored and protected, while the city continues to grow and develop.

Table 8.5 Wetland Categories

Wetland protection and use as regulated by the organic law (2005)	
Total Protection wetlands:	Protection as its natural state no agriculture and other activities will be allowed. There are no natural wetlands left within the Kigali City limits except for a few patches of Nyabarongo wetland
Conditional use wetlands:	Allows continuation of existing agricultural activities and conditional use for projects (farming, clay extraction, recreational, etc.) with proper EIA assessment (wetlands mainly along the rural areas). Final authorization of such projects would be granted by REMA
Unconditional use wetlands:	Will not require environmental impact assessment but no development activities will be allowed. These wetlands could be used for recreation, parks, fishing ponds, horticulture etc. (wetlands mainly along the urban areas of Muhima, Kimihurura, Kicukiro etc.)

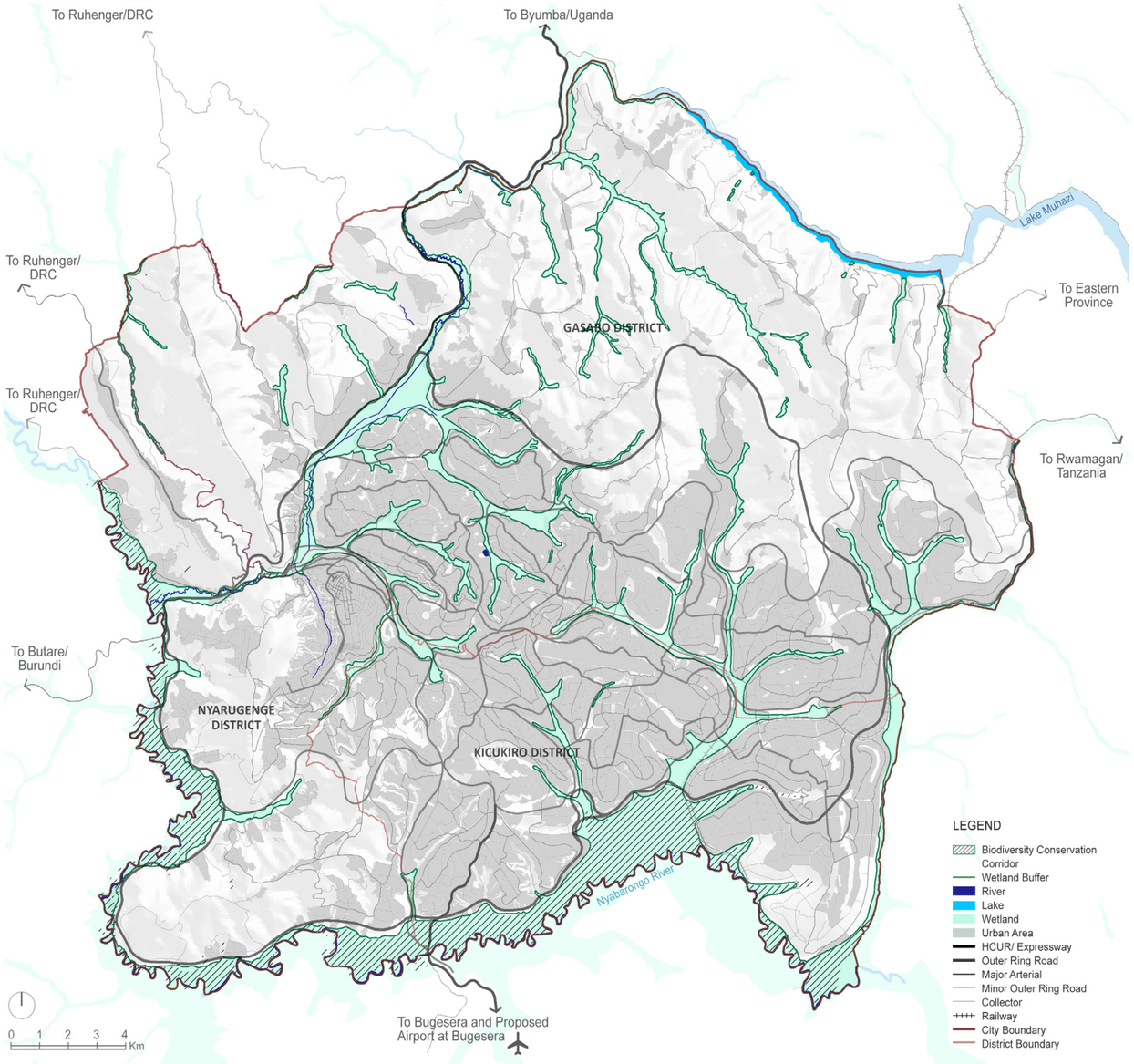


Figure 8.8 Wetlands with buffer and other waterbodies in Kigali

Wetland water bodies management strategies

- **Development of integrated Water Resource Management (IWRM) Plan,** including Wetland, Water Bodies, Watershed (Catchment), and Stormwater Management Plans with clear policy/regulatory and institutional framework. IWRM refers to *"a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."*[10]

The Government of Rwanda has adopted Integrated Water Resources Management (IWRM) as its overall approach to water resources management.[11] The IWRM Plan should be prepared at the scale of the lower Nyabarongo River catchment, encompassing Kigali and all upstream and downstream catchment areas draining to Lake Rweru, with more detailed plans at the level of sub-catchments. These plans should be aligned with planning for Kagera River Basin and the Nile River Basin Initiative. The IWRM plans should be reinforced with the standardized policies and development guidelines to incorporate sustainable wetland and water bodies management in the city. Sub-components of the IWRM Plan should include:

1. **Kigali Wetlands and Water Bodies Plan**
2. **Kigali Watersheds (Catchments) and Stormwater Management Plans**

- **Development of Wetlands and Waterbodies Management Manual** with Best Practices as part of Integrated Management Plans. Wetland and water bodies management manuals from other cities and urban areas around the world can serve as a useful starting point for development of a manual specific to the context and conditions of Kigali City;

- **Awareness Campaign and Capacity Building Trainings** on Wetland and Waterbodies Conservation, Restoration, and Sustainable Use Best Practices. Key stakeholders responsible for environmental management in Kigali City should be trained in best practices for wetland and water bodies management. In addition, the city's local population and visitors should be educated about the environmental, social and economic benefits of wetland and aquatic ecosystems;

- **Participatory Programs and Action Plans for Implementation** of wetland and waterbodies protection and restoration, creation of constructed wetlands, wetland use for agriculture, and sustainable extraction of wetland and waterbody resources (e.g. vegetation, clay and sand). Participatory wetland monitoring, research and development programs should be developed and implemented across the city to help assess the impact and benefits of restoration, creation and conservation of wetlands and water bodies in the urban landscape;

- **Preservation and Restoration** of important natural wetlands and water bodies and restricted activities in wetlands and buffer areas informed by Environmental Impact Assessments (EIA) in accordance with regulations. Wetland and waterbodies preservation will require implementation of proposed zoning guidelines to control human activities in and around the wetlands and water bodies, including regulation of activities in wetlands in accordance with the wetland protection and use regulations of the Organic Law. Wetland and river restoration should include restoration of natural hydrological conditions and reintroduction of native vegetation. Preservation of wetland and aquatic ecosystem functions will require development of various stormwater treatment techniques (e.g. constructed wetlands) within the greater catchment area and along required buffer areas to control flow of water, reduce erosion and trap pollutants from the catchment;

- **Promotion of Sustainable Wetlands and Waterbodies Use,** including promotion of sustainable (least-impact) cultivation and grazing practices, development of wetland parks, restricted extraction of wetland and waterbody resources, and sustainable restricted use of buffer areas. Vegetated buffers of a minimum of 20m as per regulations should be implemented to minimize impacts of upland activities on the wetlands;

- **Zero Net Loss of Wetlands and Waterbodies Area** in the city. As recommended in Master Plan 2013, wetland mitigation policy should be developed which balances lost or disturbed wetlands through wetland restoration, enhancement and creation. Mitigation for loss of existing wetlands should occur within the same watershed and/ or aquifer and then connected to the larger wetland system of Kigali;

- **Integration of Wetlands, Water Bodies and Natural Drainage Channel Restoration** into design and development of green open spaces, urban parks and landscapes, and green city trails/corridors. Wetlands and water bodies should be an integral part of a citywide network of green open spaces, parks and natural corridors, as the wetlands and water bodies will provide habitat for wildlife and the wetlands will provide stormwater runoff buffering and treatment functions in the landscape. The natural drainage channels in the city's catchments serve an important stormwater drainage function, limiting localized flooding if properly restored and maintained. Efforts should be made to minimize impact from development on natural wetlands and water bodies, while constructed wetland systems can be built as part of stormwater and maintained. Efforts should be made to minimize impact from development on natural wetlands and water bodies, while constructed wetland systems can be built as part of stormwater and wastewater treatment systems in the landscape;

- **Promotion of Green economy Activities (and Jobs)** for restoration and sustainable use of waterbodies and wetlands (agriculture, resource extraction, recreational use, and wetland parks; and

- **Promotion of Long-term Phased Reduction of Wetland Cultivation and Increased Upland Agricultural Area (including household kitchen gardens and green roofs)** for net zero loss of agricultural land, while expanding the area of less-impacted wetlands with greater ecological functions

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10 Global Water Partnership (GWP). 2019. GWP Website. Accessed online: 18 March 2019. https://www.gwp.org/en/About/why/the-need-for-an-integrated-approach/

11 Water for Growth Rwanda. Integrated Water Resources Management. Accessed online: 18 March 2019. http://www.water.rw/iwrm/.

8.8 Forest and Biodiversity Plan

8.8.1 Forest and flora

Much of the forest and natural vegetation of Kigali City have been cleared over the years for urban development and agro-pastoral activities (e.g. burning of forest and vegetation). In areas where forests have been reforested, native forests have been replaced by planted forests of non-native Eucalyptus and Pine species, grown for agro-forestry or for slope protection and erosion control. Other commonly planted tree species in Kigali include timber species such as *Grevillea robusta, Vernonia amygdalina, Euphorbia tirucalli, Cupressus, Acanthus Pubescens, and Ficus thonningii and horticultural species such as Persea gratissima, Psidiumguajava, Capsicum frutescens, Caric,* Coffee, Banana and Papaya trees. Most natural forests in the City are owned and managed by the central government, while forest plantations are either privately owned or under district government land.

Native tree species and flora remain only in small patches in the city. Natural vegetation of Kigali's wetlands has similarly been cleared to make way for cultivated species, while remaining areas of natural vegetation transition to fewer species with the changes in hydrology and the inflow of polluted, sediment and nutrient rich waters draining from the catchment.

8.8.2 Wildlife and fauna

Loss, degradation and fragmentation of native forest and naturally vegetated ecosystems has impacted the native fauna of the area as well. With the exception of migratory birds to Nyabarongo Wetland, wildlife biodiversity is quite low in Kigali City. There are a few species of reptiles, hares, jackals and fish found in and around Kigali.

8.8.3 Conservation Efforts

Wetlands along Nyabarongo River have been designated as an Important Bird Area (IBA) as it serves as a hotspot for diverse species of migratory and congregatory birds annually. Four wetlands (Kitagurizwa, Rugende- Isumo, Nyabarongo- Aval and Nyabarongo-Amont) within Kigali City are to be designated as Ramsar Sites, and thus recognized and protected as wetlands of international importance. Forest cover has increased by 2.2% in 2018 relative to the forest cover at the time of Master Plan 2013, which is reflective of progress in forest conservation, reforestation and afforestation efforts in Kigali.

8.8.4 Biodiversity Management Strategies

A list of biodiversity conservation strategies were presented in Kigali Master Plan 2013, which are still recommended:

- Identify and quantify current vegetation and wildlife habitat resources within the City of Kigali;
- Adopt a "No net loss of existing biodiversity strategy" applicable to all ecological communities in Kigali;

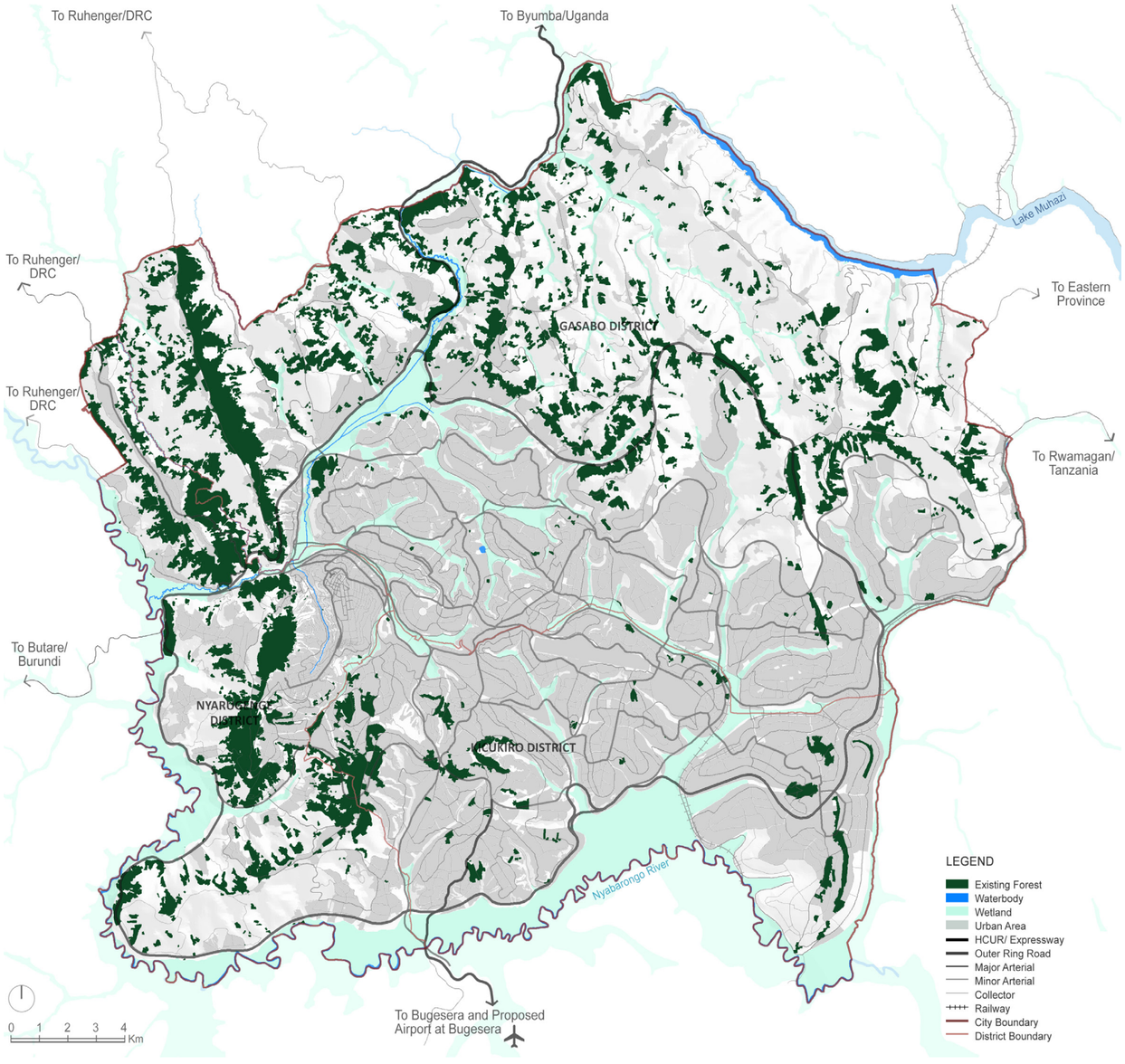


Figure 8.9 Existing forests and forest protection zones in Kigali

- Identify high value conservation vegetation, habitats and wildlife corridors; and develop a regulatory framework and management guidelines for biodiversity in these areas;

- Identify clear biodiversity protection zones and develop planning controls to manage these areas. Introduce minimum standard guidelines for biodiversity assessment and reporting for submission with a development application;

- Establish habitat conservation criteria such as corridor widths, sites and hubs in support of maintaining biodiversity and specific ecosystems and wildlife across the City;

- Identify those land, which should be managed as biodiversity corridors to maintain a network of natural areas throughout the city Ensure new development protects habitat for sensitive and protected species identified during environmental assessment process. Also, ensure new development provides habitat connectivity through the creation of wildlife corridors and there are no conflicting situations between wildlife and residents; and

- Establish indicators and measures that will be monitored over time to assist in measuring progress on and the effectiveness of the Strategy, which will assist in ensuring that amendments are made to the Strategy when necessary

8.8.5 Forest Protection Strategies

- **Development of Integrated Forest Management Plan** with clear policy/regulatory and institutional framework. The management of forests in Rwanda under specific management plans is a proposal of the government of Rwanda.[12] Consolidate district level forest data and clearly define the boundaries for the conserved forest along with the forest that can be used for timber. Consider the effects of forest management activities on the existing biodiversity such as forest land fragmentation, habitat loss, vegetation species composition, management of old growth forests etc. Establish special plans for the protected areas to preserve biological distinctive or unique features;

- **Development of Forest Management Manual** with Best Practices as part of Forest Management Plan;

- **Awareness Campaign and Capacity Building Trainings** on Forest Conservation, Sustainable Forestry and Agro-Forestry Best Management Practices; and

- **Participatory Programs and Action Plans for Implementation** of natural forest protection and restoration, reforestation and afforestation, forestry and agro-forestry. Encourage and integrate active public participation in forest management, planning and decision-making processes. Encourage community-based forest management and adoption agro-forestry practice, especially in the rural areas of Kigali;

- **Preservation and Restoration** of natural forest patches and restricted activities in accordance with forest regulations

  1. Establish no cut buffer zones along existing forest and afforestation areas.

  2. Propose afforestation along the barren steep slopes greater than 40%, which will help to increase cities forest cover and stabilize steep slopes.

  3. Maintain and improve productivity of the forest ecosystem by ensuring prompt regeneration (either naturally or by planting) of cut-overs and naturally disturbed areas by ensuring native species plantation.

  4. Protect forest habitats through the preservation of canopy cover, multi-story stands and maintenance of understory plants and debris.

  5. Maintain and protect existing wildlife habitat in the existing forest and allow forest habitat connectivity.

- **Promotion of Sustainable Forestry and Agro-Forestry**, including promotion of appropriate native species and valuable horticultural species

  1. Promote silviculture and agro-forestry practices which create more diverse, productive, profitable, healthy and sustainable forest land use;

  2. Non-buildable land between 20% and 30% should be extensively used for forestry and agro-forestry with proper slope management, soil stabilization, erosion control and terrace farming techniques;

  3. Make sure that the forestry practice maintains the long-term pool of soil nutrients without measurable soil loss due to erosion and compaction activities; and

  4. Encourage forestry and agro-forestry research

- **Zero Net Loss of Forest Areas** in the city. Existing forest land should be preserved with no permanent net loss of forest area due to human activity;

- **Integration of Afforestation (Native and Horticultural Tree Planting)** into design and development of green open spaces, urban parks, green city trails/corridors, streetscapes, and mass transport corridors;

- **Promotion of value-added economic activities (and jobs)** for timber, fruits, and nuts processing.
  Encourage development of small-scale forest-based industries with value added manufacturing and non-timber forest products. Encourage forest-based eco-tourism and recreational activities like hiking, mountain biking, passive recreation, trails with the spots for watching birds, biodiversity exploration, scenic view spots, and camping sites. Promote creation of jobs and livelihood opportunities from all uses of the forest and agro-forestry resources; and

- **Promotion of Transition to Alternative Energy Sources and Efficient Wood/ Charcoal Stoves** for cooking, to reduce pressure of forests, reduce Green House Gas emissions, and improve indoor air quality. Effective measures to reduce emissions from cooking stoves include improvements in combustion technology and increases in fuel efficiency. Shifting from use of biomass and coal to natural gas and electricity as the primary cooking energy sources would be the preferred long-term solution. Intermediate solutions include improving the quality of the biomass and coal as well as use of stoves with improved combustion technologies and providing government subsidies to promote cleaner fuels and technologies. These measures would help to decrease local CO2 emissions, reduce harmful indoor air pollution, reduce energy poverty and contribute to the local economy through local biomass industry [13]

12 Rurangwa, F., Kinyanjui, M. J., Bazimaziki, F., Peeters, J., Munyehirwe, A., Musoke, F., Habiyaremye, G. N., Bakundukize, D., Ngabonziza, P., & Uwase, J. (2018). Developing a Forest Management Plan (DFMP) for Gatsibo District in the Eastern Province of Rwanda. Open Journal of Forestry, 8, 247-265 https://doi.org/10.4236/ojf.2018.82017

13 REMA 2018. Inventory of Sources of Air Pollution in Rwanda. Determination of Future Trends and Development of a National Air Quality Control Strategy. Rwanda Environment Management Authority. P.O. Box 7436 Kigali, Rwanda. 18 January 2018.

8.8.6 Nature Restoration

Nature restoration should be implemented in Kigali City in line with existing regulatory framework and the strategies, guidelines and best management practices to be included in the Integrated Forest Management Plan and Forest Management Manuel.

Where forests lie within protected areas with clear restrictions to development activities, such as slopes above 30% slope and within protected wetland and waterbody buffer areas, reforestation is a primary recommended approach to the process of restoring the ecological functions of those landscapes as well as enhanced stability and resilience to the impacts of natural disasters.

Restoration of forests across the other areas of the city which may fall under other zoning regulations with permitted development uses will rely on development and application of a Forest Overlay (to be superimposed over established zoning). The forest overlay zones will provide more discretion and flexibility by allowing the City to protect certain areas as well as encourage or discourage certain types of development that may impact important forest resources dispersed across the city, especially an remnants of native forest. The adoption of the Forest overlay can thus be used to impose supplement restrictions, permit or disallow various forms of density as well as provide bonuses and incentives to achieve the desired nature restoration and preservation goals.

A strategy for nature restoration will include integration of afforestation into design and development of green open spaces, urban parks, green city trails/corridors, streetscapes, and mass transport corridors. Achievement of sustainable nature restoration will require encouragement of public participation in the planning and decision-making processes.

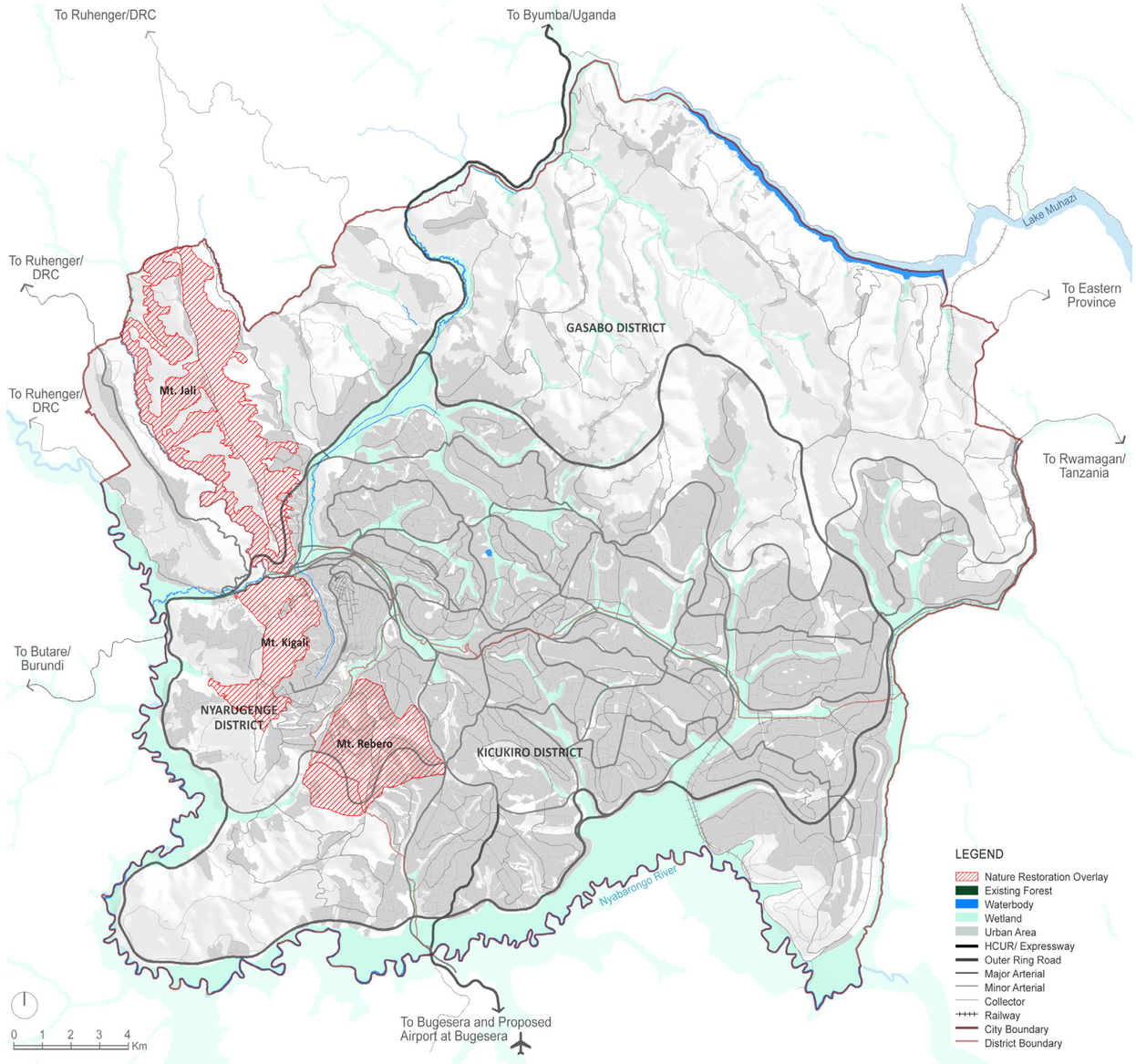


Figure 8.10 Proposed Nature Restoration Overlay

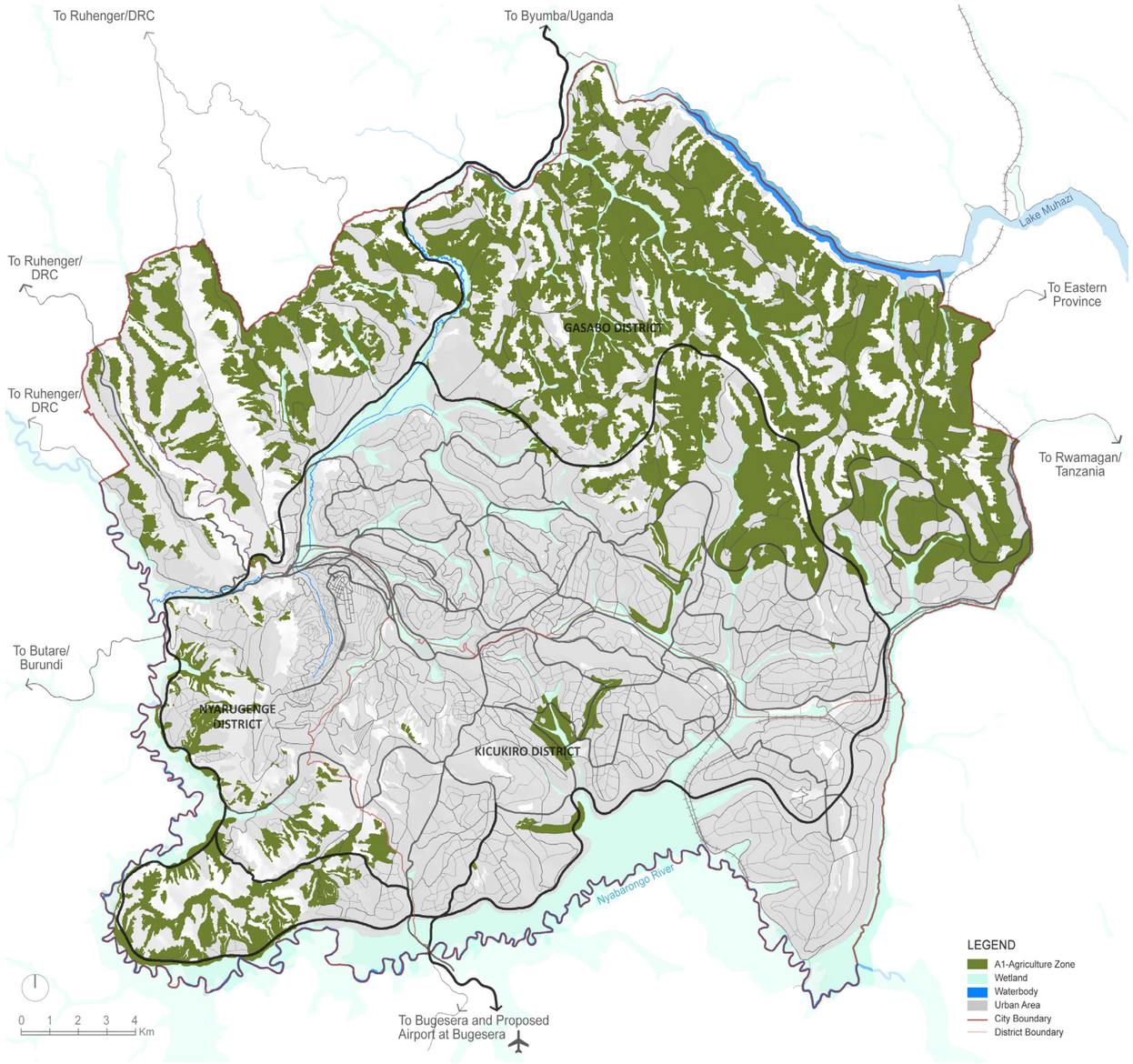


Figure 8.11 Agriculture area in the city of Kigali

8.9 Agriculture Management Plan

8.9.1 URBAN AGRICULTURE

Despite steps to diversity Rwanda's economy, the economy remains primarily agriculture-based, with agrarian activity employing most of the population in the country (including many subsistence farmers), accounting for about a third of the GDP, and providing most of the export earnings[14]. In the case of Kigali, agricultural land covers approximately 65% of the land area (including 32,189ha in Gasabo, 11,026 in Kicukiro, and 8,023 in Nyarugenge) and about a quarter of the city's working population is employed in either agriculture or the related natural resource-based fishing and forestry sectors. Rural sectors of the city are dominated by agriculture and much of the lowland and wetland areas of the city are under cultivation. The most commonly cultivated crops are sweet potatoes bananas, beans, Irish potatoes, soy beans, maize, cassava, vegetables, and coffee. Livestock raising and dairy farming are also livelihood activities for some of the city's households. Common livestock include cattle, goats and poultry are also raised by some in the city. The city's agricultural activities are both a major source of livelihood and an important food source for the city.

14 National Institute of Statistics of Rwanda, Rwanda Poverty Profile Report - Integrated Household Living Conditions Survey, EICV4 (2013/14). Available online.

Issues and challenges impacting the agriculture sector in Kigali include: population pressure on limited land resources which impacts agricultural productivity and has led to fragmentation of farm land and encroachment of urban areas into farmland and encroachment of farmland into wetland and vulnerable natural drainage and sloped areas. Unsustainable agricultural practices have led to soil erosion, vulnerability to climate change impacts (e.g. drought or heavy rains), misuse of chemical fertilizers and pesticides, and limited crop productivity.

8.9.2 AGRICULTURAL DEVELOPMENT EFFORTS

Agricultural modernization is a priority for Rwanda and was included as one of six pillars of Vision 2020. Agriculture is recognized as critical for maintaining food and nutrition security in Rwanda and a basis for development of agro-industries. Over 700 ha of Kigali wetlands were earmarked by the City of Kigali and MINAGRI for urban horticulture to increase agricultural production for local consumption and export. Immudugudu Village is a Land Tenure Reform Program designed to encourage land consolidation for intensification and mechanization of cultivation in Rwanda. Kigali Agriculture Park, including silos and treatment plan in Kigali Special Economic Zone) has been setup in Gasabo District as part of Rwanda's Post Harvest Handling and Storage program, which is supports efficient and cost-effective solutions for processing and storing grain, seeds, and fertilizer. National level

agricultural strategies and policies are in place; however, holistic agriculture, irrigation and management strategies are also needed for coordinated and environmentally sustainable development at the city scale.

Preservation of agricultural land, while promoting sustainable agricultural practices and intensification is an objective of green growth in the city.

8.9.3 Agriculture Management Strategies

- **Development of Urban Agriculture Development Plan** with clear policy/regulatory and institutional framework . Include management plans for agriculture and agro-forestry in the rural and urban areas of Kigali, including along slopes (5-20% and 20-30% slope areas);

- **Development of Urban Agriculture Extension Manual** with Best Practices as part of Agricultural Development Plan;

- **Awareness Campaign and Capacity Building Trainings** on sustainable urban agriculture (crop cultivation and livestock raising), integrated pest management, agro-forestry, and urban horticultural best management practices. Promote sustainable irrigation and fertilizing methods and promote extension and education programs for the farmers;

- **Participatory Programs and Action Plans for Implementation** of sustainable agriculture and livestock raising, integrated pest management, agro-forestry, and urban horticulture;

- **Preservation and Restoration** of fragile and vulnerable agricultural lands and application of soil and water conservation practices:

  1. Limit intensive, modern and mechanized farming for the gradual slopes less than 15%, as steep slopes provides risk for the use of tractors and other modernized techniques;

  2. For the farmlands between 15% and 25% promote agro-forestry. Give incentives to farmers to adopt terracing and alley cropping techniques and educate them with the various techniques to minimize erosion; and

  3. For the farmlands above 25% slope, promote forestry. Give incentives to farmers in these areas to shift from cultivation to forestry and alternative livelihood

- **Promotion of Sustainable Urban Agriculture,** including promotion of appropriate native species and valuable horticultural species. Protect forests allowing for recreational activities, agriculture and local material extraction in agreement with authorities;

- **Zero Net Loss of Agricultural Areas** in the city. Conserve arable land below 15% slope especially in rural areas for farming;

- **Integration of Horticulture** into design and development of green open spaces, urban parks, green city trails/corridors, streetscapes, and mass transport corridors;

- **Promotion of value-added economic activities (and jobs)** for crops, fruits, nuts, dairy, and meat processing; and

- **Promotion of Transition to Wetland to Upland Agriculture** to allow for restoration and conservation of wetlands and the important ecological services the wetlands render, while maintaining net agricultural land by expanding agricultural activities on non-sensitive/non-hazardous upland areas

8.10 Steep Slope Protection Plan

8.10.1 Slope Landscape

Kigali City's topography is characterized by hills and lowlands, with an altitude ranging from 1300m to 2100m. Nyarugenge and Gasabo Districts features steeper sloped lands but with gentler slopes along the Nyabugogo river, while Kicukiro District has plateaus with gentler slopes. Steep slopes are an environmental resource as they provide habitat for biodiversity, recreational areas, and attractive view sheds. Steep slopes, however, are vulnerable to disturbances from development and activities which alter vegetative cover and soil stability, leading to soil erosion, increased stormwater runoff, landslide potential, and loss of natural areas and habitat.[15]

15 USEPA. 2014. Addressing Green Infrastructure Design Challenges in the Pittsburgh Region: Steep Slopes. January 2014 EPA 800-R-14-002. Accessed online: 18 March 2019. https://www.epa.gov/sites/production/files/2015-10/documents/pittsburgh-united-steep-slopes-508.pdf

Unplanned settlements and agricultural activities have encroached on steep sloped areas in Kigali. This puts the population at risk of the landslide and flashflood hazards associated with these slopes and exposes the fragile (medium to high risk) soil to be heavily eroded by rainwater.

8.10.2 Slope Management Effort

Slope stabilization strategies including terrace cropping and agroforestry techniques initiated by MINAGRI are being practiced in the hills of Bumbogo, Kinyinya, Jabana, and Gihogwe in Kigali City. Erosion control strategies were established by the Seven Year Government Program (2010-2017). MINAGRI together with Rwanda Land Management and Use Authority (RLNMUA) are mapping agricultural land in Kigali for development of a land suitability guide.

After consideration of criteria for undevelopable areas from different sources and the ecological and hazard risks involved, an agreement was reached with the City of Kigali authorities to designate areas (approximately 19% of land in Kigali) which are 30% or greater in slope as undevelopable areas.

8.10.3 Slope Management Strategies

- **Development of Integrated Slope Management Plan** with clear policy/regulatory and institutional framework. The Slope Management Plan may be prepared as a part of the Watershed (Catchments) Management Plan for the City. Assessment;

- **Development of Slope Management Manual with Best Practices** as part of Slope Management Plan;

- **Awareness Campaign and Capacity Building Trainings** on Slope Hazards and Slope Management Best Practice;

- **Participatory Action Plans and Programmes for Implementation** of slope protection and management, including: stabilization, revegetation and afforestation, and erosion control;

- **Assessment and Mapping of High-Risk Slopes in Kigali** to improve landslide disaster risk avoidance and mitigation. A country-wide land slide susceptibility map has been developed for Rwanda based on Landslide Susceptibility Assessment Using Spatial Multi-Criteria Evaluation Model[16], however more detailed site assessments are recommended at the scale of the City of Kigali to more accurately assess, identify and map areas of high slope risk in the City;

- **Restricted Development Activities on Steep Slopes** in accordance with protection regulations, including no development on steep slopes (over 30% slope) and restricted development on slopes 20-30%;

16 Nsengiyumva, Jean Baptiste & Luo, Geping & Nahayo, Lamek & Huang, Xiaotao & Cai, Peng. (2018). Landslide Susceptibility Assessment Using Spatial Multi-Criteria Evaluation Model in Rwanda. International Journal of Environmental Research and Public Health. 15. 243. 10.3390/ijerph15020243.

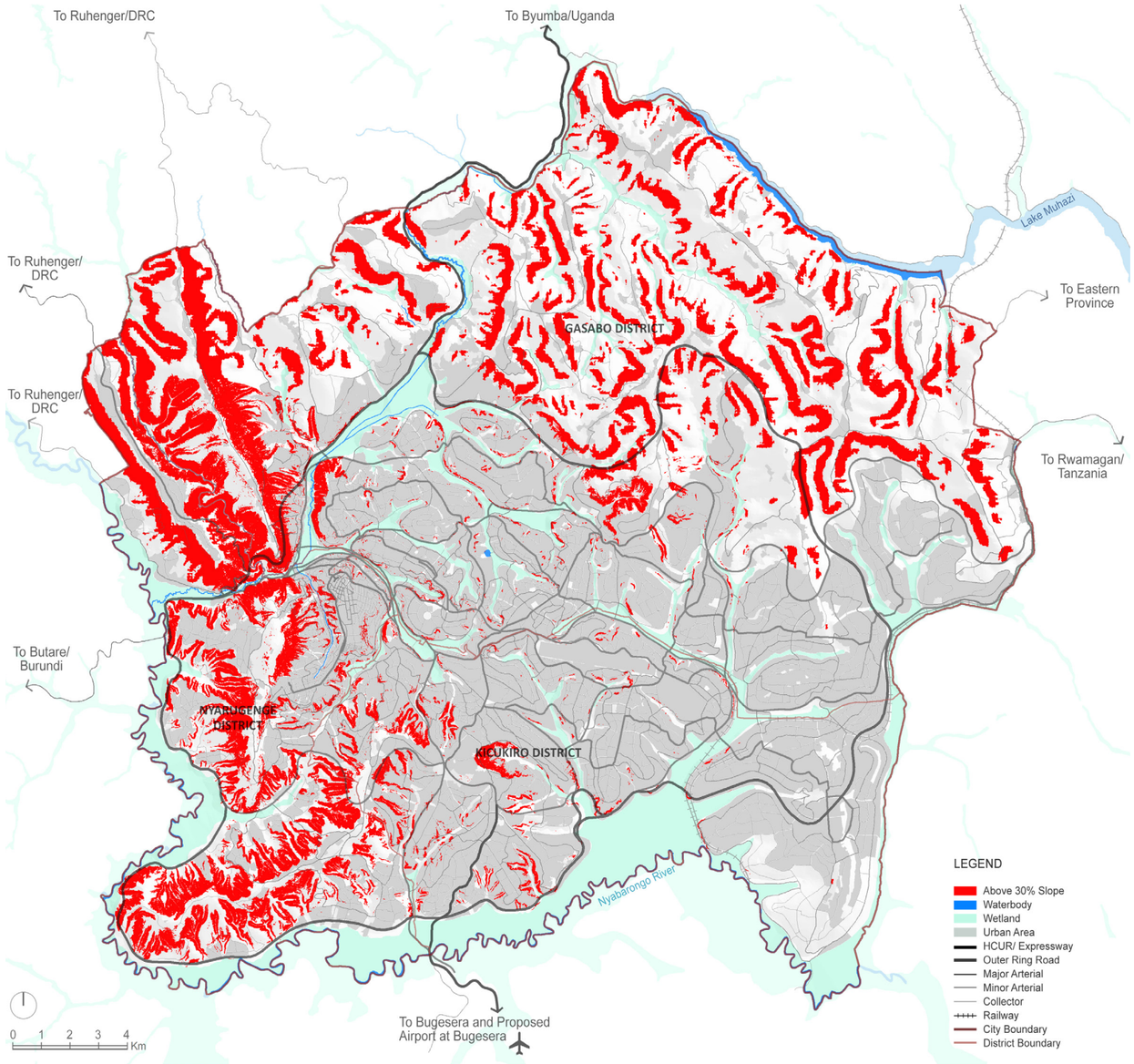


Figure 8.12 High risk areas with steep slopes above 30 percent

- **Reforestation and Implementation of Erosion Control Measures** on Steep Slopes. Steep slopes can be revegetation through standard seeding and planting if soil conditions are stable, while bioengineering and biotechnical stabilization techniques may be used where the soil is unstable. A botanist should be consulted regarding the best suited species to plant under the specific soil conditions of the slope. Vehicular and pedestrian activity should be restricted in recently revegetated areas. Please note that reforestation and revegetation of slopes helps stabilize soil, but does not prevent landslides, which remain a hazard for steep slopes.[17] Green infrastructure practices for managing stormwater runoff and thus controlling erosion on steep slopes include: bioretention, vegetated swales, planter boxes, grass channels with check dams, diversion and infiltration berms and terracing, permeable pavement, and vegetated filter strips; and

- **Relocation and Resettlement** of Households Inhabiting Restricted (>30% slope) and Hazardous Slopes sites at risk of landslides and flooding

17 USEPA. 2014. Addressing Green Infrastructure Design Challenges in the Pittsburgh Region: Steep Slopes. January 2014 EPA 800-R-14-002. Accessed online: 18 March 2019. https://www.epa.gov/sites/production/files/2015-10/documents/pittsburgh-united-steep-slopes-508.pdf

8.10.4 Slope Management Guidelines

Steep Slope (Slopes >30%)

- A large part of Kigali has steep slopes and development on steep slopes above 30% is generally restricted for safety and protection of nature and environment from possible catastrophic disaster.
- Apart from the zoning regulation no development should be allowed on the mountain ridge more than 900m elevation;
- The few conditional uses like infrastructure and passive recreation is allowed as per the P3-C protected areas overlay in the Zoning Regulation;
- Along with the detail site survey and Environmental Impact Assessment (EIA) local authority should check landslide hazard areas before approving any development plan and Protect the natural environment, its ecosystems and biodiversity
- During development of conditional uses, appropriate slope management and protection techniques should be adopted;
- Minimize erosion, excavation and vegetation removal;
- No roads should be developed along this terrain;

However, the Zoning Plan recognizes that there are existing developments on slopes above 30%, and some of the areas amid slopes between 30-50% maybe allowed for development, subject to detailed investigation and mitigation works. CoK shall ensure and enforce this Slope Overlay guidelines to deal with such developments.

This regulation is applicable for areas falling in the Slope Overlay Plan and are subject to conditional development on meeting the necessary regulations and conditions.

The intent of the Steep Slopes Zone (P3-C) is to protect steep slopes from unsustainable encroachment and exploitation.

This zone is applicable on:

- Steep slopes above 30% in case of greenfield areas.
- Steep slopes above 50% in case of brownfield areas (where there are existing developments on slopes between 30-50%).

CoK, in coordination with relevant agencies, shall regulate the development on 30-50% slopes, identified in the overlay plan.

Existing or proposed Developments on areas falling within the Slope (30-50%) overlay are subject to detailed investigation and assessment by the CoK in collaboration with relevant agencies, where required.

Existing Settlements

Existing, legally authorised settlements in 30-50% Slope Overlay may be preserved and/or upgraded and current land uses retained provided that geotechnical assessment has been conducted and reassurance has been provided about the following:

- No natural disaster risk is present, or any risk has been mitigated with appropriate resiliency measures.
- The settlement is not causing environmental pollution downstream and all measures have been taken to minimise environmental impact.
- Structures are built taking into consideration the topographic and the geological nature of the site.
- Any additional structure or any renovation work shall be authorised only after the above conditions are met.

Areas that do not meet safety requirements or are considered extremely risky, after specific geotechnical survey has been conducted, shall be considered as priority sites for population relocation procedures

Greenfield Sites

Development on slopes is generally discouraged, however, limited development may be conditionally authorised only by CoK OSC within the Slope Overlay, provided that the proposed development meets the following requirements:

- The development does not fall under the Natural Disaster Risk Overlay. In such cases, only the uses allowed in that overlay will be authorised.
- The proposed development is designed following the highest environmental standards and has obtained clearance after an EIA procedure has been conducted;
- It has a strategic tourism and/or economic value and demonstrate substantial benefits to the community in terms of job creation, nature area restoration, women or disabled inclusion or other benefit to be evaluated by CoK OSC

Medium Risk Slope Areas (slopes 20% to 30%)

- The Masterplan allows conditional development of land only for those uses which are suitable on steep slopes like passive recreation, trails, open space, small scale public facilities, single family residences (R1 zoning category only);
- Other conditional uses like infrastructure and roads are allowed as per the overall Masterplan requirement and should be developed as per best practices including use of bio-engineering erosion mitigation;
- Roads on these slopes must run diagonal than perpendicular;
- No development should be allowed on the mountain ridge more than 900m elevation; and
- Along with the detail site survey and Environmental Impact Assessment (EIA), local authority should check landslide hazard areas before approving development plans on these slopes

Table 8.6 Recommended ambient air quality standards for Rwanda (REMA 2018)

Pollutant	Averaging period	Nationa standard (µg/m³)	Justification
Sulphur Dioxide SO_2	10 minute	500	In line with WHO guideline
	24 hour	125	In line with WHO Interim Target 1 and the most common national standards
Nitrogen Dioxide NO_2	1 hour	200	In line with WHO guideline and the most common national standards
	Annual	40	
PM_{10}	24 hour	100	In line with WHO Interim Target 2, the existing Rwandan standards and other national standards
	Annual	50	
$PM_{2.5}$	24 hour	75	In line with WHO Interim Target 1
	Annual	35	
Ozone 0_3	1 hour	200	In line with the most common national standards
	8-hour daily maximum	120	In line with WHO Interim Target 1 and the most common national standards
Carbon Monoxide CO	1 hour	30,000	In line with WHO guideline and the most common national standards
	8 hours	10,000	

Low Risk Slope Areas (slopes < 20%)

- Protect environmentally significant features of the site such as wildlife, trees, natural drains, rolling slopes and soil stability;
- Slopes > 5% needs soil stabilization and erosion control measures; and
- Roads on slopes greater than 12% must run diagonally than perpendicular to the slopes, except for short distances

8.11 Climate Change and Disaster Resiliency

8.11.1 Climate change and natural disasters

Climate studies forecast an increase in Rwanda's average temperatures by 2.5oC between 1970 and 2050 and annual rainfall increases of up to 20% over the same period.[18] Climate change impacts in Rwanda include more extreme rainfall events, flooding,

18 Government of Rwanda. 2011. Green Growth and Climate Resilience. National Strategy on Climate Change and Low Carbon Development. Kigali, Rwanda.

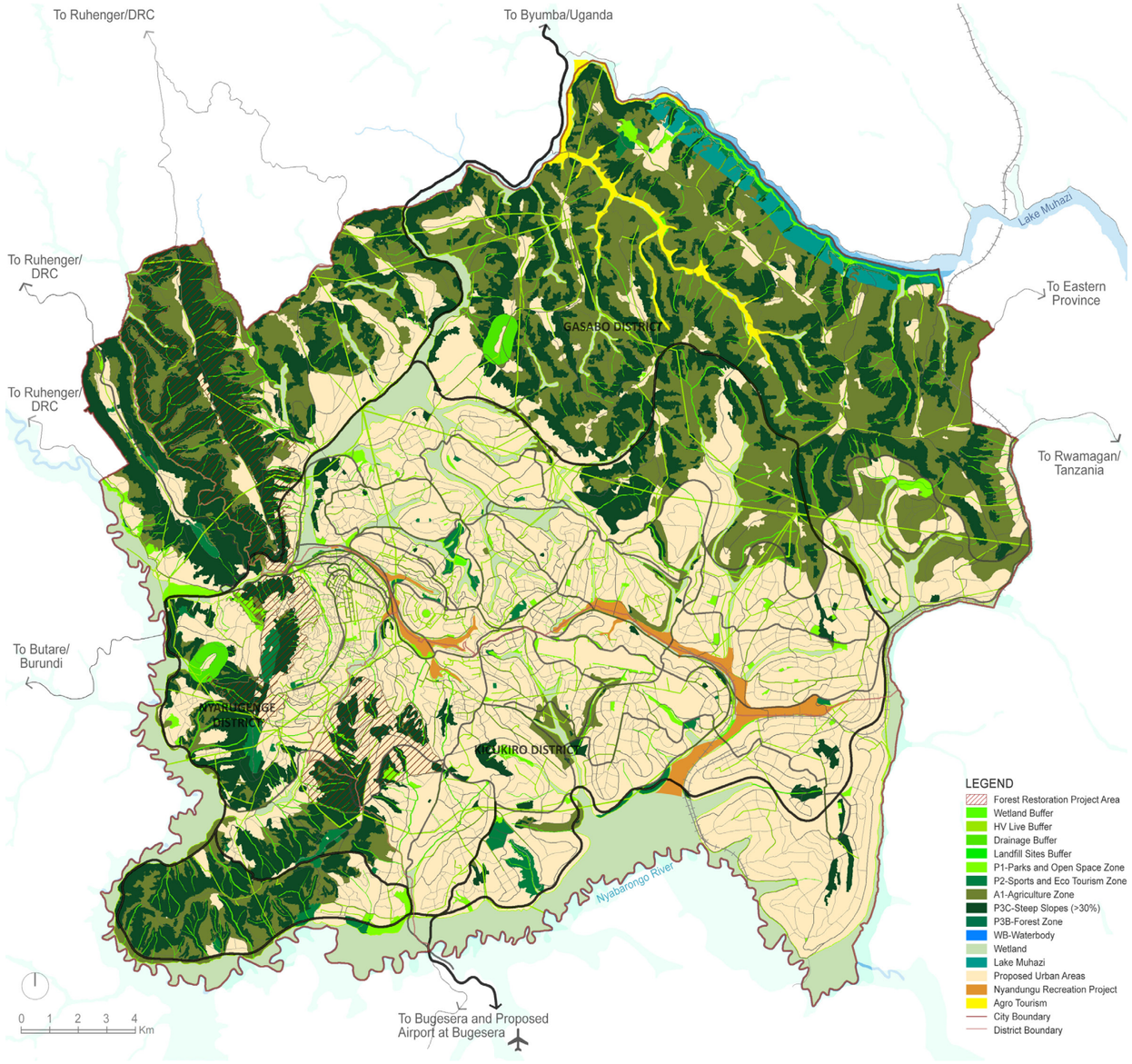


Figure 8.13 The Green Blue Plan 2050

landslides, more extreme temperatures, heat waves, and periods of drought.

Kigali has areas at risk of and experiencing natural disasters such as flooding and landslides, including areas which have been encroached upon by informal settlements, cultivation and industries. The frequency and extent of flooding in the city would be expected to increase with climate change, in the absence of environmental management actions to limit the flooding and its impacts. Kigali similarly has high risk steep sloped areas susceptible to landslides, which could have a higher risk of occurring under the conditions of increased rainfall and stormwater runoff expected in Kigali.

Climate change and disaster resiliency measures are essential to minimizing the scale and impact of flooding on infrastructure, services, economic activities, and households.

8.11.2 Greenhouse gas emissions and air pollution

Greenhouse gases (GHG) are emitted from a wide range of activities and sources in Kigali including: carbon dioxide emissions from combustion of fossil fuels and burning of biomass, vegetation, and solid waste, as well as methane emissions from rice fields, wetlands and cattle, and emissions of other GHGs from industrial processes and fossil fuel combustion. These emissions contribute to the increased atmospheric levels of GHG's which are leading to global warming and climate change.

A large number of premature deaths and morbidity in Rwanda is associated with poor air quality and is largely attributed to PM10 and PM2.5 emitted from vehicles, biomass fuel use (wood and other solid fuels), industrial processes, and seasonal burning of vegetation. Emissions are predicted to increase annually (by 4.2% under status quo or by 2.1% with implementation of air quality strategy) with population growth and development of the country with impacts from transport, stoves, energy sector, and industry all expected to increase.[19]

8.11.3 Management efforts

Rwanda's National Strategy for Climate Change and Low Carbon Development was published in October 2011 with the aim of providing strategies for green growth and climate resilience in Rwanda. Actions are proposed in that document for low carbon development/ mitigation (promoting: geothermal power generation, integrated soil fertility management, and high-density walkable cities) and climate resilience/ adaptation (promoting: irrigation infrastructure, robust road network center for climate knowledge for development and agroforestry).

An air pollution control strategy has been prepared and presented by REMA (2018) and include the following recommendations: Refresh existing air quality standards apply strict import regulations on vehicles, smooth traffic

19 REMA 2018. Inventory of Sources of Air Pollution in Rwanda. Determination of Future Trends and Development of a National Air Quality Control Strategy. Rwanda Environment Management Authority. P.O. Box 7436 Kigali, Rwanda. 18 January 2018

flows around traffic hotspots, reduce emissions from bus fleet, invest in public transport systems, reduce emissions from domestic stoves, develop renewable energy generation, and manage freight movements across Kigali.[20]

The Strategy also includes recommended ambient air quality standards as shown in table 8.7.

Climate change and disaster resiliency strategies

- A citywide climate change management plan with projects and guidelines;
- Include tax exemption and climate financing opportunities as incentives for all energy efficient development;
- Integrating climate and disaster resiliency into planning and design of buildings, infrastructure, and urban services to adapt to and minimize negative impacts from and contribution to climate change and natural disasters;
- Identification and mapping of natural disaster risk and hazard areas (e.g. Flooding, erosion, landslides, earthquakes, and lightning strikes);
- Restriction of development and activities in high risk areas;
- Relocation of households from high risk/hazardous areas;
- Preparation of early warning system;
- Preparation of disaster response plans; and
- Design of resilient infrastructure and services to minimize the impacts and disruptions from common natural disasters

20 REMA 2018. Inventory of Sources of Air Pollution in Rwanda. Determination of Future Trends and Development of a National Air Quality Control Strategy. Rwanda Environment Management Authority. P.O. Box 7436 Kigali, Rwanda. 18 January 2018.

8.12 Green and Blue Plan

The Kigali Master Plan 2013 proposed the Green and Blue Plan for the city of Kigali to develop a city-wide park network banking on the various natural wetlands and forest that are the natural assets of the city. In our interactions with various stakeholders to update the master plan, the city has presented it's desire to create more green areas and public open spaces for it's citizens using the abundant nature area available in the city in a sustainable way. Kigali Master Plan 2050 further promotes the Green Blue Plan strategy to creates distinctive tourist destinations with the thematic landscape developments unique to each district. These attractions will be appealing to both domestic and international visitors and will also develop large recreational spaces in the city.

Gasabo

Nature-based Tourism Attraction
- Heritage tree park @ Rutunga;
- Agro tourism valley of Nuduba, Rutunga & Bumbogo;
- Agrotourism resort;
- Mount Jali ridge park; and
- Eco energy farms @Gihogwe

Parks & Recreation Attraction
- Water park & resort @ lake Muhazi
- Horticultural parks;
- Valley of flowers & wetland park; and
- Golf course @ Remera;

kucikiro

Nature-based Tourism Attraction
- Kicukiro Wetland & biodiversity parks;
- Parks & recreation attractions;
- Valley of flowers & wetland park;
- Equestrian park;
- Sports city;
- Golf course & resort;
- Gikondo Lake park;
- Botanical garden; and
- Amusement park

Nyarugenge

Nature-based Tourism Attraction
- Nyabarongo eco bird park & wetlands;
- Secret valley park;
- Kinyinya wetland town park;
- Nyarugenge district center wetland park; and
- CBD Wetland Park @ Muhima

Parks & Recreation Attraction
- Kinyinya adventure sports park;
- Mount Kigali adventure forest park;
- Kinyinya nature park, spa& resorts; and
- Mageragere ridge park & resort area

City parks & attractions

- Wetland Parks;
- Hill/ Mountain Ridge Parks;
- City Squares & Plazas;
- Tourists/ Art Markets;
- Museum & Heritage / Historic Sites; and
- Stadium & Sports Clubs

8.12.1 Proposed green and blue plan 2050

Following the 2013 proposal, the Green and Blue Network Plan 2050 encourages development of seamless network of natural and urban landscape areas within Kigali. The plan features following variety of parks and public spaces:

Town parks

Town parks are the regional destination for locals as well as the visitors. The facilities are mostly associated with the major recreation, education, leisure activities and may have natural or unique features. The town plaza near town parks attracts festivities, local celebrations and public gatherings.

Local parks

The local parks cater to the neighborhood scale. They range in sizes and are programmed for active and passive recreation. They are located near residential developments to promote the community environment and provide typical park amenities for local population.

Urban Parks

Urban parks are the large thematic parks like botanical garden, horticulture parks, lake park, biodiversity park etc. They are the focal point of the community and support the identity of the place.

Valley of flowers

The proposed vaProposed Nyandungu Recreational Project will be the icon for the Kigali City. The existing wetland valley will have lush plantation of Roses and Alstromeria flowers along its buffer and peripheral areas. The parks will feature flower gardens, green house exhibits, commercial flower fields with the gift shops and florist shops.

Nature parks

The large drainage channels within towns, the unbuildable slopes and forest patches in the city are converted into nature parks.

Wetland parks

The wetland parks are developed around the existing wetlands and proposed wetland buffers. It collects and recycles surface runoff coming from the surrounding areas. It features indigenous plantation and allows passive recreation use.

park connector network

All the above open green spaces are connected through green connector network like green strips , bridges, green fingers etc. and ensure a seamless pedestrian network throughout the city.

8.12.2 Public and Open Spaces Management Strategies

- Cluster and inclusionary zoning regulations to create more public open spaces;
- Establishment of networks of parks and natural areas across the City and neighborhood nature parks;
- The open space, greater than 30% slope and scattered forest patches in the urban area to be protected and developed as nature parks;
- Large open spaces, less than 20% slope and which cater to the township recreation are developed as community parks;
- Integrate protected landscapes with the City Parks and Open Space Network plan and enhance them through park planning, design, and the use of environmental best management practices;
- Interconnect parks, trails and greenways with as much universal accessibility as possible;
- Apart from the use of existing open spaces ensure that parks are well distributed throughout the community, particularly in higher density areas;
- Work with neighborhoods to identify public parks and recreational needs and assess the level of access and distribution of park resources. Target the location of Community Park within 10 to 15min walk from the majority of the residential neighborhoods, important nodes and community interaction spots; and
- Design and program parks and open space to maximize their potential, recognizing the limits of parkland supply and changing demographics

8.12.3 Landscape Network Management Strategies

- Preserve and protect natural landform and features: refer conservation and management strategies for the landscape areas established in the previous section;
- Design buffers for the wetland, river and lake established by the Organic Law as linear park to limit growth, protect existing biodiversity and agricultural tradition;
- Incorporate public access and permissible recreation into restoration and preservation efforts;
- Develop these buffers as riparian corridors by promoting native species plantation;
- Identify potential connecting corridors between these natural areas and conserve them. For example – unique terrain of Kigali allows wetlands and waterways connection to the uplands through natural drainage valleys. These natural drains have high conservation potential and to be developed as landscape corridors allowing storm water discharge, biodiversity flow and recreation and development connection to the natural areas;
- Promote creation of continuous public trails adjacent to riparian corridors, green belts and landscape corridors to allow continuous system trail connection;
- Promote these conserved landscapes as a thematic passive recreation area relating to their ecological values and assets; and
- Promote natural resource protection to foster green jobs opportunities and training programs

9

City on the Move

9.1. Transport Overview
9.2. Strategic Transport Network

9 City on the Move

9.1 Transport Overview

The City of Kigali (CoK), one of the most active and progressive City Councils in Africa, has been working towards developing Kigali into a city with modern infrastructure and cost-effective quality services. Effec-tive transport systems are critical to enable economic growth and development in a city.
The Transport Master Plan sets out a strategic vision for Kigali to meet the requirements of a City on the Move. It will help ensure that an integrated transport network, policies and guidelines can be planned and budgeted for as the City grows. This chapter provides a brief summary of the Transport Master Plan.

The goals of the updated 2018 Transport Master Plan are:
- To become a Transit-Orientated City
- To establish a Complete Transport System
- To create a Sustainable Transport Network

The key updates to the 2018 Transport Master Plan from the 2013 version are as follows.

9.2 Strategic Transport Network

9.2.1 Road Network Strategy

The following proposed strategic, tactical and operational projects align to the suggested key strategies:
On a strategic level this updated Transport Master Plan represents a plan to guide the development of a road network with a consistent hierarchy, access and mobility functions and associated typologies and cross-sections. This plan also includes a classification system for local roads.The revised road classification for the City refer Table 9.1

The proposed Road Network Classification is as follows:
(Refer Figure 9.1)

- Upgrades along BRT routes to 2 lanes per direction
- Airport Link Road Upgrades
- Kigali Ring Road
- Arterial routes for Kigali in 2050 that will require construction or upgrades to 2 lanes per direction if not already in place. These alignments can be adjusted as required during detail design periods and the shown route alignment is only an indication of where the road is required to help meet demand.

On a tactical level the following projects should be initiated:
- Feasibility study for the tolling of the Kigali Ring Road (including investigation into tunnelling and bridges)
- Feasibility study for the Airport Link Road and the extension of BRT services to Bugasera Airport
- Feasibility study for High Capacity Urban Road (including investigation into tunnelling and bridges)
- Transport Master Plans for specific areas of interest for example the existing Kigali International Airport Planning Area, the three districts of Kigali, the four planned Regional Centres, etc.
- Traffic Management Plans for specific areas of interest for example Emergency (Police) Road Closures.
- Develop a Road Safety Strategy for Kigali
- Feasibility for a Traffic Control Centre

On an operational the following is recommended:
- Development of a Road Access Management Strategy for Kigali.
- Development of standardised geometric design guidelines including traffic calming measures.
- Development of standardised specifications for the design, procurement and installation of traffic signals.
- Development of a Road Sign and Marking Manual for Kigali.
- Development of a Parking Policy and Design Manual for Kigali.
- Development of monitoring mechanisms to survey and report on the achievement of the key performance indicators.

Strong focus on Non Motorised Transport (NMT)	• The new transport masterplan places a greater emphasis on the importance of NMT and NMT infrastucture
No Mass Rapid Transport (MRT) recommended in the short term	• The reduced population expected as well as different transport focus allows for the BRT to provide sufficient Rapid Public transport within the City - provided appropriate NMT and Parking Policies are implemented.
VISSIM Simulations for Immediate Road Network Solutions	• Upgrades to improve the existing traffic problems are recommended
Additional Objective to Implement Transport Policy Effectively	• Although this was included in the previous master plan, it was not considered a specific objective. Focus on Governance and Institutional aspects are emphaisied in this update.
Function of Motor Taxi Considered	• Scenarios were considered where more and fewer motor taxi are used within the City. Recommendations to establish a functional hierarchy where motor taxis can serve as feeders and complementary services are made.
Realignment of Major Projects Considered	• Kigali Ring Road • BRT routes • Revised road hierarchy

Table 9.1 Revised road classification for the City

Types	High Capacity Roads	Major Arterial Roads			Minor Roads		Collector Roads		Local Roads	
	Trunk Roads		MASS TRANSPORT / Bus Rapid Transport	Link Roads	Main Bus Routes	Commercial Streets	Populated / Developed / Urban Road	Unpopulated / Undeveloped / Rural Road	Residential Street	NMT Route Greenway/ Multi-Use Pathway
Description										
Design Speeds & Geometry										
Design Speed to achieve required capacity and mobility	90 - 120kph	75 - 90kph	40 - 75kph	75 - 90kph	30 – 60 kph	30 – 40 kph	30 – 40 kph	50 - 60 kph	10 – 30 km/h	-
Speed Limit (applicable in specific conditions)	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 10kph due to geometric challenges or to improve safety	
Geometry Design to International Standards										
Street Dimensions										
¬	38,0	27,0	29,4	21,6	15,0	15,0	15,0	21,0	8,0	4,0
Max ROW (Green Field)	64,0	58,0	53,4	37,5	27,6	26,6	26,0	37,0	12,5	10,0
Typical number of lanes per direction	2 – 3 lanes plus service lanes	2 – 3 lanes	2 – 3 lanes	2 – 3 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 lane	-
Minimum Carriageway Width	3.5 m per lane	3 - 3.5 m per lane	3 - 3.5m per lane	3- 3.25 m per lane	3- 3.25 m per lane	3 m per lane	3 m per lane	4 m per lane	3- 3.25 m per lane	-
Median Width	4 m	1 – 4 m	1 – 4 m (may be removed based on site conditions)	0.6 – 4 m	0.6 m (only if 2 lanes per direction are provided)	0.6 m (only if 2 lanes per direction are provided)	-	-	-	-
Hard Shoulder per direction	3 m	-		-	-	-	-	-	-	-
Sideway Easement / Verge per direction	2.5 – 6 m	2.5 – 6 m	-	-	-	-	-	2 – 3.5 m	-	-
Footpath width per direction	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min	2 m min	2 m min	2 m min	-	-
Footpath furniture / Tree pits per direction	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m
Cycle track width	One-directional: 2m min Two-directional: 3m min (must be separated from motorised vehicles by buffer)	One-directional: 2m min Two-directional: 3m min (must be separated from motorised vehicles by buffer)	One-directional: 2m min Two-directional: 3m min (must be separated from motorised vehicles by buffer)	One-directional: 2m min Two-directional: 3m min (must be separated from motorised vehicles by buffer)	One-directional: 2m min Two-directional: 3m min	One-directional: 2m min Two-directional: 3m min	One-directional: 2m min Two-directional: 3m min	One-directional: 2m min Two-directional: 3m min	-	-

Pedestrian Crossings (if warranted)	Separated Grade or Signalised	Preferably Signalised; Traffic Calming if required	Preferably Signalised; Traffic Calming if required	Preferably Signalised; Traffic Calming if required	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	-
Vehicular Pull Overs / Ramps Allowed (Dropped kerb and reinforced sidewalks to allow parking or pulling off road)	No	No	No	No	Yes	Yes	Yes	Yes	Yes	-
Traffic Calming	No	Not recommended	Yes (not on BRT lanes)	Not recommended	Yes	Yes	Yes	-	Yes	Yes
On-street Car Parking	No	No	No	No	No	Short-term (Optional)	Yes	-	Yes	No
Public Transport										
Bus Access	When required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Bus Stops	Only along service lane	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	No
Bus Shelter Width	2m min	2m min	2m min	2m min	2m min	2m min	2m min	2m min	2m min	
BRT Lanes per direction	-	-	1 - 2 lanes	-	-	-	-	-	-	-
Width of BRT lane	-	-	3.5 m min	-	-	-	-	-	-	-
BRT Station Width	-	-	4 m min	-	-	-	-	-	-	-
Other Information										
Statutory Services	In Roadside Verge	In Roadside Verge	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Roadside Verge	In Planting Strip	-
Lighting Required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional buffers	-	-	Approximately 0.2 between BRT lane and mixed traffic lanes (Semi-Traversable)	-	-	-	-	-	-	-

Note: These are generic best practice guidelines which can be adapted to suit a specific local-ised geometric design challenge or safety concern

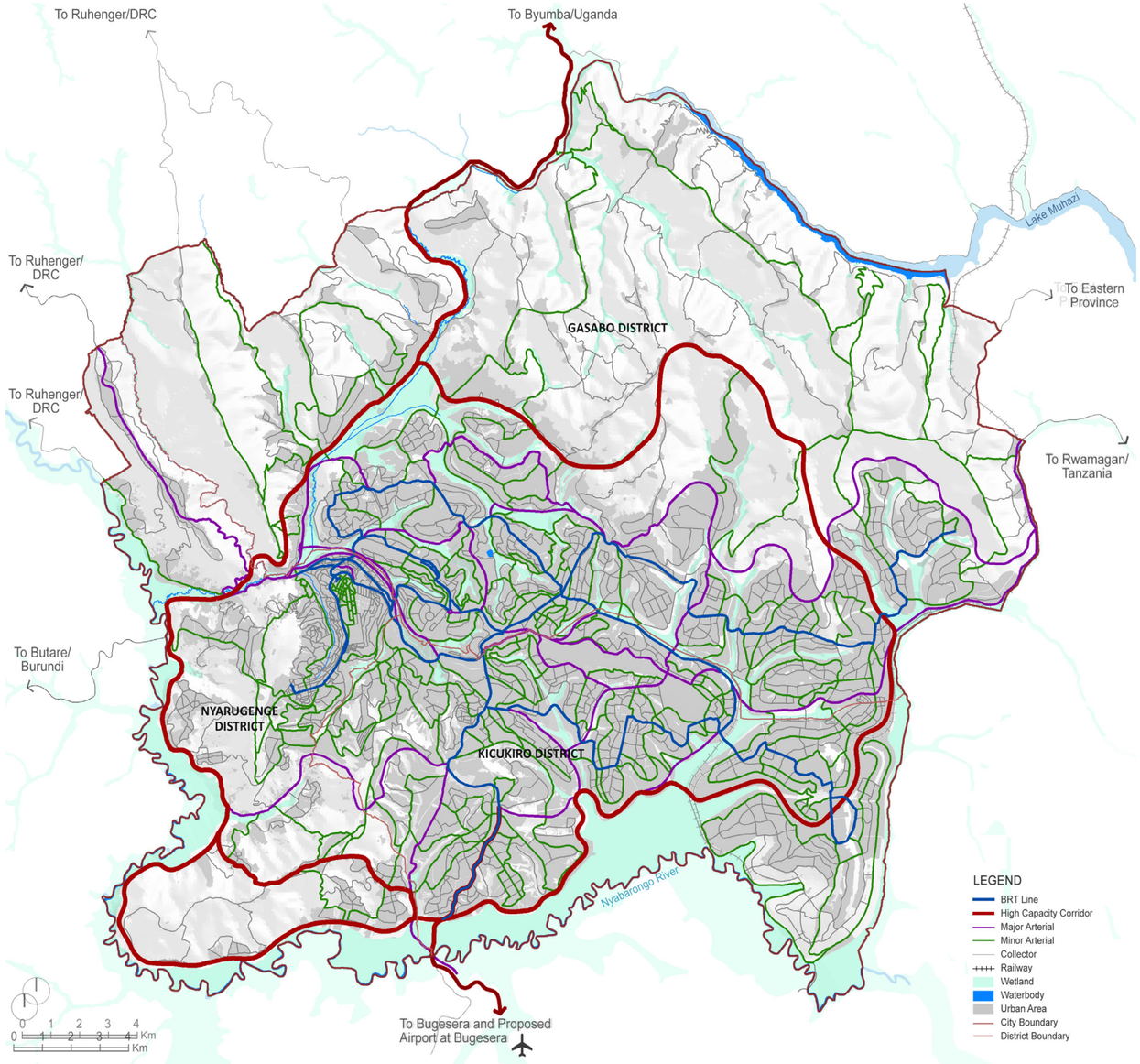


Figure 9.1 Road Network Classification

9.2.2 Public Transport Strategy

The following proposed strategic, tactical and operational projects align to the suggested key strategies:

1. Development of a strategic level Integrated Public Transport Plan which will address public transport hierarchy and function. The plan should detail aspects such as the integration of the Moto-Taxis and Other Bus Services with other forms of Rapid Public Transport (for example BRT). Some modes could act as feeder services rather than competitive modes. The plan should also identify passenger access typologies, for example stops, shelters, open stations, closed stations and interchanges and make recommendations on the appropriate level of demand and public transport mode for each. Such a plan should also include an investigation into the feasibility of the extension of a high speed public transport link to new the international airport (Bugesera). In addition the plan should investigate the potential introduction of regional passenger rail connections at the planned freight rail link connection at the Bugasera airport. Such a plan should be supported by a multi-modal transport demand model.
2. Development of tactical level detailed feasibility studies for projects identified and prioritised in the Integrated Public Transport Plan should be commissioned, for example:
   - Bus Rapid Transport and associated feeder network feasibility study and operational business plan
   - Cable car feasibility study and operational business plan Nyabugogo Transport Hub conceptual design
   - Nyabugogo Transport Hub conceptual design
3. Development of operational level assessments and designs:
   - Due diligence study to inform the reservation, zoning and accessibility of land for public transport terminals and depots.
   - Investigation into the application of ITS technologies for certain identified solutions.
   - Development of universal access design guidelines for public transport and non-motorised transport access.
   - Development of monitoring mechanisms to survey and report on the achievement of the key performance indicators.
   - Develop a rationalisation plan for public transport operating licences.
   - Electronic Ticketing for All Public Transport in Kigali
   - Develop a Public transport fare policy (for all public transport modes including taxis and shared mobility) for Kigali to be approved and updated on an as-needed basis.

9.2.3 Freight Management Strategy

The following proposed strategic, tactical and operational projects align to the suggested key strategies:

On a strategic level:

- The existing Road Freight Network as well as the status of the Rail Network is discussed in the Transport Master Plan. The proposed road network and Kigali Ring Road specifically will allow freight traffic passing the city to pass around it without adding to the internal heavy vehicle traffic.
- Provide input into the

development of a national rail master plan that should determine the status of the planned rail connections to Uganda, Tanzania and Bugasera Airport. This plan should take account of the fact that these rail connections would strengthen Kigali's position as a logistics hub to the East coast.

- Logistic hubs should be located on the outskirts of the City to allow transfer to smaller trucks within the City. They should also be near rail, major roads and industrial areas. A high level due diligence study should be carried out to determine the most appropriate locations for future logistic hubs.

On a tactical level:

- Develop freight management plans for specific areas of interest, for example the 4 planned regional centres. Such plans should identify locations for weigh bridges, inter-modal facilities, loading zones, truck stops, service facilities, dedicated routes and restrictions. The plan should take account of on-street parking and the provision of NMT infrastructure.

On an operational level:

- Develop a guideline for the management of construction traffic.

9.2.4 Green Transportation Network Strategies

Green Transport Network Strategies consist of:

- The development of an NMT network
- Green Transport Promotion Strategies
- Parking Strategy

Figure 9.2 shows the primary and secondary NMT routes proposed.

Figure 9.3 highlights areas where detailed NMT plans will be required.

It is also recommended that all roads within 500m of the BRT or Primary NMT routes be made a priority for upgrade in terms of NMT infrastructure. Refer Figure 9.4

In terms of parking the following strategies are recommended:

- On-street parking to be allowed in accordance with the refined road classification system.
- A research project be carried out to develop a policy and methodology for the payment of on-street parking, including pricing levels, parking bans, technology, enforcement mechanisms, legislation, parking design, revenue sharing models, etc.
- For off-street parking - identify areas where shared parking lots can be developed for special zones, including regional centres. This should inform the Planning Area master planning for these areas. The plan should also consider urban design principles to remove and/ or ban setback parking (between the privately owned building and the public road space), which obstructs pedestrian movements.
- Conduct a research project to establish maximum off-street parking standards for special zones, including regional centres. The project should include a benchmarking exercise as well as parking utilisation surveys.
- Identify land parcels suitable for the development of park and ride facilities particularly close to public

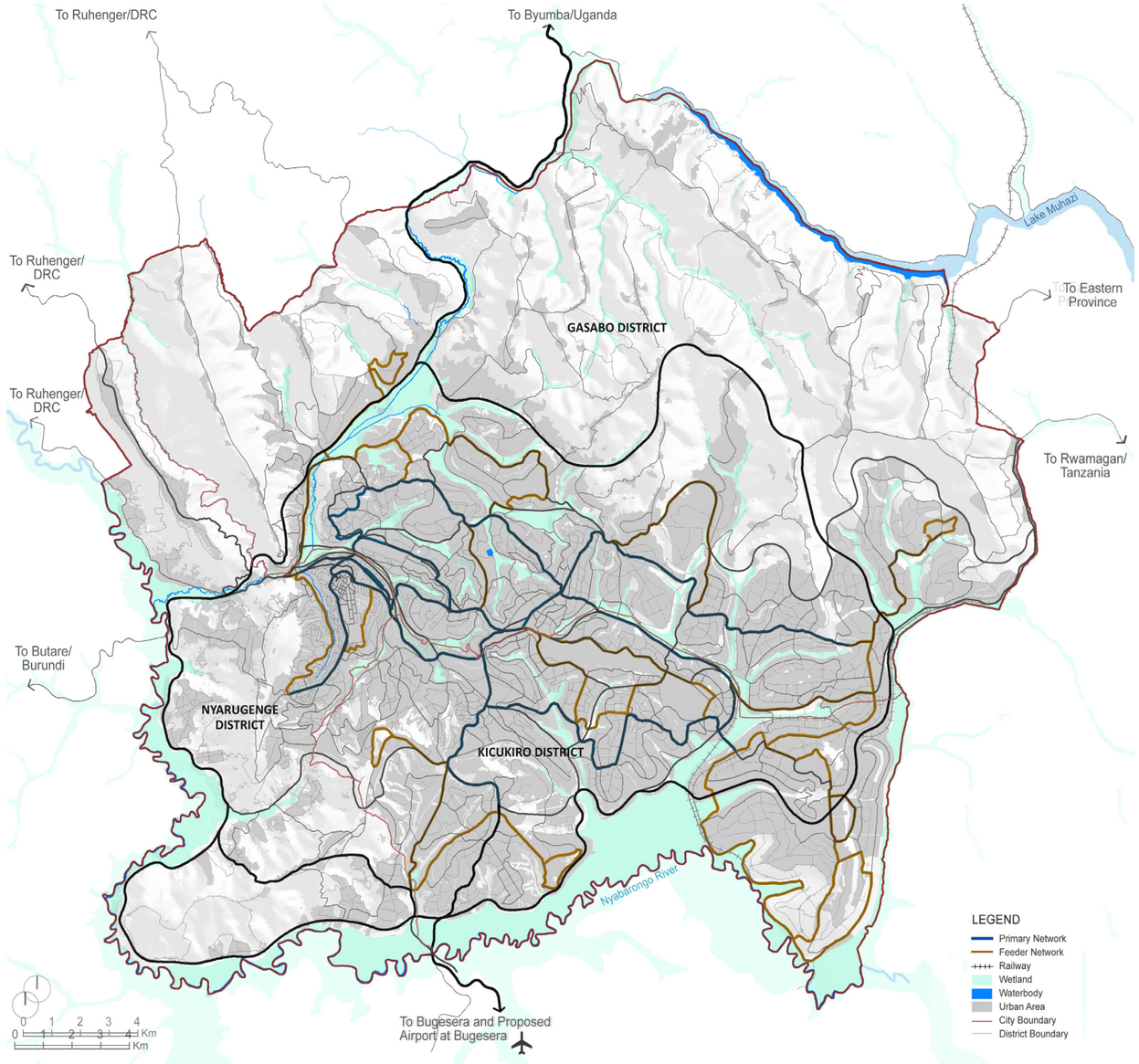


Figure 9.2 Primary and secondary NMT routes proposed

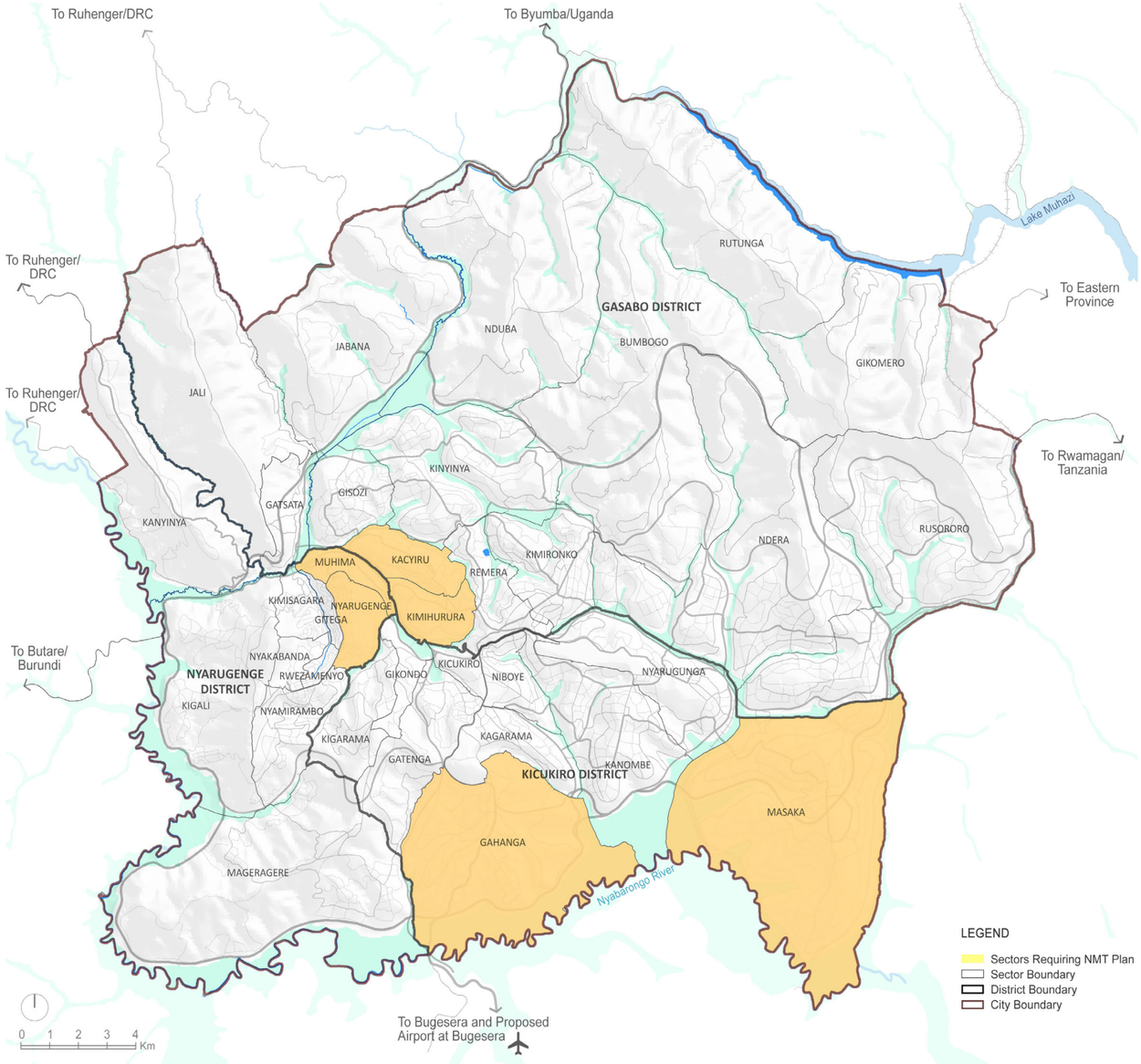


Figure 9.3 Detailed NMT plans will be required

transport systems. These park and ride facilities will generally be located in the suburbs of metropolitan areas and on the outer edges of the larger cities.

9.2.5 Effective Transport Policy Implementation

The following strategies are recommended:

- Establish the Kigali Transport Authority.

- Compile a Transport Information Register: A detailed Transport Inventory is required for the City. This should be updated every 5 years prior to the commencement of the Transport Master Plan Update and should include details on infrastructure, operations and vehicles. City-wide origin/destination surveys should be done with this.
- Develop Transport Assessment Guidelines and Manuals.
- Develop Traffic Impact Assessment and Development Application Standard Operating Procedures.
- Develop monitoring mechanisms to measure KPIs.
- Develop a multi-modal transport demand model to inform all planning for the City. Identify a custodian for the model has to be identified to protect its integrity and to ensure the "agreed demand and supply scenario" is utilised in all planning matters. The custodian should keep the model accessible to third parties for planning purposes and ensure the model is regularly updated and maintained.

An organogram showing the proposed institutional arrangement is provided Figure 9.4.

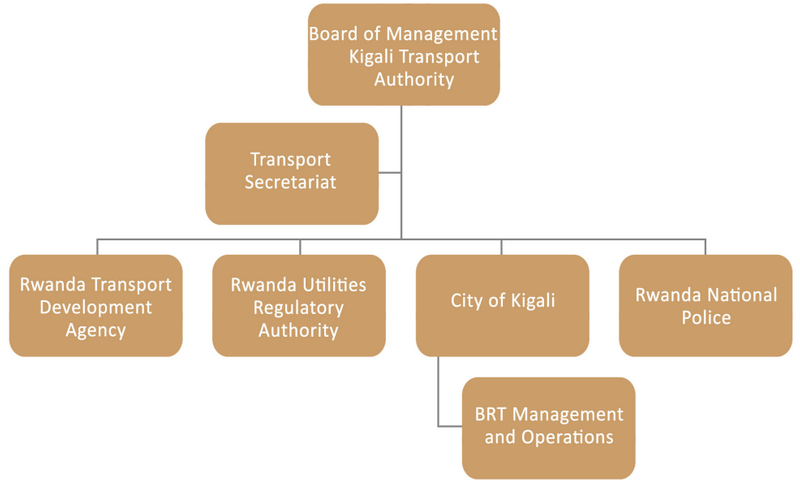


Figure 9.4 Proposed institutional arrangement

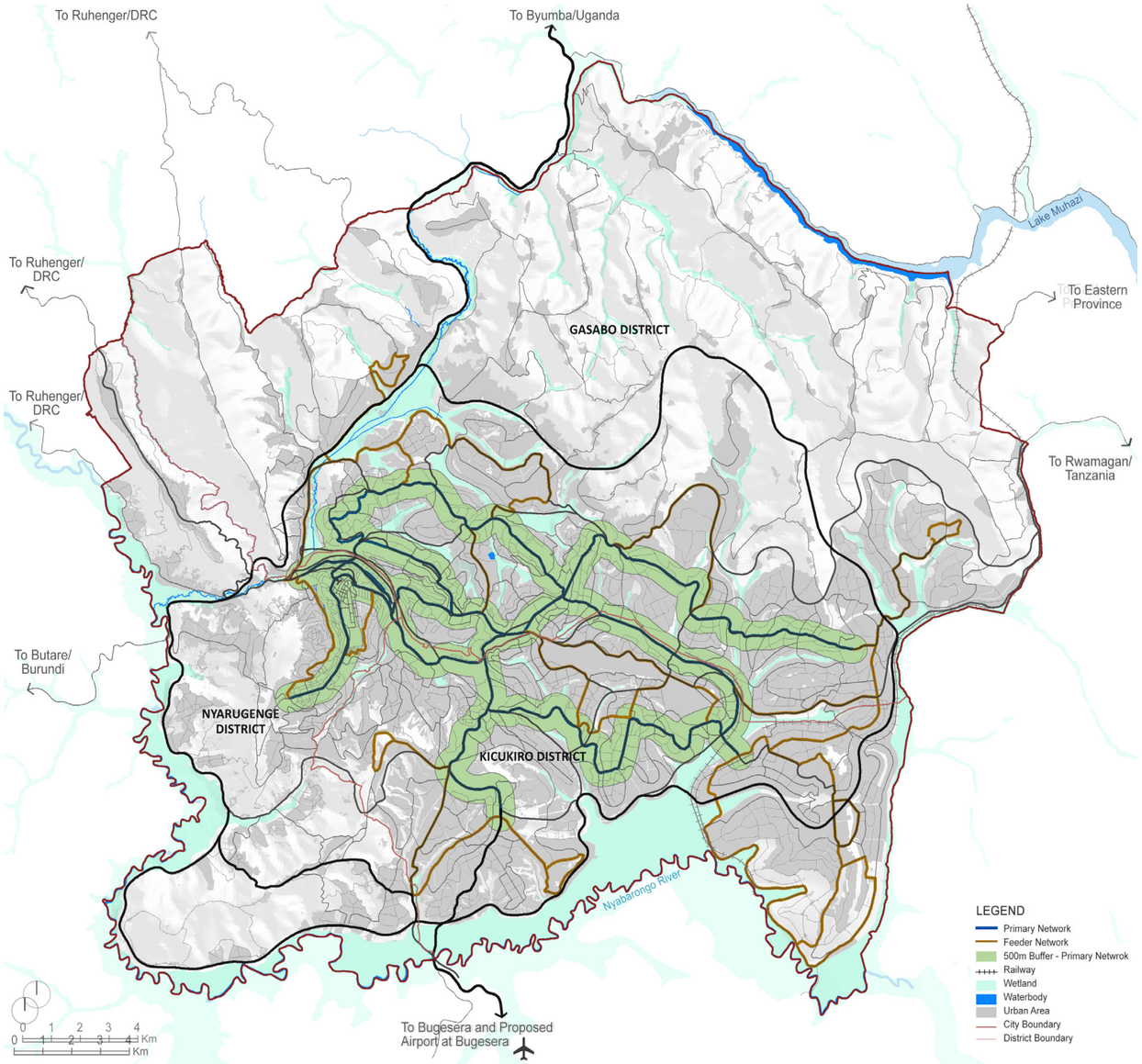


Figure 9.5 NMT infrastructure

10

Efficient City

10.1. Sustainable and Resilient Infrastructure
10.2. Water Supply Plan
10.3. Waste Water Management Plan
10.4. Solid Waste Management Plan
10.5. Storm Water Management Plan
10.6. Power Supply Plan
10.7. ICT – SMART CITY Plan
10.8 Recommendations

10 Efficient City

10.1 Sustainable and Resilient Infrastructure

The "Efficient City" chapter of this report applies to infrastructure within the Kigali City Boundary, and the National Master Plans address the integration of strategies for the country as a whole. It is important to note that the Infrastructure Master Plan of a City provides broad recommendations for bulk infrastructure planning. This includes the following:

- Treatment works;
- Primary bulk pipelines;
- Secondary bulk pipelines.

More detailed planning done in master plans for individual services should feed into the above-mentioned bulk lines. This next level of planning will include further studies to inform more detailed calculations, and therefore tertiary pipelines down to a neighbourhood level will be proposed.

Due to rapid urbanisation and land scarcity, caused by the steep topography and wetlands that are effectively "no-go" areas in the City of Kigali, efficient use of resources and sustainable management strategies are essential for its development. The "Efficient City" is one of 8 themes of development for Kigali City, and it aligns with the overarching policy pillars in the Rwanda National Urbanisation Policy.

The main criteria to be considered when providing infrastructure services for a community are:

- Availability – Access to basic services;
- Reliability – Meeting performance standards for a desired duration;
- Appropriateness – Relevant service and technologies to meet demand;
- Affordability – Available funding for implementation and reasonable tariffing for consumers,
- Sustainability – Meeting current needs without compromising future social, environmental and economic standards.

Urbanisation and population growth in emerging economies and developing countries like Rwanda, demand an increase in infrastructure development. Efficient and effective infrastructure plays a critical role in achieving the United Nations' (UN) Sustainable Development Goals (SDG). Infrastructure development plays a role in many of the SDG's, and Goal 9 speaks specifically to "Industry, innovation, infrastructure". This goal aims to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Rwanda has implemented the SDG's by integrating them into their National Policies such as the EDPRS 3 and the Vision 2020. The country has a strong advantage when it comes to achieving the SDG's due to its strong leadership, political will and enforcement.

The Global Green Growth Institute (GGGI) partnered with the Infrastructure Sustainability Council of Australia (ISCA) in October 2018 to support sustainable infrastructure development in Rwanda. ISCA has specific experience in the Infrastructure Sustainability (IS) International rating scheme. This system evaluates sustainability across the planning, design, construction and operational phases of infrastructure projects and will be implemented in Rwanda. This partnership will ensure the transfer of knowledge from the technical experts to support capacity development in Rwanda and implement green infrastructure solutions.

The UN defines resilience as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate and to recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions". The concept of resilient infrastructure can therefore be related to the structural integrity of the physical infrastructure, which is essential to ensure its continuous and optimal performance during extreme loading. This loading can be sudden (disaster-related) or gradual (climate change). Since infrastructure is designed for long-life spans, resilient infrastructure requires long-term infrastructure investments and planning.

The following Resilience Wheel (Figure 10.1) has been taken from a document titled "Introducing Infrastructure Resilience" by the Department of International Development (2016). It shows all of the parameters that play a role in making infrastructure resilient.

In order for the infrastructure in Kigali to meet the previously-mentioned resilient and sustainable requirements, it is essential to upgrade the existing-aging facilities and networks. For example, the majority of the water supply lines in

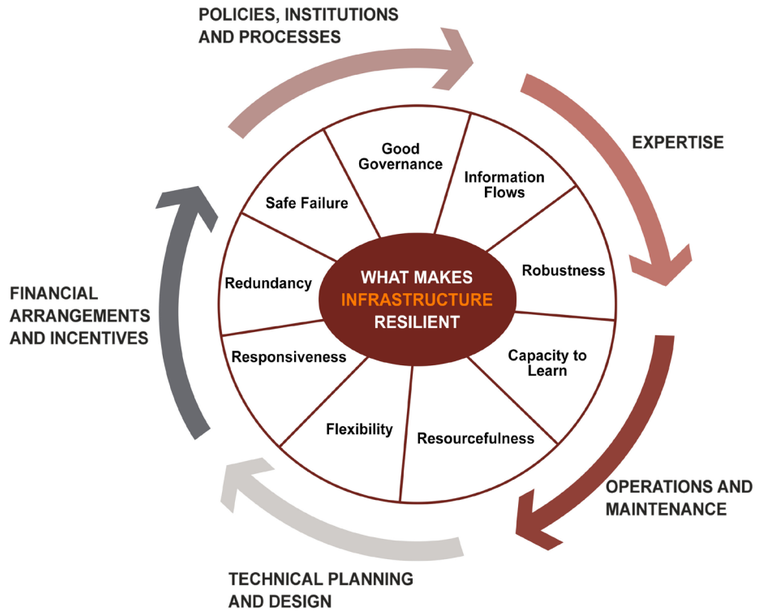


Figure 10.1 Infrastructure Resilience Properties

the City were laid in the 1970's or earlier and need to be upgraded to pressure-resistant pipe materials to reduce the amount of non-revenue water (NRW). The difficult terrain in Kigali makes the constructability and maintenance of infrastructure services a complicated task. Careful planning is required in the design phase of projects to ensure that appropriate materials are specified, for example: self-maintaining pipe systems
.

10.2 Water Supply Plan

Access to affordable, reliable, safe and high quality drinking water is a fundamental human need and therefore plays a major role in the success of a functioning city. Water supply systems are also very difficult and costly to retrofit into urban environments if space has not been allocated for this infrastructure in the land use planning and the identification of servitudes.

10.2.1 Applicable Policies and Plans

The governing policies and plans for water supply and distribution in the City of Kigali are as follows:

- National Policy for Water Resources Management (2011);

- Rwanda Vision 2020 (2012);
- Water and Sanitation Sector Strategic Plan 2013/14 - 2017/18 (2013);
- National Water Supply Policy (2016);
- National Water Supply Policy Implementation Strategy (NWSPIS) (2016);
- Economic Development and Poverty Reduction Strategy (EDPRS II) (2013);
- National Informal Settlement Upgrading Strategy (2015); and
- United Nations Sustainable Development Goals

10.2.2 Master Plan

The information relating to water supply from the 2013 City of Kigali Master Plan, as well as various documents detailing WASAC's future plans, have been used to inform this section of the report.
It must be noted that a National Water and Sanitation Master Plan is currently being prepared by Lotti Ingegneria Consultants for WASAC and was not available for use in this report. However, the baseline report has been received and considered in the compilation of this document. Lotti has indicated that their focus is not on Kigali but rather the rest of the country. This is because Nihon Suido Consultants, in association with Yachiyo Engineering, have been appointed to create a Water Supply Master Plan for the city of Kigali. The information provided as part of the Interim Master Plan for the City of Kigali will provide plans for the bulk infrastructure, which can then be used to inform the Water Supply Master Plan. The Water Supply Master Plan should provide further detail in terms of new reticulation, required upgrades and any relocations which may be required.

The outcomes of these Master Plans may affect and/or change the recommendations made in this document.

10.2.3 Key Issues

Some of the key issues to be addressed by the City relating to water supply are discussed below. Recommendations to address these issues have been made by the project team and are presented later in this report.

- **Uncoordinated planning between future land use and infrastructure:** Without proper planning, the existing infrastructure will not be able to meet the growing water demand. The City has to work closely with WASAC to determine the growth centre and the projected water demand. Sufficient land should be secured for the construction and expansion of water treatment plants and service reservoirs.

- **Shortage of water reticulation:** The current supply is lagging behind the actual demand, in terms of network reticulation but not source capacity. The 80 lpcd city wide goal set by the MININFRA was due to limited water supply. In the long run, as the population and standard of living rises due to urbanization, this goal has to be reviewed. The City also has to utilise the current resources more efficiently and identify new ones for long term planning.

- **Difficulty in expanding the water network:** The undulating terrain of Rwanda poses a challenge in laying and expanding the existing water pipe network to cover the entire City. It is more economically viable to consider local water supply sources for areas that are inaccessible to the existing network. Expansion plans should also consider methods for appropriate pressure management due to the vast and varying ground elevations. On the other hand, the supply of water across varying elevations generates high amounts of energy that could be converted into power. This can lead to a cost reduction for WASAC when needing to provide power to their systems.

- **Age and coverage of existing network:** WASAC only supplies 32 of 35 sectors in Kigali, the remaining 3 sectors are covered by local systems. To meet the target of supplying water to 100% of the population, WASAC needs to implement projects to reach these areas. It is also essential to upgrade the aging facilities and networks (mostly laid in the 1970s or earlier) to pressure-resistant materials to reduce the amount of Non-Revenue Water (NRW).

- **Management of water losses:** The cause of water losses in the system need to be identified, addressed and continuously managed. The Japan International Cooperation Agency (JICA) is currently working on a 3-year project with WASAC to reduce non-revenue water (NRW), this began in 2016. The project aims to enhance WASAC's supply capacity by metering all cross-connections and managing the network.

- **Design guidelines and construction management standards:** It is essential that guidelines are developed to ensure the quality of the future water facilities and ensure the integrity of the existing structures and systems that are in place. The National Water Supply Policy and the National Implementation Strategy have been implemented since the last Master Plan, but there is still a need for City design guidelines and regulations.

- **Knowledge of groundwater resources:** According to the Baseline Data Report prepared by Lotti Ingegneria, it is noted that there is a huge knowledge gap in the groundwater resources of the country. This statement was made based on the failure of previously drilled boreholes that were done with limited geo-hydrological knowledge. As a result of this, there is a need for a detailed geo-hydrological map with continuous water resource monitoring.

10.2.4 Water Demand Estimation

Demand Parameters

In a presentation done by WASAC on 9 October 2018, the following information was presented:

- Production capacity is 145,000m³/ day.
- WASAC's estimated water demand is 143,000m³/ day;
- Current average water supply is 90,000m³/ day.

According to the 2013 Kigali Master Plan, the average supply per person was 45 l/day. Using the 2018 estimated population of 1,590,298 (IPAR), and WASAC's current supply of 90,000m³/ day, the average water supply rate per person is now 57 l/day. This has therefore improved from the 45l/day in 2013. This suggests that the system improvements that have been implemented since the last master plan have been successful, but that additional improvements are still required.

Since the WASAC production capacity is 145,000m³/day, a second analysis can be done assuming that the entire 2018 population has access to water. The average supply rate would then be 91l/ day.

For the purposes of this Master Plan the following parameters have been used to estimate the water demand in the city based on various land uses. These have been selected based on international industry practice as well as the National Water Supply Policy.

The water demand for rural/ low-density areas is proposed to be in line with City-wide goal to supply 80 l/cd of potable water to the residents. The water demand for the urban/ high-density areas is significantly higher to cater for a higher standard of living in urban areas. However, the proposed water demand of 120l/cd is still relatively lower than the average water consumption of other urban cities such as Singapore, Cape Town, Amsterdam and Melbourne (refer to Table 10.2 for the comparison). This relatively lower rate is adopted based on the assumption that substantial water

Figure 10.2 2018 High Density vs. Low Density

Figure 10.3 2050 High Density vs. Low Density

demand management strategies would be implemented as the City is being developed.

In order to determine which sectors, have high-density or low-density water demands, an assessment needed to be done in terms of infrastructure levels of service. For 2018, income levels were used to determine standards of living which also coincides with levels of urbanisation. After which the relevant demand parameters were applied. The income levels were rationalised based on the results from the household surveys that were done at the start of this project, as well as a visual assessment of the current development.

For 2050, the proposed Zoning Plan was used and the following sectors were added to the high-density areas as a result of growth and development: Bumbogo, Gahanga, Rusororo and Ndera. Figure 10.2 and Figure 10.3 show high-density areas in a darker shade and low-density areas in a lighter one. It is clear that development and growth in the City is moving towards the eastern and southern boundaries.

Water Treatment Plants/ Supply Zones

Various documents have been used to determine WASAC's current supply areas for the three (3) main water treatment plants; namely the JICA Report (Basic Data Collection Study on Urban Water Supply Systems in the Republic of Rwanda, 2017), and the WASAC website. Kimisagara, Nzove Karenge are shown in three different colours in Figure 10.4. WASACs water supply footprint does not extend to the Nduba, Rutunga and Gikomero Sectors in the north. The reason for the limited supply is due to the sectors being far from urban areas and the supply networks not being sufficiently developed. The Jali sector is not supplied by the three above-mentioned treatment plants, it is serviced by the Bugarama Plant.

It should be noted that the water distribution zones in the Baseline Report prepared by Lotti differ to the ones presented in Figure 10.4. The following discrepancies were observed:

- The Baseline Report addresses "supply zones" in a more regional manner by looking at areas as opposed to administrative sector boundaries as

Table 10.1 Water Demand Parameters

Land use		Demand	Unit
Residential	Rural/ Low-density	80	l/person/d
	Urban/ High-Density	120	l/person/d
Agriculture		No Demand	
Commercial		32	kl/ha/d
		3200	m³/km²/d
Industries		24	kl/ha/d
		2400	m³/km²/d
Infrastructure		No Demand	
Mixed-use		400	l/d/100m²
		0.4	m²/d/100m²
		4000	m³/d/km²
Nature		No Demand	
Open Space		10000	l/d/ha
		10	m³/d/ha
		1000	m³d/km²
Admin		400	l/d/100m²
		0.4	m³/d/ 100m²
		400	m³d/ 100m²
Special Use		No Demand	
Water Bodies		No Demand	

Table 10.2 Water Demand Unit Rate Comparison

City	Singapore	Cape Town	Amsterdam	Melbourne	Kigali
Water Demand (l/person/d)	130	201*	135	155	120

*It must be noted that the Cape Town demand of 201 l/cd was for the year 2016. Due to severe water shortages in 2018, a personal water use limit was set to 50 l/cd and then 70 l/cd as a result of water restrictions.

done in this report;
- Some of the sectors mentioned in the Baseline Report fall outside of the City's boundary, and are therefore not considered in this report.

The National Master Plan that is being prepared by JICA will look at this in more detail and a complete assessment will be done by looking at the country's water supply as a whole.

2018 - 2050 Water Demand Calculation

The planning horizon for water supply is split into two, and follows the land use plans for 2018 and 2050. The water demands for 2018 and 2050 are shown per sector in Table 10.3, based on the current supply zones. "Other" refers to all land uses other than residential, i.e. commercial, industrial etc. The following land uses are assumed to not have a water demand on WASAC's supply network: agriculture, infrastructure, nature, special use, and water bodies.

The water demands have been calculated on the assumption that the City-wide goal of universal water access is currently being met, even though this is not the case. This is assuming that all residents in low-density areas have access to a standpipe within 500m and use 80 litres of water per person per day. On the other hand, also assuming that all residents in high-density areas are using 120 l/person/day.

It must be noted that water demands have been calculated within the limit of the City boundary. However, it is known that some of the networks in Kigali extend outside the borders of this study.

The results of this water demand analysis are less than what was presented in the City's 2013 Master Plan. It is likely that this is as a result of the population numbers and the growth rates applied for future projections. For the purposes of this report, the IPAR population values have been used. Further detail can be found in Chapter 5 of this Interim Master Plan Report.

The following maps (Figure 10.5-Figure 10.8) show the water demand volume (m^3/day) per sector as well as the demand intensities (m^3/day/km^2) per sector. The demand intensity is calculated by taking the demand per sector and dividing it by the sector's coverage area.

The existing water reticulation has been overlaid on these maps to indicate which areas are currently serviced and where the highest demands are coming from in both the 2018 and 2050 scenarios.

The highest water demand volumes are predominantly coming from the eastern sectors of Kigali, this is purely due to their size. The demand intensity map presents a more accurate image in terms of where the concentration of the demand lies and where the supply should be focused. There is a big difference in demand intensity from 2018 to 2050, which is in line with the drive to densify the city.

10.2.5 Water Supply vs. Demand

Table 10.4 shows a summary of the

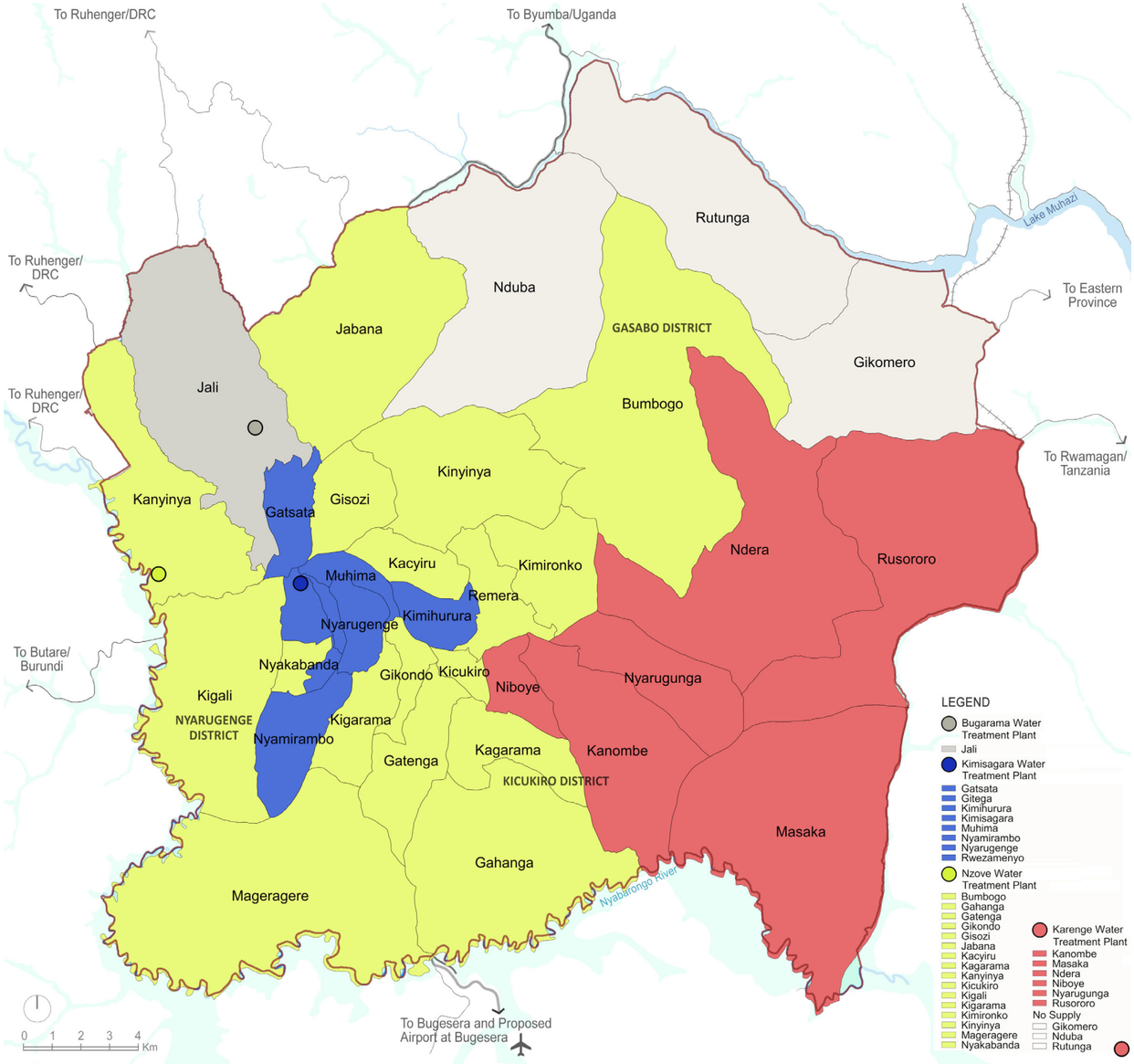


Figure 10.4 2018 Water Distribution Zones

Table 10.3 2018-2050 Water Demand Calculation

WTP	Sector	2018 Demand (m³/day)		2050 Demand (m³/day)	
		Other	Resident	Other	Resident
Kimisagara	Kimisagara	380.548	7548.240	739.528	1689.600
	Muhima	1749.426	4615.320	4524.736	4059.360
	Rwezamenyo	287.535	2477.400	441.169	2465.280
	Gitega	321.331	7800.600	371.445	1535.040
	Nyarugenge	2797.418	4053.840	3717.386	4188.960
	Nyamirambo	472.263	5873.760	994.561	9721.440
	Gatsata	686.814	6193.560	517.942	1957.440
	Kimihurura	1794.248	3282.360	2701.503	3632.160
Nzove	Kanyinya	596.174	2212.320	3844.511	2572.160
	Kigali	290.355	4121.680	3043.100	7037.120
	Mageragere	128.403	3814.160	6972.569	10795.840
	Nyakabanda	171.218	4681.320	231.673	2260.800
	Gisozi	940.482	2776.680	722.226	9422.400
	Jabana	600.869	5205.200	969.969	5463.360
	Kacyiru	1478.541	5486.520	2601.649	6515.520
	Kimironko	2211.432	6618.840	3549.381	17985.120
	Bumbogo	185.494	4469.120	7410.670	20456.640
	Remera	2231.570	4428.960	4020.339	10834.560
	Kinyinya	1633.865	3983.400	2548.101	29207.040
	Kagarama	323.393	2530.680	976.360	13258.080
	Kigarama	674.054	7169.280	557.063	6765.600
	Gahanga	795.309	3831.600	11083.467	42668.160
	Gatenga	1215.501	5967.360	2405.475	10016.640
	Gikondo	2562.328	3016.200	2096.520	3781.440
	Kicukiro	1655.015	3343.680	4380.924	3206.880
Karenge	Rusororo	880.405	5142.640	12397.136	43109.280
	Ndera	1936.140	4916.720	13137.335	49499.520
	Kanombe	610.357	7456.560	5036.762	28906.560
	Nyarugunga	1952.639	5395.560	4773.290	14742.720
	Niboye	486.086	6096.360	2149.696	7922.880
	Masaka	1392.583	7324.080	16489.908	55705.440
Bugarama	Jali	334.257	3964.800	277.897	2934.080
No Supply	Gikomero	379.074	2942.960	832.545	1294.400
	Nduba	47.009	4414.640	1164.928	4657.600
	Rutunga	68.316	3440.960	2646.108	2553.600
Total		**201047.812**		**573150.592**	

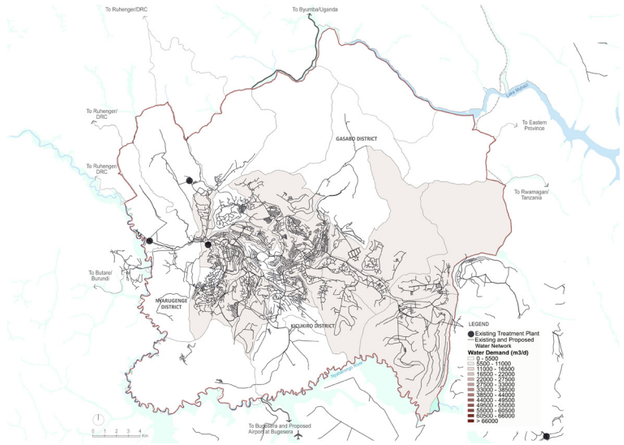


Figure 10.5 2018 Water Demand

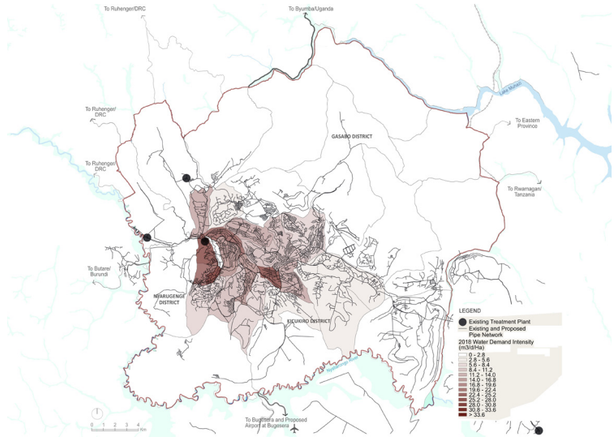


Figure 10.6 2018 Water Demand Intensity

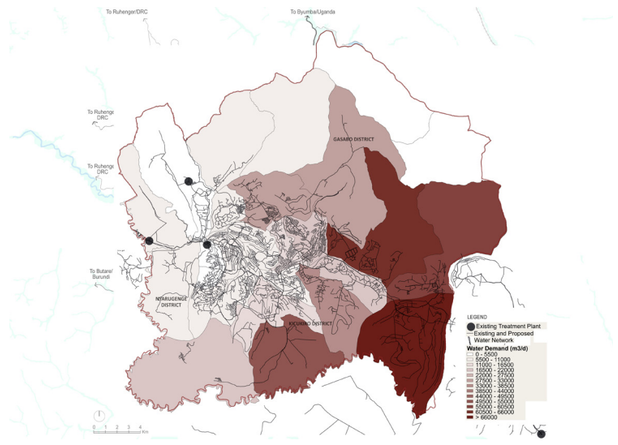


Figure 10.7 2050 Water Demand

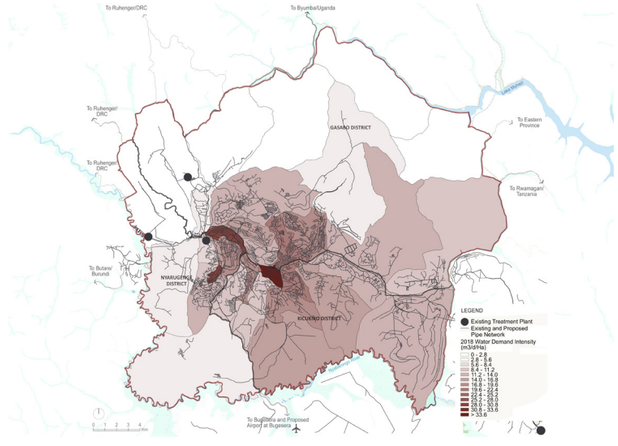


Figure 10.8 2050 Water Demand Intensity

2018 water treatment plant capacities measured against the demands in their relevant supply areas, based on 120 l/ person/day in high density areas, and 80 l/person/day in low density areas. The water supply surplus or deficit is then calculated by subtracting the water demand from the water supply, or in this case the actual capacity (as mentioned previously, the current supply network does not allow for the full capacity of the plants to be used).

The Bugarama supply capacity is unknown and therefore the situation in Jali is assumed to be a deficit. The overall results of this exercise show the inadequacy of the water supply in meeting the demands for 2018 and therefore as the city grows, for 2050 too.

Based on experience, the 120 l/ person/d and 80 l/person/d demand parameters are relatively high. This is also significantly higher than the current supply of 57 l/person/d from WASAC. The water demand model is sensitive to changes in the demand parameters and a supply vs. demand analysis (Table 10.5) has been redone for comparison purposes, using the following average guidelines:

- Urban/ high-density areas: 80l/ person/d
- Rural/ low-density areas: 25l/ person/d

The results of the analysis show that in the 2018 scenario, the supply is sufficient to meet the current demands. However, in 2050 there will be a significant deficit.

10.2.6 Planning Approach

The flowchart in Figure 10.11 highlights the elements that form part of a formal water supply and distribution system. These elements will be addressed in this Planning Approach section of the report.

In 2018 and 2050 the City of Kigali would

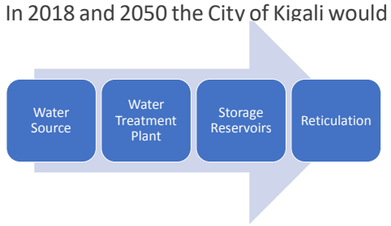


Figure 10.11 Water supply hierarchy

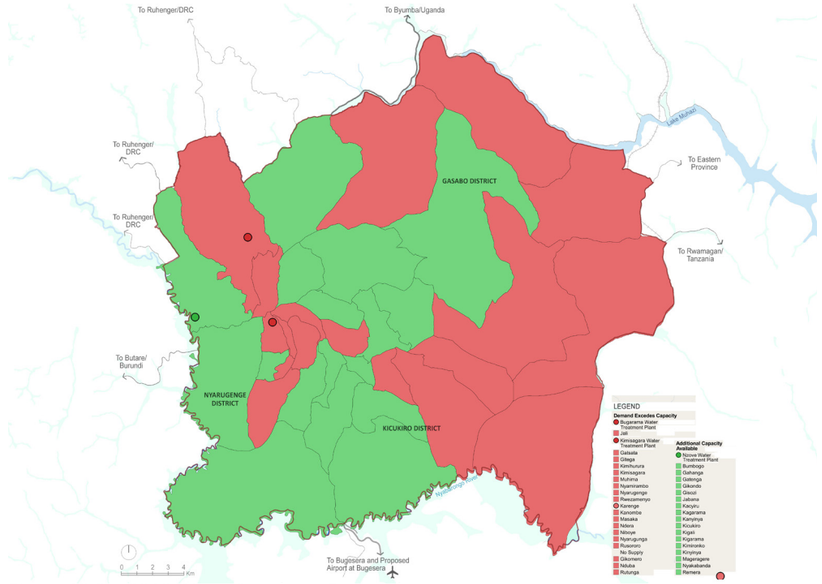


Figure 10.9 2018 Water Supply vs. Demand *Karenge WTP is not only supplying Kigali

Table 10.4 Water Supply vs. Demand (80-120)

Source	Water Treatment Plant	2018 Capacity (m^3/day)	2018 Demand (m3/day)	2018 Deficit/ Surplus (m^3/day)
Yanze River	Kmisagara	28000.000	50514.664	-22514.664
Nyabarongo River	Nzove	105000.000	91351.002	13648.998
Mugesera Lake	Karenge	12000.000	43590.130	-31590.130
Spring	Bugarama	Unknown	4299.057	-4299.057
-	No Supply	0.000	11292.959	-11292.959
Total		145000.000	201047.812	-56047.812

Table 10.5 Water Supply vs. Demand Sensitivity Analysis (25-80)

Source	Water Treatment Plant	2018 Capacity (m^3/day)	2018 Demand (m3/day)	2018 Deficit/ Surplus (m^3/day)
Yanze River	Kmisagara	28000.000	-8566.304	-7730.297
Nyabarongo River	Nzove	105000.000	46578.818	50824.541
Mugesera Lake	Karenge	12000.000	-15916.800	-15125.605
Spring	Bugarama	Unknown	-1573.257	-1536.851
-	No Supply	0.000	-3868.949	-3876.627
Total		145000.000	128346.492	16653.508

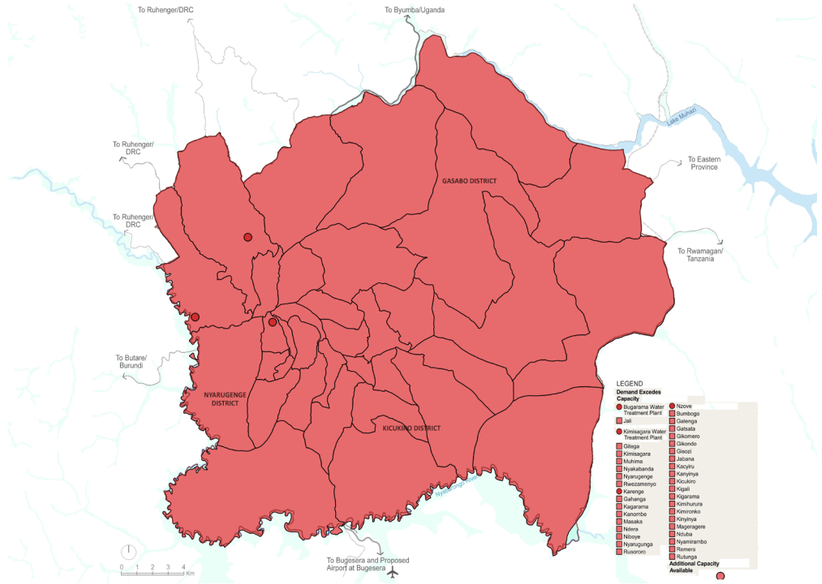


Figure 10.10 2050 Water Supply vs. Demand

need to supply 201,047.812m³/day and 573,150.592m³/day, respectively, of potable water to its residents. This is significantly higher than the current potable water supply of 145,000m³/day from the existing water treatment plants. The following section addresses this issue by doing the following:

- Identifying potential water resources;
- Proposing revised water supply zones;
- Augmenting the existing water treatment capacity and proposing additional plants;
- Proposing additional reservoirs; and
- Planning a water network that provides the most cost effective and sustainable solutions for the city's water supply system

Proposed Level of Service

In order to meet the Rwandan goals of providing 100% of the population with water the following levels of service are proposed:

- Rural / low-density areas – Community standpipes (Figure 10.12) accessible within 500m (80l/person/day); and
- Urban / High density areas – Individual household connections (120l/person/day) (Figure 10.13)

Potential Water Resources

To overcome the water supply deficit, the existing WTPs have to be expanded and new water resources need to be explored to augment the current water supply capacity. The following are some of the options that have been considered:

- The 2013 Master Plan identified a spring in Mutobo, Musanze District as an alternate water abstraction point (Figure 10.14). This source was planned to supply Kigali and surrounds. It is also noted that this water will require minimal treatment as it is of a high quality;

Figure 10.12 Metered and un-metered community standpipe

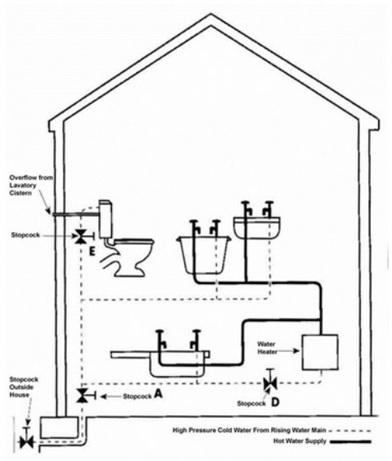


Figure 10.13 Individual household connection

- The ESMP Report by the African Development Bank Group identified a water source and location for a WTP in Kanzenze. The plant will have a capacity of 40,000 m³/day, and groundwater will be extracted from the south bank of the Nyabarongo River; and

- The JICA Report (Basic Data Collection Study on Urban Water Supply Systems in the Republic of Rwanda, 2017) makes reference to a proposed Masaka Treatment Plant with a capacity of 130,000 m³/day using the Nyabarongo River as a source

During the implementation stage, a detailed hydrological and yield study will need to be carried out for each water source to confirm their maximum yields. Due to the absence of a waterborne sewer network, the quality of ground water is susceptible to contamination and therefore all water extracted from below ground needs to be treated at a plant prior to distribution.

Proposed Water Treatment Plants/ Supply Zones

The water distribution zones (Figure 10.15) have been revised towards a more simplified system, based on the City's watershed and sector boundaries. The watershed was used with the aim to consider the topography of the land and thus lessen the number of pump stations required. Sector boundaries were also looked at from an administrative point of view to simplify the revenue collection process by keeping an entire sector within one supply zone.

For sectors that fall on both sides of the watershed, supply zone allocation was done taking the majority of the sector's area into account. For example, if most of the sector lies in the southern catchment, the sector is placed in the Karenge Supply Zone. For sectors that are evenly split across the watershed, the allocation was less of an issue, since a reservoir will be placed at the high point and supply will be possible on either side. The previously proposed level of service has been independently determined, and these supply zones are not based on them.

Table 10.6 shows the proposed supply at each facility to serve the above-mentioned distribution zones. A unit ratio of 0.03 Ha / m³ has been used to determine the space allocations for the proposed plant sizes with their upgrades, based on research done on other treatment plants.

Proposed Reservoirs

The existing reservoirs/ water tanks in Kigali have been looked at in terms of their current capacities. This information was taken from shape files received from WASAC, and only the primary reservoirs at the treatment plants have been considered, excluding all tanks at other facilities. These tanks have been omitted due to their size as they are seen to be used as emergency water supply in instances of water cuts.

Based on the City's projected demands, the following table provides recommendations in terms of the reservoir capacity required per sector. The reservoirs are sized so as to provide their supply areas with 48 hours of water should there be a municipal supply interruption. The reservoirs have also been sized to make provision for fire-

Table 10.6 2050 Augmented Supply

Water Treatment Plant	Current Capacity (m³/day)	2050 Demand (m³/day)	2050 Deficit/ Surplus (m³/day)	2050 Proposed Capacity (m³/day)	Space Required (Ha)
Kimisagara	28000.000	26224.978	1775.022	28000.000	0.000
Nzove	105000.000	221857.042	-116857.042	222000.000	6.555
Karenge	12000.000	321856.595	-309856.595	322000.000	9.507
Bugarama	Unkown*	3211.977	-309856.595	10000.000	0.300
Total	**145000.000**	**573150.592**	**-428150.592**	**582000.000**	**16.360**

*The capacity is unknown and therefore the upgrade is assumed to take the form of a new plant

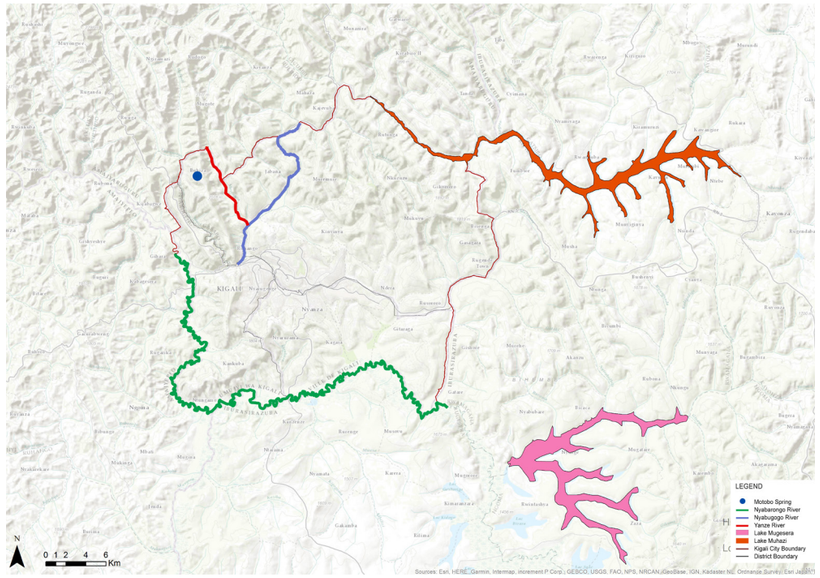


Figure 10.14 Potential Water Resources

fighting systems should the need arise. Details regarding fire-fighting systems to be addressed in the City's Disaster Management Plan. The new reservoirs should be placed on high-ground, as far as possible, so as to limit the pumping requirements. In terms of allocating space for the proposed reservoirs, a unit ratio of 0.04ha per 1,000m³ can be used, based on research done on other reservoirs For example, for a 20,000m³, 0.88 Ha would be required.

The phasing of the reservoirs will be elaborated on in the Implementation Report of this project, and will most like be proposed in increments of 10,000 – 15,000 – 20,000m³ sizes.

Figure 10.16 and Table 10.7 shows the placement of the reservoirs in 2050. The fact that these are located in high-lying areas is clearly visible based on the contours.

Proposed Water Supply Plan

The provision of bulk water infrastructure follows the areas in which the population density increases. It is sustainable to provide infrastructure in areas where there is a high concentration of people. Most of the water supply within the City would be distributed through the expansion of the existing water supply network. Where the network is planned, valves and meters are needed at cross connections.

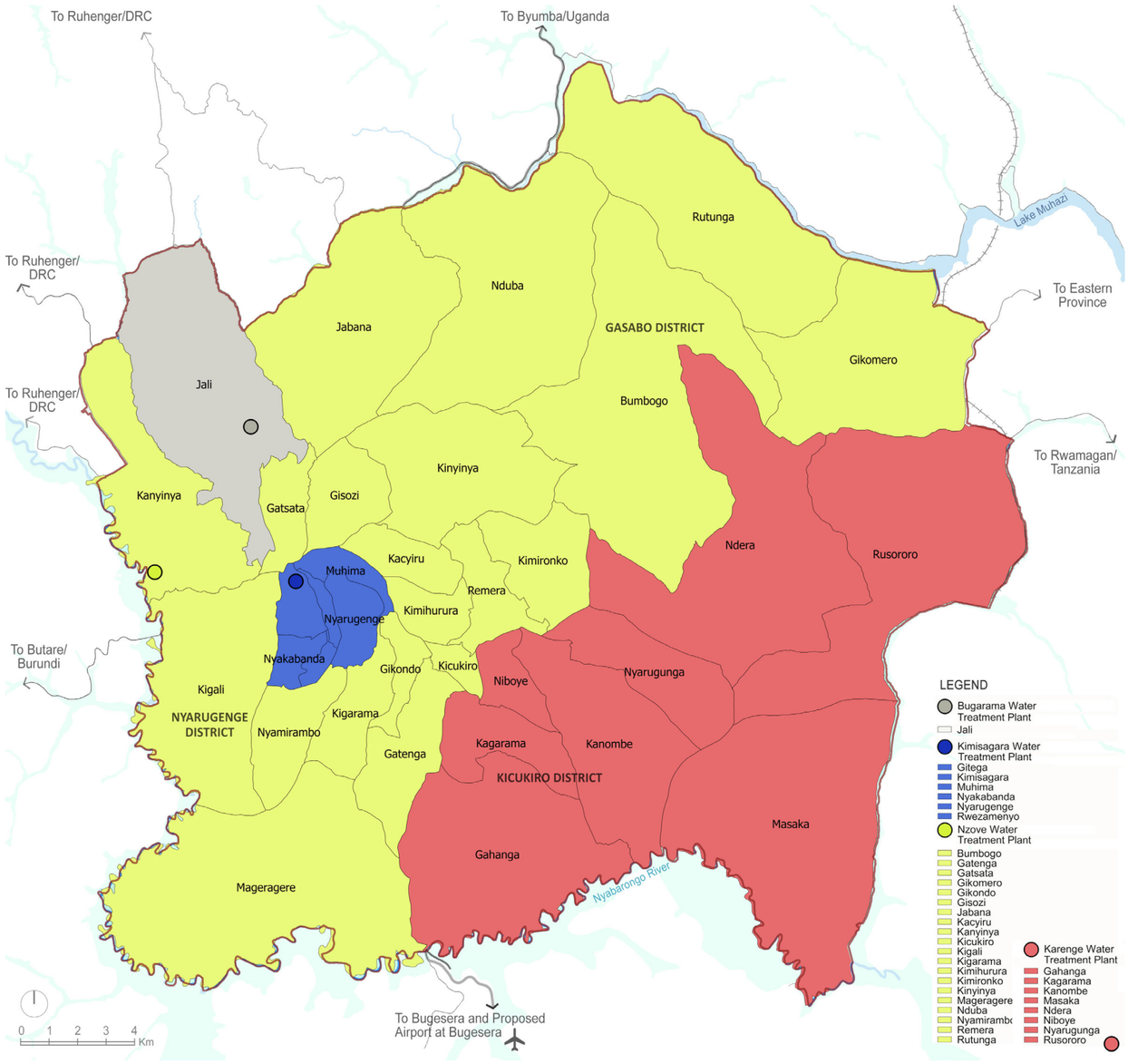


Figure 10.15 2050 Proposed Water Distribution Zones

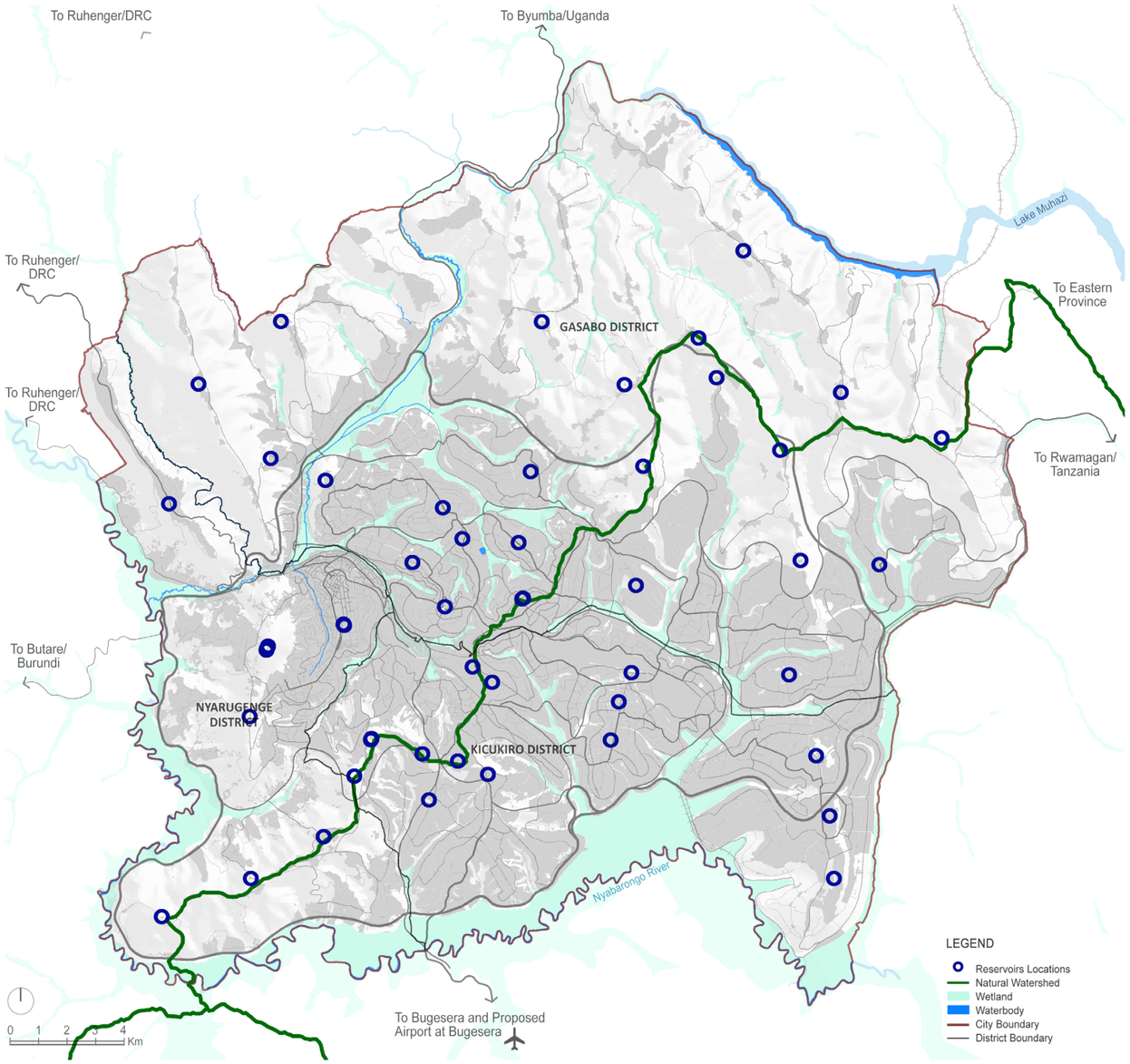


Figure 10.16 2050 Reservoir Locations

Table 10.7 2050 Proposed Reservoirs

Sector	Current reservoir capacity (m³)	Surplus/ Deficit (m³)	2050 Proposed Reservoir (1000m³)
Kimisagara	4800.000	-58.257	0
Muhima	25000.000	7831.807	0
Rwezamenyo	-	-5812.898	10
Gitega	-	-3812.969	5
Nyarugenge	-	-15812.692	15
Nyamirambo	-	-21432.001	25
Gatsata	-	-4950.764	5
Kimihurura	-	-12667.325	15
Kanyinya	2036.000	-10797.342	10
Kigali	-	-20160.440	20
Mageragere	-	-35536.819	35
Nyakabanda	-	-4984.946	5
Gisozi	-	-20289.252	20
Jabana	-	-12866.657	15
Kacyiru	-	-18234.338	20
Kimirimko	-	-43069.002	45
Bumbogo	-	-55734.619	60
Remera	-	-29709.797	30
Kinyinya	-	-63510.828	65
Kagarama	-	-28468.880	30
Gahanga	-	-107503.254	110
Gatenga	-	-24844.230	25
Gikondo	-	-11755.920	15
Kicukiro	-	-15175.609	15
Rusororo	-	-111012.832	115
Ndera	-	-125273.711	125
Kanombe	-	-67886.644	70
Nyarugunga	-	-39032.021	40
Niboye	-	-20145.153	20
Masaka	-	-144390.695	145
Jali	180.000	-6243.954	10
Gikomero	-	-4253.889	5
Nduba	-	-11645.057	15
Rutunga	-	-10399.415	10

The planning of the water distribution network expansion is based on the following factors:

- **Level of service** - Based on the proposed levels of service discussed in a previous section of this report, the water supply in rural and urban areas will differ. The rural areas will have a bulk water line for the provision of stand pipes accessible to all communities within 500m. The water networks in urban areas will run along the road network to ensure that each stand is provided with an individual-metered connection.
- **Water demand distribution** - The expansion of the existing water supply network focusses on areas of high future demands, by considering the changes in the land use.
- **Topography** – The expansion of network is considered in areas where the elevation is not significantly higher than the existing network i.e. where pumping is still reasonable.
- **Integration of services** – The planning of the water supply and distribution networks will consider the provision of all other services in the City. This is discussed in more detail in the Infrastructure Integration section of this report.

Figure 10.17 shows the proposed network plan to cater for the city's 2050 water demands. The proposed pipelines, as in the legend are taken from WASAC's plan. The additional proposed pipes are as recommended by the project team. Reticulation has only been shown for bulk or primary and secondary lines, as the detailed reticulation of the tertiary pipelines should be proposed by the Water Supply Master Plan, currently being undertaken. Although there have been changes made to the existing road network, the existing pipe network has not been adjusted. Depending on the nature of the land use and exact location of development on the land, it may not be necessary to move the existing pipes. Without detailed information, it cannot be determined if moving these pipes is feasible. The possible relocation should be investigated and planned as part of a more detailed study.

Water Demand Management

The management of water resources and the provision of water services in Kigali require the development and implementation of new approaches where Water Conservation and Water Demand Management (WC/WDM) strategies play a crucial role in environmental sustainability, social equity and economic development.
With particular reference to the ever increasing demand on water resources as a result of:

- Population growth;
- The increased percentage of population with access to water services, as backlogs are being addressed; and
- The drive for improvement in the standard of living, increasing the per capita water consumption figures.

WC/WDM strategies are becoming an important tool to be utilized by cities to reduce their amount of non-revenue water (NRW) and manage the resource effectively and efficiently.

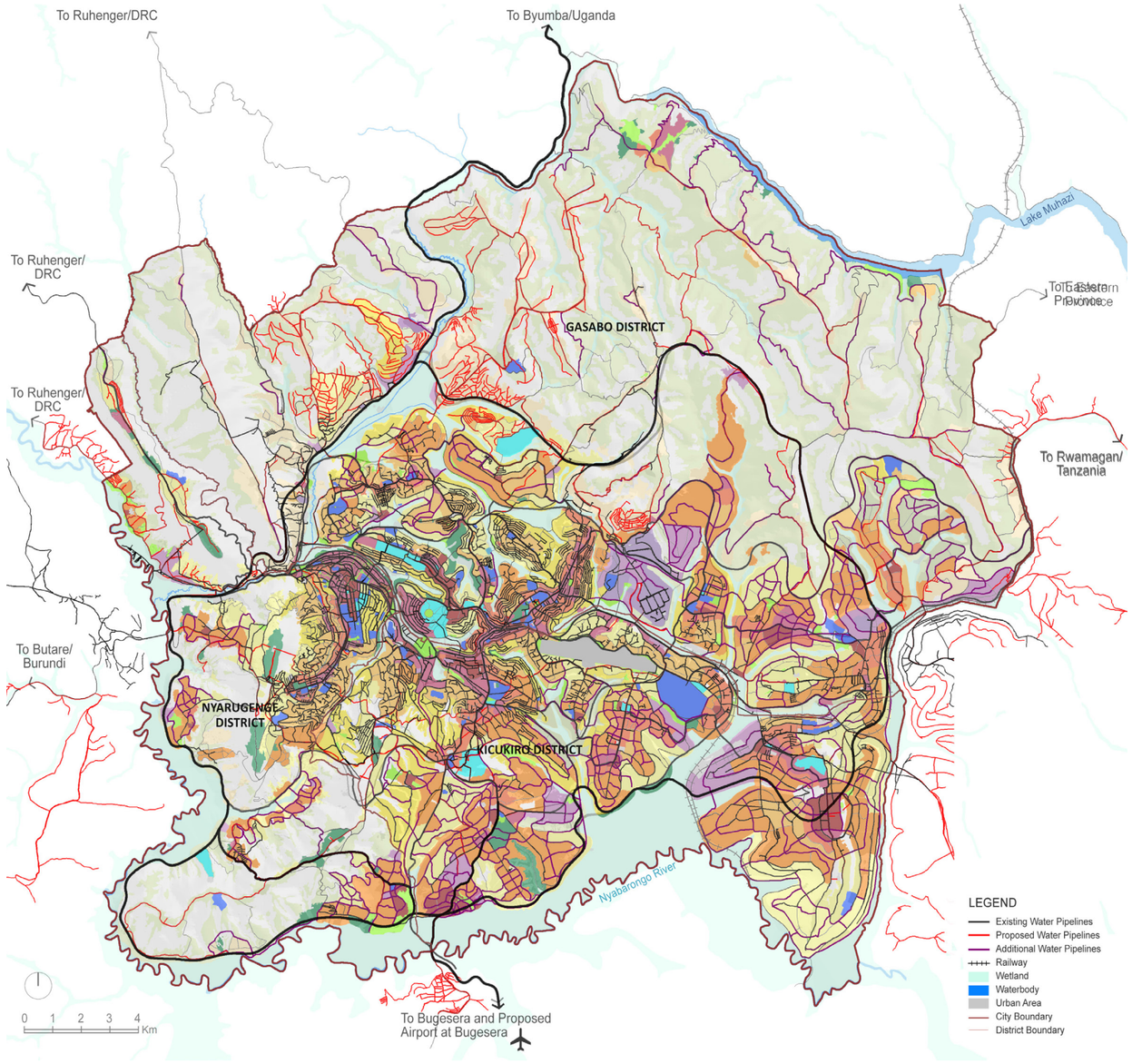


Figure 10.17 2050 Proposed Water Supply Network

There are many variations on the definition of water demand management, but a good general description is: "The management of the total quantity of water abstracted from a source of supply using measures to control waste and undue consumption." In addition, Water Demand Management can be defined as the adaptation and implementation of a strategy by a water institution or consumer to influence the water demand and usage of water in order to meet any of the following objectives:

- Economic efficiency;
- Social development;
- Social Equity;
- Environmental protection;
- Sustainability of water supply and services; and
- Political acceptability.

Besides augmenting the water supply, it is advisable to manage the water demand from a household level to the Planning Area level. At a household level, installing water saving devices should be encouraged to reduce water use. Social awareness campaigns are necessary to educate communities in this regard, and to change water use patterns. At a Planning Area level, the City should be looking at using alternative water sources such as rainwater harvesting or treated effluent from STP for non-potable use. These strategies, if implemented properly, would reduce the dependence on the potable water supply system.

10.3 Waste Water Management Plan

The provision of adequate sanitation systems in conjunction with the safe supply of water, is essential for social and economic development and the overall health of a city. Sanitation systems are also very difficult and costly to retrofit into urban environments if space has not been allocated for this infrastructure in the land use planning and the identification of servitudes.

10.3.1 Applicable Policies and Plans

The governing policies and plans for sewer drainage and treatment in the City of Kigali are as follows:

- Rwanda Vision 2020 (2012);
- Water and Sanitation Sector Strategic Plan 2013/14 - 2017/18 (2013);
- National Sanitation Policy (2016);
- National Sanitation Policy Implementation Strategy (NWSPIS) (2016);
- Economic Development and Poverty Reduction Strategy (EDPRS II) (2013);
- National Informal Settlement Upgrading Strategy (2015).

10.3.2 Master Plan

The information relating to waste water from the 2013 City of Kigali Master Plan, as well as various documents detailing WASAC's future plans, have been used to inform this section of the report.

It must be noted that a Water and Sanitation Master Plan is currently being prepared by Lotti Ingegneria Consultants for WASAC and was not available for use in this report. However, the baseline report has been received and considered in the compilation of this document. Lotti has indicated that their focus is not on Kigali but rather the rest of the country. We understand from Lotti that Nihon Suido Consultants, in association with Yachiyo Engineering, have been appointed to create a Water Supply Master Plan for the City of Kigali, however a Sanitation Master Plan should also be done. The information provided as part of the Interim Master Plan for the City of Kigali will provide plans for the bulk infrastructure, which can then be used to inform the Master Plan. The Master Plan should provide further detail in terms of new reticulation which may be required.

The outcomes of these Master Plans may affect and/or change the recommendations made in this document.

10.3.3 Key Issues

Some of the key issues to be addressed by the City relating to waste water are discussed below. Recommendations to address these issues have been made by the project team and are presented later in this report.

- **Direct discharge of sewage into the existing water bodies** - This not only contaminates the water quality of the resource, but also poses a threat to public health. The City needs to progressively phase out septic tanks in urban areas and provide adequate sewer connections and treatment plants to curb the problem of sewer discharge into water sources.

- **Contamination of ground water by pit latrines** - As the sewage infiltrates the soil, it needs time to be treated by the organisms and cations in the ground. Most of the contamination cases occur at areas with high water tables or near water bodies when the sewage has shorter retention time in the soil. Due to the density of development, this is more of a concern in urban areas. Phasing out of pit latrines in these areas will assist in significantly improving the current water quality. In rural areas, careful consideration needs to be given for the placement of pit latrines in order to minimise the associated risks.

- **Semi-centralised sewerage systems efficiency** - Many of these systems have functional problems such as; clogging and broken aerators. In addition to this the quality of the effluent discharge does not complying with national standards.

- **Sludge waste** - The new WWTP should make provision for receiving sludge from exhauster trucks. The City should encourage converting the sludge into biofuels, as done at the Pivot Plant.

- **Faecal sludge management** - Removal services should be improved in unplanned settlements by upscaling the eVac services and regulating manual emptiers to avoid illegal dumping of sludge. Standards should be established for containment, emptying and transportation of sludge.

- **Technical experience** - A capacity development programme will need to be put in place to train CoK staff in terms of managing, operating and maintaining sewerage systems and waste water treatment plants.

- **Tariffs** - There is no tariff structure currently in place for sanitation services.

- **Environmental concerns of location of the centralised STPs** - The sites that is currently being considered are susceptible to flooding and are an environmental concern due to being placed in wetlands. Detailed environmental studies will need to be done in order to propose mitigation methods to limit the negative impact on the environment and water quality.

- **Bylaws and regulations** – Waste water treatment to ensure that developers apply the City By-laws and regulations to be prepared for the correct technical standards to their developments.

10.3.4 Sewage Flow Estimation

The sewage flow is estimated based on the assumption that 80% of the water consumption would be collected as waste water by the sewerage network. However, there is currently no waterborne sewer network in Kigali. The planning horizon for sewer flow is split into two, and follows the land use plans for 2018 and 2050. Based on the projected water demand, the sewage flow for year 2018 and year 2050 is shown in Table 10.8.

It must be noted that the following land uses are assumed to not have a water demand, and therefore no

Table 10.8 2018-2050 Sewer Flow Calculation

SECTOR	2018 SEWER FLOW (M^3/DAY)	2050 SEWER FLOW (M^3/DAY)
Kimisagara	6343.031	1943.303
Muhima	5091.797	6867.277
Rwezamenyo	2211.948	2325.159
Gitega	6497.545	1525.188
Nyarugenge	5481.006	6325.077
Nyamirambo	5076.818	8572.800
Gatsata	5504.299	1980.306
Kimihurura	4205.287	5066.930
Kanyinya	2246.795	8064.176
Kigali	3529.628	8064.176
Mageragere	3154.050	14214.728
Nyakabanda	3882.030	1993.979
Gisozi	2973.730	8115.701
Jabana	4644.855	5146.663
Kacyiru	5572.049	7293.735
Kimironko	7064.217	17227.601
Kagarama	2283.258	11387.552
Kigarama	6274.667	5858.130
Gahanga	3701.527	43001.302
Gatenga	5746.289	9937.692
Gikondo	4462.822	9937.692
Kicukiro	3998.956	6070.244
Rusororo	4818.436	44405.133
Ndera	5482.288	50109.484
Kanombe	6453.534	27154.658
Nyarugunga	5878.559	15612.808
Niboye	5265.956	8058.061
Masaka	6973.331	57756.284
Jali	3439.246	2569.582
GIKOMERO	2657.627	1701.556
NDUBA	3569.320	4658.023
RUTUNGA	2807.421	4159.766
TOTAL	**160838.250**	**458520.474**

corresponding sewer flow: agriculture, infrastructure, nature, special use, and water bodies.

The results of this sewer flow analysis are less than what was presented in the City's 2013 Master Plan. It is likely that this is as a result of the population numbers and the growth rates applied for future projections at that time. For the purposes of this report, the IPAR population values, as discussed previously in this report, have been used.

10.3.5 Planning Approach

The following flow chart (Figure 10.18) highlights the elements that form part of a formal sewer drainage system. These elements will be addressed in this Planning Approach section of the report.

The waste water planning approach that has been adopted for this master plan is as follows:

- Identifying drainage catchments;
- Assessing the proposed waste water treatment plant and proposing additional plants;
- Planning a bulk sewer network that provides the most cost effective and sustainable solutions for the city's waste water drainage system;
- Allowing for all future collectors, as determined by more detailed studies, to easily drain into the bulk network.

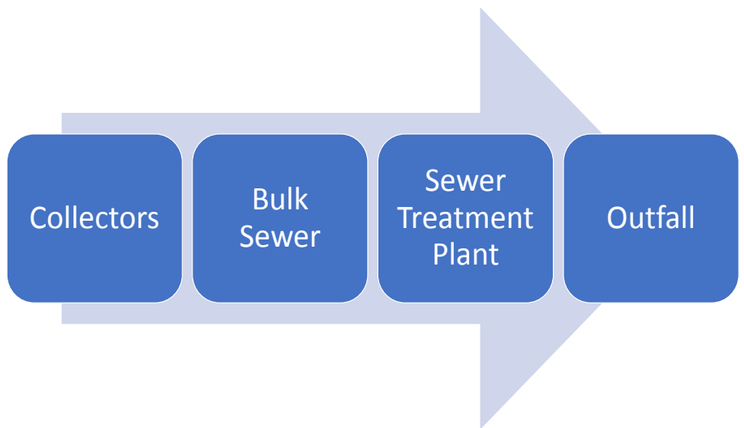


Figure 10.18 Sewer drainage hierarchy

10.3.6 Assessment of Current Proposal

There are current plans to build a phased-sewer network with a 12 000 m^3/day treatment plant in Phase 1 for Kigali. The plant has been designed to serve the following areas: Muhima, Nyarugenge, Kacyiru, Kimihurura, Kimironko, Remera and Nyarugunga. The site identified for the plant is in a low-lying wetland area, with obvious environmental implications. The current design allows for flooding, where untreated effluent will overflow into the surrounding environmentally protected area.

In the Engineering Design and Preparation of Tender Report by Mott MacDonald in March 2017, it is stated that 1% was used as the annual population growth rate for projection purposes. This calculation was done using the 2012 census data as a baseline and is likely to be an under estimate.

In an article by The New Times on 5 January 2019, it is said that construction will commence in June 2019 and the completion is set for the year 2022.
In the following map, the highlighted sectors are the ones that will be served by the treatment plant. It is clear that these catchments cross the natural watershed. This implies that significant pumping would be required to get the waste water to the treatment plant. Future network planning should consider the watershed so as to encourage gravity flow, which will minimise the costs associated with a pumped network.

There are also plans to construct a Faecal Sludge Treatment Plant in Masaka. This will formally replace the informal dumping of sludge that is happening at the existing Nduba dump site. A feasibility study was done in July 2018 where a suitable site was selected for the plant. It was however found that the access road to the site is not fit for vacuum trucks and therefore upgrades to the road are required, including widening and surfacing. In addition to the reuse of sludge for composting purposes, the feasibility study team also proposed that the sludge be processed further to a point where it can be sold as fuel to industries. The proposed plant will serve approximately 0.8 million residents in Kigali and the implementing agency is WASAC (outsourced by the City of Kigali). The financing of the project will be done through CoK and MININFRA.

The three main activities to be considered are as follows:

- Collection of sludge from septic tanks with vacuum trucks, and the emptying of pit latrines, followed by the transportation of sludge to the treatment plant;
- Processing of solid-sludge content into fuel/ compost;
- Treatment of liquid-sludge content/ effluent.

All of the above steps need to be undertaken in an environmentally-sound way, not only to protect the natural environment but also for the health and safety of residents. The following image (Figure 10.19) shows the current sewer proposal with the location of the proposed faecal sludge treatment plant

The following main issues were identified in the feasibility study to be resolved prior to the construction of the proposed plant:

- Resettlement – Farmers occupying the site will need to be resettled;
- Design Issues – There are various aspects relating to the technical design and capacity of the plant that still need to be confirmed/ resolved;

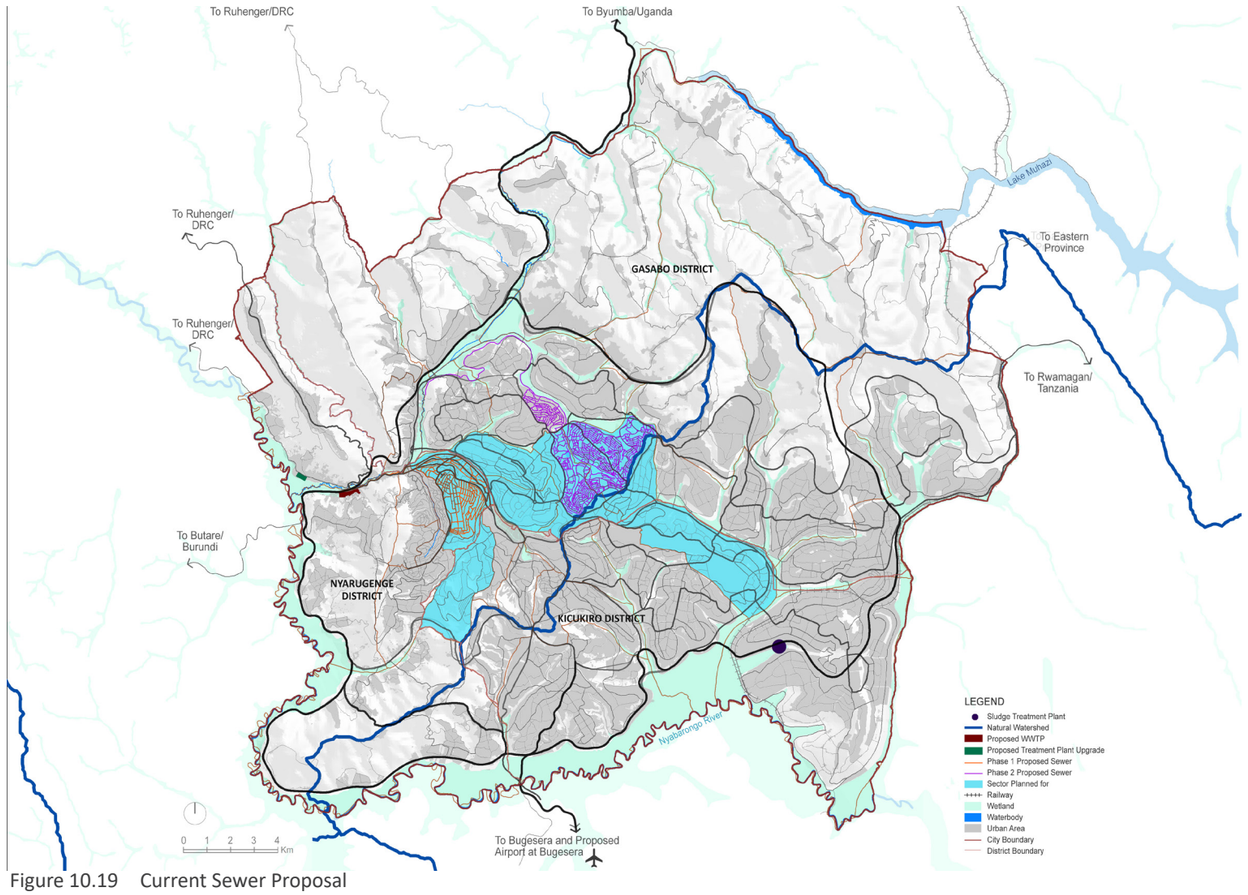


Figure 10.19 Current Sewer Proposal

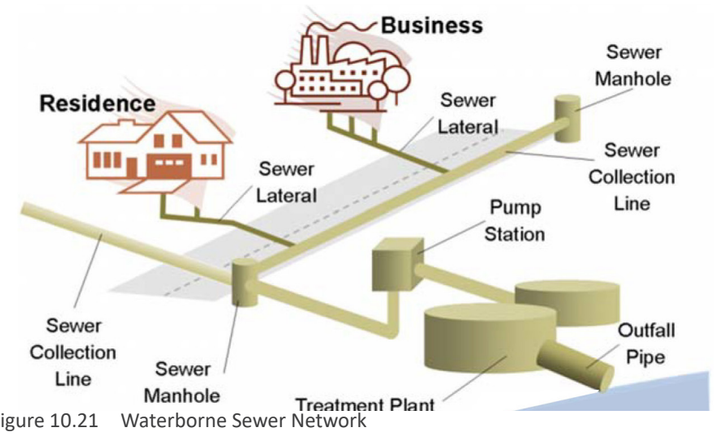


Figure 10.21 Waterborne Sewer Network

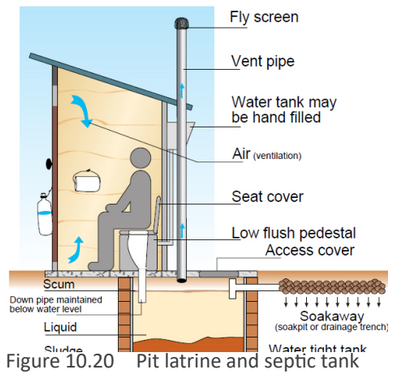


Figure 10.20 Pit latrine and septic tank

- Environmental Impacts – Effluent discharge into the environment to meet the required environmental standards;
- Sustainability – CoK has no experience with running these types of operations, therefore international experience will be required for the operation and maintenance of the plant;
- Financing – Funding for additional studies, closure of existing dump site and access road upgrades to be confirmed.

Proposed Level of Service

The Rwandan goal is to provide 100% of the population with access to an improved type of sanitation system. Improved sanitation systems are considered to include flush toilets, EcoSan toilets and pit latrines with solid slabs. In order to meet goal, the following levels of service are proposed:

- Rural / low-density areas – On site treatment: Pit latrines with septic tanks and solid slabs, shown in Figure 10.20 / EcoSan toilets;
- Urban / high-density areas – Off site treatment: Flush toilets with connection to a waterborne sewer network to be treated at a waste water treatment plant, see Figure 10.21.

Adjusted Sewer Flows

As presented in the previous section, the proposed level of service for rural/ low-density areas does not include the provision of a waterborne sewer network. Therefore, the proposed sewer system will be designed to exclude the flows generated in these areas. It is also proposed that all industries treat their own effluent or waste water, and that it is not discharged into the sewer network. This is the current situation in the city and is recommended due to the varying nature and potential chemical composition of the waste water generated by these facilities. With this in mind, the sewer flows have been recalculated to inform the proposed designs and land uses.

The following maps (Figure 10.22-Figure 10.25) show the sewer flow generated, as well as the sewer intensities per sector. The sewer intensity is calculated by taking the flow per sector and dividing it by the sector's area. WASAC's proposed sewer network has been overlaid on the maps in order to determine if the focus areas are being

addressed. The highest sewer volumes are coming from the central and eastern sectors of Kigali. The high flows in the eastern sectors can be attributed to the size of the sectors. The sewer intensity map presents a more accurate image in terms of where the concentration of the demand lies and where the sewer collection systems should be focused. There is a big difference in flow intensity from 2018 to 2050, which is in line with the goal of densifying the city.It is clear on the intensity maps that the proposed sewer network is not covering the areas of highest demand in both the 2018 and the 2050 scenarios. Recommendations to address this matter are presented in the next section of this report.

Proposed Waste Water Treatment Plants/ Catchment Areas

Currently, there is no sanitary sewer network or a centralized sewage treatment plant (STP) in the City of Kigali. The construction of the Gitikinyoni Treatment Plant as well as the central sewerage system that is planned for the City is going ahead and tender documentation has been issued. It was noted in the 2013 Master Plan that the site that was being considered for the plant is susceptible to flooding and could cause operational issues as well as potential sewer overflow into the surrounding areas. According to the report by Mott MacDonald titled “Kigali Central Sewerage – Engineering Design and Preparation of Tender”, the location has moved to the other side of the road adjacent to the quarry to reduce the environmental risks.

In addition to the proposed Gitikinyoni

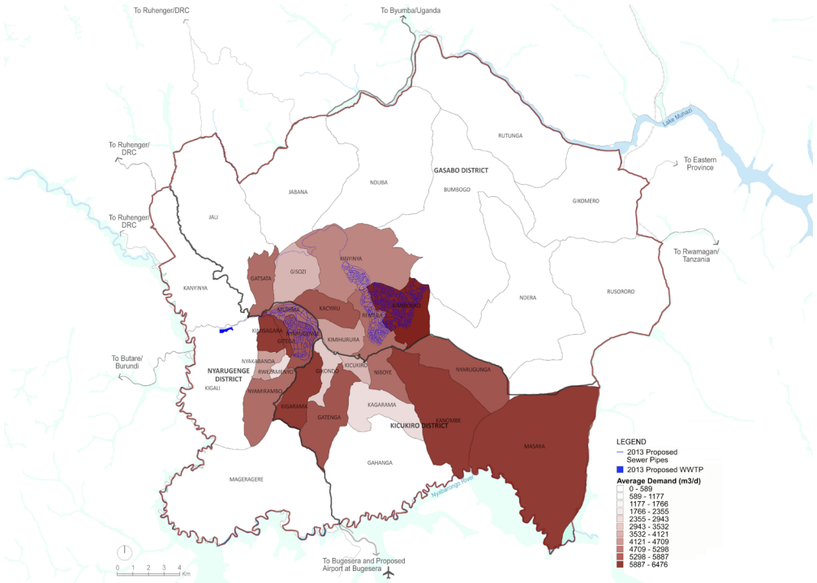


Figure 10.22 2018 Sewer Demand

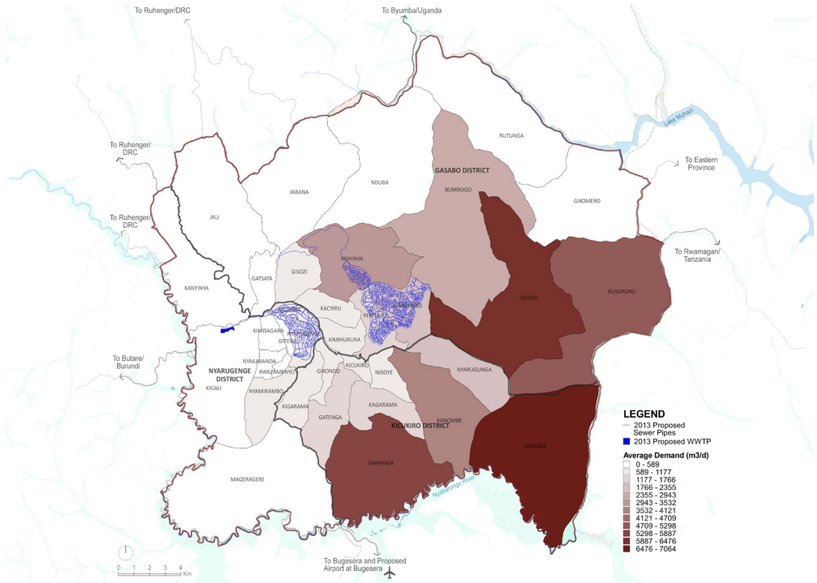


Figure 10.23 2050 Sewer Demand

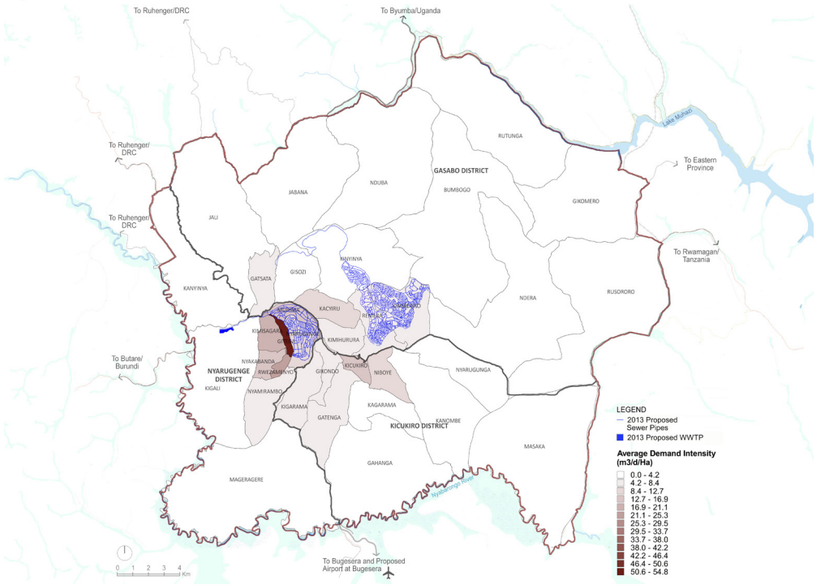


Figure 10.24 2018 Sewer Demand Intensity

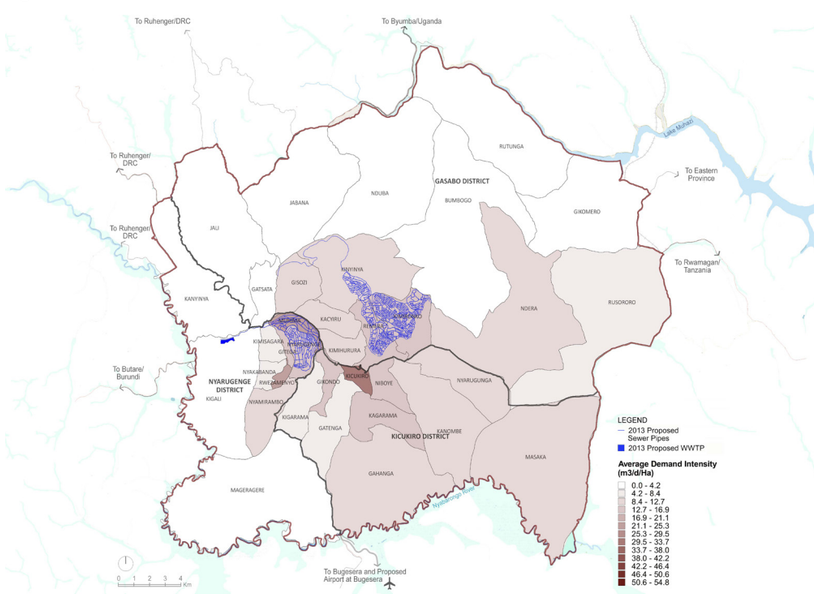


Figure 10.25 2050 Sewer Demand Intensity

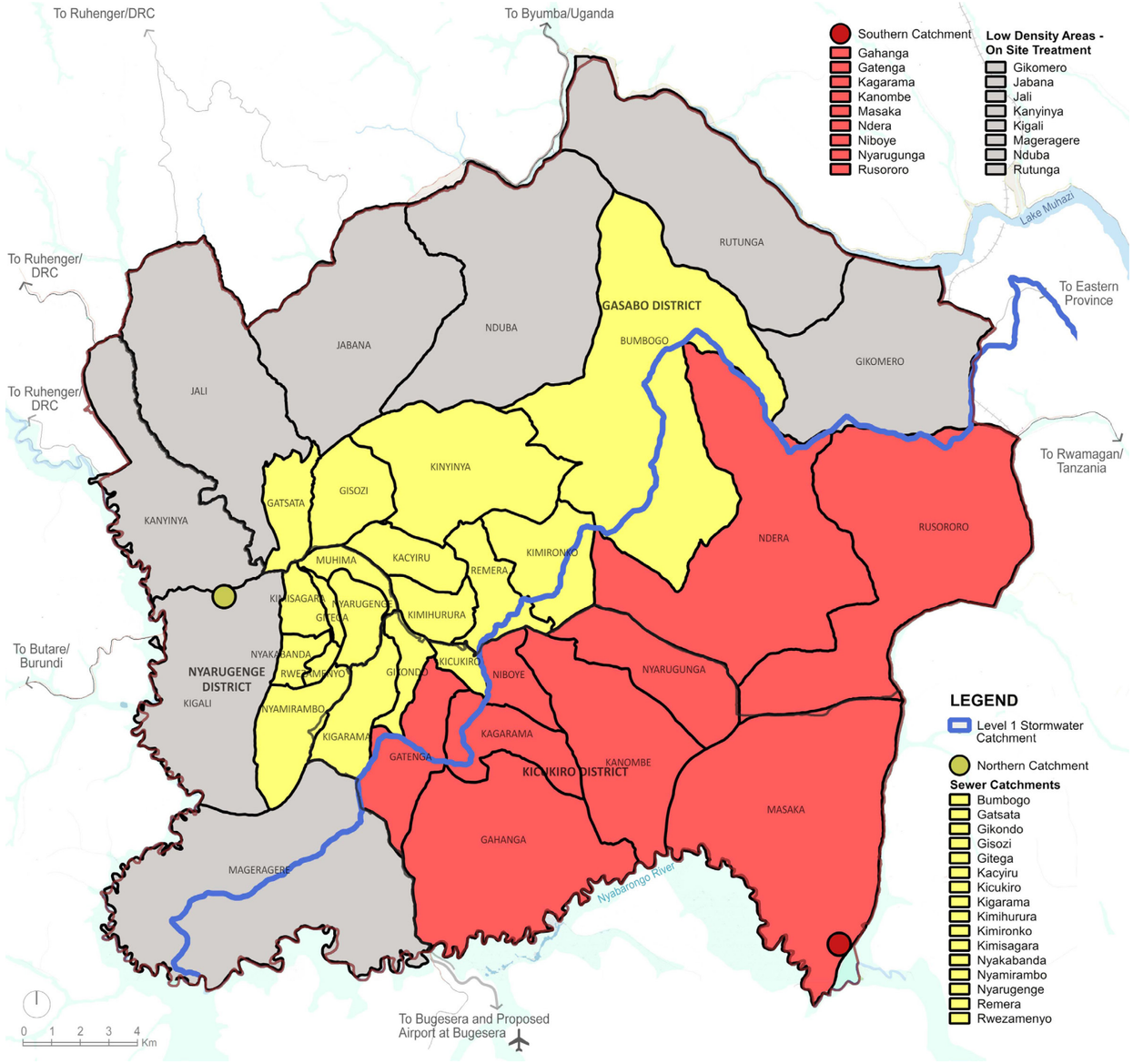


Figure 10.26 2050 Proposed Sewer Catchments

Treatment Plant in the west of Kigali, an additional plant is proposed for the south east. Figure 10.26 shows the two contributing catchments for the two treatment plants on either side of the City's watershed, with low density sectors being excluded from the catchments. For sectors that fall on both sides of the watershed, catchment allocation was done taking the majority of the sector's area into account. For example, if most of the sector lies in the southern catchment, the sector is placed in the catchment for the Southern Treatment Plant.

Table 10.9 shows the proposed capacity at each facility to serve the above-mentioned catchment areas. A unit ratio of 0.45 Ha / Ml has been used to determine the space allocations for the proposed plant sizes, based on the space allocation for the currently proposed Gitikinyoni Plant. These full scale treatment plants will be built in a phased-approach until their full capacities are required to deal with the 2050 waste water flows. This is elaborated further in the Implementation and Phasing Report. ETZ's will be used to service isolated developments where required as interim solutions.

Proposed Sewer Plan

The provision of bulk sewer infrastructure follows the areas in which the population density increases. It is sustainable to provide infrastructure in areas where there is a high concentration of people.

The planning of the sewer drainage network is based on the following factors:

- **Level of service** - Based on the proposed levels of service discussed in a previous section of this report, the sewer supply in rural / low-density and urban / high-density areas will differ. The rural areas will treat and dispose of their own waste water and will not be connected to a waterborne system. The urban areas will be served by piped networks draining to a treatment plant. This network will run along the roads, to ensure that each stand is provided with an individual-drainage point.
- **Sewer demand distribution** - The proposed sewer network has been planned to focus on areas of high future demands, by considering the changes in the land use.
- **Topography** – The lay of the land is considered so as to maximise gravity sewer flow and the proposed networks are placed accordingly.
- **Integration of services** – The planning

Waste Water Management Plant	2050 Flow/ Capacity (m³/day)	Space Required (Ha)
Gitikinyoyi	145449.677	66.113
Proposed WWTP 2	281637.695	128.017
Total	**427087.372**	**194.131**

Table 10.9 2050 Waste Water Treatment Sizing

of the sewer networks will consider the provision of all other services in the City. This is discussed in more detail in the Infrastructure Integration section of this report.

Figure 10.27 shows the contours as well as the level 3 catchments that have been used to determine the location of the required sewer network and treatment plants. The network has been planned to not cross watershed and along valley lines as far as possible.

Figure 10.28 shows the proposed network plan to cater for the city's 2050 sewer demands. This indicates the bulk or primary line to the treatment plants together with the secondary collector lines from each drainage catchment. In the urban / high-density areas an intricate network should be built, and this will be handled in future, more detailed studies. It is also important to note that a detailed environmental study must be done on the wetlands that will be affected by these proposals.

10.4 Solid Waste Management Plan

Solid waste disposal is one of the most challenging issues faced by developing countries due to large solid waste quantities, causing its management to be a worldwide challenge. Efficient collection and disposal of solid waste is critical to protect the environment as well as the health of the population. In order to address these concerns an Integrated Waste Management Plan (IWMP) is required for the City. Despite its shortcoming to provide a formal waste collection and disposal service, the City of Kigali is one of the cleanest cities in Africa.

10.4.1 Applicable Policies and Plans

The governing policies and plans for solid waste management in the City of Kigali are as follows:

- Rwanda Vision 2020 (2012);
- National E-Waste Management Policy for Rwanda (2016);
- National Sanitation Policy (2016);
- National Sanitation Policy Implementation Strategy (NWSPIS) (2016);
- By-laws of prohibiting the dumping of household waste outside individual private property.

10.4.2 Master Plan

Solid waste management in the City of Kigali is undertaken by the Infrastructure Department of the City. Even though Kigali is known to be one of the cleanest cities in Africa, there is currently no Solid Waste Master Plan / Management Plan for the city.

10.4.3 Key Issues

Some of the key issues to be addressed by the City relating to solid waste management are discussed below. Recommendations to address these issues have been made by the project team and are presented later in this report.

- Implementation of regional landfill and recycling facility - As raised in the 2013 Master Plan, the site that

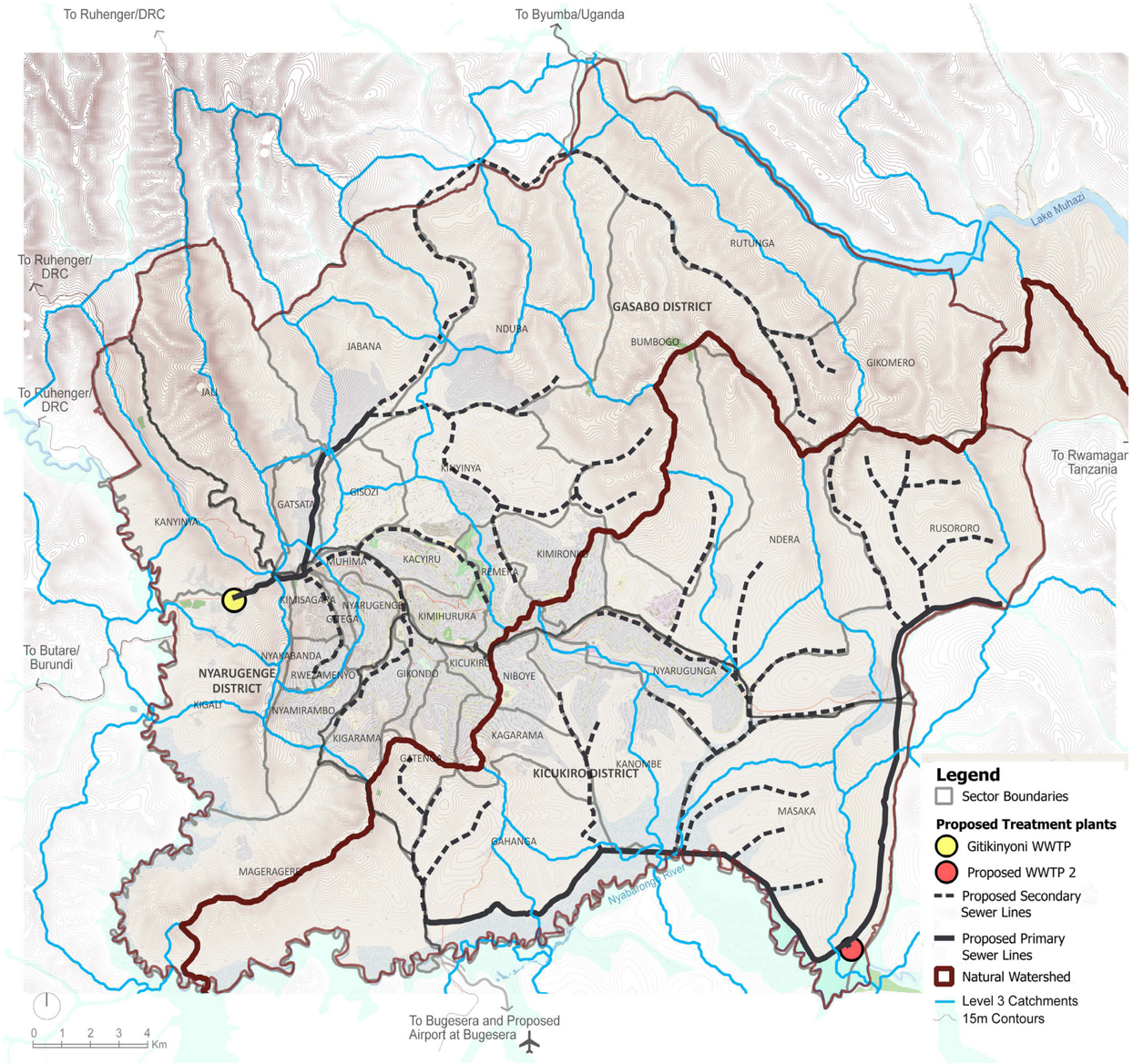


Figure 10.27 Proposed Sewer Network - Contours & Catchments

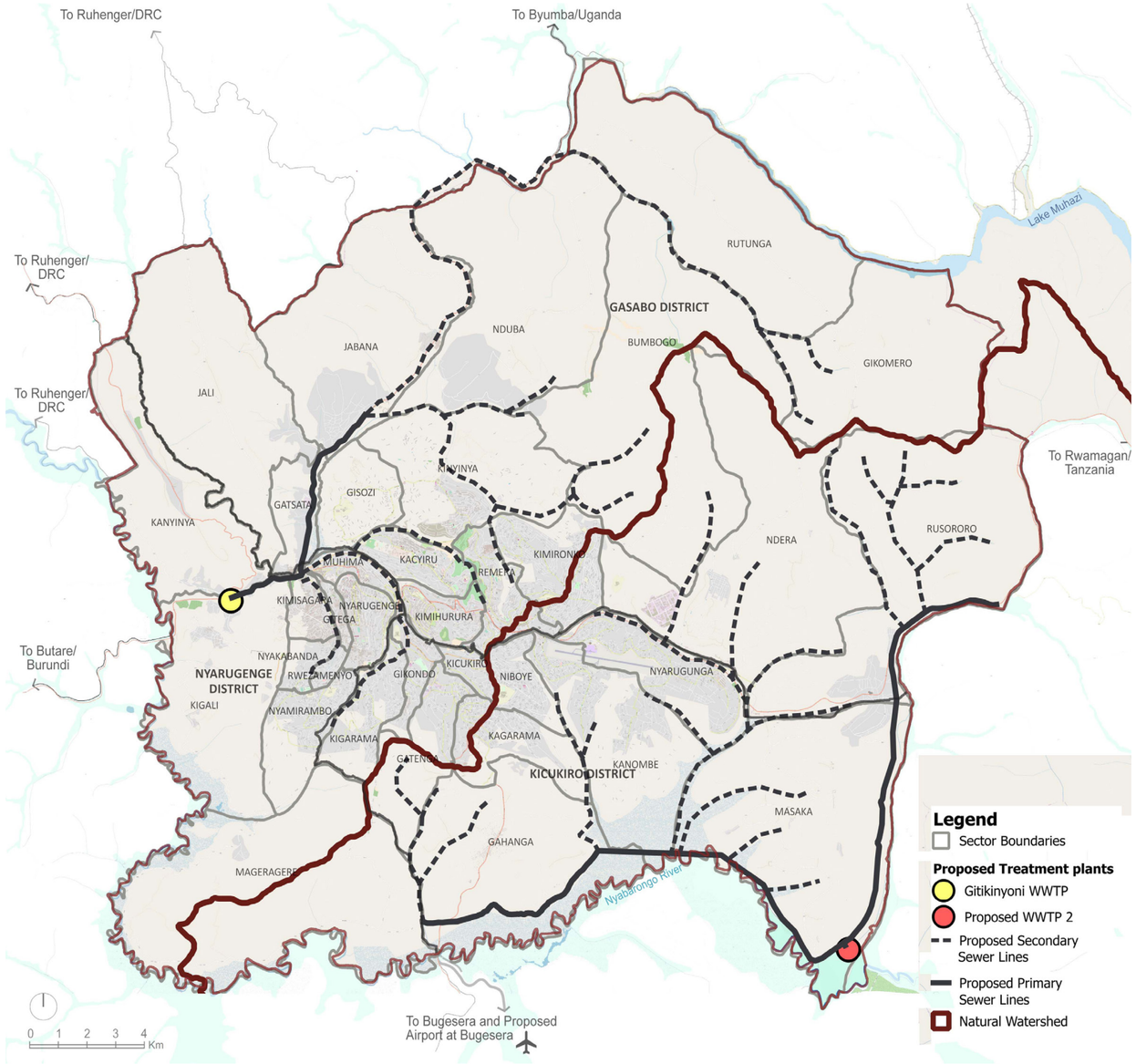


Figure 10.28 2050 Proposed Sewer Network

is currently being considered by the City has several limitations such as its proximity to the City Centre and Nyabarongo River, one of City's main water sources. Higher priority needs to be given to this project. Ideally the landfill site should be located away from the population. It should be properly lined to prevent the leachate from infiltrating and contaminating the ground, with a monitoring protocol. To increase the life span of the landfill, waste recycling should be encouraged at various stages before disposal at the landfill.

- Close Nduba landfill - The current Nduba landfill, which was only for temporary use should be closed and the appropriate rehabilitation steps taken.
- Waste management plan - CoK to develop a waste management plan.
- Waste unit - A waste unit department to be established in CoK to manage, monitor and implement the waste management plan.
- Separation at source - A "separation-at-source" programme should be developed with supporting infrastructure.
- Household collection issues - Frequency of removal is not in-line with the rate of waste generation. Transfer stations are required to reduce the collection time and increase frequency of collection. The types and sizes of collection vehicles are not always appropriate for the areas in which they operate. CoK does not have sufficient capacity to monitor vehicles in terms of trips/ movement and weight.
- Transfer of Waste – The travel time between the collection points and the dump site can take up to 1.5 hours per trip (one way), to cover 25-30 km. This results in the need for more trucks / collection vehicles.

10.4.4 Waste Generation Estimation

The planning horizon for solid waste management is split into two, and is based on the population projections for 2018 and 2050 from IPAR. The solid waste generated for 2018 and 2050 are shown per sector in Table 10.10, and is based on a generation rate of 0.6 kg / person /day for Kigali (http://www.atlas.d-waste.com/).

The result of this waste generation calculation for 2018, is significantly higher than the volume of waste presented in the Africa Engineering Conference 2017 of 350 t/day. It is likely that this is as a result of the population numbers and the growth rates applied for future projections. For the purposes of this report, the IPAR population values, as discussed previously in this report, have been used.

10.4.5 Planning Approach

The following flow chart (Figure 10.29) highlights the elements that form part of a formal solid waste collection and disposal system. These elements will be addressed in this Planning Approach section of the report.

In 2018 and 2050 the City of Kigali would need to cater for 945.179 and 2 307.384 t/day of waste generated. The solid waste planning approach that has been adopted for this master plan

to deal with the waste generated is as follows:

- Assessment of waste volumes, as well as its chemical and physical content;
- Review/ proposal for collection areas and routes;
- Appropriate vehicle selection for waste transportation;
- Intermediate waste management at transfer stations;
- Landfill management and classification;
- Public awareness and training regarding separation at source, composting, waste reuse etc.

Proposed Level of Service

The vision of the National Sanitation Policy is to ensure sustainable, equitable and affordable access to waste management services for all Rwandans. In order to meet this goal, the following levels of service are proposed:

- Rural / low-density areas – On-site disposal, including composting of organic waste (CoK to develop guidelines to formalise this process), see Figure 10.30; and

- Urban / high-density areas – Off-site disposal, formal collection service with recycling and discarding at an engineered landfill, see Figure 10.31

Adjusted Solid Waste Volumes

As presented in the previous section, the proposed level of service for rural / low-density areas does not include formal waste collection with off-site disposal at a landfill. Therefore, the landfill and collection plan will be designed to exclude the waste volumes generated in these areas. With this in mind, the waste generation has been recalculated to inform the proposed designs and land uses and the remaining sections will refer to these adjusted values.

The following maps (Figure 10.31-10.35) show the solid waste volume (t/day) per sector as well as the generation intensities (t/day/Ha) per sector. The intensity is calculated by taking the waste generated per sector and dividing it by the sector's coverage area. The highest waste volumes are coming from the eastern sectors of Kigali, this is purely due to their size. The generation intensity map presents a more accurate image in terms of where the concentration of the waste generation lies and where the collection should be focussed. There is a big difference in the waste generation intensity from 2018 to 2050, which is in line with the drive to densify the city.

Waste Properties

There are 3 main categories of solid waste generated in the City:

- **Organic Waste** – Biodegradable waste is the main type of waste generated in the City. Examples of organic waste are food, biomass and garden waste. They are usually disposed of directly into a landfill or in most cases in Kigali, composted at source.

- **Non-organic Waste** – Plastic, paper, glass, metal, and combustibles are the most common types of non-biodegradable waste. Recycling of non-organic waste is not common.

Table 10.10 2018-2050 Solid Waste Generation

Sector	2018 Waste Generation (t/day)	2050 Waste Generation (t/day)
Gitega	39.003	7.675
Kanyinya	16.592	19.291
Kigali	30.913	52.778
Kimisagara	37.741	8.448
Mageregere	28.606	80.969
Muhima	23.077	20.297
Nyakabanda	23.407	11.304
Nyamirambo	29.369	48.607
Nyarugenge	20.269	20.945
Rwezamenyo	12.387	12.326
Bumbogo	33.518	102.283
Gatsata	30.968	9.787
Gikomero	22.072	9.708
Gisozi	13.883	47.112
Jabana	39.039	40.975
Jali	29.736	22.006
Kacyiru	27.433	32.578
Kimihurura	16.412	18.161
Kimironko	33.094	89.926
Kinyinya	19.917	146.035
Ndera	36.875	247.498
Rutunga	25.807	19.152
Kanombe	37.283	144.533
Nduba	33.110	34.932
Remera	22.145	54.173
Rusororo	38.570	215.546
Gahanga	28.737	213.341
Gatenga	29.837	50.083
Gikondo	15.081	18.907
Kagarama	12.653	66.290
Kicukiro	16.718	16.034
Kigarama	35.846	33.282
Masaka	36.620	278.527
Niboye	30.482	39.614
Nyarugunga	26.978	73.714
Total	**954.179**	**2307.384**

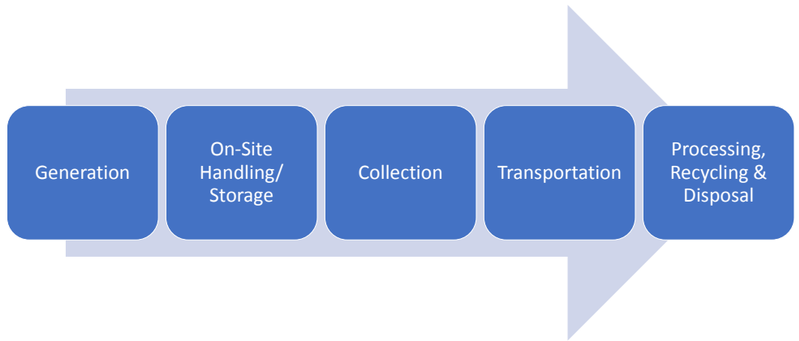


Figure 10.29 Solid Waste Management Hierarchy

Figure 10.30 Composting of Organic Waste

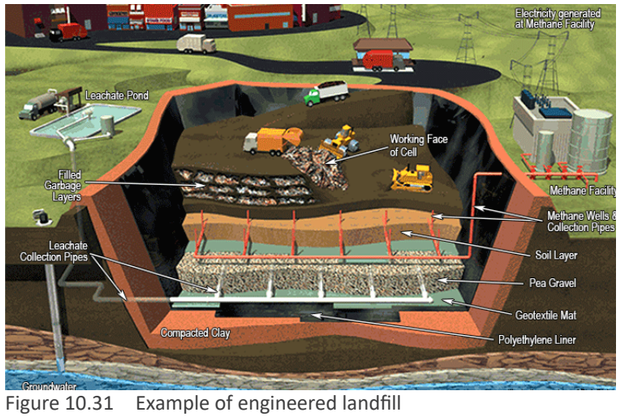


Figure 10.31 Example of engineered landfill

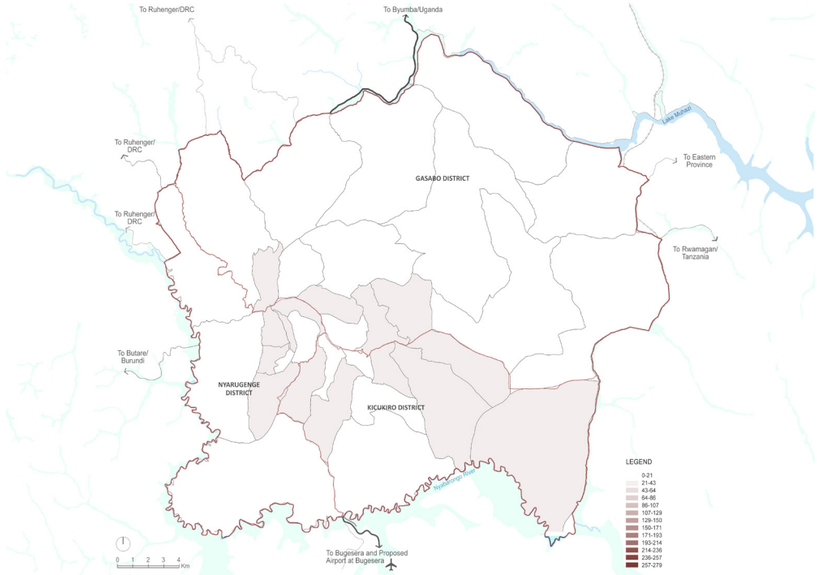


Figure 10.32 2018 Solid Waste Collection

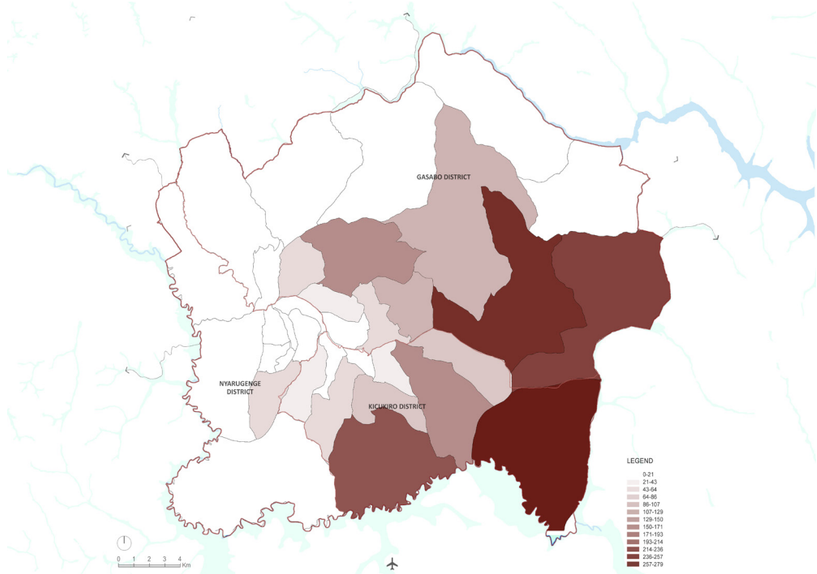


Figure 10.33 2050 Solid Waste Collection

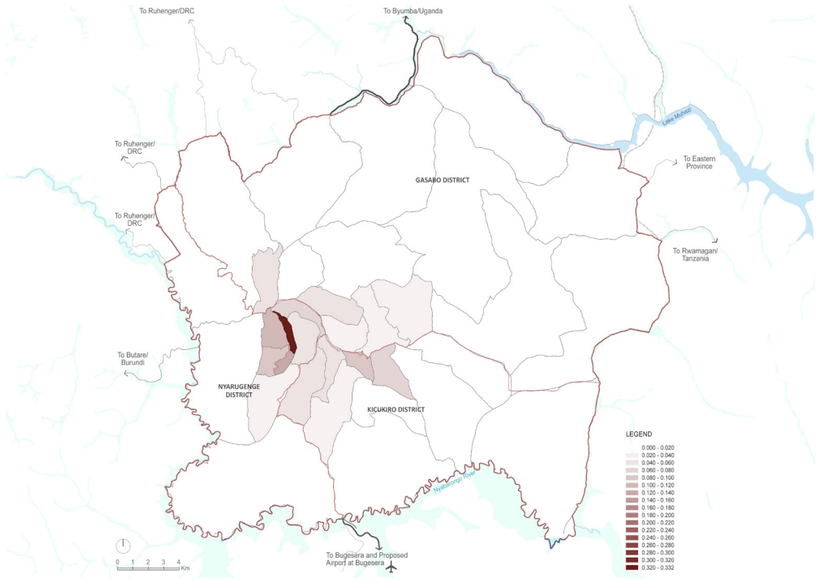


Figure 10.34 2018 Solid Waste Intensity

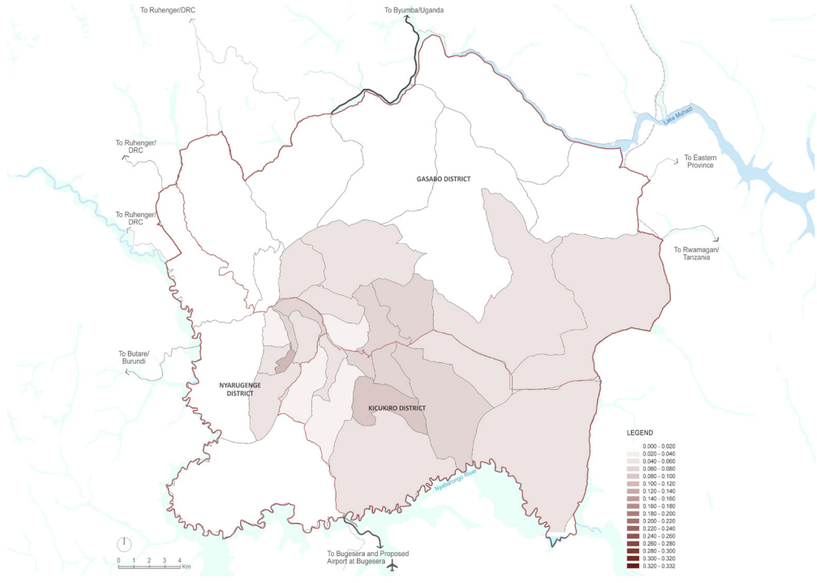


Figure 10.35 2050 Solid Waste Intensity

However, there is a national ban on the use of plastic bags which has helped to reduce the volume of non-organic waste in the City.

- **Hazardous Waste** – Any waste that poses threat to human health and the environment is classified as hazardous waste. They are mainly generated by hospitals, industries and other facilities. Currently, hazardous waste is disposed of at incinerators and is not taken to a dump site.

Table 10.11 outlines the main methods of solid waste disposal in Kigali, according to the Integrated Household Living Conditions Survey (EICV 5).

Proposed Collection and Routes

The collection and transportation of solid waste in Kigali is handled by the private sector. Billing is done directly from the service provider to the household. The reason for the involvement of the private sector is as a result of CoK not having the capacity to provide the service, as well as the enforcement of by-laws prohibiting the dumping of waste outside private properties. Various private companies have designated areas within which they operate, as indicated in the following figure. The map (Figure 10.36) has been created based on information presented at the Africa Engineering Conference (AEC) 2017, on the “Perspective of Solid Waste Collection in the City of Kigali”.

It must be noted that collection is done in areas that have been identified as rural/ low density, for example: Jabana, Jali and Kigali. With the proposed level

COMPOST HEAP	THROWN IN BUSHES/ FIELDS	RUBBISH COLLECTION SERVICE	DUMPED IN RIVED/ LAKE	PUBLICLY MANAGED REFUSED AREA	BURNT	OTHER
13.6%	33.5%	48.9%	0.7%	2.6%	0.3%	0.3%

Table 10.11 Methods of waste disposal

of service in mind, together with the low intensity of waste generated in these areas, they have not been considered for formal collection planning in this report. However, this should not prohibit companies from collecting in these areas.

A comparison has been done between the collection areas map and the waste generation maps. It is clear that the areas with the highest demands, i.e. high-density/ urban areas, do have a waste collection service. For this reason, no changes are proposed in terms of the coverage of the collection services. It must be noted that some areas do not get their waste collected due to restricted access. Waste drop off centres should be established for citizens in these areas.

In a presentation done at the Africa Engineering Conference (2017), it is stated that 350 t of waste is collected daily and transported to the Nduba dump site. This is significantly less than the 954 t/day calculated in this report for 2018. Even though all the critical areas are being serviced in terms of coverage, there is still a deficit relating to the amount of waste that is collected and removed.

Waste collection should be revised by optimising the collection routes, adjusting the frequency of collection and the carefully selecting the number of vehicles required for the operation. This will be further improved by the introduction of formal transfer stations around the city which will reduce the waste transfer time from source to landfill. It is important to note that the collection and transfer of waste accounts for the bulk of the costs relating to waste management systems and therefore needs to be handled as efficiently as possible.

The following factors should be considered when planning waste collection routes:

- Routes should not overlap and vehicles should only travel once on the same road;
- The starting point of collection should be as close as possible to the garage/ vehicle storage area;
- The ending point should be located as close as possible to the landfill or transfer station;
- Busy roads should be avoided in peak hour;
- On hills or steep slopes, collection should be done whilst travelling downhill;
- Vehicle maintenance should be scheduled into collection routes if standby vehicles are not available.

PROPOSED VEHICLE SELECTION

There are varied functions in the waste

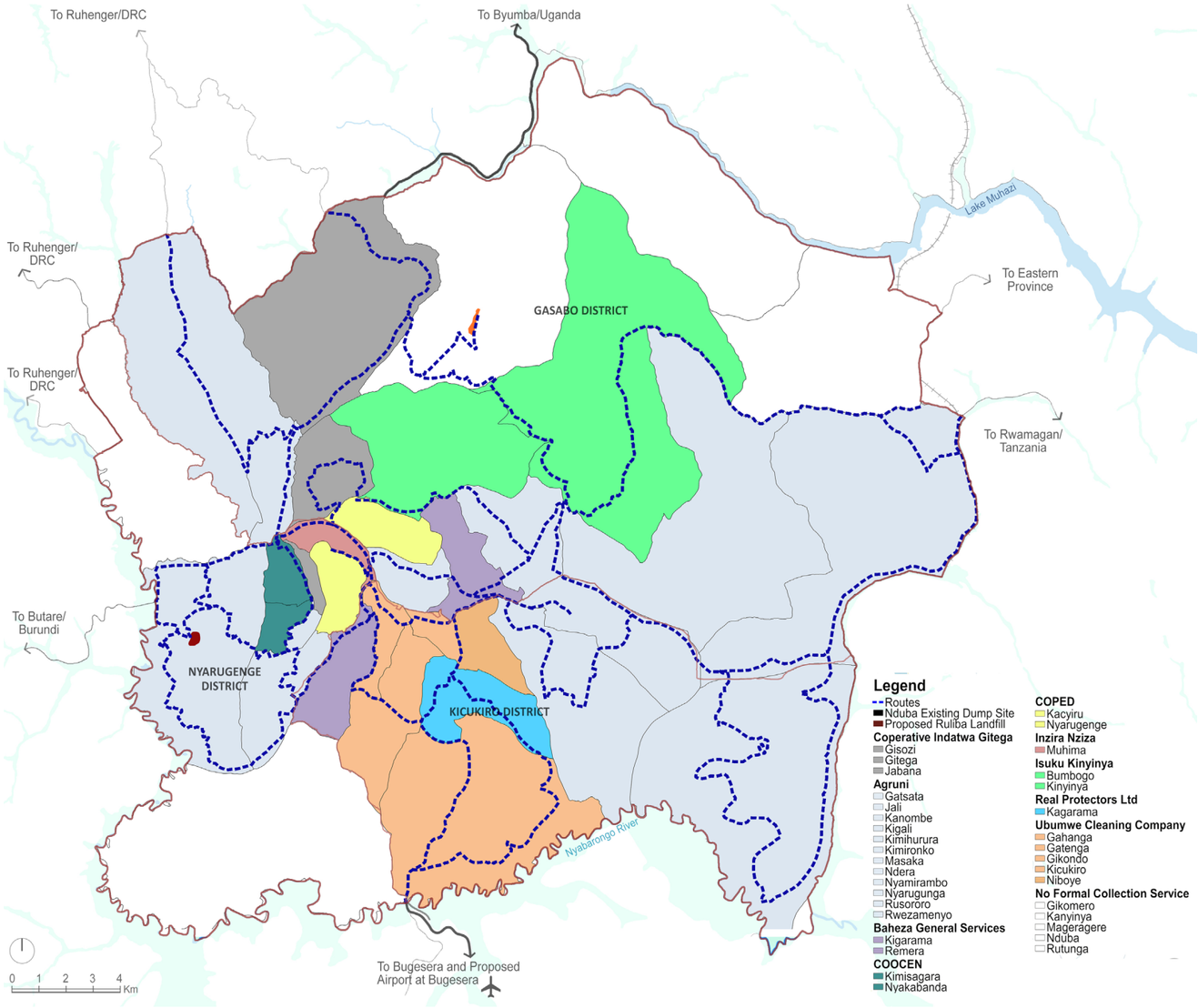


Figure 10.36 Waste Collection Areas and Routes

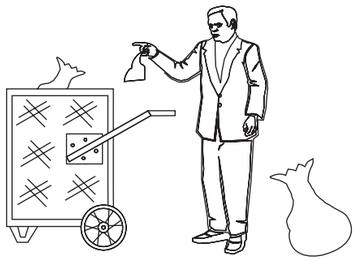


Figure 10.37 Push cart

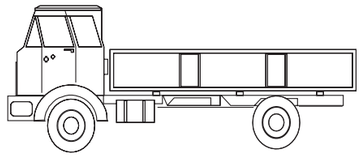


Figure 10.38 Flat-bed truck

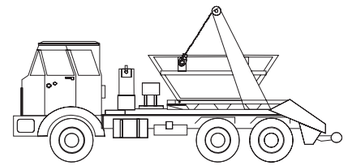


Figure 10.39 Load lugger / skip loader

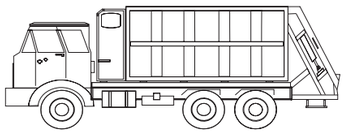


Figure 10.40 Rear-end loader

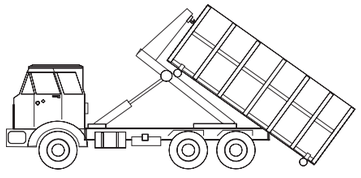


Figure 10.41 Roll-on roll-off

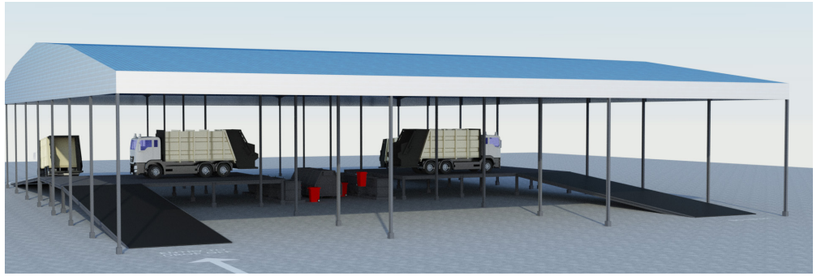
Table 10.12 Transfer Station Sizing

Item	2018 Waste	2050 Waste
Total (t/day)	954.179	2307.384
Urban/ High-density (t/day)	590.603	2027.573
Assumed waste density (m³/day)	3.61*	
Urban/High-density (m³/day)	2132.076	7319.538
No. of 30m³ skips to receive waste	71	244
No. of 30m³ skips to remove waste	71**	244**
No. of transfer stations	10	41
Total skips per transfer stations	14	12

*Density as per detailed design report for Ruliba Landfill

**Should static compactors be introduced the amount of outgoing waste will be reduced significantly, and thus less vehicles would be required.

Figure 10.42 6 m^3 and 30 m^3 skip bin



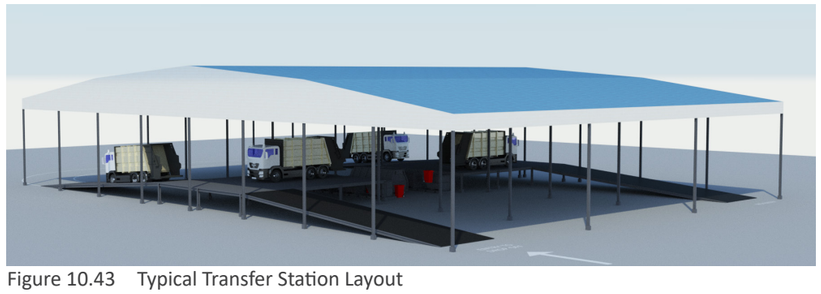


Figure 10.43 Typical Transfer Station Layout

management process and therefore it is necessary to utilize the most suitable vehicle to get the job done. The following factors should be considered when selecting a waste collection vehicle:

- Operational cost per km;
- Size of area to be served;
- Method of collection;
- Width and surface of roads;
- Topography (critical for Kigali);
- Type of waste;
- Degree of source separation; and
- Distance to off-loading point.

A few examples of waste collection vehicles are shown (Figure 10.37 - Figure 10.41), from the basic hand cart to the more technically sophisticated motorized options.

Proposed Transfer Stations

A transfer station is a facility that receives waste from collection vehicles. The waste is usually compacted into containers that are then collected by roll-on vehicles and then transported to a landfill/ processing facility. The number of transfer stations required is a function of the proposed size of transfer stations, the more transfer stations provided, the smaller they can be. This is generally based on the properties of the contributing area, and the associated activities and waste generation patterns. Considering the proposed level of service discussed previously in this report, the transfer stations will be sized based on the amount of waste generated and collected from the urban / high-density areas only. Transfer stations should be located in areas where there is easy access for collection vehicles, close to main routes and where the population is dense. Table 10.12 shows the calculation for the number of skips required at the transfer stations to receive and remove waste, assuming that 30m^3 skips are used, as shown in Figure 10.42.

The following transfer station layout is proposed (Figure 10.43), with the number of skips varying according to what is required:

Figure 10.44 shows the positions of the proposed transfer stations for Kigali to handle the waste collected in year 2050.

Proposed Landfill

Disposing of waste in a landfill involves burying the waste below or above-ground. A properly-designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. However, poorly-designed or poorly-managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin (such as mice or rats), and generation of liquid leachate. Another common bi-product of landfills is gas (mostly methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. Not only is this a greenhouse gas, but it can create odour problems and also kill surface vegetation.

The design characteristics of a modern landfill include methods to contain leachate, such as clay lining material. Deposited waste is normally compacted

to increase its density and stability, and covered to prevent attracting vermin. Many landfills also have landfill gas extraction systems installed to extract the gas that is generated. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

Up until 2014, all waste in Kigali was sent to the Nyanza landfill, which reached its capacity and was closed down. Subsequently, the Nduba dump site has been used as a temporary disposal point. This is not an engineered landfill and does not treat any waste, it simply contains it. The City of Kigali is planning to construct a regional sanitary landfill and recycling centre to replace the existing Nduba dump site. Various detailed studies and surveys have already been done for this landfill however funds are required for its implementation.

According to the 2013 Kigali Master Plan, there is a proposed 11 Ha landfill site, located 2.6km east of the brick factory in Ruliba, Nyarugenge District. It must be noted that development on this site may have adverse environmental impacts, which need to need addressed. According to the detail design report for the Ruliba Landfill, the facility has been sized to last 10 years and is based on a waste input of 105 000 tonnes per year. Using a waste generation rate of 0.6kg/ person / day, and assuming that waste in rural/ low-density areas is not collected for disposal at the landfill, the team has calculated the waste generation per year as follows:

- 2018: 215 570 t/ year;
- 2050: 740 064 t/ year.

The results of this solid waste generation calculation are significantly less than what is presented in design report of the Ruliba Landfill. It is likely that this is as a result of the population numbers and the growth rates applied for future projections. For the purposes of this report, the IPAR population values have been used.

In order to deal with the future waste generated in the City, the following landfill properties are proposed:

- Proposed lifespan: 50 years;
- Start year: 2020;
- Landfill to be closed: 2070;
- Waste collected in 2020: 215,570.022t/year;
- Waste collected in 2050: 740,064.072t/year;
- Waste collected in 2070: 1,599,815.565t/year;
  Compaction ratio: 1t = 1m^3;
- Assumed waste stacking height: 20m;
- Space required for landfill in 2020: 2ha;
- Space required for landfill in 2050: 69ha;
- Space required for landfill in 2070: 182ha; and
- This could be split into multiple landfill sites if required

It must be noted that the proposed landfill needs to cater for hazardous waste as well sludge from septic tanks in the rural/ low-density areas. The integrated management plan should provide recommendations in terms of design standards and requirements for the safe disposal of hazardous and

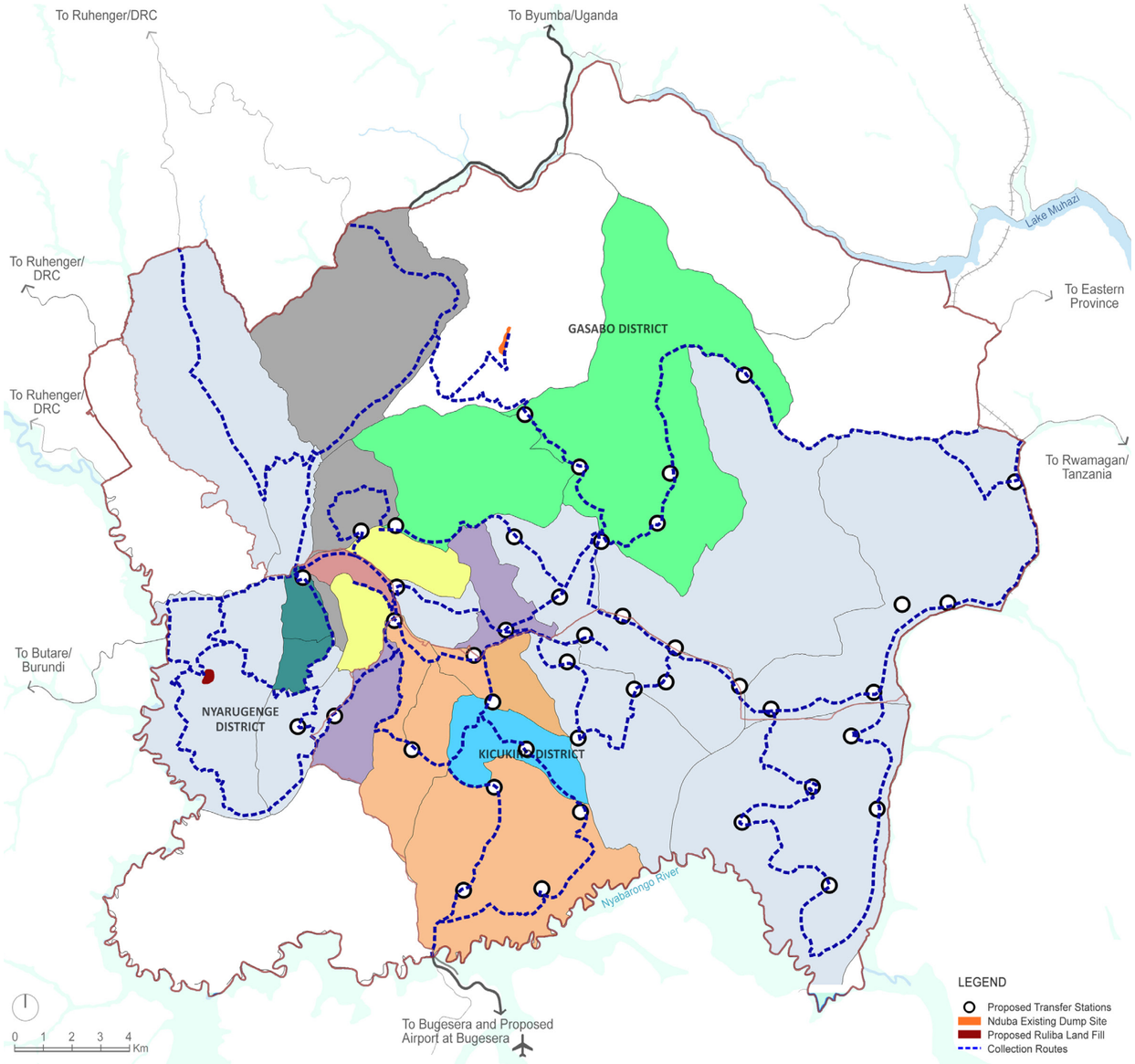


Figure 10.44 Proposed Transfer Stations

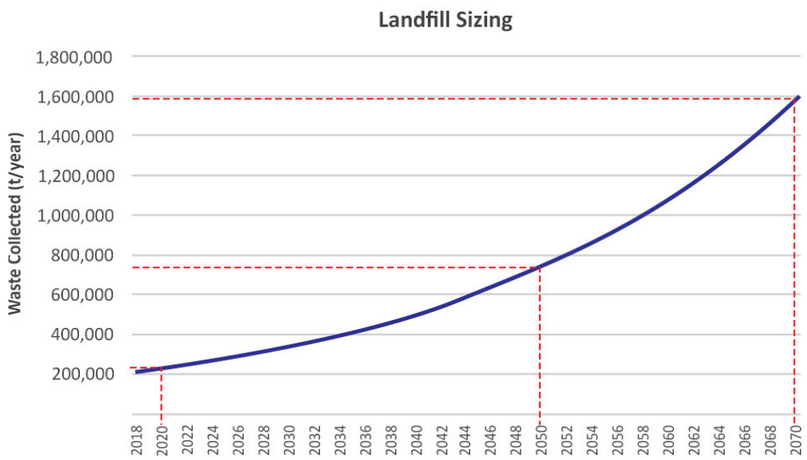


Figure 10.45 Landfill Sizing

sludge waste.

Micro-economic activities such as waste pickers for recycling, are also recommended. This is to align with the vision to reduce final disposal volumes to the landfill, and therefore minimise the space requirements.

The above chart (Figure 10.45) shows the landfill sizes required from the start year 2020 to 2070.

Before a landfill can be developed or permitted for operation, it will have to be demonstrated that any adverse environmental impacts will be addressed in the landfill design and its operating plan. No landfill should be developed without a fatal flaw evaluation that should consider the following factors that will influence the selection of the potential landfill site:

- Proximity to airports (Landfills attract birds, this is a risk for airplanes landing or taking off);
- Flood lines (Potential pollution of water bodies);
- Unstable areas (Fault zones, seismic zones, dolomitic areas);
- Sensitive areas (Ecological/ historical areas should be preserved);
- Groundwater (Depth to water table to be considered and not polluted);
- Topography (Steep gradients may result in unstable slopes); and
- Land use (Noise, smells and windblown litter in residential areas)

Following a public participation process, a Feasibility Study should be done followed by an Environmental Impact Assessment (EIA). Only once all of the environmental authorisations are granted, can the construction of the landfill site go ahead.

10.5 Storm Water Management Plan

The adequate management of stormwater within a city is critical to reduce property damage, erosion, flooding, pollution and many other environmental and health and safety issues.

10.5.1 Applicable Policies and Plans

The governing policies and plans for stormwater drainage in the City of Kigali are as follows:

- Economic Development and Poverty Reduction Strategy (EDPRS II) (2013);
- Rwanda National Land Use Planning Guidelines (2017);
- Rwanda Building Code (2015).

10.5.2 Master Plan

The stormwater drainage system in the City of Kigali is constructed and maintained by the Infrastructure Department of the City. This City plays a reactive role by identifying flood-prone areas, but there is no existing Stormwater Management Plan and no modelling is done.

A need has been identified for a full scale stormwater master planning study to be conducted by the city. The study should include the creation of a detailed hydrological model for the city, in order to obtain the information required to inform a stormwater master plan. The master plan should consider the flood line delineation results in order to inform land use around all natural water courses. In addition the model will highlight flood prone areas where additional infrastructure will be required to limit and mitigate the effects of stormwater runoff.

All future roads should be designed with an element of stormwater drainage, as per the recommendations that should be set out in the stormwater master plan.

10.5.3 Key Issues

Some of the key issues to be addressed by the City relating to stormwater management are discussed below. Recommendations to address these issues have been made by the project team and are presented later in this report.

- **Stormwater and waste water not separated** – The water in the public drains is contaminated by the sewer, in turn affecting the quality of the receiving water bodies. To resolve this issue, close coordination with the implementation of the sanitation policy is required and proper sewage treatment system is necessary.

- **Maintenance and upgrading of the damaged channels** - Damaged channels will not function at their optimum design capacity, which may cause localised flooding in the event of heavy rains. The City has to conduct regular checks and maintenance of the existing drains to ensure that they are in good condition.

- **Lack of stormwater management** - The City has a high rainfall annually generating large stormwater volumes, this should be seen as a resource to be valued and utilised. With proper stormwater management, it could be harvested for non-potable use such as landscape irrigation and general area washing. Besides, providing an additional water resource, proper stormwater management (e.g. rainwater harvesting and stormwater retention) would also help to reduce flood risks.

- **Lack of proper drainage design guideline** - Without a standard local design guideline, there is no common basis for designing drains in new developments or for verifying the adequacy of the drainage capacities of the receiving drains and canals. With the rapid urbanization process, and for proper development control; a local standard guideline with relevant rainfall data should be established.

- **Erosion at the areas with steep slopes** - The Gikondo Industrial Area is an example of a problematic area. The government has been relocating the industrial zone since 2013 to the newly established SEZ in Gasabo, however this is not complete due to lack of funding. The slopes result in the eroded soil ending up in the water courses and water bodies, thus reducing the drainage capacity and polluting the water environment. Earth control measures such as afforestation, soil terracing, contour farming, etc. should be implemented to minimise soil erosion.

- **Need for policy** - CoK should develop a policy to deal with on-site attenuation

for short-duration, high-intensity storms. This policy should also deal with excess stormwater runoff that cannot be viably contained and how this should be accommodated by downstream land owners.

- **Building plan approval** - The approval process should include a stormwater management plan that addresses how stormwater will be controlled on the site and points out the areas downstream of the site that could potentially be affected.

- **Relocation in high risk zones:** It should be reinforced that people settling in high risk zones such as wetlands, floodplains, and steep slopes (30% +) should be relocated.

10.5.4 Stormwater Flow Estimation

The topography in and surrounding the City of Kigali creates a situation where the runoff generated to the north of the city, flows into and through the high density areas of the city, creating an additional demand for allocated safe drainage paths. For this reason, a complete stormwater master plan must be created for the city. The following sections provide some basic information on the stormwater flows in the city.

Most of the flow through the city runs into rivers with wetlands on the river banks, thus providing a natural buffer for the runoff. The calculations below focus on the Mpazi Sub Catchment, which includes the Kimisagara, Gitega, Nyakabanda and Rwezamenyo Sectors, where natural drainage has been disrupted by high density development.

Demand Parameters

Rainfall:

The Mean Annual Precipitation (MAP) in Kigali is 1028mm per year. The rainy season is from September to May.

Intensity Calculation:

According to an article entitled "Analysis of Rainfall Intensity-Duration-Frequency Relationship for Rwanda" (Negash Wagesho1*, Marie Claire2, June 2016) the following intensity, duration, frequency (IDF) curve can be used to determine storm intensities in Kigali:

Runoff Factors:

The amount of rainfall that runs off the surface is determined by the topography, the type of vegetation and the landscape. These aspects are combined into a runoff factor which provides the portion of rainfall which is converted to runoff. The table below shows the runoff factors which were assigned for each land use.

Catchments

The City of Kigali is split into a northern and a southern catchment by the primary catchments that have been delineated by the Rwanda Water and Forestry Authority. The city if further split into 25 tertiary (level 3) catchments. The catchment used for determining the runoff in the city were the level 3 stormwater catchments, seen in Figure 10.46.

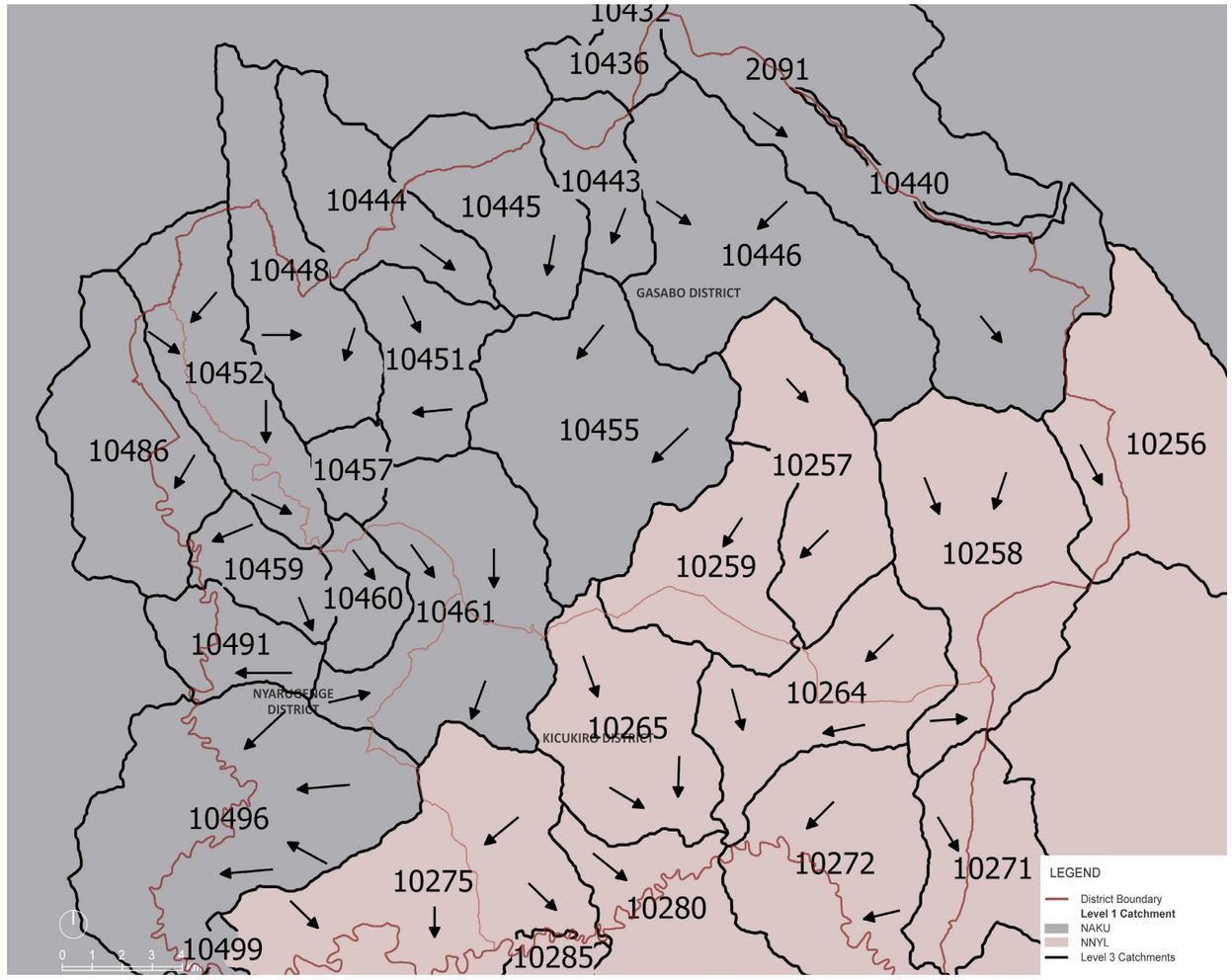


Figure 10.46 Stormwater Catchments for the City of Kigali

2018-2050 Stormwater Calculations

In the absence of a full stormwater management plan and the detailed information required for stormwater calculations a crude estimate of the expected runoff has been done for the Mpazi Sub Catchment, which includes the Kimisagara, Gitega, Nyakabanda and Rwezamenyo Sectors. The calculations have been summarised below.

Intensity:
Storm intensities have been determined using the IDF shown in Figure 10.47 the following intensities were obtained.

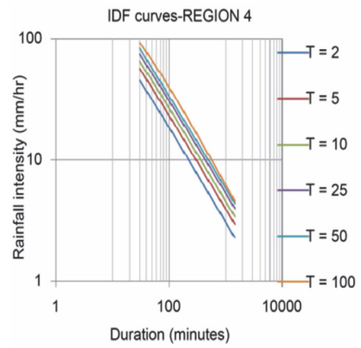


Figure 10.47 IDF Curve for Kigali (Negash Wagesho1*, Marie Claire2, June 2016)

Flow:
The following formula is used to calculate the flows for various storm intensities:

$Q = ciA$

Where:

Q = Flow Rate (m^3/s); (Table 10.13)
c = Runoff coefficient (unit less);
i = Intensity (m/s); (Table 10.14)
A = Catchment area (m^2).

Generally accepted best practice is to not allow development within the 1 in 100 year flood line, which would be determined by detailed modelling procedures, as suggested as part of the stormwater master planning exercise. Since no such plan has been determined for Kigali the flow depth and width at the outflow from the catchment has been estimated using the Manning's Equation, shown below.

$$Q = \frac{1}{n}\frac{A^{\frac{5}{3}}}{P^{\frac{2}{3}}}\sqrt{S}$$

Table 10.13 Flow Rates for various Storm Intensities

Return Period	2018 Q(m^3/s)	2050 Q(m^3/s)
2	86.982	72.340
5	98.979	82.318
10	110.977	92.296
5	119.975	99.779
50	127.473	106.016
100	134.972	112.252

Table 10.14 Storm Intensities

Return Period	I (mm/h)	I (m/s)
2	58	1.61111E-05
5	66	1.83333E-05
10	74	2.05556E-05
5	80	2.22222E-05
50	85	2.36111E-05
100	90	0.000025

Where:
n = Manning's roughness coefficient (0.035 for natural channel);
A = Flow area (m^2);
P = Wetted perimeter (m);
S = Slope of the water course.

The results for the width and depth of flow for various storms is shown in Table 10.15

The value for the 100 year return period shown above would be used to approximate the area within which development would not be allowed, due to a high risk of flooding. These areas have been overlayed onto the zoning plan as drainage buffers. It is important to note the change in width from 2018 to 2050 as a result of the decrease in flow, due to changes in the land use.

10.5.5 Planning Approach

The large number of impervious surfaces found in built up areas leads to high runoff volumes flowing at high speeds. The high densities and increased prevalence of industries also leads to pollutants being picked up and carried along the stormwater runoff's flow path. These pollutants eventually run into the water bodies and compromise the water quality. As a result of the increased volume, speed and energy of the flowing water, there is a greater risk of flash flooding and soil erosion.

Sustainable Urban Drainage has become popular in first world countries including, amongst others Australia, Singapore, UK and should be seen as standard practice for stormwater management.

In order to improve the drainage system in the city and to ensure that the buffer zones are correctly delineated a more detailed stormwater master plan should be developed. The stormwater master plan should follow a planning approach which aims to minimize flood risk through on-site retention, improve the quality of discharge and to integrate the storm water infrastructure into the urban setting. It should be planned based on the following criteria:

- Removal of pollutant at source;
- Slow down of stormwater runoff;
- Stormwater retention;
- Stormwater reuse;

Table 10.15 Depth and width of flow for various storms

	2018			2050		
Return Period	2018 E (m^3/s)	Depth Required (m)	Width (m)	2050 E (m^3/s)	Depth Required (m)	Width (m)
2	86.982	1.164	27.934	72.340	1.086	26.069
5	98.979	1.222	29.321	82.318	1.140	27.363
10	110.977	1.275	30.606	92.296	1.190	28.562
25	119.975	1.313	31.514	99.779	1.225	29.410
50	127.473	1.343	32.239	106.016	1.254	30.086
100	134.972	1.372	32.938	112.252	1.281	30.738

- Beautification of the existing and future waterways.

10.5.6 Proposed Stormwater Management

In order to prevent damage and loss of life a number of drainage buffers have been added as an overlapping layer to the zoning plan.. These buffers are located in areas where stormwater would naturally be flowing due to topography. They are required as a safety measure in order to ensure that development does not occur in flood prone areas. In most cases the drainage buffers fall within parks, roads, infrastructure, protected areas and agriculture zoning categories. These are all areas that will safely allow for natural drainage. These buffers must be verified and formalised by determining the 1 in 100 year flood lines, which should form part of a greater stormwater master plan for the city. Drainage buffers that do not fall within the previously mentioned zoning categories can then be engineered to run within the safe zones. A detailed risk assessment will be required for all existing settlements that lie within the buffer zones.

The Interim Master Plan has not provided a planned stormwater network, as the detailed information required to accurately plan the system is not currently available. In order to ensure that stormwater is safely channeled through and away from the city, a full hydrological model should be created. This will provide planners with a full detailed understanding of the current runoff in the city and identification of problem areas. It will allow planners

to determine if the best solution is to upgrade systems in the problem areas, or if mitigation upstream of these areas would be more suitable.

The zoning shown in Table 10.16 shows an increase in the formal open spaces. This is a good example of sustainable urban drainage, as the increase green space decreased the runoff from the catchment, as can be seen by the decrease in the calculated runoff factor for the catchment. This is an effective first step in the reduction of runoff and stormwater management.

The following are examples of sustainable stormwater management practices which could be considered for Kigali:

Vegetated Swales (Figure 10.48) - an open-channel drainage ways used to convey storm water runoff that can be used as replacement for the conventional drainage system

Bioretention Swale (Figure 10.49) - is a vegetated swale with additional bio-treatment system at the base

Bioretention Basin (Figure 10.50) - is a landscaped depression or a shallow vegetated basin that is designed to slow down and treat the storm water runoff on-site.

Constructed Wetland (Figure 10.51) - are shallow and extensively vegetated water bodies designed to remove finer and dissolved particles.

	2018				2050			
Zoning	**Area (km²)**	**Area (ha)**	**Runoff Coef.**	**Weighted Average of Runoff Coef.**	**Area (km²)**	**Area (ha)**	**Runoff Coef.**	**Weighted Average of Runoff Coef.**
Agricultural	0.232	23.247	0.300		0.000	0.000	0.300	
Open Space	1.554	155.421	0.200		3.312	331.244	0.200	
Residential	4.548	454.824	0.800		3.104	310.413	0.800	
Commercial	0.259	25.933	0.700		0.377	37.685	0.700	
Industrial	0.043	4.341	0.900		0.020	2.009	0.900	
Infrastructure	0.823	82.304	0.950	0.680	1.051	105.057	0.950	0.566
Mixed Use	0.000	0.039	0.850		0.000	0.000	0.950	
Public Facilities	0.443	44.345	0.850		0.076	7.572	0.850	
Special Use	0.000	0.000	0.900		0.000	0.000	0.900	
Water Bodies	0.035	3.525	0.000		0.000	0.000	0.000	
Total	7.940	793.980			7.940	793.980		

Table 10.16 Runoff factors

10.6 Power Supply Plan

The energy sector, and thus the power sector, is systemically and intrinsically linked to almost all sectors of the economy such as transport, housing and urbanization, manufacturing, agro-processing, mining and ICT services. This linkage to all economic sectors makes the power sector pivotal to the growth and welfare of the Rwandan economy. Electricity is an essential driver of modern technology and socio-economic development. Its use is required at low levels for devices such as lights and mobile phones, as well as at high levels for industrial processing activities that contribute to economic value-added products and job creation.

Main foucs programs of power sector include:

- Focus on improving institutional capacity for operations and planning, as well as coordination between the electrical utility (REG) and the city. Key elements of this focus program include:
- Strengthen institutional capacity to service increased number of consumers, in terms of operations (e.g. vending and maintenance), and capital expenditure programs (e.g. refurbishment and upgrade projects, network expansion projects).
- Ensure full functioning of utility's planning department in the monitoring of demand growth, participating in urban planning

Figure 10.48 Vegetated Swale (Source: ABC Water Guideline)

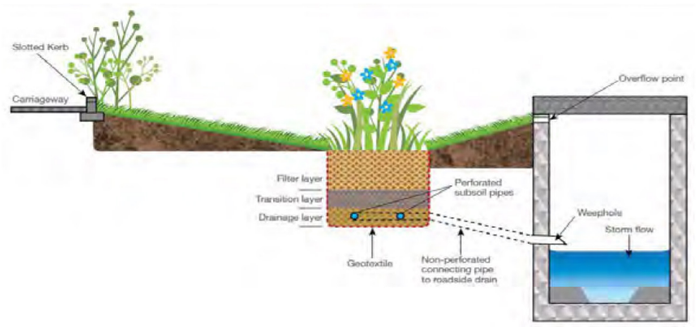


Figure 10.49 Bioretention Swale (Source: ABC Water Guideline)

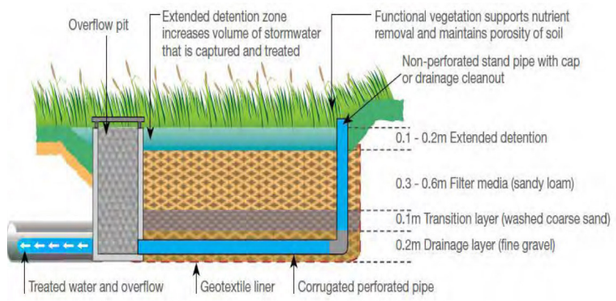


Figure 10.50 Bioretention Basin (Source: ABC Water Guideline)

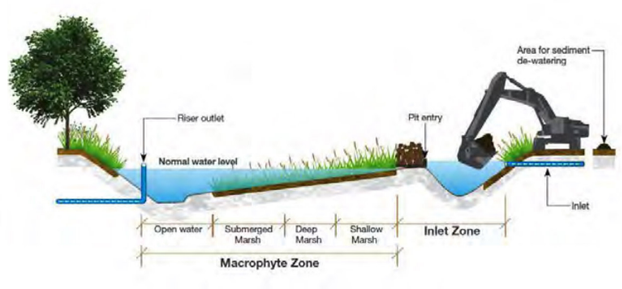


Figure 10.51 Constructed Wetland (Source: ABC Water Guideline)

structures, and adjusting the electricity master plan at regular intervals.
  - Enhance the electricity master plan of the city to align with updated and evolving urban planning.
  - Incorporate electricity provision aspects in the building control regime applied by the city authorities.
- Streamline government programs (within the city boundaries) in an energy efficiency and demand-side management strategy for the city. The strategy can cover themes such as:
  - Energy efficiency programs covering consumption by non-residential end-users
  - Solar Water Heaters (SWH) roll-out through investment incentives
  - Energy Efficient Streetlighting projects to specifically reduce non-revenue generating consumption
  - Localised application at city level of national programs and strategies specific to the electricity sector, including:
  - Energy Efficiency Strategy, with the goal of improving efficiency across full scope electricity delivery and consumption.
  - Electricity Access Roll-out Program, driving on-grid access growth
  - National Electrification Plan, covering expansion of the electricity service (on- and off-grid)

10.6.1 Electricity Sector Background

The electricity sector is a key enabler of Rwandan economic development.

Institutional Framework

The institutional framework of acts, policies and plans governing electricity supply and distribution in the City of Kigali include:

- Rwanda Vision 2020 (2012)
- Economic Development and Poverty Reduction Strategy (EDPRS II) (2013)
- Rwanda Energy Policy (2015)
- Energy Sector Strategic Plan (current version 2018/19 to 2023/24)
- Rwanda Electricity Law: Law No 21/2011 of 23/06/2011 Governing Electricity in Rwanda
- Decision No 002/BD/ER-/RURA/2018 of 02/08/2018 Reviewing the End User Electricity Tariffs in Rwanda
- Rural Electrification Strategy
- Rwanda Grid Code
- Regulations on Rwanda Renewable Energy Feed in Tariff
- Rwanda Energy Group Reticulation Standards
- Electricity Safety Regulations
- Electricity Quality of Service Regulations
- Regulations on Electrical Installations
- United Nations Sustainable Development Goals

The Rwanda Energy Group Limited (REG) was incorporated in 2014 to expand, maintain and operate the energy infrastructure in Rwanda through its two subsidiaries, the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL). EUCL is the trading arm that serves Rwanda's electricity customers, while EDCL focuses on developing new energy generation and transmission projects.

Electricity Sector Issues

Key issues relevant to the electricity sector that should be addressed in the development of an electricity or power sector plan for Kigali City, are discussed below.

Sufficient electricity supply is vital to economic growth and expanding household electricity access. Planning must ensure that infrastructure adequately responds and enables commercial, industrial and residential growth and access. Planning for future land use must be coordinated with infrastructure planning.

Forecasting future electricity demand in a high-growth country is challenging; therefore, planning must be flexible and progressive with the analysis supporting it regularly updated. The diversification of power sources to include sustainable and renewable power sources must be continued and expanded.

Increasing access to electricity requires further expansion of the electricity to continue through the Energy Access Roll-out Program (EARP). Policy documents place specific focus on connection of productive electricity users, that contribute to socio-economic growth and welfare.
The reliability of electricity supply must be improved significantly, reducing the frequency and duration of outages. This will require introducing multiple transmission lines for evacuation of power from generation plants, as well as expanding system redundancy at transmission and distribution voltages. Raising the reserve margin of generation facilities and improving power dispatch operations at these facilities will contribute to the reliability of supply.

The undulating terrain of Rwanda poses a challenge in laying and expanding the existing electricity network to cover the entire City. Plans for expanding the service reach of the electricity network must identify service corridors and inform urban planning for the city. The age and condition of the current infrastructure negatively impacts the quality of power supply, and necessitates reinvestment for upgrading of the existing network to enable the foreseen expansion.
Further initiatives in the electricity sector include public lighting, covering community area lighting and road lighting. Public lighting contributes to improved road safety and community safety. The Energy Efficiency Strategy seeks to improve the efficiency across the whole electricity sector value chain, with aspects such as demand-side management elements and reduction of network losses.

Energy Sector Plan

The main objective of the Rwandan Energy Sector Strategic Plan (ESSP) is to ensure effective delivery of the set targets in the energy sector as set out under the EDPRS-II and to guide in the implementation of the Rwanda National Energy Policy (REP). The ESSP covers three subsectors: electricity, biomass and petroleum.

The latest iteration of the ESSP list its key objectives as:
- Generation capacity increased to ensure that all demand is met and a 15% reserve margin is maintained;
- Reliability of electricity supply improved (with set targets for duration and frequency of outages);
- Household access to electricity increased to 100% (on-grid and off-grid);
- Productive user access to electricity increased to 100%;
- Existing, new major national and urban roads provided with street lighting;
- Losses in the transmission, distribution networks and commercial reduced to 15%;
- Halve the number of households using traditional cooking technologies to achieve a sustainable balance between supply and demand of biomass through promotion of most energy efficient technologies; and
- Petroleum strategic reserves increased to cover three months' supply

The ESSP is aligned to the Rwanda National Electrification Plan, aimed at ensuring universal access across Rwanda. Figure 10.52 illustrates the extent of electrification across Rwanda.

This illustrates the extent of electricity services across Rwanda. The yellow shaded areas indicate areas to be served by off-grid solutions, with a clear focus on more rural areas, where significant investment in grid infrastructure would not generate adequate return in terms of consumption sales.

Network Planning Challenges

Several challenges to the applicability and accuracy remains present in the

forecast and planning of the generation resources of the country. The foremost challenge is to ensure realistic assumptions and scenarios, which result in realistic planning that ensures prudent investment in generation plants. Similarly important is the need to maintain adequate strategic generation reserve margin (15%) throughout the planning period. The generation plan indicates that for part of the planning period, the reserve margin is planned to reduce to levels below 15%, recovering to above 15% by the end of the period.

The expansion of transmission and distribution networks and the national electrification plan will bring a vast increase in access to electricity. This will significantly increase pressure on the available generation resources. This pressure may result in moving forward the completion of planned powerplants, as well as increased maintenance of powerplants to ensure the requisite plant availability figures.
It is foreseen that significant strengthening of the transmission and distribution grid network will be required to adequately evacuate generated power and to service grid-connected load centres and consumers. Grid strengthening initiatives will have multiple objectives that are to be met, such as: increased transfer capacity, higher reliability criteria, reduced network losses, and system stability.

10.6.2 Power Generation

Generation Planning

The current generation plan has been aggregated at national level based on the national demand forecast that was used to establish supply requirements. This methodology seeks to establish a balance between the forecasted electricity demand and the available (current and future) power generation facilities, with due consideration of reserve margin at generation level. This methodology is based on the presumption of widespread grid connectivity of load centres across the country.

The current generation plan is based on an August 2018 starting point to the forecasting period, with 2024 as the planning horizon.

Demand Forecasting

The forecasting process reviewed historical data from 1998 to 2016, determining that real growth in electricity demand was sustained at a level below the 10% annual growth projection. The forecasting scenario compared annual demand growth at 8%, 10% and 12%. The 10% growth figure was selected as realistic scenario. The impact of potential drastic changes in demand is not explicitly addressed in the forecast. Such drastic changes may occur due to expansion of the consumer base, rapid economic growth, or changes in consumer characteristics. Evaluating the impact of such changes is dependent on the availability of applicable socio-economic study results, as well as the successful implementation of government policy programmes.

The forecast and planning focused on ensuring strategic reserve margin at

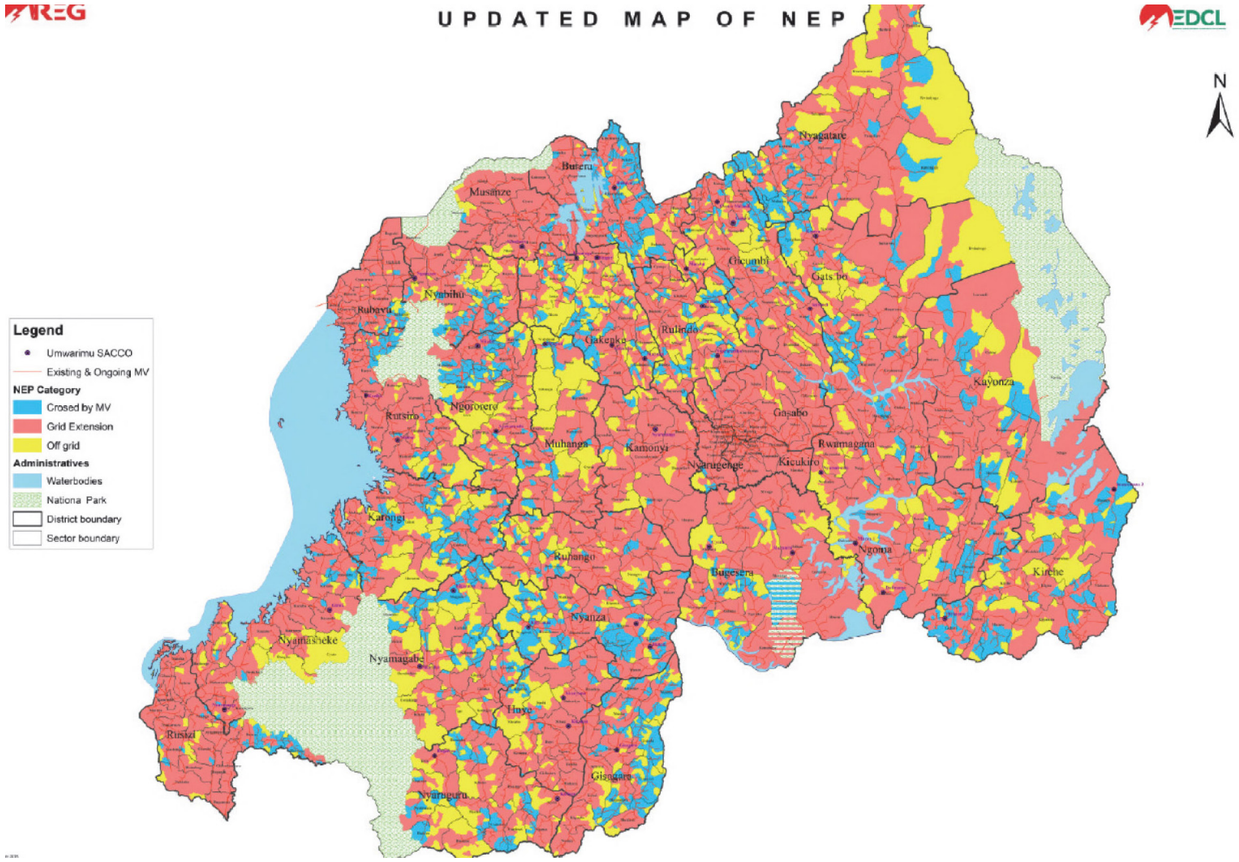


Figure 10.52 National Electrification Plan Map

generation level. The planning identified the significance of the influence that the dry season has on hydropower generation output. The impact of severe dry seasons is adequately significant that these periods may result in suppressed (unserved) demand.

The forecast relied on extrapolation of results from the previous forecasting period to the new planning horizon of 2018 to 2030, at fixed annual growth figures of 8%, 10% and 15%. It is noted that the extrapolation from previous periods results in the potential under-statement of the demand base.

Consumer Characteristics

The current consumption figure quoted for Rwanda is 54kWh pppa (per person per annum), though it must be noted that this figure is significantly affected by the low access to electricity. The figure is very low when compared with World Bank figure of approximately 2000kWh pppa for middle income countries. For sake of comparison, the consumption figures for lower middle-income countries range from 200 to 400kWh, and for upper middle-income countries the range is 1500 to 4000kWh (World Bank data).

Given the low consumption figure, it is prudent to consider the impact of a significant shift of consumption behaviour which is foreseen through government policy aimed at raising socio-economic conditions comparable to middle income countries. Considering such impact can reveal the sensitivity of the demand forecast results to changes in input data. This exercise may reveal valuable information to the adjustment of forecast values and risk mitigation strategies.

It is noted that the reliability of the demand forecast is affected by the lack of load profile recording history for different consumer classes, specifically the residential consumer. This is especially notable for low peak load consumer classes, with weakening correlation between energy consumption and peak demand as the level of demand decreases.

Generation Mix

The planning of the generation mix was optimised to reduce the potential of the strategic reserve margin falling below 15%. However, the availability factor of generation plant remains a specific concern in the dry seasons, with the reserve margin being significantly under pressure in the event of an excessively dry period (below average rainfall).

The current generation mix (mix of power generation sources) is specifically aimed at reducing dependency of fossil fuel powered plants and cross-border importing of electricity. A key aspect of the plan is to increase the contribution of renewable energy sources from 44% in 2018 to 54% in 2024.

Table 10.17 depicts the changing generation mix. The Optimal Power Generation Mix at the end of the 2024 planning horizon is illustrated in Figure 10.53.

As shown above, the import of electricity is planned to be reduced to 0%, eliminating dependency on sources located outside the country. With cross-border interconnections in place, the possibility of importing electricity remains available in the event of a shortfall in domestic production.

The use of diesel powered plant is planned to be greatly limited at the end of the planning period. It is evident that the use of diesel powered plants will in future (beyond the planning horizon) be limited to emergency operations.

The use of solar power plants is increased nominally although significant solar resource is available for exploitation in the country. It is also noted that the national electrification plan indicates that almost half of new consumers will be supplied with solar installations (off-grid) to increase access to electricity. This increased use of solar power is not reflected in the generation mix.

Methane power plants are planned to increase by more than 40%, indicating that plants located at or near to Lake Kivu will be expanded or additional plants established. Peat power plants are indicated to grow by more than 140%, building on vast resources available in-country. Implementing methane and peat power plants must be cognisant of the extent of the available resource considering the long replenishment periods associated with these resources.

Figure 10.54 illustrates the evolving generation mix split over the five primary power sources, over the planning period under consideration.

The figure illustrates the increased contribution of hydropower, biomass and natural gas power plants, in contrast to the reduced reliance on diesel powered generation plants. This clearly demonstrates that planning of the generation mix is in alignment with the policy objectives of moving towards sustainable power sources.

Source	2018 Contribution	2024 Contribution
Hydropower	45%	50%
Diesel	27%	5%
Methane	14%	20%
Peat	7%	17%
Solar	6%	8%
Imports	3%	0%

Table 10.17 Mix of Generation Plants

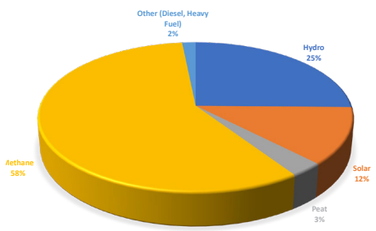


Figure 10.53 Power Generation Mix, 2024 Plan

Power Generation Plants

The Least Cost Power Development Plan (LCPDP) lists the major power generation facilities across the country as per Table 10.18

10.6.3 Transmission Network

The function of the Transmission Network (110kV and 220kV) is to evacuate power from the generation stations to the main substations in the country. The stated REG objective is to ensure efficient operation of the transmission network ensuring minimized losses across the network, enable reliable power supply and maintaining flexibility of network configurations.

Current Network

The Rwandan transmission network consist of lines and substations at 110kV and 220kV voltage level. The current transmission network suffers from the challenges of:

- Being isolated from neighbouring transmission networks (in neighbouring countries);
- A number of transmission substations with only one source of supply;
- Some substations do not have a redundancy option to connect to the network;
- Power plants only have one

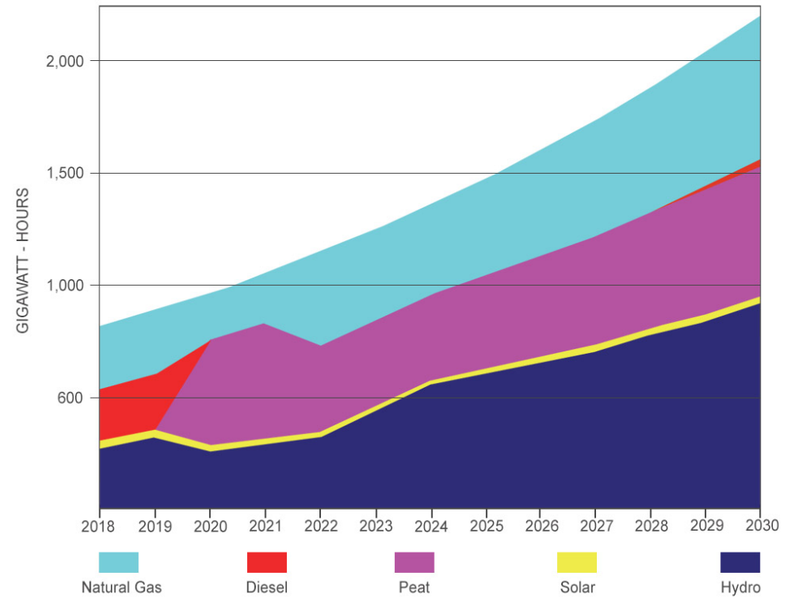


Figure 10.54 Power Dispatched per Source

evacuation line;
- Instances of inadequate transfer capacity; and
- Instances of voltage profile issues due to long feeder distance

The Transmission Plan uses the 2017 network configuration as departure point, as shown below (Figure 10.55). As expected, the geographic spread of the transmission network is directed towards the locations of the power generation plants with further linkage to current primary load centres.

Transmission Planning

REG has focused the current iteration of its Transmission Network Development Plan on the following planning aspects:

- Network configuration under contingency conditions to increase network operational flexibility;
- Redundancy of lines at power plants to increase the availability of evacuation options;
- Upgrading of network negating interference with ongoing operations; and
- Cross-border inter-connections

The Transmission plan expands its forecast demand growth in terms of different growth curves for established consumers, new electrification-based connections and bulk load additions. This approach depends on knowledge of the rate and volume of new electrification connections, as well as knowledge of upcoming bulk connections. The forecast is cognisant of the split in new electrification connections between on-grid (52%) and off-grid (48%) connections. For the purpose of urban planning, this approach must be cautiously inspected to ensure appropriate infrastructure response to requirements within urban boundaries.

Given the extent of the LCPDP generation plan that more than doubles the generation capacity of Rwanda over the period of 2018 to 2024; the transmission planning has to respond with extensive expansion of the network. This expansion is illustrated in the depiction of the 2024 network in Figure 10.56.

The planned network shows significant expansion in the southern (220kV) and eastern (110kV) parts of the country. Significant to the development of planning for the urban centres in Rwanda is the expansion of intra-connections of the 110kV network. Further significant development appears on the front of establishing and expanding transformation capacity from 220kV to 110kV level.

Project Planning

The current Transmission Plan provides the project listing for the planning period of 2018 to 2024 (Table 10.19) with project values totalling more than USD 500 million.

The project listing includes provision for the following:

- Upgrading of existing infrastructure (increase capacity and flexibility of current lines);
- Expansion of facilities (Additional lines and substations);
- Increase transfer capacities to certain service areas;
  - o Increase of voltage level
  - o Increase transformer capacity (High Voltage to Medium Voltage transformation)
- General high-level assessment of infrastructure condition and response planning

The current planning presents direct advantage to the urban planning for the city in the form of the following projects:

- 110kV Gahanga-Ndera Line at KSEZ Project
- 110kV Gahanga-Bugesera Line (2 projects)
- Nzove Substation
- 110kV Gahanga-Gasogi Line

The construction of transmission lines, extension of Gahanga and Gasogi Substations and construction of the new Nzove substation aim to deliver an improved, reinforced and flexible 110kV transmission network in Kigali City.

10.6.4 Distribution Planning

The function of the Distribution Network is to connect service areas (zones) to the transmission grid bringing power supply to the customer base. The distribution network shares the objectives of the Transmission Network of ensuring minimized network losses, reliable power supply and maintaining flexibility of network configurations. The distribution network has a primary role in contributing to achieving universal access.

Table 10.18 Generation Facilities (current & future)

Generation Facilities				
Plant	**Installed Capacity (MW)**	**Available Capacity (MW)**	**Technology**	**Commissioning Date**
Current (Blg. 9)				
KivuWatt	26.40	25.08	Methane	2016
Jabana II	20.00	19.00	Diesel	2009
Gishoma Peat	15.00	14.25	Peat	2017
Nyabarongo	28.00	13.44	Hydro	2014
Ntakura	11.25	2.59	Hydro	1959
Rusizi II	12.00	10.68	Hydro	1986
Mukungwa I	12.00	6.00	Hydro	1982
Rukaraka I	9.50	3.80	Hydro	2010
So Energy	30.00	28.50	Diesel	2017
Others	51.90	27.20	Mixed	1957-2017
Subtotal	**216.05**	**150.60**		
Ongoing Planned Projects				
KivuWatt Extension	8.00	7.60	Methane	2019
Hakan-Mamba	80.00	76.00	Peat	2020
Rusomo FHPP	26.70	25.37	Hydro	2021
Symbion I	50.00	47.50	Methane	2022
Symbion Extension	25.00	23.75	Methane	2022
Rusizi III	48.33	45.92	Hydro	2023
Nyabarongo II	43.50	24.80	Hydro	2024
Small IPPs	46.49	17.13	Hydro & Biomass	2023
Subtotal	**328.02**	**268.07**		
Total	**544.07**	**418.67**		

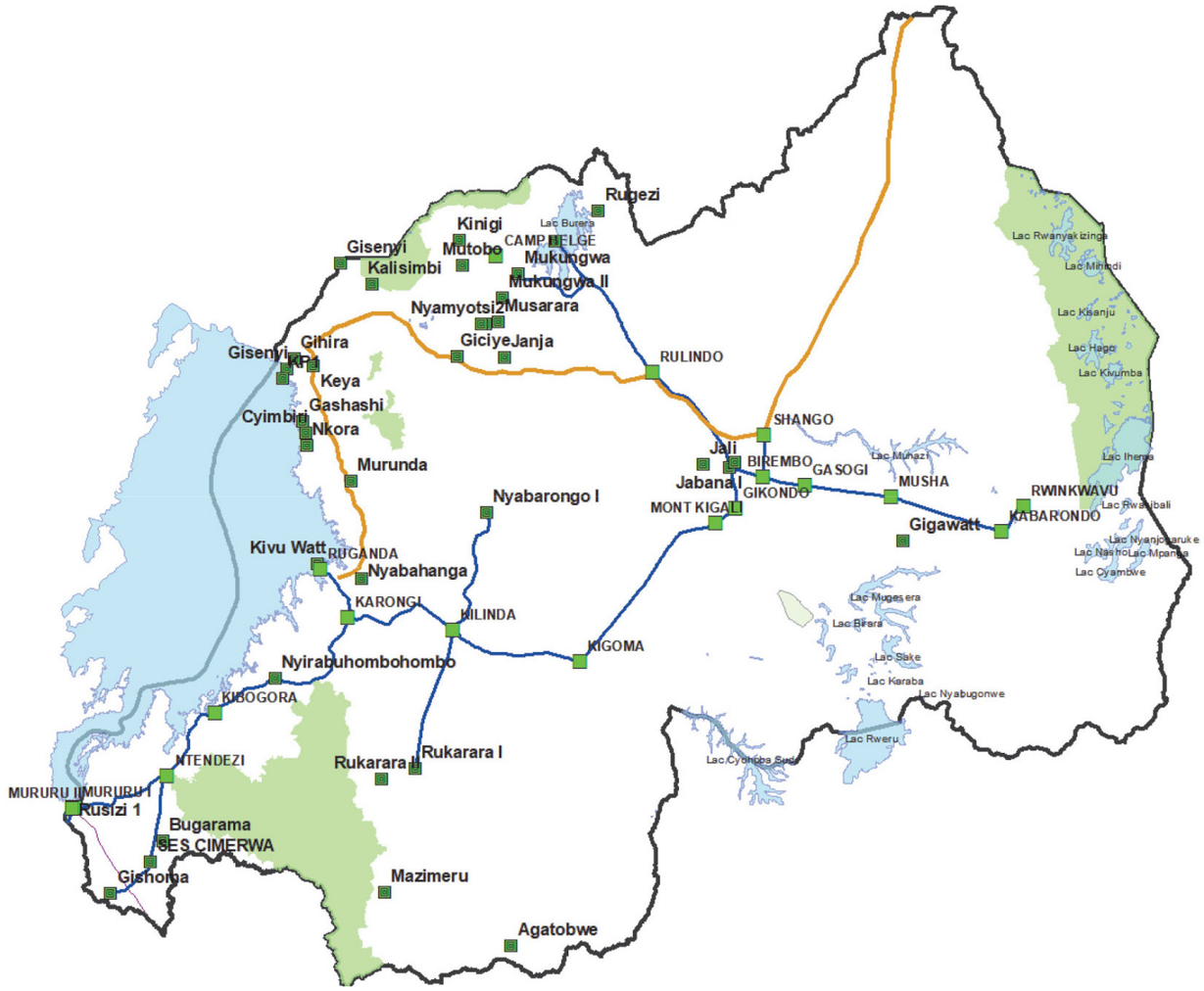


Figure 10.55 2017 Network Configuration

Current Network

The Distribution Master Plan (DMP) (2018 version) presents the existing distribution network as in Figure 10.57. The distribution network shows concentration around the urban centres in Rwanda. The feeders emanating from distribution substations cover vast distances of the countryside; however, these feeders do not enter the more remote rural areas,

The voltages in use for medium voltage distribution networks are 30kV and 15kV, with 30kV voltage level better suited for higher load feeders, interconnections between substations, and longer feeder lengths.

Substations are typically equipped with high to medium voltage transformer capacity when connecting to the transmission grid e.g. 110/30kV and 110/15kV transformation. In the more dense service areas (for instance in Kigali City)

It is noted that the provided network information indicates the presence of 6,6kV in Rubavu, with this infrastructure due for upgrade in the near future. The use of this voltage level in other parts of Rwanda cannot be excluded but has not been indicated otherwise.

The extent of the Kigali City distribution network based on GIS information provided is shown in Figure 10.58 (Wrong Graphic?).

The distribution network shows fair distribution across the city area, with increased density closer to the central city sectors. It is noted that three power plants have been established within the city area (Jali, Jabana 1 and Jabana 2 plants).

Network Challenges

The Distribution Master Plan (DMP) identifies the current prevalent network challenges as:

- Very long feeders
- Lack of contingency options ((N-1) solutions)
- Network instability
- Kigali City currently supplied from one source.

The statement on the presence of long feeders does not immediately correlate with the condensed nature of an urban setting; however, this statement gathers context in that feeder lengths requires to be limited in these urban settings given the density of the load in the designated service area, caused by higher residential densities, and the presence of commercial and industrial activities.
The lack of contingency options can exhibit and impact at different levels of the network hierarchy:

- Connections to the transmission network (single circuit feeders)
- Singular connection to the transmission network (e.g. one transmission serving Kigali City)
- Firm capacity at transmission/ distribution substations (single transformers)
- Medium voltage substation or busbar configuration
- Medium voltage network topology

The presence of network instability is a factor that will require closer investigation in terms of aspects such as demand level, network losses, protection and control measures, etc. The impact of network instability both on consumers and on network operations, is only exacerbated by the lack of contingency options.

Distribution Planning

The DMP seeks to provide solutions to current prevalent network challenges

through:

- Reducing feeder length by introduction of new substations
- Reducing feeder load by introducing new feeders
- Reinforcing existing feeder to increase rated capacity
- Planning for contingency supply to the distribution networks
- Planning the future network

REG indicates in the DMP that its planning approach for the distribution network considers the following criteria throughout the process:

- Major load centres (towns) must have reliable supply (substations)
- All substations must be supplied from more than one line (n-1 contingency)
- Substations are planned with two transformers for contingency supply
- Firm supply provided to Industrial Parks to enable growth and development
- Improvement of losses on long feeders by reducing feeder length
- Improvement of low voltage profiles on long feeders
- Contingency supply (n-1) on long lines with many customers
- Improvement of reliability due to exposure of very long lines (due to lightning, vandalism, rain, and other impacts)
- Extension of the network to supply the fast-growing network
- Cost-effective planning by considering different alternatives.

The planning approach of the DMP results in the emphasis on the importance of reinforcing the distribution network, specifically in regard to improving losses, low voltage profile, contingency provision and reliability of supply. The focus of providing firm supply to industrial parks to enable and support economic development influences the site selection for the location of additional substations near these parks.

The DMP provides a listing of more than 40 projects totalling in excess of USD 40 million, focused solely on distribution network reinforcement.

It is noted that capital expenditure programmes for distribution networks are generally easier to plan, budget for and implement on shorter timescales when compared to transmission network capital programmes. To some extent, this focus on reinforcement projects further contextualises the "ring-fencing" or separation of mandates between EDCL and EUCL.

Grid Network Infrastructure Planning

Combining the current transmission and distribution planning with the current generation project listing produces the overall grid infrastructure planned network depicted in Figure 10.59.

The figure illustrates the envisioned spread of electricity grid infrastructure, with distinct clustering of infrastructure around larger urban centres such as Kigali City, Rubavu and Musanze. The development of the high voltage transmission network (110kV and 220kV) and its readiness for cross-border connections to neighbouring countries is also visible.

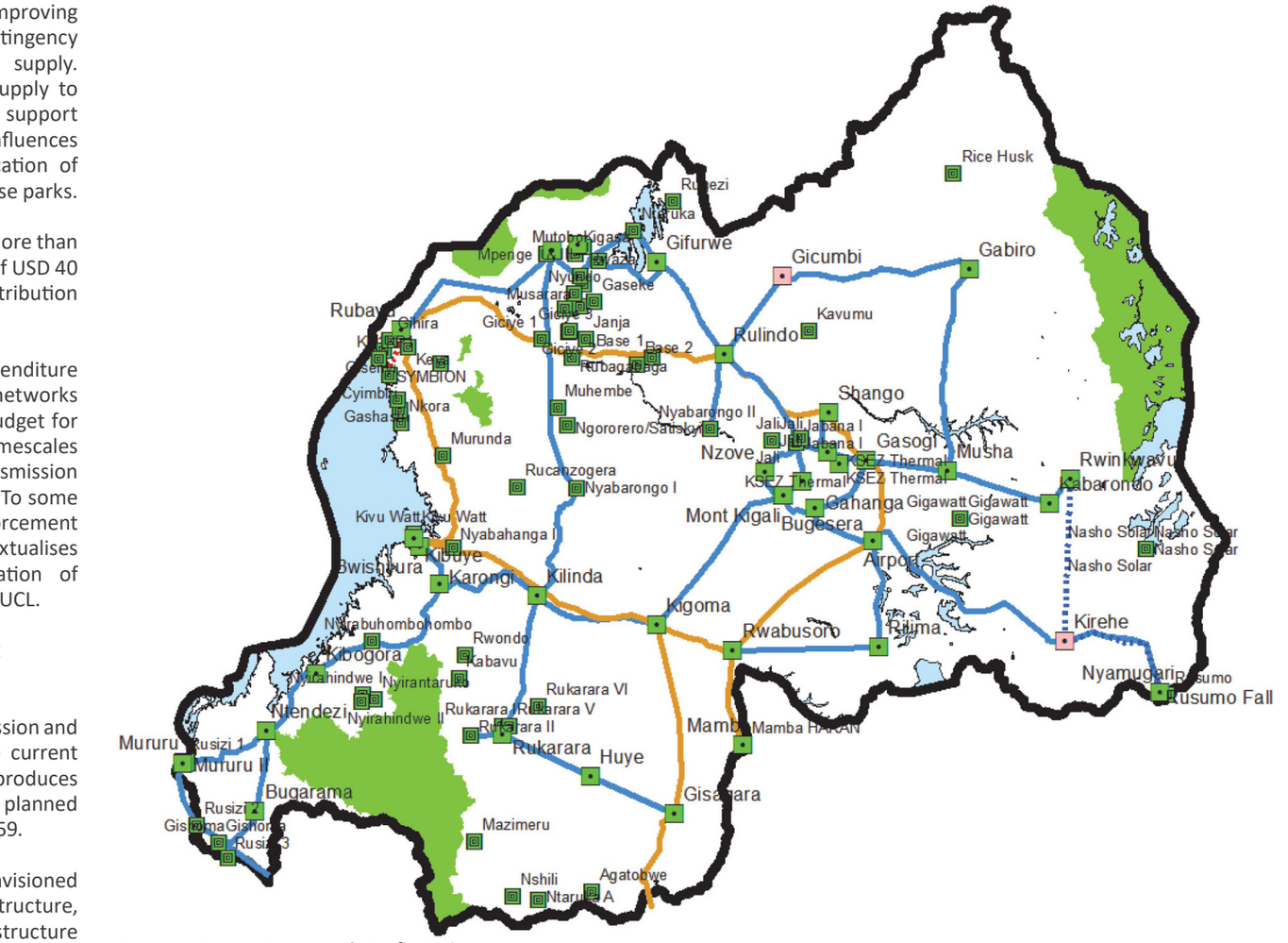


Figure 10.56 2024 Network Configuration

The presence and density of distribution infrastructure in areas with more economic activity demonstrates the planned prioritisation of serving productive electricity users. The geographic spread of the distribution infrastructure may also be viewed as coinciding with the location of users who are able to afford electricity tariffs. The geographic spread of the network also correlates with the strategy of utilising off-grid electrification technology.

Year	Project Name	Project Component	Length/ Capacity
2018	Gifurwe Substation	Upgrade of Gifurwe Substation	10.00
	Rulindo Substation	Rehabilitation of Rulindo Substation	20.00
	110kV Mukungwa-Nyabihu Line (Single Circuit)	Construction of Transmission Line	29.00
		Construction of Musanze Substation	
	Musha-Gabiro-Rulindo 110kV Line and Gabiro Substation	Upgrade Musha Substation	109.50
		Construction of Gabiro Substation	
	110kV Gahanga-Ndera Line at KSEZ (Single Circuit)	Construction of Transmission Line	17.80
		Extension of Gahanga Substation	
		Extension of Gasogi Substation	
	110kV Gahanga-Bugesera Line	Construction of Transmission Line	17.50
2019	220kV Interconnector, Rwanda-Burundi / Kigoma-Gisagara-Burundi Border	Construction of Transmission Line	64.00
	220kV Bwishyura-Kigoma-Rwabusoro, Upgrade of Bwishyura and Kigoma Substation	Construction of Transmission Line	74.00
		Extension and Upgrade of Kigoma Substation	
		Construction of Rwabusororo Substation	
	220kV Mamba-Rwabusoro-Bugesera Line, Mamba Busbar and Rwabusoro Substation	Construction of Transmission Line	73.00
		Construction of Mamba Substation	
		Extension of Bugesera Substation	
	110kV Nyabarongo I-Nyabihu Line (Single Circuit) (Changed to Nyabarongo I-Musanze)	Construction of Transmission Line	55.00
		Extension of Nyabarongo I Substation	
	110kV Bugesera-Rilima Line (Single Circuit) (Initially will be operated on 30kV within one year)	Construction of Transmission Line	24.00
		Construction of Rilima Switchgear	
	110kV Gahanga-Bugesera Line	Construction of Transmission Line	17.50
2020	110kV Rwabusoro-Rilima	Construction of Transmission Line	32.00
	Rilima Substation (Industrial Park)	Construction of Substation	20.00
	Nzove Substation	Construction of Substation	30.00
2021	220kV Rusumo-Nyamugari (Single Circuit) & 110kV Nyamugari-Bugesera-Chango	Transmission Line	114.00
		Construction of Bugesera S/S	
	110kV Gahanga-Gasogi Line (Single Circuit)	Construction of Transmission Line	17.80
2022	110kV Nyabihu - Rubavu Line (Single Circuit)	Construction of Transmission Line	40.00
	110kV Rukarara-Huye-Gisagara Line (Single Circuit)	Construction of Transmission Line	40.71
		Extension of Rukarara Substation	
		Construction of Huye Substation	
2023	110kV Nyabarongo II-Rulindo Line (Single circuit)	Construction of Transmission Line	16.64
		Construction of Nyabarongo II Substation	
		Extension of Rulindo Substation	
2024	110kV Rwinkwavu-Kirehe-Nyamugari (Rusomo) Line (Single Circuit)	Construction of Transmission Line	89.07
		Upgrade of Rwinwau Substation	
		Construction of Kihere Substation	
		Construction of Nyamugari Substation	
	Gicumbi Substation	Construction of Substation	30.00
	220kV Symbion-Rubavu Line (Double Circuit)	Construction of Symbion Substation	10.50
		Construction of Evacuation Line	

Table 10.19 List of Transmission Projects (current & future)

10.6.5 Institutional Capacity

REG has offices in all districts across Rwanda, giving a presence directly within the serviced areas from which maintenance, customer services, and project implementation operations are run.

Customer Interaction

REG is applying concerted efforts to ensure easy-to-use online systems for interactions with customers, service providers, stakeholders and the general public. This effort is in response to the Rwandan Government's endeavours to embrace the digital landscape. Published documents and information available on the website portal includes:

- Post-paid customers' database
- Environmental, Health and Safety Plans for different projects
- Environmental and Social Impact Assessment study reports
- Environmental and Social Management Plans (ESMP's) for different projects
- Resettlement Action Plans
- Outage planning (indicating dates and affected areas)
- Network performance indicator data (System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI)

In addition, full information on tariff structuring and applying for new connections is made available on the portal. The application process provides for different customer categories, distinguishing between low and medium voltage connections with emphasis placed on the distance from current network to desired service point. REG's connection policy allows for negotiating the payment of connection fees in installments.

Customer Categories and Tariffs

REG employs a tariff design structure that firstly distinguishes between Industrial and Non-Industrial customers. Non-industrial customers include the following categories:

- Residential
- Non-Residential
- Telecom Towers
- Water Treatment plants and Water pumping stations
- Hotels
- Health Facilities
- Broadcasters

The Residential and Non-Residential categories apply an inclining block tariff structure type. The consumption ranges of the Residential category provide insight into the provision for indigent and low-income household consumption that REG has built into the tariffs.

The three (3) monthly electricity

consumption brackets (measured in kWh) are: 0 to 15kWh, 15 to 50kWh, and above 50kWh. The 50kWh mark corresponds to a very low annual consumption figure for electrified households in this category.

Industrial customers are those registered as industries with Rwanda Development Board (RDB). Industrial customers are categorized based on their level of consumption: Small (below 22,000kWh), Medium (between 22,000 and 660,000 kWh) and Large (above 660,000 kWh). The tariff structure applied to Industrial Customers is of the "Time-of-Use" type. The tariff structure consists of consumption charges, maximum demand charges per daily time periods (peak, shoulder, off-peak) and a fixed customer service charge.

Separating Operations and Project Development

The Rwanda Energy Group Limited (REG) was incorporated in 2014 to expand, maintain and operate the energy infrastructure in Rwanda through its two subsidiaries, the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL).

The Energy Utility Corporation Limited (EUCL) is to deliver devoted attention to the provision of energy utility services in Rwanda through operations and maintenance of existing generation plants, transmission and distribution network and the retail of electricity to end-users.

The focus of EUCL is to strive to achieve:

- Optimized generation capacity and economic plant dispatch to meet short and long-term energy supply requirements;
- Enhanced operational efficiency (progressive system loss reduction, billing and collection efficiency, network reliability and high quality of service);
- Improved customer service;
- Network growth and increased connections within the foot print of electrified areas thereby making an effective contribution to the EDPRS targets.

The Energy Development Corporation Limited (EDCL) is mandated to:

- Increase investment in development of new energy generation projects in a timely and cost-efficient manner to expand supply in line with EDPRS and other national targets;
- Develop appropriate transmission infrastructure to evacuate new plants and deliver energy to relevant distribution nodes;
- Plan and execute energy access projects to meet the national access targets
- EDCL's key focus is listed as the following aspects:
- Development and implementation of the least cost energy development plan in line with the Government Policy and strategic objectives;
- Direct the Electricity Access Roll-Out Program by establishing and implementation plan and strategy in line with the overall sector strategy;
- Undertake economic and technical studies needed for the development of the infrastructure required new electric power plants, transmission and distribution network, oil and gas infrastructure, primary and social energy resources development projects;
- Establish appropriate project and contract management policies and procedures;
- Advise on the development of social energy projects.

Figure 10.57 Existing Rwanda Distribution Network - 2018

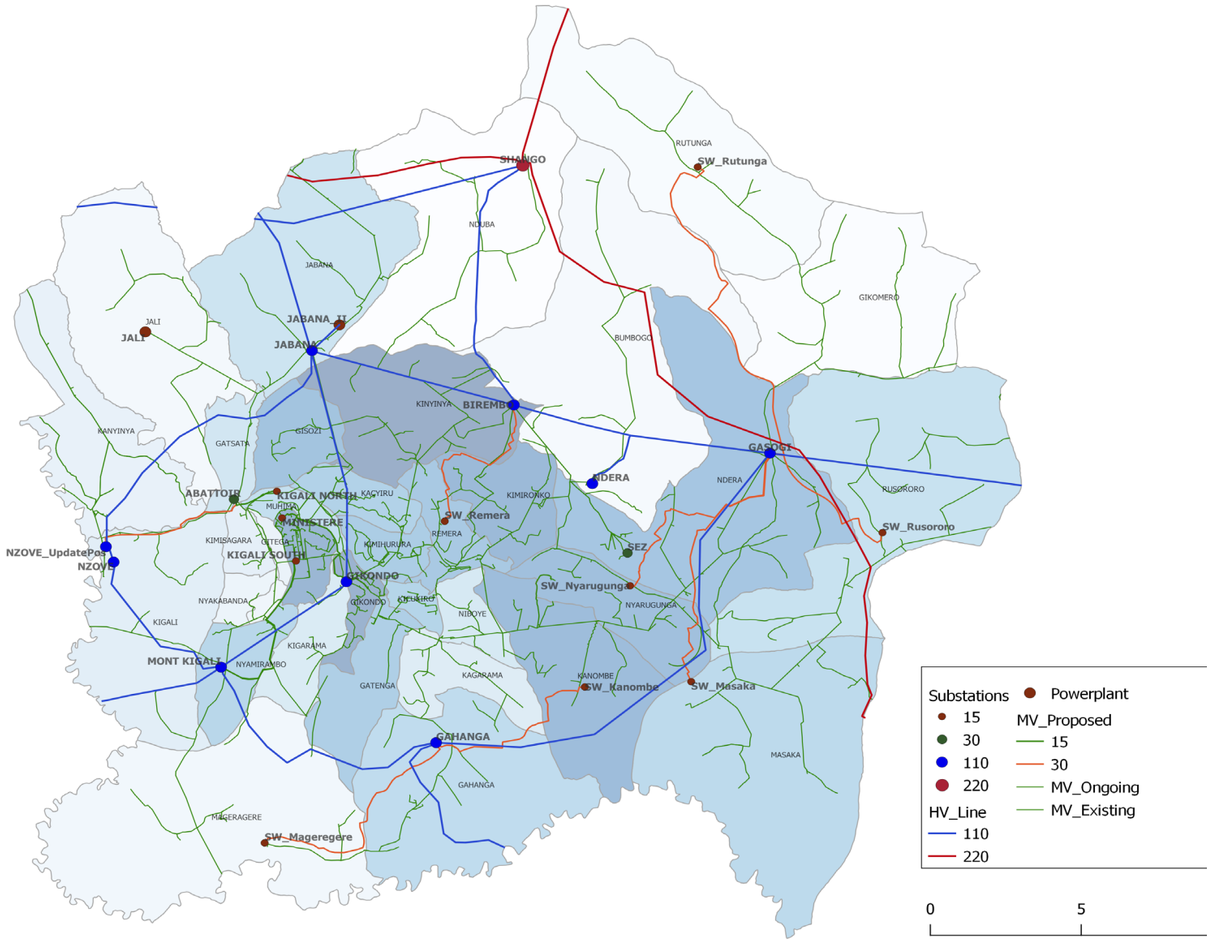


Figure 10.58 Kigali City Distribution Network

10.6.6 Kigali City

Focusing on the electricity network planning for the urban area of Kigali City requires an assessment of the demand for the baseline year of 2018 in comparison with the horizon year of 2050.

Demand Estimation

The electricity demand (Table 10.20) estimation is based on the land use tables and the population projections as currently available for the urban area. Specific peak demand figures that are characteristic to the respective land uses are applied, with normalisation of peak demand to compensate for the convergence of different typical load profiles.

It must be noted that the following land uses are assumed to not have a demand for power supply, and therefore do not contribute to the bulk electricity demand figure: agriculture, infrastructure, nature, special use, and water bodies.

The demand estimation presented above is subject to review and amendment due to the context of the iterative nature of the urban design process currently underway, the refinement of load characteristic data and adjustment of estimation factors in conjunction with relevant stakeholders.

Existing and Planned Infrastructure

The spatial distribution of GIS information indicates the locations of various substation in the study area as per Figure 10.60.

The current distribution of substations across the city area correspond well to the spread of the estimated demand, with specific spatial concentration of substations closer to the centre of the urban area.

10.6.7 Planned Projects in Study Area

The current transmission planning presents direct advantage to the urban planning for the city in the form of the following projects:

- 110kV Gahanga-Ndera Line at KSEZ Project
- 110kV Gahanga-Bugesera Line (2 projects)
- Nzove Substation
- 110kV Gahanga-Gasogi Line

The construction of transmission lines, extension of Gahanga and Gasogi Substations and construction of the new Nzove substation aim to deliver an improved, reinforced and flexible 110kV transmission network in Kigali City.

The current distribution planning includes direct advantage in the form of the following reinforcement projects (planned, ongoing and recently completed):

- Load reduction at Jabana Feeders (using Base Feeder)
- Reduce stress on Kigali Feeder (Jabana) using Nzove Substation
- Split Busbars in Kigali North and Kigali South (improved flexibility)
- Upgrade of Gahanga- Gikondo

distribution line (increased capacity)
- Install Gikondo to Ministere feeders (increased capacity, improved flexibility)
- Install Mont Kigali to Kigali South feeders (increased capacity, improved flexibility)
- Install up to 5 feeders from Nzove Substation (increased capacity, expanded network)
- Nzove to Abattoir double circuit feeder (increased capacity, improved flexibility)
- Upgrade Abattoir Substation (increased capacity, improved flexibility)

The construction and upgrading of substations fulfil the primary need of increased capacity, while also facilitating the improvement of network flexibility and redundancy. The establishment of additional feeders between the substations will drastically improve the network configuration flexibility.

Specific attention can be paid to the current planning for distribution networks servicing the central business district of Kigali City and its immediate surrounds, as depicted in Figure 10.61 below. Significant investment is directed at ensuring that the economic centre of the urban area has electricity network infrastructure that responds to (and enables) the requirements of adequate capacity, redundancy in supply options, flexibility of configuration and interconnectedness. The figure below illustrates the effect of the vast majority of the current projects listed above, on the Kigali City electricity infrastructure.

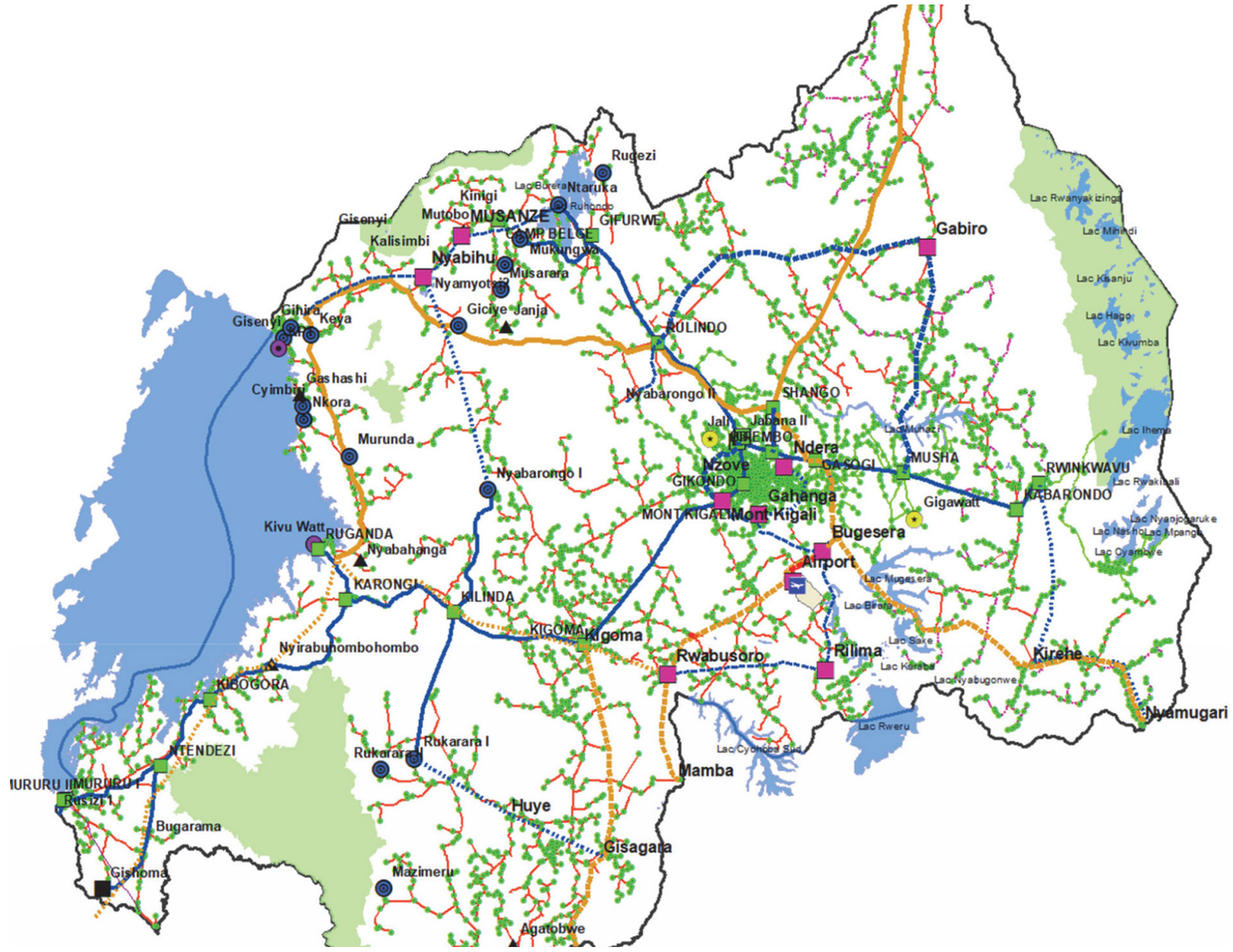


Figure 10.59 Rwanda Electricity Network (Generation Plant and Transmission Network)

Future Planning for the Study Area

The requirements posed by the future service area will be assessed with a detailed demand forecast based on socio-economic projections, population projections and envisaged land use. The demand forecast will be modelled on relevant land use tables covering the designated urban boundaries, using typical load parameters for each land use category. The forecast will be based on convergent peak demand with derivation of the electrical energy consumption.

The demand forecast will be followed by a high-level assessment of the electricity infrastructure required to support and enable such demand. This assessment will be cognisant of the extent and

Sector	Demand 2018 (MVA)	Demand 2050 (MVA)
Bumbogo	2.71	4.66
Gahanga	4.5	15.2
Gatenga	2.41	3.6
Gatsata	3.14	26.63
Gikomero	3.14	15.54
Gikondo	2.6	4.94
Gisozi	4.14	21
Gitega	5.31	22.26
Jabana	6.21	29.77
Jali	6.56	32.93
Kacyiru	14.01	26.26
Kagarama	1.77	2.64
Kanombe	5.51	24.55
Kanyina	7.26	17.43
Kicukiro	2.01	3.65
Kigali	5.95	18.45
Kigarama	5.99	21.11
Kimihurura	16.38	32.57
Kimironko	3.14	12.36
Kimisagara	4.48	28.66
Kinyinya	9.63	20.77
Mageregere	2.45	13.69
Masaka	8.61	19.12
Muhima	2.28	14
Ndera	5.74	27.52
Nduba	1.48	6.84
Niboye	5.01	9.94
Nyakabanda	3.6	11.1
Nyamirambo	1.97	10.63
Nyarugenge	1.87	5.36
Nyarugenge	5.69	18.44
Remera	0.74	6.75
Rusororo	4.47	19.98
Rutunga	10.82	31.08
Rwezamenyo	0.48	5.45
Total	**172.04**	**585.89**

Table 10.20 Electricity Demand Estimation

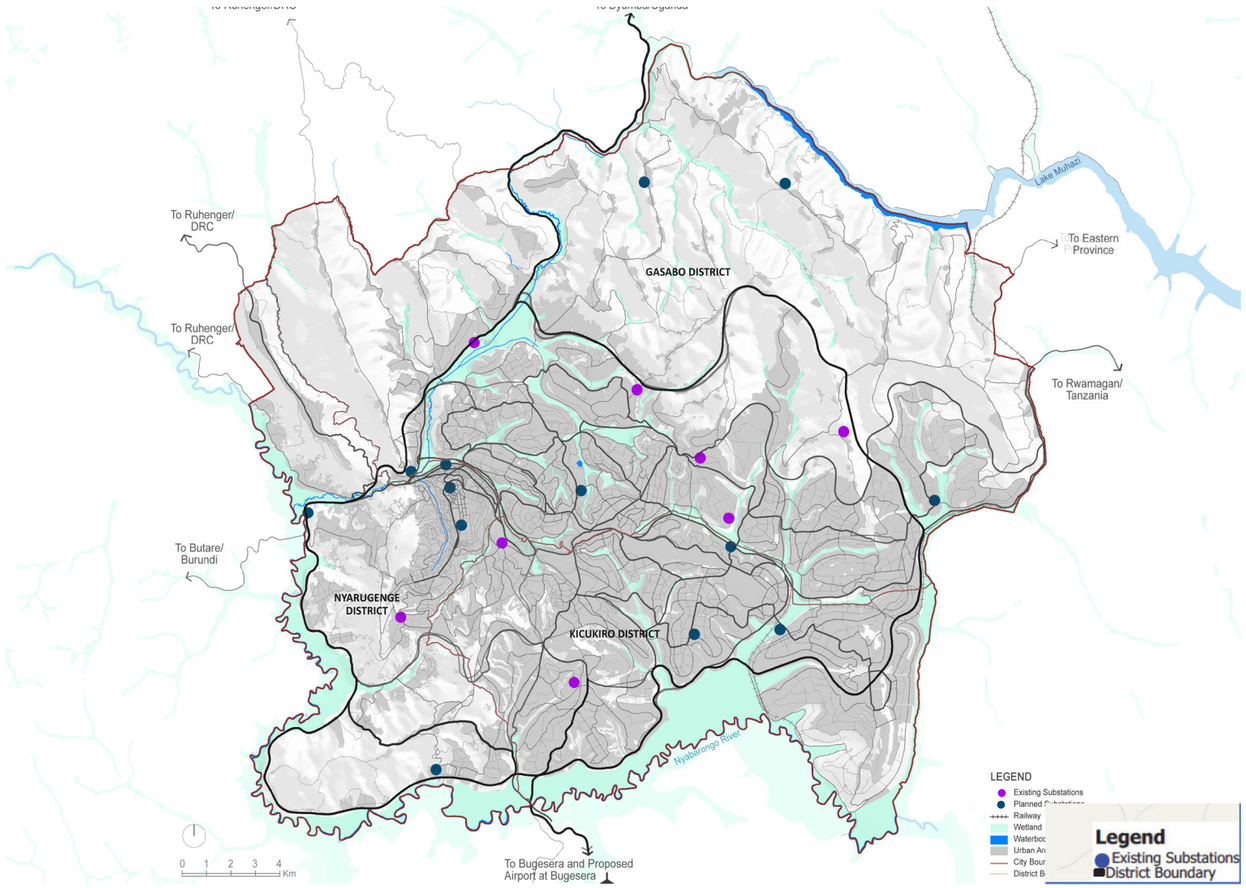


Figure 10.60 Distribution Substations (Planned & Existing)

Figure 10.61 Kigali Central Distribution Network Planning

presence of current infrastructure, the present power infrastructure planning, as well as progressive development of infrastructure to the full extent required. The key aspects that this assessment will focus on are the establishment of adequate infrastructure capacity, selection of substation locations and the reservation of service corridors in the updated urban plan. Key elements of transmission planning and distribution planning will be focused towards achieving progressive implementation.

10.7 ICT/ Smart City

ICT services are provided and managed by numerous private companies in Rwanda. Various documents such as: Vision 2020, ESPRS II, 7-year Government Program and Smart Rwanda 2020 Master Plan, all aim to transform Rwanda into a knowledge-based society. One of the main aims is focused on digital Government transformation driving a cashless and paperless economy. The Irembo platform has been developed as a one stop portal for numerous online government services.

The definition of a smart city according to the Smart City Rwanda Master Plan is:

"A smart city uses digitalization and technology to provide a high quality of life for its citizens, businesses and visitors. A smart city embeds technology and data across city functions to make them more efficient, competitive and innovative. Cities become smarter through a series of steps that enable them to become increasingly resilient and able to respond quicker to new challenges. A smart city is also a sustainable city. Through innovation, openness and connectivity, smart cities ensure that they meet the environmental, social and economic needs of present and future generations."

10.7.1 Applicable Policies and Plans

The governing policies and plans for ICT in the City of Kigali are as follows:

- Rwanda ICT in Education Policy (2008);
- National Information and

Communication (NICI) Plan (2015);
- National Media Policy (2014);
- National Broadband Policy (2013);
- SMART Rwanda Master Plan (2015).

10.7.2 Master Plan

The Smart City Rwanda Master Plan is the governing document for smart-related initiatives in the country. This master plan identifies projects that can be used as a starting point for towns and cities to become "smarter". It must be noted that due to different cities having diverse challenges and goals, each local authority should select initiatives that meet their priorities. The following image (Figure 10.62) shows an overview of the Smart Rwanda Master Plan, with its themes, goals and core objectives.

10.7.3 Key Issues

Some of the key issues to be addressed by the City relating to ICT/ Smart City are discussed below.

- Establish commercial & public building connectivity as a requirement in zoning regulations;
- Free Wi-Fi areas in the City;
- Fibre to key catalytic nodes;
- Joint fibre planning bulk utilities;
- Improve and expand access to ICT skills and innovation capacity;
- CoK to appoint a "City Information Officer" to identify, promote and co-ordinate Smart City initiatives;
- Build a shared robust and resilient infrastructure to underpin service delivery and support National ICT initiatives;
- Centralised GIS platform to prioritize, select & monitor projects (to then be extended for secondary cities).

10.7.4 ICT in Rwanda

Rwanda is a landlinked (previously referred to as landlocked) country in Africa. A landlocked country is defined as a country with no direct access to the ocean. Approximately 20% of the world's countries are landlocked. This represents 46 landlocked countries in the world of which 16 are in Africa (Figure 10.63).

Typical characteristics of landlocked countries:

- Reliant on neighbouring countries for access to seaports;
- Among the poorest countries in the world – all with developing status;
- Typically some of the weakest growth rates of developing countries;
- Heavily dependent on a very limited number of commodities for their export earnings.

The African Development Bank previously noted that trade in landlocked countries is adversely impacted from a timing perspective in that on average an additional 4 days for export and 9 days for import should be factored in to trade transactions. The challenges are, however, common to developing countries with focus areas of health, education, infrastructure, transport, services provisioning, communication etc. Fibre infrastructure is more prevalent in coastal regions and there is disparity in the current deployed base between "developing" and "developed" continents as indicatively reflected in Figure 10.64.

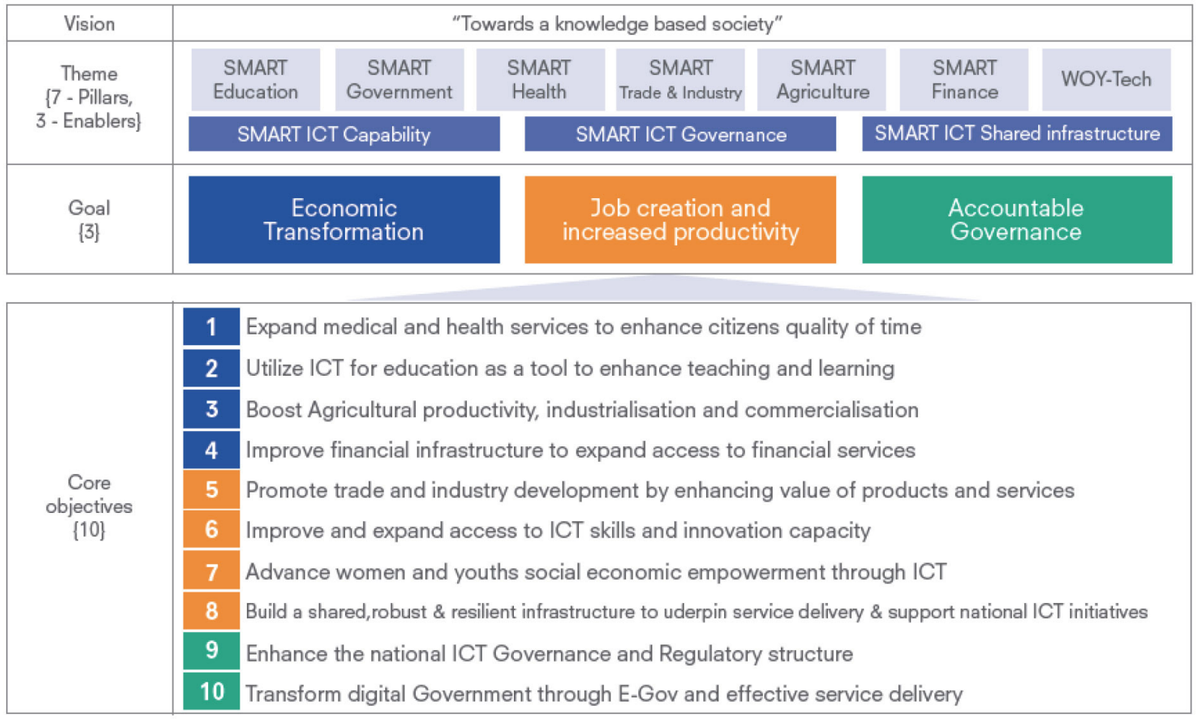


Figure 10.62 Smart Rwanda Master Plan Overview

Figure 10.63 Landlocked countries

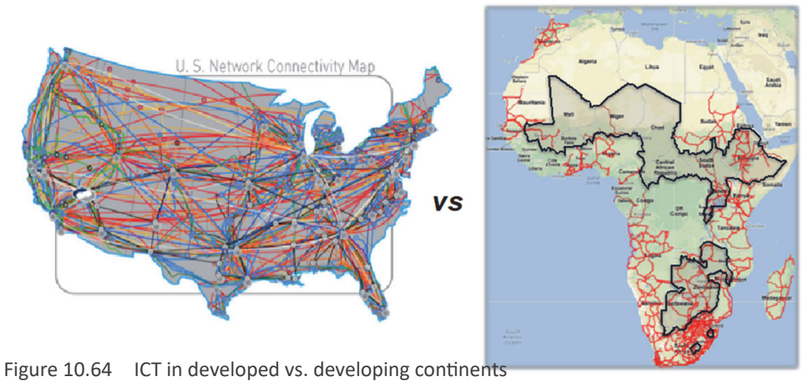


Figure 10.64 ICT in developed vs. developing continents

10.7.5 Rwanda from an African Perspective

From a market perspective Africa has latent potential and is regarded as fertile ground for economic development. The following statistics (Figure 10.65) is reflective of the foregoing.

As a developing economy, Rwanda has the advantage of not suffering from any legacy infrastructure; this very aspect giving it the capability to catapult and leapfrog itself ahead of its Africa counterparts as the center of excellence in a developing continent.

Despite the drive of Paul Kagame, the President of Rwanda and also the co-chair of the Broadband Commission for Sustainable Development, to transform Rwanda to a digital economy, Rwanda, from a global perspective, does not rank well when compared against the new 12-pillar Competitiveness evaluation model of the World Economic Forum (Figure 10.66).

The World Economic Forum 2018 Global Competitiveness Index ranks Rwanda 115th and 120th for the enabling pillars of Infrastructure and ICT adoption. These global comparisons are made against the 140 economies in the world. ICT adoption is key as general-purpose technologies are increasingly embedded in structure of the economy and viewed as important to the availability of power and transport infrastructure.

10.7.6 The Impact of Broadband on Emerging Economies

The introduction of a world class broadband enabled network will aim to address specific pillars, i.e.

- Economic growth – business through improved ICT capability, ICT services etc.
- Public safety – combatting crime, Cyber security, border control etc.
- Social upliftment – health care, education, job creation, rural connectivity SMME development, tourism etc.

From an ICT perspective, access to communication and specifically broadband internet access is of primary concern as this is regarded as a key enabler in addressing the literacy challenge in developing countries. The late Kofi Annan, a former Secretary-General of the United Nations, was quoted in saying: “Literacy is a bridge from misery to hope”.

Innovative initiatives were launched in 2017 in Rwanda to improve the level of digital literacy in Rwanda, especially targeting the rural communities. The Rwanda Ministry of Youth and Information Communication Technology (MYICT) in partnership with the World Economic Forum’s (WEF) Internet for All Northern Corridor initiative and Digital Opportunity Trust (DOT) launched the Digital Ambassadors Program (DAP) in 2017. The programme aimed to accelerate digital inclusion in the country and create new opportunities for youth as they work as Digital Ambassadors to deliver digital literacy programs in rural communities. The training programs would target 5 million Rwandans who would receive hands-on training to use Information and Communication Technologies (ICT), Internet and mobile applications.

A key enabler and pre-requisite to internalize the improved digital capability of individuals, is affordable access to broadband internet. The establishment of the required ICT infrastructure will also facilitate the migration to a Smart Cities and Smart Towns.

A Smart City as defined in a by the International Telecommunication Union (ITU) is: “A smart sustainable city is an innovative city that uses ICT and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring it meets the needs of present and future generations in respect of economic, social and environmental aspects.”

Under this definition, ICT infrastructure acts as a nerve center to orchestrate all the different interactions between smart city elements (Figure 10.67). ICT is an essential ingredient because it “glues” together all the component parts of a smart sustainable city. ICT also acts as a “great equalizer” – human-to-human, human-to-machine and machine-to-machine – to connect a variety of everyday services, such as water and power utilities, to public infrastructure.

10.7.7 Key ICT Infrastructure Building Blocks to enable Digital Transformation in Rwanda

A fundamental element in economic development of Rwanda is the establishment of a first world broadband enabled network with modern communications infrastructure of various capabilities (Figure 10.68) to attract multinational companies to use Rwanda as a business hub in the East Africa region. This will also be a key enabler of driving the digital transformation in support of the envisioned National Strategies and Development Themes as highlighted in the Kigali Master Plan Analysis & Visioning report.

Strategies should be developed to create the ICT Infrastructure layer which will inter alia include:

- National optical network infrastructure (fibre and equipment);
- Cloud data center with a disaster recovery (DR) and network operation center/s;
- Hosting facilities along strategic routes;
- Communications infrastructure to provide connectivity to borders and airports, and;
- Support systems and tools (OSS and BSS) to facilitate network management and commercial operations.

The deployed ICT infrastructure build will form an efficient common platform to launch Smart Applications in support of the Smart City objectives. Equipment and application servers should be hosted in a well management data center environment to improve the overall service stability and availability to the end users.

The establishment of the required ICT infrastructure will be guided and governed by the policy and regulatory framework of the Rwanda Utilities Regulatory Authority (RURA) with specific reference to the ICT sector which also includes the important are of Cybersecurity.

To this end Korea Telecom (KT) in conjunction with the Rwandan Government has constructed a 2,500 km national fibre backbone to connect all the districts in the country as well as the 9 border posts on a fiber-optic network. The project aimed to enable high speed broadband internet and improved access to the internet to a broader sector of the country.

It is, however, important that any refinement and expansion of the physical routing of the fibre network infrastructure and placement of network facilities to support the national core infrastructure in Rwanda should be a function of structured interactions between key stakeholders in Government as well as industry role players i.e. main telecom operators, Internet Service Providers (ISPs), Wholesale Network Service and Network facility providers.

Key considerations will be:

- Points of interest – public, education, health, social, business, security etc.;
- Current Telecom Market Analysis –

availability and location of current services;
- Economic & Market analysis – establishment of commercialization potential;
- Government security service enablement – e.g. facial recognition and bio metrics at all key locations, vehicle management at borders, Cyber Defense Operation Centre etc.

At the heart of the ICT infrastructure development master plans should be the establishment of a cloud data centre in Rwanda. Lack of access to reliable power and connectivity, global best practice in design and local construction expertise are typical challenges for all data centres. This is, however, more pronounced in developing markets.

Building data centres in Africa is no longer simply about competing in the local markets, but about becoming globally competitive in order to attract major cloud providers and multinationals, as well as local enterprises. Social media presents a powerful platform for creating multiple stories about Africa. Embracing the accessibility of modern technology, African social media bloggers and commentators are using Facebook, YouTube and other platforms to undermine longstanding "Afro-pessimistic" stereotypes – the backward continent characterised by strife and poverty.

The Government has invested in the building of a National Data Center which will serve as a central data storage facility and provide access to applications used by government institutions. This facility was completed in 2010 and a Data Mirroring Center was launched in 2018.

Although the National Fibre Backbone and the National Data Center are key elements in the ICT value chain and key enablers of high impact growth areas such as Modern Infrastructure and Urbanization and Transformation of the Society, appropriate open access business models will be important to ensure these national elements can be leveraged and utilised by the service providers to deliver affordable internet access to the digitally deprived areas.
To further attract global players to Rwanda, it will be important that the National Data Center has a Tier 4 certification and an efficient and effective Operations and Maintenance Model is in place to ensure network stability and resilience i.r.o. the national fibre optic backbone.

The current telecommunications infrastructure in the country does not seem adequate to match the key functionality and capacity required to support the envisioned Smart Country initiatives.

The evolution of open access infrastructure across the value chain will be key in paving the way for Rwanda to become a Smart Country and typical infrastructure components of the value chain to enable broadband are shown in Figure 10.69.

Appropriate last mile access technologies, fibre and wireless, should

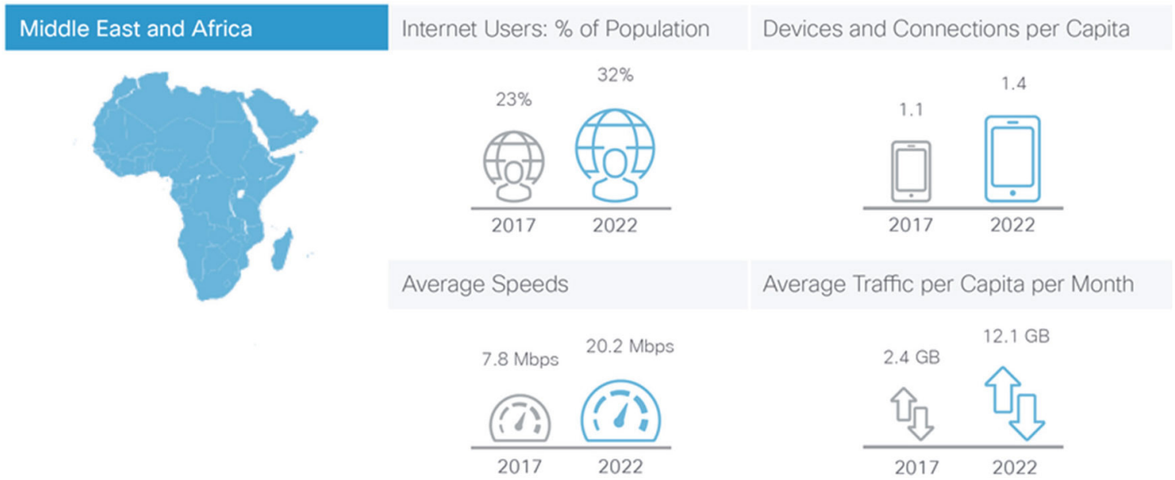


Figure 10.65 ICT Stats in Africa (Source: Cisco System VNI Index 2018)

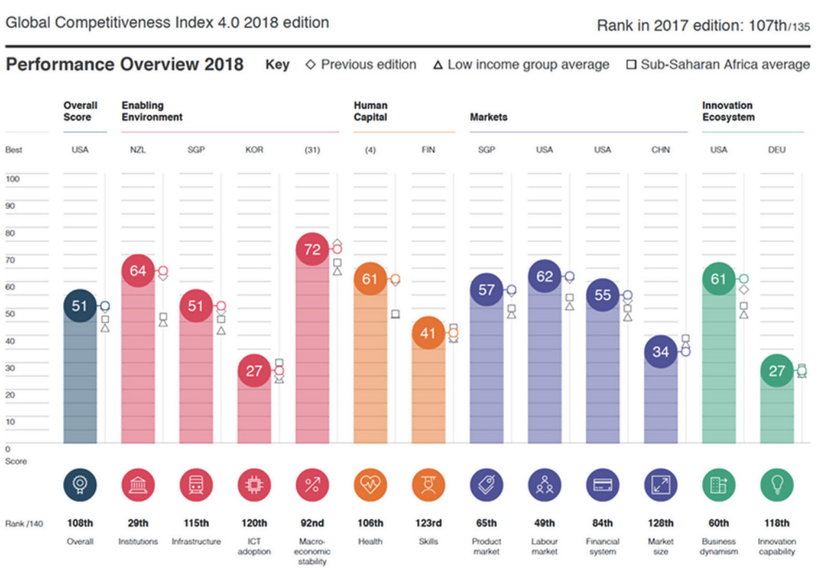


Figure 10.66 Competitiveness Evaluation Model (Source: World Economic Forum Country/ Economic Profile 2018)

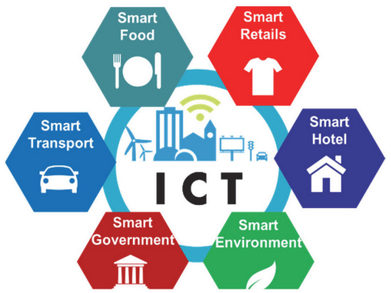


Figure 10.67 Smart City ICT

Figure 10.68 Smart City ICT

Figure 10.69 ICT Infrastructure

be explored by the operators and service providers to enable the delivery of services to end customers and communities.

10.7.8 Key ICT Infrastructure Building Blocks to enable Digital Transformation in Kigali

ICT infrastructure acts as a nerve center to orchestrate all the different interactions between smart city elements. ICT is an essential ingredient because it "glues" together all the component parts of a smart sustainable city. ICT also acts as a "great equalizer" – human-to-human, human-to-machine and machine-to-machine – to connect a variety of everyday services, such as water and power utilities, to public infrastructure.

Typical ICT infrastructure that will be deployed to support and enable "smart" services are highlighted in the sections below. It should be noted that the responsibility for the deployment of the infrastructure and facilities as applicable should be governed by structured interactions between key stakeholders in Government, regulatory bodies as well as industry role players i.e. main telecom operators, Internet Service Providers (ISPs), Wholesale Network Service and Network facility providers.

Fibre Optic Cable Infrastructure (Passive)

Installation of an optic fibre cable in a ring configuration strategically planned to pick up key locations along the route. The key locations could include

- Public sector locations e.g. health care (hospitals & clinics), educational institutions (universities, colleges, schools), government offices, safety & security (military, police, national intelligence) etc,
- Business locations e.g. business parks, industrial areas, shopping centres etc,
- Residential areas e.g. multi dwelling complexes, gated communities, suburbs etc, and
- Peri urban areas.

The dimensioning of the cable will be aligned with the "smart" services that will need to be supported.

Data Center

A data center will be required as the hosting environment for Smart Applications and platforms. The data center design should be guided by the specific hosting requirements of the customers and key data center design considerations would include:

- Usable data space i.e. how many racks will need to be accommodated, taking into account growth requirements;
- Associated ancillary ICT energy requirements i.e. power, cooling etc;
- Cable entry diversity;
- Disaster recovery (DR) data center requirements – a 2nd data center that can fulfill the role of a DR site would be recommended;
- High capacity data center interconnects between the main Data Center and the DR site;
- Data center certification requirement e.g. Tier 4. This will specifically impact redundancy of power and cooling and associated costs;
- To ensure that the hosting requirements of global players can be accommodated, a Tier 4 classification would be recommended.

Equipment Hosting Facilities

Facilities will have to be identified along the physical optical fiber cable route to accommodate the hosting of transmission equipment and IT infrastructure as required. The specific locations along the route will be guided by:

- Transmission design requirements;
- Customer specific locations where network equipment will be required to aggregate traffic from specific "smart" services e.g. safety and security services at ley locations, airports and borders;
- Network management requirements e.g. remote fibre test systems etc.

The identified facilities will need to be fit for purpose to meet the equipment hosting requirements i.r.o. optic fiber cable access, access security, space, power and cooling and could include:

- Equipment rooms in existing buildings – upgrades might be required to meet minimum hosting requirements as specified above;
- Containerised facilities on newly established sites – fitted out to meet minimum hosting requirements as specified above.

Network Operations Center (NOC)

All ICT infrastructure elements need to be managed from a Network Operation Center (NOC) for day-to-day operating activities. This will include all infrastructure elements associated with the optical fibre network (passive and active), data centers and facilities.

The major functions of the NOC include network infrastructure facilities surveillance, performance monitoring, fault management, change management and other required activities for the continual operation of the ICT network infrastructures and assurance of service levels to meet the respective committed Service Level Agreements (SLA) and Key Performance Indicators (KPI) of end users and customers.

Systems and Associated IT Infrastructure

The following will be critical elements to ensure the effective network and service management:

- Support systems and tools (OSS and BSS) to facilitate network management and commercial operations – all systems in support of all the layers of the OSI model;
- The OSS systems will cover all ICT infrastructure elements (network and element management systems as applicable) including the environmental management systems associated with facilities.

The choice of systems will be guided by the specific Smart City services and applications that will be rolled out as well as the underlying enabling technology choices (OEM specific).

10.7.9 Infrastructure Integration

One of the major issues that has been highlighted across all service sectors is the need for integrated planning. Due to the extreme topography and the limited developable space in Kigali, it is crucial that corridors are secured in order to make provision for all possible future services. In terms of ICT for example, the idea is not only to reserve the space required for future services but to actually install a sleeve to allow for this. The CoK should be responsible to develop, control and co-ordinate all the utility space requirements. The

following two figures (Figure 10.70 and Figure 10.71) show a typical cross section through a BRT-type road indicating the space required for various services.

The rate of urbanisation is increasing faster than ever before across the globe in all countries but especially developing countries with rural farming jobs diminishing exponentially. Technology offers vast opportunities to improve the way that infrastructure is delivered and managed. It strikes at the heart of an engineer's purpose – to support society, improve communities and citizen's quality of life.

The opportunity is enabled by the valuable asset that technology presents us with namely data. Accessible data allows engineers and users to make better, faster decisions, leading to more efficient infrastructure networks and improved outcomes, especially in the transport space. For example, in London all non-personal data about its services is in an open format, enabling developers to build applications and widen the reach of information to citizens. With many apps now powered by this data, the approach has delivered huge benefits for to the citizen's travelling in the city. Commuters are better informed about journey options and delays. Congestion and overcrowding have reduced, overall network efficiency has improved and economic benefit is enormous. A lot can be done to create smarter cities with shorter commutes and more efficient public transport to reduce the wasteful daily commute that is the result of cities urban sprawl caused by cities developing around the use of the

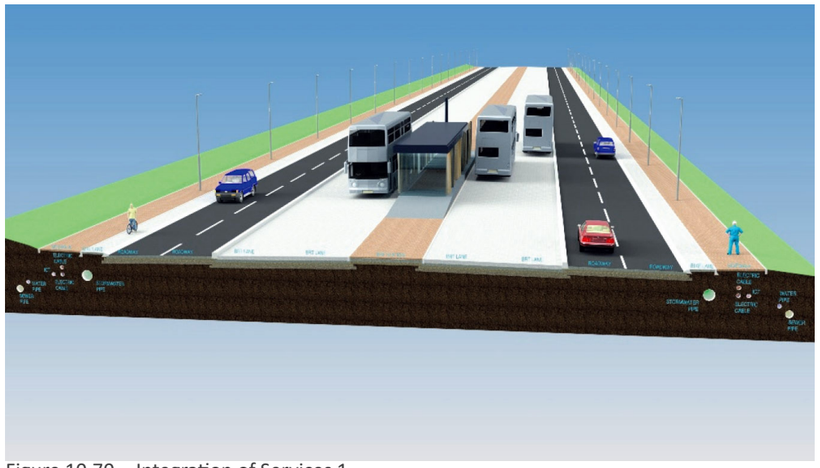


Figure 10.70 Integration of Services 1

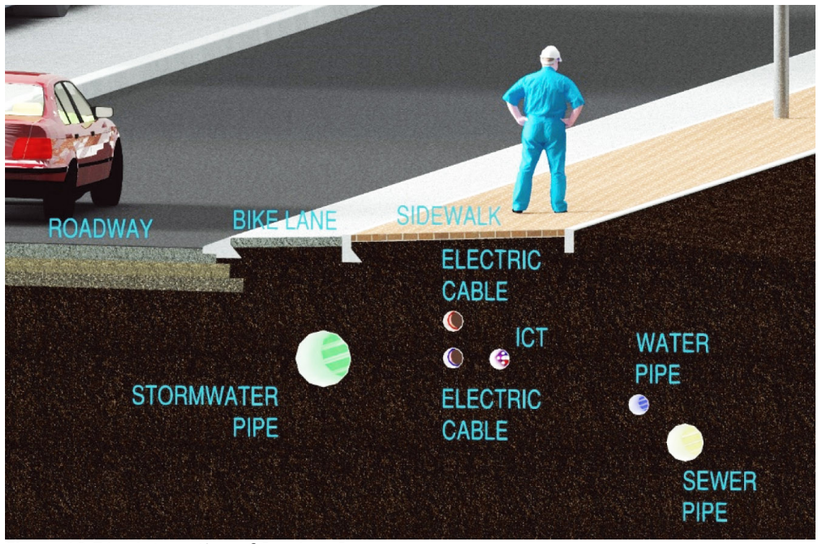


Figure 10.71 Integration of Services 2

car. Building more and wider roads is not the answer, it is important to get efficient, safe and affordable public transport systems in place.

10.8 General Recommendations

The following section provides some general recommendations for the provision of infrastructure in the City.

10.8.1 General

- A criteria should be established for development in high risk areas considering steep slopes and soil conditions – special dispensation to be allowed in certain cases;
- Population growth and urbanisation rates need to be aligned across the country to be used by government and supply authorities for planning purposes;
- Service authorities and CoK to meet annually to align infrastructure planning and budgeting;
- Responsibilities of National Supply Authorities vs. City of Kigali to be defined;
- Regular reviews and updates should be done to the Infrastructure Master Plan and related projects; and
- "Sister City" partnerships to be considered to increase skills and knowledge sharing between cities with similar properties / issues (e.g. City of Durban).

10.8.2 Water

- A Water Master Plan for the City should be done (there is currently one in progress), and it would typically include:
  - Status quo analysis of water supply elements already in place;
  - Framework for management of water resources;
  - An engineering determination of the required elements of supply, storage and distribution of water down to a household level;
  - Prioritization of projects required to manage and complete the water supply scheme in the short, medium and long term;
  - Develop implementation plan with financial resources required;
  - Develop programs for inspection and maintenance of water supply facilities.
- Water specific design guidelines and standards should be developed for the City;
- Integrated Urban Water Management (IUWM) practices to be implemented to manage fresh water, waste water and stormwater as components of a basin-wide management plan, to meet the goals of Water Sensitive Urban Design.
- A tariff review needs to be done with the aim to ensure that the rates for high water users are higher than that for those in rural areas who consume significantly less;
- CoK Master Plan to be revised to align with National Water Master Plan when issued;
- Water demand management (WDM) strategies to be implemented including the following processes:

  1. Water network to be modelled to determine whether the system is operating effectively;
  2. Visual and intrusive leak detection

to be done to observe leaks at peak pressure;

3. Setup and management of supply zones with boundary valves where flow is monitored per zone;
4. Pressure management with the installation of pressure reducing valves (PRV) with flow monitoring and pressure adjustments;
5. Water meter assessment to ensure full functionality and adequate sizing

10.8.3 Waste Water

- A Waste Water Master Plan for the City should be done (there is currently one in progress), and it would typically include:
  - Responsibilities of National, Regional and Local Government in respect of all aspects relating to water supply;
  - Status quo analysis of sanitation systems already in place;
  - An engineering determination of the required elements of sanitation systems down to a household level;
  - Prioritization of projects required to manage and complete the sanitation scheme in the short, medium and long term;
  - Develop implementation plan with financial resources required;
  - Develop programs for inspection and maintenance of water supply facilities.
- A waste water department should be established in CoK to manage, monitor and implement the waste water plan;
- Waste water specific design guidelines and standards should be developed for the City;
- Standards should be established for containment, emptying and transportation of sludge to the waste water treatment plant;
- By-laws should clearly state that it is illegal to discharge stormwater into the waste water system;
- Capacity development programme and maintenance programme to be implemented to train CoK staff on waste water management practices;
- Create tariff plan for the proposed service provision;
- CoK Master Plan to be revised to align with National Sanitation Master Plan when issued;
- Location of Waste Water Treatment Plants to be assessed with an Environmental Impact Assessment (EIA) and all relevant approvals to be obtained prior to implementation;
- Pit latrines to be phased out in areas with high water tables to avoid groundwater contamination, and to be replaced with flush-toilets where applicable or EcoSan toilets in areas with no waterborne sewer networks;

10.8.4 Stormwater

- A stormwater management plan should be developed for the City to include:
  - Responsibilities of National, Regional and Local Government in respect of all aspects relating to water supply;
  - Background information and study area profile, including hydrogeology, surface and ground water quality infrastructure etc.;
  - Catchment delineation and analysis;
  - Environmental impact of stormwater from existing and planned development;
  - Assessment of rainfall data, major and minor system modelling;
  - Highlighting areas of concern, flood –prone regions etc. based on floodline delineation;
  - Effectiveness of existing stormwater management systems;
  - Identify and evaluate stormwater improvement and retrofit opportunities;
  - Establish the approach for stormwater management in the area;
  - Develop implementation plan with financial resources required;
  - Develop programs for inspection and maintenance of stormwater facilities.
- A stormwater department should be established in CoK to manage, monitor and implement the stormwater plan;
- Floodlines to be generated with an assessment of establishments in stormwater buffer zones;
- Stormwater department to liaise with RWFA in terms of the water quality monitoring that is currently being done;
- Stormwater specific design guidelines and standards should be developed for the City;

Figure 10.72 Solid Waste Management Hierarchy

- CoK should develop a policy to deal with on-site attenuation for short-duration, high-intensity storms. This policy should also deal with excess stormwater runoff that cannot be viably contained and how this should be accommodated by downstream land owners.
- The building plan approval process should include a stormwater management plan that addresses how stormwater will be controlled on the site and points out the areas downstream of the site that could potentially be affected.

10.8.5 Solid Waste

- Integrated waste management plan should be developed for the City by using a holistic approach. The plan shall resemble the hierarchy of solid waste management (reduce, reuse, recycle, recover, disposal) (Figure 10.72)
- This plan will include and is not limited to the following:
  - A situational analysis with a description of the demographics of the area, quantities and types of waste generated, waste management services that are currently in place;
  - Responsibilities of National, Regional and Local Government in respect of all aspects relating to waste management;
  - Priorities and objectives of the waste management department and relevant authorities;
  - Long and short term targets for collection, minimisation, re-use and recycling of waste;
  - Approach to the planning of new facilities for disposal and decommissioning of existing disposal facilities;
  - Financial resources required to implement the plan.
- A waste unit department should be established in CoK to manage, monitor and implement the waste management plan;
- Public awareness/ education campaigns to be set up to assist with best practices in terms of waste management, including minimising waste to landfill by reducing waste production on a household and manufacturing level;
- Waste separation at source to be encouraged by providing different colour waste bags/ bins/ containers;
- Tax rebates to be provided for products manufactured from recyclable materials;
- Guidelines to be developed for hygienic on-site waste disposal and management in rural/ low-density areas for health purposes and to mitigate adverse environmental impacts.

11

City for Citizens

11.1. Introduction
11.2. Defining Social Infrastructure
11.3. The Purpose of Social Infrastructure
11.4. Proposed Hierarchies and Standards of Social Infrastructure
11.5. Planning Social Infrastructure within Flexible Zoning
11.6. Education Facility Plan
11.7. Healthcare Facility Plan
11.8. Open Space Plan
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11.10. Civic Facility Plan
11.11. Other Social Facilities
11.12. Disabled and Disadvantaged Groups Strategies
11.13. Tools for Community Engagement and Participation

11 City for Citizens

11.1 Introduction

Kigali aims to become the City for Citizens that respect the needs of various groups of people to create a home for all. It essentially focuses on provision of mixed-use neighbourhoods, affordable housings, participatory rights to all its population to live in an inclusive environment, together with the development of public spaces and social facilities.

The Rwanda National Urbanization Policy (2015) outlines the urbanization strategy set out for Rwanda with the aim to create well-managed growth that generates vibrant urban environments and sustainable economic development. The four overarching policy pillars that illustrate the cross-cutting character of urbanization touching all aspects of life are identified. City for Citizens emphasizes on the pillars of coordination and conviviality to ensure an integrated provision of community facilities as well as to create an inclusive society that promotes community engagement and participation amongst the citizens in shaping their city.

City of Kigali (CoK) identifies specific and pressing social issue in Kigali:

1. Large disparity in living conditions between "Rich" & " Poor"; and
2. Increasing urban sprawl with unplanned settlements lacking physical and social infrastructure

The Urban Sustainability Framework is established to address these aspects by providing guiding principles for the subsequent planning processes that will ensure the long term sustainability of Kigali. The key strategies and recommendations to tackle the above mentioned issues and the challenges are elaborated in Table 11.1.

To achieve the long term vision for Kigali 2050, the theme for creating an inclusive city is proposed with key planning strategies and approaches:

1. Promote mixed-use, affordable development with access to social infrastructure and facilities for all
2. Develop mixed use, mixed income development through alternative zoning
3. Promote participatory planning/ bottom up approach
4. Support upgradation and redevelopment of unplanned settlement to provide quality living environment minimising relocations

11.2 Defining Social Infrastructure

Social infrastructure includes a wide range of services and facilities that meet community needs for education, health, social support, recreation, cultural expression, social interaction and community development. Social infrastructure (including schools, community centres, libraries, community health centres and recreation facilities) is an essential feature of holistically planned communities and contributes to overall community wellbeing.

For the purposes of the Planning Social Infrastructure for Kigali, social infrastructure includes three broad, interrelated categories:

1. Community facilities – the "hard infrastructure" component that includes a variety of buildings and associated grounds used for community purposes;
2. Public services – the "activity program" that provide support, advice, education and information to a wide range of groups within a community; and
3. Community participation – the processes that assists community members to identify and address their needs and priorities

The diagram shows these key elements of social infrastructure and emphasises the importance of the interrelationships. The diagram shows that all elements play an important role in creating an inclusive community. The diagram also shows that social infrastructure is provided and accessed within a physical context and the qualities of that environment are also important in determining access, usage, quality, amenity, and the potential for community building.

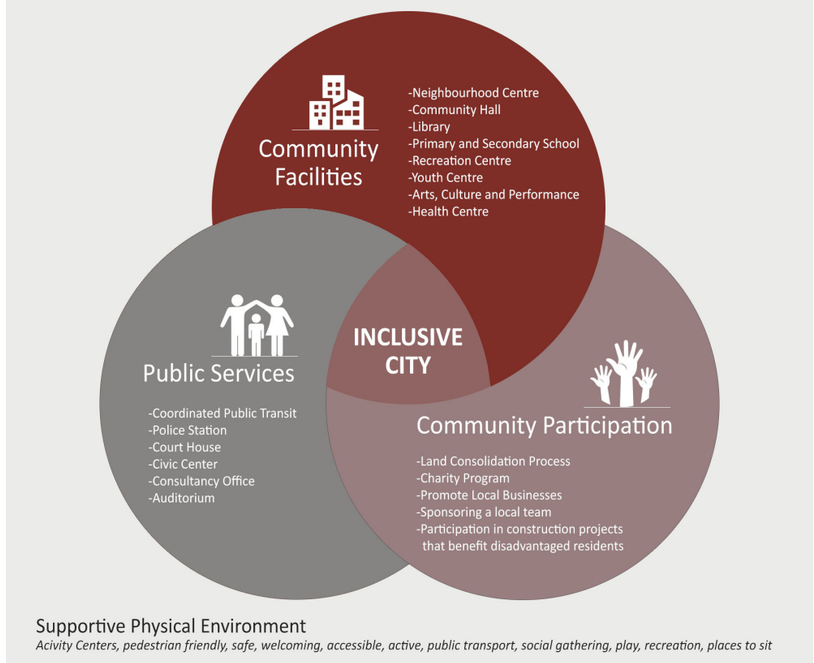


Figure 11.1 Defining Social Infrastructure

Table 11.1 Updated Urban Sustainability Framework for Inclusive City

Components	Key Issues	Direction	Challenges	Recommendations
SOCIAL Inclusive city	• Large disparity in quality of living environment between the high and low income groups • Poor living quality in unplanned settlements with lack of physical and social infrastructure	• Inclusive development that considers the needs of all including gender, youth, vulnerable groups • Create Mixed-use Neighbourhoods • Community Engagement in implementation and local design	• Need for large funding resources • Balancing the needs of various groups of citizens • Brownfield developments • Implementation of mixed-use neighbourhoods	• Create good affordable housing/ home improvement schemes • Develop mixed-use neighbourhoods with a mixed of housing, commercial, recreation, transport facilities and employment opportunities • Ensure improved living quality for commoners and minimize the gap in terms of living quality • Conduct regular stakeholders meetings for city and local level project implementation

11.3 The Purpose of Social Infrastructure

Generally, the purpose of social infrastructure is based on some key objectives. These are that social infrastructure should:

1. **Be targeted to local needs and reflective of community priorities** to ensure they are tailored to the particular social needs of the area they serve. Understanding and responding to the unique and individual circumstances of each area increases the utilisation of facilities and ensures that they address the needs and interests of the local population; and
2. **Contribute to the health, wellbeing and quality of life of members of the community** through a range of services, activities and programs that support the lifestyle needs, foster social networks and social interaction between different groups, contribute to social cohesion and social inclusion and build the skills and capacity of individuals and groups

Other general objectives of social infrastructure include that it should:

1. Ensure equitable access for all members of the community to a range of community spaces;
2. Provide access to affordable programs, activities, services and events to the community;
3. Promote strategic priorities such as community wellbeing, lifelong learning and social inclusion;
4. Provide life skills, health, recreation, leisure and learning programs which build skills and address community interests;
5. Provide space for a range of both formal and informal activities that promote social connectivity and sense of community;
6. Ensure the efficient use of resources to ensure maximum community benefit is obtained within available resources;
7. Involve a range of measures to involve community members in planning, programming, operation and management so as to build community capacity and ownership; and
8. Provide volunteering opportunities to build skills, confidence and enhance community members' wellbeing and sense of belonging

11.4 Proposed Hierarchies and Standards of Social Infrastructure

Four categories of social infrastructure have been proposed in city of Kigali catering for different administrative districts and serving areas:

1. National Level Facilities;
2. District Level Facilities;
3. Planning Area Level Facilities; and
4. Neighborhood Level Facilities

11.4.1 National Level Facilities

Kigali City being the economic and cultural centre of Rwanda owns larger specialized facilities which cater to the whole of Rwanda (national level) like the referral hospitals, sports stadiums and tertiary education centres. IPAR's study shows that in the high population growth scenario, the resident population of Kigali City will reach about 3.8 million by 2050. Therefore, it has been assumed that the proposed social infrastructure is suitable for the corresponding population.

As the administrative centre of Rwanda, it also houses key civic and administrative institutions like the parliament, supreme court, and key government institutes and ministries etc. With the clustering of sports facilities, Gahanga will be the Sports Hub of Rwanda.

Kigali 2019 Zoning Plan has categorized the national level facilities into the New Zone - Public Administrative and Services (PA) following Urban Planning Code. This zone applies to lands owned by governmental agencies for public use or benefit.

11.4.2 District Level facilities

District level facilities are the facilities that cater to needs of the residents of the entire district. These are provided keep in mind, existing facilities, approved projects and the immediate catchment population. According to IPAR's high growth scenario projection, by 2050, three districts in Kigali will have 0.75 million in Nyarugenge, 1.9 million in Gasabo, and 1.2 million in Kicukiro respectively.

District level facilities including Regional Hospitals, Higher Education Institutes, Regional Parks, Sports Centres, Regional Library, Government Offices etc. are proposed to serve a 500,000 population catchment.

Similarly, district level facilities will be classified into PA zone in Kigali 2019 Zoning Plan.

11.4.3 Planning Area Level Facilities

Planning Area level facilities are the ones that cater to the needs of the residents of each Planning Area. A wide variety of commercial developments, industrial estates and public facilities are proposed within each Planning Area. These facilities help to minimize the time need to travel beyond the Planning Area for local facilities. According to Kigali Master Plan 2013, Kigali City is proposed to be restructured into 24 self-sufficient Planning Areas[1]. The typical Planning Area size proposed for Kigali is around 900 to 1,000ha accommodating an average population of 100,000 - 120,000 residents each.

Each Planning Area is proposed to have a Town Centre that comprises of an Vocational/ ICT Institute, polyclinic, town park, museum/ cultural centre, along with retail and offices. All these facilities should be located close to public transport - BRT corridors for ease of accessibility. Other facilities such as police office, fire stations, post office, schools, sports fields and cemeteries are also provided in each Planning Area.

1 Planning Area as a terminology defines specific self-contained planning areas and replaces the terminology "Planning Area" used in the 2013 Kigali Master Plan.

Kigali 2019 Zoning Plan has categorized the Planning Area level facilities into the Zoning Overlays - Neighbourhood Level Public Facilities Overlay. The public facilities overlay zone is to provide for a range of public facilities, that are required by the community at walkable distances within the neighbourhood.

11.4.4 Neighbourhood Facilities

Neighbourhood facilities are provided within each neighbourhood (approximately 15,000 - 20,000 residents). Everyday facilities such as neighborhood centres, primary and secondary schools, religious facilities, health clinic and local parks are provided within walking distance to residents. Neighbourhood level facilities are also part of Neighbourhood Level Public Facilities Overlay added on all underlying residential zones distributed in different locations based on the demand. This shall allow flexibility in the master plan to address the needs of the growing population in the existing and upcoming neighbourhoods. Special care is taken to revitalise existing health, civic and commercial facilities and integrate further with new facilities forming urban social nodes. These facilities include:

1. Neighborhood park with neighborhood centre;
2. Health centre with neighborhood centre;
3. Community hall with neighborhood centre;
4. Primary schools; and
5. Secondary schools

These facilities should be within the neighbourhood catchment area and should be sited close to arterial and collector roads.

11.4.5 Public Facility Provision Standards

Basing on the comparative analysis of international standards, the public facilities standards have been established in Kigali Master Plan 2013. According to the discussion with Focus Group and various government councilors, the standards made in 2013 will continue to be adopted for the 2019 Kigali Master Plan update. Standards were calculated based on the relationship between hierarchy of spaces and the proposed population served (Table 11.2).

Figure 11.2 Key elements and interrelationship of social infrastructure

Table 11.2 Public Facilities Standards

TYPE	PUBLIC FACILITIES	PORPOSED FOR KIGALI
Commercial	Neighborhood Centre	1 per neighborhood; 1.2 ha site.
	Sub-City Centre	1 per Planning area ; 12.0 ha site.
	Regional Centre	1 per 0.5 million, 50 ha site.
Educational Facilities	Primary School	1 per neighborhood (15,000-20000 population). 1.5 ha site.
	Secondary School	1 per 20,000 - 25,000 population. 2.4 ha site.
	Primary + Secondary School (Combined)	2.8 ha site. (Based on existing school sites)
	Vocational / ICT Institute	1 per Planning area . 2.0 ha site
	Higher Education Institute	1 per 500,000 population. 6.0 ha site
Socio-Cultural Facilities	Community Hall*	1 per Neighbourhood. 0.5 ha site.
	Regional Library	1 per 500,000 population. 0.5 ha site.
	Religious Facility	1 per neighborhood (15,000- 20000 population). 0.5 ha site.
	Cemeteries Crematorium	1 10 ha site per 200,000-250,000 population 1 per 150,000 population; 2 ha site
	Museums/ Cultural Centre etc.	1 per Planning Area. 1.5 ha site.
Health Facilites	Health Clinic *	1 per neighborhood (15,000-20000 population). 0.5 ha site.
	Polyclinic	1 per Planning Area. 5.0 ha site. Max travel time of 30 mins.
	Regional Hospital	1 per 500,000 population. 5.0 ha site
Parks & Open Spaces	Neighborhood Park	1 per neighborhood (15,000-20000 population). 1.0 ha site
	Sub-City Park	1 per Planning Area. 6.0 ha site
	Sports Field	1 per Planning Area . 1.5 ha site. (Near to schools or community centres or combine with parks.)
Sports & Recreation	Sports Centre (with swimming pool and stadium)	1 for every 500,000 population. 6.0 ha site.
Civic facilities	Fire Station	5 minutes response time. 0.5 ha site.
	Government/ Municipal Offices	1 Sector office per Sector. 1 District office per District.
*(as part of neighborhood centre)		

Source: Kigali MP 2013

11.5 Planning Social Infrastructure within Flexible Zoning

The inclusive city requires to promote integrated, affordable development with access to social infrastructure and facilities for all, and develop mixed use, mixed income development through flexible zoning.

Referring to the Analysis and Visioning report, mixed-use neighborhood planning as one of the key theme for Kigali Master Plan Review essentially focuses on provision of mixed-income, mixed use housing options to diversify the residential population and create a vibrant and inclusive community, together with the development of public spaces and social facilities which attracts diverse users to enjoy and liven up the area.

11.5.1 Flexible Zoning

To achieve this mixed-use development with focus on social infrastructure, various flexible zoning approaches have been brought to the process of Master Plan Update:

- Overlay Zoning is a tool used by urban development authorities to provide flexibility to a land use zone so that it can take a development direction based on market forces. Neighbourhood level and town level public facilities will be planned as overlays added on all underlying residential zones based on served population and demands;

- Incentive Zoning, offers a reward[1] to a developer who does something "extra" that is in the community's interest (such as more open space, public facilities, transit access) or promotes a public goal (such as affordable housing). It allows a developer to build a larger, higher-density project than would be permitted under existing zoning regulations;

- Land Consolidation approach replots and subdivides fragmented land in an orderly and regular manner. The size of individual plots might be reduced, while the remnant land can be used for common public facilities to enhance the living quality.

These flexible zoning approaches can improve the quantity and quality of social infrastructure efficiently. Social infrastructure will be planned based on population and demands in most effective locations. Additionally, more space for public facility can be generated from awarding incentives to private developers or land consolidation from collective landowners.

11.5.2 Planning for Social Infrastructure

Strategic planning methods are proposed to suit the different hierarchies of social infrastructure.

1 Incentives include low interest financing tools, cash subsidies and grants, free or low-cost land, density bonuses, tax abatement programs, rehabilitation assistance, fast-tracking of plan reviews and permits, and reduced or waived fees

National and District Level Social Infrastructure

Kigali 2019 Zoning Plan has categorized the national level and district level social facilities into the New Zone - Public Administrative and Services (PA). This zone is designated for public administration and services and shall only apply to lands owned by governmental agencies for public use or benefit. The PA zone (Figure 11.3) applies to lands identified as public facilities, and to other publicly owned properties as listed below.

1. Government offices
2. Correctional and rehabilitation facilities
3. Defence and security uses
4. Fire station
5. Police station
6. Transport Interchange
7. Other public uses

The development of national level facilities mostly follow national strategies and serve a larger catchment of population. Following principals are used to guide decisions regarding the location, design and operation of national and district level social infrastructure.

- **Central to catchment and provide equitable access to all users:** Central is about accessibility and convenience in respect to the population that the social infrastructure is intended to serve. Planning for national level and district level social facilities needs integrate them with key population areas (major Planning Areas), urban structure (key activity centres) and transport routes (proposed BRT system);
- **Promote accessibility and visibility:** To be well used and serve identified social needs, national level and district level facilities should be highly accessible and visible. They should provide equitable access to all potential users, be accessible by public transport and have good pedestrian and cycling connections. In Kigali, they are placed along the BRT corridors or potentially integrate with TOD development to promote the accessibility of facilities to all groups;

- **Sufficient size and design to enable expansion and adaptation:** Existing national level and district level social facilities will be retained and retrofitted when there is room. For instance, Nyarugenge and Gikondo Campuses of University of Rwanda are in the process of renovation. In greenfield sites, it is important to provide some flexibility in the provision of community facility space. Flexibility for expansion can be accommodated in strategic locations with a design that enables expansion once a particular population threshold is reached;

- **Promote flexibility and multiple use:** National level and district level facilities should be designed and built to maximise flexibility in use, so they can respond and adapt as needs change. Flexibility is enhanced by providing multi-purpose spaces capable of accommodating a diversity of uses, thereby enabling a range of

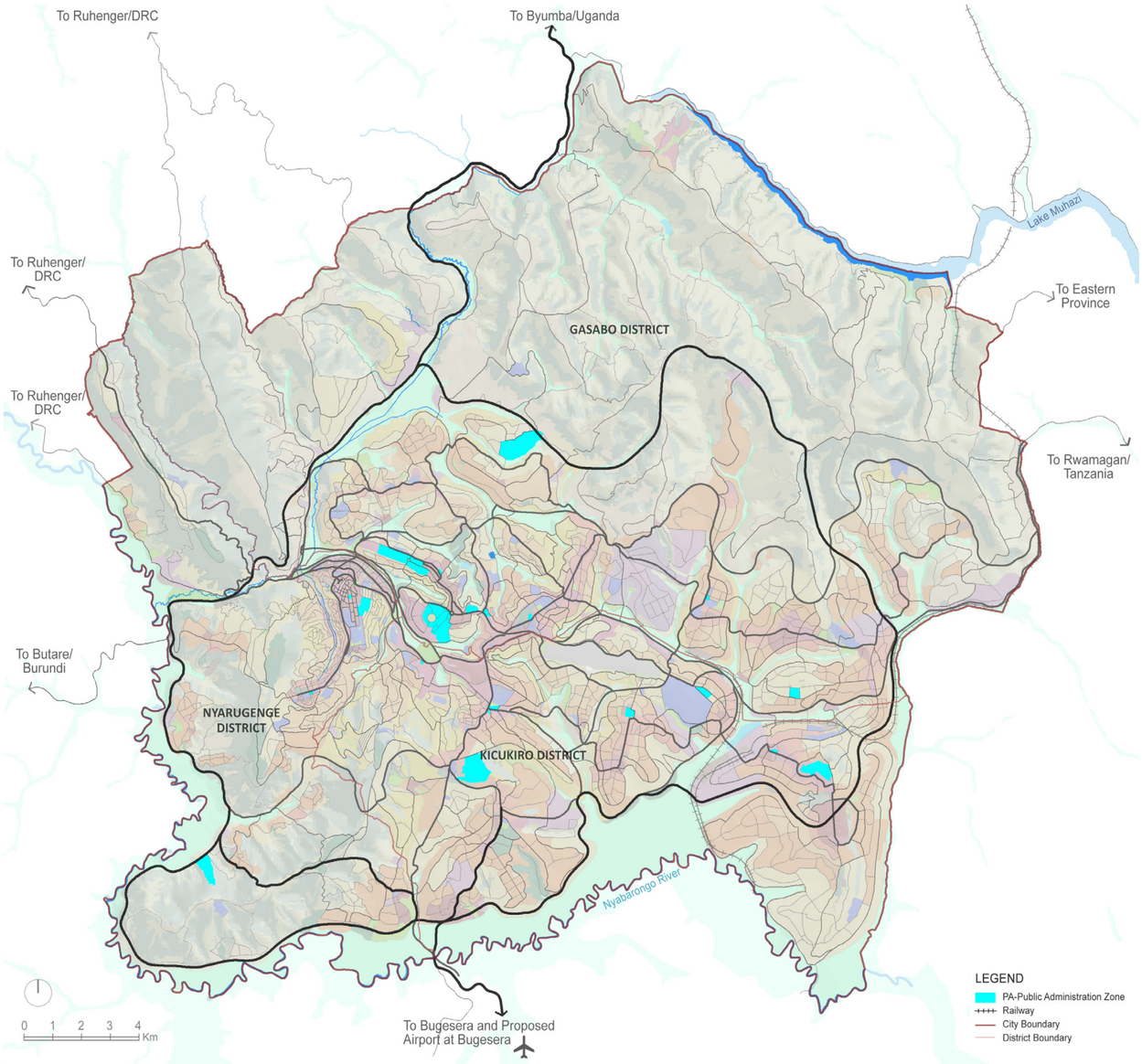


Figure 11.3 Kigali Master Plan - Proposed Public Administrative and Services

activities and target groups to use the facility.

Town and Neighbourhood Level Social Infrastructure

For Planning Area level and neighborhood level facilities with smaller population served, two contemporary social facility planning approaches are proposed with a focus on community development which is in conformity with flexible zoning requirement.

Community Hubs

A community hub, in essence, is a multipurpose public gathering and activity place where a variety of activities occur and where a wide range of community needs can be met in both formal and informal ways. The key to the community hubs concept is integration.

Locating social infrastructure within community hubs helps meet social needs by encouraging compatible uses, and increasing activity and flexibility within a defined geographic area[2].

Master planning, a common feature of many urban growth areas, provides a great opportunity for the creation of community hubs as it enables greater integration with activity centres, transport nodes, public spaces and other people generating activities and places. Meanwhile, space required for community facilities are generated spontaneously following the demands of public needs.

Mixed Use Development

The infusion of mixed uses in a socially inclusive manner is not only achieved by horizontal planning approach, where residential, commercial and other community uses are planned adjacent to each other, but also follow vertical planning approach, where these mix of uses are spread at different levels providing an active and vibrant street edge at the ground floor.. The conception of community facilities as part of positive, active and vibrant community hubs positions them well to act as the active ground floor use of a mixed use building. The mixed use building model offers the opportunity for residential, office and other uses to be used to help to subsidise or support the capital and operational costs of the facility. This arrangement helps to provide different scales and services of community uses that are good for residents living above or nearby, following current and expected social needs.

2 Source: The Sunshine Coast Social Infrastructure Strategy (Sunshine Coast Council, 2011)

Public Facility Overlay

The Public Facilities Zones (PF) are established to clearly identify each category of public facilities provided for the community. These facilities provide basic and essential support services for the community at the city level, planning area level and at neighbourhood level, depending on the type of facilities and the requirements of the community.

- PF1 - Public Facilities Zone-Education and Research
- PF2 - Public Facilities Zone -Health
- PF3 - Public Facilities Zone -Religious
- PF4 - Public Facilities Zone-Cultural/ Memorial
- PF5 - Cemetery/Crematoria

As discussed in chapter 4 - flexible zoning, the neighbourhood level and town level public facilities are proposed to be planned as overlays superimposed on all underlying residential zones to boost the flexibility and adaptability in the Zoning Plan, . The listed neighbourhood level facilities will be provided within 400metre walking radius in residential neighbourhoods based on served population and demands:

- Neighbourhood centre;
- Neighbourhood park;
- Primary school;
- Health centre;
- Religious facility;
- Civic office; and
- Other additional facilities

Other additional facilities like secondary school, combined school (primary school and secondary school), sports field, civic office etc. are distributed in different locations based on the demand.

Planning Area level public facilities including town centres are also part of this overlay but they are spread based on the population size good for Planning Area level facilities. The following Planning Area level facilities will be provided within 800metre walking radius in residential zones based on served population and demands:

- Town centre;
- Town park;
- Vocational/ ICT Institute;
- Polyclinic;
- Museum/ Cultural Centre;
- Sports field;
- Fire station; and
- Policy station

Applying Public Facilities Standards (Table 11.2) of Planning Area level and neighborhood level facilities to the projected population of different Planning Areas as updated from the Master Plan 2013, the number of Planning Area level and neighbourhood level facilities can be calculated as indicated in Table 11.3. The typical Planning Area size proposed for Kigali is around 900 to 1000ha accommodating an average population of 100,000 to 120,000 residents each. The walkable neighbourhood of around 5000 dwelling units will house 15,000 to 20,000 residents each.

Figure 11.4 illustrates neighbourhood level and Planning Area level public facilities overlay. The location of existing neighbourhood centres and public facilities (schools, health centres etc.)

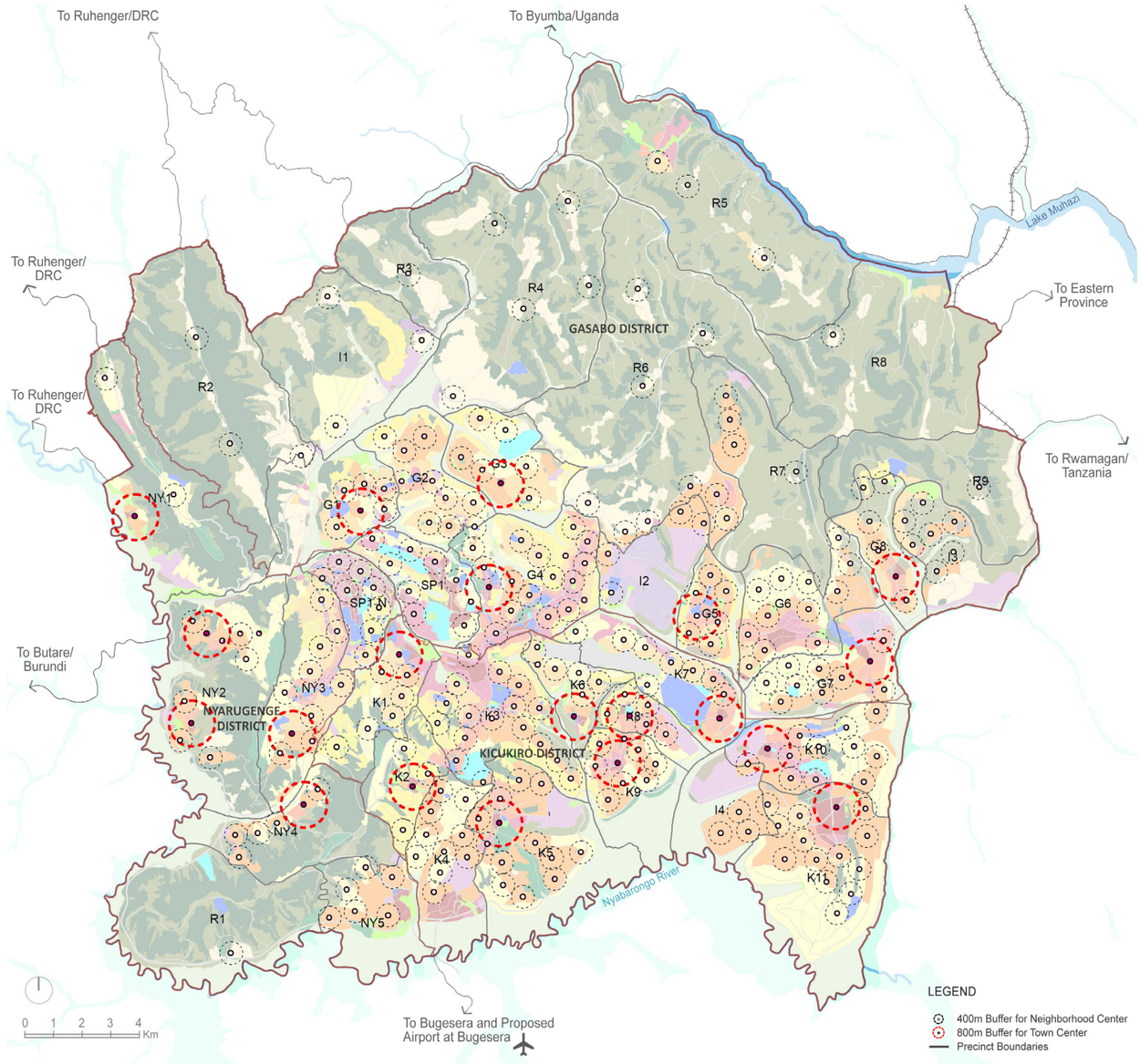


Figure 11.4 Kigali Master Plan - Proposed Public facility Overlay

from the existing land use plan 2018, along with the overall densities and numbers of required facilities based on calculation from different Planning Areas as updated from the Master Plan 2013, have been used as guiding principles for the overlay to allow community facilities to be planned within the neighbourhoods.

The Local Area Plans for different neighbourhoods may use this overlay to provide public facilities in addition to the existing facilities as per the requirement based on the population demands of the neighbourhood. These facilities may be planned together to create a cluster of facilities for each Planning Area and neighbourhood, like a “community hub” with mixed use commercials along the main streets of the neighbourhoods.

Figure 11.5 illustrates idea of Community Hub for a typical 400metre walking radius within any neighbourhood. Fundamental facilities (neighbourhood centre, neighbourhood park, primary school, etc.) are indicated along mixed-use streets and major junctions for easy access and share of space, while additional facilities (secondary school, etc.) can be provided with flexibility driven by demands. The number of Community Hubs meets demands of density and population on various Planning Areas.

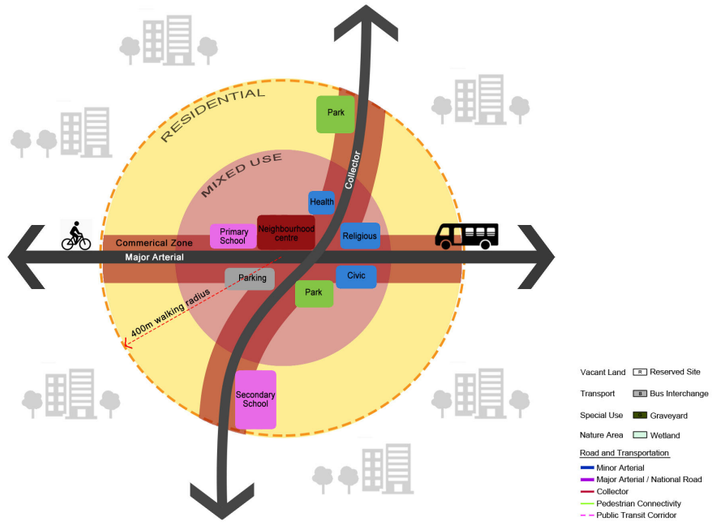


Figure 11.5 Neighbourhood Level Community Hub

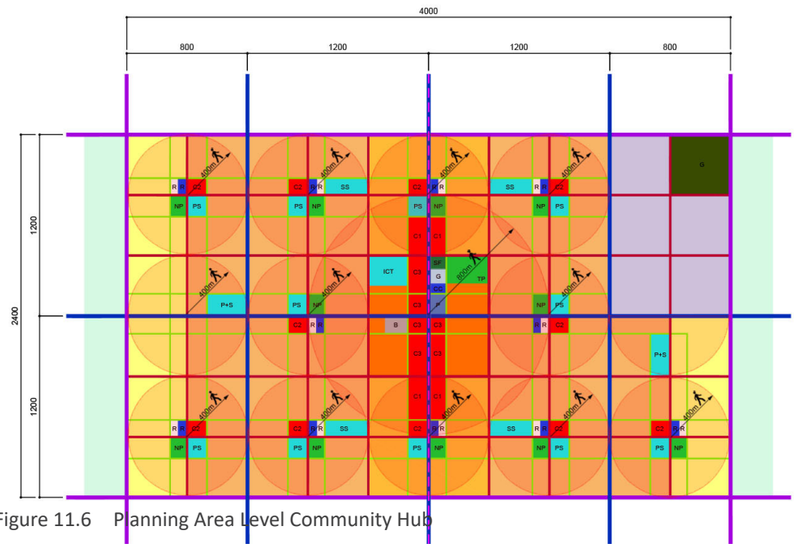


Figure 11.6 Planning Area Level Community Hub

Table 11.3 Number of Planning Area and Neighbourhood in Kigali Master Plan 2019

District	Planning Area	Area (ha)	Population	Number of Neighbourhood
Gasabo	G1	1449.9	94816	7
	G2	1213.3	131552	11
	G3	1246.2	112408	7
	G4	1846.6	240404	19
	G5	717.9	90500	7
	G6	1564.5	227956	12
	G7	1354.4	150512	10
	G8	832.6	85348	6
	I1	2481.9	42564	5
	I2	1181.4	56692	5
	I3	1187.8	114260	7
	R2	3744.5	36512	6
	R3	1154.8	25728	2
	R4	4668.8	58220	6
	R5	4258.7	31920	4
	R6	5459.6	139928	13
	R7	2100.5	65876	4
	R8	3478.9	15816	2
	R9	1861.5	11212	2
	SP1	1068.8	84440	10
Nyarugenge	SP1-N	764.3	68756	4
	NY1	2423.1	32152	4
	NY2	2945.3	88036	11
	NY3	1672.9	147204	11
	NY4	1604	44468	7
	NY5	1175	83308	6
	R1	2562.7	7208	1
Kicukiro	K1	1127.9	87496	9
	K2	829.4	30296	6
	K3	1983.3	256064	17
	K4	1317.7	161568	11
	K5	2325.7	194504	16
	K6	681	74200	7
	K7	1381.6	121936	9
	K8	544	68688	6
	K9	1230	98964	9
	K10	1523.7	162300	14
	K11	2623.8	212716	19
	I4	1016.5	89108	3
		72605	3845636	315

Figure 11.6 illustrates idea of Community Hub for a typical 800-metre walking radius at proposed locations within each Planning Area. Primary facilities (town centre, town park, Vocational/ ICT Institute, Polyclinic, Museum/ Cultural Centre, Sports field, etc.) are conglomerated with BRT stations and surrounded by medium to high density mixed-use environment following the TOD development.

11.6 Education Facility Plan

Education plays a significant role in building the skilled human resources that will be required to support inclusive urbanization.

Rwanda's Vision 2020 and its Economic Development and Poverty Reduction Strategy (EDPRS) aim at the development of a knowledge-based and technology-led economy.

Education is a fundamental human right and an essential tool to ensure that citizens - women and men, girls and boys - realize their full potential. The development of human resources is one of the principal factors in achieving sustainable economic and social development. Education and training has been considered as a critical lynchpin to achieve development and poverty reduction in Rwanda.

The major aims of education and training should be:

- To give all Rwandese people - women and men, girls and boys - the necessary skills and values to be good citizens; and
- To improve the quality of human life through the formal and informal systems at all levels

According to Focus Group and CoK Councilors, Education Hub will be proposed in a few areas in Kigali to boost economic development. Meanwhile, city is looking for improving the living condition and quality of residential areas like Nyamweru where are lack of basic infrastructures like schools.
The Development Guideline Plan prioritizes the provision of standard for primary, secondary and tertiary education facilities across the whole city in the light of long-term education policies, demographic changes and future manpower demand.

As per the master plan update, a few key planning actions for siting educational facilities are:

National and District Level Education Facility

- Two major University towns with student accommodation facilities are proposed in Gahanga and Masaka sector, close to the Regional Centres. This allows for more interaction between students, research management and working professionals;
- According to Rwanda Development Board, an education city next to Lake Muhazi in Rutunga sector is being proposed as part of the program to develop a tourism and cultural town

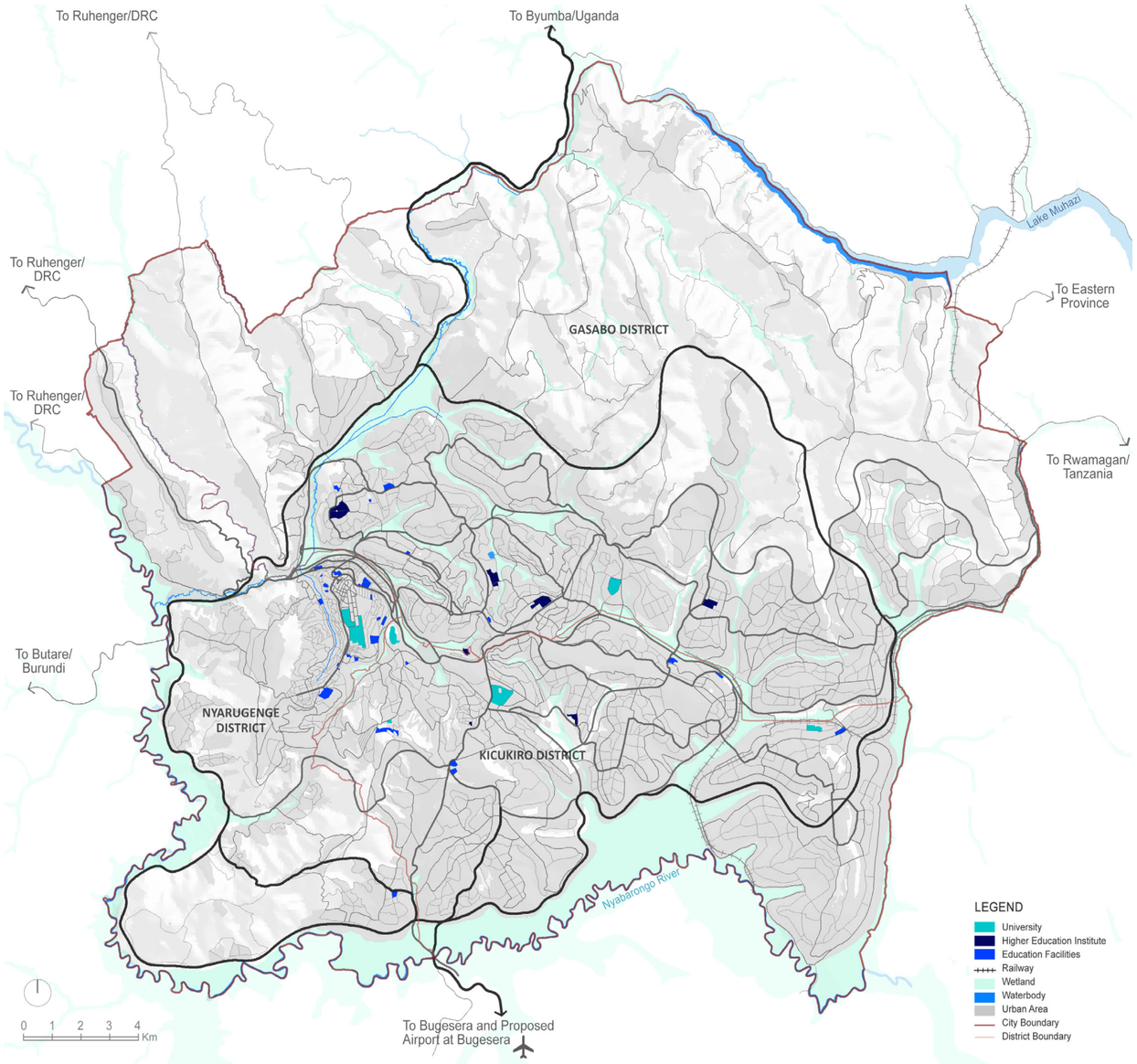


Figure 11.7 Kigali City - Education Facilities Plan

Imagery: University of Rwanda, College of Education

Imagery: Adventist University of Central Africa

Imagery: Vocational Training

Imagery: Umubano Primary School

20
Universities and Higher Education Institutes by year 2050

30
Vocational/ ICT Institute by year 2050

190
Primary Schools by year 2050

400m
Average Travel Distance to Primary School

150
Secondary Schools by year 2050

800m
Average Travel Distance to Secondary School

in the north of Kigali;

- Amahoro stadium with the Kigali Institute of Education are proposed to be redeveloped into an Edutainment hub for the District;
- New universities have been proposed in Gisozi and Ndera sector; and
- The existing Poly-technique Institute in Kicukiro sector is going to be upgraded to a university

Planning Area and Neighbourhood Level Education Facility

- Existing primary schools have been recognized in the Master Plan;
- Primary schools to be sited within 400m of walking distance in each neighbourhood;
- Primary Schools are to be integrated with the Neighbourhood Centre for their central location and accessibility;
- Shared use of facilities with the community: In view of the shortage of school sites, particularly in the urban areas, consideration is given for schools to share the use of adjacent community and recreation facilities (the neighbourhood parks, assembly grounds, community halls, etc). Where appropriate, government school facilities should also be shared for use by the community;
- Clustering of Schools: To utilise land and other resources more efficiently, Primary and Secondary Schools are to be combined where feasible, in either pairs or in clusters so that the school facilities can be shared, or the sites can be developed jointly;
- Facilities for Technical Education and Vocational Training are to be sited one in each Planning Area close to the Town Centre;
- All existing schools in the rural areas would be retained and rejuvenated. Based on the catchment population, additional schools to be planned in the rural settlements

Since these facilities are part of an overlay, the city may plan them based on the requirement of the growing population using participatory approach for locating these facilities within the neighbourhood or Planning Area.

11.7 Healthcare Facility Plan

Social Transformation Pillar under 7years Government Programme aims to ensure a quality healthy population by prioritizing in “enhancing demographic dividend through ensuring access to quality health for all”.

The need for health centres at the neighbourhood level has been made by different sources. According Rwanda State of Environment and Outlook Report 2017, there is an imbalance in the distribution of health centres throughout the city, and health centres suffer from congestion and overcrowding.

The government’s health sector development strategy is based on decentralized management and district level care. Health services in Rwanda are provided through the public sector, government-assisted health facilities (GAHFs), private health facilities, and traditional healers.

The public sector has two main categories: the secondary health centers and primary health centers. The secondary health center consists of referral hospitals with a catchment at a national level and the district hospital caters to the district population. The primary health centre consists of health centres at sector level, military/police hospitals, prison hospitals, privately run polyclinics, dispensaries and health posts.

1. Secondary Health Centre: Referral Hospital, Regional Hospital

A provision standard was developed as part of the 2013 Kigali Master Plan as per which one regional hospital was to be provided per 500,000 people, with 5ha minimal lot size. According to 2013 Kigali Master Plan there are, three (3) referral hospitals in Kigali, four (4) district hospitals, one (1) military hospital which provides for the public, and one (1) police hospital. The military hospital in Nyarugunga will be upgraded to regional hospital as city’s one of the implementation status projects. There will be two regional hospitals proposed in proximity to the regional centres in Masaka and Ndera to have a greater catchment for district population. Sustainable Tourism Master Plan (STMP) of 2015 suggests to develop a 100ha Health City next to Masaka regional centre to attract tourism for healthcare.

2. Primary Health Centre: Polyclinic,

Imagery: Health City Novena
Source: www.healthcitynovena.sg

Imagery: King Faisal Hospital

Imagery: Polyclinique La Medicale
Source: The News Times

Imagery: Health Centre in Rwanda

5
Referral Hospital by year 2050

8
Regional Hospital by year 2050

30
Polyclinic by year 2050

190
Health Centre by year 2050

1km
Average Travel Distance to Polyclinic

400m
Average Travel Distance to Health Centre

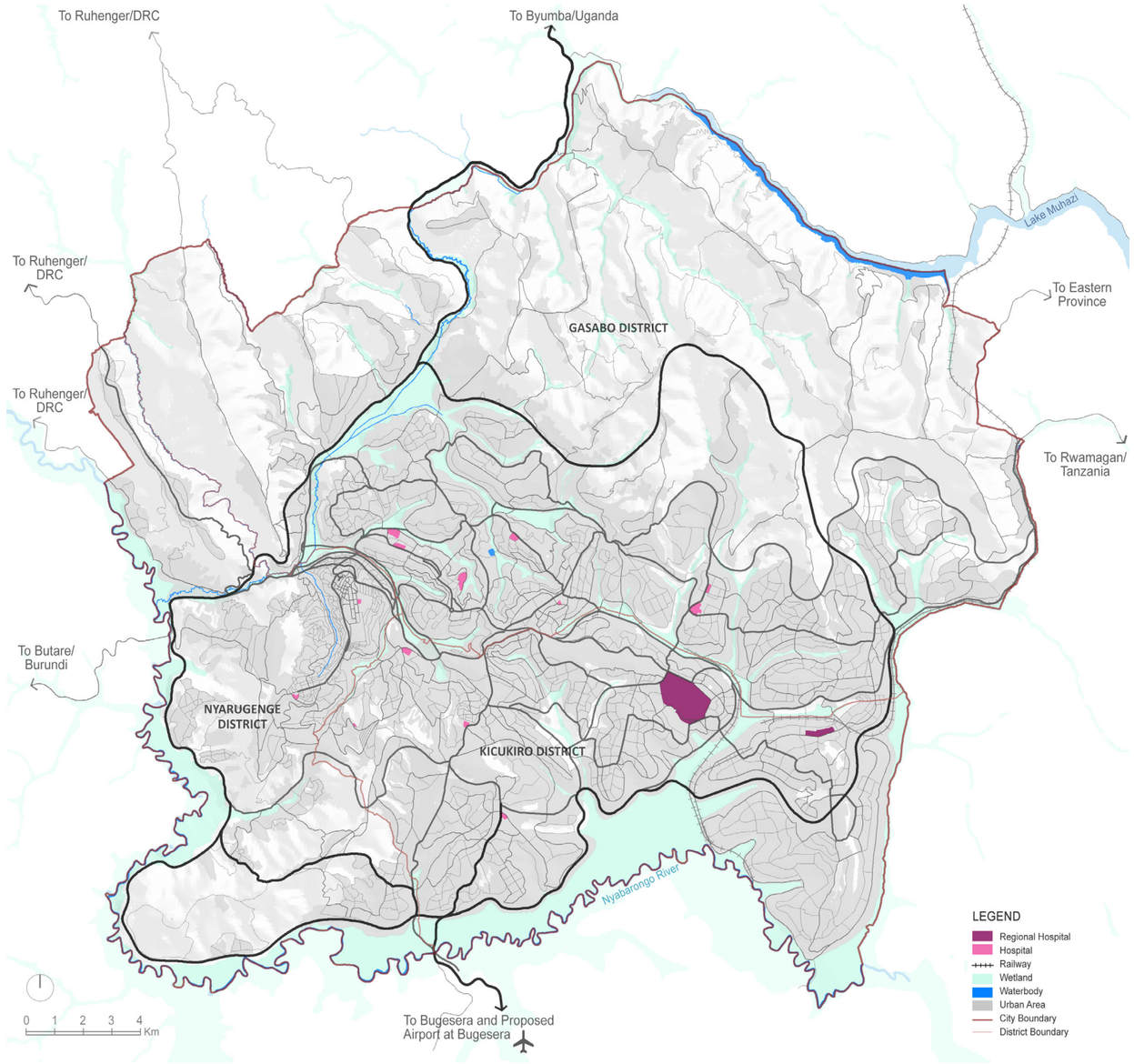


Figure 11.8 Kigali City - Healthcare Facilities Plan

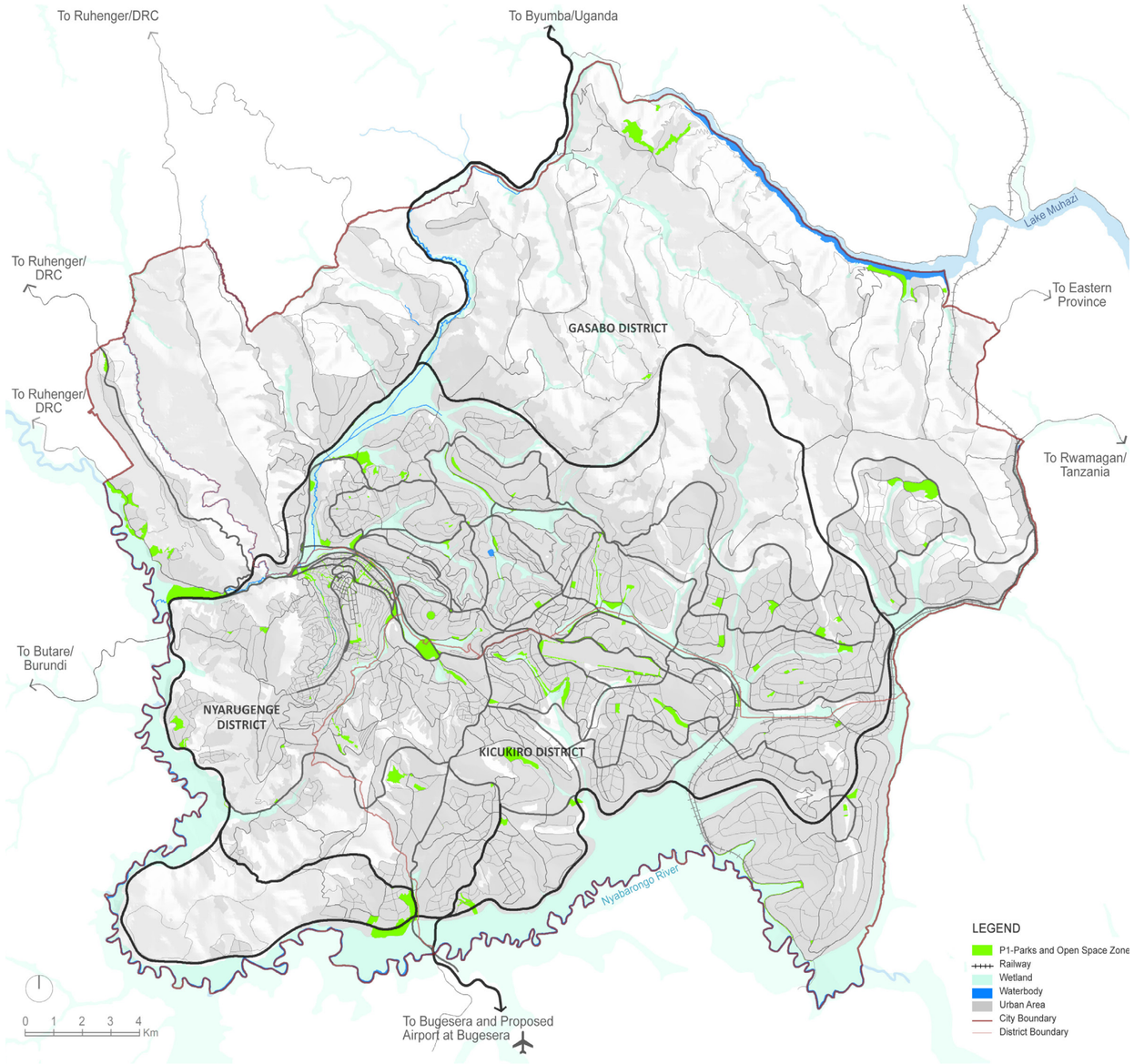


Figure 11.9 Kigali City - Open Space Plan

Health Centre

As per provision standards for primary health centres, one polyclinic should be provided for each Planning Area with an area of 5ha. One health centre should to be provided per 15,000 people which would be part of the neighbourhood centre having a minimum area of 0.5ha.

The primary health centres may be planned as part of the mixed use Community Hubs proposed as part of the public facilities overlays.

11.8 Open Space Plan

The need for open public spaces at the city and neighbourhood level has been one of the key concerns of the City of Kigali. Citizens perceive this lack of quality public spaces within their neighbourhoods and have suggested the Master Plan to review the policies with regard to implementation of public open spaces in the city. While the Master Plan 2013 suggested to locate public space in each neighbourhood, the land tenure system in the City (most land is privately owned) prevented the authorities from effectively implement the scheme. Public open spaces are one of the key community facilities to be provided at the neighbourhood level. Like other public facilities, it is required by the city to acquire land before being able to implement these, leading to a substantial disbursement of public funds. Land consolidation can be an effective tool to convert the remnant land from landowners into shared open space to enhance the living quality.

The city is actively working on strategies to build more parks and public green open spaces for its residents, trying to integrate the increasing urban density in Kigali with the environment.

Kigali Master plan updates the proposed zones P1 and P2 that are planned as passive and active recreation zones in the master plan 2013. 43.6 sqkm, 6% of the total land is Kigali falls within the P1 and P2 zones.

Passive Recreational Zone (P1) are established to provide recreational and leisure facilities and activities in selected areas that have unique features (including visual corridors, environmentally sensitive areas, buffer areas, or along significant routes). These parks can include recreational commercial or public facilities at the neighbourhood, community, and regional level.

The Active Recreational Zone (P2) is established to provide parks that offer active recreational and sporting activities.

National and District Level Open Space

The city is also discussing the strategy to use the natural assets of the city including forests and wetlands for eco-tourism development and recreation purposes:

- Kigali CBD Wetland Park has been proposed to transform the wetland into a tourism site;
- The proposed Nyandungu Wetland park near the existing airport is another 130ha public park evolved from the abundant wetlands; and

- The city's largest wetland rejuvenation project next to the lake Muhazi crossing Rutunga and Gikomero sectors was the catalytical project to transform the district into tourist destination outside of the city

Developing the Wetland Parks as Public Open Spaces will have the following benefits:

- Utilising natural city assets for the benefit of the residents;
- Restoration of lost natural wetland;
- Recreational and tourism venue;
- Vegetation and horticulture can be used in sustainable ways to clean the grey water discharged from residential areas; and
- Habitat for migratory birds and aquatic life

Some open space projects have been added into city central areas or key district commercial nodes:

- In Kimihurura sector, three major public space projects can be found in part of city's key commercial and civic node; and
- A regional park has been proposed to integrate with Gahanga regional centre

Imagery: Hong Kong Wetland Park

Planning Area and Neighbourhood Level Open Space

Most of the proposed open spaces are integrated with communities or neighbourhoods following the public facilities overlay for different neighbourhoods. Implementation Strategy of Participatory Land Readjustment is suggested where the land is consolidated and all land owners contribute for public open spaces and common infrastructure. Replotting Increases the value of plots despite reducing their size making room for public open spaces and utilities Following are the key benefits of this approach:

- Encourage social equity through public participation;
- Improved accessibility for different parcels;
- Improved quality Housing;
- Improved basic services; and
- Improves public health and quality of life with improved urban environment for residents

As per the prescribed standards,

- One town park to be provided per Planning Area having a minimum area of 6ha; and

Imagery: Tot Lot Park

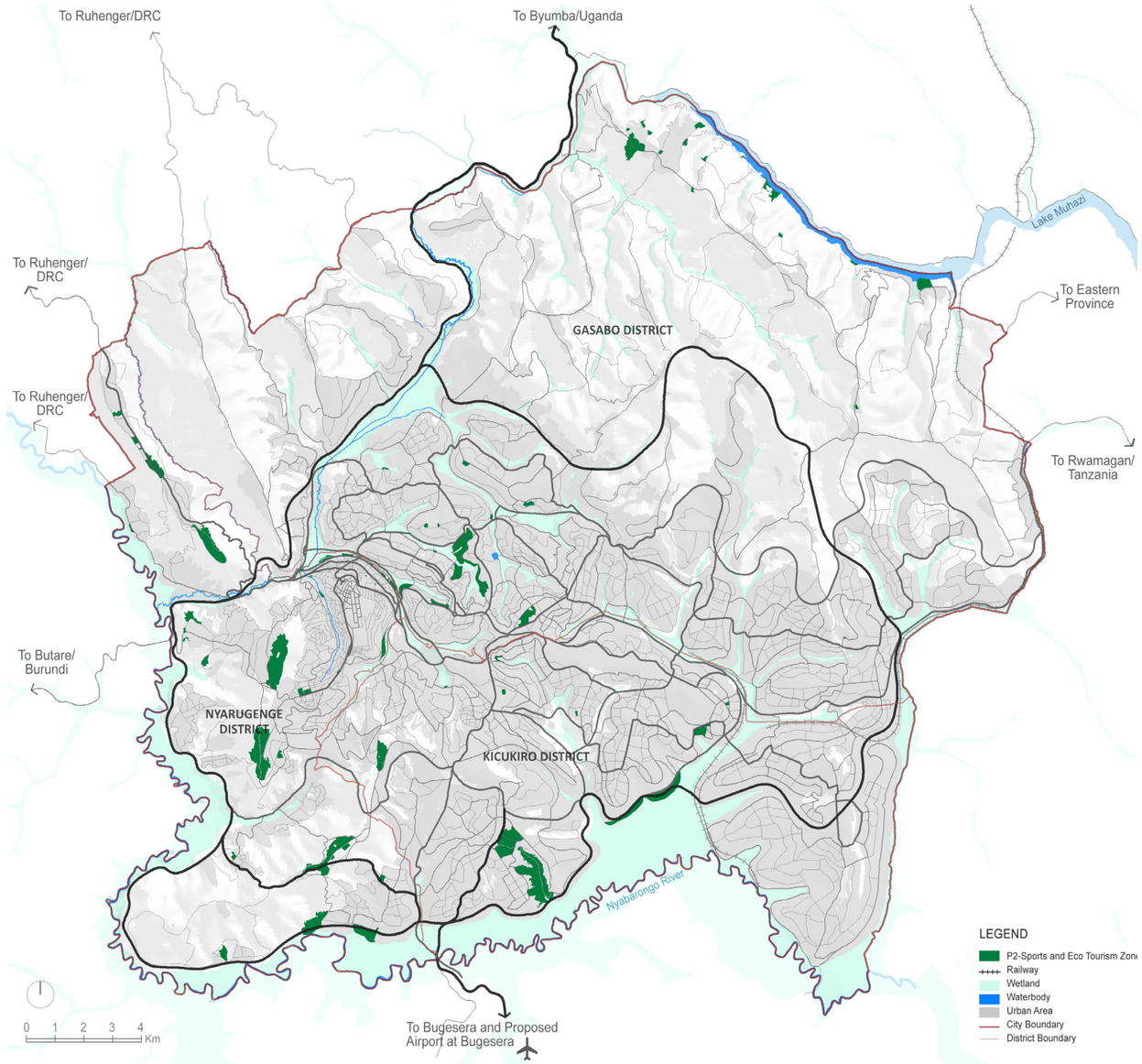


Figure 11.10 Kigali City - Sports and Recreation Plan

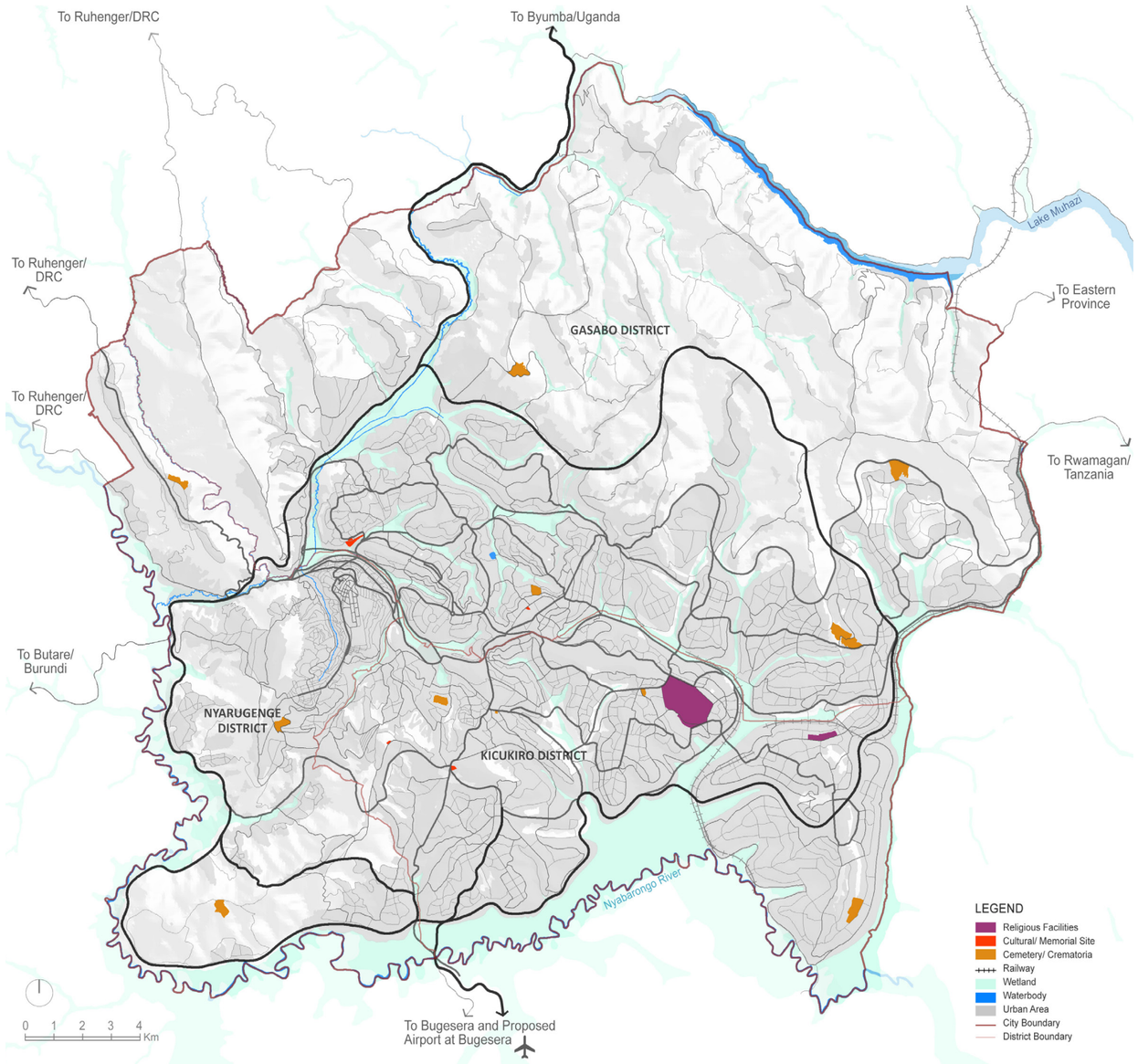


Figure 11.11 Kigali City - Socio Cultural facilities

- One neighborhood park to be provided for a catchment of 10,000-12,000 population (per neighborhood) with 1ha space

11.9 Sports and Recreation

The Social Transformation Pillar under 7years Government Programme sets objective for "Transition to a Modern Rwandan Household in urban and rural areas" and takes actions to "Promote recreational activities and sports for all to increase the socioeconomic impact of sports facilities to the citizens".

The city is actively working on strategies to build more sports and recreational facilities for its residents, trying to host more international sports events to attract tourists and provide places for residents to keep fit.

- One regional large-scale Sports Hub with indoor and outdoor stadiums, sports complex and water sports facilities are proposed in the Gahanga Sector stimulating recreation and tourism growth;

- There are two major venues for national stadium in Kigali, one is Amahoro National Stadium sitting in-between Gisimenti Gateway and Kimironko Market; another one is Nyamirambo Stadium integrated with city's fringe centre in Nyakabanda sector;

- New stadium and sports facilities are proposed in Ndera Sector next to SEZ for an integrated industrial development;

- Besides the existing Kigali Golf Course in Kacyiru and its extension for club house and a 9-hole course in Remera, a new golf is being proposed in south of Masaka sector facing to Nyabarongo River; and

- Several sports and recreation projects have been proposed to sit along the ridges of hills in Mageragere, Gatenga and Kanyinya sectors, providing residents and tourists good views in the surroundings while having recreational activities

As per prescribed standards, one (1) sport field to be provided per Planning Area having a minimum area of 1.5ha, near to education institutes or town centres or combined with town parks.

11.10 Other Social Facilities

The city of Kigali currently has a variety of other social infrastructures facilities like public library, police station, fire station, cultural centres, community halls, etc. There are also a variety of religious buildings like churches and mosques and, All these are vital for a vibrant and inclusive society and need to be provided in the new urban setting . In 2019 Kigali Master Plan, these facilities have to be distributed according to the walking radius of neighbourhoods, within the Planning Area. Following the Community Hub concept, facilities can be shared in uses and residents can mingle with each others. Most importantly, facilities are provided basing on surrounding demands.

Cemeteries are another such key public facilities required in Kigali. Currently, the government provides land for cemeteries which are given in the form of 20-year lease. Two such new cemeteries were provided at Mageragere in Nyarugenge and Rusororo in Gasabo. Such facilities are necessary for all three districts. However, with the impending shortage of land in the future, new types of cemeteries need to be developed. 10 hectares of land per 250,000 population and 2 hectares of land per 150,000 population is reserved respectively for cemeteries and crematorium , necessary for all Planning Areas. Similarly, for large scale social infrastructure which require a large land area, new developable spaces will have to be explored and secured by the government through either incentive zoning or land consolidation tool.

11.11 Disabled and Disadvantaged Groups Strategies and Regulations

The National Roadmap for Green Secondary City (NR) plans for a walkable city that is "safe for other groups with limited mobility such as the elderly or disabled". The Strategic Transport Master Plan for Rwanda prepared by Rwanda Transport Development Agency (RTDA) provides guidance for the development of integrated medium and long-term land transport programs for the next 10 years in conformity with Vision 2020 and the objectives of EDPRS 2. One of the initiatives is "Development of 100 km of High Quality footpath on both sides of roads with shade tree at 10 m interval including wheel chair access facilities for the disabled".

Persons with disabilities face widespread lack of accessibility to built environments, from roads and housing, to public buildings and spaces, basic urban services such as sanitation and water, health, education, transportation, and emergency response programmes. Barriers to information and communications, including relevant technologies and cultural attitudes including negative stereotyping and stigma also contribute to the exclusion and marginalisation of persons with disabilities in urban environments.

Proposed by the Third UN Conference on Housing and Sustainable Development (Habitat III) in October 2016, a "New Urban Agenda" promotes accessibility and inclusion of persons with disabilities in building inclusive and sustainable urban development for all. Proposed by a UN experts group meeting[1], the following strategies and regulations can relate to Kigali's content and further accessible and inclusive urban development:

1. Promoting accessibility, a key component in urban policy, design, and planning:

A good policy to achieve inclusive and sustainable urban development is a foundation for full accessibility and effective participation of all. This requires strong commitments in concrete terms, which include inclusive and disability-responsive urban policy frameworks, appropriate regulatory structures and standards, "design for all" approaches in planning and design guidelines.

2. Accessible housing and built infrastructures:

According to the NR, the urban environment must be easy to navigate, where walking routes are direct, and destinations and nodes are linked with easily viewed urban spaces. However, Kigali City is built on hilly landscape sprawling across ridges and wetlands. 35% of the entire city land area is occupied by steep slopes of more than 20%. Many of the unclassified roads are unpaved and criss-crossing hilly terrains with very steep gradient at various locations within the District. They are mostly of narrow single carriageway without proper road furniture and drainage provision. These hilly terrain and existing unplanned elements pose a great threat to the accessibility especially to the disabled and disadvantaged groups in the city.

Towards achieving a city accessible and inclusive to all, city of Kigali is working on the direction where upcoming projects either for commercial or housing developments are regulated by building standards, laws and effective enforcement mechanisms to create a barrier-free city for disabled and disadvantaged groups.

Additionally, integrated transportation facilities and services not only are reliable and affordable but also are accessible for all in a journey from the starting point to the final destination smoothly.

Kigali 2019 zoning plan requires all new development to provide for 10% universal access residences, in the road design, building access, etc.

3. Active public participation of persons with disabilities and multi-stakeholders partnership for advancing inclusive and accessible urban development:

To achieve a truly inclusive city, a holistic and people-centred approach that informs, engages, and involves persons with disabilities and their organizations is necessary in all aspects of urban development, in particular in their access to affordable housing, public spaces, transportation, public facilities, etc.

1 UNDESA- UN Habitat Forum on Disability Inclusion and Accessible Urban Development, Nairobi, 28-30 October 2015

11.12 Tools for Community Engagement and Participation

Structured Participatory approach in Urban Planning processes to establish an official platform of consultation and discussion for Urban Development activities of the City of Kigali will be suggested in the Implementation Plan. It has to be highlighted that participatory activities at grassroots and local levels are more difficult to implement in a city-wide physical planning exercise as the level of details and inputs are more suitable for Urban Redevelopment and Upgrading Plans, or Urban Design and Land Subdivision Plans.

Although, opportunities for community engagement and participation could be fitted in activities and projects conducted at neighbourhood and local levels, with the support of Civil Society Organizations (CSO). All these events could be suitable situations to raising awareness and sharing information on Master Plan objectives and strategies, such as Land Consolidation or Adjustment Projects, which require citizens support and engagement or giving the chance to conduct pilot projects, applying participatory design approach.

The involvement and participation of CSOs and other vulnerable group Associations during Master Planning exercise would ensure that gender issues and other specific requirements and needs will be taken into consideration, fostering the development of an inclusive and fair Master Plan. In this regard, Kigali Master Plan review process set up a series of Focus Group (FG) discussions to tackle specific issues request by different Stakeholders and succeed to collect valuable and meaningful suggestions and contributions. It is envisaged to have more opportunities to involve community representatives in the FG discussions, although strong facilitation skills and knowledge of participatory planning tools are required to be provided by Planning and Management Team.

Rwanda administrative organization and local practices to engage civil society and communities are offering others opportunities to engage residents and share information on Master Plan process. Imidugu Leaders and Meetings, Umugmanda Meetings, Inteko z' Abaturage – Citizens councils - are platform, among others, where citizens can be consulted and involved to provide their comments.

An extensive multi-platform communication campaign to support the participation and citizens' engagement and to reach all levels of population is required to explain and share information with the population. Media platforms (TV and Radio talk shows, social media, email address, SMS, WhatsApp, newspapers, etc.) are tools to support Citizens to participate in discussions and share their needs and priorities.
Participatory tools to monitoring and assessing the performance of the Plan and its realization is recommended during the implementation phase, ensuring interaction with relevant actors and allowing citizens to continuous participation in the Master Plan implementation.

12

Creative City

12.1. Introduction
12.2. Introducing Vibrancy into City Centre
12.3. Local Identity Development
12.4. Kigali Tourism Development Strategy Plan
12.5. Kigali Culture and Heritage Assets

12 Creative City

12.1 Introduction

Tourism in Rwanda has been identified as a priority sector to achieve the country's development goals as set out in the Vision 2020 strategy. It is projected to play a big role in job creation and revenue generation for the economy. The 7 Years Government Programme (NST 1) 2017-2024 aims to double tourism revenues to USD 800 million by 2024 from USD 404 million in 2016. This will be achieved through:

1. Positioning Rwanda as a world class and high-end eco-tourism destination;
2. Increasing investments in tourism infrastructure including the development of the Kivu Belt tourism master plan;
3. Developing hospitality industry and building the capacity of the private sector to provide high levels of service delivery; and
4. Accelerating MICE tourism growth by attracting big events and conferences and developing cultural and religious tourism working with the private sector; ensuring the branding of Rwanda as a world class conference destination

The Vision 2050 suggests tourism as one of the key strategies to encourage "economically connected districts". As Kigali's bordering districts are also increasingly integrated with Kigali's economy, coordinated tourism infrastructure is required to develop cross-district "corridors".

The Urbanisation pillar of Economic Transformation also aims towards "transformation for prosperity" by developing high value and competitive jobs and sectors. Improved productivity and competitiveness through diversified tourism, development of local industries e.g. handcrafts, high quality services in public and private sectors including hospitality are some of the key drivers identified to achieve objectives of the Economic Transformation pillar.

The interaction of landscape, built form, history, people and their local culture gives a distinct identity to a place. The continuance of the local character gives people a sense of belonging, celebrates its creativity while enhancing community life. This distinctness is attractive to tourists and investors, creating a competitive edge by virtue of its identity.

Creative city reflects a new planning paradigm for cities that advocates a culture of creativity be embedded in how cities operate and grow. While cities must be efficient and fair, a creative city must also be one that is committed to fostering creativity among its citizens and to providing emotionally satisfying places and experiences for them. It must therefore identify, nurture and celebrate its unique culture, heritage, traditions, festivals with all its citizens and encourage "play environment" in the city to make the city more vibrant, safe and appealing for citizens and tourists alike.

City of Kigali identifies specific and pressing need for diversifying economy growing the tourism sector as an important economic driver:

1. Need for employment opportunities to cater to the increasing population;
2. Push for green economic growth; and
3. Significance of green recreational areas for social and health benefits of its citizens

The Urban Sustainability Framework is established to address these aspects by providing guiding principles for the subsequent planning processes that will ensure the long term sustainability of Kigali. The key strategies and recommendations to tackle the above mentioned issues and the challenges are elaborated in Table 12.1.

To achieve the long term vision for Kigali 2050, the theme for creating a Creative City is proposed with key planning strategies and approaches:

Vibrant City:

1. Identify key nodes for mixed uses and entertainment activities;
2. Improve accessibility to mixed use nodes; and
3. Encourage activity generating land uses to create a 24 hour city where people live-work-play-create

Tourism & Culture:

1. Review and incorporate sites for tourism and suggest related economic activities;
2. Support balanced development of natural resources for economic activities;
3. Improve and extend ICT accessibility and connectivity to promote/ enhance digital marketing, online MICE conferences etc; and
4. Create more public open spaces to showcase cultural and tourist activities

Heritage:

1. Including heritage sites in Master Plan; and
2. Provide guidance on further studies on mapping of heritage sites for preservation and tourism

Table 12.1 Updated Urban Sustainability Framework for City of Kigali

Components	Key Issues	Direction	Challenges	Recommendations
SOCIAL Vibrant city	• Lack of well-serviced attractive areas for investment • Need for more employment opportunities for the increased natural and migrant population • Promote green economic growth	• Greens jobs creation • Promote tourism development	• Balanced and complementary development for Kigali city and 6 secondary cities • Attract green economic investments	• Promote green economy investments and green jobs creation • Increase vibrancy and activities, promote tourism with preservation of culture and heritage

12.2 Introducing Vibrancy into City Centre

A “vibrant urban area” is an area of the city where a significant number of individuals (with different age and sex) in a wide range of time during day, are doing themselves or social activities[1].

Urban centers play an important role in the economic health of a town or city. Vitality of city centers booms economic activity and business in the region and finally attracts tourists to the area. In addition, the city center contains people’s imagination of environment which is a valuable legacy for society. It is aesthetically pleasing urban center should be full of action, especially the pedestrian activity. Conveyance positive and attractive image of the community also helps to attract visitors to the core of city center. Four components to improve the efficiency of urban space, which are[2]:

- Accessibility;
- Land use diversity;
- Concentration and density or compactness of land uses; and
- Well-organized urban governance

In order to introduce vibrancy into city centre, several strategies and policies have been proposed in the Table 12.2.

1 M. Khastou, N. SaeediRezvani, Factors affecting the vitality of urban spaces creating a lively urban environment with emphasis on the pedestrian shopping center
2 Cyril B. Paumier, Creation a vibrant city center

Table 12.2 Strategies and policies for creating a vibrant urban space

GOAL	KEY ISSUES	DIRECTION
Create and promote a vibrant and responsive urban spaces	Strengthen good permeability	• Increase the number of accessible routes and entrances • Organization of public transport services
	Strengthen the visual proportions	• Coordinating the construction materials with historical context of district • Observe the sky and make sense of enclosure • Attention to details in district and a coordinated range of urban furniture
	Maintain and strengthen the identity and sense of place	• Preserve and enhance significant and evocative areas • Avoid the sameness of modern city development • The creation of urban open spaces with walking priority
	Creating a variety of land uses	• Place various mixed-use places for integration of activities and users • Predict areas for ceremonies and special activities • Create a visual connection between spaces and activities
	Promote the organized urban governance	• Organized complexity makes city midway between chaos and boringness[1] • Increase the sense of security via applying effective governance manners • The strengthening of network access with respect to hierarchy of road • Well-planned public facilities with comfortable serving radius provided in public spaces eg. public toilets, solid waste collection points, other basic infrastructure, etc.
	Establish and strengthen the flexibility	• Activate the edges and make effective use of the mobility and vitality • Ground floors of buildings are encouraged to have more mixed-use activities

1 The School of Life, founded by Alain de Botton

Kigali is working towards a 24hour city promoting mix of uses in all urban centres and public transit corridors where different scales and cost range of commercial activities can co-exist. The mixed use centres can create vibrant places and vibrant economies enabling people to carry out a number of activities in one location.

Imagery: Mixed Use Development with BRT Corridor

Imagery: Mixed Use Development - Kigali Heights

12.3 Local Identity Development

A distinct urban character can be achieved through development of specific heritage conservation and urban design strategies. The key approach to develop areas with distinct local character are as below:

- Identify key historical buildings and Planning Areas in the city for conservation;
- Retain and reinforce the existing built fabric of key identified areas as Special Planning Areas;
- Recognize and allow existing activities which give the identified areas its special character and sense of place;
- Retain existing landmarks and develop new urban landmarks in the City;
- Develop more public spaces for social gatherings;
- Retain the unique landscape and terrain and optimize it as special attractions;
- Develop new urban attractions; and
- Develop urban design plans for key areas in the city

The natural, cultural, heritage and key built features in the city are proposed to be enhanced by providing them with roles that will make them identifiable attractions in the city. These features will become the key attractions in the city for tourists as well as locals. Along with being entertainment and recreational destinations, the local character of the city also needs to be maintained and developed to create a sense of belonging for the residents.

To showcase City's identity and character and highlight as well as develop the local character of places, the city needs to focus on developing:

- Special Planning Areas comprising of heritage and urban Planning Areas;
- Unique landmarks comprising of historical buildings , cultural/ religious buildings and/ or other urban icons;
- Distinctive streetscapes comprising of streets with special character;
- Attractive public places comprising of special urban plazas; and
- Special city attractions comprising of regional recreational and tourism destinations

12.3.1 Special Planning Areas

Areas with potential heritage value and unique urban character are proposed to be developed as special Planning Areas with special guidelines. Such areas are mainly categorized as:

- Heritage Planning Areas; and
- Special Urban Planning Areas

Heritage Planning Areas

Heritage plays an important role in creating a sense of identity. It creates a link to the past providing lessons, and in connecting tangible and intangible narratives of places. Heritage forges a common understanding and bond of shared experiences. The built and physical heritage in Kigali represents the collective memory of the people. If erased this will create a vacuum that will be a loss to the society as a whole.

The fast pace of change in the city threatens the old built-up areas as these are being replaced by more financially profitable structures. Similarly, there is a threat to the natural environment heritage and the cultural heritage. Urban Design and Heritage Conservation Strategy (in section 12.5) play a key role in ensuring that developments respond better to the surrounding context, particularly in heritage areas. This is especially true in today's context where heritage and old parts of the city comes in conflict with development pressures.

Special heritage Planning Areas with strong architectural and urban character need to be identified. These Planning Areas could be areas that are heritage districts, cultural areas, religious areas, markets, or traditional settlements.

Some of the areas proposed as Heritage Planning Areas include the Urukundu Potter's Village at Kacyiru, Muslim Quarter at Nyamirambo, etc. The heritage significance may range from important local feature to a streetscape or facade representing a period in history. A detailed heritage study is recommended to identify more of such potential areas to be retained as Heritage Planning Areas that reflect local character and special identity of the City (in section 12.5).

Imagery: Rwanda's Vernacular Architecture

Imagery: Rwanda's Natural Landscape

Imagery: Kigali Genocide Memorial

Imagery: Urukundu Potters Village at Kacyiru

Imagery: Paroisse Regina Pacis Remera

Imagery: Kigali Urban Streetscape

Heritage is not limited to the historic built form, monuments and other physical artefacts and can extend to the nonphysical elements such as community traditions, performing arts, rituals, and festive events which is unique and not replicated elsewhere. Every effort should be made to preserve them so that they represent Kigali in terms of city image. Cultural heritage is community based; it is not solely inherited tradition, but can also be contemporary urban or rural practices. It is recommended to foster this intangible heritage by recognizing them as unique communities which represent the unique characters of the city. Areas identifiable with such communities can be defined as heritage Planning Areas.

Further recommendation for heritage in Kigali are as below:

- Identification and classification of heritage assets as per categories;
- Development of heritage regulations and policies;
- Development of proper incentives and benefits for owners of such heritage districts;
- Provision of infrastructure and guidelines to support heritage assets;
- Establishment of heritage management body; and
- Implementation of government initiated heritage pilot projects

Special Urban Planning Areas

Kigali is planned to have hierarchy of multiple centres around the City and along the proposed transit corridors. These nodes shall have high quality developments, which are compact, walkable, and mixed use in character. These centres are proposed to be transit oriented developments well integrated with the transportation station. These urban centres should be developed to have a distinctive urban character. Nyabugogo Market Planning Area, Kimironko Market Planning Area, Gakinjiro Market Planning Area, etc are some of the urban areas proposed to be developed as special urban Planning Areas. Similarly, the new regional and town centres are also recommended to be developed as urban Planning Areas with special character.

Some of the strategies for the special urban Planning Areas are:

- Creation of seamless transportation experience through urban design strategies that promote better integration of developments and improved pedestrian connections;
- Provision of development guidelines to promote better street edge character and more compact development;
- Promotion of mixed use development for more variety of uses and vibrant urban character;
- Development of pedestrian friendly environment and attractive features with retail at street level to create lively urban environment; and
- Provision of organized car parking that is well integrated with the development to reduce traffic congestion

12.3.2 Unique Landmark

A landmark gives a strong urban character and an immediate recognition to the City. Landmarks enhances City's skyline and helps to distinguish one city from the other. Landmarks also help to create sequential experience while traversing the city. Landmarks are focal points and node in this sequence which gives a sense of arrival to the place. Landmarks could be historical buildings, monuments, civic and cultural buildings, or other special iconic urban buildings. Kigali has some of such iconic landmarks and local features which help to orient the visitor's better in the city. These landmarks include Genocide Memorials, Museums, Kigali Convention Centre, etc.

While the existing landmarks in the City need to be enhances, it is also important to introduce new land marks in the City. The new landmarks will help create distinct City identity especially for new urban areas in the city and provide the reference points. An exciting urban skyline can be achieved for Kigali City through introduction of unique and recognizable landmarks on the undulating terrain complementing its foreground of wetlands and backdrop of hills. At the moment, the proposed landmark feature include Reconciliation Garden and more of these landmark sites will be identified at detail planning stage.

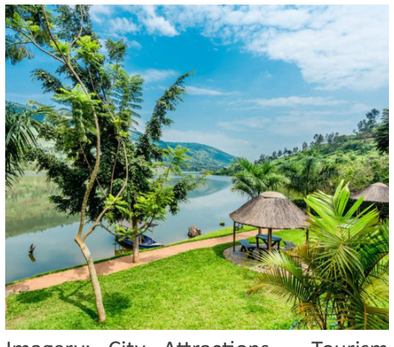
Imagery: Special Urban Planning Areas - Kimironko Market Planning Area

Imagery: Special Urban Planning Areas - Gisimenti Planning Area

Imagery: Unique Landmark - Kigali Convention Centre

Imagery: Attractive Public Places - Open Space at CBD

Imagery: City Attractions - Kigali Cultural Village



Imagery: City Attractions - Tourism Development at Lake Muhazi

Some of the strategies for developing landmarks are:

- Identification of strategic locations for potential landmarks; and
- Promote State-of-the-Art development in these sites through international design competitions

12.3.3 Vibrant Streetscapes

An excitement in a City-life is demonstrated by the walkability of the City. Variety of street scales and character, from grand to intimate will create a better sense of orientation across the city. New boulevards, shaded shopping streets, seamless pedestrian networks, and vibrant heritage streets all provide character and variety in experiencing the city. Such streetscapes help in creating a more human city.

Nyaburongo Avenue, Airport Boulevard, Kimironko Market Street, Kabuga Market Street and Nyandungu Recreational Project are some of the potential areas identified as distinctive streetscapes that will enhance the City's identity.

Some of the key steps to creating better streets for Kigali are:

- Improve design of streets to become social spaces for communities than just corridors for movement;
- Prioritize on improving the pedestrian experience as opposed to private vehicle;
- Add human scale features and visual richness in local streets;
- Allow activity generating uses with friendly street edge in Streets around transit nodes; and
- Introduction of street planting and landscaping plans

12.3.4 Attractive Public Places

Kigali has many natural assets like wetlands and forests, however lacks urban public open spaces in the City. New public places and urban open spaces such as urban plazas and squares provide not only relief spaces in the urban areas but also improves the experience of the city. These imaginative new urban places create a more livable city. CBD and Kimironko Market Plaza are some of the potential urban plazas identified as urban open space that can be developed to create a distinct urban identity.

Some strategies to create distinctive landscapes are:

1. Identification of sites for attractive public places;
2. Development of variety of attractive & distinctive urban parks and plazas with unique features and activities;
3. Requiring private developers to provide for iconic public spaces through incentive zoning tool;
4. Reserve common open space from land consolidation tool contributed by individual landowners; and
5. Promotion of public art in public spaces

12.3.5 City Attractions

Currently, Kigali has limited regional tourist attraction within the City. Cultural Village near Juro Park is under construction. There is proposal for a large tourism area proposed near Lake Muhazi. The Lake Muhazi Tourism Area is recommended to include water based theme parks in the tourism programme as a new recreational destination.

New additional attractions will continually refresh the identity of the City and will make the City an exciting destination for the locals as well as regional visitors. The Tourism Corridors have been proposed by the Tourism Strategy (in section 12.4). This has identified the key tourism attractions for the various areas of Kigali. Amongst these some are new City attractions. Some of the city attractions proposed are the Botanical Garden, Wetland - Biodiversity Park, Eco-Bird Park, Horticulture Park, Forest Adventure Parks etc optimizing the natural landscape. Some of these parks are proposed to be developed as integrated resort parks. Other attractions include the heritage Planning Areas with variety of cultural activities attached.

Some of the key strategies to develop these attractions are:

- Safeguard land for regional attractions;
- Create variety of attractive destinations that makes the City distinct; and
- Facilitate private sector/ international investors to develop such destinations

12.4 Tourism Development Strategy for Kigali City

12.4.1 Rwanda Sustainable Tourism Development Master Plan

The "Rwanda Sustainable Tourism Development Master Plan" (STMP, 2009) was conceived, aiming at developing and positioning Rwanda as a major tourism and regional conference hub for Central and Eastern Africa. Since 2009, significant progress has been made, piloted by the Tourism and Conservation Department of the Rwanda Development Board (RDB), in developing and promoting Rwanda's product base along the strategic lines established by the master plan, in conserving and safeguarding iconic animals, developing alternative nature based tourism and eco-tourism, diversifying tourism products and sharing Rwanda's cultural and natural heritage with the world. However, tourism potential is still not fully realised and much still needs to be done in order to achieve the Government's long-term vision.

STMP 2009 was revised in 2015 to appraise results so far and review strategies to meet new national targets pertinent to tourism. The revised STMP 2015 Strategies are grouped into six pillar areas, named after the following six imperatives selected for successful tourism development namely:

1. Ensure an appropriate institutional and legal framework;
2. Improve visitor experience;
3. Expand the product base;
4. Provide the necessary infrastructure and superstructure;
5. Provide marketing and branding of the destination; and
6. Ensure sustainability across the whole strategy

The Revised STMP 2015, further develops the "hub and spokes" tourism development concept set forth by STMP 2009 where the spatial organization of tourism in Rwanda has been articulated around seven DMAs, each encompassing one or more districts. While Kigali has been identified as the central tourism hub from which tourism corridors (spokes) and trails will link to the rest of the country (Figure 12.1), the DMAs have been identified with a "flagship" theme/ project to spread the benefits of tourism across the whole country by celebrating diversity in a way that should engage the interest of the international marketplace. STMP 2015 also identifies nationwide "national initiatives" for tourism and three tourism corridors with focus on eco-agro, scenic and community tourism.

Following are the key tourism products:

1. National Initiatives;
2. Kigali Hub;
3. Volcanoes DMA;
4. Rubavu DMA;
5. Karongi DMA;
6. Nyungwe DMA;
7. Heritage DMA;
8. Muhazi DMA;
9. Akagera DMA;
10. Eco-Agro Corridor (Kigali – Volcanoes);
11. Scenic Corridor (Kigali – Kibuye); and
12. Community Corridor (Nyungwe – Rubavu/ Gisenyi)

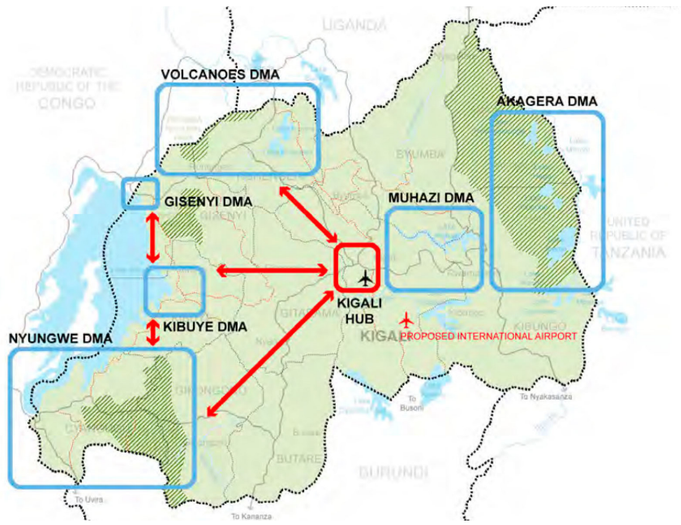


Figure 12.1 Kigali is the main Hub of 7 other Destination Management Areas (DMA)

12.4.2 Proposed Key Tourism Development Corridor for Kigali

Kigali master plan has mapped out a forward looking urban development strategy with key emphasis on the existing city center, transit oriented development and limiting urban development to less than 35% of the available land. The concept focused on new developments in green field areas, while intensifying th-e inner city area surrounding CBD through regeneration. Due to the hilly terrain in Gasabo district and parts of Nyarugenge District, the master plan emphasizes more extensive development to the center and south of Kigali. In the hilly areas, due to terrain constraints, the master plan focuses more on rural development, agriculture and environment protection strategies.

Kigali is the first destination to Rwanda. To further strengthen the master plan concept, Kigali tourism development should focus on providing diversified tourism products that are well served by roads instead of dispersed independent development. The clustering of tourism products will make it easier for service providers to organize, manage and regulate. The collected effort will result in improved service quality and achieve a better tourism satisfaction.

In light of this concept of creating tourism clusters in Kigali, four major tourism development corridors were proposed in Kigali Master Plan 2013, with each of them focusing on a distinct market segment. (refer to Figure 12.2) In Kigali Master Plan 2019, the objective of tourism development corridors will be maintained. Meanwhile, the Revised Sustainable Tourism Master Plan of 2015 suggests the 5-Year Product Diversification Action Plan for Kigali in Table 12.3. These tourism products will be prioritized to adopt and incorporated in the Tourism Development Strategy for Kigali.

Urban Culture Corridor

Spanning over key areas in the city center, the Urban Culture Corridor is not only an opportunity to showcase the new city image, but also a chance to highlight the rich Rwandan culture. It is usually the first destination for visitors before making the trip to the National Parks outside the city. It is also the place where locals meet and interact with the visitors. It is a place for first impressions, and a place where different cultures and behaviors fuse.

Therefore, Urban Culture Corridor will focus on developing tourism products that can represent the rich Rwandan culture and history. It should also function as a key transportation node for regional commute. As the city grows, the status of this transit node may need to switch to other locations in order to mitigate traffic pressure.

Key attractions and 5-Year Tourism Product in the Urban Cultural Corridor could include the Kigali Convention Center, Kigali Genocide Memorial Site, Reconciliation Garden and Gallery, Market streets, Kigali Cultural Village (KCV), etc. The character of this area will be more urban with colorful and vibrant streets, pedestrian walkways, and public open spaces.

Table 12.3 5-Year Product Diversification Action Plan for Kigali

Product	Opportunities	Anticipated benefits	Location(s)
MICE Tourism	National convention centre for business and events	National Convention centre attracts international conferences with regional hotels accommodating spinoff smaller events, seminars etc.	Kigali
Kigali Cultural Village		Major flagship attraction in the capital to extend length of stay by international tourists. May also host special events	Kigali
Cultural villages network	Development of network of cultural villages around the country, to share best practice in the preservation, interpretation and presentation of Rwanda's cultural heritage.	Enhanced visitor experience plus opportunities for local economic development	Kigali Cultural Village as lead site Mwima (Nyanza); Kitabi (Nyamagabe)
National Medical Tourism Initiative	cosmetic surgery and dental and eye treatment	Develops new niche market with potential long length of stay plus accompanying family/ friends/ escorts. May stimulate repeat visits	Nationwide but focus on Kigali
National Sports Tourism Initiative	Initial opportunities include soccer, mountain biking, road cycling	Another niche market that can be relatively high spending if national teams/ pro teams are attracted to the destination. Can lead to spin offs via international and national events which attract participants and spectators	Nationwide with focus on Kigali
Contemporary handicrafts product lines – "Treasures of Rwanda"	Work with selected group of craft workers to adopt contemporary designs that add value to existing product lines. Market products through top end lodges and hotels, also airport shop		
Cultural museums	Develop two small, high quality museums: 1: themed on palaeography and early man, linking in with story of emergence of mankind in the Rift Valley 2: themed on political history of the country and resolution of cultural differences	Supports development of cultural tourism to the country, and extends length of stay in Kigali. Also acts as focal point for niche tours of East Africa	Kigali
New hotels	Ensure sufficient sites are zoned for new hotels and that investment incentives are available	Delivers bed spaces required to accommodate projected increase in visitor numbers	Kigali
Nature tourism development at Muhima wetland	Development of wetland tourism resource for birding and fishing	Provides alternative excursion option for tourists overnighting in Kigali	Nyarungenge
Mount Kigali Recreation Facilities	Develop footpaths, viewing points and interpretation facilities	Provides alternative excursion option for tourists overnighting in Kigali	Mount Kigali

Source: Revised Sustainable Tourism Master Plan (STMP) 2015

1. **MICE:** The STMP 2015 is working towards positioning Rwanda as Africa's most interesting business and MICE tourism hub to boost tourism earnings. Investment in improving the MICE product is well underway, centred around the development of the iconic Kigali Convention Centre (KCC). The MICE product shall target at conference and event organisers, incentive tour operators, exhibition organisers, larger companies, major international organisations such as the United Nations, NGOs and many other organisations.
2. **Kigali Cultural Village:** The development of Kigali Cultural Village (KCV) is envisaged to open up new and demand oriented products in the direction of unique cultural and historical heritage, sports and agro-tourism. Most of all, Rwanda possesses a distinguished African heritage, history and social activities a visitor will certainly wish to become familiar with and possibly participate in development and promotion of cultural tourism assets.
3. **Muhima Waterfront development:** Waterfront development is proposed along Muhima wetland north of Kigali CBD. The attractions need to be optimized to create a distinct waterfront with Urban Design measures which shall also improve public open spaces and recreation zones in the city centre.
4. **New Hotels:** Star hotels, "value for money" economy hotels will have presence along this corridor facilitated by different dining and shopping opportunities. The urban and culture corridor is meant to set the image of "quality service" and "unique tourism experience" to travelers.
5. **Infrastructure:** The government has invested heavily in infrastructure including building inter-city roads, renovating the airport, and inking a deal to build Bugesera Airport, 25km outside Kigali. The airport is expected to handle 4.5 million passengers a year, which is seven times the current traffic. The aviation industry is critical to the growth of tourism and hospitality.

Nature Adventure Corridor

The Nature Adventure Corridor is located to the west of Nyarugenge district. It is a hilly area with good connectivity to the city through major highway and arterial roads. The large supply of lush green and interesting terrain makes it the best destination for nature adventure tourism. Along this corridor, travelers can find the most exciting action themed adventure parks that are perfect for group expedition, physical training, and exceptional cultural experiences.

Nature adventure corridor offers a safe and well managed environment for human to explore the nature. The authenticity of nature setting so close to the city is a unique feature for tourists and visitors. Adventure programs such as bicycle tours, horseback riding, fruit picking, hiking etc will be incorporated within the Nature Adventure Corridor.

Key attractions and 5-Year Tourism Product in the Nature Adventure Corridor will be concentrated on Mount Kigali and Mount Jali. Kigali lies between the two mountains of Mount Kigali and Mount Jali. The city takes its name from Mount Kigali which is one of the highest hills in Kigali. One can hike to the mountain to get abundant views of the city and thus it has great potential for developing recreation facilities around adventure tourism and eco-tourism.

Eco-Wetland Corridor

The Eco-Wetland Corridor refers to the south periphery of Kigali. The site covers a large area of natural wetland, and functions as one of the main features in the city's green network. It is the backyard garden for Kigali, and will bring about a good mix of both aesthetic and economic value to the city.

It is a good place for a weekend getaway for local residents and eco-tourism lovers to experience the unique wetlands of Kigali City. A botanic garden is also proposed which besides being a showcase of Rwanda flora will also be an attractive destination for hosting live performance and culture shows.

The bio-intensive method of introducing floral farming will reduce environmental degradation as well as protect the wetland zones. The lucrative export industry of floriculture can be a new value added agroindustry that also supports tourism by transforming the area into a recreational destination. Besides being a valued employment generator, the Nyandungu Recreational Project will create a lively visual treat to urban dwellers and visitors and make a lasting impression. The corridor will

also have many wetland corridor parks and cycling routes connecting many local residential neighborhoods.

Agro Community and Waterfront Development Corridor

Located on the north of Kigali and surrounded by the rolling hills of Gasabo district, the agro and community themed development is a true escape from the bustling city life. Accessed by the scenic drive through the hills, the journey of commute itself becomes part of the adventure.

Community based tourism enables the tourist to discover local habitats and wildlife, and celebrates and respects traditional cultures, rituals and wisdom. The community will be aware of the commercial and social value placed on their natural and cultural heritage through tourism, and this will foster community based conservation of these resources.

The clustering of community tourism, offers a “staged authenticity” that helps to preserve the social values. The themed establishment is closely associated with the authentic regions that interest tourists. It can also offer a genuine impression to tourists of the social establishment of the region. Villagers are able to seek employment in tourism industry closed to their homes and keep their usual occupation, normally as farmers, at the same time. The key focus of the community tourism area will be the Royal Heritage Parks, which is at close proximity to Lake Muhazi.

Lake Muhazi waterfront is a designated area for tourism development. Approved projects include Lake Muhazi Golf and County Resort, the Seeds of Peach Center, and other resort development. Muhazi shorefront is also the main access to Akagera National Park. It provides travelers a variety of lake activities such as boating, fishing and bird watching. It will be a place to retreat from the busy urban lifestyle to enjoy the tranquility of the lake and nature.

Special Tourism Products

The city of Kigali is also exploring development of new tourism products like Health City, Education City, Sports City to improve footfall of tourists coming to the city to get state of the art health treatments or higher education within the East African region or even develop state of the art sports facilities to host national and international sports events. This shall also improve quality of social infrastructure within the city of Kigali.

Key 5-Year Special Tourism Product in Kigali shall include:

1. Gahanga Sports Hub can host either international sports event and local indoor and outdoor activities;
2. Health City in Masaka provides accommodation and niche market for accompanying family/ friend/ escort to stay and live; and
3. University near Lake Muhazi to be part of the program as a tourism and education town in the north of Kigali

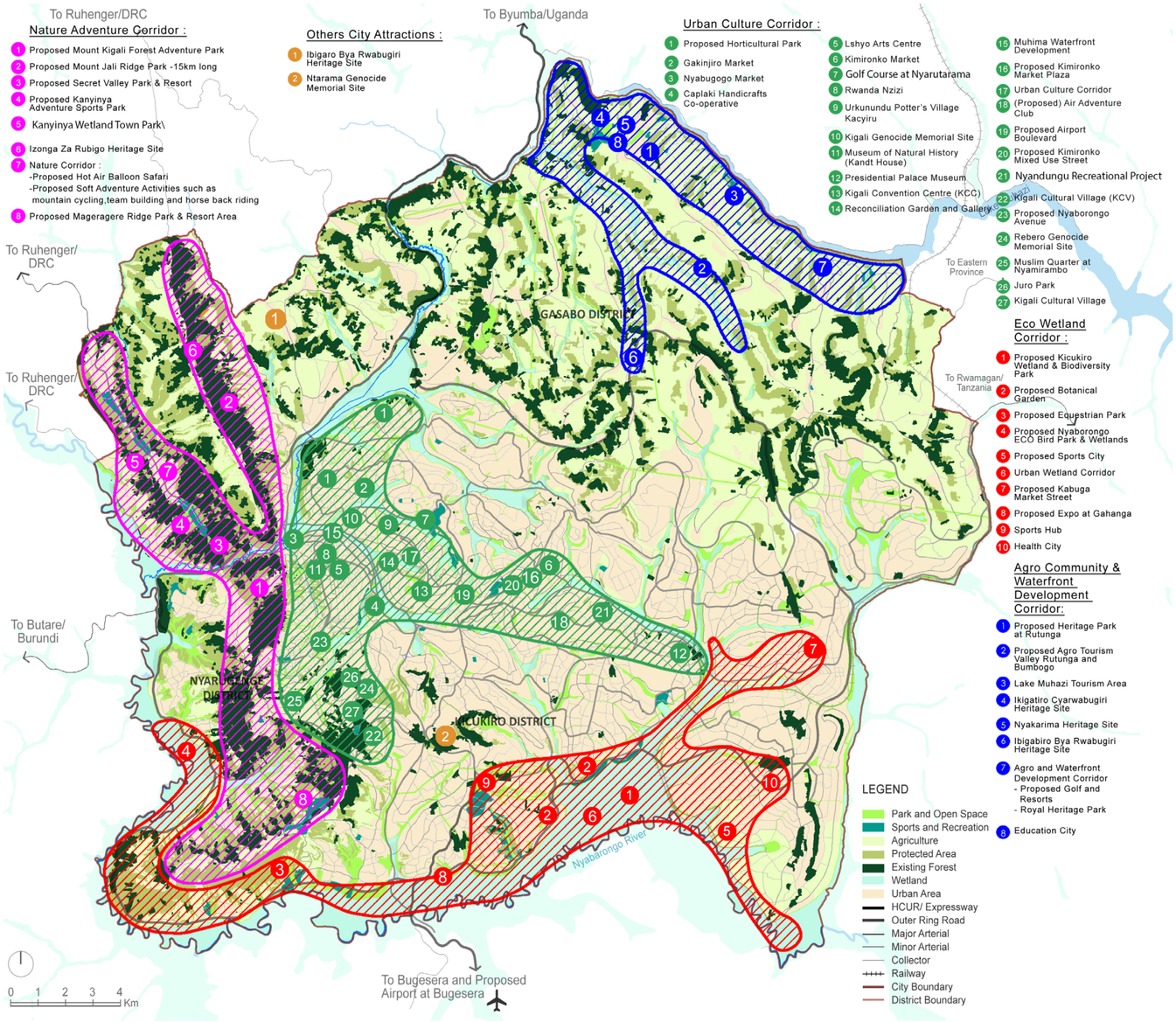


Figure 12.2 Kigali Tourism Development Strategy

12.5 Kigali Culture and Heritage Assets

Introduced as Heritage Planning Areas in section 12.3, heritage plays an important role in creating a sense of identity. It creates a link to the past providing lessons, and in connecting tangible and intangible narratives of places. Areas with historic built form, monuments, physical artefacts as well as intangible cultural heritage are proposed to be named as heritage Planning Areas along with special planning regulations.

In definition, the places and structures of heritage value shall reflect the following values:

1. **Aesthetic:** reflected in design, style, construction and age;
2. **Historical:** influenced by the historic event, phase or activity;
3. **Social:** where buildings and structures have become a focus for spiritual, political or national cultural sentiment; and
4. **Technological:** the degree to which a building, structure or monument reflects the technology available at the time of construction

Identified by heritage values, the list of heritage and cultural assets in Kigali will be illustrated in Figure 12.3.

12.5.1 Heritage conservation and promotion overlay

In the effort to protect and promote the heritage and culture assets, Kigali 2019 Zoning Plan has created Heritage Conservation and Promotion Overlay applicable to all identified places of heritage significance such as buildings, sculptures, structures, landmarks, tombs, and historical sites of national or local significance.

Kigali should develop a heritage strategy to manage its wide variety of assets. This heritage strategy should be an integral part of the urban development framework. As the city gears towards rapid urbanization, it should take stock, identify the heritage assets, and develop policies and incentives to promote heritage conservation and management. There is a need to develop a system to classify and grade heritage assets and develop appropriate heritage regulations, policies and incentives to manage them. A dedicated urban design & heritage conservation division should be part of the city's planning department This division will play the pivotal role in managing the cities heritage assets and deal with the related urban developments.

Planning permit/approval from CoK shall be required for the use, restoration and development of heritage sites, including land subdivision, demolition or removal of part of a building, external alteration of a building (including painting), displaying signboard etc. The assessment of the applications shall be based on the heritage guidelines (prepared at the National level) and heritage management plan (to be prepared by the CoK in coordination with relevant heritage conservation authorities).

In case of restoration and development of these sites of heritage value, CoK in coordination and assessment with relevant stakeholders and in line with the heritage guideline/management plan, may offer grants or loans or an incentive package to motivate the property owners towards conservation.

Any development that takes place within and in immediate surrounding of the heritage site shall happen in a manner that is appropriate to the significance, character and appearance of the heritage area.

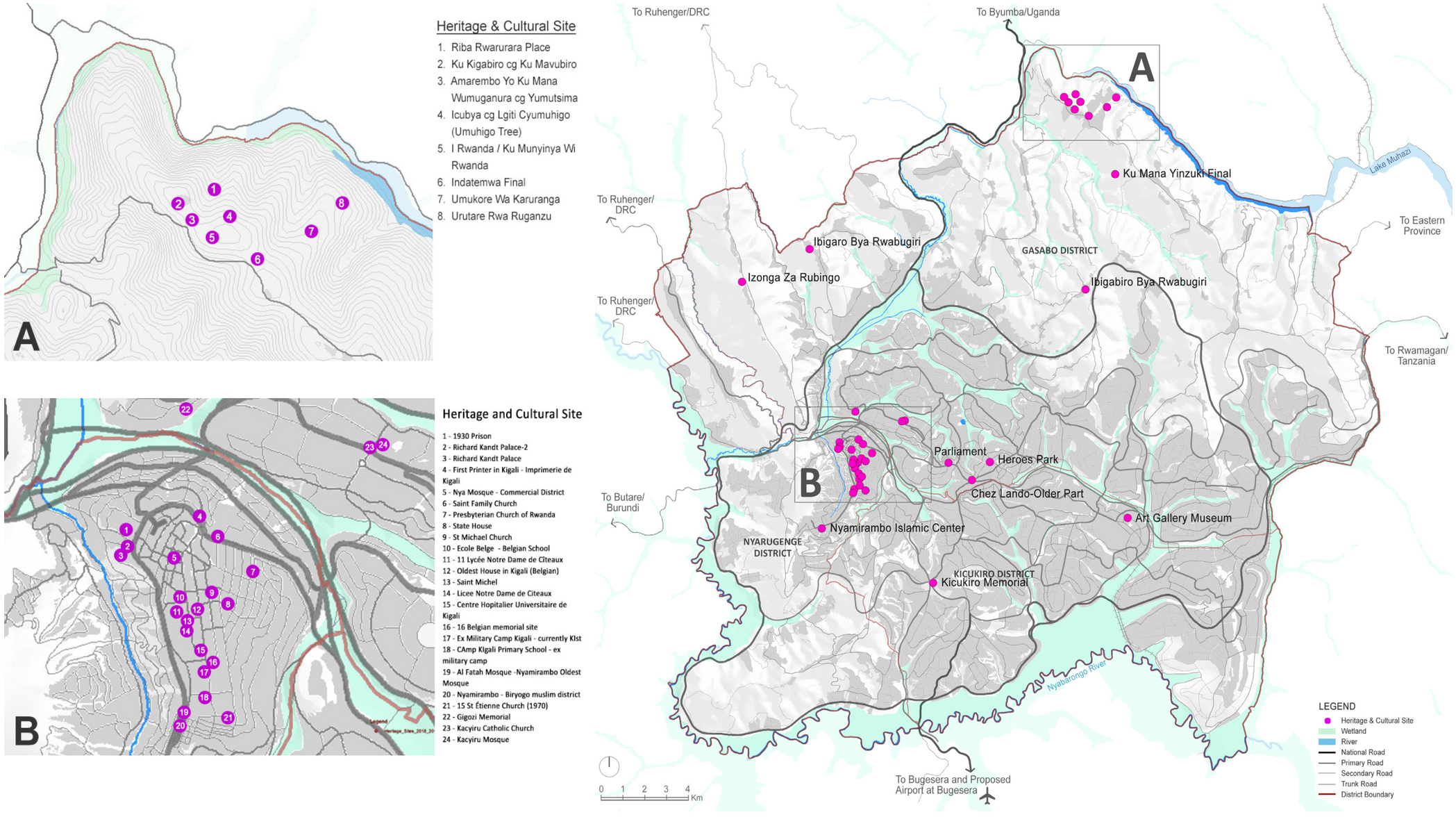


Figure 12.3 Location of Heritage and Cultural sites in Kigali

13

Kigali Phasing Plan

13.1 Phasing Development
13.2 Broad Land Requirements by Phasing
13.3 Phasing 1 Development (2019-2024)
13.4 Phasing 2 Development (2025-2031)
13.4 Phasing 3 Development (2032-2038)
13.4 Phasing 4 Development (2039-2045)
13.4 Phasing 5 Development (2046-2050)

13 Kigali Phasing Plan

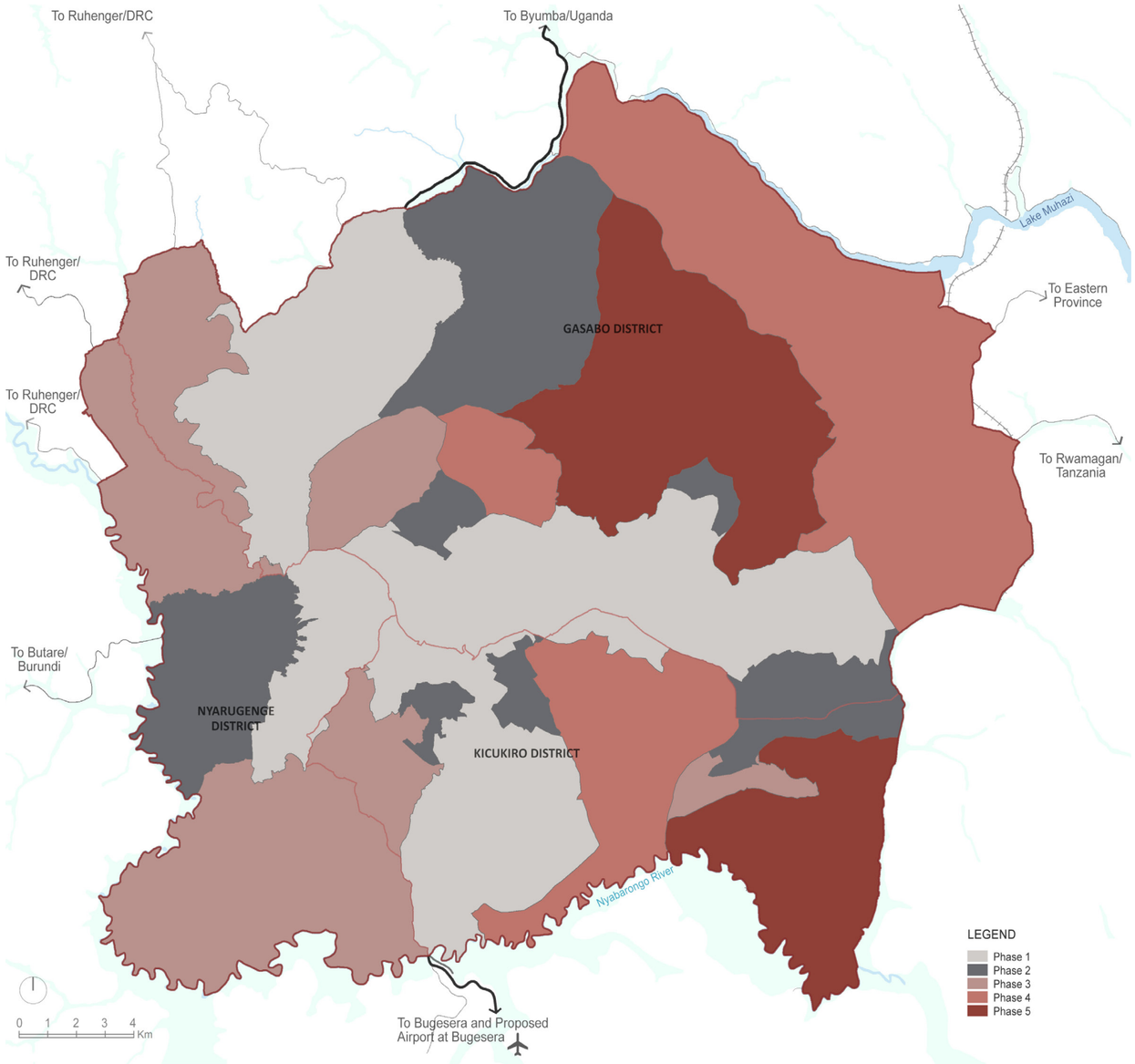


Figure 13.1 Kigali Master Plan 2019 - Proposed Phasing Plan

13.1 Phasing of Development

The phasing plan is a key tool for the implementers to prioritise development in a particular area of the City, and source adequate funding to finance the project. It also helps in facilitating a compact development of the city, limiting the sprawl. It provides the government, community, and donors/ financers with rationale to prioritize infrastructure and associated urban services to incrementally develop in a phased manner.

Referring to Kigali Master Plan Zoning Regulations 4.2, phasing regulations can be applied to all zones/areas covered in the Proposed Kigali Zoning Plan 2050. City of Kigali (CoK) shall initiate and carry out the implementation of the master plan according to the phasing plan. Meanwhile, CoK shall prioritize and publicize the 7- Year Development Programme with financial plans. The sequencing of development according to the phasing plan shall require flexibility that is responsive to the market demands. The provision of infrastructure and services planning shall be carried out incrementally and align with 7-year Development Programme. However, each phase shall contain adequate infrastructure and other public facilities to allow the phase to stand on its own without depending on the development of subsequent phases. The prioritization of developmental activities within each phase shall consider, any relocation of people, land management approaches, funding availability, and relevant policies and legislation, that maybe required. The legal agreement and exemption for the phasing plan development shall be referred to the Zoning Regulation report.

Kigali Master Plan is proposed to be demarcated into five phases to allow incremental development in the city in line with the market demand (Figure 13.1). The amount of land allocated for each phase (Table 13.1) is driven by Kigali Broad Land Requirement established to respond to the needs of the projected population and employments in phases. The key factors and considerations for phasing demarcation will include:

1. 7- Year Development Programme;
2. Catalyst Programme and Implementation Projects;
3. Priority areas in redevelopment of unplanned settlements; and
4. Priority areas in development of Sites and Services Areas;

The planning in different phases is elaborated in the following sections.

Table 13.1 Land area by phases

Phase	Area (sqkm)	% Completion
Phase1	197.9	27
Phase2	108.4	42
Phase3	142.3	61
Phase4	165.5	84
Phase5	115.5	100
	729.6	100

13.2 Broad Land Requirements by Phasing

Following the same rationale elaborated in Section 4.4 Broad Land Requirements in Chapter 4, phase wise broad residential land requirement is estimated (Table 13.2). Based on the population projection for the proposed phases, affordability study, housing need from IPAR , a series of housing share for different residential zones have been proposed and computed to meet the overall demand and broad land requirement for perspective residential zones have been calculated to guide the planning in proposed phases.

The provision of total commercial space in different phases is derived from IPAR's phase wise employment projection in the services sector with commercial space distribution in different employment nodes (by hierarchy of commercial space) guided by IPAR's Commercial Real Estate Study (Annexure II). A series of commercial share for different commercial zoning have been proposed and computed to meet the overall demand and broad land requirement for perspective commercial mixed use zones have been calculated in phase-wise manner (Table 13.3).

Similarly, taking account of IPAR's employment projection in industrial sectors , phase wise broad industrial land requirement has been estimated (Table 13.4).

Table 13.2 Broad Residential Land Requirements for Phasing: Housing Composition

	Housing Share	Density Share	Projected Dwelling Units					PROJECTED DU (2050)	NET Density (DU/HA)	GROSS DENSITY DU/HA	Residential Land (HA)BY PHASING				
			2024	2031	2038	2045	2050				2024	2031	2038	2045	2050
R1	2.6%	29% Low density	11,958	14,747	21,796	25,336	25,522	25,522	15	10	1,196	1,475	2,180	2,534	2,553
R1A	11.9%		39,304	59,486	78,643	92,067	117,457	117,457	30	20	1,965	2,974	3,932	4,603	5,873
R1B	14.2%		39,916	78,066	87,135	113,002	140,333	140,333	70	40	998	1,952	2,178	2,825	3,508
R2	17.9%	71% medium to High density	71,031	96,221	114,776	167,820	176,454	176,454	100	60	1,184	1,604	1,913	2,797	2,941
R3	29.6%		107,594	153,416	195,750	231,343	291,895	291,895	90	50	2,152	3,068	3,915	4,627	5,838
R4	13.5%		69,307	83,459	92,936	125,517	133,210	133,210	120	80	866	1,043	1,162	1,569	1,665
C1	7.1%		50,678	55,139	57,244	63,582	69,757	69,757	110	77	658	716	743	826	906
C3	3.1%		19,204	20,359	23,358	25,660	31,022	31,022	100	70	274	291	334	367	443
Total	100%		408,992	560,893	671,638	844,327	985,650	985,650			9,294	13,124	16,358	20,148	23,728

Table 13.3 Broad Commercial Land Requirements for Phasing: Commercial Composition

Zone	Types	Share	Projected Employment					employment	SQM per person	FAR	Commercial Land (HA) by phasing				
			2024	2031	2038	2045	2050				2024	2031	2038	2045	2050
C1	Mixed Use Commercial	30.35%	210,619	229,157	237,907	264,249	289,912	289,912	15	1.6	282.07	306.90	318.62	353.90	388.27
C3	CBD, Town Level	34.65%	204,886	217,208	249,210	273,764	330,966	330,966	15	2.4	182.94	193.94	222.51	244.44	295.51
O-C2 OVERLAY,MIXED USE RESIDENTIAL IN R2,R3, & R4	Neighbourhood Level	35.00%	136,792	184,461	224,156	290,098	334,336	334,336	15	1.4	221.16	300.80	367.88	473.32	549.69
TOTAL		100.00%	552,297	630,826	711,273	828,111	955,214	955,214			686.17	801.64	909.01	1,071.65	1,233.47

Table 13.4 Broad Industrial Land Requirements for Phasing: Industrial Composition

Zone	Types	Projected Employment from IPAR					FAR	Commercial Land (HA) 2024	Commercial Land (HA) 2031	Commercial Land (HA) 2038	Commercial Land (HA) 2045	Commercial Land (HA) 2050
		2024	2031	2038	2045	2050		2024	2031	2038	2045	2050
I1	Light industrial zone	117,480	15	201,579	240,345	246,184	15	1.6	641.30	807.65	1,100.38	1,100.38
I2	General industrial zone	44,169	44,169	44,169	44,169	44,169	15	2.4	415.72	415.72	415.72	415.72
I3	Mining/ Extraction/Quarry	3,740	3,740	3,740	3,740	3,740	15	1.4	35.21	35.21	35.21	35.21
TOTAL		165,389	47,924	249,488	288,254	294,093			1,092.23	1,258.58	1,551.31	1,551.31

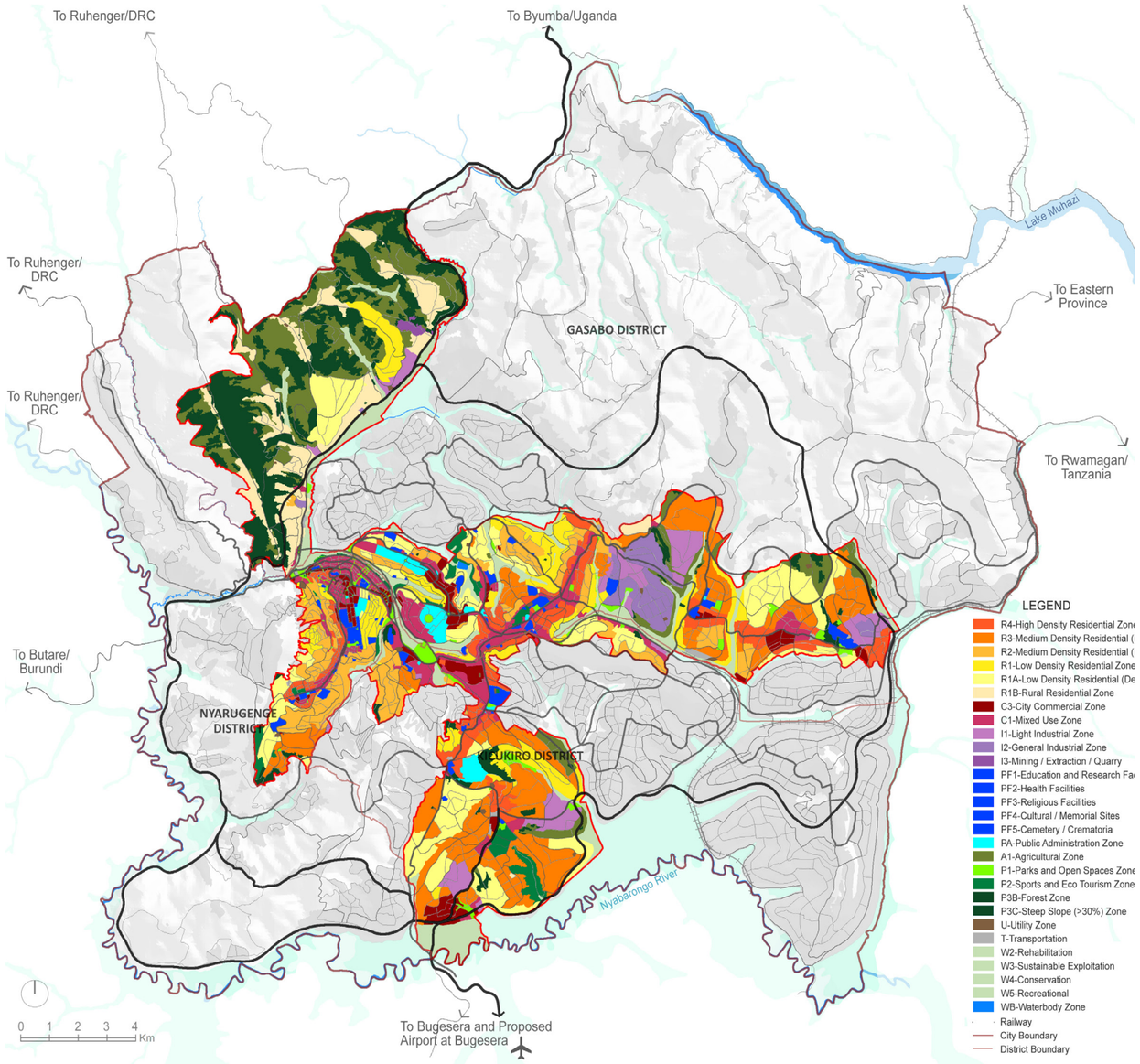


Figure 13.2 Kigali Master Plan 2019 - Proposed Phase 1

13.3 Phase 1 Development (2019-2024)

Supported by quantum of broad land requirement for different zones under housing, commercial and industry, Phase 1 development boundary and land use distribution are suggested to follow priority areas and projects:

1. Strengthening of existing CBD City core area;
2. Strengthening the existing and fragmented commercial mixed use corridors along the proposed BRT lines 1&2 as part of phase 1;
3. Strengthening the existing and upcoming mixed use commercial nodes along the BRT corridors - The Civic and Commercial development at Kigali Business Centre (KBC), the upcoming mixed use commercial development at fringe centres in Kimironko and Nyamirambo;
4. Further consolidating industries in existing SEZ phase 2 and 3. Encouraging polluting industries along the wetlands in Gikondo and other areas in Kigali to move to the SEZ;
5. Establish affordable housing around the SEZ with social infrastructure to promote Integrated industrial development;
6. Development of the Airport Expressway and mixed use commercial areas along the route to the new airport.
7. Development of upcoming Gahanga light industrial estate and regional centre as an employment node along the airport expressway.
8. Land consolidation for affordable housing development (sites and services) in Gahanga and Ndera supporting the employment centres;
9. Development of Airport Boulevard;
10. Tourism development in Mount Jali; and
11. Land consolidation for rural settlements and farmlands in Jali and Jabana

Table 13.5 Proposed Kigali Phase 1

Phase 1 - Proposed Zoning		Area (sqkm)
Agriculture zone	A1	22.0
Mixed use zone	C1	9.5
City commercial zone	C3	4.4
Light industrial zone	I1	6.4
General industrial zone	I2	4.2
Mining/ Extraction/Quarry	I3	0.4
Parks and open spaces zone	P1	3.2
Sport and Eco tourism zone	P2	3.4
Forest zone	P3B	15.7
Steep slopes (> 30%) zone	P3C	5.8
Public Administration zone	PA	2.5
Education and research facilities	PF1	2.0
Health facilities	PF2	0.6
Religious facilities	PF3	0.4
Cultural/ memorial sites	PF4	0.0
Cemetery/ crematoria	PF5	0.6
Low density residential zone	R1	11.8
Low density residential densification zone	R1A	20.3
Rural residential zone	R1B	9.6
Improvement zone	R2	**12.7**
Expansion zone	R3	**22.6**
High density residential zone	R4	9.2
Transportation zone	T	15.7
Utility zone	U	0.4
Rehabilitation	W2	6.0
Sustainable Exploitation	W3	3.7
Conservation	W4	3.2
Recreational	W5	1.6
Waterbody zone	WB	0.1
Total Area		198.0

13.4 Phase 2 Development (2025-2031)

As subsequent development of Phase 1, Phase 2 development boundary and land use distribution are suggested to follow priority areas and projects:

1. Development of mixed use regional centre at Ndera as an employment centre supporting growing population surrounding the SEZ;
2. Strenghening the upcoming fringe centre at Kicukiro supporting the CBD with mixed use commercial development;
3. Integrated industrial development in Rusororo Industrial Estate including heavy and light industry;
4. Integrated industrial Development of Masaka Industrial Estate including proposed Kigali Logistics Platform (KLP) as one of the major infrastructure developments in Kigali to boost the logistics sector and overall city economy;
5. Development of civic corridor along BRT network and redevelopment of unplanned settlements in Kacyiru;
6. Tourism development in Mount Kigali;
7. Planning Area development in suburban sector Kigali; and
8. Land consolidation for rural settlements and farmlands in Nduba

Table 13.6 Proposed Kigali Phase 2

Phase 2 - Proposed Zoning		Area (sqkm)
Agriculture zone	A1	22.3
Mixed use zone	C1	1.0
City commercial zone	C3	0.3
Light industrial zone	I1	1.7
Parks and open spaces zone	P1	1.5
Sport and Eco tourism zone	P2	1.9
Forest zone	P3B	13.9
Steep slopes (> 30%) zone	P3C	8.1
Public Administration zone	PA	0.1
Education and research facilities	PF1	0.1
Health facilities	PF2	0.2
Religious facilities	PF3	0.0
Cemetery/ crematoria	PF5	0.3
Low density residential zone	R1	2.6
Low density residential densification zone	R1A	10.4
Rural residential zone	R1B	9.6
Improvement zone	R2	4.6
Expansion zone	R3	9.7
High density residential zone	R4	1.9
Transportation zone	T	5.3
Utility zone	U	0.6
Rehabilitation	W2	3.5
Sustainable Exploitation	W3	4.5
Conservation	W4	3.9
Recreational	W5	0.2
Waterbody zone	WB	0.2
Total Area		108.4

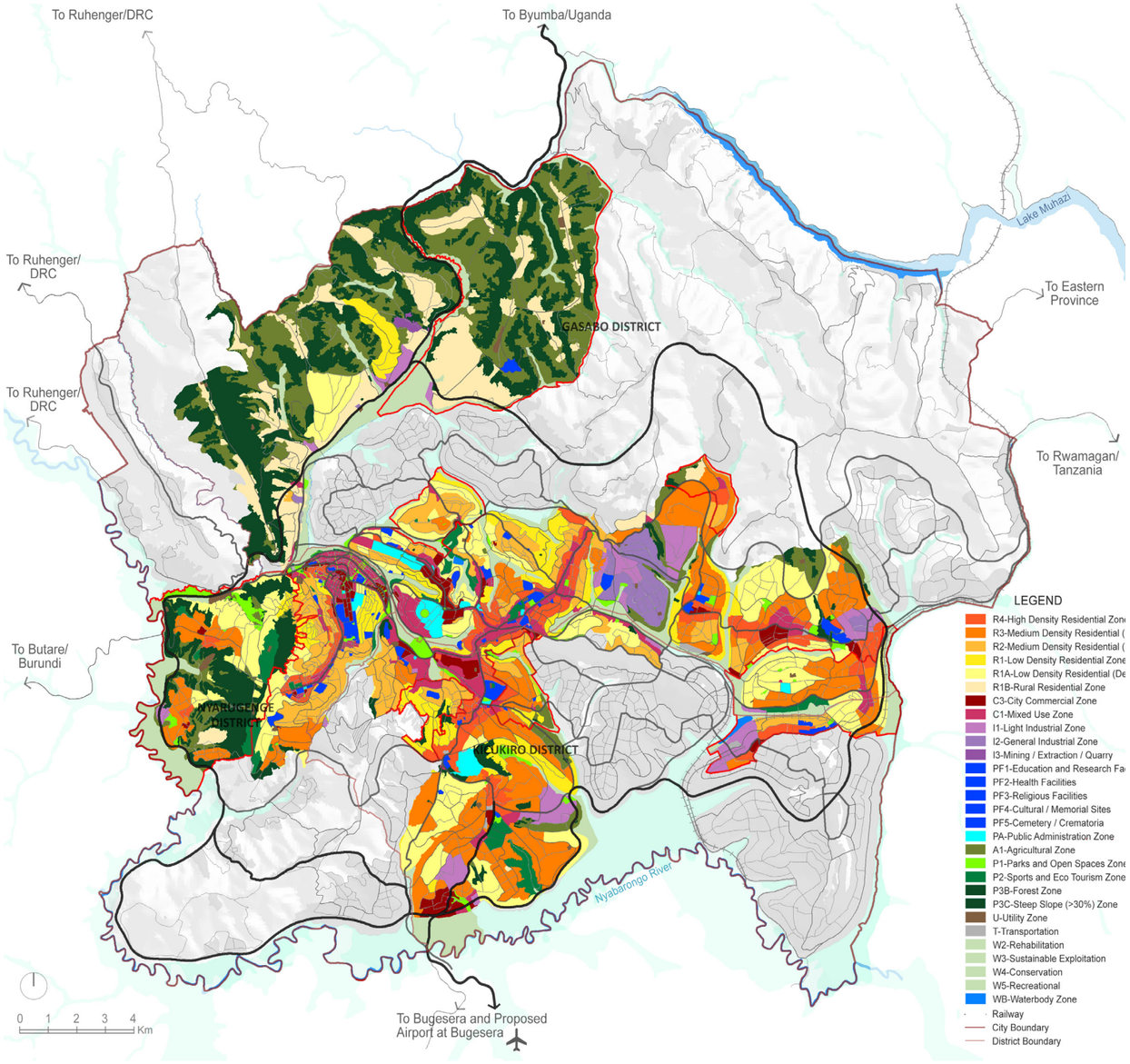


Figure 13.3 Kigali Master Plan 2019 - Proposed Phase 2

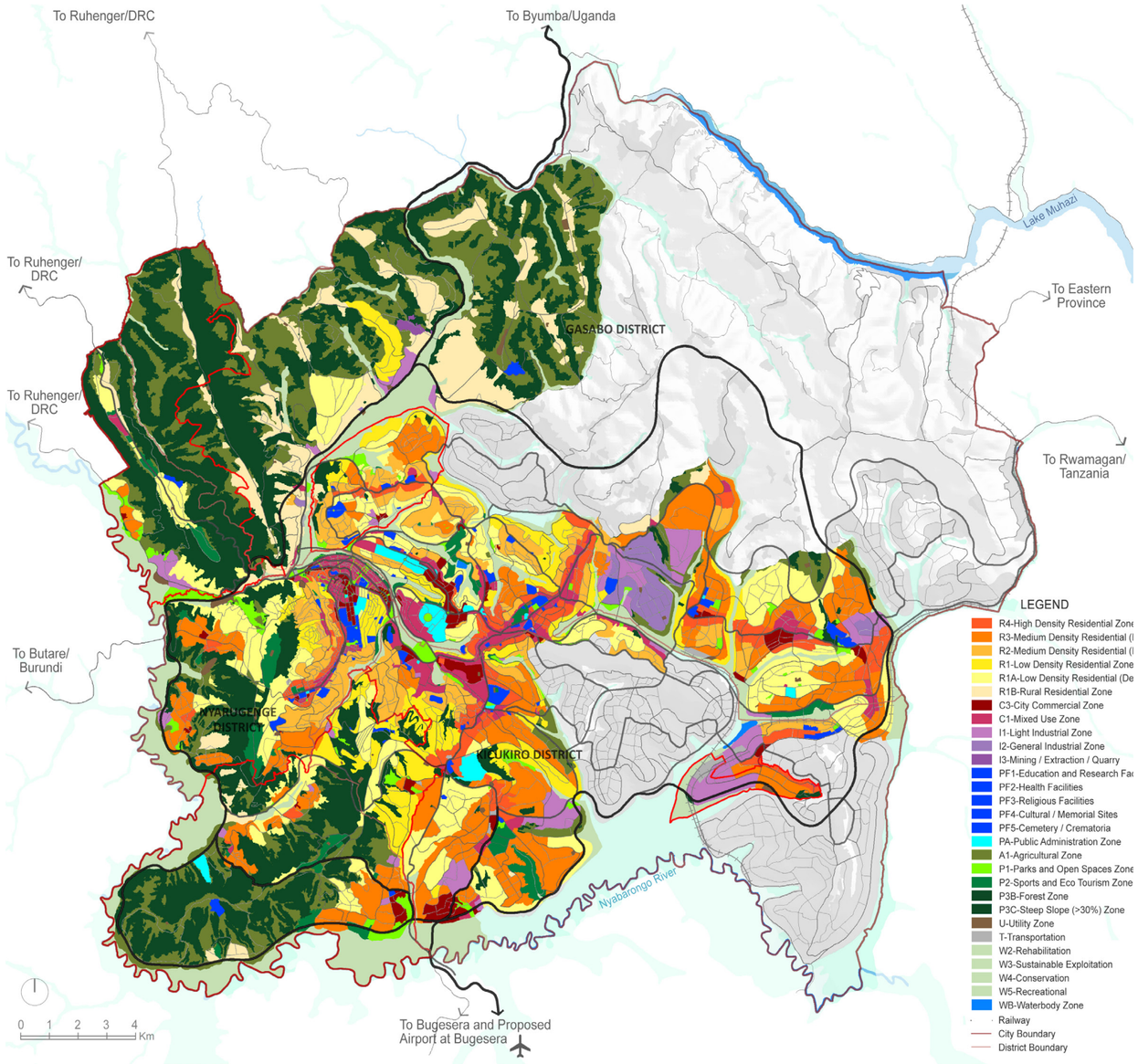


Figure 13.4 Kigali Master Plan 2019 - Proposed Phase 3

13.5 Phase 3 Development (2032-2038)

As subsequent development of Phase 2, Phase 3 development boundary and land use distribution are suggested to follow priority areas and projects:

1. The mixed use commercial development at fringe centres in Kinyinya;
2. Development of BRT line 5 and its neighboring areas;
3. Extension of Integrated industrial Development of Masaka Industrial Estate;
4. Integrated industrial Development in Kanyinya for clay extraction, processing and transportation;
5. Sports and recreation development in Kanyinya mountain ridge;
6. Tourism development in Gatenga including Kigali Cultural Village;
7. Planning Area development in suburban sector Mageregere; and
8. Land consolidation for rural settlements and farmlands in Mageregere

Table 13.7 Proposed Kigali Phase 3

Phase 3 - Proposed Zoning		Area (sqkm)
Agriculture zone	A1	23.7
Mixed use zone	C1	0.4
City commercial zone	C3	0.7
Light industrial zone	I1	2.9
Parks and open spaces zone	P1	2.6
Sport and Eco tourism zone	P2	2.1
Forest zone	P3B	35.2
Steep slopes (> 30%) zone	P3C	15.5
Public Administration zone	PA	0.3
Education and research facilities	PF1	0.4
Health facilities	PF2	0.0
Religious facilities	PF3	0.1
Cultural/ memorial sites	PF4	0.1
Cemetery/ crematoria	PF5	0.3
Low density residential zone	R1	6.9
Low density residential densification zone	R1A	9.8
Rural residential zone	R1B	2.6
Improvement zone	R2	3.3
Expansion zone	R3	9.0
High density residential zone	R4	1.3
Transportation zone	T	6.9
Utility zone	U	0.3
Rehabilitation	W2	1.7
Sustainable Exploitation	W3	2.2
Conservation	W4	13.8
Recreational	W5	0.0
Total Area		142.2

13.6 Phase 4 Development (2039-2045)

As subsequent development of Phase 3, Phase 4 development boundary and land use distribution are decided by the following priority projects and regions:

1. Planning Area development in Kanombe and Nyarugunga served by new development of BRT line 4;
2. Development of BRT line 4 and its neighboring areas;
3. Tourism development including education city and heritage conservation area near Lake Muhazi;
4. Land consolidation for rural settlements and farmlands in Rutunga and Gikomero;
5. Land consolidation for affordable housing development (sites and services) in Kinyinya and Rusororo;
6. Integrated industrial Development in Rusororo for trade and transportation located in the eastern border;

Table 13.8 Proposed Kigali Phase 4

Phase 4 - Proposed Zoning		Area (sqkm)
Agriculture zone	A1	57.9
Mixed use zone	C1	1.1
City commercial zone	C3	0.4
Light industrial zone	I1	2.2
Parks and open spaces zone	P1	2.9
Sport and Eco tourism zone	P2	3.9
Forest zone	P3B	10.6
Steep slopes (> 30%) zone	P3C	13.8
Public Administration zone	PA	1.0
Education and research facilities	PF1	0.1
Health facilities	PF2	1.9
Cemetery/ crematoria	PF5	0.3
Low density residential zone	R1	3.8
Low density residential densification zone	R1A	7.0
Rural residential zone	R1B	6.7
Improvement zone	R2	9.5
Expansion zone	R3	7.6
High density residential zone	R4	4.1
Transportation zone	T	9.6
Utility zone	U	0.2
Rehabilitation	W2	1.0
Sustainable Exploitation	W3	6.7
Conservation	W4	11.2
Waterbody zone	WB	1.9
Total Area		165.5

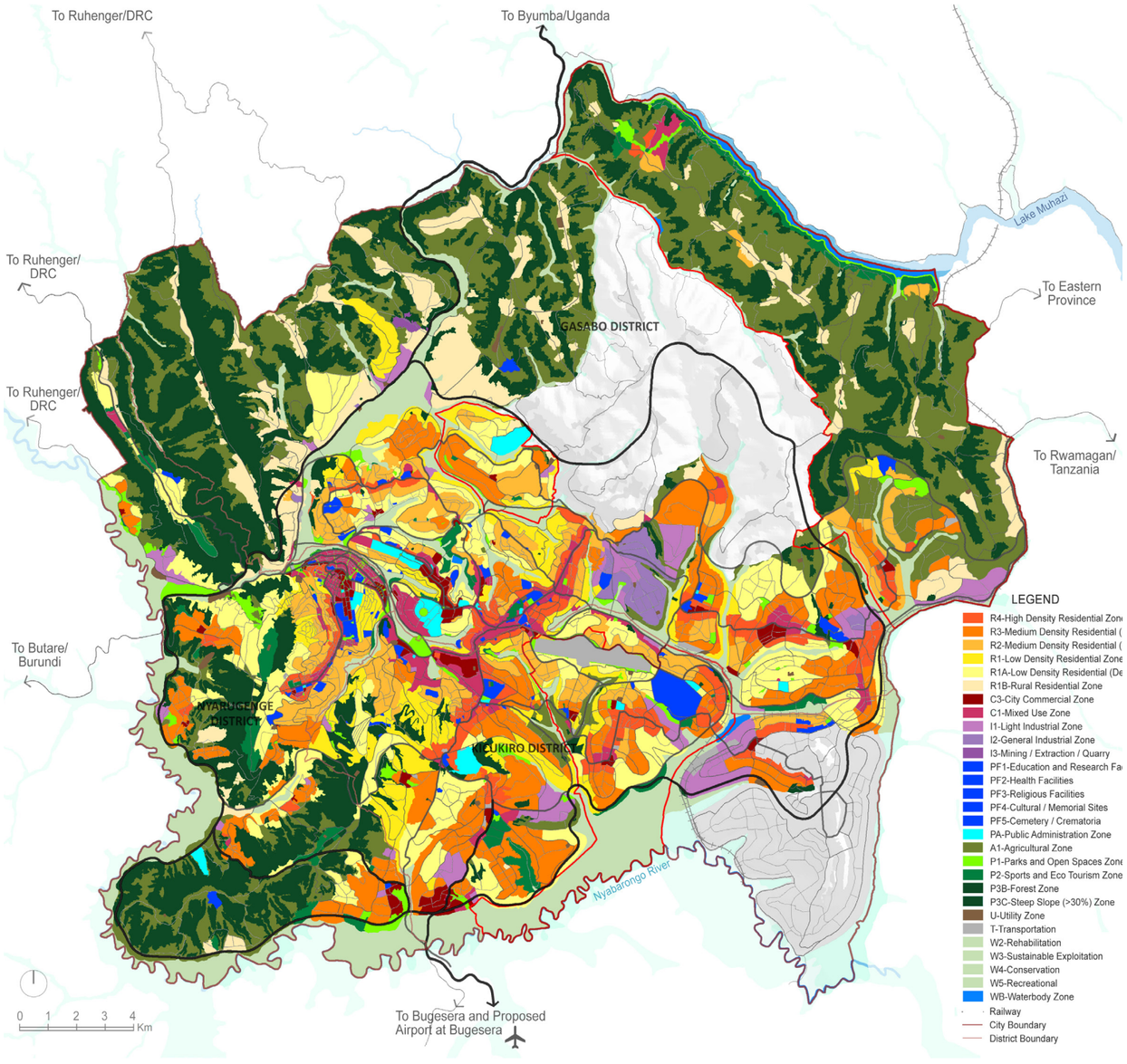


Figure 13.5 Kigali Master Plan 2019 - Proposed Phase 4

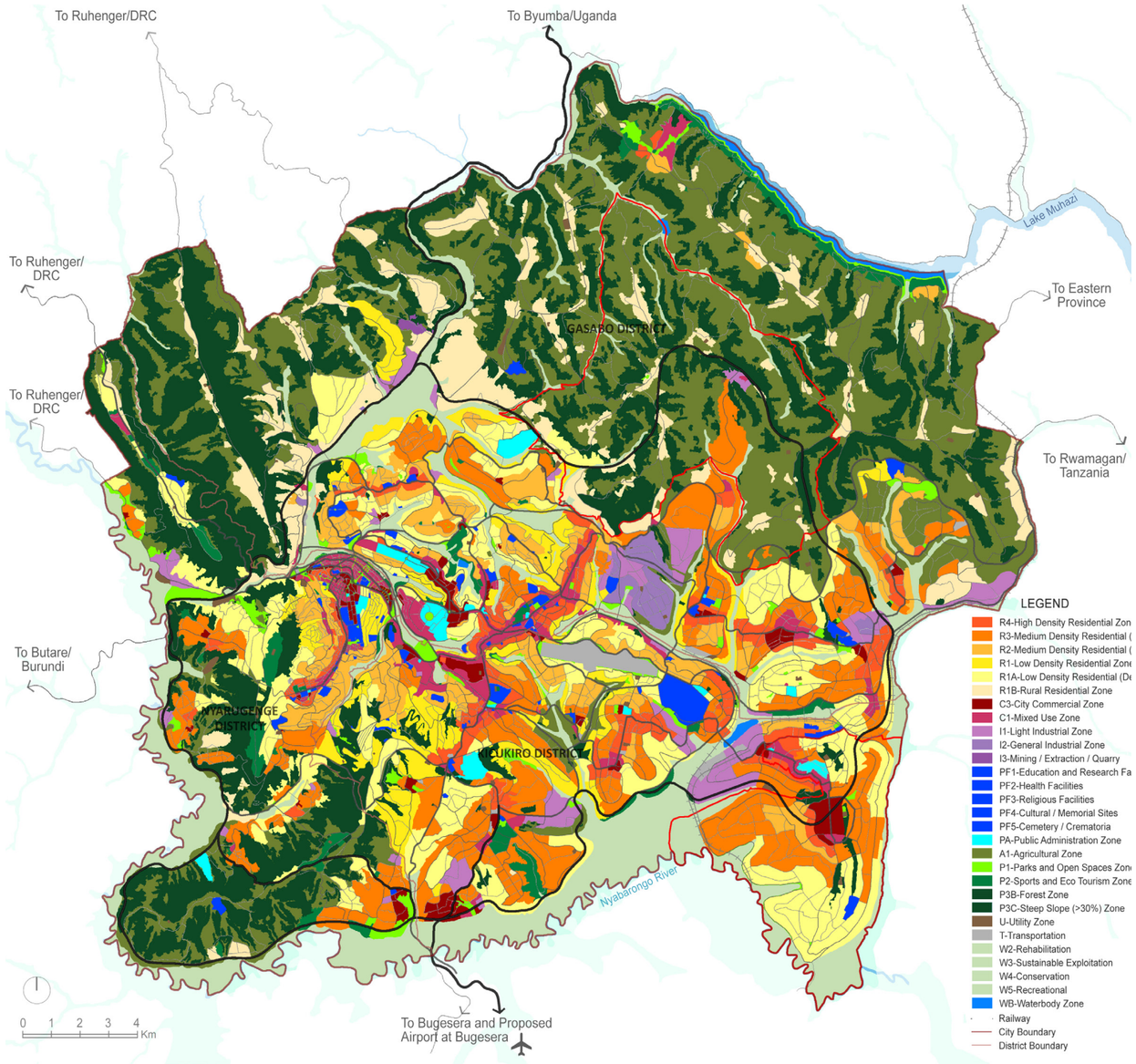


Figure 13.6 Kigali Master Plan 2019 - Proposed Phase 5

13.7 Phase 5 Development (2046-2050)

As subsequent development of Phase 4, Phase 5 development boundary and land use distribution are suggested to follow priority areas and projects:

1. Mixed use development of Masaka regional centre served by new development of BRT line;
2. Mixed use development of Bumbogo regional centre;
3. Integrated industrial Development in Bumbogo for trade and transportation next to the Outer Ring Road;
4. Land consolidation for rural settlements and farmlands in Bumbogo and Masaka;
5. Land consolidation for affordable housing development (sites and services) in Bumbogo and Masaka;

Table 13.9 Proposed Kigali Phase 5

Phase 5 - Proposed Zoning		Area (sqkm)
Agriculture zone	A1	39.6
Mixed use zone	C1	1.2
City commercial zone	C3	1.3
Light industrial zone	I1	0.3
Parks and open spaces zone	P1	0.4
Forest zone	P3B	12.4
Steep slopes (> 30%) zone	P3C	10.3
Public Administration zone	PA	0.4
Health facilities	PF2	0.0
Cemetery/ crematoria	PF5	0.3
Low density residential zone	R1	0.2
Low density residential densification zone	R1A	12.9
Rural residential zone	R1B	5.5
Improvement zone	R2	1.5
Expansion zone	R3	13.0
High density residential zone	R4	1.0
Transportation zone	T	4.4
Utility zone	U	0.1
Sustainable Exploitation	W3	3.2
Conservation	W4	7.5
Waterbody zone	WB	0.1
Total Area		115.4

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Annexure

Master Plan Zoning - Kigali and Secondary Cities		Zoning Colour
R4	High density residential zone	255, 90,37
R3	Medium density residential - Expansion zone	255,127, 0
R2	Medium density residential - Improvement zone	255,187,54
R1	Low density residential zone	255,236,24
R1A	Low density residential densification zone	255,255,127
R1B	Rural residential zone	255,235,176
C4	Regional commercial zone (O-C4)	102,0,13
C3	City commercial zone	150,2,2
C2	Neighbourhood commercial zone (O-C2)	254,36,0
C1	Mixed use zone	204,51,102
I1	Light industrial zone	194,122,192
I2	General industrial zone	156,122,188
I3	Mining/ Extraction/Quarry	148,82,165
PF-1	Education and research facilities	0,63,255
PF-2	Health facilities	0,63,255
PF-3	Religious facilities	0,63,255
PF-4	Cultural/ memorial sites	0,63,255
PF-5	Cemetery/ crematoria	0,63,255
PA	Public Administration zone	0,255,255
P1	Parks and open spaces zone	125,255,0
P2	Sport and Eco tourism zone	0,127,63
P3-A	National parks zone	13,73,37
P3-B	Forest zone	13,73,37
P3-C	Steep slopes (> 30%) zone	13,73,37
P3-D	Natural Conservation Zone	13,73,37
A1	Agriculture zone	110,129,49
W	Wetland zone	198,224,180

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