REPUBLIC OF KENYA

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URBAN CLIMATE RISK PROFILE FOR RONGO MUNICIPALITY

Urban Climate Risk Profile for Rongo Municipality, Migori County

Prepared by:

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Prepared by:
Rongo Municipality
Under the State Department for Housing and Urban Development
Kenya Urban Support Programme Phase II (KUSP II)

Contributors:
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Climate Risk Assessment and Urban Resilience Unit – State Department for Housing and Urban Development

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The Urban Risk Profile for Rongo Municipality provides a general overview of urban risks based on available information at the time of preparation. It is intended for planning and guidance purposes only and does not replace detailed technical or site specific assessments. Urban risks may change over time and the municipality and users bear no liability for decisions made based on this document.

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Foreword

This climate Risk Profile Assessment has been prepared for Rongo Municipality under the Kenya Urban Support Program (KUSP2) to enhance understanding of climate related risks that may affect urban development and service delivery. The assessment focuses on key climate hazards such as flooding, prolonged rainfall, droughts, rising temperatures and extreme weather events, and how these risks interact with existing urban, environmental and socio-economic conditions.

The preparation was undertaken by the municipality following a two-day Climate Risk Profile Training organized by the State Department for Housing and Urban Development under the Kenya Urban Support Programme Phase 2. The training was delivered by the Global center on Adaptation (GCA) in partnership with the World Bank, the Government of Kenya, and the Council of Governors, held on September 22-23, 2025 in Nairobi, Kenya

The profile also provides a basis for integrating climate resilience and adaptation measures into municipal planning, infrastructure development and service provision supported under KUSP2 by identifying vulnerable areas, populations and systems. The assessment supports informed decision-making aimed at reducing climate induced losses, protecting livelihoods and safeguarding public investments.

Through this climate-focused approach, Rongo Municipality seeks to strengthen its adaptive capacity, promote sustainable and inclusive urban growth and align local development initiatives with national climate policies and global commitments on climate resilience and sustainable developments

We appreciate the technical guidance and capacity support provided through this collaboration, which has enabled our Municipality to generate data-driven insights for climate-resilient urban planning. This document will serve as a critical tool for policymakers, urban planners, and development partners as we align our strategies with Kenya's broader climate adaptation and sustainable urban development goal.

On behalf of Rongo Municipality Board, I commend the efforts of the Municipal Environment Officer, Mrs Evaline Onyango and the technical team for their dedication in developing this wonderful report. I also acknowledge the support of Migori county government and all stakeholders who contributed to this valuable input.

Together, we are laying the foundation for a resilient, inclusive, and sustainable Municipality that can withstand the impacts of climate change and ensure the well-being of our residents for generations to come.

Mr. Brighton Ang'ienda.

Chairperson, Rongo Municipal Board.

Migori County, Kenya 2025

Executive Summary

[First complete all other sections of the Urban Climate Risk Profile. As the last action, write up an executive summary to provide a brief of the document. This should include:

- Objective(s) of the rapid climate risk assessment,
- List of key hazards identified,
- Risk results summary filled for each key hazard as presented below,
- Key takeaways on what can be done to mitigate the higher risks.]

Table 1.Summary of Pluvial Flooding risks for Rongo Municipality

Category	Risk Level				
	Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services					
Solid waste management	Medium	Medium	Very High	High	Very High
Water & Wastewater Management	Low	Low	High	Medium	High
Storm water drainage	Medium	Medium	Very High	High	Very High
Transport and Mobility	Low	Low	High	Medium	High
Energy	Low	Low	Medium	Low	Medium
Economic Infrastructure	Low	Low	High	Medium	High
Social Infrastructure	Low	Low	Medium	Low	Medium
Emergency Services	Medium	Medium	Very High	High	Very High
Populations					
Urban Residents	Low	Low	Medium	Low	Medium
Informal Settlement Residents	Medium	Medium	Very High	High	Very High
Vulnerable and Marginalized Groups	Medium	Medium	Very High	High	Very High
Natural Assets					
Urban Green Infrastructure	Low	Low	High	Medium	High
Urban Blue Infrastructure	Medium	Medium	Very High	High	Very High
Peri-urban and Agricultural Systems	Low	Low	High	Medium	High

Table 2. Summary of Drought risks for Rongo Municipality

Category	Risk Level				
	Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services					
Stormwater Drainage	Very Low	Low	Low	Low	Low
Water & Wastewater Management	Medium	Medium	Very High	High	Very High
Solid Waste Management	Low	Low	Medium	Low	Medium
Transport and Mobility	Low	Low	Medium	Low	Medium
Energy	Low	Low	High	Medium	High
Economic Infrastructure	Low	Low	Medium	Low	Medium

Category	Risk Level				
	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Social Infrastructure	Low	Low	High	Medium	High
Emergency Services	Low	Low	Medium	Low	Medium
Populations					
Urban Residents	Low	Low	High	Medium	High
Informal Settlement Residents	Low	Low	Medium	Low	Medium
Vulnerable and Marginalized Groups	Medium	Medium	Very High	High	Very High
Natural Assets					
Urban Green Infrastructure	Low	Low	High	Medium	High
Urban Blue Infrastructure	Medium	Medium	Very High	High	Very High
Peri-urban and Agricultural Systems	Medium	Medium	Very High	High	Very High

Table 3. Summary of Heat Stress/Extreme Heat risks for Rongo Municipality

Category	Risk Level				
	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services					
Stormwater Drainage	Low	Low	Medium	Low	Medium
Water & Wastewater Management	Low	Medium	High	High	High
Solid Waste Management	Very Low	Very Low	Low	Low	Low
Transport and Mobility	Very Low	Very Low	Low	Low	Low
Energy	Very Low	Very Low	Low	Low	Low
Economic Infrastructure	Very Low	Very Low	Low	Low	Low
Social Infrastructure	Very Low	Very Low	Low	Low	Low
Emergency Services	Very Low	Very Low	Low	Low	Low
Populations					
Urban Residents	Low	Low	Medium	Low	Medium
Informal Settlement Residents	Low	Low	High	Medium	High
Vulnerable and Marginalized Groups	Low	Low	High	Medium	High
Natural Assets					
Urban Green Infrastructure	Low	Low	High	Medium	High
Urban Blue Infrastructure	Low	Low	High	Medium	High
Peri-urban and Agricultural Systems	Low	Low	High	Medium	High

Table 4. Summary of Land degradation risks for Rongo Municipality

Category	Risk Level				
	Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services					
Storm water Drainage	Medium	Medium	Very High	High	Very High
Water & Wastewater Management	Low	Low	High	Medium	High
Solid Waste Management	Low	Low	Medium	Low	Medium
Transport and Mobility	Low	Low	High	Medium	High
Energy	Low	Low	Medium	Low	Medium
Economic Infrastructure	Low	Low	High	Medium	High
Social Infrastructure	Medium	Medium	Very High	High	Very High
Emergency Services	Medium	Medium	Very High	High	Very High
Populations					
Urban Residents	Medium	Medium	Very High	Medium	Very High
Informal Settlement Residents	Medium	Medium	Very High	High	Very High
Vulnerable and Marginalized Groups	Medium	Medium	Very High	High	Very High
Natural Assets					
Urban Green Infrastructure	Medium	Medium	Medium	High	Very high
Urban Blue Infrastructure	Medium	Medium	Very High	High	Very High
Peri-urban and Agricultural Systems	Medium	Medium	Very High	High	Very High

Table 5. Summary of Changes in Precipitation Patterns risks for Rongo Municipality

Category	Risk Level				
	Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services					
Storm water Drainage	Low	Low	High	Medium	High
Water & Wastewater Management	Medium	Medium	Very High	High	Very High
Solid Waste Management	Low	Low	High	Medium	High
Transport and Mobility	Low	Low	High	Medium	High
Energy	Low	Low	Medium	Low	Medium
Economic Infrastructure	Low	Low	High	Medium	High
Social Infrastructure	Low	Low	Medium	Low	Medium
Emergency Services	Low	Low	High	Medium	High
Populations					
Urban Residents	Low	Low	Medium	Low	Medium
Informal Settlement Residents	Medium	Medium	Very High	High	Very High
Vulnerable and Marginalized Groups	Medium	Medium	Very High	High	Very High
Natural Assets					
Urban Green Infrastructure	Low	Low	High	Medium	High
Urban Blue Infrastructure	Medium	Medium	Very High	High	Very High
Peri-urban and Agricultural Systems	Medium	Medium	Very High	High	Very High

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List of Acronyms

ASAL's	**Arid and Semi-Arid Lands**
CCAP	**County Climate Change Action Plan**
COG	**Council of Governor's**
CSO's	**Civil Society Organizations**
CIDP	**County Integrated Development Plan**
DRR	**Disaster risk reduction**
GCA	**Global Center on Adaptation**
GHG	**Green House Gas**
KUSP	**Kenya Urban Support Programme**
KNBS	**Kenya National Bureau of Statistics**
PWD	**Persons with Disability**
NCCAP	**National Climate Change Action Plan**
NDOC	**National Disaster Operations Centre**
NEMA	**National Environmental Management Authority**
PCRA	**Participatory Climate Risk Assessment**
RCRA	**Rapid climate risk assessment**
UNCED	**United Nations Conference on Environment and Development**
UNFCC	**United Nations Framework Convention on Climate Change**
VMG	**Vulnerable and Marginalized Groups**

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• Context

.1. Objective

This Urban Climate Risk Profile aims to identify, assess, and document the key climate-related risks affecting Rongo Municipality. It seeks to understand the extent and impact of hazards such as flooding, drought, heat stress, Pests and diseases, change in precipitation patterns, storms, vulnerability and land degradation on the Populations, urban systems, infrastructure, and communities. The profile further aims to provide evidence-based insights to guide local planning, enhance climate resilience, and inform the integration of adaptation and mitigation measures into municipal development strategies.

.2. Urban Context

.2.1. Geographic area (photo)

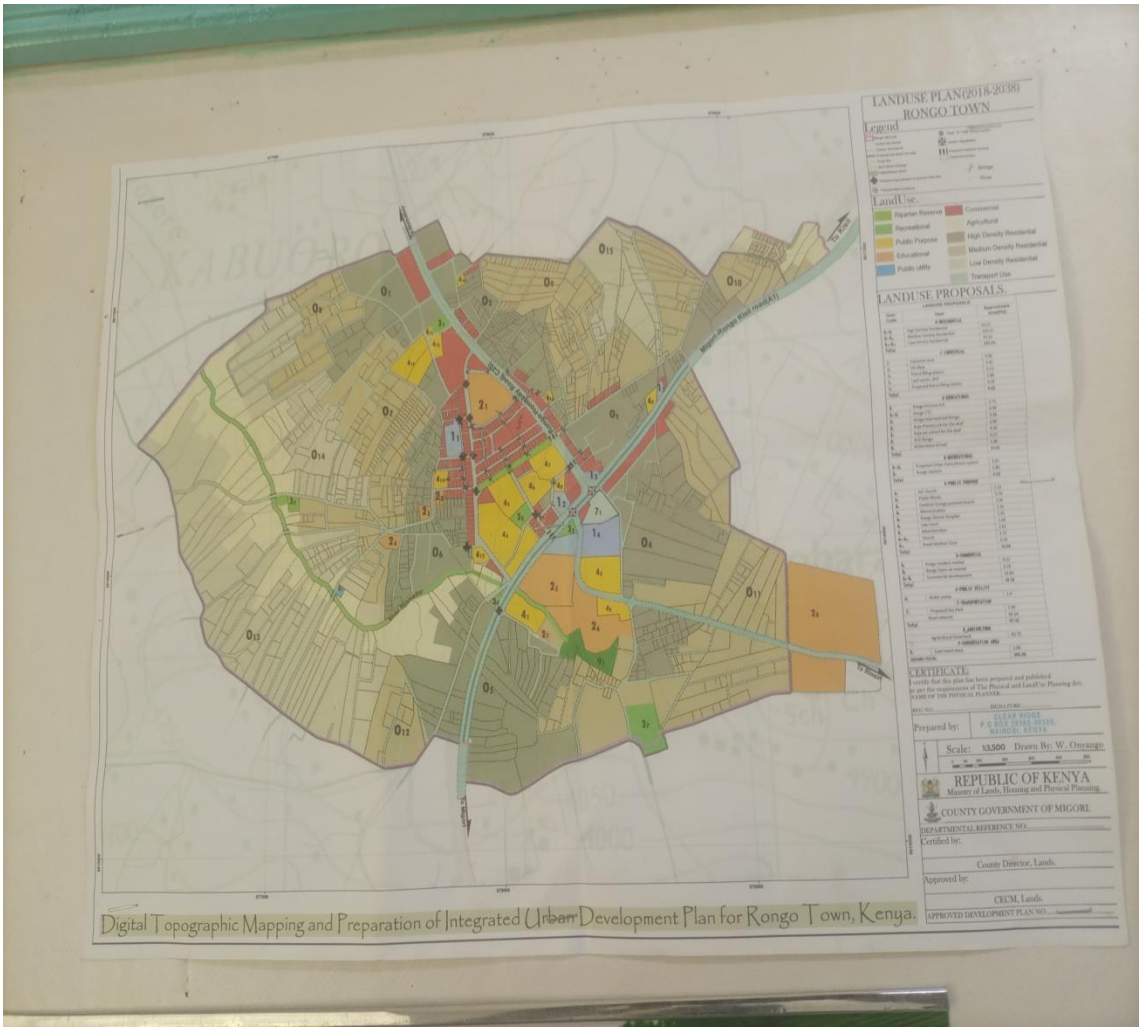


Figure 1: Geographical mapping of Rongo Municipality

Profile of Rongo Municipality

Rongo Municipality is one of the municipalities of Migori County. It is situated along the Kisii-Sirare route at the junction of Homa-bay and Riosiri and is boadered by the major urban

areas such as Homabay 32.4km NW, Migori Municipality 36km SW,Kisii 21km NE and Oyugis32.8km NE. The Municipality is served externally by three major roads: Kisii-Rongo-Migori Highway, Rongo-Homabay and Rongo-Riosiri road. Internally, the municipality has fairly well maintained road network within the core-urban but poor roads in the peripheral areas

Population Size and Distribution

According to the population Census and Household survey (2019), Rongo Municipality has a population of 81,968 people, which is projected to grow below:

Rongo Municipality population projections

	Region	**2019**	**2021**	**2023**	**2025**
Rongo	Urban	**32,216**	**35,518**	**39,159**	**43,173**
	Peri-Urban	**49,752**	**54,852**	**60,474**	**66,672**
Total		**81,968**	**90,370**	**99,633**	**109,845**

Topography

Rongo Municipality covers an area of approximately 43.39 Okusu which is a major growth node as the Rongo University is located here. Its altitude ranges from 1470m to 1600m above the sea level. The lowest part of the Municipality include Kabuoro and Opapo while the upper most parts include North Kanyajuok and Koderobara.The main rivers in the Municipality includes: River Kuja, Misadhi,Khichuri, Kira, Olando, Odundu and Nyamador which provide water for commercial and domestic purposes in the major urban centers within the Municipality.

Climate

Rongo Municipality experiences rainfall patterns varying from 900mm to 1800mm per year, with short rains occurring between October and December while the long rains fall during March and May. Due to its location, the Municipality climate is affected by both Lake Victoria and Kisii highlands. The annual average temperatures are 20.6oc

The temperatures shows a minimum of 17oc and maximum of 20 degrees Celsius with high humidity and a potential evaporation of 1800 to 200mm per year. The climate is mild inland equatorial type modified by a relief altitude and proximity to the lake. It favors the cultivation of sugarcane which is the main industrial crop.

Governance

It is based on the above background information that in the year 2028, through a County Assembly resolution , the Migori County Governor conferred the status of Municipality to Rongo Town by granting it a municipal charter. On 20th March 2020 this charter was officially gazzetted in the Kenya Government Gazette Notice. This culminated in the establishment of the first Rongo municipality board and recruitment of first municipal manager as the very fundamental aspects to head municipality of Rongo

The development and management of the urban area within Rongo Municipality falls under the jurisdiction of the County Government of Migori, operating through a structured system guided by the Urban Areas and Cities Act, 2011 (Revised 2019)**.**

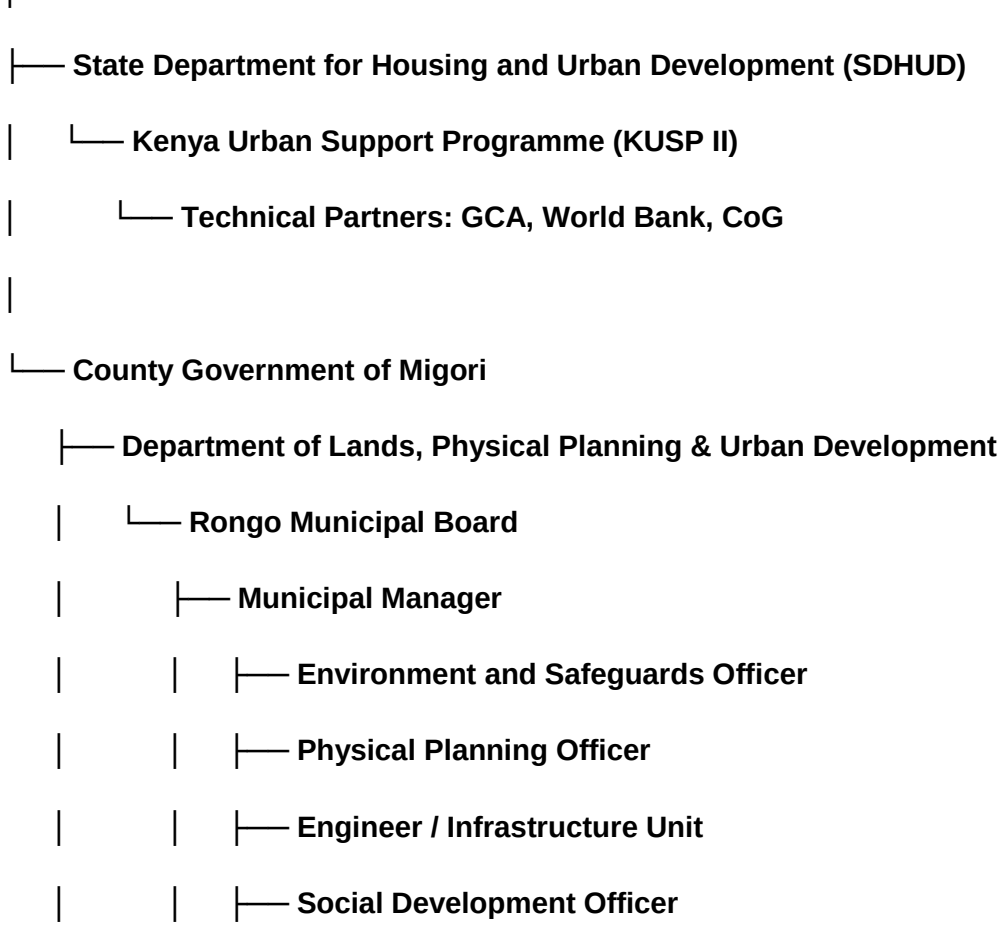
The Municipal Board of Rongo is the primary governing body responsible for oversight, policy guidance, and decision-making on urban development matters. The Municipal Manager serves as the administrative head, coordinating the daily operations and implementation of municipal projects, including climate resilience and environmental sustainability initiatives.

The Climate Risk Profile (CRP) was developed collaboratively under the Kenya Urban Support Programme Phase II (KUSP II), with technical guidance from the State Department for Housing and Urban Development (SDHUD), in partnership with the Global Center on Adaptation (GCA), the World Bank, and the Council of Governors (CoG).

At the county level, preparation of the Integrated Development Plan (CIDP) is led by the Department of Finance, Economic Planning, and Development, working in coordination with the Department of Lands, Physical Planning, and Urban Development, and the Rongo municipal Board to ensure that climate resilience priorities identified in the RCRP are integrated into broader development frameworks.

Organogram for Rongo Municipality Responsible for RCRP

National Government



└── Finance & Administration Unit

└── Community Representatives

└── Department of Finance, Economic Planning & Development

└── Responsible for County Integrated Development Plan (CIDP)

.2.2. Socio-economic Context

Rongo Municipality has high potential to tap in on the trade and tourism sectors given the growing population and the Rongo University student population. The diverse cultures and heritage among the residents is great advantage to advancement of Rongo Municipality. Social services such as schools, hospitals, shops and public transports needed at an early stage in the life of new communities.

It includes four wards, North Kamagambo, East Kamagambo,Central Kamagambo and South Kamagambo. The total population of Rongo Municipality as per 2019 census was 81,968 people.

This rapid demographic growth will intensify the demand for housing, infrastructure, health, and education services, while also heightening exposure to climate-related risks such as flooding, water scarcity, and heat stress.

.2.3. Economic Context

1. Overview

The economy of Rongo Municipality is a blend of a rich agricultural hinterland and a developing urban commercial hub positioned as a major junction town along a busy regional highway.

2. Sectoral Contribution to the Local Economy

Sector	Current Contribution (2025)	Projected Contribution (2030)	Key Drivers and Challenges
Agriculture	40%	34%	Maize, Sugarcane, coffee. The rolled out of agriprenuer and business acceleration model aims to build farmers capacity, promote technology adoption and link producers to markets.
Trade and Commerce (SMEs)	25%	27%	Growth in retail, hardware, and agri-input enterprises; digital platforms expanding market access.
Public Administration & Education	15%	17%	This growth is facilitated by Rongo University and Siala Technical put in place. Besides that the build up of both county and national administrative offices.
Real Estate & Construction	10%	12%	Rapid growth in residential and mixed-use developments; driven by demand for urban housing.
Transport and Logistics	6%	4%	Sustained by improved road networks; impacted by fuel costs and infrastructure pressure.
Hospitality & Services	4%	6%	Expanding tourism, accommodation, and restaurant services; boosted by local conferences and student population.

- *Employment by Sector (2025)*

Sector	Share of Employment (%)
Agriculture	43%
Trade & SMEs	28%
Public Sector & Education	12%
Construction & Real Estate	8%
Transport	5%
Hospitality/Other Services	4%

Observation:

- Employment remains heavily dependent on agriculture and informal trade.

- The service sector and construction are expected to grow fastest over the next decade, creating new urban jobs but also increasing environmental pressures.

- *Key Economic Zones and Growth Corridors*

Zone / Centre	Economic Role	Key Characteristics
Rongo Town	Commercial & Institutional Hub	Hosts major retail outlets, banks, government offices, and educational institutions.
Kitere town	Administrative & Service Centre	Rapid construction of residential expansion and agricultural based trade
Riosiri and Opapo	Agricultural Production Zone	Sugarcane, coffee, and dairy farms; transition to mixed land use.

- *Projected Economic Growth (2020–2030)*

Year	Municipal GDP Estimate (Ksh Billion)	Growth Rate (%)	Main Drivers
2020	10.8	–	Agriculture, retail, and government services
2024	15.6	2.8	Construction, SMEs, education, real estate
2027	18.2	30.0	Infrastructure development and service growth
2030	24.5	40.2	Diversification and urban expansion

- *Income and Poverty Indicators*

Indicator	Value (2024)	Projected (2030)	Comment
Average Monthly Income	KSh 18,500	KSh 25,000	Increase due to urban employment growth.
Poverty Rate	28%	20%	Expected decline due to job creation and SME support.
Informal-Sector Employment	65%	58%	Gradual formalization as municipal regulation improves.
Unemployment Rate	10%	8%	Reduced through youth-focused training and enterprise funding.

- *Major Challenges Impacting the Local Economy*

  - **Climate Risks:** Flooding and erratic rainfall disrupt agriculture, transport, and market activities.
  - **Low agricultural productivity:** climate change such drought, unreliable rainfall
  - **Weak value addition and industrial growth:** raw products sold without processing
  - **Governance and regulatory issues:** corruption and bribery has been the issue affecting local economy
  - **Waste and Infrastructure Strain:** Poor solid waste management and inadequate drainage affect business operations.
  - **Energy and Water Supply:** Fluctuations in power and water reliability hinder industrial growth.
  - **Limited access to Finance:** Small enterprises still face limited access to affordable credit.

.1.1. Land-use Context

1. Overview

The municipality's economy is transitioning from a primarily agricultural base toward a more diversified urban economy characterized by growth in trade, real estate, construction, education, and public administration. This transformation, however, is occurring within a context of increasing climate-related risks such as floods, prolonged droughts, and land degradation that affect productivity and urban infrastructure. The rapid shift to build up environments has resulted in the loss of vegetation and in some cases inadequate compliance with land use policies, leading to environmental degradation.

2. Economic Structure and Sectoral Contribution

The Rongo Municipality strategic plan (2020-20250 and subsequent updates focus on promoting optimal, and sustainable land use to manage urban sprawl, improve infrastructure and support economic growth.

The economy of Rongo is heavily driven by agriculture, particularly sugarcane farming along with a vibrant informal trade sector (juakali) and small scale commercial enterprise.

Public administration, education, and health services are major formal employers, while real estate and construction are rapidly growing due to rising housing demand. The hospitality and services sector is also expanding, driven by the increasing number of students, civil servants, and conferences held in the area.

- *Sectoral Contribution Table*

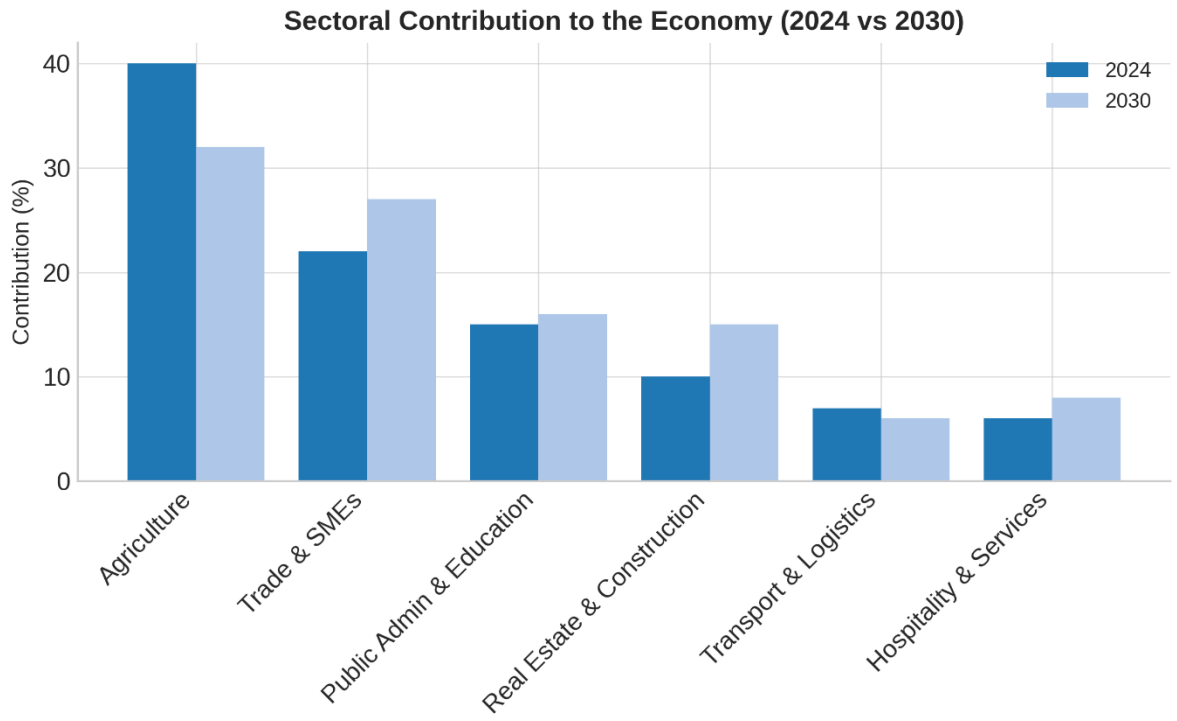


Figure 2: Sectoral Contribution to the Economy (2024 vs 2030)

Sector	Current Contribution (2024)	Projected Contribution (2030)	Key Observations
Agriculture	40%	32%	Still dominant but affected by climate variability and land conversion.
Trade & SMEs	22%	27%	Growing due to expanding urban markets.
Public Admin & Education	15%	16%	Stable; supported by public service and education sectors.
Real Estate & Construction	10%	15%	Fastest-growing; driven by housing and urban infrastructure projects.
Transport & Logistics	7%	6%	Influenced by fuel prices and urban mobility challenges.
Hospitality & Services	6%	8%	Increasing with tourism and institutional visitors.

4. Economic Growth Trends

Between 2020 and 2030, the municipal GDP is projected to grow from KSh 16.8 billion to KSh 20.5 billion, averaging about 5% annual growth. This growth is expected to be fueled by infrastructure investments, SME expansion, and continued urbanization.

Figure 3: Projected Economic Growth (2020-2030)

5. Employment Profile

The labor market in Rongo Municipality remains largely informal, with over 55% of residents engaged in agriculture and 18% in trade and small-scale enterprises. The share of construction, services, and public employment continues to rise, providing a growing number of formal jobs.

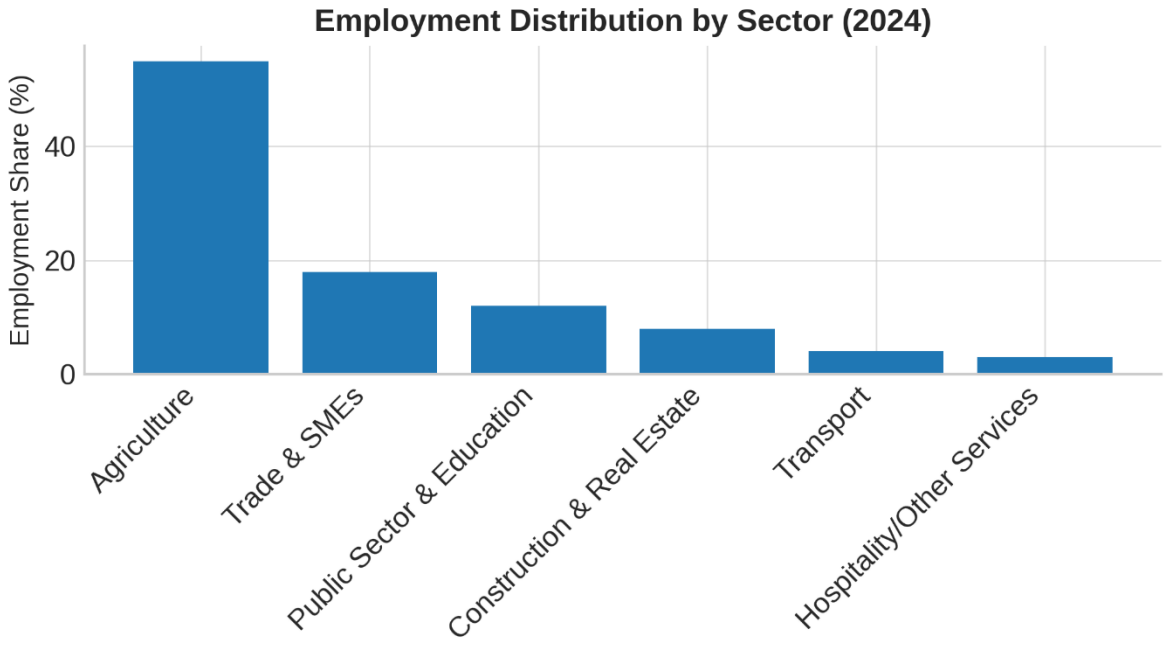


Figure 4: Employment Distribution by Sector (2025)

6. Economic Zones and Growth Corridors

The municipality comprises of distinct economic zones that play complementary roles in growth and service delivery:

Zone / Area	Economic Function	Remarks
Rongo town	Commercial, Administrative, Educational, and Health Hub	Hosts real estate, retail, financial institutions, hospitals, and polytechnics.

Kitere Town	Administrative & Service Center	Hostels and Rongo university
Riosir market	Agricultural High Potential Zone and local market activities	Coffee, maize sugarcane and dairy production; vulnerable to rainfall changes.

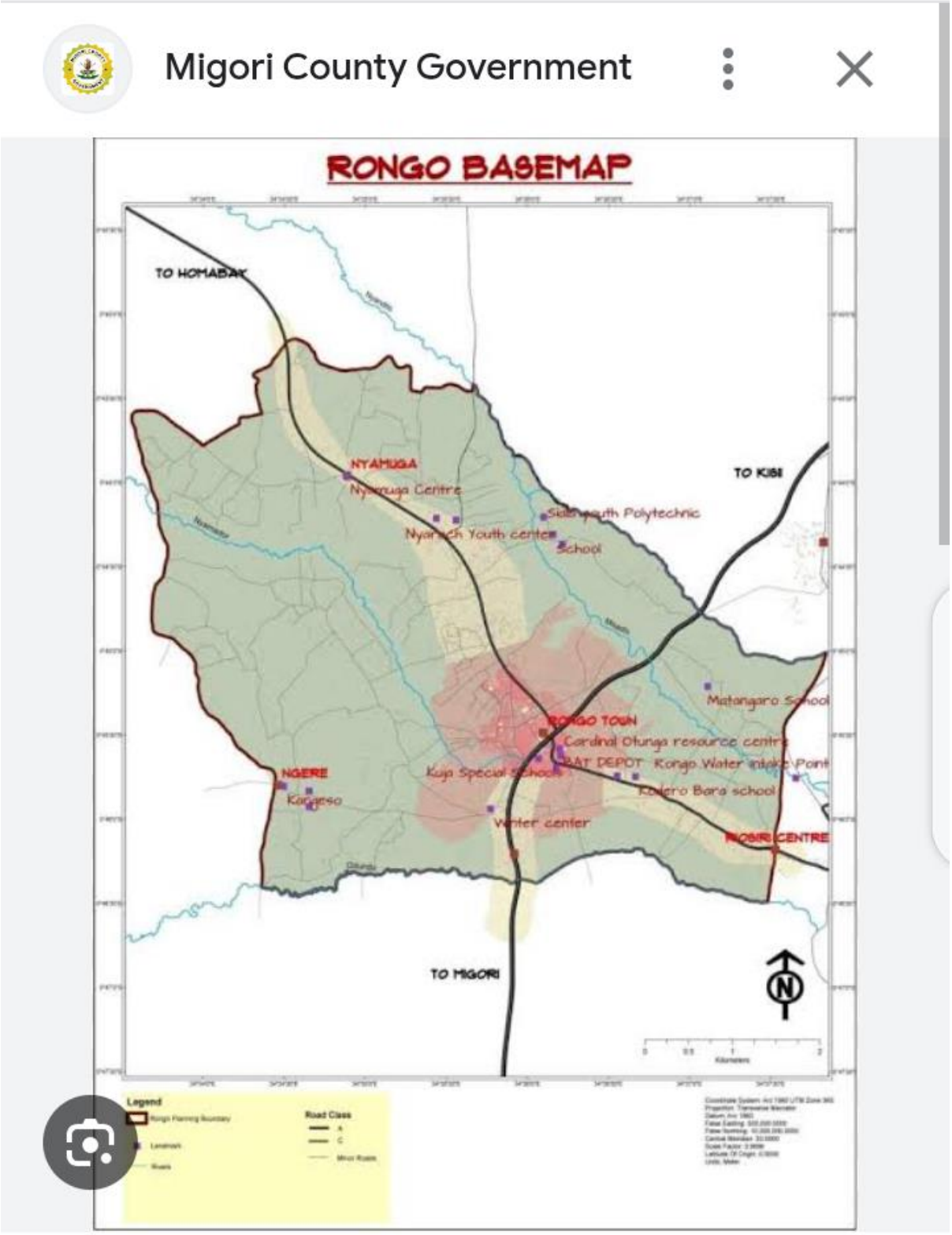


Figure 5: topographic map of Rongo municipality.

Key Economic Challenges

- **Climate Risks:** Unpredictable rainfall and flooding threaten agricultural yields and market access.
- **Urban Sprawl:** Conversion of fertile land to real estate reduces food production.
- **Infrastructure Pressure:** Poor drainage, traffic congestion, and waste mismanagement constrain economic efficiency.
- **Energy and Water Supply Instability:** Affects SMEs and light industries.
- **Limited Financial Access:** Especially for youth and women-led enterprises.

Rongo Municipality is poised for steady economic transformation over the next decade. By 2030, it is projected to evolve into a vibrant secondary urban hub that balances growth with environmental sustainability. Strategic urban planning, investment in infrastructure, and integration of climate resilience into municipal development plans will be vital in ensuring inclusive and sustainable growth.

.1. Key Stakeholders & Inclusiveness

The stakeholders relevant for the RCRA are mapped according to their:

Influence -the extent to which stakeholders can shape the RCRA process and outcomes,

Interest -to the degree to which they are likely to be involved in the assessment and findings.

This will guide the approach through which they could be involved in the RCRA, and subsequent planning processes.

It emphasizes multi-stakeholder engagement to ensure that climate risk identification, assessment, and prioritization reflect local realities and community needs. The process promotes inclusivity, transparency, and ownership across different governance levels — from the municipal board to community-based organizations and technical experts.

Stakeholders are engaged through consultative meetings, data validation workshops, field assessments, and participatory mapping sessions. Their inputs guide the identification of vulnerabilities, prioritization of sectors for adaptation, and validation of the final risk profile.

High	**High Influence – Low Interest** • National Treasury and Planning (Indirect through KUSP II) • Private Developers and Major Investors	**High Influence – High Interest** • Municipal Board of Rongo municipality • Global Center on Adaptation (GCA), World Bank, Council of Governors (CoG) • Municipal Manager & Technical Team • County Department of Lands, Physical Planning & Urban Development • State Department for Housing & Urban Development (SDHUD)

Low Influence – Low Interest • General Residents not directly engaged in urban development • Informal sector groups (casual workers, micro vendors)	**Low Influence – High Interest** • Community Representatives (Youth, Women, PWDs, Farmers, Traders) • Civil Society Organizations (CSOs), NGOs • Local Business Associations

Low High

Figure 6: Stakeholder mapping for Rongo Municipality(photo)

• Hazard Assessment

The Hazard Assessment provides a systematic, proactive process of identifying potential sources of harm (hazards) that affect Rongo Municipality. The assessment identifies and groups the main hazards affecting the municipality, their general cause and the purpose of conducting the assessment. Hazards may result in loss of life, damage of property, environmental pollution and disruption of social and economic activities.

The assessment identifies and categorizes the municipality's hazards into three main groups:

1. **Geophysical Hazards** – including landslides, soil erosion, and localized instability caused by slope gradients, deforestation, and unregulated construction.
2. **Hydro-Meteorological Hazards** – such as erratic rainfall, flooding, drought, and heat stress, which are becoming more frequent due to climate variability.
3. **Environmental Hazards** – driven by rapid urbanization, poor waste management, water pollution, deforestation, and biodiversity loss.

The purpose of this hazard assessment is to:

- Identify the key hazards affecting Rongo municipality
- Group hazards into categories for easier planning and response
- Identify hazard prone areas and vulnerable groups within the municipality
- Support disaster preparedness and emergency response planning
- Guide mitigation measures and promote safe urban development
- Strengthen coordination among departments and stakeholders in disaster risk reduction.

This assessment draws on field observations, stakeholder consultations, and secondary data from relevant government agencies and climate studies. The findings highlight the urgent need for integrated land-use planning, improved infrastructure, and community-based adaptation initiatives to reduce exposure and enhance urban resilience.

.1. Key Climate Hazards

Table 6. Hazard screening for Rongo Municipality

Hazard	Hazard Likely (Y/N)	Significant Impact (Y/N)	High Priority (Y/N)	Key Hazard (Y/N)
Heat Stress				
Average surface temperature increase	**Y**	**Y**	**N**	**Y**
Average ocean temperature increase	**N**	**N**	**N**	**N**
Extreme heat	**Y**	**Y**	**Y**	**Y**
Cold Stress				
Average surface temperature during winter	**N**	**N**	**N**	**N**
Extreme cold (e.g., cold spells, frost)	**N**	**N**	**N**	**N**
Snowfall and ice storms	**N**	**N**	**N**	**N**
Flooding				
Changes in precipitation patterns	**Y**	**Y**	**Y**	**Y**
Pluvial (surface level) flooding, including flash flooding and urban flooding	**Y**	**Y**	**Y**	**Y**
Fluvial (river) flooding	**Y**	**N**	**N**	**N**
Sea level rise	**N**	**N**	**N**	**N**
Coastal flooding, including storm surges	**N**	**N**	**N**	**N**
Waterlogging	**Y**	**N**	**N**	**N**
Water Stress				
Drought (meteorological, hydrological)	**Y**	**Y**	**Y**	**Y**
Groundwater salinization	**Y**	**Y**	**Y**	**Y**
Saline intrusion	**N**	**N**	**N**	**N**
Wildfire				
Wildfires & bushfires	**N**	**N**	**N**	**N**
Storms				
Extreme wind	**N**	**N**	**N**	**N**
Tropical cyclones	**N**	**N**	**N**	**N**
Sand and dust storms	**N**	**N**	**N**	**N**
Hailstorms	**N**	**N**	**N**	**N**
Mass Movement				
Landslides	**N**	**N**	**N**	**N**
Coastal erosion	**N**	**N**	**N**	**N**
Gully erosion	**N**	**N**	**N**	**N**
Marine Conditions				
Ocean acidification	**N**	**N**	**N**	**N**
Geophysical*				
Subsidence	**N**	**N**	**N**	**N**
Earthquakes	**N**	**N**	**N**	**N**
Volcanos	**N**	**N**	**N**	**N**

** These hazards, if present, can be highly impactful and are therefore included in the screening step, as they may significantly influence the urban planning informed by this urban climate risk profile.*

.2. Climate Indicators and Hazard Thresholds

Table 7. Climate indicators and hazard thresholds selected for the assessment

Key Hazard	Climate Indicator	Data Source	Thresholds		
			Low	Medium	High
Pluvial Flooding	Number of days with precipitation > 50 mm	• World Bank Climate Change Knowledge Portal / Kenya Meteorological Department	< 3 days/year	3 – 6 days/year	> 6 days/year
Drought	Standardized Precipitation–Evapotranspiration Index (SPEI)	• SPEI Database / Kenya Meteorological Department	> -1.0	-1.0 to -1.5	< -1.5
Heat Stress / Extreme Urban Heat	Number of days with heat index > 35°C (mean)	• World Bank Climate Change Knowledge Portal / IPCC Data Portal	< 5 days/season	5 – 15 days/season	> 15 days/season
Land Degradation	Normalized Difference Vegetation Index (NDVI) anomaly or soil erosion rate	• FAO Global Land Degradation Information System / SERVIR East Africa	NDVI > 0.5 (stable)	NDVI 0.3–0.5 (moderate degradation)	NDVI < 0.3 (severe degradation)
Changes in Precipitation Patterns	Coefficient of Variation (CV) of seasonal rainfall	World Bank Climate Change Knowledge Portal / Kenya Meteorological Department	CV < 15% (stable rainfall)	CV 15–25% (moderate variability)	CV > 25% (high variability)

.3. Current Hazard Levels and Climate Projections

Table 8. Current and future hazards levels for Rongo Municipality

Hazard	Current (Baseline)	2050 SSP2–4.5	2050 SSP5–8.5	2100 SSP2–4.5	2100 SSP5–8.5
Pluvial Flooding	**Medium** – Frequent flash floods during long rains, drainage overflow in low-lying areas.	**High** – ↑ Intense rainfall (>50 mm/day) events expected to double; 20–30% increase in flood days.	**Very High** – Heavy rainfall events become more extreme; urban flooding more frequent and widespread.	**High** – Sustained increase in rainfall intensity; moderate adaptation may reduce severity.	**Very High** – Severe pluvial flooding becomes chronic in unplanned and poorly drained areas.
Drought	**Medium** – Periodic dry spells during short rains affecting crops and water supply.	**High** – Longer dry periods; seasonal water scarcity increases by 20–25%.	**Very High** – Severe droughts likely every 2–3 years; water stress rises sharply.	**High** – Persistent rainfall deficits; reduced soil moisture affecting agriculture.	**Very High** – Multi-year droughts and water crises likely; ecosystem and livelihood stress.
Heat Stress / Extreme Urban Heat	**Medium** - Temperatures average 18.7°C, with ~5–10 heat days > 35°C per season.	**High** – +1.5°C increase; heat index > 35°C for 15–20 days/season.	**Very High** – +2°C to +2.5°C rise; heat waves more intense and prolonged.	**High** – +2.5°C average increase; significant heat island amplification in urban cores.	**Very High** – +3°C to +4°C; extreme heat becomes a major urban hazard affecting health and productivity.
Land Degradation	**Medium** – Soil erosion, deforestation, and poor	**High** – Accelerated erosion on slopes;	**Very High** – Strong link with drought and deforestatio	**High** – Land restoration possible but	**Very High** – Irreversible degradation in

	land-use practices increasing.	declining soil fertility.	n; reduced vegetation cover.	pressure from urbanizatio n persists.	unmanage d zones; reduced agricultural productivity .

For this Urban Climate Risk Profile, hazard levels should be interpreted in accordance with the table below.

Table 9. Interpretation of hazard levels

Level	Interpretation
High	Hazard events that are likely to occur with high frequency and/or intensity
Medium	Hazard events that are likely to occur with moderate frequency and/or intensity
Low	Hazard events that are likely to occur with low frequency and/or intensity

.4. Current and Future Hazard Impact Areas

I. **Erratic rainfall and water stress:** the area is experiencing unpredictable rainfall patterns, with periods of both below normal and intense rains affecting planting schedules
II. **Flooding in low lying areas:** heavy rainfall events during seasonal rains have led to flooding especially near river channels and poorly urban zones. This disrupts transport, damages infrastructure and displace households.
III. **Environmental degradation:** intense rainfall and surface run off contribute to soil erosion and degraded land, undermining agricultural activities and increasing sedimentation in waterways.
IV. **Heat stress:** rising temperatures and heat stress are already evident, impairing crop performance and contributing to reduce yields and food security.

Future climate impact areas

Extended dry spells and drought: while some models project increased dry spells and drought conditions may still occur between rainy seasons or if rainfall becomes more erratic. Water scarcity may intensify posing risk for water security.

• Exposure & Vulnerability Assessment

The exposure and vulnerability assessment for Rongo Municipality examines how various urban elements including infrastructure, services, populations, and natural assets are affected by climate and environmental hazards**.** This analysis identifies which assets are most exposed to flooding, drought, heat stress, and land degradation, and evaluates their capacity to adapt or recover from these impacts.

The result prioritizes investment and adaptation planning to enhance urban resilience, protects livelihoods, and guide sustainable land use**.**

.1. Urban Elements

Table 10. Urban elements inventory

Category	Subcategory	Included in the RCRA (Y/N)	Available in GIS format (Y/N)	Description
Infrastructure & Services				
Storm water Drainage	Storm water drainage conveyance network	**Y**	**Y**	Open drainage channels exist in Rongo Municipality but are undersized and poorly maintained, resulting in frequent flooding during heavy rainfall.
	Storm water storage	**N**	**N**	No major storm water retention ponds; water stagnates in low-lying areas.
Water & Wastewater Management	Pumping stations	**N**	**N**	No centralized pumping stations within the municipality.
	Groundwater abstraction	**Y**	**Y**	Boreholes and shallow wells supply institutions and residential areas, especially during dry seasons.
	Water treatment facilities	**N**	**N**	There is no water treatment facilities within the municipality
	Water supply networks	**Y**	**Y**	Piped water covers some areas within Rongo municipality more so Rongo university and some parts of Kanga school
	Sewer networks	**N**	**N**	There are no sewer networks within Rongo municipality.
	Wastewater treatment facilities	**N**	**N**	No functional waste water treatment within the municipality
Solid Waste Management	Transfer facilities	**Y**	**N**	There is one transfer station within the municipality and periods of time waste are taken to the dumpsite.

Category	Subcategory	Included in the RCRA (Y/N)	Available in GIS format (Y/N)	Description
	Landfills and dump sites	**Y**	**N**	Oyugi Ogango dumpsite serves as the main waste disposal site; lacks proper lining and leachate control.
	Recycling centers	**N**	**N**	Recycling conducted informally by waste pickers and small youth groups.
	Collection fleet	**Y**	**N**	Municipal uses County fleet and is limited; waste collection irregular, particularly in peripheral markets like Opapo and Mwata market
Transport and Mobility	Road networks	**Y**	**Y**	Well-developed network connects Rongo-Riosir and Opapo. some rural access roads become impassable during rains.
	Bridges	**Y**	**N**	Some small bridges exist over from Rongo town to Kitere centre
	Public transport networks (rail, bus, mini-bus, etc.)	**Y**	**N**	Matatus and boda-boda services dominate; no formal bus terminal.
	Transportation terminals	**N**	**N**	No terminal has been developed so far within he municipality.
	Vehicle depots	**N**	**N**	N/A
	Non-motorized transport networks	**N**	**N**	No well developed pedestrian walkways
	Freight and logistics hubs	**N**	**N**	N/A
Energy	Energy power plants	**N**	**N**	N/A
	Poles and power lines	**Y**	**Y**	Kenya Power lines cover the whole municipality except some peripheral wards do not have power connection
	Transformers and substations	**Y**	**Y**	Several small substations serving Rongo and Kitere town stable supply.
	Street lighting	**Y**	**Y**	Installed along major streets and public facilities; limited coverage in peri-urban zones.
Economic Infrastructure	Markets	**Y**	**Y**	Rongo modern market, okusu, Riosiri and Opapo market serves as open air markets critical for livelihoods but prone to flooding.

Category	Subcategory	Included in the RCRA (Y/N)	Available in GIS format (Y/N)	Description
	Businesses and commercial hubs	**Y**	**Y**	High concentration in both Rongo and Kitere center; exposed to heat stress and poor drainage.
	Industrial zones/parks and logistics parks	**Y**	**N**	Well developed recreational park is coming up within the municipality
Social Infrastructure	Government buildings and service centers	**Y**	**Y**	County and municipal offices in Rongo town exposure to drainage and access disruption during floods.
	Education facilities	**Y**	**Y**	Over 27 schools and Rongo University; some in erosion-prone slopes (Siala Technical).
	Healthcare facilities	**Y**	**Y**	Rongo Level 4 Hospital serves the region;
	Public spaces	**N**	**N**	No well developed recreational public space. Although Rongo recreational park is coming up and it is on the second stage of development
	Faith-based buildings	**Y**	**N**	Numerous across wards; act as emergency.
	Cultural and heritage assets	**N**	**N**	None formally documented.
Emergency Services	Fire stations	**N**	**N**	No well developed fire stations
	Police stations	**Y**	**Y**	Main stations in Rongo town; accessible but limited emergency response capacity.
	Telecommunications networks	**Y**	**Y**	Mobile coverage is good; supports early warnings.
	Early warning systems	**N**	**N**	No dedicated local system; reliant on county and national alerts.
	Disaster management centers and shelters	**N**	**N**	None established; Public schools and churches serve as temporary shelters.
	Evacuation routes	**N**	**N**	Not formally designated or mapped.
Populations				

Category	Subcategory	Included in the RCRA (Y/N)	Available in GIS format (Y/N)	Description
Urban Residents	Population	**Y**	**Y**	Estimated population (2019 81968 census); projected 150,000 by 2050.
	Households	**N**	**N**	Municipal Households have not been documented unless it is done in the next Census for the County.
Informal Settlement Residents	Population living in informal settlements	**N**	**N**	Not documented
	Households lacking land tenure	**N**	**N**	Not documented
	Households / residents lacking access to basic services	**N**	**N**	Not documented
Vulnerable and Marginalized Groups	Low-income households	**Y**	**N**	Women-headed households, PWDs, elderly, and unemployed youth concentrated in peri-urban zones.
	Women-headed households	**N**	**N**	Not Documented
	Children and youth	**N**	**N**	Not Documented
	Elderly persons	**N**	**N**	Not Documented
	People with disabilities (PWD)	**N**	**N**	Not Documented
	Homeless populations	**N**	**N**	Not Documented
	Unemployed or precariously employed workers	**N**	**N**	Not Documented
	Seasonal workers / migrant laborers	**N**	**N**	Not Documented
	Nomadic groups in peri-urban areas	**N**	**N**	Not Documented
	Urban refugees and migrants	**N**	**N**	Not Documented
	Minority ethnic groups in urban areas	**N**	**N**	Not Documented
Natural Assets				
Urban Green Infrastructure	Urban parks and gardens	**Y**	**Y**	Tree-lined streets, urban gardens, and riparian vegetation; limited protection.
	Green corridors	**Y**	**Y**	Tree-lined streets, urban gardens, and riparian vegetation; limited protection.

Category	Subcategory	Included in the RCRA (Y/N)	Available in GIS format (Y/N)	Description	
	Street landscaping	**N**	**N**	N0t documented	
	Urban forests and forest reserves	**N**	**N**	Not documented	
Urban Blue Infrastructure	Natural wetlands	**N**	**N**	Not documented	
	Rivers	**y**	**Y**	Rivers Kira, kobilo stream and Kuja prone to pollution and flooding.	
	Riparian zones	**Y**	**Y**	River Kuja and Kira prone to pollution and flooding.	
	Lakes, ponds and reservoirs	**Y**	**N**	Not Documented	
	Coastal ecosystems	**N**	**N**	N/A	
	Urban agriculture	**Y**	**Y**	Kobillo stream and River Kuja prone to pollution and flooding.	
Peri-urban and Agricultural Systems	Peri-urban agriculture	**Y**	**Y**	Agro forestry and smallholder farms dominate outskirts; highly climate-sensitive.	
	Agro forestry systems	**Y**	**Y**	Agro forestry and smallholder farms dominate outskirts; highly climate-sensitive	Y
	Forests and forest reserves	**Y**	**Y**	Not Documented	
	Protected areas and national parks	**Y**	**Y**	Need to be Documented	
	Savannahs and rangelands	**N**	**N**	N/A	

.2. Exposure, Vulnerability, and Impacts of Climate Hazards on Urban Elements

For this Urban Climate Risk Profile, exposure and vulnerability levels should be interpreted in accordance with the table below.

Table 11. Interpretation of exposure and vulnerability levels

Level	Exposure Level Interpretation	Vulnerability Level Interpretation
High	Few or no critical urban elements lie within the hazard footprint or area of impact.	The urban element is vulnerable to the climate hazard due to high natural sensitivity – considering physical and non-physical characteristics – and limited adaptive capacity.

Medium	A moderate number or a mix of low- and medium-value urban elements is located within the hazard footprint.	The urban element is somewhat vulnerable to the climate hazard due to moderate sensitivity and adaptive capacity.
Low	A large number and high-value urban elements (e.g., critical infrastructure, dense neighborhoods, major economic assets) are located within the hazard footprint.	The urban element is minimally vulnerable to the climate hazard due to limited sensitivity and/or a high degree of adaptive capacity.

For this Urban Climate Risk Profile, the following matrix summarizes likely impacts on each urban element by combining the assigned exposure and vulnerability levels.

Table 12. Impact Matrix

		Vulnerability Level		
		Low	**Medium**	**High**
Exposure Level	**High**	Moderate	Major	Catastrophic
	Medium	Minor	Moderate	Major
	Low	Insignificant	Minor	Moderate

Table 13. Exposure, Vulnerability, and Impacts of Pluvial Flooding on Urban Elements

Hazard:Pluvial flooding

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	• Urban drainage channels (within Rongo CBDs) are undersized, informal open drains present; . Frequent blockage by solid waste reduces conveyance capacity.	**High**	**Sensitivity:** Major — drains are shallow/undersized and many roads drain into low points. **Adaptive Capacity:** • Low — limited municipal maintenance budget, few retention ponds, no large stormwater storage.	**High**	**Catastrophic**
Water & Wastewater Management	• Piped networks in cores; many peri-urban areas depend on boreholes.	**Medium**	• **Sensitivity:** Medium — partial sanitation exists but many systems are informal (septic/pits) that are vulnerable to inundation. **Adaptive Capacity:** • Low–Medium — some institutional management (MIWASCO) but limited treatment and flood-resilient infrastructure.	**Medium**	**Moderate**
Solid Waste Management	• Main dumpsite (Oyugi Ogango) located in low area; open dumping and poor collection lead to blocked drains and increased surface water contamination during floods.	**High**	• **Sensitivity:** High — unlined dumps and informal burning increase contamination risk when inundated. **Adaptive Capacity:** • Low — irregular collection fleet, informal recycling; limited engineered transfer stations.	**High**	**Catastrophic**
Transport and Mobility	• Urban roads and some rural access roads become impassable during	**Medium**	• **Sensitivity:** High — key arterial and feeder roads cross low points.	**Medium**	**Moderate**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	pluvial events; small bridges over Rongo and Kitere subject to scouring. Key pedestrian routes flood (no continuous non-motorized infrastructure).		**Adaptive Capacity:** • Low — maintenance is reactive; limited alternative routes and weak design standards for drainage capacity.		
Energy	• Overhead power lines & utility poles run through peri-urban slopes; substations located in accessible urban nodes that can be surrounded by flood water.	**Medium**	• **Sensitivity:** Medium — poles can be undermined by erosion; substations tolerate some water but prolonged inundation risks service outages. **Adaptive Capacity:** • Medium — Kenya Power maintains networks but localized resilience measures are limited.	**Medium**	**Moderate**
Economic Infrastructure	• Rongo and Riosir markets, shops and commercial premises concentrated in CBDs and market yards that flood, disrupting trade and perishable goods.	**High**	• **Sensitivity:** High — businesses suffer stock losses, supply chain interruption. **Adaptive Capacity:** • Low–Medium — some insurance/stock shifting for larger businesses but most SMEs are informal with little buffer.	**High**	**Catastrophic**
Social Infrastructure	• Schools, health centres (Rongo level 4), and government offices in town centres are reachable but roads to them flood at times; some facilities sit in moderate-low ground.	**Medium**	• **Sensitivity:** Medium — critical services affected by access loss rather than total asset loss. **Adaptive Capacity:** • Medium — institutions have contingency practices but limited formal flood proofing.	**Medium**	**Moderate**
Emergency Services	• Single fire station (Migori) and police posts; limited amphibious response	**Medium**	• **Sensitivity:** High — response time hindered by flooded roads.	**High**	**Major**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	and no dedicated local early-warning for pluvial events. Shelters are informal (churches, schools).		**Adaptive Capacity:** • Low — limited resources, no mapped evacuation routes or dedicated shelters.		
Populations					
Urban Residents	• Majority live in formal and peri-urban neighborhoods; many households in low points face periodic inundation; population density rising (urbanization).	**Medium**	• **Sensitivity:** Medium — property damage and health risk when flooded. **Adaptive Capacity:** • Medium — some households can cope (savings, kin networks) but many cannot.	**Medium**	**Moderate**
Informal Settlement Residents	• High concentration of informal housing in low-lying Kutus & Kabatero areas with poor drainage and insecure land tenure; limited access to services.	**High**	• **Sensitivity:** Very High — lightweight housing, no sanitation, high exposure to water contamination and displacement. **Adaptive Capacity:** • Very Low — low income, limited options to relocate.	**High**	**Catastrophic**
Vulnerable and Marginalized Groups	• Tend to live in lower quality housing and have weaker mobility/resources to evacuate or protect assets.	**High**	• **Sensitivity:** Very High — health & livelihood impacts disproportionate; evacuation access limited. **Adaptive Capacity:** • Very Low — limited savings, social protection coverage.	**High**	**Catastrophic**
Natural Assets					
Urban Green Infrastructure	• Street trees, small parks and riparian vegetation are sparse/fragmented;	**Medium**	• **Sensitivity:** Medium — degraded green cover reduces infiltration.	**Medium**	**Moderate**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	green cover provides limited attenuation of runoff.		**Adaptive Capacity:** • Low–Medium — potential to expand green infrastructure but constrained by land pressure		
Urban Blue Infrastructure	• Rutui, Thiba and Kiringa rivers have narrowed riparian zones in places; overflow during intense storms causes local inundation and contamination.	**High**	• **Sensitivity:** High — river channels modified and banks vulnerable to erosion. **Adaptive Capacity:** • Low — limited riverbank restoration or buffer enforcement.	**High**	**Catastrophic**
Peri-urban and Agricultural Systems	• Low-lying farm plots and roadside plots receive runoff; soils already eroding on slopes and terraces; agricultural drains often fail under heavy surface flows.	**Medium**	• **Sensitivity:** Medium — crop damage, soil loss. **Adaptive Capacity:** • Low–Medium — traditional terraces exist but severely stressed; limited investment in retention structures.	**Medium**	**Moderate**

Table 14. Exposure, Vulnerability, and Impacts of Drought on Urban Elements

Hazard:Drought

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	• Stormwater systems provide little buffering for dry-season water supply; retention basins absent so no drought storage.	**Medium**	• **Sensitivity:** Medium — limited role in drought adaptation. **Adaptive capacity:** **Adaptive Capacity:** • Low — lack of multifunctional storage.	**Medium**	**Moderate**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Water & Wastewater Management	• Municipal piped network in cores supplemented by boreholes; many peri-urban and rural households depend on shallow wells and springs. Reduced recharge lowers borehole yields; some springs and shallow wells historically dry up during prolonged dry spells.	**Medium**	• **Sensitivity:** High — water infrastructure reliant on surface/groundwater recharge. **Adaptive capacity:** **Adaptive Capacity:** Medium — KIRIWASCO provides management but limited storage/resilience (few reservoirs/treated surface storage).	**High**	**Major**
Solid Waste Management	• Reduced water can increase concentration of wastes in informal dumps; however direct drought exposure is low.	**Low**	• **Sensitivity:** Low. **Adaptive capacity:** **Adaptive Capacity:** • Low — service disruptions possible due to resource constraints.	**Low**	**Insignificant**
Transport and Mobility	• Roads and bridges not directly water-supply dependent; drought reduces river flows (less scouring) but also increases dust and road surface deterioration.	**Low**	• **Sensitivity:** Low–Medium. **Adaptive Capacity:** • Medium — routine maintenance possible but costs rise.	**Low**	**Insignificant**
Energy	• Small-scale energy users (pumped water supply, pumps for irrigation) see increased demand from borehole pumping; higher diesel/electricity costs.	**Medium**	• **Sensitivity:** Medium — increased energy demand for water supply and irrigation; grid reliability affects pumps. **Adaptive Capacity:** • Medium — some institutional capacity to manage but limited backup.	**Medium**	**Moderate**
Economic Infrastructure	• Markets, agro-processing units and agribusiness (tea/coffee nurseries, horticulture) rely on steady water	**High**	• **Sensitivity:** High — agricultural value chains sensitive to yield loss and water scarcity.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	supply; irrigation systems limited.		**Adaptive Capacity:** • Medium — some larger farms have irrigation or better access to credit; smallholders are less resilient.		
Social Infrastructure	• Schools, hospitals need reliable water for sanitation and hygiene; limited on-site storage increases risk of service disruption.	**High**	• **Sensitivity:** High — critical services impacted by lack of water for sanitation and clinical needs. **Adaptive Capacity:** • Medium — can implement rationing but limited reserves.…	**High**	**Catastrophic**
Emergency Services	• Firefighting and health response require water; drought reduces available water sources and complicates response.	**Medium**	• **Sensitivity:** Medium — emergency effectiveness compromised. **Adaptive Capacity:** • Low — no dedicated drought contingency water reserves	**Medium**	**Moderate**
Populations					
Urban Residents	Urban households rely heavily on piped water from KIRIWASCO and community boreholes; drought reduces yields and increases rationing. High dependence on river-fed water treatment works; reduced river flows during drought directly affect urban water availability.	**High**	**Sensitivity:** • High — limited on-site water storage in most rental units and flats. • High — rising population density increases demand during shortages. **Adaptive Capacity:** **Medium** — some households purchase water from vendors or store in small tanks; affordability is limited for low-income households.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Informal Settlement Residents	• Dependence on shallow wells, springs, informal water vendors and communal taps, many of which dry during prolonged droughts. • Located in areas without formal water infrastructure; water scarcity immediately raises costs and burden on women/youth for collection.	**High**	**Sensitivity:** • **Very High** — limited sanitation, poor drainage, and overcrowding increase health risks when water is scarce. • **High** — limited financial capacity to buy vendor water during drought. **Adaptive Capacity:** • **Low** — minimal water storage, low incomes, limited resilience infrastructure, and often no formal connection to KIRIWASCO networks.	**High**	**Catastrophic (for prolonged drought)**
Vulnerable and Marginalized Groups	• Typically live in areas with poor service coverage or depend on communal water sources that dry faster. • □ Disproportionately affected by rising water prices during scarcity.	**High**	**Sensitivity:** • Very High — infant care, elderly care, disability needs heighten dependence on reliable water. • High — marginalized groups often lack capacity to queue for water or purchase emergency supplies. **Adaptive Capacity:** • **Low** — limited income, limited access to climate-information, and fewer safety nets.	**High**	**Catastrophic**
Natural Assets					

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Urban Green Infrastructure	□ Drought causes die-off of trees, drying of parks and urban vegetation; increased wildfire risk in peri-urban forest patches. □ Urban heat island effect worsens as vegetation loses moisture.	**Medium**	**Sensitivity:** □ Drought causes die-off of trees, drying of parks and urban vegetation; increased wildfire risk in peri-urban forest patches. □ Urban heat island effect worsens as vegetation loses moisture. **Adaptive Capacity:** • **Medium** — county can support replanting and watering, but budget and water constraints limit action.	**Medium**	**Moderate**
Urban Blue Infrastructure	□ River flows (e.g. Kuja, Misadhi) significantly drop during drought; wetlands and springs shrink or dry completely. □ Urban runoff and pollution intensify due to low water volume.	**High**	**Sensitivity:** □ High — heavy dependence on consistent river flow for domestic supply and municipal treatment works. □ Wetlands are already degraded by agriculture and urban expansion. **Adaptive Capacity:** • **Low/Medium**— limited wetland protection, siltation control, or regulated abstraction.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Peri-urban and Agricultural Systems	Heavily reliant on rainfall and shallow groundwater; drought sharply reduces yields (coffee, tea, vegetables). Competition for water between agriculture and domestic use increases.	**High**	**Sensitivity:** Very High — crops like vegetables, bananas, and dairy systems are extremely water-sensitive. Heavy reliance on seasonal rivers that nearly dry during severe droughts. **Adaptive Capacity:** • **Medium/Low** — few farmers have irrigation; adoption of drip irrigation and water-efficient systems is slowly growing.	**High**	**Catastrophic (if drought is prolonged)**

Table 15. Exposure, Vulnerability, and Impacts of Heat Stress on Urban Elements

Hazard:Heat Stress

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	□ Heat stress accelerates evaporation, drying drains and sediment traps, increasing accumulation of debris. □ Concrete surfaces expand and crack under prolonged high temperatures.	**Medium**	**Sensitivity:** • **Medium** — drains deteriorate faster under thermal stress. **Adaptive Capacity:** • **Medium** — maintenance possible but may be irregular; limited shading/vegetation reduces resilience.	**Medium**	**Moderate**
Water & Wastewater Management	□ Higher temperatures increase evaporation in water pans and reduce surface water reliability. □ Increased water demand (cooling, sanitation) stresses municipal supply systems.	**Medium**	**Sensitivity:** • **High** — demand spikes outstrip storage; pipes and treatment systems degrade faster under heat. **Adaptive Capacity:** • **Medium** — KIRIWASCO can ration and optimize supply, but limited storage capacity remains a constraint.	**High**	**Major**
Solid Waste Management	• High temperatures accelerate decomposition and odor emissions from dumpsites. □ Increased risk of spontaneous fires at informal dumpsites.	**Medium**	**Sensitivity:** • **Medium** — waste handling becomes more hazardous; public health risks rise. **Adaptive Capacity:** • Low — informal dumpsites lack fire-control and monitoring systems.	**Medium**	**Moderate**
Transport and Mobility	□ Extreme heat softens asphalt surfaces, causing rutting; dust increases on	**Medium**	**Sensitivity:** • **Medium** — roads degrade faster; heat affects public transport reliability.	**Medium**	**Moderate**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	unpaved roads. □ Pedestrian mobility reduces, especially for elderly and vulnerable groups.		**Adaptive Capacity:** • **Medium** — routine maintenance possible but costly.		
Energy	□ Increased cooling demand (fan use, refrigeration, cold storage) drives up electricity consumption. □ Heat affects transformer efficiency and increases chances of power outages.	**High**	**Sensitivity:** • **High** — increased demand stresses the grid, especially in urban centres. **Adaptive Capacity:** • **Medium** — KPLC system adjustments possible but limited redundancy.	**High**	**Catastrophic**
Economic Infrastructure	□ Heat affects productivity of markets, shops, agro-processors, and informal businesses. □ Post-harvest losses increase due to faster spoilage. •	**High**	**Sensitivity:** □ Heat affects productivity of markets, shops, agro-processors, and informal businesses. □ Post-harvest losses increase due to faster spoilage. **Adaptive Capacity:** • **Medium** — some businesses adopt refrigeration, but high energy costs limit access.	**High**	**Catastrophic**
Social Infrastructure	□ High indoor temperatures reduce learning capacity and increase heat-	**High**	**Sensitivity:** • **High** — buildings poorly ventilated; few have cooling systems.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	related illnesses. □ Hospitals face increased caseloads for dehydration, heat exhaustion.		**Adaptive Capacity:** • **Medium** — can adopt shading, ventilation strategies but limited funding.		
Emergency Services	• Fire risk and heat-related medical emergencies increase; staff performance may drop in extreme heat.	**Medium**	**Sensitivity:** • Medium— emergency operations directly affected by high temperatures. **Adaptive Capacity:** • **Medium** — response capacity exists but is strained during heat waves.	**High**	**Major**
Populations					
Urban Residents	□ High temperatures increase discomfort, indoor overheating, and energy bills for cooling. □ Heat stress worsens in dense settlements with limited tree cover.	**High**	**Sensitivity:** • **High** — many homes lack ventilation, insulation, or shading. **Adaptive Capacity:** • **Medium** — some can afford fans or cooling, but energy prices limit uptake.	**High**	**Catastrophic**
Informal Settlement Residents	□ Corrugated iron-sheet houses trap heat, making indoor conditions extremely high. □ Little vegetation or shaded areas; limited access to cooling.	**High**	**Sensitivity:** • **Very High** — poor housing materials, overcrowding, and lack of water worsen heat stress. **Adaptive Capacity:** • **Low** — low incomes and lack of cooling infrastructure.	**High**	**Catastrophic**
Vulnerable and Marginalized Groups	□ Infants and elderly at greatest risk; heat	**High**	**Sensitivity:** • **Very High** — physiological susceptibility to overheating.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	stress worsens chronic illness. □ Limited mobility increases difficulty accessing cool areas.		**Adaptive Capacity:** • **Low** — depend on caretakers and access to cooling or water. …		
Natural Assets					
Urban Green Infrastructure	□ Parks, trees, and green belts dry quickly; canopy cover reduces. □ Increased risk of vegetation die-off.	**High**	**Sensitivity:** • **High** — species sensitive to moisture loss. **Adaptive Capacity:** • **Medium** — county watering programs exist but limited in scale.	**High**	**Catastrophic**
Urban Blue Infrastructure	□ Higher temperatures accelerate water loss and reduce oxygen levels, affecting ecosystems. □ Reduced flow worsens pollution concentration.	**High**	**Sensitivity:** • **High** — aquatic ecosystems fragile under heat. **Adaptive Capacity:** • **Medium** — poor protection of riparian areas; limited restoration programmes.	**High**	**Catastrophic**
Peri-urban and Agricultural Systems	□ Heat reduces crop yields (vegetables, bananas, coffee seedlings). □ Livestock experience heat stress reducing productivity.	**High**	**Sensitivity:** • **Very High** — many crops are temperature sensitive; heat increases irrigation demand. **Adaptive Capacity:** • **Low** — limited irrigation access; smallholder farmers lack cooling sheds.	**High**	**Catastrophic**

Table 16. Exposure, Vulnerability, and Impacts of Land Degradation on Urban Elements

Hazard:Land Degradation

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	• Land degradation increases soil erosion and siltation, blocking drains, culverts and outlets; upstream catchment degradation increases sediment load into urban drainage.	**Medium**	**Sensitivity:** • **Medium** — system dependent on stable soils. **Adaptive Capacity:** • Low — limited desilting equipment and irregular maintenance.	**Medium**	**Moderate**
Water & Wastewater Management	• Catchment degradation reduces surface water reliability and increases turbidity, raising treatment costs; siltation of intakes and spring sources.	**High**	**Sensitivity:** • **High** — treatment stressed by sediment-heavy water. **Adaptive Capacity:** • Medium — some treatment adjustment possible but limited redundancy.	**High**	**Catastrophic**
Solid Waste Management	• Land degradation creates informal dumping zones and erosion exposes buried waste, though overall exposure remains low.	**Medium**	**Sensitivity:** • **Low**— exposed waste increases environmental risks. **Adaptive Capacity:** • Low — poor site management and limited equipment.	**Low**	**Minor**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Transport and Mobility	• Road shoulders erode; unpaved roads degrade faster under runoff; gullies affect access routes.	**Medium**	**Sensitivity:** • **Medium** — transport corridors sensitive to soil instability. **Adaptive Capacity:** • **Medium** — maintenance possible but expensive.	**Medium**	**Moderate**
Energy	• Soil instability undermines electricity poles, small substations and distribution lines.	**Low**	**Sensitivity:** • Low — overall network resilient. **Adaptive Capacity:** • Medium — routine repairs possible.	**Low**	**Insignificant**
Economic Infrastructure	• Agricultural processing, local markets, and agri-business depend on productive land—declining soil fertility disrupts value chains.	**High**	**Sensitivity:** • **High** — strong dependence on land productivity. **Adaptive Capacity:** • **Medium** — larger enterprises can invest in conservation; smallholders cannot.	**High**	**Catastrophic**
Social Infrastructure	• Schools/health facilities in peri-urban areas affected by erosion of compounds and access roads.	**Medium**	**Sensitivity:** • Medium — disruptions to sanitation and accessibility. **Adaptive Capacity:** • Medium — local repairs possible but funding limited.	**Medium**	**Moderate**
Emergency Services	• Land degradation limits access routes for fire engines and ambulances, especially in steep or rural areas.	**Medium**	**Sensitivity:** • **Medium** — response times affected by degraded roads. **Adaptive Capacity:** • **Medium** — rerouting possible but delays increase.	**Medium**	**Moderate**
Populations					

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Urban Residents	• Households on steep slopes, riverbanks and informal settlements exposed to erosion, unstable soils and gully formation.	**High**	**Sensitivity:** • **High** — informal settlements lack stabilization and drainage. **Adaptive Capacity:** • **Low** — limited resources for soil conservation.	**High**	**Catastrophic**
Informal Settlement Residents	• More likely to settle on degraded marginal lands with poor infrastructure.	**Medium**	**Sensitivity:** • **High** — limited relocation options. **Adaptive Capacity:** • **High** —financial constraints restrict adaptation.	**High**	**Major**
Vulnerable and Marginalized Groups	• Direct exposure to soil fertility decline, gully formation and reduced yields.	**Medium**	**Sensitivity:** • **High**— financial constraints restrict adaptation. **Adaptive Capacity:** • High — degradation increases workload and reduces resource availability.	**High**	**Major**
Natural Assets					
Urban Green Infrastructure	• High exposure to deforestation, soil erosion and surface runoff.	**High**	**Sensitivity:** • High — vegetation loss accelerates degradation loops. **Adaptive Capacity:** • Medium — reforestation possible but slow.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Urban Blue Infrastructure	• Exposed to siltation, reduced water quality and unstable banks from erosion.	**High**	**Sensitivity:** • **High** — aquatic ecosystems rapidly degrade. **Adaptive Capacity:** • **Medium** — restoration achievable with strong management.	**High**	**Catastrophic**
Peri-urban and Agricultural Systems	• Directly exposed to erosion, nutrient depletion and gully formation.	**High**	**Sensitivity:** • **Very High** — primary asset affected. **Adaptive Capacity:** • **Low** — natural recovery slow without intervention.	**High**	**Catastrophic**

Table 17. Exposure, Vulnerability, and Impacts of Change in Precipitation Patterns on Urban Elements

Hazard: Change in Precipitation Patterns

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Storm water Drainage	• Drainage systems exposed to intense rainfall events leading to overflow, siltation, and blockages; prolonged dry spells reduce system functionality due to sediment accumulation.	**High**	**Sensitivity:** • High — infrastructure not designed for current rainfall extremes. **Adaptive Capacity:** • Medium — limited upgrades, desilting irregular.	**Medium**	**Major**
Water & Wastewater Management	• Water supply and wastewater systems exposed to fluctuating rainfall affecting groundwater recharge, surface water quality, and wastewater overflow during	**High**	**Sensitivity:** • High — turbidity spikes overwhelm treatment; wastewater plants affected by storm water infiltration.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	storms.		**Adaptive Capacity:** • Medium — some operational flexibility but infrastructure constraints remain.		
Solid Waste Management	• Dumpsites exposed to leachate increases during heavy rainfall; waste washed into waterways; disruption of collection during extreme weather.	**Medium**	**Sensitivity:** • Medium — poor containment increases environmental risks. **Adaptive Capacity:** • Low — few engineered disposal sites and limited drainage controls.	**Medium**	**Moderate**
Transport and Mobility	• Roads and bridges exposed to flooding, erosion, and pavement weakening during heavy rains; dry spells lead to dust and surface cracking.	**High**	**Sensitivity:** • High — erosion and washouts common during storms. **Adaptive Capacity:** • Medium — maintenance possible but reactive and underfunded.	**Medium**	**Major**
Energy	• Energy distribution infrastructure exposed to storm-related disruptions (lightning, wind, erosion); rainfall variability affects systems reliant on steady water supply.	**Medium**	**Sensitivity:** • Medium — outages increase with storm intensity. **Adaptive Capacity:** • Medium — restoration capacity exists but challenges persist.	**Medium**	**Moderate**
Economic Infrastructure	• Markets, agro-processing and SMEs exposed to disruptions in supply chains, reduced access, and water-related operational challenges.	**High**	**Sensitivity:** • High — dependent on consistent water availability and functional access roads. **Adaptive Capacity:** • Medium — some private actors adapt, but small enterprises vulnerable.	**High**	**Catastrophic**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Social Infrastructure	• Schools, hospitals and social facilities exposed to flooding, roof leaks, and sanitation challenges during irregular rains.	**Medium**	**Sensitivity:** • High — essential services require stable water and infrastructure conditions. **Adaptive Capacity:** • Medium — some facilities have basic storage but structural resilience is limited.	**High**	**Major**
Emergency Services	• Emergency operations exposed to access difficulties during storms; communication and mobility disrupted by road flooding or washouts.	**High**	**Sensitivity:** • Medium — response heavily dependent on road network and weather. **Adaptive Capacity:** • Medium — alternative routing possible but limited.	**Medium**	**Major**
Populations					
Urban Residents	• Exposed to flash floods, drainage overflows, water shortages during dry spells, and health risks from water contamination.	**Medium**	**Sensitivity:** • Medium — reliant on municipal systems with limited redundancy. **Adaptive Capacity:** • Medium — can adopt household coping measures depending on income.	**High**	**Major**
Informal Settlement Residents	• Highly exposed to flooding, runoff, contamination of drinking water, and storm-related hazards due to marginal settlement locations.	**High**	**Sensitivity:** • High — poor housing, inadequate drainage, and overcrowding. **Adaptive Capacity:** • Low — limited financial and institutional support.	**High**	**Catastrophic**
Vulnerable and Marginalized Groups	• Children, elderly, PWDs, and low-income households exposed to health hazards, mobility constraints, and service disruptions.	**High**	**Sensitivity:** • High — disproportionate impact from water shortages and extreme rainfall. **Adaptive Capacity:** • Low- limited ability to relocate or reinforce homes.	**Medium**	**Major**

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Natural Assets					
Urban Green Infrastructure	• Trees, parks, and landscaped areas exposed to drought stress, soil erosion, and storm damage from intense rains.	**Medium**	**Sensitivity:** • Medium — vegetation quickly affected by rainfall extremes. **Adaptive Capacity:** • Low — limited irrigation and management resources.	**High**	**Major**
Urban Blue Infrastructure	• Rivers, streams, and wetlands exposed to fluctuating water levels, sedimentation, and pollution during erratic rainfall events.	**High**	**Sensitivity:** • High — ecosystems easily destabilized by runoff and pollutant loads. **Adaptive Capacity:** • Medium — restoration possible but requires sustained effort.	**Medium**	**Major**
Peri-urban and Agricultural Systems	• Farms and peri-urban land exposed to irregular rains affecting planting seasons, crop yields, and increasing erosion.	**High**	**Sensitivity:** • High — rainfall-dependent cropping systems highly impacted. **Adaptive Capacity:** • Medium — irrigation limited; smallholder farmers vulnerable.	**High**	**Catastrophic**

• Climate Risk Assessment

The Climate Risk Assessment evaluates the combined effects of hazard exposure, vulnerability, and adaptive capacity to determine the overall level of climate risk facing Rongo Municipality. It integrates scientific data, stakeholder insights, and spatial analysis to identify which sectors, populations, and assets are most at risk from climate-induced events such as flooding, drought, heat stress, land degradation etc. This assessment provides a critical foundation for prioritizing resilience actions, informing planning decisions, and guiding sustainable investments that safeguard the municipality's people, economy, and environment against the growing impacts of climate change.

For this Urban Climate Risk Profile, the following matrix summarizes overall risk for each urban element by combining the assessed hazard level and the estimated impact level.

Table 18. Risk matrix

		Hazard Level		
		Low	**Medium**	**High**
Impact Level	**Catastrophic**	High	Very High	Very High
	Major	Medium	High	Very High
	Moderate	Low	Medium	High
	Minor	Low	Low	Medium
	Insignificant	Very Low	Low	Low

For this Urban Climate Risk Profile, risk levels should be interpreted based on the table below.

Table 19. Interpretation of risk levels

Level	**Interpretation**
Very High	Very high risks are unacceptable. Risk should be avoided, reduced or transferred. Immediate planning and implementation of risk reduction measures is required. Allocate resources and coordinate interventions to prevent or minimize impact.
High	High risks should be actively addressed. Develop and implement mitigation actions promptly. Monitor environmental indicators and ensure readiness of emergency or adaptation measures.
Medium	Medium risks should be managed. Plan and implement mitigation activities to reduce them to acceptable levels. Regularly review climate data and risk levels.
Low	Low risks are acceptable under current conditions. Minimal control or monitoring is needed, provided they remain stable and do not escalate.
Very Low	Very low risks are negligible in terms of likelihood and consequences. No immediate action is required beyond routine monitoring and periodic review.

.1. Current and Future Climate Risks on Urban Elements

[Complete the table below by following the steps under Section-3 for each key hazard.

- Use outputs from Step-2.3. to fill the "Hazard Levels" row.
- Use outputs from Step-3.3. to fill the "Impact" column.
- Refer to Step-4.1. to fill the "Risk Level" columns, using the Risk Matrix.

The rows for urban elements not included in the assessment, if any, can be removed.]

Table 1. Summary of Pluvial Flooding risks for Rongo Municipality

	Time Horizon& Climate Scenario	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
	Hazard Level					
Categories	**Impact**	**Risk Levels**				
		Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services						
Storm water Drainage	Moderate	Medium	Medium	High	Medium	High
Water & Wastewater Management	Moderate	Medium	High	High	High	High
Solid Waste Management	Moderate	Medium	Medium	High	Medium	High
Transport and Mobility	Major	High	High	High	High	High
Energy	Moderate	Medium	Medium	High	Medium	High
Economic Infrastructure	Major	High	High	High	High	High
Social Infrastructure	Major	High	High	High	High	High
Emergency Services	Moderate	Medium	High	High	High	High
Populations						
Urban Residents	Major	Medium	High	High	High	High
Informal Settlement Residents	Catastrophic	High	High	High	High	High
Vulnerable and Marginalized Groups	Major	Medium	High	High	High	High
Natural Assets						
Urban Green Infrastructure	Major	Medium	High	High	High	High
Urban Blue Infrastructure	Major	High	High	High	High	High
Peri-urban and Agricultural Systems	Major	High	High	High	High	High

Table 2. Summary of Drought risks for Rongo Municipality

	Time Horizon & Climate Scenario	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
	Hazard Level					
Categories	**Impact**	**Risk Levels**				
		Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services						
Stormwater Drainage	Minor	Low	Medium	Medium	Medium	Medium
Water & Wastewater Management	Major	High	High	High	High	High
Solid Waste Management	Minor	Medium	Medium	High	Medium	High
Transport and Mobility	Moderate	Medium	High	High	High	High
Energy	Moderate	Medium	High	High	High	High
Economic Infrastructure	Major	High	High	High	High	High
Social Infrastructure	Major	High	High	High	High	High
Emergency Services	Moderate	Medium	High	High	High	High
Populations						
Urban Residents	Major	High	High	High	High	High
Informal Settlement Residents	Major	High	High	High	High	High
Vulnerable and Marginalized Groups	Major	High	High	High	High	High
Natural Assets						
Urban Green Infrastructure	Major	High	High	High	High	High
Urban Blue Infrastructure	Major	High	High	High	High	High
Peri-urban and Agricultural Systems	Major	High	High	High	High	High

Table 3. Summary of Heat Stress/Extreme Heat risks for Rongo Municipality

	Time Horizon & Climate Scenario	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
	Hazard Level					
Categories	**Impact**	**Risk Levels**				
		Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services						
Stormwater Drainage	Moderate	Medium	Medium	High	Medium	High
Water & Wastewater Management	Moderate	Medium	High	High	High	High
Solid Waste Management	Moderate	Medium	High	High	High	High
Transport and Mobility	Moderate	Medium	High	High	High	High
Energy	Minor	Medium	Medium	High	Medium	High
Economic Infrastructure	Major	High	High	High	High	High
Social Infrastructure	Major	High	High	High	High	High
Emergency Services	Moderate	Medium	High	High	High	High
Populations						
Urban Residents	Major	High	High	High	High	High
Informal Settlement Residents	Major	High	High	High	High	High
Vulnerable and Marginalized Groups	Major	High	High	High	High	High
Natural Assets						
Urban Green Infrastructure	Major	High	High	High	High	High
Urban Blue Infrastructure	Moderate	Medium	Medium	High	Medium	High
Peri-urban and Agricultural Systems	Major	High	High	High	High	High

Table 4. Summary of Land Degradation risks for Rongo Municipality

	Time Horizon & Climate Scenario	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
	Hazard Level					
Categories	**Impact**	**Risk Levels**				
		Current	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Infrastructure & Services						
Stormwater Drainage	Moderate	Medium	High	High	High	High
Water & Wastewater Management	Major	High	High	High	High	High
Solid Waste Management	Moderate	Medium	Medium	High	Medium	High
Transport and Mobility	Moderate	Medium	Medium	High	Medium	High
Energy	Moderate	Medium	Medium	High	Medium	High
Economic Infrastructure	Major	High	High	High	High	High
Social Infrastructure	Moderate	Medium	Medium	High	Medium	High
Emergency Services	Moderate	Medium	Medium	High	Medium	High
Populations						
Urban Residents	Moderate	Medium	Medium	High	Medium	High
Informal Settlement Residents	Major	High	High	High	High	High
Vulnerable and Marginalized Groups	Major	High	High	High	High	High
Natural Assets						
Urban Green Infrastructure	Major	High	High	High	High	High
Urban Blue Infrastructure	Major	High	High	High	High	High
Peri-urban and Agricultural Systems	Major	High	High	High	High	High

Table 5. Summary of Changes in Precipitation risks for Rongo Municipality

	Time Horizon & Climate Scenario	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
	Hazard Level					

Categories	Impact	Risk Levels				
		Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services						
Stormwater Drainage	Major	Medium	Medium	High	Medium	High
Water & Wastewater Management	Major	Medium	Medium	High	Medium	High
Solid Waste Management	Moderate	Medium	Medium	High	Medium	High
Transport and Mobility	Major	Medium	Medium	High	Medium	High
Energy	Moderate	Medium	Medium	High	Medium	High
Economic Infrastructure	Major	High	High	High	High	High
Social Infrastructure	Major	High	High	High	High	High
Emergency Services	Moderate	Medium	Medium	High	Medium	High
Populations						
Urban Residents	Moderate	Medium	Medium	High	Medium	High
Informal Settlement Residents	Major	High	High	High	High	High
Vulnerable and Marginalized Groups	Major	High	High	High	High	High
Natural Assets						
Urban Green Infrastructure	Moderate	Medium	Medium	High	Medium	High
Urban Blue Infrastructure	Major	High	High	High	High	High
Peri-urban and Agricultural Systems	Major	High	High	High	High	High

.2. Climate Risk Hotspots

Climate risk hotspots and key climate related vulnerabilities in Rongo Municipality based on climate risk profiles and county data. The available assessments of Rongo area show where major climate risks concentrate and what local hazards are most relevant.

1. **Drought and water scarcity:** the broader Migori region and some parts of Rongo municipality are erratic, rainfall, prolonged dry spells and increased temperatures, which drive drought conditions that harm agriculture and water supply.

2. **Flood risk zones:** although flood hazard data For Rongo specifically is limited, flooding is recognized risk across Migori county related to increasingly erratic and intense rainfall during the long rains. Low-lying areas near rivers and drainage channels in Rongo town and nearby settlements are prone to urban and riverine floods during heavy rainfall.
3. **Extreme Heat and heat stress:** Rongo experience higher temperatures and prolonged sunshine, contributing to heat stress.
4. **Environmental degradation and land management:** poor waste handling , illegal dumping contribute to environmental degradation around urban areas within the municipality. Soil erosion and deforestation limit the lands ability to buffer climate extremes increasing vulnerability during both drought and intense rainfall.

Key vulnerable areas within Rongo Municipality

Climate risks tend to be concentrated in:

- Low –lying built up zones where drainage is poor- risk of surface flooding
- Peri-urban – with high dependence on rainfall – drought and crop failure risk
- Riparian zones –along small streams (kobila stream)- flood and erosion risk during heavy rains.

• What's Next?

.1. Key Findings

[Refer toStep-5.1. tosummarize:

- A list of the key hazards, including those that are associated with higher risks,
- populations and assets that are most at risk,
- trends that are most likely to intensify in the future, referring back to the future trends recorded in Step-1.2.

Additionally, fill the table below based on the guidance in Step-5.1. If there are no key hazards at "Very High" or "High" levels for a particular urban element category for either climate scenario at a given time horizon, then the cell can be left blank or marked not applicable (i.e. n/a, N/A, or NA).

The rows for urban elements not included in the assessment, if any, can be removed.]

Table n. Summary of climate risks affecting urban elements for Rongo Municipality

Category	List of Key Hazards		
	Current	Mid-term (2050)	Long-term (2100)
Infrastructure & Services			
Storm water Drainage	Urban flooding blocked drains.	Flash floods Public health risk	Permanent loss of natural drainage pathways

Category	List of Key Hazards		
	Current	Mid-term (2050)	Long-term (2100)
Water & Wastewater Management	Discharge of untreated sewage, seasonal water shortages.	Infrastructure stress from extreme weather Higher pollution of rivers	Chronic water scarcity Long term groundwater contamination
Solid Waste Management	Blocked storm water due to plastic waste, increased contamination water sources.	Extreme weather intensification. Disease risk.	Chronic flooding. Landfill relocation. Methane emissions.
Transport and Mobility	Traffic distruption during storms, potholes from intense rainfall.	Damage to culverts and bridges. Rising maintenance costs.	Costly infrastructure. Chronic flooding.
Energy	Flooding, Heatwaves/high temperatures.	Increased rainfall variability. Soil erosion.	Chronic water scarcity. Population growth and urban expansion.
Economic Infrastructure	Droughts,heat, erosion. Heat	Water stress erosion	Systemic failures Cyclic extremes
Social Infrastructure	Flooding, water scarcity,	Droughts, Health hazards.	Structural degradation, Chronic water shortage.
Emergency Services	Disease outbreaks, power outages, heat waves, flooding and heavy rains.	Water scarcity. Population displacement.	Chronic extreme heat. Infrastructure collapse.
Populations			

Category	List of Key Hazards		
	Current	Mid-term (2050)	Long-term (2100)
Urban Residents	Flooding, water scarcity, air pollution.	Food insecurity, vector and infectious disease expansion.	Chronic water shortages, infrastructure failure impacts, Persistent air quality degradation
Informal Settlement Residents	Poor water quality, storm damage, Flooding.	Water scarcity, erosion, Waste accumulation.	Health crises, Chronic water stress, environmental degradation.
Vulnerable and Marginalized Groups	Heatwaves and extreme temperatures, flooding and water loggings ,food insecurity	Chronic water scarcity, health vulnerabilities, education disruption	Chronic poverty and enequality, food system collapse , mental health impacts, social instability.
Natural Assets			
Urban Green Infrastructure	Heat waves and extreme temperatures, heavy rainfall and flooding, storms and strong winds.	Prolonged droughts, loss of biodiversity	Permanent loss of green cover, altered hydrology, ecosystem collapse.
Urban Blue Infrastructure	Heavy rainfall and flash floods, water contamination.	Prolonged droughts, bank erosion and siltation.	Chronic water scarcity, collapse of storm water systems, collapse of ecosystem services.
Peri-urban and Agricultural Systems	Loss of top soil fertility, prolonged droughts.	Reduced agricultural productivity. Increased livestock vector-borne diseases.	Chronic food security. Severe Land degradation.

[Refer to the filled table to write the main takeaways from the climate risk assessment.]

.2. Climate Adaptation and Resilience Solutions

[Refer to Step-5.2. to propose a preliminary list of adaptation and resilience solutions that will address the key hazards for each urban element category listed in the previous Section 5.1. The rows for urban elements not included in the assessment, if any, can be removed.]

Table n. Climate adaptation and resilience solutions recommended for Rongo municipality

Category	Recommended Solutions		
	Immediate	**Mid-term**	**Long-term**
Infrastructure & Services			
Storm water Drainage	• Desilt and unblock all existing storm water drains, culverts and manhole • Remove solid waste, silt and illegal obstructions	• Drainage system upgrading • Construct retention and detention ponds	• Develop an integrated urban storm water management (IUSWM) system • Implement upstream soil and water conservation measures to reduce run off entering town.
Water & Wastewater Management	• Promote household and institutional rain water harvesting using rooftop tanks • Identification and stop illegal waste water discharges into drains, rivers and open land	• Drill and equip climate resilient boreholes • Upgrade treatment plants to handle viable water quality during floods	• Protect and restore water catchment areas and riparian zones upstream of Rongo • Construct or upgrade centralized waste water treatments plants for climate resilient standards
Solid Waste Management	• Operational and service measures- clear waste from drainage channels, road reserves and flood prone areas • Dumpsite and disposal risk control- improve drainage around existing dumpsites to prevent flooding. -restrict waste disposal during extreme rainfall events where necessary	• Infrastructure improvement: upgrade waste collection equipment (covered trucks, skips) • Waste reduction and segregation: introduce waste segregation at source Support recycling initiatives for plastics paper and metals.	• Integrated and circular waste systems: develop a sanitary landfill or controlled disposal facility designed for extreme rainfall • Climate smart waste treatment: scale up composting facilities to reduce organic waste and methane emissions Introduce waste to energy waste where feasible

Category	Recommended Solutions		
	Immediate	**Mid-term**	**Long-term**
Transport and Mobility	• Road and drainage maintenance: desilt and clear road side drains, culverts and bridges before and during rainy season • Flood and safety management: identify and mark flood prone road sections and black spots • Non-motorized Transport Protection 9NMT)- Clear foot paths and pedestrian crossings Improve street lighting for safety during extreme weather events	• Climate-resilient Road Design: upgrade roads using climate resilient standards Replace undersized culverts and bridges with larger, climate resilient structures. • Mobility and Traffic Management: design safer bus stops and loading zones that are flood resilient	• Green and Low Mobility: expand Non Motorized Transport (NMT) networks • Smart and Digital solutions: implement smart traffic and asset management system.
Energy	• Protection of critical energy infrastructure :protect transformers and meters from flooding through elevation and fencing • Emergency power and preparedness: provide backup generators or solar power systems for critical facilities	• Climate resilient energy infrastructure :expand solar powered systems for street lighting, water pumping and public buildings • Diversion of energy sources :promote decentralized renewable energy (solar, mini-grids, rooftop PV)	• Integrated and smart energy systems: introduce smart grids and digital monitoring systems for efficient energy management • Renewable energy transition: promote public-private partnership for large scale renewable projects
Economic Infrastructure	• Enforce land-use regulations to prevent construction on riparian reserves. • Routine maintenance of infrastructure to prevent climate related deteriotion	• Expand and modernize storm water management systems • Integrate climate risk considerations into municipal planning, budgeting and infrastructure design	• Develop and implement a climate resilient infrastructure master plan • Promote low-carbon and climate smart infrastructure (green buildings, renewable energy hub)
Social Infrastructure	• Conduct rapid climate risk assessments on social facilities • Raise community awareness on climate related health and safety risks	• Upgrade schools and health facilities using climate –resilient designs • Train teachers, health workers and facility managers on climate risk management	• Develop and implement a climate-resilient social infrastructure strategy aligned with national policies. • Relocate or redesign social facilities located on high risk zones.

Category	Recommended Solutions		
	Immediate	**Mid-term**	**Long-term**
Emergency Services	• Conduct rapid climate risk and capacity assessments for emergency service facilities and equipment • Identify and map climate hazard hotspots and high risk communities	• Upgrade fire stations, ambulance centre and emergency operation centre • Develop incident command systems and standard operation procedures for climate emergencies	• Develop and implement a climate resilient emergency service master plan. • Establish permanent, well equipped Emergency Operation centers (EOCs)
Populations			
Urban Residents	• Provide early warning systems for floods, and storms through Radios and sms • Promote solid waste management and drainage maintenance	• Enhance access to clean water and sanitation for all urban residents • Establish community –based disaster response teams trained in first aid and emergency evacuation	• Integrate urban planning with social resilience strategies (safe roads, access to heath, schools) • Ensure inclusive governance and decision making
Informal Settlement Residents	• Conduct rapid vulnerability and risk assessment in informal settlements • Clear blocked drains and debris to reduce flooding risk	• Improve water, sanitation and drainage systems • Upgrade housing structure with climate resilient materials	• Relocate or upgrade informal settlements I high risk areas • Inclusive planning and social protection
Vulnerable and Marginalized Groups	• Conduct rapid vulnerability assessments to identify marginalized households and high risk communities • Promote access to clean water, sanitation and health care services	• Strengthen access to climate-resilient housing for low income and marginalized groups • Promote inclusive health and social services with outreach programs for women, children, elderly and persons with disability	• Establish long term livelihood programs and social protection mechanisms for marginalized groups • Relocate or upgrade settlements in high risk zones with social safeguards for vulnerable residents.
Natural Assets			
Urban Green Infrastructure	• Maintain and protect existing urban trees, parks and vegetated areas • Establish temporary green interventions such as potted plants, green barriers and rooftop gardens	• Expand urban parks, green corridors and street trees to enhance urban cooling and flood mitigation • Integrate green infrastructure into drainage systems.	• Establish permanent green corridors and protect urban forest • Promote nature-based solutions to complement grey infrastructure for example wetlands.

Category	Recommended Solutions		
	Immediate	**Mid-term**	**Long-term**
Urban Blue Infrastructure	• Clear illegal encroachments and dumping along watercourses… • Conduct rapid assessment of water bodies and drainage systems to identify vulnerabilities	• Upgrade and expand storm water management systems • Improve urban water storage and distribution systems for drought resilience	• Promote nature –based solutions for urban water management, including urban wetlands • Integrate innovative water management technologies (smart drainage, sensors, real-time monitoring)
Peri-urban and Agricultural Systems	• Water and soil protection: promote mulching, minimum tillage and cover cropping to retain soil moisture. • Livestock resilience: promote strategic destocking during prolonged drought periods.	• Water management and irrigation: develop small-scale, climate –resilient irrigation systems • Market and value chain resilience: improve rural-urban feeder roads to ensure market access during extreme weather.	• Integrated landscape and food systems: implement integrated landscape management linking urban, peri-urban and rural systems • Climate- resilient food systems: encourage reuse of treated wastewater for irrigation

Bibliography

[Alphabetically list all the resources/literature utilized to develop the Urban Climate Risk Profile. One example is provided below as reference.]

Annex N2. Data Sources

[Record the resources used for the analyses in Sections 2-5. Add as many rows as needed to the table below.]

Page	Data	Data Source
	Census Data (population distribution)	Kenya Bureau of Statistics
	climate projections and scenarios (RCPs, SSPs)	SPEI database
	GCA, Urban Climate Risk profile: preparation guidelines, 2025	World Bank climate change portal
	Historical weather and rainfall records	Meteorological department
	Rongo municipality, strategic plan 2020-2025	Rongo municipality website.

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