THIKA MUNICIPALITY

URBAN CLIMATE RISK PROFILE

2025

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Disclaimer:

The Thika Municipality Urban Climate Risk Profile (2025) has been prepared for planning and informational purposes. The analyses, projections, and findings presented in this report are based on the best available data at the time of publication and are subject to uncertainties associated with climate science and changing local conditions.

While every effort has been made to ensure the accuracy and reliability of the information provided, any decisions, actions, or investments made based on this report remain the responsibility of the user. Users are therefore encouraged to seek further guidance from relevant authorities, technical experts, and other appropriate stakeholders before implementing any policies, programmes, or interventions.

Foreword

Climate change is no longer a distant threat; it is a present and escalating reality that is already disrupting life and development in Thika Municipality. Recurrent flooding during the rainy seasons, rising temperatures, and prolonged dry spells are placing increasing pressure on our infrastructure, economy, and the well-being of our people. The impacts are visible, urgent, and demand immediate and coordinated action.

This Urban Climate Risk Profile represents a decisive step toward understanding these risks and responding effectively. Developed through an inclusive and participatory process involving municipal departments, ward administrators, community groups, and vulnerable populations, it provides a clear and evidence-based assessment of the hazards facing our municipality. It establishes a strong foundation for the Thika Integrated Climate Risk Management Plan and will guide critical decisions on planning, investment, and resilience-building.

The time for action is now. I call upon all municipal departments, development partners, private sector actors, and residents to take collective responsibility and use this document as a guiding tool for action. Climate resilience must be integrated into every decision we make—from infrastructure development to service delivery and community planning.

Together, through commitment, collaboration, and decisive leadership, we can safeguard livelihoods, protect our environment, and build a resilient, sustainable, and inclusive Thika Municipality that is prepared not just to withstand, but to thrive in the face of a changing climate.

Gathii Kanyi.
Municipal Manager.
Thika Municipality.

Executive Summary

This Urban Climate Risk Profile assesses current and future climate risks in Thika Municipality, focusing on flooding, drought, and extreme cold. The assessment draws on climate data from the Kenya Meteorological Department, projections from ICPAC, and participatory consultations with local communities. Using the IPCC risk framework (hazard × exposure × vulnerability), the profile evaluates the potential impacts of climate hazards on infrastructure, water supply, agriculture, and vulnerable populations under current conditions and future climate scenarios (SSP2-4.5 and SSP5-8.5 for 2050 and 2100).

Flooding is the highest-risk hazard, affecting transport networks, stormwater drainage systems, and informal settlements such as Kisii Estate and Landless Estate. Current flooding already disrupts mobility, damages property, and threatens livelihoods. Projections indicate risks will intensify significantly by 2050, particularly under high-emission scenarios, due to more frequent intense rainfall and increased surface runoff.

Drought poses high risks to water supply, agriculture, and low-income households. Future scenarios show increased water stress and prolonged dry periods, threatening both domestic consumption and peri-urban farming.

Extreme cold currently generates medium risks to health and education services. Although projections suggest slight moderation under high-emission scenarios, occasional cold events may still impact vulnerable populations.

Most at risk include informal settlement residents, elderly persons, and boda boda operators, who are disproportionately exposed to hazards and have limited adaptive capacity.

Priority actions recommended include upgrading stormwater drainage, expanding water harvesting and storage, implementing early warning systems, and climate-proofing schools and health facilities.

This profile provides critical insights for local and county decision-makers to plan adaptation interventions, reduce hazard impacts, and enhance the resilience of Thika Municipality's people, infrastructure, and livelihoods under both current and projected future climate conditions.

List of Acronyms

Acronym	Meaning
CCCAP	County Climate Change Action Plan
EMCA	Environmental Management and Coordination Act
FLLoCA	Financing Locally Led Climate Action
GIS	Geographic Information System
IPM	Integrated Pest Management
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
THIWASCO	Thika Water and Sewerage Company
NEMA	National Environment Management Authority
PCRA	Participatory Climate Risk Assessment
PWD	Person with Disability
RCP	Representative Concentration Pathway
SSP	Shared Socioeconomic Pathway
WEENR	Water, Environment, Energy and Natural Resources
RCRA	Rapid Climate Risk Assessment

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1. CONTEXT

1.1. Objective

This Urban Climate Risk Profile aims to:

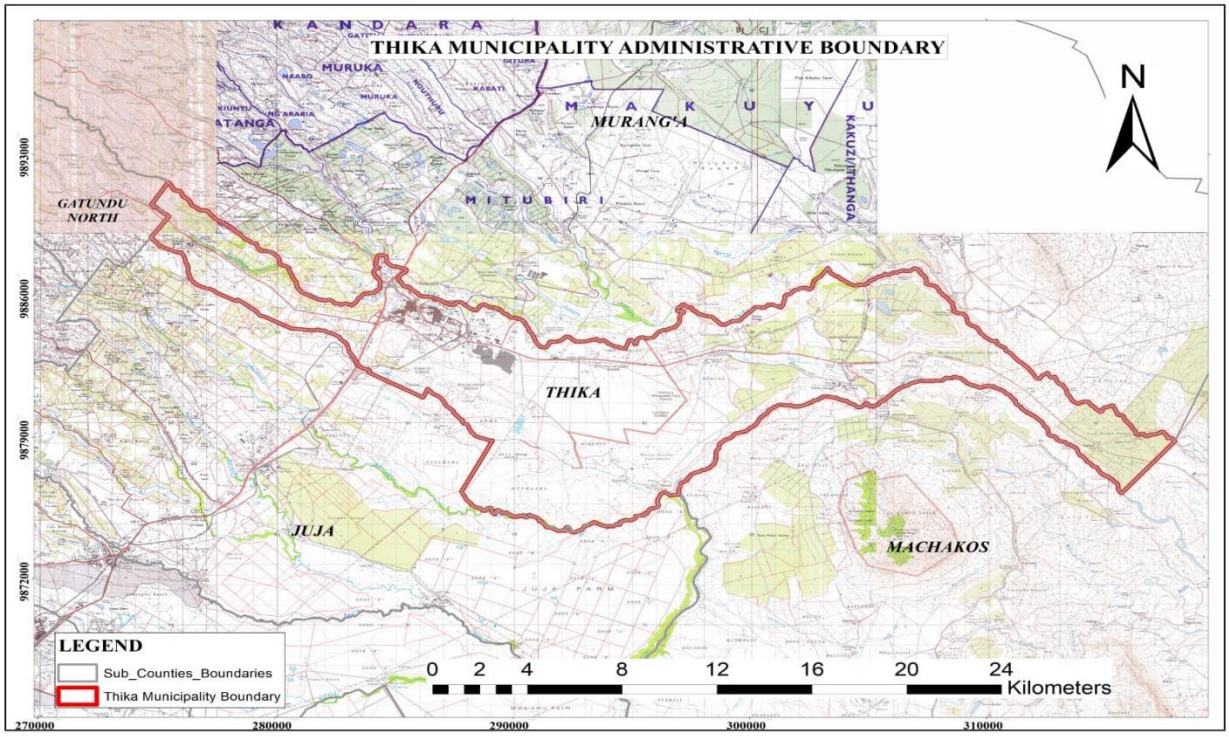
- Provide a strong evidence base to inform the Thika Integrated Development Plan and the County Climate Change Action Plan.
- Identify and prioritise the key climate hazards affecting Thika Municipality.
- Assess the exposure, vulnerability, and impacts of these hazards on urban infrastructure, populations, and natural systems.
- Equip municipal decision-makers, stakeholders, and communities with actionable climate risk information to guide planning, policy development, and adaptation investments under the FLLoCA programme.

1.2. Urban Context

Geographic area

Thika Municipality in Kiambu County, Kenya covers an estimated area of approximately 147 km² and is located within the Nairobi Metropolitan Region, about 42 km northeast of Nairobi City County. It borders Juja Sub-County to the west, Ruiru Sub-County to the south, Gatundu North to the north, and parts of Murang'a County to the east.

The municipality falls within Thika Constituency and comprises several wards, including Township, Kamenu, Hospital, Gatuanyaga, and Ngoliba



Thika Municipality administrative boundaries.

Governance Structure

Thika Municipality is governed by a Municipal Board appointed by the Kiambu County Government, in accordance with the Urban Areas and Cities Act (2011). Key departments involved in climate resilience include:

- Municipal Manager's Office – overall coordination
- Department of Environment & Climate Change – lead for this profile
- Department of Physical Planning & Urban Development
- Department of Water & Sanitation
- Department of Roads, Transport & Public Works
- Department of Health & Public Services

The preparation of this profile was led by a Municipal Technical Working Group, comprising representatives from all key departments as well as community-based organisations, ensuring a coordinated and inclusive approach to climate risk assessment and planning.

Socio-economic Context

According to the 2019 Kenya Population and Housing Census, Thika Municipality had a population of 279,429 people. Its rapid growth is driven by urbanization, industrial development, and its strategic location within the Greater Nairobi Metropolitan Area. The municipality is a key industrial and commercial hub, attracting workers and businesses, which fuels demand for housing, education, health services, and infrastructure. This population growth, combined with economic activity, underscores the need for strategic planning to ensure sustainable socio-economic development and service delivery.

Economic Context

Thika Municipality's economy is primarily industrial and commercial, with a mix of manufacturing, trade, services, and peri-urban agriculture. The town is a major industrial hub in Kiambu County, hosting factories and processing plants that provide formal employment. Many residents also work in commerce, retail, and services, while some commute to Nairobi for additional opportunities. Small-scale trade, transport (matatus and boda boda), and peri-urban agriculture supplement incomes.

Industrial Zones:

- Concentrated in Kamenu, Township, and Hospital wards, including textile, cement, and food processing industries.
- Major employers include Bidco Oil Industries Ltd, Devki Steel Mills, Broadway Bakeries, Thika Rubber Industries Ltd, Thika Cloth Mills Ltd, United Textile Industry (K) Ltd, and macadamia nut processing facilities.
- Agro-based Activities:Horticulture and dairy farming are practiced on the peripheries of the municipality, supplying local markets and cooperatives..

Commerce and Trade:

Local markets, retail hubs, and small-scale enterprises provide business opportunities for micro and small businesses.

Education and Skills Development:

- **Universities & Colleges:** Mount Kenya University – Thika Campus, Gretsa University, JKUAT Thika Campus, KMTC Thika Campus.
- **Technical & Vocational Institutions:** Thika Technical Training Institute, International Centre of Technology (ICT Thika), Equip Africa Institute.
- **Primary & Secondary Schools:** Thika High School, Mang'u High School, Joytown Primary School, among others.

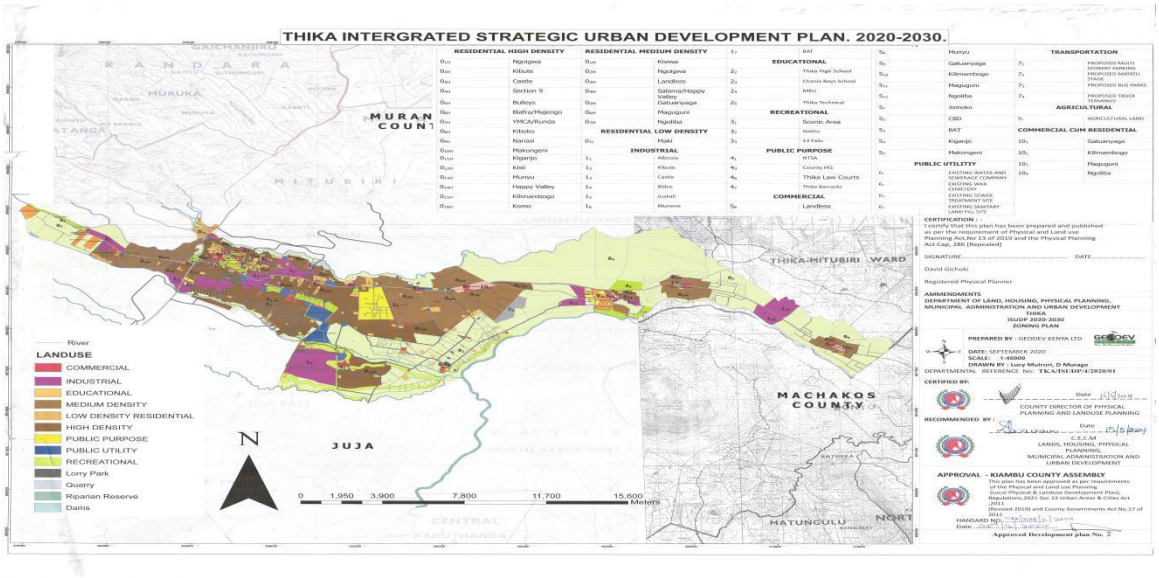
Youth Employment: Unemployment is notable in informal settlements, with challenges in substance use and limited access to vocational training.

Land-use Context

Land use in Thika Municipality is diverse, reflecting its role as an industrial, commercial, and peri-urban centre:

- Residential: High-density settlements are concentrated in Township and Kamenu wards, with medium-density estates and peri-urban homesteads in Gatuanyaga and Ngoliba.
- Commercial: Concentrated around Thika town centre, local markets, banks, and retail hubs, supporting trade and services.
- Agricultural: Peri-urban farming includes horticulture, dairy, and smallholder crop production, supplying local markets and cooperatives. Flower farms and high-value crops contribute to incomes on the outskirts.
- Industrial: Industrial zones are concentrated in Kamenu, Township, and Hospital wards, including textile, cement, food processing, and chemical factories.
- Institutional: Schools, colleges, technical training institutes, health facilities, administrative offices, and community centres are scattered throughout the municipality.
- Conservation: Riparian reserves along rivers and small wetlands are preserved for ecological balance, particularly in Ngoliba and Gatuanyaga wards.

Rapid population growth, urbanization, and peri-urban expansion are converting agricultural land into residential and commercial developments, reducing pervious surfaces, increasing pressure on drainage systems, and raising flood risk in low-lying areas.

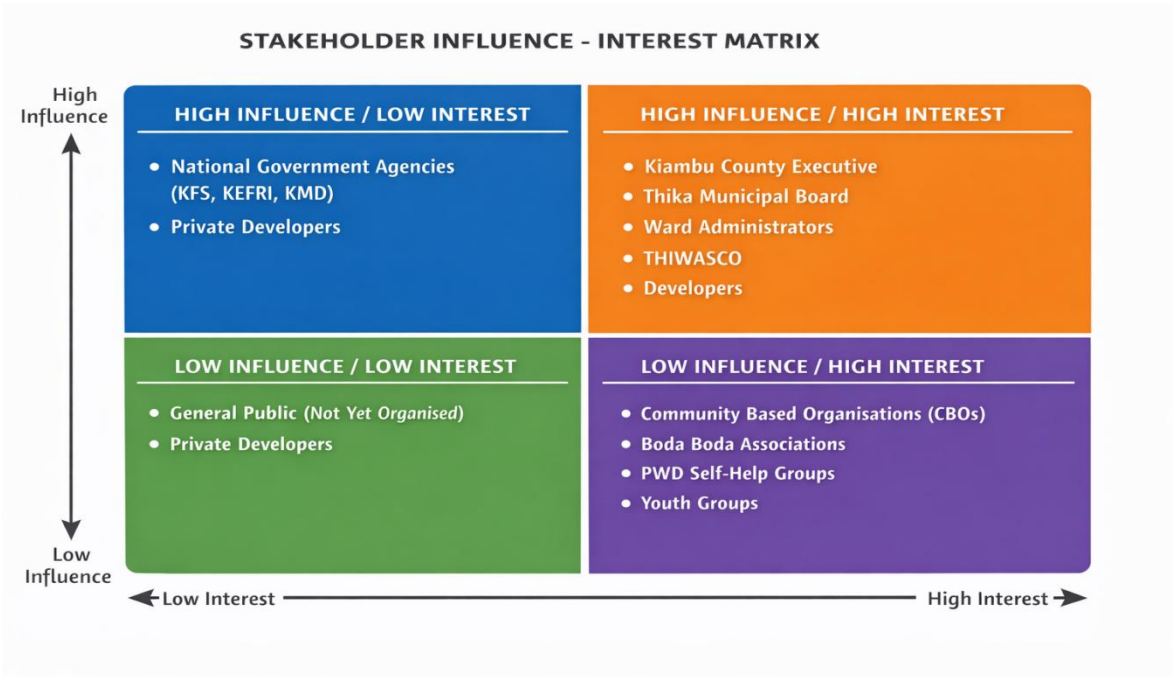


Thika Municipality Land use map.

1.3. Key Stakeholders & Inclusiveness

Stakeholder engagement in Thika Municipality builds on participatory and inclusive planning approaches embedded in county and national planning frameworks. Public participation forums are regularly held to involve residents in municipal planning, infrastructure feedback, and project prioritization, in line with constitutional requirements for public input into development plans and budgets. These engagements bring together community members, local leaders, County Government officials, and development partners to ensure that diverse voices influence decision-making.

Stakeholder mapping (Influence–Interest Matrix):



Inclusiveness measures:

Efforts in Thika to broaden participation include:

- Holding public participation forums in accessible venues and multiple locations across wards to allow wider community involvement.
- Engaging residents of informal settlements in project development and plan reviews to ensure priorities reflect local needs.
- Providing feedback mechanisms such as municipal grievance redress systems so stakeholders can raise and track issues.
- Collaboration with NGOs and community networks (e.g, youth and slum dwellers' associations) during environmental cleanups and planning dialogues.

Thika's approach to stakeholder engagement supports inclusive planning and accountability, ensuring that women, youth, persons with disabilities, the elderly, and informal settlement residents have avenues for meaningful participation in municipal decisions and development priorities.

1.4 Methodology

This Urban Climate Risk Profile for Thika Municipality was developed using a qualitative and evidence-based assessment approach combining climate data analysis, literature review, and urban risk assessment methods. The methodology is aligned with international urban climate risk assessment frameworks and national climate planning guidelines.

The assessment involved a review of available climate data, municipal planning documents, and relevant national and county-level policies, including Kenya's climate change frameworks. Climate trends and hazard projections were informed by publicly available datasets, particularly from the World Bank Climate Change Knowledge Portal and the Kenya Meteorological Department, which provide historical climate data and future projections under different emissions scenarios.

The analysis focused on key climate hazards affecting Thika Municipality, notably flooding along river systems such as the Thika River, periodic drought conditions affecting water supply and peri-urban agriculture, and localized cold conditions in elevated and peri-urban areas. These hazards were assessed in relation to their impacts on urban systems, including infrastructure, housing, economic activities, and natural ecosystems.

Exposure analysis considered the spatial distribution of population and infrastructure across the five wards—Township, Hospital, Kamenu, Gatunyaga, and Ngoliba—highlighting flood-prone low-lying areas, rapidly urbanising zones, and peri-urban agricultural regions. Vulnerability assessment was based on factors such as settlement patterns (including informal settlements), infrastructure capacity, access to services, and socio-economic sensitivity of different population groups.

The climate risk assessment applied a risk-based approach by examining the interaction between:

- Climate hazards (e.g., floods, droughts, cold conditions)

- Exposure (people, infrastructure, and assets located in risk-prone areas)
- Vulnerability (susceptibility of systems and populations to harm)

This process enabled the identification of priority risks and areas requiring urgent intervention, particularly in relation to stormwater drainage, water supply systems, and informal settlements.

Key components of the assessment included:

- Identification of major climate hazards affecting Thika Municipality
- Analysis of exposure of urban systems, infrastructure, and key assets
- Assessment of vulnerability across sectors and population groups
- Development of a climate risk matrix for current and future scenarios (2050 and 2100)
- Identification of practical adaptation and resilience measures for the municipality

This methodology provides a structured and locally relevant basis for understanding climate risks in Thika Municipality and supports evidence-based decision-making for climate-resilient urban planning, infrastructure development, and investment prioritization.

2.HAZARD ASSESSMENT.

2.1. Key Climate Hazards

Thika Municipality faces multiple climate-related hazards driven by natural conditions and rapid urban growth. Situated in the Thika River basin, low-lying areas are prone to flooding, worsened by blocked drains and urban runoff. Droughts and water stress affect households, industries, and peri-urban agriculture due to rising demand. Heat stress impacts health and productivity in built-up areas, while erosion and land degradation occur in peri-urban zones like Gatunyaga and Ngoliba, reducing soil fertility and siltating drains. Riverine and environmental degradation, including riparian encroachment and pollution, further heightens vulnerability.

2..1.1 Flooding and Waterlogging

Flooding is a major climate hazard in Thika Municipality, driven by intense rainfall events, inadequate drainage infrastructure, rapid urban growth, and increasing impervious surfaces.

Areas particularly prone to flooding include:

- Kamenu
- Township (near Thika Town Market)
- Kisii Estate lowlands
- Makongeni
- Juakali area

Flooding is often worsened by blocked stormwater channels, encroachment on natural drainage pathways, and poor maintenance of urban drains.

Example Flooded street in Thika Town

2.1.2 Drought and Water Stress

Water stress is widespread across Thika Municipality, largely due to increasing population pressure, limited water infrastructure, and periodic dry spells.

Water services are primarily managed by:

- **Thika Water and Sewerage Company (THIWASCO)** – serving most of Thika Town and surrounding areas

Frequent water rationing affects households, businesses, schools, and industries, making the urban system vulnerable to droughts.

Peri-urban agricultural areas, such as**, Kamenu outskirts, and Kiamumbi farms**, face:

- Reduced crop yields
- Higher irrigation costs
- Declining household incomes

[picture:fourten falls thika low water levels during prolonged dry periods]

2.1.3 Heat Stress and Rising Temperatures

Thika Municipality is experiencing rising temperatures intensified by urbanization. Areas with dense buildings and limited vegetation, including:**Thika Town Centre Estate** ,**Makongeni** ,**Kamenu** experience the urban heat island effect due to:

- Limited green spaces
- Expansive paved surfaces
- High population density

Heat stress impacts health, increases water demand, and reduces productivity, especially for outdoor workers and vulnerable groups.

picture: street with minimal tree cover

2.1.4 Erosion and Minor Landslide Risks

While large-scale landslides are uncommon, Thika Municipality faces localized soil erosion and minor slope instability, particularly along riverbanks and poorly managed slopes. Areas along the **Thika River** and its tributaries show:

- Riverbank erosion
- Minor slope failures
- Land degradation from farming and construction activities

Without improved land-use planning and environmental management, these risks may worsen over time.

2.1.5 Quarry-Related Environmental Risks

Thika has several abandoned or poorly managed quarries, which present environmental and safety hazards:

- Water accumulation causing localized flooding
- Risk of drowning, especially for children and nearby residents
- Ground instability and potential collapse
- Environmental degradation due to inadequate rehabilitation

Many quarries are located near residential neighborhoods, increasing exposure to these risks. These sites are often unmanaged, unfenced, and vulnerable during extreme rainfall events.

Addressing quarry-related risks will require detailed mapping, rehabilitation programs, and enforcement of land restoration laws.

Table 1:Hazard Screening Thika Munucipality.

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**	**Y**	**Y**
Average ocean temperature increase	**N**	**N**	**N**	**N**
Extreme heat	**Y**	**Y**	**Y**	**Y**
Marine heatwaves	**N**	**N**	**N**	**N**
Cold Stress				
Average surface temperature during winter	**Y**	**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 & urban flooding	**Y**	**Y**	**Y**	**Y**
Fluvial (river) flooding	**Y**	**Y**	**Y**	**Y**
Sea level rise	**N**	**N**	**N**	**N**
Coastal flooding, including storm surges	**N**	**N**	**N**	**N**
Waterlogging	**Y**	**Y**	**Y**	**Y**
Water Stress				
Drought (meteorological, hydrological)	**Y**	**Y**	**Y**	**Y**
Groundwater salinization	**N**	**N**	**N**	**N**
Saline intrusion	**N**	**N**	**N**	**N**
Wildfire				
Wildfires & bushfires	**N**	**N**	**N**	**N**
Storms				
Extreme wind	**Y**	**Y**	**Y**	**Y**
Tropical cyclones	**N**	**N**	**N**	**N**
Sand and dust storms	**Y**	**Y**	**N**	**N**
Hailstorms	**N**	**N**	**N**	**N**

Hazard	Hazard Likely (Y/N)	Significant Impact (Y/N)	High Priority (Y/N)	Key Hazard (Y/N)
Mass Movement				
Landslides	**Y** *(localized)*	**N**	**N**	**N**
Coastal erosion	**N**	**N**	**N**	**N**
Gully erosion	**Y**	**Y**	**Y**	**N** *(managed under flooding/runoff)*

Final key hazards: · 1 Average surface temperature increase / Extreme heat, 2.Changes in precipitation patterns ,3.Pluvial (surface) flooding, including flash & urban flooding ,4..Fluvial (river) flooding,5.Waterlogging 6.Drought (meteorological, hydrological) .

2.2. Climate Indicators and Hazard Thresholds

Table 1.hazard and thresholds.

Key Hazard	Climate Indicator	Data Source	Thresholds		
			Low	**Medium**	**High**
Extreme Heat / Rising Temperatures	Daily maximum temperature (°C)	KMD / CORDEX-Africa	< 28	28–32	> 32
	Heatwave days (≥35 °C)	KMD	0–1 day/month	2–4 days/month	> 4 days/month
	Average surface temperature increase (annual trend)	KMD / CORDEX-Africa	< 0.5 °C / decade	0.5–1.5 °C / decade	> 1.5 °C / decade
Changes in Precipitation Patterns	Monthly rainfall deviation (%)	KMD / CHIRPS	±10 %	±10–25 %	> 25 %
Pluvial (Surface / Urban) Flooding	Daily rainfall intensity (mm/day)	KMD /	< 20	20–50	> 50
	Surface water accumulation (cm)	drainage reports	< 5	5–15	> 15
Fluvial (River) Flooding	River level (m) – Thika River & tributaries	WRA / local gauges	Below bank	Near bank	Over bank
Waterlogging	Extent of inundation (% urban area)	drainage reports	< 5 %	5–15 %	> 15 %

Key Hazard	Climate Indicator	Data Source	Thresholds		
Drought (Meteorological / Hydrological)	Standardised Precipitation Index (SPI-12)	KMD / CHIRPS	> –0.5	–0.5 to –1	

Data sources are detailed the Annex.

2.3. Current Hazard Levels and Climate Projections

Climate trends observed across Kenya indicate increasing climate variability, characterized by shifts in rainfall patterns, more frequent extreme weather events, and rising temperatures. According to the World Bank Climate Change Knowledge Portal, Kenya has experienced gradual increases in average temperatures over recent decades, alongside increasing variability in seasonal rainfall.

Rainfall patterns in central Kenya, including Thika Municipality, are typically bi-modal: the long rains occur between March and May (MAM) and the short rains between October and December (OND). However, these seasonal patterns have become less predictable in recent years. Periods of intense rainfall have occasionally caused localized flooding in urban and peri-urban areas, especially in low-lying neighborhoods or where drainage infrastructure is insufficient.

Extended dry periods between rainy seasons have also been observed. These contribute to water stress, particularly in areas reliant on rainfall for agriculture or where municipal water supply is limited.

Climate projections for East Africa suggest that temperatures will continue increasing, raising heat stress, evaporation rates, and urban discomfort—particularly in dense areas with limited vegetation. Future projections indicate that rainfall events may become more intense, even if annual totals do not change substantially. This increases the likelihood of urban flooding in municipalities such as Thika, where rapid urban development and impervious surfaces reduce natural infiltration and amplify stormwater runoff.

Future projections for Thika are derived from the Kiambu County PCRA, downscaled from CMIP5 models under RCP4.5 (SSP2-4.5) and RCP8.5 (SSP5-8.5) scenarios:

Flooding: Historical trends indicate frequent high-intensity rainfall during MAM and OND. Projections suggest a wet signal for annual rainfall (+5–10% by 2050), with more rain concentrated in fewer days. This will increase both pluvial (surface/urban) and fluvial (river) flood hazards, particularly along the Thika River and low-lying urban areas.

Drought: Rainfall deficits during MAM are projected to increase under RCP8.5, with OND rainfall remaining variable. Higher temperatures and evaporative demand will exacerbate agricultural and water supply drought.

Extreme Heat: Maximum and average temperatures are projected to increase by 1–2 °C by 2050, increasing heat stress in urban neighborhoods.

Extreme Cold: Minimum temperatures are projected to rise by 0.8–1.5 °C by 2050, reducing frost frequency. Cold spells will remain rare and localized in higher-elevation zones within the municipality.

Table 2: hazard current and future baseline

Hazard	Current (Baseline)	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Flooding	High	High	Very High	High	Very High
Drought	Medium	High	Very High	High	Very High
Extreme Heat	Medium	High	Very High	High	Very High
Extreme Cold	Low	Low	Very Low	Low	Very Low

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

Interpretation of hazard levels:

Level	Interpretation
Very High	Hazard events are likely to occur with very high frequency and/or intensity; extreme events may become the new normal.
High	Hazard events occur frequently; moderate to severe intensity.
Medium	Hazard events occur occasionally; moderate intensity.
Low	Hazard events are rare and/or mild.

Understanding these trends is important for planning climate adaptation measures thataddress both current and future climate risks affecting the municipality.

2..3.1Historical Climate Hazard Events

Historical hazard events provide important insight into the types of climate impacts that have affected Thika Municipality and its surroundings. Observed flooding events in central Kenya, including Kiambu County, demonstrate how intense rainfall can disrupt infrastructure, housing, and mobility.

In Thika, localized flooding has frequently occurred in areas such as Landless Estate and Kisii Estate, as well as other low-lying neighborhoods and informal settlements. During periods of heavy rain, these areas experience water accumulation that inundates residential compounds, disrupts transport networks, and overwhelms drainage systems. The risk is exacerbated where rapid urban development has increased impervious surfaces or encroached on natural waterways and wetlands.

These historical flooding events highlight the need for strengthened urban drainage, better land-use planning, and community-level flood preparedness measures to reduce vulnerability.

Table 3: Selected Historical Climate Hazard Events affecting Thika

Year	Hazard Event	Observed Impacts in Thika Municipality	Affected Areas / Notes
2016–2017	Drought, water shortages	Rivers and boreholes dried up, reducing water availability; water rationing increased due to supply–demand gap	Across Thika town and peri-urban estates experiencing dry taps and high demand
2017 (Nov)	Heavy rainfall & flash flooding	Floodwaters submerged houses and roads; hundreds of homes inundated; property damage worth millions; residents relocated	Kisii Estate, Makongeni, Kiganjo, Landless, Kiandutu, Gatuanyaga
2020	Flood risk & drainage issues	Town and low-lying neighborhoods reported flooding during rainy season; authorities initiated major drainage works	Landless, Happy Valley, Gatundu, Storm Water, Magana estates
2022	Water scarcity & supply deficit	Water supply deficit widened with demand exceeding supply; residents relied on boreholes	Landless and other estates in Thika town
2023	Rivers, boreholes dry up due to drought	Several rivers and boreholes dried, forcing water delivery by bowser; Chania River levels fell, stressing supply	Thika and peri-urban areas reliant on river/borehole water
2024	Heavy rainfall & flooding reducing water production	Thika River overflow caused massive flooding; water intake silted, cutting production from ~36,000 m³ to ~24,000 m³/day; enhanced water rationing	Waterworks intake along Thika River and surrounding estates

2.3.2 Future Climate Projections

Climate projections for Kenya indicate a continued rise in temperatures and greater variability in rainfall patterns in the coming decades. According to the World Bank Climate Change Knowledge Portal, mean annual temperatures are expected to increase by approximately 1.5–2.5°C by the 2050s under intermediate emissions scenarios. Rainfall is projected to become more erratic, with an increase in the frequency and intensity of extreme rainfall events. These changes are likely to increase the risk of flooding, landslides, and water stress in rapidly urbanizing areas of Thika Municipality, particularly in low-lying estates such as Kisii, Landless and Makongeni where drainage systems are often overwhelmed and water supply depends heavily on the Thika River and local boreholes.

2.4. Current and Future Hazard Impact Areas

The impacts of climate hazards are not evenly distributed across the municipality. Certain locations may be more exposed to specific hazards due to environmental conditions, land-use patterns, and infrastructure limitations.

Table 4.current impacts and future senarios

Hazard	Current Impact Areas (Thika)	Affected Wards	2050 SSP2-4.5 (Intermediate Emissions)	2050 SSP5-8.5 (High Emissions)	2100 SSP2-4.5 (Intermediate)	2100 SSP5-8.5 (High)
Drought / Water Stress	Peri-urban farms and Thika River-dependent estates; Kisii Estate, Landless Estate	Township, Hospital, Kamenu, Gatuanyaga, Ngoliba	Moderate increase in soil moisture stress; higher pressure on water supply	Greater rainfall variability; higher drought intensity; increased household water demand	Regular seasonal drought affecting agriculture and water supply reliability	Persistent drought; water rationing likely; shift toward drought-resistant crops and improved water storage
Extreme Heat / Urban Heat	Thika town centre, Kisii Estate, Landless Estate, Makongeni	Township, Hospital, Kamenu, Gatuanyaga, Ngoliba	Expansion of warmer urban zones; warmer nights; reduced cooling periods	Higher frequency of hot days and heat stress, especially in dense built-up areas	Municipality-wide temperature increase; heat exposure rises for vulnerable populations	Frequent extreme heat events; increased health risks, higher energy demand for cooling, reduced outdoor productivity
Flooding / Intense Rainfall	Low-lying estates near rivers and drainage channels: Kisii Estate, Landless Estate.	Township, Hospital, Kamenu, Gatuanyaga, Ngoliba	Increased frequency of intense rainfall causing localized flooding and drainage overflow	Higher rainfall intensity → flash floods and damage to roads, buildings, and drainage infrastructure	Larger flood-prone zones along rivers and urban drainage channels	Severe flood events affecting roads, settlements, businesses; greater disruption to transport networks
Soil Erosion / Landslides	Hilly areas including **Kilimamabogo Mountain slopes** and peri-urban farming zones	Township, Kamenu, Ngoliba	More frequent minor slope failures and surface soil erosion during heavy rains	Increased slope instability and small landslides during extreme rainfall	Expanded erosion-prone areas affecting farms, roads, and settlements	High-risk slope zones expand; potential major landslides threatening infrastructure and communities

1. Average Surface Temperature / Extreme Heat

Thika town centre (CBD), Makongeni, Kiandutu, Landless, Kiganjo, and sections of Majengo

experience rising temperatures due to dense development, limited tree cover, and expanding built-up areas. Extreme heat increases health risks, reduces outdoor productivity, and raises energy demand for cooling. By 2050, under intermediate emissions scenarios, hotter days and warmer nights will become more common, while high-emission scenarios will result in more frequent extreme heat events. By 2100, heat exposure is expected to be significant across the municipality.

2. Changes in Precipitation Patterns

Rainfall variability affects peri-urban areas such as Gatuanyaga, Ngoliba, Kiganjo outskirts, and surrounding agricultural zones, as well as low-income settlements like Kiandutu and Landless, impacting water supply and agriculture. By 2050, intermediate scenarios suggest moderate rainfall variability and occasional dry spells, while high-emission scenarios indicate more erratic wet and dry seasons and increased water demand. By 2100, more persistent extremes are expected, placing pressure on water supply systems, agriculture, and urban water management.

3. Pluvial (Surface) Flooding

Low-lying areas within Thika such as **Landless, Kiandutu, Kisii Estate, Majengo, and parts of Makongeni** are prone to urban and flash flooding due to inadequate stormwater drainage and blocked channels. Flooding leads to road waterlogging, disruption of local businesses, and property damage. By 2050 and 2100, flood-prone areas are expected to expand due to increased rainfall intensity, urban expansion, and encroachment into drainage corridors and riparian zones.

4. Fluvial (River) Flooding

Areas along the **Thika River and Chania River**, particularly near **Gatuanyaga, Ngoliba, and downstream sections toward Kiganjo**, are at risk of riverine flooding during periods of heavy rainfall. Future projections indicate expansion of flood-prone zones and increased flood severity due to more intense rainfall events.

5. Waterlogging

Waterlogging frequently affects low-lying estates such as **Landless, Kiandutu, Kisii Estate, and sections of Makongeni**, disrupting roads, settlements, and commercial activities. Poor drainage, solid waste blockage, and flat terrain exacerbate the problem. By 2050 and 2100, waterlogging is expected to worsen due to increased rainfall intensity and continued urban expansion.

6. Drought (Meteorological & Hydrological)

Peri-urban areas such as **Ngoliba, Gatuanyaga, and Kiganjo outskirts**, along with households dependent on boreholes and shallow wells, experience water stress during prolonged dry periods. This affects domestic water supply and smallholder farming. High-emission scenarios indicate more intense and frequent dry spells, increased water demand, and pressure on groundwater resources.

7. Extreme Cold / Frost (Localized)

Higher elevation areas near Mount Kilimambogo and parts of **Gatuanyaga** occasionally experience cold conditions and localized frost during the June–August season, affecting

exposed housing and small-scale farming. However, frost occurrence is relatively rare and is expected to decline gradually due to increasing temperatures, although occasional cold spells may still impact vulnerable populations and crops.

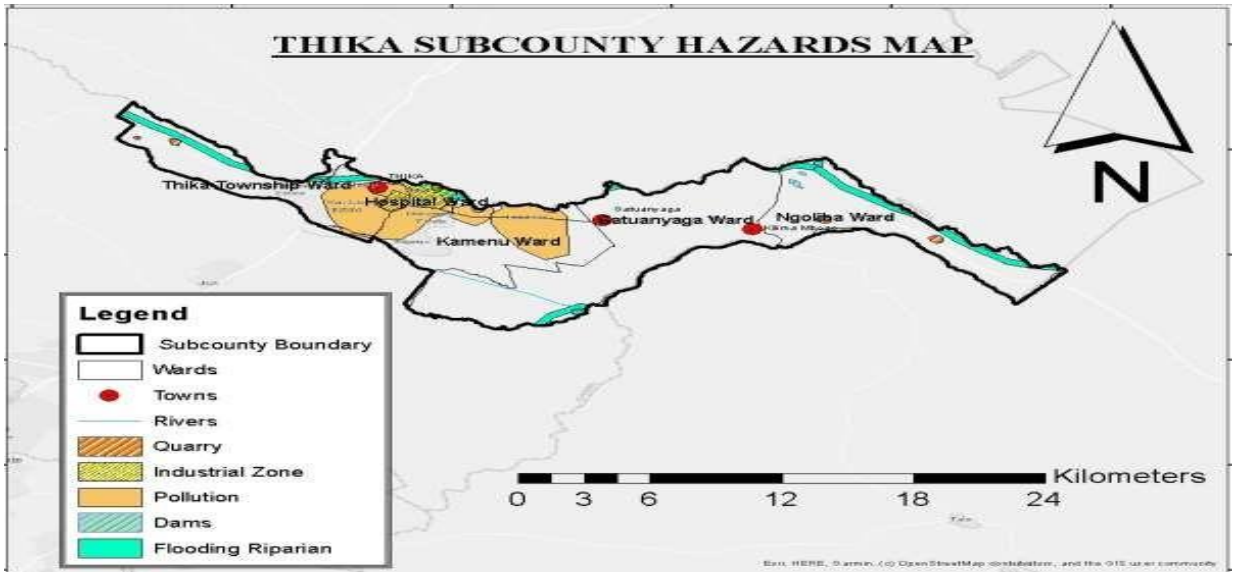


Figure 3:climate risk hotspots Thika

Source department of gis kiambu county

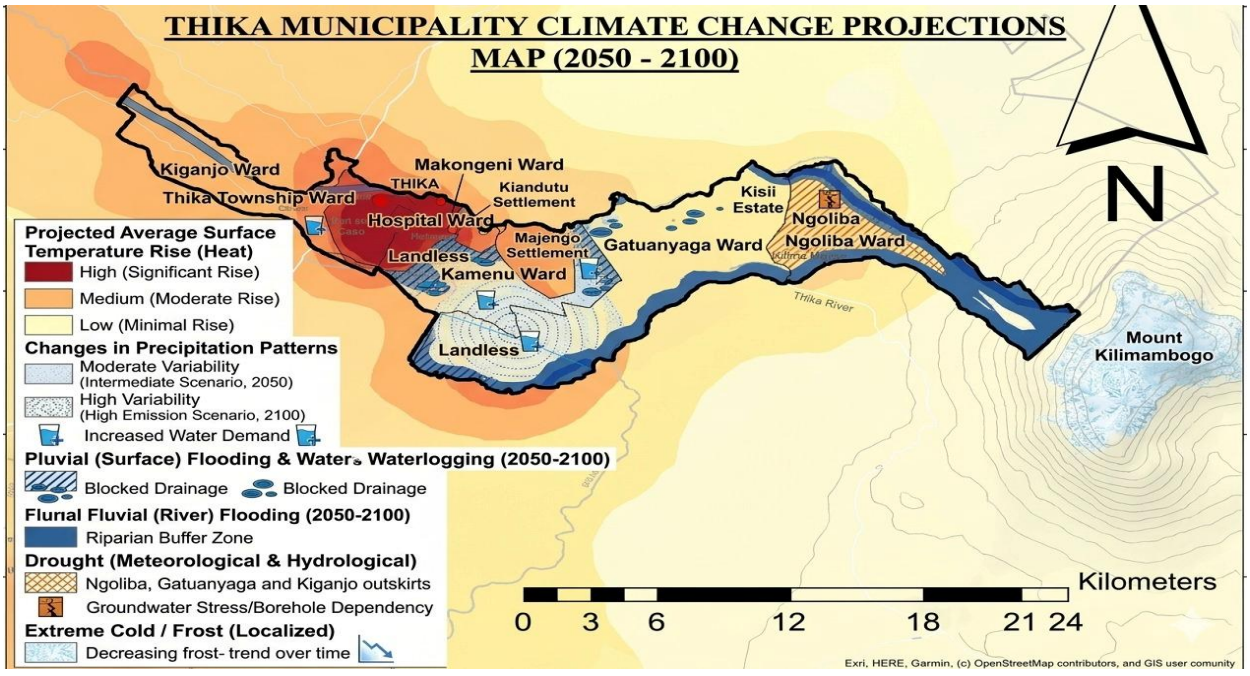


Figure 4:Thika Municipality Climate Change Projections

Source department of gis kiambu county

3.Exposure & Vulnerability Assessment.

3.1 Urban Elements.

Table 5. Urban elements inventory

Category	Subcategory	Included in RCRA (Y/N)	Available in GIS (Y/N)	Description
Infrastructure & Services				
Stormwater Drainage	Stormwater conveyance network	Y	N (partial)	Roadside drainage channels and culverts along major roads such as Thika Superhighway, Garissa Road, and internal roads; inadequate drainage in estates such as Kisii Estate, Landless, Makongeni, and parts of Thika town.
	Stormwater storage	N	N	No formal stormwater retention systems; reliance on natural drainage systems and open channels.
Water & Wastewater Management	Pumping stations	Y	N (partial)	Water pumping facilities operated by Thika Water and Sewerage Company (THIWASCO).
	Groundwater abstraction	Y	N	Boreholes supplement water supply, especially during dry periods and rationing.
	Water treatment facilities	Y	Y	Water treatment works abstracting raw water from the Thika River for municipal supply.
	Water supply networks	Y	Y	Piped water distribution network operated by THIWASCO serving residential, commercial, and industrial areas.
	Sewer networks	Y (partial)	N	Sewer network available in parts of Thika town; many estates rely on septic tanks and pit latrines.
	Wastewater treatment facilities	Y	N	Wastewater lagoons exist but operate under capacity constraints due to population growth.
Solid Waste Management	Transfer facilities	Y	N	Waste collected by Kiambu County and private operators for transport to disposal sites.
	Landfills and dump sites	Y	N	Waste disposed mainly at Kangoki dumpsite serving Thika and surrounding areas.
	Recycling centres	N (limited)	N	Recycling is largely informal through waste pickers and small private recyclers.
	Collection fleet	Y	Y	County trucks and private collectors serving estates and commercial zones.
Transport & Mobility	Road networks	Y	Y	Major roads include Thika Superhighway, Garissa Road, and internal roads linking Makongeni, Kiganjo, Landless, and other estates; some feeder roads remain unpaved.
	Bridges	Y	N	Bridges and culverts along drainage channels and river crossings within the municipality.

Category	Subcategory	Included in RCRA (Y/N)	Available in GIS (Y/N)	Description
	Public transport networks	Y	N	Matatu and boda boda services connecting Thika to Nairobi, Nyeri and muranga and asurrounding areas.
	Transportation terminals	Y	Y	Thika bus park and major matatu stages within the CBD.
	Non-motorised transport	N (limited)	N	Limited pedestrian walkways and cycling infrastructure.
Energy	Poles and power lines	Y	Y	Electricity distribution network by Kenya Power across residential and industrial zones.
	Transformers and substations	Y	Y	Multiple transformers across estates and industrial areas.
	Street lighting	Y	Y	Solar and grid-powered street lighting along major roads and trading centres.
Economic Infrastructure	Markets	Y	Y	Thika Main Market and estate-level markets supporting trade.
	Businesses & commercial hubs	Y	N	Active commercial centres in Thika CBD, Makongeni, and along Garissa Road.
	Industrial zones	Y	Y	Thika Industrial Area with manufacturing and processing industries.
Social Infrastructure	Government buildings	Y	Y	Sub-county and municipal administrative offices located within Thika town.
	Education facilities	Y	Y	Numerous ECDE centres, primary, secondary schools, and tertiary institutions.
	Healthcare facilities	Y	Y	Thika Level 5 Hospital and several private hospitals and clinics.
	Public spaces	Y	N	Limited public recreational spaces and open grounds.
	Faith-based buildings	N	N	Numerous churches and religious institutions across the municipality.
Emergency Services	Fire stations	Y	Y	Fire station located within Thika town.
	Police stations	Y	Y	Thika Police Station and several police posts.
	Early warning systems	N	N	No formal municipal-level early warning system.
	Disaster management centres	N	N	Disaster response coordinated at county level.
Populations				
Urban Residents	Population	Y	Y	Estimated population above 270,000 with rapid urban growth.
	Households	Y	N	High number of households across formal and informal settlements.

Category	Subcategory	Included in RCRA (Y/N)	Available in GIS (Y/N)	Description
Informal Settlement Residents	Population in informal settlements	Y	N	Informal settlements in areas such as Kiandutu and parts of Landless.
	Households lacking land tenure	Y	N	Residents with insecure land tenure in informal areas.
	Households lacking basic services	Y	N	Limited sewerage, drainage, and waste services in informal settlements.
Vulnerable & Marginalized Groups	Low-income households	Y	N	Many depend on informal sector employment.
	Women-headed households	Y	N	Present across formal and informal areas.
	Children and youth	Y	Y	Youth form a large share of the population.
	Elderly persons	Y	N	Vulnerable to climate-related risks.
	People with disabilities	Y	N	Limited access to infrastructure and services.
	Unemployed youth	Y	N	Youth unemployment remains a challenge.
	Seasonal workers	Y	N	Common in industrial and service sectors.
Natural Assets				
Urban Green Infrastructure	Urban parks and gardens	Y	N	Limited formal parks; greenery mainly within institutions and private compounds.
	Green corridors	N	N	No formally designated ecological corridors.
	Urban forests	Y	N	Scattered urban trees and small green spaces.
Urban Blue Infrastructure	Natural wetlands	Y	N	Seasonal wetlands and drainage areas in low-lying estates.
	Rivers	Y	Y	The Thika River is the main river supplying water and influencing flood risk; Chania River supports the wider catchment.
	Riparian zones	Y	N	Some encroachment from settlements and urban development.
	Lakes/ponds	Y	N	Small farm ponds and dams in peri-urban areas.
Peri-urban & Agricultural Systems	Peri-urban agriculture	Y	N	Small-scale farming, horticulture, and dairy in outskirts.
	Agroforestry	Y	N	Mixed farming systems with trees and crops.
	Forests and reserves	Y	Y	Mt Kilimambogoslopes and surrounding vegetation provide ecological value.

3.2 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 6. Interpretation of exposure and vulnerability levels

Level	Exposure Level Interpretation	Vulnerability Level Interpretation
High	A large number and high-value urban elements are located within the hazard footprint.	The urban element is vulnerable to the hazard due to high sensitivity and limited adaptive capacity.
Medium	A moderate number or mix of low- and medium-value elements are located within the hazard footprint.	The element is somewhat vulnerable due to moderate sensitivity and adaptive capacity
Low	Few or no critical urban elements lie within the hazard footprint.	The element is minimally vulnerable due to limited sensitivity and/or high 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 7. Impact Matrix

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

Table 8. Exposure, Vulnerability, and Impacts of Flooding on Urban Elements
Hazard: Flooding.

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	Drainage channels in Kisii Estate, Landless, Makongeni and parts of Thika CBD frequently overflow during heavy rainfall; rapid urbanisation has increased runoff beyond drainage capacity.	High	Sensitivity: Inadequate and undersized drainage, often blocked by solid waste. Adaptive Capacity: Low – limited stormwater planning and irregular maintenance.	High	Catastrophic
Water & Wastewater Management	Water supply systems relying on the Thika River and boreholes are exposed to flooding, contamination, and reduced supply during extreme weather; septic systems overflow during floods.	Medium	Sensitivity: On-site sanitation vulnerable to contamination; infrastructure exposed to climate shocks. Adaptive Capacity: Medium – utility response exists but infrastructure gaps remain.	Medium	Major
Solid Waste Management	Waste collection points in Thika town, Makongeni and Landless often overflow during storms, with waste entering drainage channels and waterways.	High	Sensitivity: Poor waste management practices and illegal dumping block drainage. Adaptive Capacity: Low – limited recycling and inconsistent collection in some areas.	High	Catastrophic
Transport & Mobility	Flooding affects sections of Garissa Road, Thika Superhighway access roads, and feeder roads in Kiganjo, Makongeni and Landless, disrupting transport and trade.	Medium	Sensitivity: Murram roads prone to erosion; undersized culverts. Adaptive Capacity: Medium – repairs are reactive rather than preventive.	Medium	Major
Energy	Power distribution infrastructure is vulnerable to storms, strong winds, and falling trees.	Medium	Sensitivity: Overhead lines exposed to weather damage. Adaptive Capacity: Medium – outages restored but disruptions occur.	Medium	Moderate
Economic Infrastructure	Markets and commercial areas in Thika CBD and Makongeni experience localized flooding affecting traders and businesses.	Medium	Sensitivity: Poor drainage and informal structures. Adaptive Capacity: Low – limited resilience among small traders.	Medium	Major

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Social Infrastructure	Schools, health facilities and public institutions in low-lying areas face drainage challenges and access disruptions during heavy rainfall.	Medium	Sensitivity: Limited flood-resilient infrastructure. Adaptive Capacity: Medium – repairs occur but upgrades are limited.	Medium	Major
Emergency Services	Emergency response depends on road access and county-level systems, which may be disrupted during floods.	Medium	Sensitivity: Limited local disaster response infrastructure. Adaptive Capacity: Low – lack of early warning systems and local disaster centres.	Medium	Major
Populations					
Urban Residents	Rapid population growth in estates such as Landless, Kisii Estate and Makongeni increases exposure to flooding and infrastructure stress.	High	Sensitivity: High density and informal expansion. Adaptive Capacity: Medium – access to services exists but is strained.	High	Major
Informal Settlement Residents	Informal settlements in Kiandutu and parts of Landless are located near drainage channels and flood-prone areas.	High	Sensitivity: Poor housing, sanitation, and drainage. Adaptive Capacity: Very Low – limited resources and insecure tenure.	High	Catastrophic
Vulnerable & Marginalised Groups	Elderly persons, children, PWDs, and low-income households are highly exposed to floods, drought and heat.	High	Sensitivity: Reduced mobility and higher health risks. Adaptive Capacity: Low – limited targeted support systems.	High	Catastrophic
Natural Assets					
Urban Green Infrastructure	Urban vegetation and green spaces are declining due to urban expansion, reducing natural flood control.	Medium	Sensitivity: Loss of vegetation increases runoff. Adaptive Capacity: Medium – tree planting exists but limited coverage.	Medium	Moderate
Urban Blue Infrastructure	The Thika River and drainage channels receive runoff and waste, increasing flood and pollution risks.	High	Sensitivity: Encroachment and poor riparian protection. Adaptive Capacity: Low – weak enforcement of environmental regulations.	High	Catastrophic
Peri-urban & Agricultural Systems	Farming activities in peri-urban Thika are affected by rainfall variability, soil erosion, and water shortages.	Medium	Sensitivity: Dependence on rain-fed agriculture. Adaptive Capacity: Medium – some adoption of climate-smart practices.	Medium	Major

Table 9. Exposure, Vulnerability, and Impacts of Drought on Urban Elements

Hazard: Drought

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Water & Wastewater Management	Thika relies on surface water from the Thika River and boreholes. During drought, reduced river flow and declining borehole yields lead to water rationing in estates such as Kisii Estate, Landless and Makongeni.	High	Sensitivity: High dependence on river and groundwater; rising demand from population and industry; water losses. Adaptive Capacity: Low – limited storage and rainwater harvesting systems.	High	Catastrophic
Solid Waste Management	Dry conditions increase fire risk at Kangoki dumpsite and informal waste collection points.	Low	Sensitivity: Waste becomes highly combustible during prolonged dry periods. Adaptive Capacity: Low – limited fire control systems.	Medium	Minor
Energy	Electricity supply is mainly grid-based and not directly affected locally, though national hydropower variability may influence supply.	Low	Sensitivity: Low direct exposure. Adaptive Capacity: High – diversified national energy mix.	Low	Insignificant
Economic Infrastructure	Markets and businesses in Thika town and Makongeni face reduced agricultural supply, increasing food prices and lowering trade volumes.	Medium	Sensitivity: Dependence on agricultural supply chains. Adaptive Capacity: Medium – alternative sourcing possible but costly.	Medium	Major
Social Infrastructure	Schools and health facilities experience water shortages, affecting sanitation and operations.	Medium	Sensitivity: Limited water storage capacity. Adaptive Capacity: Low – reliance on water trucking.	High	Major
Emergency Services	Firefighting is constrained by limited water availability during drought.	Medium	Sensitivity: Reduced access to water sources. Adaptive Capacity: Low – limited emergency water reserves.	High	Major
Populations					
Urban Residents	Residents in estates such as Kisii Estate, Landless and Makongeni face water rationing and depend on vendors during drought.	High	Sensitivity: High demand and limited storage. Adaptive Capacity: Low – limited household harvesting systems.	High	Catastrophic

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Informal Settlement Residents	Settlements such as Kiandutu rely on water vendors whose prices increase during drought.	High	Sensitivity: Limited access to piped water and sanitation. Adaptive Capacity: Very Low – low incomes and minimal storage.	High	Catastrophic
Vulnerable & Marginalised Groups	Elderly, children, PWDs and low-income households face higher risks due to water scarcity and rising food prices.	High	Sensitivity: Health and nutrition risks. Adaptive Capacity: Low – limited social support systems.	High	Catastrophic
Natural Assets					
Urban Green Infrastructure	Vegetation and green spaces experience water stress and decline.	Medium	Sensitivity: Non-drought-resistant species. Adaptive Capacity: Low – limited irrigation systems.	High	Major
Urban Blue Infrastructure	Reduced flows in the Thika River increase water scarcity and pollution concentration.	High	Sensitivity: Over-abstraction and pollution pressure. Adaptive Capacity: Low – weak catchment protection.	High	Catastrophic
Peri-urban & Agricultural Systems	Farming areas experience crop failure, reduced pasture and lower productivity.	High	Sensitivity: Dependence on rain-fed agriculture. Adaptive Capacity: Low – limited irrigation and resilience measures.	High	Catastrophic

Table 10. Exposure, Vulnerability, and Impacts of Extreme Cold on Urban Elements

Hazard: Extreme Cold

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Transport & Mobility	Early morning fog occasionally affects visibility along sections of Thika Superhighway, Garissa Road and internal roads, increasing accident risk.	Medium	Sensitivity: Some road sections experience reduced visibility; limited fog warning systems. Adaptive Capacity: Low – limited traffic control measures during fog events.	Medium	Major

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Energy	Increased electricity demand during cold periods due to heating needs and hot water use in households.	Low	Sensitivity: Power infrastructure is generally resilient to cold. Adaptive Capacity: Medium – outages are managed but demand may rise.	Low	Minor
Social Infrastructure	Schools and ECDE centres experience cold conditions during early mornings in the June–August season.	Medium	Sensitivity: Many classrooms lack insulation. Adaptive Capacity: Low – reliance on warm clothing rather than infrastructure improvements.	Medium	Major
Emergency Services	Health facilities record increased cases of respiratory illnesses during cold seasons.	Low	Sensitivity: Children and elderly more susceptible. Adaptive Capacity: Medium – treatment available but limited preventive outreach.	Low	Minor
Populations					
Urban Residents	Residents across Thika experience cold nights during June–August, especially in less dense and peri-urban areas.	Medium	Sensitivity: Housing with poor insulation increases exposure. Adaptive Capacity: Medium – use of warm clothing and indoor heating methods.	Medium	Major
Informal Settlement Residents	Informal settlements such as Kiandutu and parts of Landless have poorly constructed housing that provides minimal protection from cold.	High	Sensitivity: Poor housing materials, overcrowding, and inadequate bedding. Adaptive Capacity: Very Low – limited financial capacity to improve living conditions.	High	Catastrophic
Vulnerable & Marginalised Groups	Elderly persons, young children, and individuals with respiratory conditions are highly affected during cold periods.	High	Sensitivity: Increased risk of respiratory infections and complications. Adaptive Capacity: Low – limited targeted support systems.	High	Catastrophic
Natural Assets					
Urban Green Infrastructure	Cold conditions may slow growth of urban vegetation and ornamental plants during cooler months.	Low	Sensitivity: Some plant species are not cold-tolerant. Adaptive Capacity: Medium – replanting and maintenance possible.	Low	Minor

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Peri-urban & Agricultural Systems	Farming activities in peri-urban Thika and areas near Kilimambogo Hill may experience slower crop growth during cold periods.	Medium	Sensitivity: Some crops are sensitive to low temperatures. Adaptive Capacity: Medium – farmers adjust planting schedules and crop varieties.	Medium	Major

Table 11. Exposure, Vulnerability, and Impacts of Landslides on Urban Elements

Hazard: Landslides / Mass Movement

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Transport & Mobility	Roads along sloping areas in Kiganjo, peri-urban Thika and near river valleys may experience soil erosion and minor slope failures during heavy rainfall, affecting road stability.	Medium	Sensitivity: Road sections often lack proper slope drainage and protection; erosion during storms. Adaptive Capacity: Low – slope stabilization measures are limited and maintenance is mostly reactive.	Medium	Major
Water & Wastewater Management	Water pipelines and borehole infrastructure located near slopes and drainage channels may be damaged by soil movement and erosion during heavy rains.	Medium	Sensitivity: Pipelines vulnerable to displacement in unstable soils. Adaptive Capacity: Medium – repairs are carried out but preventive measures are limited.	Medium	Major
Energy	Electricity poles and overhead lines in sloping and peri-urban areas may be affected by soil erosion and falling trees during storms.	Medium	Sensitivity: Poles with shallow foundations are vulnerable to soil instability. Adaptive Capacity: Medium – repairs are done but preventive relocation is limited.	Medium	Moderate
Social Infrastructure	Schools, health facilities and residential buildings near slopes and riverbanks may experience structural risks due to soil erosion.	Medium	Sensitivity: Limited geotechnical considerations in some developments. Adaptive Capacity: Low – minimal use of retaining walls and slope protection.	Medium	Major

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Emergency Services	Access to some neighbourhoods may be disrupted when erosion damages roads or blocks drainage systems.	Medium	Sensitivity: Some areas depend on single access routes. Adaptive Capacity: Low – no dedicated slope monitoring or early warning systems.	Medium	Major
Populations					
Urban Residents	Residents living near river valleys and sloping terrain in peri-urban Thika face risks of soil erosion and localized slope instability.	Medium	Sensitivity: Unplanned construction and poor drainage on slopes. Adaptive Capacity: Medium – some household-level mitigation but limited resources.	Medium	Major
Informal Settlement Residents	Informal settlements such as Kiandutu and parts of Landless may extend into marginal lands near drainage channels and unstable ground.	High	Sensitivity: Poor housing materials and lack of drainage infrastructure. Adaptive Capacity: Very Low – limited capacity for slope stabilization.	High	Catastrophic
Vulnerable & Marginalised Groups	Elderly persons, children and PWDs face higher risk during erosion events due to limited mobility and response capacity.	High	Sensitivity: Physical limitations and higher exposure. Adaptive Capacity: Very Low – limited targeted emergency support.	High	Catastrophic
Natural Assets					
Urban Green Infrastructure	Vegetation cover helps stabilize soils but is being reduced due to urban expansion and land clearing.	Medium	Sensitivity: Loss of vegetation increases erosion risk. Adaptive Capacity: Medium – tree planting initiatives exist but are not widespread.	Medium	Moderate
Peri-urban & Agricultural Systems	Farming activities on sloping land in peri-urban Thika and around the foothills of MT Kilimambogo may accelerate soil erosion during heavy rains if conservation measures are inadequate.	Medium	Sensitivity: Cultivation on slopes without proper soil conservation. Adaptive Capacity: Medium – some adoption of terracing and conservation practices.	Medium	Major

Table 12. Exposure, Vulnerability, and Impacts of Strong Winds on Urban Elements

Hazard: Strong Winds / Storms

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Energy	Overhead electricity lines across Thika are vulnerable to strong winds and falling trees, especially in residential estates such as Makongeni, Kiganjo and Thika town.	High	Sensitivity: Overhead lines and poles exposed to wind and falling branches. Adaptive Capacity: Medium – outages are repaired but preventive vegetation management is limited.	Medium	Major
Transport & Mobility	Strong winds and storms can cause trees and debris to block roads along Thika Superhighway, Garissa Road and internal estate roads, disrupting transport.	Medium	Sensitivity: Road reserves with trees and limited storm drainage allow debris accumulation. Adaptive Capacity: Low – clearance is mostly reactive after storms.	Medium	Major
Social Infrastructure	Schools, ECDE centres and health facilities with lightweight roofing may experience roof damage during storms.	Medium	Sensitivity: Corrugated iron sheet roofing is common. Adaptive Capacity: Low – limited structural reinforcement and maintenance budgets.	Medium	Major
Economic Infrastructure	Market stalls and informal businesses in Thika CBD and Makongeni are exposed to damage from strong winds and storms.	Medium	Sensitivity: Many structures are temporary and lightweight. Adaptive Capacity: Low – limited financial capacity for reinforcement.	Medium	Major
Emergency Services	Storm events increase emergency response demand and may block access routes due to fallen trees and debris.	Medium	Sensitivity: Some areas rely on limited access roads. Adaptive Capacity: Low – reliance on county-level emergency systems.	Medium	Major
Populations					
Urban Residents	Strong winds may damage roofs and property across residential estates, particularly in rapidly developing areas.	Medium	Sensitivity: Variation in construction quality and roofing materials. Adaptive Capacity: Medium – some capacity for repairs but limited insurance coverage.	Medium	Major
Informal Settlement Residents	Informal settlements such as Kiandutu and parts of Landless are highly exposed due to weak structures.	High	Sensitivity: Temporary materials and poor structural integrity. Adaptive Capacity: Very Low – limited resources for reinforcement or relocation.	High	Catastrophic
Vulnerable & Marginalised Groups	Outdoor workers (e.g. boda boda riders, street vendors) and school children are exposed to injury during storms.	High	Sensitivity: High outdoor exposure and limited shelter. Adaptive Capacity: Very Low – limited access to protective infrastructure.	High	Catastrophic

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Natural Assets					
Urban Green Infrastructure	Strong winds may uproot trees and damage vegetation in urban areas and along roads.	Medium	Sensitivity: Some tree species are shallow-rooted and prone to wind damage. Adaptive Capacity: Medium – tree maintenance and replanting exist but are limited.	Medium	Major
Peri-urban & Agricultural Systems	Farms in peri-urban Thika and areas near Kilimambogo Hill may experience crop damage due to strong winds and storms.	Medium	Sensitivity: Crops exposed to wind damage and associated soil erosion. Adaptive Capacity: Medium – limited use of windbreaks and protective farming practices.	Medium	Major

4.Climate Risk Assessment.

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 13. Risk matrix

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

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

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.

4.1 Current and Future Climate Risks on Urban Elements

Table 14. Summary of Flooding risks for Thika Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level	—	High	High	Very High	High	Very High
Infrastructure & Services						
Stormwater Drainage	Catastrophic	Very High	Very High	Very High	Very High	Very High
Water & Wastewater Management	Major	High	High	Very High	High	Very High

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Solid Waste Management	Catastrophic	Very High	Very High	Very High	Very High	Very High
Transport & Mobility	Catastrophic	Very High	Very High	Very High	Very High	Very High
Energy	Moderate	Medium	High	High	High	Very High
Economic Infrastructure	Catastrophic	Very High	Very High	Very High	Very High	Very High
Social Infrastructure	Catastrophic	Very High	Very High	Very High	Very High	Very High
Emergency Services	Major	High	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	Very High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Catastrophic	Very High	Very High	Very High	Very High	Very High
Vulnerable & Marginalized Groups	Catastrophic	Very High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Moderate	Medium	High	High	High	Very High
Urban Blue Infrastructure (incl. the Thika River)	Catastrophic	Very High	Very High	Very High	Very High	Very High
Peri-urban & Agricultural Systems	Major	High	High	Very High	High	Very High

Table 15. Summary of Drought risks for Thika Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level	—	Medium	High	Very High	High	Very High
Infrastructure & Services						
Water & Wastewater Management	Catastrophic	High	Very High	Very High	Very High	Very High
Solid Waste Management	Minor	Low	Medium	Medium	Medium	High
Energy	Insignificant	Very Low	Low	Low	Low	Medium
Economic Infrastructure	Catastrophic	High	Very High	Very High	Very High	Very High
Social Infrastructure	Major	Medium	High	Very High	High	Very High
Emergency Services	Major	Medium	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Vulnerable & Marginalised Groups	Catastrophic	Very High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Major	Medium	High	Very High	High	Very High
Urban Blue Infrastructure *(Thika River & tributaries)*	Catastrophic	High	Very High	Very High	Very High	Very High
Peri-urban & Agricultural Systems	Catastrophic	Very High	Very High	Very High	Very High	Very High

Table 16. Summary of Extreme Cold risks for Thika Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level	—	Medium	Medium	Low	Medium	Low
Infrastructure & Services						
Transport and Mobility	Major	High	High	Medium	High	Medium
Energy	Minor	Low	Low	Low	Low	Low
Social Infrastructure	Major	High	High	Medium	High	Medium

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

Table 17. Summary of Landslide Risks for Thika Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level	—	Medium	High	Very High	High	Very High
Infrastructure & Services						
Transport and Mobility	Catastrophic	High	Very High	Very High	Very High	Very High
Water & Wastewater Mgmt	Major	Medium	High	Very High	High	Very High
Energy	Moderate	Medium	High	High	High	Very High
Social Infrastructure	Catastrophic	High	Very High	Very High	Very High	Very High
Emergency Services	Major	Medium	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Vulnerable & Marginalized Groups	Catastrophic	High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Moderate	Low	Medium	High	Medium	High

Table 18. Summary of Wind Risks for Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level	—	Medium	High	Very High	High	Very High
Infrastructure & Services						
Transport and Mobility	Catastrophic	High	Very High	Very High	Very High	Very High
Water & Wastewater Mgmt	Major	Medium	High	Very High	High	Very High
Energy	Moderate	Medium	High	High	High	Very High
Social Infrastructure	Catastrophic	High	Very High	Very High	Very High	Very High
Emergency Services	Major	Medium	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Vulnerable & Marginalized Groups	Catastrophic	High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Moderate	Low	Medium	High	Medium	High
Peri-urban & Agricultural Systems	Major	Medium	High	Very High	High	Very High

4.2 Geoghraphical Climate Risk Hotspots

Township Ward – Moderate flood risk along low-lying zones near the Thika River and adjacent drainage channels. Key areas such as the central business district and surrounding estates are prone to waterlogging during heavy rainfall. Infrastructure including schools, markets, and small businesses is vulnerable. The ward also experiences moderate drought risk affecting domestic water supply and peri-urban urban agriculture.

Hospital Ward – Very high drought risk, particularly in residential areas and peri-urban farming zones. Water shortages affect households, small-scale horticulture, and livestock production during dry seasons. Localized flood risk exists in areas adjacent to seasonal streams and drainage channels, especially during intense rainfall events.

Kamenu Ward – High extreme cold and frost risk in elevated areas affecting agricultural productivity, particularly horticulture. Vulnerable populations living in poorly insulated housing are at increased health risk. Drought risk is moderate, impacting water supply and peri-urban farming.

Gatunyaga Ward – High flood risk along natural drainage paths and low-lying settlements, especially in built-up areas with inadequate stormwater management. Roads, homes, and commercial outlets are frequently inundated during heavy rainfall. The ward also experiences moderate drought conditions affecting water availability for households and small-scale agriculture.

Ngoliba Ward – Moderate flood and cold risk, particularly near riverine sections and poorly drained streets. Seasonal water accumulation and localized flooding affect households, schools, and small businesses. Dry spells contribute to intermittent water shortages, affecting both domestic use and urban agriculture

5. What's Next?

5.1 Key Findings.

Flooding:
Flooding is the most pervasive and severe hazard in Thika Municipality, with very high risks currently affecting stormwater drainage systems, transport infrastructure, solid waste management, economic activities, and social infrastructure such as schools and health facilities. Flood events particularly impact low-lying areas along the Thika River and poorly drained zones in **Township, Gatunyaga, and Ngoliba wards**. Multiple population groups, including residents of informal settlements, are affected. Future climate projections indicate that flood risks are likely to increase from very high to catastrophic by 2050–2100 under high-emission scenarios unless mitigation and adaptation measures are implemented.

Drought:
Drought poses very high risks to water supply, smallholder agriculture, and climate-sensitive livelihoods, especially in **Hospital and Kamenu wards**, where households rely on rain-fed farming and limited groundwater sources. Prolonged dry spells reduce water availability, crop yields, and incomes. Under the SSP5-8.5 (high-emissions) scenario, these risks are projected to intensify significantly by 2050.

Extreme Cold / Frost:
Cold and frost events currently present high risks, particularly in elevated areas of **Kamenu and Gatunyaga wards**, affecting horticulture, small-scale farming, and vulnerable populations living in poorly insulated housing. Cold conditions reduce agricultural yields and increase health risks for children, the elderly, and residents with limited heating options. Projections suggest a slight decline in cold-related risk under high-emission scenarios, though vulnerable groups will remain exposed.

Most At-Risk Groups:

Residents of informal settlements in low-lying and flood-prone areas (e.g., Township, Ngoliba).

- Elderly persons and children.
- Smallholder farmers dependent on rain-fed agriculture (Hospital, Kamenu).
- Daily-wage workers, including market traders and farm laborers.
- Transport operators (boda boda riders) exposed during extreme weather events.

Trends Intensifying Future Risks:

Rapid urbanisation reducing pervious surfaces and increasing runoff in built-up wards.

- Encroachment on riverbanks, riparian zones, and wetlands.
- Increasing water demand due to population growth.
- Limited municipal budget for new infrastructure and maintenance.
- Insufficient stormwater management and climate-resilient urban planning.

Table 19. Summary of climate risks affecting urban elements for Thika Municipality

Category	Current	Mid-term (2050)	Long-term (2100)
Infrastructure & Services			
Stormwater Drainage	Flooding (Very High)	Flooding (Very High)	Flooding (Very High)
Water & Wastewater Mgmt	Drought (High), Flooding (High)	Drought (Very High), Flooding (Very High)	Drought (Very High), Flooding (Very High)
Solid Waste Management	Flooding (Very High)	Flooding (Very High)	Flooding (Very High)
Transport & Mobility	Flooding (Very High), Cold (High)	Flooding (Very High), Cold (Medium)	Flooding (Very High), Cold (Medium)
Economic Infrastructure	Flooding (Very High), Drought (High)	Flooding (Very High), Drought (Very High)	Flooding (Very High), Drought (Very High)
Social Infrastructure	Flooding (Very High), Cold (High)	Flooding (Very High), Cold (Medium)	Flooding (Very High), Cold (Medium)
Emergency Services	Flooding (High), Drought (Medium)	Flooding (Very High), Drought (High)	Flooding (Very High), Drought (High)
Populations			
Urban Residents	Flooding (Very High), Drought (High), Cold (High)	Flooding (Very High), Drought (Very High), Cold (Medium)	Flooding (Very High), Drought (Very High), Cold (Medium)
Informal Settlement Residents	All hazards (Very High)	All hazards (Very High)	All hazards (Very High)
Vulnerable & Marginalized Groups	All hazards (Very High)	All hazards (Very High)	All hazards (Very High)
Natural Assets			
Urban Blue Infrastructure	Flooding (Very High), Drought (High)	Flooding (Very High), Drought (Very High)	Flooding (Very High), Drought (Very High)
Peri-urban & Agricultural Systems	Drought (Very High), Flooding (High), Cold (High)	Drought (Very High), Flooding (Very High), Cold (Medium)	Drought (Very High), Flooding (Very High), Cold (Medium)

5.2 Climate Adaptation and Resilience Solutions

The following solutions are drawn from community consultations and the Kiambu County PCRA adaptation strategies. They are prioritised as immediate (0-2 years), mid-term (3-7 years), and long-term (8-15 years).

Table 20. Climate adaptation and resilience solutions recommended for Thika Municipality

Category	Immediate (0–2 years)	Mid-term (3–7 years)	Long-term (8–15 years)
Infrastructure & Services			
Stormwater Drainage	Desilt and unblock existing roadside drains in Township, Hospital, Kamenu, Gatunyaga, and Ngoliba; install trash traps at drainage hotspots; map the municipal drainage network in GIS.	Construct lined drainage channels in flood-prone areas (Hospital town centre, Gatunyaga trading areas); upgrade culverts and drainage crossings on major roads.	Implement Sustainable Urban Drainage Systems (SUDS) in new developments; restore and protect riparian zones along rivers and streams.
Water & Wastewater Management	Promote household rainwater harvesting tanks; repair leaks in municipal water distribution networks; solarise selected municipal boreholes.	Expand piped water supply networks to underserved estates; construct additional boreholes and community storage tanks.	Develop climate-resilient municipal water supply systems with large storage reservoirs; introduce wastewater recycling and reuse for irrigation.
Solid Waste Management	Provide waste bins in commercial areas and flood-prone zones; conduct regular community clean-ups of drainage channels; support waste sorting and recycling initiatives.	Establish a municipal material recovery facility (MRF); introduce segregated waste collection systems.	Implement circular economy strategies and reduce waste sent to landfills; develop modern waste treatment facilities.
Transport & Mobility	Repair drainage along major roads prone to flooding; grade and maintain murram feeder roads; install warning signage at flood-prone road sections.	Upgrade key murram roads to all-weather standards; construct additional culverts and improve road drainage infrastructure.	Integrate climate resilience into all road design standards; develop pedestrian walkways and non-motorised transport networks.
Energy	Trim trees near power lines to reduce storm damage; expand solar street lighting in residential areas.	Promote solar water heating and rooftop solar in households and institutions.	Develop decentralised renewable energy systems and micro-grids.

Category	Immediate (0–2 years)	Mid-term (3–7 years)	Long-term (8–15 years)
Economic Infrastructure	Improve drainage in markets and trading centres; train small traders and farmers on climate risk management.	Construct cold storage facilities to reduce food losses; promote climate-smart agribusiness and food supply systems.	Establish climate-resilient commercial centres and markets.
Social Infrastructure	Install rainwater harvesting tanks in schools and health facilities; improve sanitation facilities in public institutions.	Retrofit selected schools and clinics to improve resilience to floods and storms.	Develop model climate-resilient schools and healthcare facilities.
Emergency Services	Develop ward-level disaster preparedness plans; train community emergency response teams (CERTs).	Install local weather monitoring and early warning systems; equip emergency services with disaster response equipment.	Establish a municipal disaster management and operations centre.
Populations			
Urban Residents	Conduct public awareness campaigns on flood safety and water conservation; promote rainwater harvesting at household level.	Provide subsidies or incentives for household water storage systems; expand access to affordable health insurance.	Integrate climate resilience standards into housing regulations.
Informal Settlement Residents	Improve sanitation and drainage in informal settlements; provide temporary safe water access points.	Implement participatory slum upgrading programs; improve access to basic infrastructure services.	Implement in-situ upgrading with climate-resilient housing and services.
Vulnerable & Marginalised Groups	Register vulnerable groups for social protection programmes; conduct targeted climate risk awareness programmes.	Develop livelihood diversification programmes for vulnerable households; provide grants for youth entrepreneurship in climate-resilient sectors.	Implement inclusive climate action plans with dedicated funding for vulnerable groups.
Natural Assets			
Urban Green Infrastructure	Plant indigenous trees along streets and in public spaces; protect existing green spaces.	Develop urban green corridors along rivers and roads; establish community tree nurseries.	Increase municipal tree cover significantly through long-term urban forestry programmes.
Urban Blue Infrastructure	Demarcate and protect riparian zones; remove encroachments along rivers.	Restore degraded riverbanks and wetlands; promote nature-based flood control measures.	Fully rehabilitate urban wetlands and integrate them into green infrastructure networks.

Category	Immediate (0–2 years)	Mid-term (3–7 years)	Long-term (8–15 years)
Peri-urban & Agricultural Systems	Train farmers on drought-resilient farming practices; promote water-efficient irrigation methods.	Expand drip irrigation and agroforestry systems; support climate-smart agriculture programmes.	Develop peri-urban areas as climate-smart agriculture hubs supporting urban food security.
Category	**Immediate (0–2 years)**	**Mid-term (3–7 years)**	**Long-term (8–15 years)**
Infrastructure & Services			
Stormwater Drainage	Desilt and unblock existing roadside drains in Township, Hospital, Kamenu, Gatunyaga, and Ngoliba; install trash traps at drainage hotspots; map the municipal drainage network in GIS.	Construct lined drainage channels in flood-prone areas (Hospital town centre, Gatunyaga trading areas); upgrade culverts and drainage crossings on major roads.	Implement Sustainable Urban Drainage Systems (SUDS) in new developments; restore and protect riparian zones along rivers and streams.
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Energy	Trim trees near power lines to reduce storm damage; expand solar street lighting in residential areas.	Promote solar water heating and rooftop solar in households and institutions.	Develop decentralised renewable energy systems and micro-grids.
Economic Infrastructure	Improve drainage in markets and trading centres; train small traders and farmers on climate risk management.	Construct cold storage facilities to reduce food losses; promote climate-smart agribusiness and food supply systems.	Establish climate-resilient commercial centres and markets.

Category	Immediate (0–2 years)	Mid-term (3–7 years)	Long-term (8–15 years)
Social Infrastructure	Install rainwater harvesting tanks in schools and health facilities; improve sanitation facilities in public institutions.	Retrofit selected schools and clinics to improve resilience to floods and storms.	Develop model climate-resilient schools and healthcare facilities.
Emergency Services	Develop ward-level disaster preparedness plans; train community emergency response teams (CERTs).	Install local weather monitoring and early warning systems; equip emergency services with disaster response equipment.	Establish a municipal disaster management and operations centre.
Populations			
Urban Residents	Conduct public awareness campaigns on flood safety and water conservation; promote rainwater harvesting at household level.	Provide subsidies or incentives for household water storage systems; expand access to affordable health insurance.	Integrate climate resilience standards into housing regulations.
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Peri-urban & Agricultural Systems	Train farmers on drought-resilient farming practices; promote water-efficient irrigation methods.	Expand drip irrigation and agroforestry systems; support climate-smart agriculture programmes.	Develop peri-urban areas as climate-smart agriculture hubs supporting urban food security.

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Annex 1. Data Sources

Page	Data	Data Source
11	Population figures	KNBS 2019, Kiambu CIDP 2023-2027
16	Hazard screening	PCRAThika Sub-County consultations, 2023
20	Climate indicators, thresholds	KMD, CHIRPS, CORDEX-Africa, ERA5-Land
21	Current hazard levels	Kiambu County PCRA (Chapter 3)
23	Future hazard projections	Kiambu County PCRA (Chapter 4) – downscaled CMIP5
21	Urban elements inventory – infrastructure	Thika Municipal Board asset register (2024)
27-40	Exposure, vulnerability, impacts	PCRA community workshops, 2023; expert judgment
40-44	Risk levels	Derived using IPCC AR5 risk framework
44	Climate risk hotspots	PCRA hazard maps, municipal physical planning
53	Adaptation solutions	PCRA adaptation strategies