

Hotspot analysis – Murang'a county

Technical report

December 2025



GLOBAL
CENTER ON
ADAPTATION

TABLE OF CONTENTS

Hotspots analysis – Murang’a

Error! Bookmark not defined.

Table of contents	iii
Table of Figures	vi
1. Introduction	1
1.1 Context	1
1.2 Objectives of the report	5
1.3 Methodology	5
1.4 Hotspots hazard exposure screening	7
1.4.1 Pluvial flood hazard mapping	7
1.4.2 River flood hazard mapping (100 years return period)	7
1.4.3 Rising water table flooding hazard	8
1.4.4 Soil salinity	8
1.4.5 Landslide	9
1.4.6 Conclusion	9
2. Hotspot Assessment Report	10
2.1 Irate River and its intake works	10
2.1.1 Proposed Projects	10
2.1.2 Site Description	10
2.1.3 Rapid climate risk screening in the area	11
2.1.4 Challenges to Water Supply	12
2.1.5 Adaptation measures observed	13
2.2 Kiarathe Water Supply	14
2.2.1 Proposed Projects	14
2.2.2 Site Description	15
2.2.3 Rapid climate risk screening in the area	16
2.2.4 Challenges to Water Supply	17
2.2.5 Adaptation measures observed	17
2.2.6 Gender and Socio-economic Impacts of Climate Hazards	18
2.3 Gatamathi Water Supply Extension and Metering	18
2.3.1 Proposed Projects	18
2.3.2 Site Description	19
2.3.3 Rapid climate risk screening in the area	19
2.3.4 Challenges to Water Supply	20

2.3.5	Adaptation measures observed	20
2.3.6	Community Involvement	20
2.4	Rubiro Area, Ithanga	21
2.4.1	Proposed Projects	21
2.4.2	Site Description	21
2.4.3	Rapid climate risk assessment	22
2.4.4	Challenges to Water Supply and Sanitation	22
2.4.5	Adaptation measures observed	23
2.5	Kwa Mukudi, Ithanga Ward	23
2.5.1	Proposed Projects	23
2.5.2	Site Description	23
2.5.3	Rapid climate risk screening in the area	24
2.5.4	Challenges to Water Supply	24
2.5.5	Adaptation measures observed	25
2.6	Kimamo Area	25
2.6.1	Proposed Projects	25
2.6.2	Site Description	25
2.6.3	Rapid Climate risk assessment	26
2.6.4	Challenges to Sanitation	27
2.6.5	Adaptation Measures Observed	27
2.7	Kiawambeu, Fort Treatment Plant	27
2.7.1	Proposed Projects	27
2.7.2	Site Description	28
2.7.3	Rapid climate risk assessment	28
2.7.4	Challenges to Water Supply	29
2.7.5	Adaptation Measures	30
2.8	Maragua Town	30
2.8.1	Proposed Projects	30
2.8.2	Site Description	30
2.8.3	Rapid climate risk assessment	31
2.8.4	Challenges to Sanitation	31
2.8.5	Adaptation measures observed	32
3.	Lessons learnt	32
4.	Next steps	32
Annex 1.	Workshop and mission report	33

1. Background and Context	33
2. Field Mission Schedule	34
3. Workshop Schedule	35
4. Participants	36
5. Delivery Methods	37
6. Focused Group Discussion Findings	38
7. Challenges and Lesson Learned	46
Annex 2. Workshop Photo Gallery	47
Annex 3. Field Hotspot Assessment Photo Gallery	48
Annex 4. List of Investments & their Locations	49
Annex 5. Hotspot Assessment Key Informants Response Form	79
Annex 6. FGD Group Work – Response Form	82
Annex 7. Workshop Attendance List	85
Annex 8. Climate Risk Assessment Presentation – Murang’a	88



TABLE OF FIGURES

Figure 1: Murang'a County Pluvial flood hazard exposure	2
Figure 2: Murang'a County 100-years return period flood exposure mapping	2
Figure 3: Average groundwater depth in Murang'a County and related exposure	3
Figure 4: Murang'a Landslide Mapping	3
Figure 5: Landslide hazard at subcounty level	4
Figure 6: Murang'a Soil Salinity Mapping	4
Figure 7: Overall assignment process	5
Figure 8: Hotspots location.....	6
Figure 9: Location of Irate water intake	10
Figure 10: Irate Intake on River Irate in Gachocho area.	11
Figure 11: Shrinking Irate Intake reservoir capacity as a result of siltation caused by soil erosion	13
Figure 12: Water Supply HDPE pipes anchored by reinforced concrete anchors along the foot of the slopes to deter impacts of landslides and rock fall at Irate Intake. Second phot also show evidence of poor slope clearance and cultivation	13
Figure 13: Impacts of Landslides in Kiarathe, Crops swept away as mass movement continues downhill ..	15
Figure 14: IDP Camp housing at Kiarathe Academy.....	16
Figure 15: Relocated pipes running along River South Mathioya valley in Kiarathe with river crossing fitted with GI pipes from the joint chambers and firmly anchored by concrete reinforced anchors.	17
Figure 16: One of the water kiosks in Rubiro Area, Ithanga.....	22
Figure 17: Road to Kwa Mukudi village where the main trunk line of the current water supply is located.	24
Figure 18: Sewer pipes crossing River Gathamba near Muwasco Offices.....	26
Figure 19: Sedimentation and Dosing Chambers at the treatment plant	28
Figure 20: Testing Laboratory and Sedimentation Chambers at the treatment plant.....	28
Figure 21: Slope Stabilization Gabions along a slope in Murang'a	30
Figure 22: Open Sewer Channels in Maragua Town.....	31

1. INTRODUCTION

1.1 Context

This document is developed as part of the K-WASH program led by the Government of Kenya and the World Bank. GCA is providing additional support to the project by bringing in Climate and Gender and social inclusion expertise through the Consultancy services of Groupe Huit.

The K-WASH program will contribute to increase sustainable access to improved water and sanitation services, eliminate open defecation, and improve the financial performance of water services providers in selected counties, including refugee-hosting counties.

Result areas across which these program development objectives (PDO) will be implemented are:

- Results Area 1: Increasing sustainable access to improved water services for households in climate vulnerable rural areas.
- Results Area 2: Increased sustainable access to improved sanitation services and elimination of open defecation in climate-vulnerable rural areas.
- Results Area 3: Improved operational and financial performance of Water Services Providers in participating counties.
- Results Area 4: Improving sector reforms, coordination, and M&E Capacity for integrated water management.
- Results Area 5: Improving integrated WASH services delivery for refugees and host communities.

As part of the GCA assignment, the Consultant has provided Climate Risk Analysis (CRA) for the Counties of Murang'a and Tana River and support to other counties for them to develop their own CRA. This has been done in parallel with ensuring that climate risk assessment outcomes were properly integrated into the Counties Water Supply and Sanitation Investment Plans (CWSSIP) for the latter to be validated by K-WASH task teams and the World Bank. CWSSIPs are guiding and strategic documentation which also enables to meet the first DLI of the K-WASH project.

More precisely the Climate Risk Assessment (CRA), based on a review of relevant literature – particularly the PCRA and CCAP documentation – identified key hazards that were mapped (see below) and studied further. The hazards outlined below have direct or indirect implications for WASH systems and are considered of major importance for the county:

- Floods:
 - ▶ Pluvial floods
 - ▶ River floods
 - ▶ Rising water table floods
- Heat stress and droughts
- Landslides
- Soil and water salinity
- Sand and dust storms
- Pests and diseases

Some hazard exposure maps for the county are presented below. Building on this screening, the consultant further deepened the hazard exposure assessment at the county level. The next step focuses on detailing these risks at the infrastructure level, to inform climate risk-informed WASH investment planning and design.

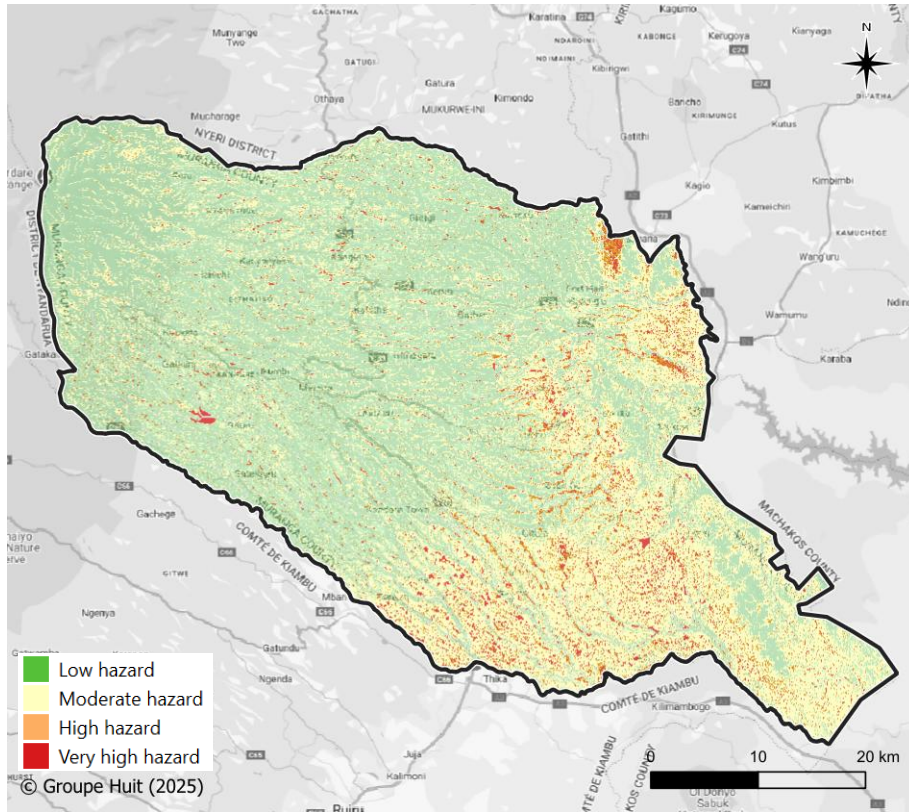


Figure 1: Murang'a County Pluvial flood hazard exposure

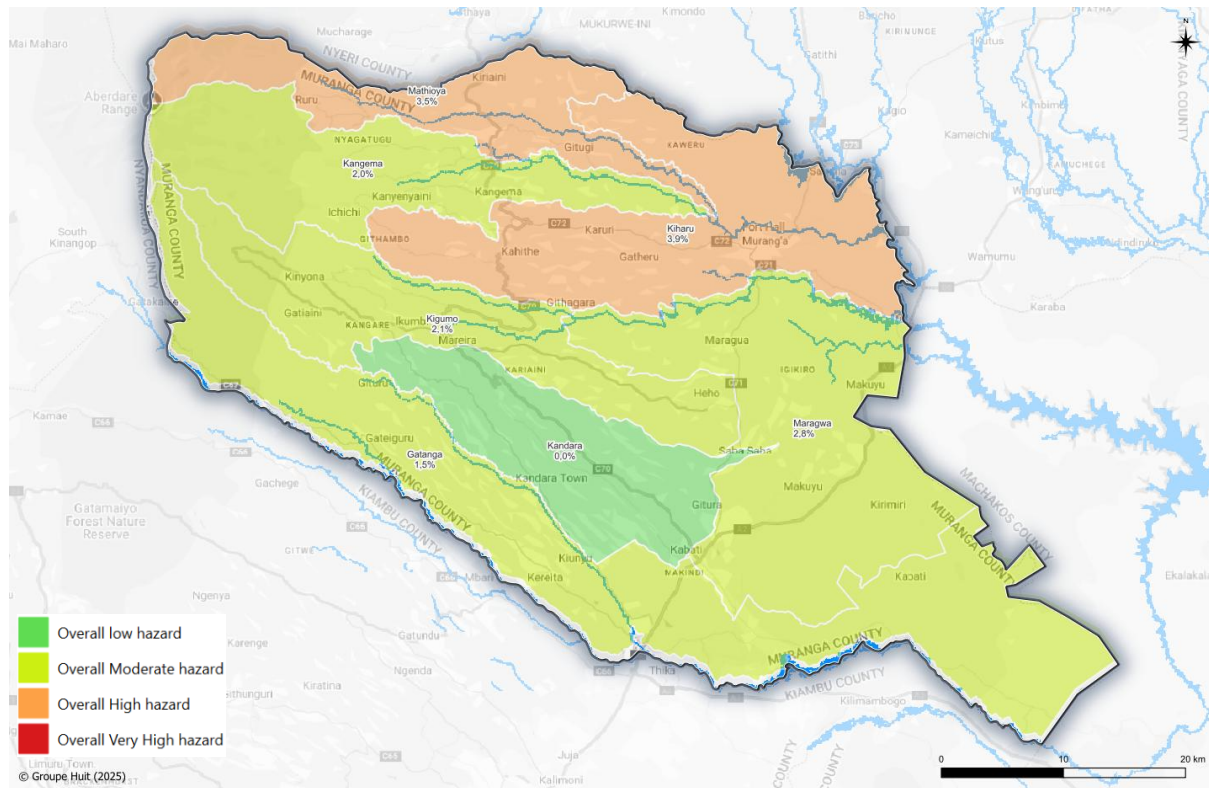


Figure 2: Murang'a County 100-years return period flood exposure mapping

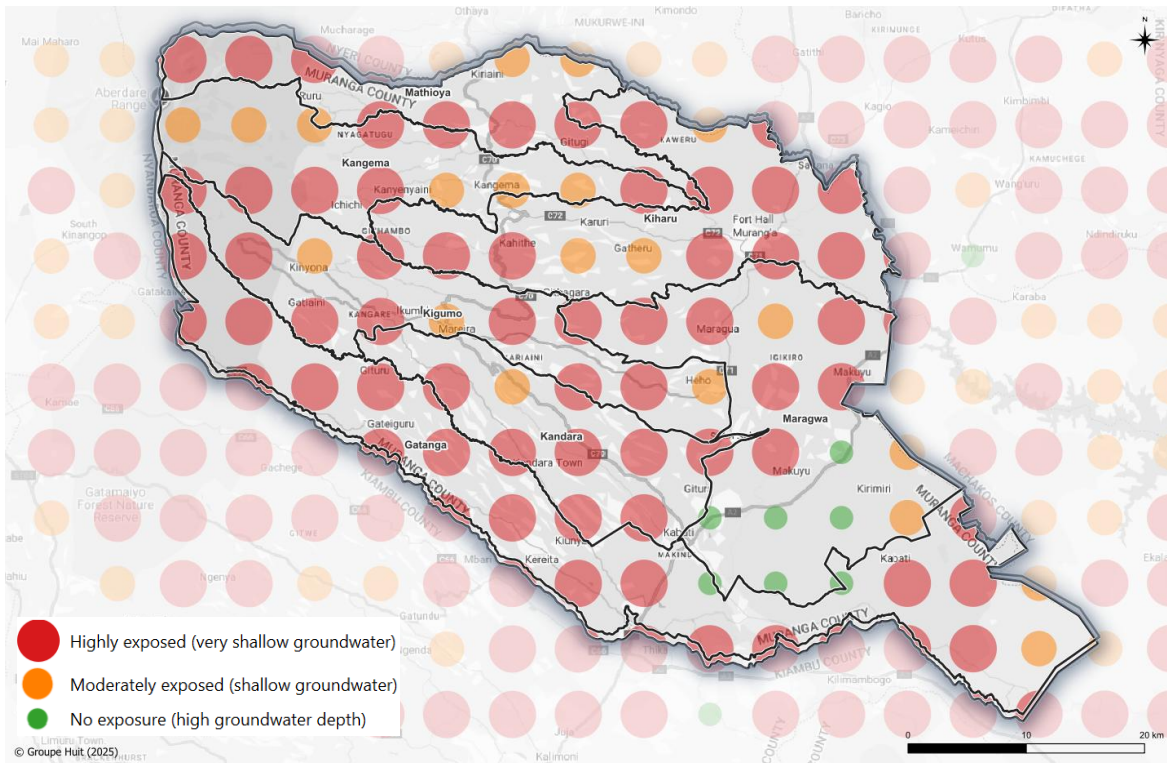
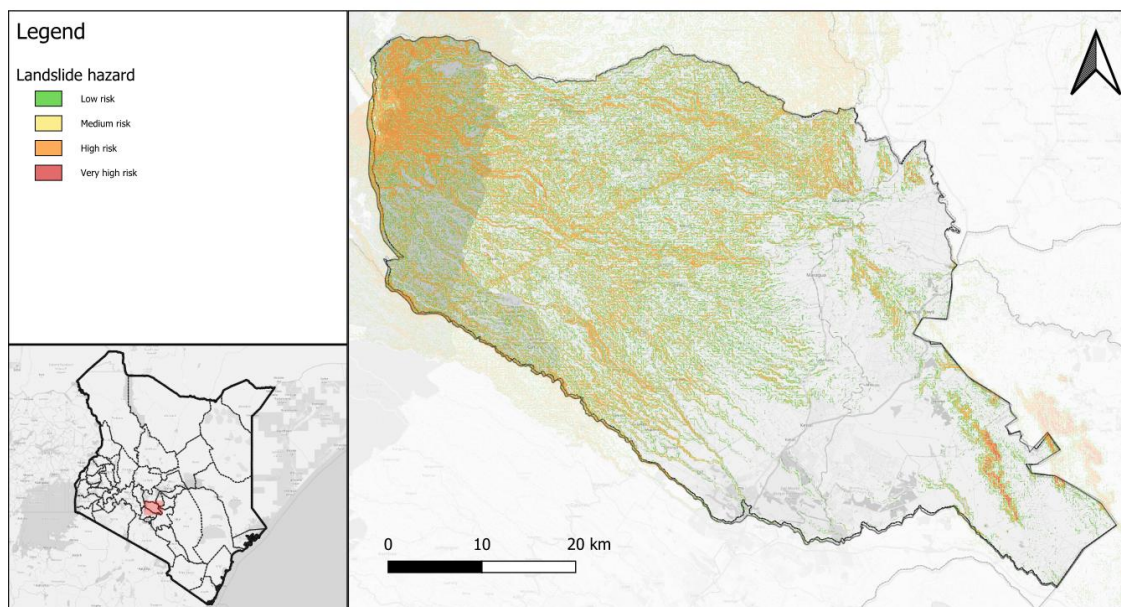


Figure 3: Average groundwater depth in Murang'a County and related exposure

K-WASH Program
Climate Risk and Vulnerability Assessment, Murang'a County
 Landslide mapping



Prepared by : Groupe Huit
 Date : March 2025
 Source : Based on Green Water Credit (GWC) programme in the Upper Tana River Valley (KENSOTER)



Figure 4: Murang'a Landslide Mapping

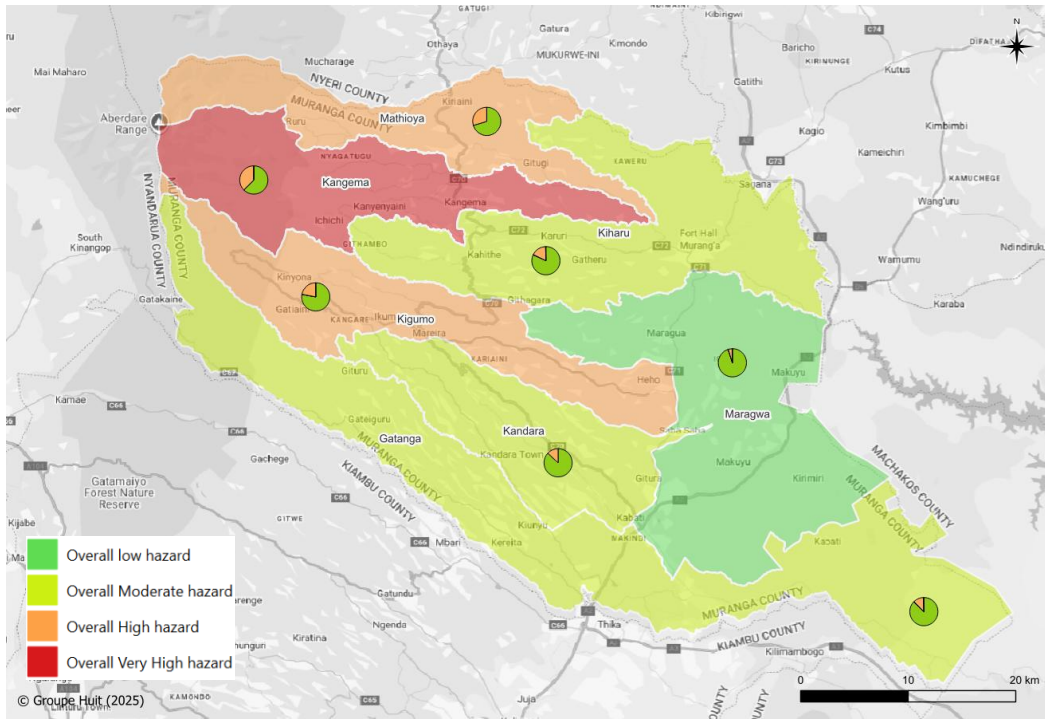
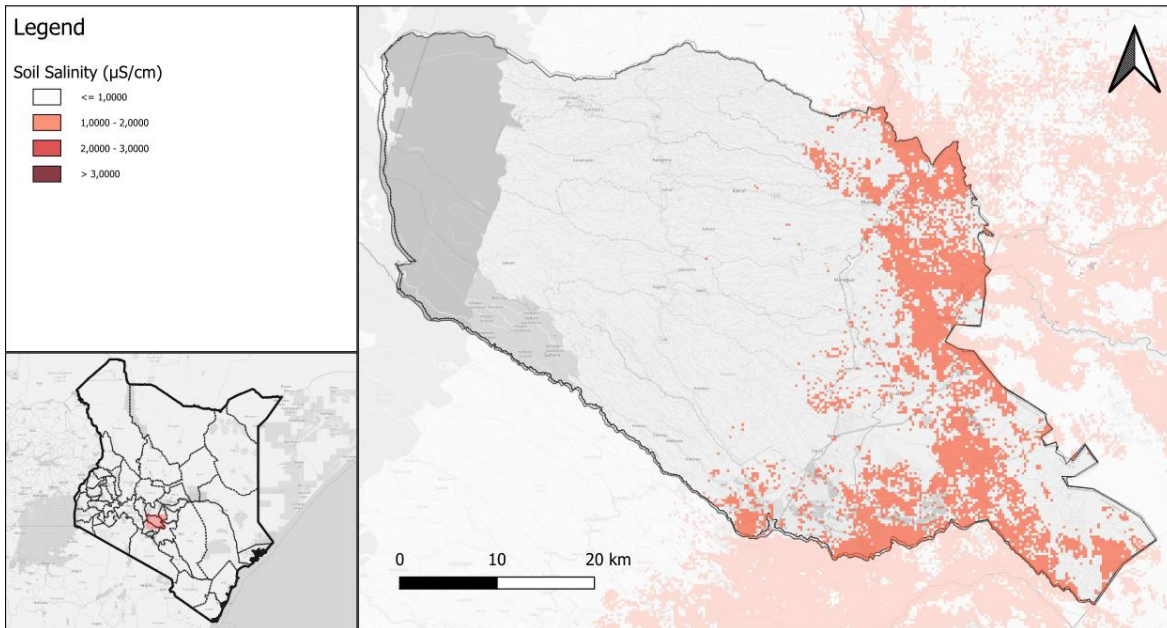


Figure 5: Landslide hazard at subcounty level

K-WASH Program
Climate Risk and Vulnerability Assessment, Murang'a County
 Salinity mapping



Prepared by : Groupe Huit
 Date : March 2025
 Source : Based on Green Water Credit (GWC) programme in the Upper Tana River Valley (KENSOTER)



Figure 6: Murang'a Soil Salinity Mapping

1.2 Objectives of the report

This report presents assessments for eight hotspots in Murang'a County. It explains how the sites were selected building on the Climate Risk Assessment and the provided list of proposed infrastructure (CWSSIP), this document includes a hazard exposure screening and onsite assessments. The findings will inform the Adaptation Options Report, which will specify the technical adaptation measures than can improve WASH systems resilience in Kenya and in the County. This process is presented in the Figure below.

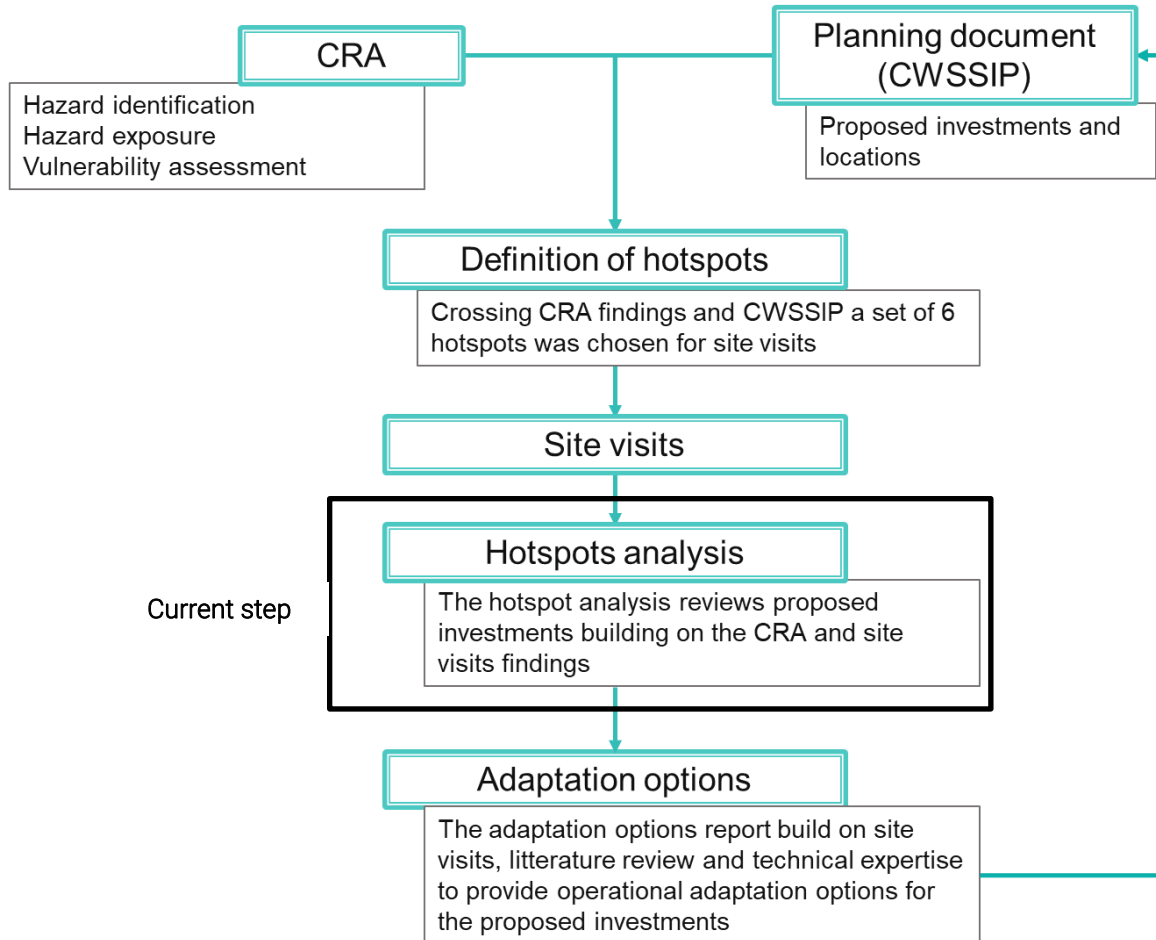


Figure 7: Overall assignment process

1.3 Methodology

The identified hotspots were selected during a workshop. Based on the group's listing of hazard hotspots for field assessment, the consultant and participants jointly agreed on a select number of sites to be visited to reflect (i) different typologies of WASH aspects—covering both water supply and sanitation interventions such as pipelines, boreholes, and latrine systems—and (ii) a range of hazard exposures influenced by the county's diverse geographical and climatic conditions. These include differentiated exposure to flooding, landslides and droughts. Hazard mapping has been done to highlight exposure of each hotspot to main hazards identified in Murang'a.

While the mission focused on areas with planned infrastructure under the K-WASH program, the field assessment necessarily extended to examining existing infrastructure, service conditions, and associated challenges. The site visits undertaken in September 2025 served as the main mode of data collection. The County Director for Water accompanied the consultants to each hotspot, where key informant interviews and

direct observations were carried out to gather data on the nature and extent of climate-related hazards, their frequency, impacts, and the adaptation measures currently in place.

The findings presented in this report are contextualized against the existing and proposed water and sanitation infrastructure in the identified hotspot areas. Subsequent sections provide a detailed account of the field observations, hazard characteristics, and recommended adaptation options to enhance the resilience and sustainability of planned K-WASH investments in Murang'a County.

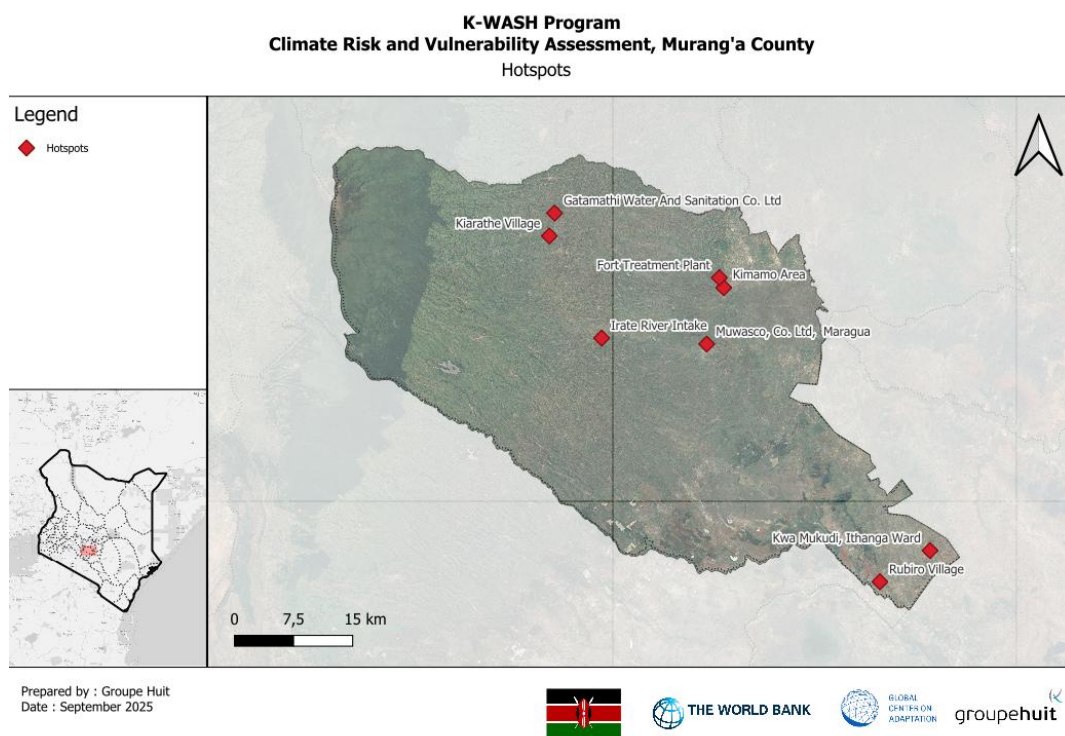
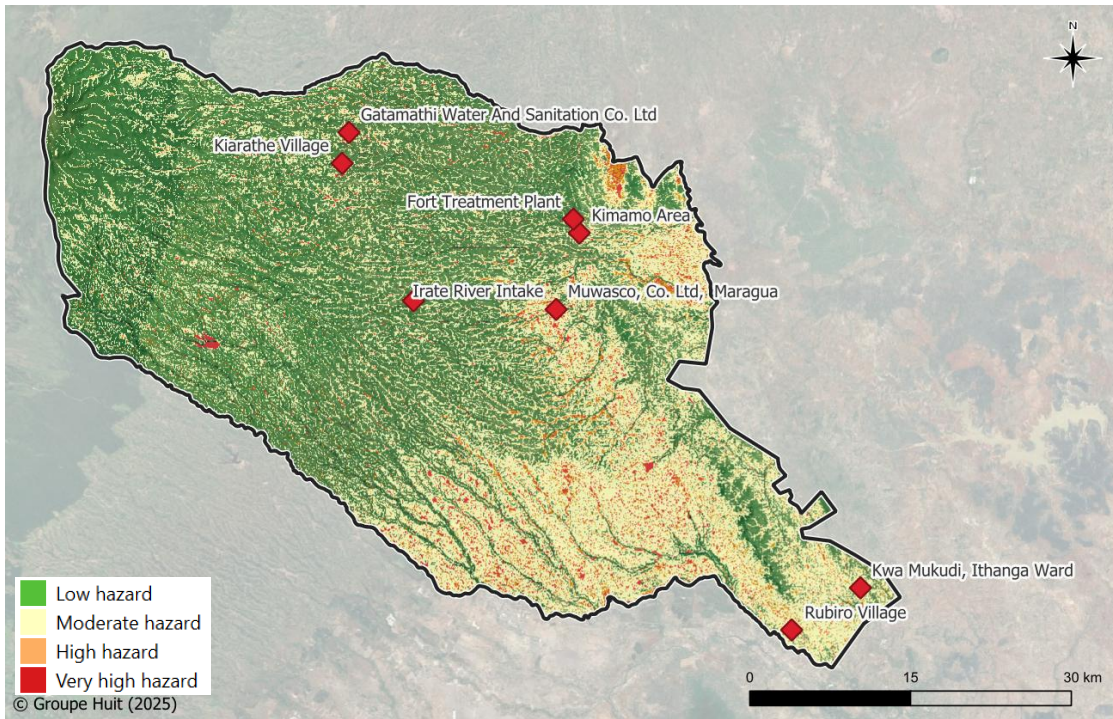


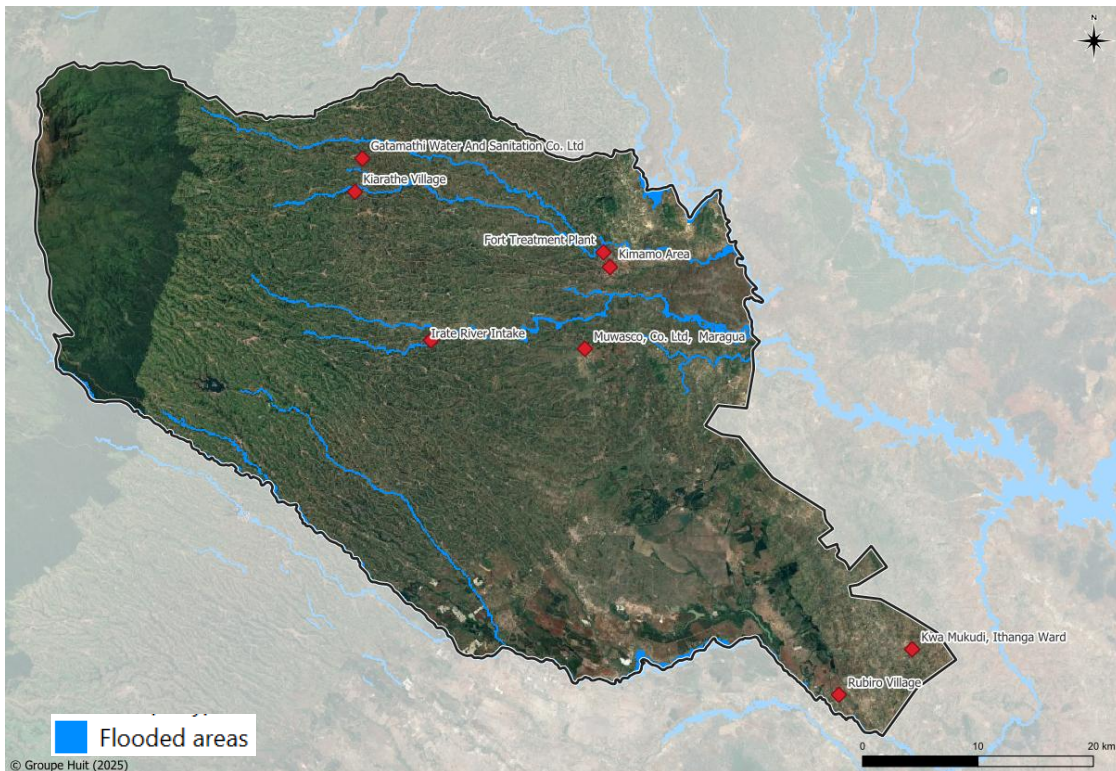
Figure 8: Hotspots location

1.4 Hotspots hazard exposure screening

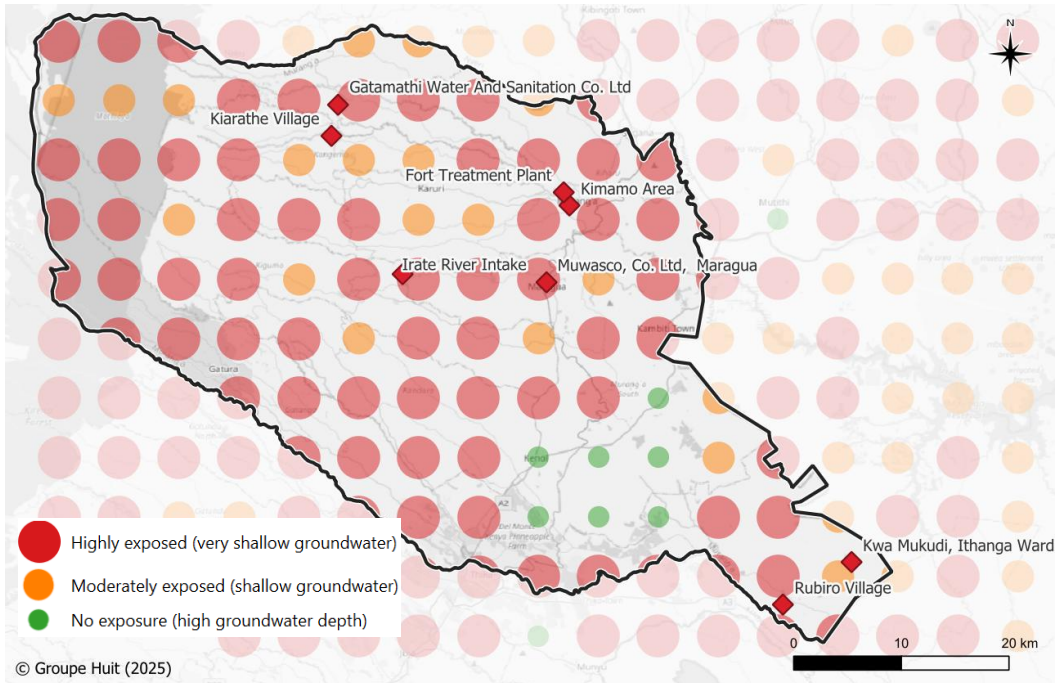
1.4.1 Pluvial flood hazard mapping



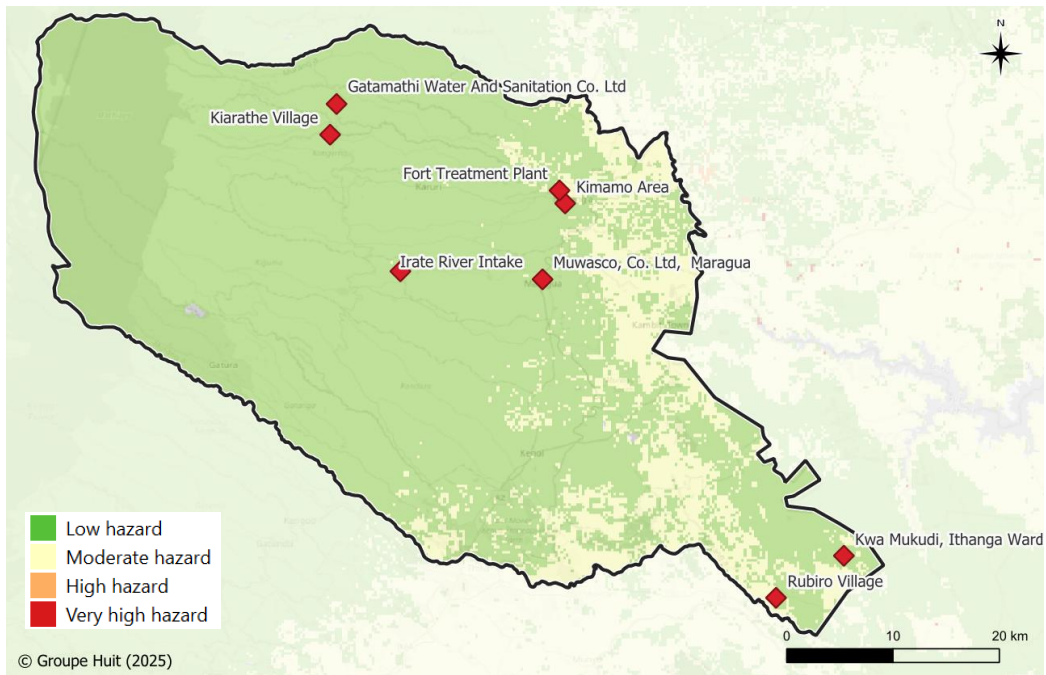
1.4.2 River flood hazard mapping (100 years return period)



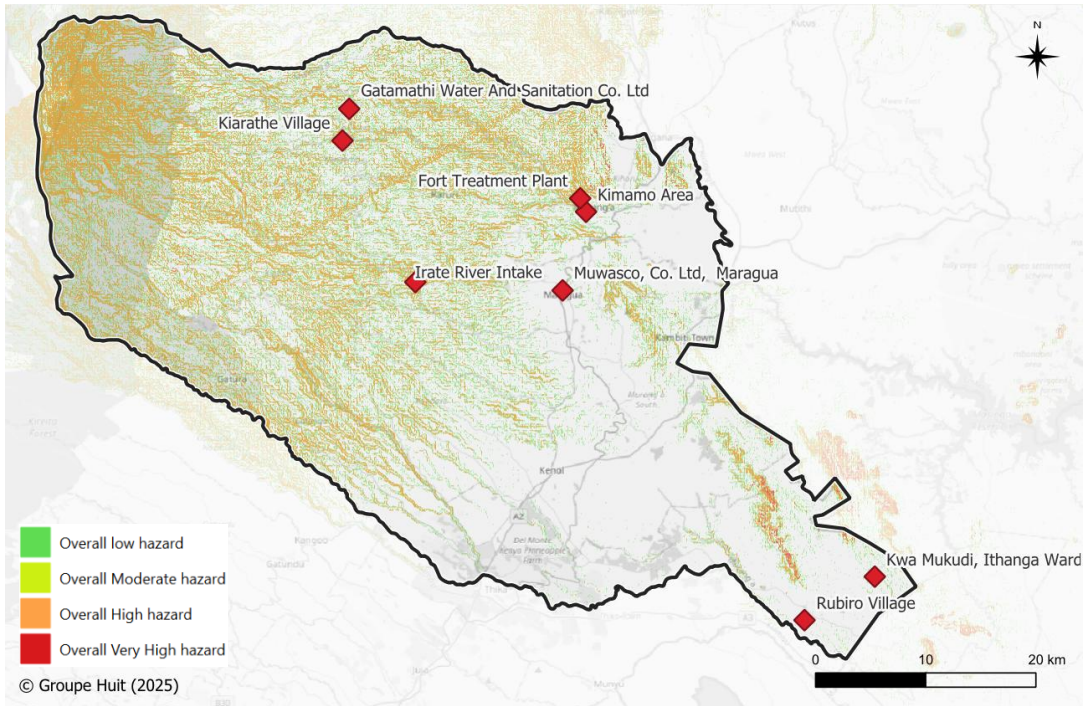
1.4.3 Rising water table flooding hazard



1.4.4 Soil salinity



1.4.5 Landslide



1.4.6 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Irate River intake works	Low	Moderate	High	Low	High
Kiarathe Water Supply	Moderate	Low	High	Low	High
Gatamathi Water supply extension and Metering	Moderate	Low	Moderate	Low	High
Rubiro area	Moderate	Low	High	Low	Low
Kwa Mukudi, Ithanga Ward	Moderate	Low	Moderate	Low	Low
Kimamo Area	Very high	Low	High	Low	Low
Kiawambeu, Fort Treatment Plant	Moderate	Low	High	Moderate	Low
Maragua Town	Moderate to high	Low	High	Low	Low

2. HOTSPOT ASSESSMENT REPORT

2.1 Irate River and its intake works

2.1.1 Proposed Projects

It is proposed to lay a parallel line from the intake to the treatment plant and rehabilitating the existing channel.

Coordinates : -0,78481096 ; 37,0116800



Figure 9: Location of Irate water intake

2.1.2 Site Description

The Irate Intake is situated on the Irate River in Gachocho area of Kigumo Sub-county, an area characterized by hilly and steep slopes. The slopes are dominated by nutrient-rich, loamy red volcanic soils, which make the land highly suitable for cultivation. As a result, much of the area is under farming, while in some sections, rock outcrops with limited vegetation cover are visible. This lack of firm ground cover makes the slopes highly susceptible to landslides and rock falls. These hazards are most common during the rainy season, particularly in May, when the soils become saturated and unstable.

The system operates on gravity, with a running capacity of about 10,000 m³ during the dry season, averaging around 9,800 m³ weekly. Water from the intake is conveyed over a distance of approximately 17 kilometers to the Kiawambea treatment plant.

The scheme serves Murang'a town as well as nearby settlements including Embassy village and Kahuti village. The current daily water demand in these areas is estimated at 25,000 m³, while the system presently supplies about 17,000 m³ daily. Despite the shortfall, the Irate source is considered one of the most reliable because the water is comparatively less turbid to other intakes.



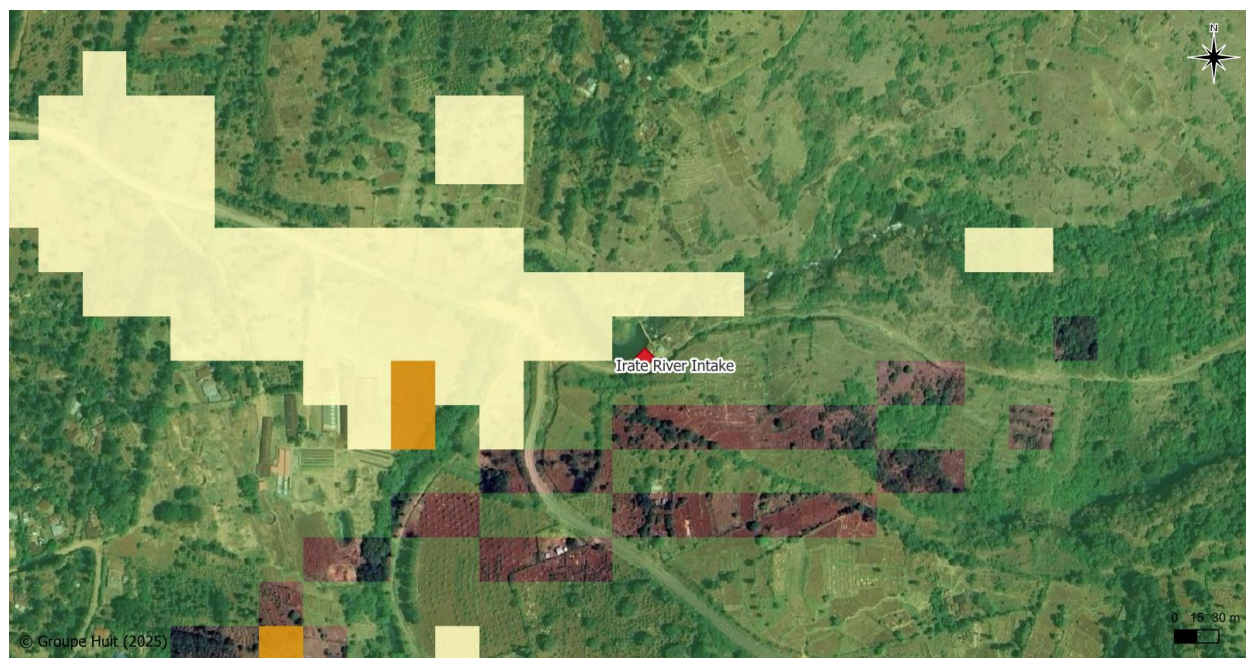
Figure 10: Irate Intake on River Irate in Gachocho area.

Source: Field Survey, 2025

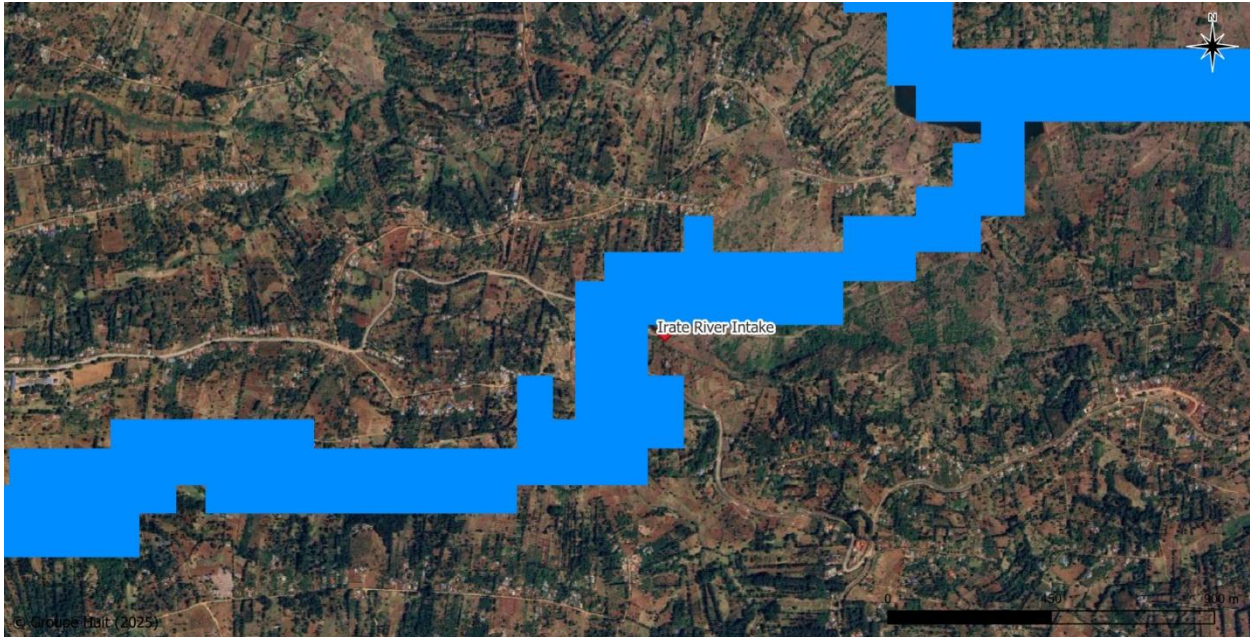
2.1.3 Rapid climate risk screening in the area

To get a closer look at flood hazard mapping, below are zoomed in maps of pluvial and river flood hazard exposure at Irate River intake.

2.1.3.1 Pluvial Flood hazard mapping



2.1.3.2 River flood (100 years return period) mapping



2.1.3.3 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Irate River intake works	Low	Moderate	High	Low	High

Based on these maps as well as the ones presented in introduction, it can be noted that overall, the Irate River intake works site is exposed to a range of natural hazards, with the **highest risks associated with rising water table flooding and landslides**. **River flooding presents a moderate level of concern** as the intake falls at the border of the 100-years return period flooded area, it should nevertheless be considered as the infrastructure can be very vulnerable to such hazard. Finally, **pluvial flooding and soil salinity are considered low-risk hazards**.

2.1.4 Challenges to Water Supply

Although the Irate intake system is considered relatively reliable, it faces several critical challenges:

- **Landslides and Rock falls:** Unstable slopes along the pipeline corridor have repeatedly damaged nearly 1 km of the transmission line hence cutting of water supply and leading to increased maintenance costs. The May, 2018 landslide was particularly destructive, damaging key infrastructure including the NIB pipe, Murang'a pipes, and the Maragua line. Ongoing rockfalls, compounded by explosions and blasting activities in the area, continue to threaten the system's stability.
- **Soil Erosion and Siltation:** Agricultural activities practiced on upstream slopes in Kangema accelerate soil erosion. This leads to siltation of the intake reservoir, reducing its storage capacity and limiting the efficiency of water abstraction.
- **Low River Flows in Dry Seasons:** During prolonged dry periods, water levels in the Irate River drop significantly. To sustain downstream flows, outfalls at the intake reservoir must be opened, which in turn limits the volume of water available for abstraction.

- ▶ **Flow Regulation by Maragua Dam:** The Maragua Dam, located along the same river, further influences flows downstream of the intake, especially during the dry season, thereby affecting the reliability of water supply.



Figure 11: Shrinking Irate Intake reservoir capacity as a result of siltation caused by soil erosion

Source: Field Survey, 2025

2.1.5 Adaptation measures observed

To reduce the risks posed by landslides and rock falls, several engineering interventions have been implemented. Pipe anchors have been reinforced with concrete up to 7 meters into the hardpan, providing greater stability in vulnerable sections. In areas with high rock fall risk, the pipeline has been diverted away from rocky zones or buried deeper underground to minimize exposure and damage.



Figure 12: Water Supply HDPE pipes anchored by reinforced concrete anchors along the foot of the slopes to deter impacts of landslides and rock fall at Irate Intake. Second phot also show evidence of poor slope clearance and cultivation

Source: Field Survey, 2025

Use of HDPE pipes that are much stronger and can withstand damage. Reducing the number of joints within the hotspot zone by electro fusing the joints.

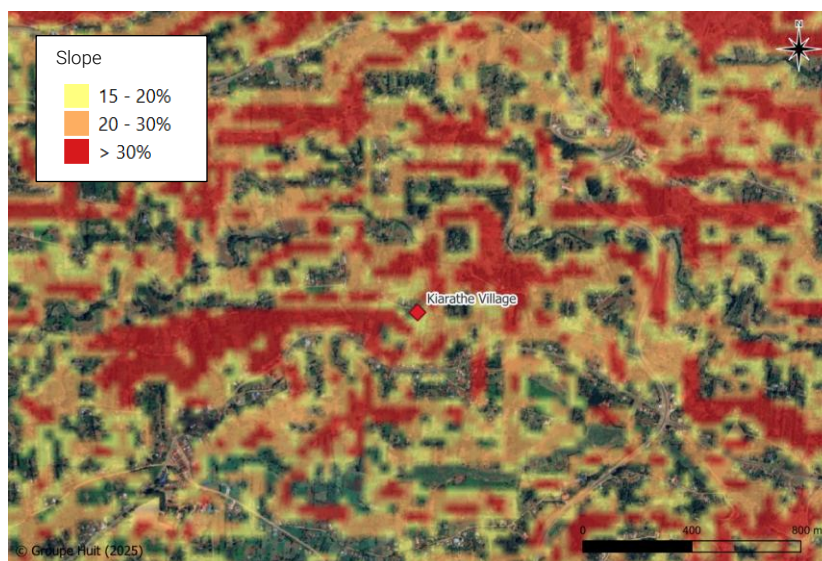
While the Irate intake system remains a reliable source of water for Murang'a, its long-term sustainability will depend on continued efforts to address vulnerabilities associated with landslides, rock falls, and the increasing demand for water as little efforts have been done to reduce cultivation on the slopes, which exposes the slopes to landslides and erosion.

2.2 Kiarathe Water Supply

2.2.1 Proposed Projects

It is proposed to rehabilitate the water supply pipes.

Coordinates : -0,6683542 ; 36,9519700



The exact areas for pipe rehabilitation is unknown, the map above presents the overall area, showing that houses are scattered along roads and that the area has steep slopes.

2.2.2 Site Description

Located in Musoso Village, the area has steep slopes with loose red volcanic loamy soils. The vegetation cover along the slopes is scattered mostly made of tealeaves, coffee trees and other agricultural plants like bananas and in some cases nappier grass. The continued farming along these steep slopes expose the pipes to risks of landslides.

The landslides have been occurring but have been severe since 2018 and have occurred in 2022, 2024 and 2025 especially in the month of May which is the wettest month when soils are waterlogged and saturated resulting to earth movements.

There are currently three pipes traversing the area: two for Murang'a West Water and Sanitation Company (MWEWASCO) and one for the National Irrigations Board (NIB). All pipes are currently running along the river. Initially the MWEWASCO pipes were running along the ridge but had to be relocated to run along the river (River South Mathioya), which is safer.

The National Irrigations Board (NIB) line supplies water to Kiamara, Yego, Nyakahola which are dry places with semi-arid conditions. It was reported that the water is consumed directly without treatment as it considered clean from the intake deep inside the Aberdare Forest with little disturbance.



Figure 13: Impacts of Landslides in Kiarathe, Crops swept away as mass movement continues downhill

Source: Field Survey, 2025

One-pipe supplies water to Gekayi, G and Kanorera locations in Kangema sub-county while another line is dedicated to Kahuro subcounty.

Twenty-one families were displaced to the IDP camp, have been provided by a shared kitchen, and piped water supply from MWEWASCO. Each family has been provided with a 3-bedroom house and for the single one a two-bedroom house. The church pays for water and electricity bills for the IDPs. There are also adequate sanitation facilities at the camp for the IDPs.



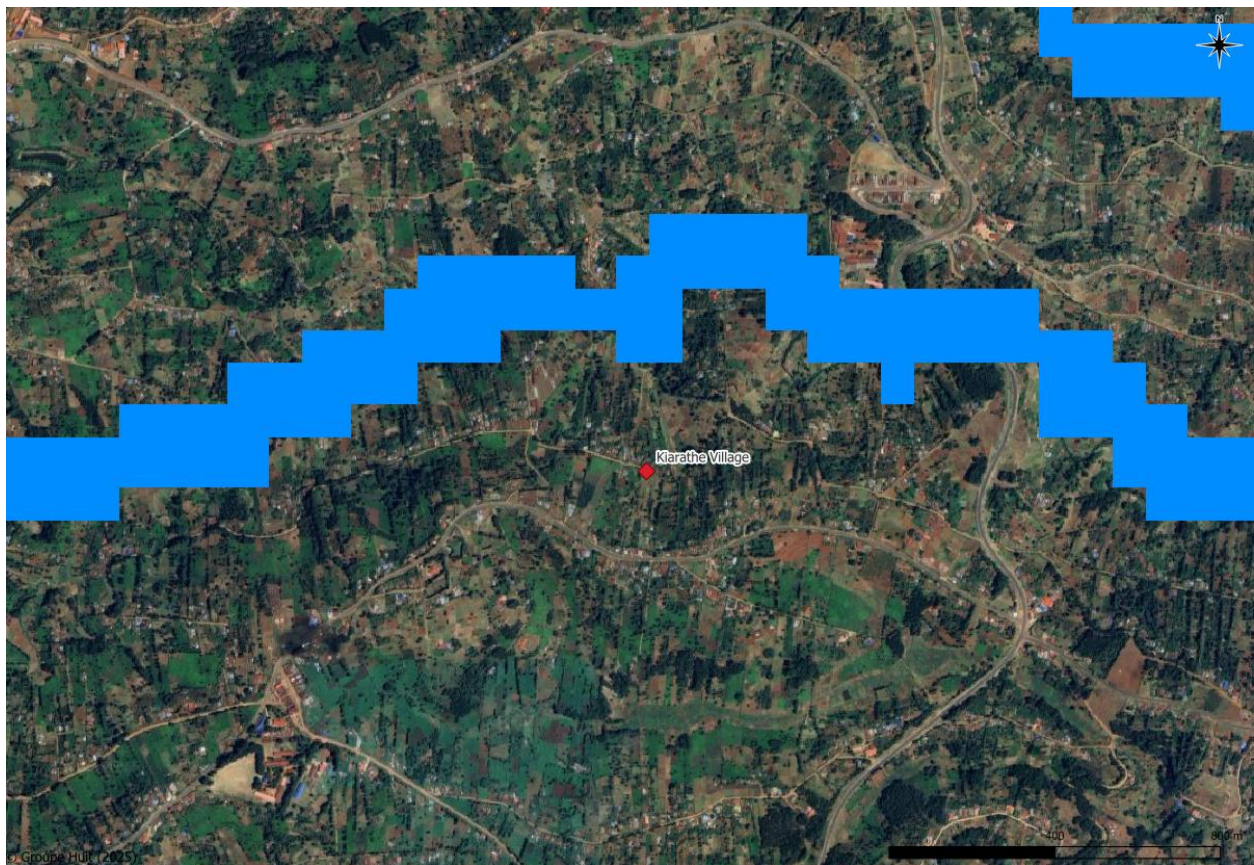
Figure 14: IDP Camp housing at Kiarathe Academy

Source: Field Survey, 2025

2.2.3 Rapid climate risk screening in the area

2.2.3.1 River flood hazard exposure (100 years return period)

As it is not very clear on the map at county scale here is a zoom in of Kiarathe location to highlight that it is not into the flooded area of a 100 years return period river flood hazard.



2.2.3.2 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Kiarathe Water Supply	Moderate	Low	High	Low	High

The Kiarathe Water Supply area faces **high exposure to both rising water table flooding and landslides**, which could impact water infrastructure and surrounding settlements. **Pluvial flooding** is rated as **moderate**, suggesting some vulnerability to intense rainfall events, while **river flooding** and **soil salinity** risks remain **low**.

2.2.4 Challenges to Water Supply

In May 2025, a landslide in Kiarathe swept away approximately 200 meters of GI pipes, disrupting water supply to the area. The disaster also displaced residents, forcing them to seek temporary shelter at an IDP camp established at Kiarathe Academy, which is managed by the local church. The incident has resulted in recurrent budgetary expenditures for restoring the water supply, thereby significantly increasing operational costs.

Even though there is no formal project proposed at Kiarathe yet, the existing water supply pipes are located within a landslide and erosion hotspot hence requiring a lot of monitoring and repair during the occurrence of such events.

2.2.5 Adaptation measures observed

Sections of the pipeline have been relocated from running along the ridge to following the river alignment, thereby reducing exposure to landslide-prone areas.

Galvanized Iron (GI) pipes have been installed across structurally weak sections of the supply network, particularly at river crossings. At these points, a concrete reinforced joint chamber with a washout has been established to secure the crossing and enhance maintenance.



Figure 15: Relocated pipes running along River South Mathioya valley in Kiarathe with river crossing fitted with GI pipes from the joint chambers and firmly anchored by concrete reinforced anchors.

Source: Field Survey, 2025

Some community members have adopted terrace farming along the slopes to stabilize the soil, minimize erosion, and reduce the risk of landslides.

2.2.6 Gender and Socio-economic Impacts of Climate Hazards

The landslides have caused significant disruptions to social and economic life, with distinct gendered impacts:

Burden on Women: Women in the IDP camps must fetch firewood from Musoso village, about 17 km away, to cook for their families. The long distance is exhausting, leading some women to cook in their landslide-prone homesteads and then carry the food back to the camp, as this is seen as less strenuous.

Loss of Privacy and Dignity: Families in the IDP camp are crowded into single housing units, resulting in a lack of privacy and discomfort.

Challenges for Girls and Young Women: With limited employment opportunities in the rural setting, displacement has further worsened the prospects of girls and young women seeking livelihoods.

Many residents depended on coffee farming as their main source of income. Landslides have destroyed farms and rendered land uncultivable, cutting off a vital economic base.

Restrictions and Social Tensions: IDPs, particularly men, are subject to an 8 p.m. curfew imposed by the church, which weakens social cohesion and limits interactions. Families are also required to seek church permission to host guests, further restricting freedom.

Family Separation: Some families have been separated, as siblings or relatives who lived outside the landslide zone were not enumerated and therefore excluded from housing and support within the IDP camp.

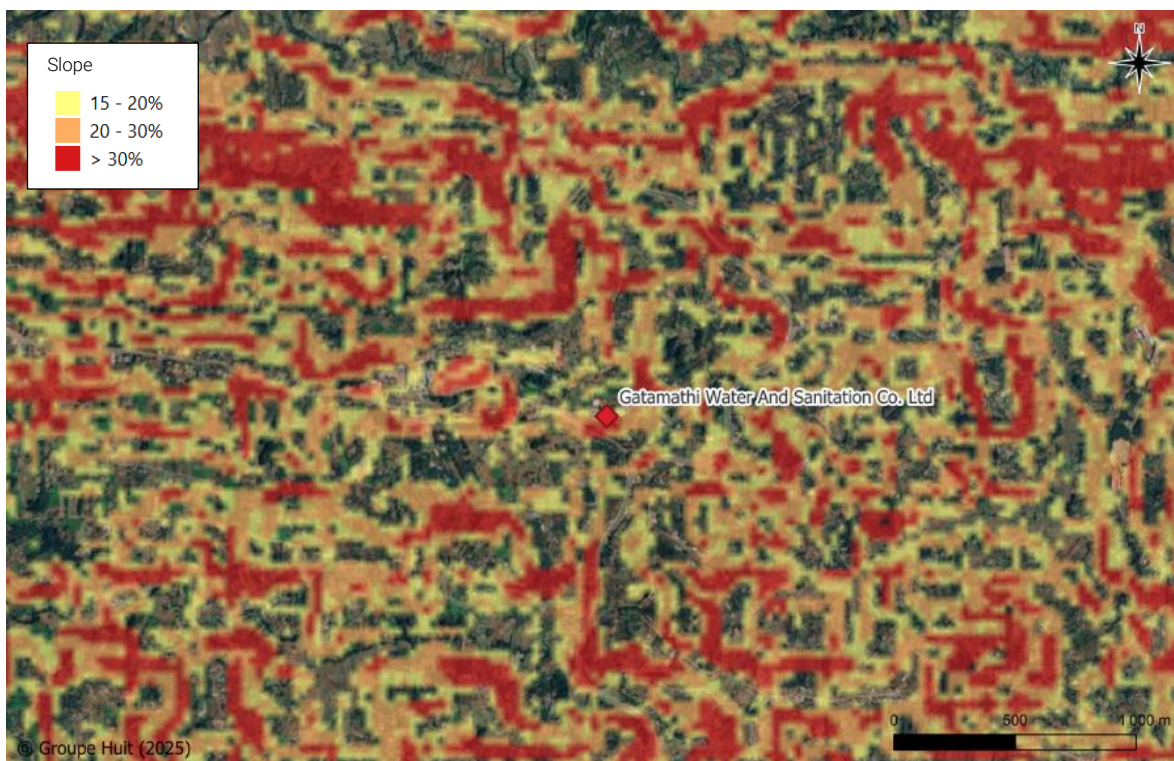
2.3 Gatamathi Water Supply Extension and Metering

2.3.1 Proposed Projects

Extension of water supply network and metering to Kiambuigi, Mugeka, Gaturi, Kigetuiine, Thoithu and Karengo-ruru.

Coordinates : -0,64229494 ; 36,9578800





The exact location and extent of the proposed project remain to be mapped, the above maps mainly intend to show the hilly terrain of Gatamathi.

2.3.2 Site Description

The Gatamathi Water and Sanitation Company (GAWASCO), which manages the Gatongo and Mathioya Water Schemes, has planned a water supply extension and metering programme targeting residents of Kiambuigi, Mugeka, Gatari, Kigetuiine, Thoithu, and Karengo-Ruiru. These areas are recognized as landslide hotspots, characterized by steep slopes, loose loamy red volcanic soils, and unsustainable farming practices along the hillsides. Landslides in the region are most frequent in May, coinciding with the heavy rains when soils are fully saturated.

The company currently serves approximately 12,400 active households connections. However, only 65% of customers are metered, while the remaining 35% are unmetered. For non-metered households, a fixed monthly fee of KES 500 is charged, while water from the company's three kiosks is sold at KES 3 per 20-litre jerrican. Financial limitations have hindered the company from metering all connections.

The utility's main water sources are intakes from the Aberdare Forest on the North Mathioya River, Gatongo River, and Mathioya River.

2.3.3 Rapid climate risk screening in the area

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Gatamathi Water supply extension and Metering	Moderate	Low	Moderate	Low	High

At Gatamathi, **landslide hazard** is identified as **high**, posing a serious threat to water supply extensions and associated metering systems. **Rising water table flooding** represents a **moderate** risk, as does **pluvial flooding**, while **river flooding** and **soil salinity** are of **low concern**.

2.3.4 Challenges to Water Supply

In May 2024, landslides in Gitugi swept away water pipelines, cutting off supply to residents and tragically claiming six lives. Such hazards force the water company to divert resources from planned activities to emergency response and customer relocation, disrupting budget estimates. This not only inflates operational costs but also delays or limits expansion projects, constraining the company's overall progress.

2.3.5 Adaptation measures observed

Several measures have been adopted to strengthen the resilience of the water supply system against landslides:

- Pipe Replacement: In areas such as Kiamahinu, damaged PVC pipes have been replaced with more durable HDPE pipes.
- Gabions have been constructed to stabilize vulnerable slopes and protect pipeline infrastructure.
- Use of Stronger Material for instance in landslide-prone areas, GI and HDPE pipes are now preferred over PVC pipes, which are more susceptible to damage.
- Field officers regularly monitor the pipeline network to detect leaks and identify potential points of weakness early.

2.3.6 Community Involvement

The company has established mechanisms for involving the community in the design and operation of the water supply system, including:

- Community members are consulted on the location of infrastructure, as pipelines and facilities often traverse their land.
- Reservoir tanks are constructed on land provided by local residents.
- Residents are engaged in activities such as trenching for pipelines, contributing labor to reduce project costs.
- Support for Vulnerable Households - Through collaboration with chiefs and board members, the company identifies poor households and provides them with free water connections while also covering their water bills.

2.4 Rubiro Area, Ithanga

2.4.1 Proposed Projects

Extension of Water Supply in Mavoloni, Muti, Ngereria an Mkundi, Ithanga, Kakiuzi and Mito Mbili areas in Ithanga sub-county

Coordinates : -1,062716200 ; 37,3290520



2.4.2 Site Description

The Gatanga Water and Sanitation Company has planned a water supply extension to the areas of Mavoloni, Muti, Ngereria an Mkundi, Kakiuzi and Mito Mbili in Ithanga Sub-County, a region severely affected by drought with occasional flash floods. The area is characterized by high temperatures and erratic rainfall, with rains mainly occurring between March and May.

The most recent flooding event occurred in May 2025, consistent with the pattern of annual flooding during this season. Floodwaters in the area can persist for up to one month due to continuous rainfall. The soils are predominantly black cotton, which further influences runoff and erosion.

The planned expansion will draw water from the Blue Post intake on the Thika River, conveyed through a 400 mm main pipeline. Currently, the company manages about 1,800 active connections (roughly 30% coverage), supported by water kiosks and water pans. Demand for household connections remains high, particularly as this part of Murang'a borders Machakos County, where Gatanga Water is permitted to supply up to 1 km across the county boundary.

The company applies a progressive tariff structure, with water sold at KES 70 per unit for 1–6 units and KES 120 per unit for 7–20 units. Previously, customers paid a flat rate of KES 250 for 0–6 units. On average, households consume six units per month.



Figure 16: One of the water kiosks in Rubiro Area, Ithanga.

Source: Field Survey, 2025

2.4.3 Rapid climate risk assessment

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Rubiro area	Moderate	Low	High	Low	Low

In the Rubiro area, the primary risks stem from rising water table flooding (high) and pluvial flooding (moderate). The area is relatively stable in terms of landslide potential, rated as low, and faces minimal exposure to river flooding and salinity

2.4.4 Challenges to Water Supply and Sanitation

- **Over-abstraction of Thika River.** Large-scale agribusinesses such as Delmonte and Kakuzi draw heavily from the Thika River. During droughts, this over-abstraction leads to critically low water levels, forcing the County to regulate water allocation and, in some cases, prompting the Ministry of Water and Irrigation to consider revoking certain water permits.
- **Damage to Sanitation Infrastructure.** During floods, toilet bases often collapse or sink when inundated, leading to loss of facilities and increased public health risks.

- **Water Contamination Risks.** Floodwaters and poor pipe integrity result in seepages into the distribution network, contaminating potable water supplies hence increasing health risks.

2.4.5 Adaptation measures observed

Several measures have been adopted to strengthen the resilience of the water supply and sanitation systems:

- Promotion of household and institutional rainwater harvesting to supplement piped water, especially during drought periods.
- New infrastructure installation are of HDPE and PPR pipes, which are thicker and more resistant to both water loss and heat-related damage compared to conventional materials.
- Flood-Resilient Sanitation Facilities – County encourages the community to construct raised and concrete-reinforced toilet walls to reduce the risk of collapse or damage during flood events.

2.5 Kwa Mukudi, Ithanga Ward

2.5.1 Proposed Projects

Proposed water supply extension to Kwa Mukudi residents in Ithanga Ward

Coordinates : -1,027133600 ; 37,3861350



2.5.2 Site Description

Kwa Mukudi village is situated in Ithanga Ward, Ithanga Sub-county, an area severely affected by recurrent drought. Local water sources include piped supply from Gatanga Water, seasonal rivers, boreholes, and water pans. The village is predominantly rural, with mangoes, lemons, and oranges being the main crops grown.



Figure 17: Road to Kwa Mukudi village where the main trunk line of the current water supply is located.

Source: Field Survey, 2025

2.5.3 Rapid climate risk screening in the area

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Kwa Mukudi, Ithanga Ward	Moderate	Low	Moderate	Low	Low

Kwa Mukudi in Ithanga Ward shows moderate exposure to both pluvial and rising water table flooding, while other hazards – river flooding, salinity, and landslides – remain low.

2.5.4 Challenges to Water Supply

The village faces multiple challenges related to water supply:

- Frequent water shortages and rationing during droughts, largely due to over-abstraction upstream along Thika River by large agricultural farms such as Delmonte and Kakuzi.
- Community boreholes often dry up and experience increased salinity during prolonged drought periods.
- High water costs in drought seasons, with prices rising to KES 20–25 per 20 litres compared to the usual KES 5, making access difficult for low-income households.
- The community water pan is no longer accessible after the land on which it sits was purchased and fenced off by a private individual, worsening shortages.
- Women, who traditionally bear the responsibility of fetching water, spend long hours searching for it during drought periods.

- Water at the treatment plant is heavily colored by effluents from nearby coffee plantations at Kakuzi, increasing treatment costs.
- Laundry activities along the river reduce water quality and pose risks to human health.

2.5.5 Adaptation measures observed

Facing these challenges a few adaptation measures have already been adopted:

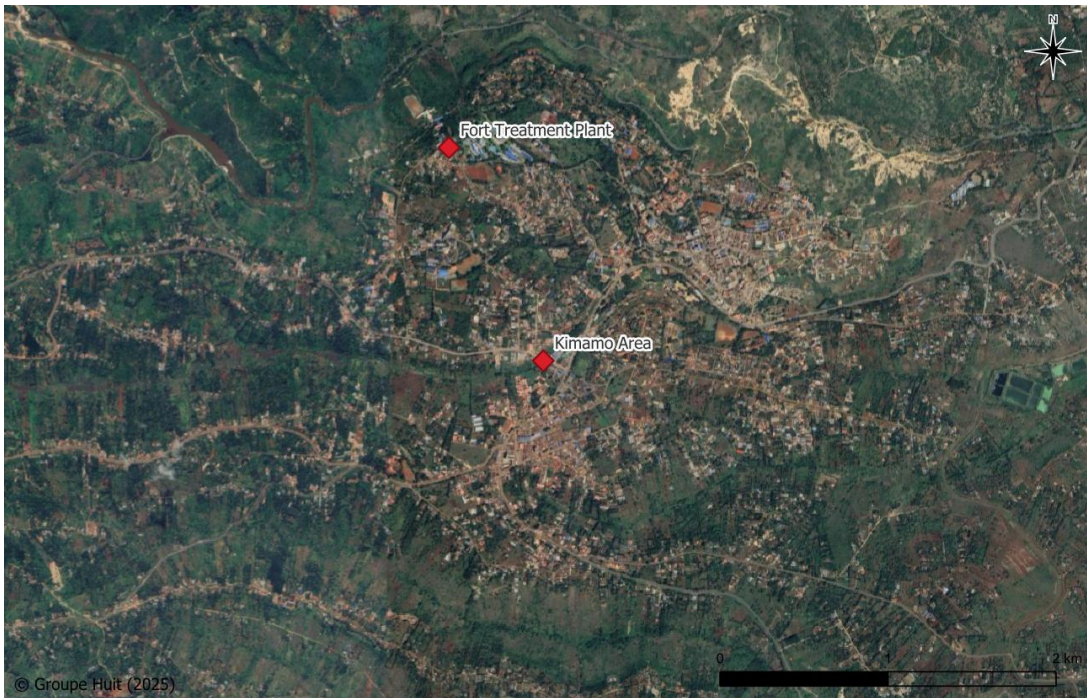
- Reduced frequency of showering during drought periods, as water becomes scarce and expensive.
- The County government identifies poor and vulnerable households and connects them to piped water supply free of charge.
- Community members practice rainwater harvesting from iron sheet roofs and store the collected water for later use.

2.6 Kimamo Area

2.6.1 Proposed Projects

Rehabilitation of the sewer network pipes and connection of new 1000 households around St. Mary's School and 9500 households at Township area, Mbiri Ward.

Coordinates : -0,7273877 ; 37,1508030



2.6.2 Site Description

The sewer pipe rehabilitation site is located in the Kimamo area along River Gathamba, near the MUWASCO offices in Murang'a town. The pipes are heavily affected by flooding, which damages the infrastructure and causes sewage to leak into the river, leading to water pollution. Similar challenges are also observed in the Kwa Base area within Murang'a town. Flooding occurs annually between February and April and is mainly caused by the river when it bursts the banks

Currently, only 38% of residents in Murang'a town are connected to the sewer system. The area is characterized by dense settlements with limited road reserves, where both stormwater drainage channels and sewer networks are constrained.

For each household, sewer charges are set at half the cost of the water bill. Every household connected to piped water is also linked to the sewer system, with sewer charges billed together with water bills.



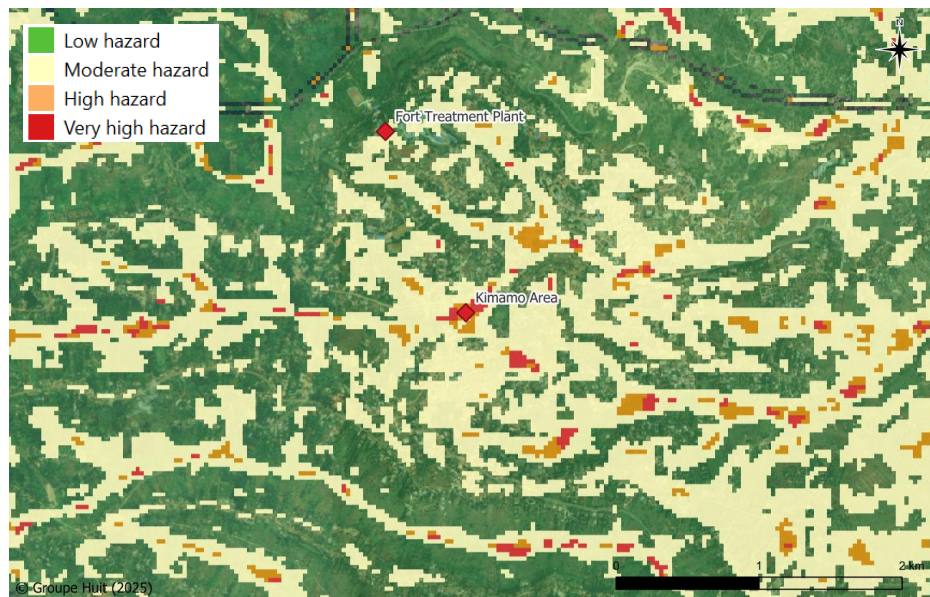
Figure 18: Sewer pipes crossing River Gathamba near Muwasco Offices.

Source: Field Survey, 2025

2.6.3 Rapid Climate risk assessment

2.6.3.1 Pluvial flood hazard mapping

The pluvial flood hazard mapping provided at county scale does not enable to clearly show how Kimamo area is exposed to pluvial flood hazard. Here is a zoomed in map showing the exposure in the area.



2.6.3.2 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Kimamo Area	Very high	Low	High	Low	Low

The Kimamo area exhibits a very high exposure to pluvial flooding. It also faces high risk from rising water table flooding, while other hazards, including river flooding, salinity, and landslides, are low.

2.6.4 Challenges to Sanitation

Heavy flooding frequently damages sewer pipes, causing sewage leaks into River Gathamba. This leads to water pollution and heightens health risks, with cholera outbreaks being common in the area.

Narrow roads limit access for exhauster trucks, making it difficult to unclog blocked sewer pipes and household connections.

2.6.5 Adaptation Measures Observed

The County is in the process of replacing the damaged sewer pipes with Galvanized Iron (G.I.) pipes. These pipes are stronger, more resistant to corrosion, and offer greater durability compared to the previous materials, thereby reducing the risk of frequent breakages and leakages.

2.7 Kiawambeu, Fort Treatment Plant

2.7.1 Proposed Projects

Multiple projects are proposed under this CWSSIP line of investment

- Rehabilitation of the Irate Raw Water Main Intake on Irate River
- Construction of a sedimentation Basin
- Construction of another intake on Irate River to supply raw water to Fort Treatment Plant
- Rehabilitation of Fort Treatment Plant

Coordinates : -0,71592593 ; 37,1457750



2.7.2 Site Description

The treatment plant is located in Kiawambeu area. It draws raw water from the Irate intake on River Irate, situated about 17 km away, through G.I.-coated pipes. While landslides or erosion does not directly affect the plant itself, its operations are indirectly impacted by changes in water quality originating at the intake. The design capacity of the facility is 10,000 cubic meters but currently serving 9,800 cubic meters only. The facility as designed and constructed by the Tan/Athi Water Development Authority and handed over to MUWASCO for operations.

The following pictures show the treatment plant currently in operation.



Figure 19: Sedimentation and Dosing Chambers at the treatment plant

Source: Field Survey, 2025



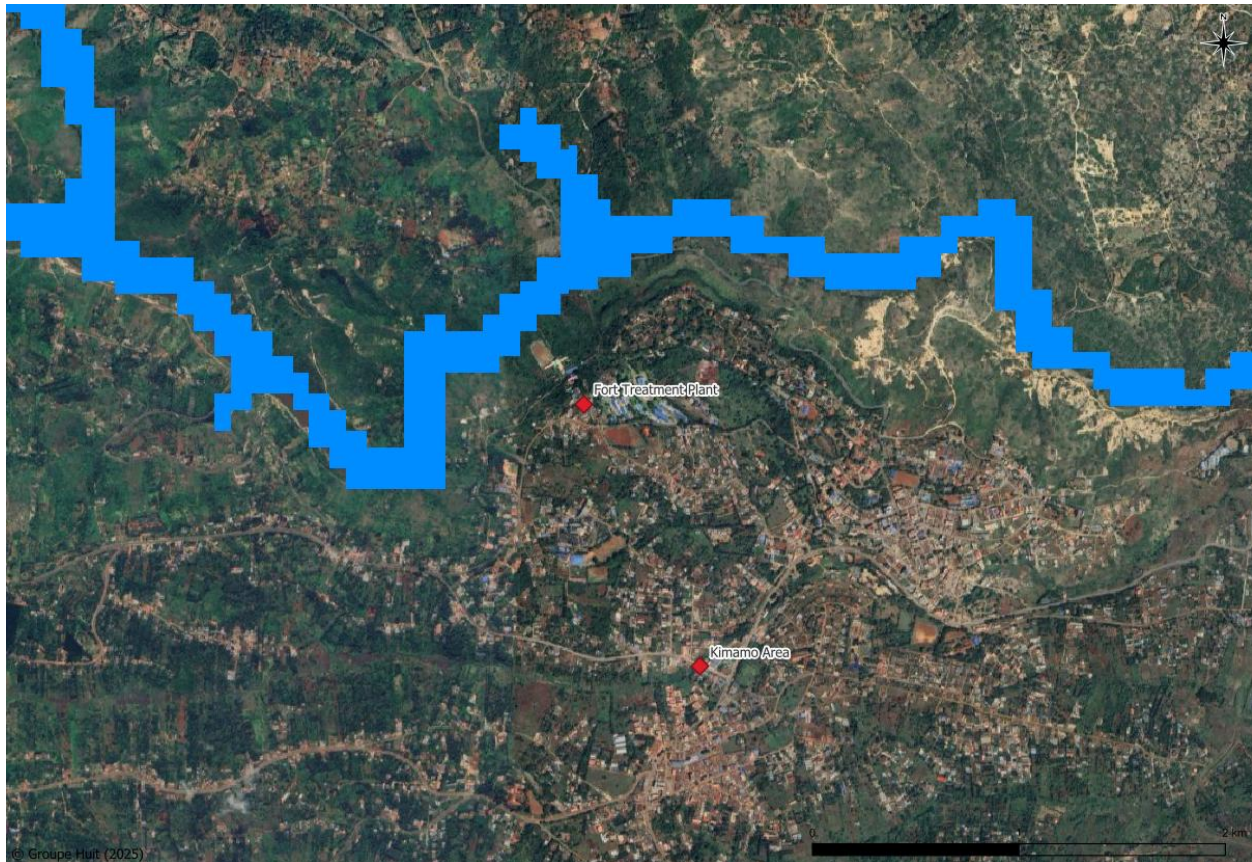
Figure 20: Testing Laboratory and Sedimentation Chambers at the treatment plant

Source: Field Survey, 2025

2.7.3 Rapid climate risk assessment

2.7.3.1 River flood hazard exposure (100 years return period)

As is it is not very clear on the map at county scale here is a zoom in of Fort Treatment plant location to highlight that it is not into the flooded area on a 100 years return period model of a river flood hazard.



2.7.3.2 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Kiawambeu, Fort Treatment Plant	Moderate	Low	High	Moderate	Low

At the Kiawambeu Fort Treatment Plant, the **rising water table flood risk is high**, posing potential threats to treatment operations and structural integrity. **Pluvial flooding** and **soil salinity** are assessed as **moderate**, whereas **river flood** and **landslide** hazards are **low**.

2.7.4 Challenges to Water Supply

Landslides at the intake often damage the water supply pipes, cutting off flow to the treatment plant. Soil erosion upstream contributes to increased turbidity, especially during heavy rainfall events, which significantly raises treatment costs. During such periods, turbidity levels range between 2,000 and 4,000 NTUs, compared to a near-normal level of 6.4 NTUs recorded on the day of the visit.

In addition, water entering the facility during heavy rains is highly saline. This is attributed to upstream farming activities, where surface runoff washes farm chemicals into the river and eventually into the intake.

It should thus be noted that while the facility is not directly exposed to important climate hazards its associated facilities are which leads to cascading impacts at the Fort Treatment Plant.

2.7.5 Adaptation Measures

The County distributes free tree seedlings from KFS to farmers for planting upstream, particularly during World Water Day events, to help stabilize slopes. Communities living along the pipeline are provided with free community water kiosks.

Reinforced concrete pipe anchors are installed to protect pipelines from being swept away or damaged during landslides. Gabions are constructed along slopes to enhance stability and reduce the risk of landslides, as shown in the picture below



Figure 21: Slope Stabilization Gabions along a slope in Murang'a

Source: Field Survey, 2025

2.8 Maragua Town

2.8.1 Proposed Projects

Decentralized Treatment Facility and Co-polymer Septic with Bio digesters and sewer network.

Coordinates : -0,7916032 ; 37,1314200



2.8.2 Site Description

Maragua town is a rapidly growing municipality, with low-income residents forming the majority of its population. At present, most households rely on pit latrines and septic tanks for sanitation. To improve

sanitation, the County has constructed 500 toilets in the Mjini and Kiambini areas, along with public toilets in the market and for various community groups.

The town is highly susceptible to flash floods due to its loose, loamy volcanic red soils. Flooding typically occurs during the rainy seasons (April–May and October–December), with water levels rising up to 1 metre. Such events inundate many sanitation facilities, posing serious health hazards.

In addition, a large number of households discharge effluents through open sewer systems that flow into nearby trenches, further compromising sanitation and public health as shown below.



Figure 22: Open Sewer Channels in Maragua Town

Source: Field Survey, 2025

2.8.3 Rapid climate risk assessment

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Landslide
Maragua Town	Moderate to high	Low	High	Low	Low

Maragua Town is exposed to high risk from rising water table flooding and moderate to high risk from pluvial flooding, reflecting vulnerability to both surface and subsurface water accumulation. River flooding, salinity, and landslide hazards are considered low.

2.8.4 Challenges to Sanitation

The loose, loamy volcanic soils in Maragua make pit latrines structurally weak, leading to frequent collapses and unsafe conditions during floods.

The area’s low water table limits availability of groundwater for sanitation-related uses.

Frequent cholera outbreaks because of poor sanitation practices, contaminated water sources, and flooding that spreads pathogens.

Open sewer channels discharge directly into River Maragua, and during floods, effluents spread widely, polluting water sources.

Poverty and community perceptions – Many residents still see Maragua as rural, making them less receptive to urban sanitation infrastructure such as sewer systems and modern toilets.

The town’s growth is outpacing the expansion of sanitation services, leading to increased strain on existing facilities.

Poor physical planning and weak enforcement of building codes – Informal settlements and poorly constructed facilities hinder the establishment of proper sanitation infrastructure.

2.8.5 Adaptation measures observed

The following adaptation measures have already been implemented:

- Construction of a decentralized treatment facility and installation of co-polymer septic systems with bio-digesters, alongside the development of a sewer network in Maragua Town.
- Promotion of septic tank use, with the county providing subsidies for exhaustor services to improve sewer disposal.
- Construction of reinforced concrete walls for pit latrines and elevation of their bases to prevent inundation during floods.
- Construction of public toilets with septic tanks at specific places within the town for use by the public.

3. LESSONS LEARNT

The hotspot analysis offered valuable insights into how climate change considerations can be more effectively integrated into investment planning and infrastructure design thanks to community consultation and review of current practices (current infrastructure designs). A key takeaway is that WSP companies engagement provides an indispensable foundation for understanding the proposed investments location, purpose and related challenges as well as context-specific vulnerabilities and identifying feasible, locally accepted adaptation measures, for this community engagement is also needed.

The exercise also highlighted the importance of involving teams with prior experience in climate risk assessment (CRA) processes to undertake the assignment. Such expertise allows for the right framing of questions in line with the specific topic considered (in this case : WASH), encourages adaptive thinking during consultations, and supports the identification of effective, locally relevant good practices.

4. NEXT STEPS

These lessons will inform the next phase of the assignment – the “Adaptation Options” report – which will build directly on this hotspot analysis to propose practical and technically grounded adaptation measures for future K-WASH investments in Murang’a County.

This hotspots analysis also provides most relevant information of gender and socio-economic impacts of climate events in the hotspots areas which will be most valuable for the Gender vulnerability and gap assessment and the related recommendations and action plan.

ANNEX 1. WORKSHOP AND MISSION REPORT

1. BACKGROUND AND CONTEXT

The Global Center on Adaptation (GCA), in partnership with the World Bank, is providing targeted support on climate adaptation and capacity building under the recently approved Kenya Water, Sanitation, and Hygiene (K-WASH) program, a \$458 million initiative launched in December 2023.

The K-WASH program, financed by the World Bank, aims to expand access to water and sanitation services in 19 underserved counties across Kenya. Under this initiative, the GCA is providing specialized assistance to strengthen the integration of climate risk assessments and resilience-building measures into each county's Countywide Water and Sanitation Strategies and Investment Plans (CWSSIPs). As part of this collaboration, the GCA engaged a consultant to deliver specific technical support.

As part of the deliverables in this assignment for the consultant, support focuses on enhancing the capacity of county officials to ensure that climate risks and adaptation options are adequately incorporated into the CWSSIPs. This is to be done through providing tailored support for county Climate Risk informed County Water and Sanitation Strategies and Investment Plans through:

- Conducting a workshop for Capacity Strengthening on Climate Risk Assessment targeted at county officials, WB-hired consultant team providing technical guidance on development of the CWSSIPs, and other Program and government officials as needed.
- Undertaking Climate Risk Assessments for Murang'a and Tana River counties.

The workshop built on earlier engagements and it informed field assessments of hazard hotspot areas that identified during this workshop. It was designed to:

- Review the CWSSIP and identify climate hazard hotspots in areas where water and sanitation investments have been proposed and their impacts.
- Identify mitigation and adaptation measures at design, county, and community levels for the identified hazards.
- Discuss gender and cultural norms influencing adaptation.
- Examine institutional arrangements and policy frameworks promoting mitigation and adaptation.
- Select priority hazard hotspot areas for further field assessments scheduled for 2nd–5th September 2025.
- Strengthen the capacity of the County Technical Committee on Water and PIU, to integrate climate risks and adaptation options into proposed water and sanitation infrastructure investments, ensuring they are climate-resilient and sustainable as per the World Bank guidelines.

2. FIELD MISSION SCHEDULE

The field mission was conducted from 1st September to 5th of September comprising a workshop day and four field assessment days as outlined below.

Day	Activity	Actors
1 st Sept	Stakeholders Workshop at Stanley's Haven Hotel, Murang'a	Consultants GCA Representative County Representative
2 nd Sept	Hotspot Assessment & Key Informant Interviews (Locations to be determined at the Workshop)	Consultants GCA Representative County Representative
3 rd Sept	Hotspot Assessment & Key Informant Interviews (Locations to be determined at the Workshop)	Consultants GCA Representative County Representative
4 th Sept	Hotspot Assessment & Key Informant Interviews (Locations to be determined at the Workshop)	Consultants GCA Representative County Representative
5 th Sept	Hotspot Assessment & Key Informant Interviews (Locations to be determined at the Workshop)	Consultants GCA Representative County Representative

3. WORKSHOP SCHEDULE

The workshop took place at Stanley Havens Hotel in Murang’a town on 1st September 2025 as per the schedule below.

Time	Activity	Presenter or Moderator
9:00- 9:15 AM	Tea and Registration	
9:15- 9:30 AM	Introductions & Opening Remarks	Director Water, WB and GCA Representatives
9:30- 10:15 AM	Presentation By Murang’a County on KWASH Programme & CWSSIP Investments	Director Isaac
10:15- 10:45 AM	CRVA Presentation and FGD Organization	Nelson Kisanya
10:45- 11.45 AM	Focused Group Discussion	Groupe Huit Team
11:45- 1.30 PM	Presentation of Focused Group Discussion	Group Secretaries
1:30PM – 1:45 PM	Closing Remarks	County, WB and GCA Representative
1:30PM -	Lunch and Departure thereafter	
END OF THE WORKSHOP		
2.30PM	Debrief & Route Planning for Hotspot Assessments	Director Water, WB and GCA Representative Consultant

4. PARTICIPANTS

The workshop targeted key stakeholders involved in the development of the county water policy, specifically the County Technical Committee and PIU members for the water sector as listed below.

S/NO.	DESIGNATION	SECTOR
1	CCO - Water	Water
2	CD - Water	Water
3	CD - Special Programmes	Disaster Response
4	CD – Environment	Environment
5	CD - Climate Change	Climate Change
6	CD - Livestock	Livestock
7	CD – Agriculture	Agriculture
8	CD – Health Services	Public Health & Sanitation
9	CD – Education	Education
10	CD – Fisheries	Fisheries
11	CD – Trade	Trade
12	CD – Administration	Administration
13	CD – Economic Planning	Economic Planning
14	MDs of WSPs	Water Service Provider
15	CD – MET	Water
19	CD – Environment	NEMA
20	KWASH County PIU	Water & Sanitation
21	CD- Physical Planning	Physical Planning

A list of those who participated in the workshop has been provided in Appendix 4 of this report.

5. DELIVERY METHODS

The workshop was delivered through a combination of formal presentations and focused group discussions. A focused group discussion form was also used to capture the participants' input at the workshop. See Appendix 5.

The Director of Water for Murang'a County delivered a brief presentation on the K-WASH programme, outlining its objectives, requirements, key milestones, and the Murang'a CWSSIP. This was followed by a technical presentation by the consultant on the Murang'a Climate Risk Assessment (CRA), which focused on climate hazards influencing water, sanitation, and hygiene (WASH) infrastructure and services. The presentation also highlighted key gaps existing in the preparation of the Murang'a CRA and the completion of CWSSIP and the next steps to completion. (Refer to the presentation slides in Appendix 6).

After the presentations, participants were divided into three thematic groups based on the key hazard events affecting Murang'a: **flooding, drought, and landslides**. Each group discussion focused on:

- Identifying hazard hotspot areas;
- Stating the frequency and duration of hazard events;
- Assessing impacts of hazards on water supply and sanitation;
- Documenting mitigation measures and adaptation practices at design, county, and community levels;
- Exploring gender and cultural norms influencing adaptation;
- Reviewing institutional arrangements and policy frameworks supporting mitigation and adaptation:
 - ▶ Identifying relevant policy documents, plans, and acts;
 - ▶ Clarifying county roles; and
 - ▶ Clarifying community roles.
- Selecting priority hazard hotspot areas for further field assessments visited from 2nd–5th September 2025.

6. FOCUSED GROUP DISCUSSION FINDINGS

6.1 Landslides

Hazard	Landslides
<p>Hotspot Areas</p> <ul style="list-style-type: none"> • Gitugi in Mathioya SC • Miro in Kiru ward, Mathioya SC • Kiarathe in Kangema SC • Kigumo Ward in Kigumo SC • Gachocho in Kinyona Ward, Kigumo SC • Rwathia in Kangema SC • Tutho in Kanyenyaini (Kangema SC) • Murarandia in Kahuro SC 	
<p>From the hotspots listed above, which areas should the consultant visit for further on-the-ground assessment?</p> <ul style="list-style-type: none"> • Gitugi in Mathioya SC • Gachocho in Kinyona Ward, Kigumo SC • Kiarathe in Kangema SC 	
<p>Frequency and Duration</p> <ul style="list-style-type: none"> • Kiarathe in Kangema SC; regularly since 2018 • Gitugi in Mathioya SC; rainy seasons since 2018 • Gachocho in Kinyona Ward, Kigumo SC; during rainy seasons since 2018 	
<p>Vulnerable Groups</p> <ul style="list-style-type: none"> • Women • Children • Men • The elderly • Terminally ill 	
<p>Why Vulnerable (social factors)</p> <ul style="list-style-type: none"> • Disruption of water supplies • Destruction of sanitation facilities • Livelihoods loss (crops, houses, livestock) • Exposure to weather elements 	

Impacts observed/recorded

- Submerging of water pipes
- Damaged water infrastructure
- Destruction of sanitation facilities
- Water borne diseases
- Psychological disturbance
- Open Defecation

Gender and Cultural Norms Influencing Adaptation

- No separate sanitation for females/males
- Noninvolvement of vulnerable groups in decision making regarding water and sanitation facilities
- Beliefs on ancestral land

Adaptation Measures

a) Design Level

- Site selection and planning
- Structural plans
- Redesigning routes for the pipelines
- Environmental and Social Assessment
- Plans to include reinforced infrastructures to withstand landslide shocks.
- Mapping of areas with fault lines as potentials landslide hotspots
- Institutionalization of women roles as part of community fabric.
- Green adaptation e.g. planting certain types of trees to hold the soils. Deep rooted tree species
- Integrate community based knowledge in early warning systems.

b) County Level

- Policy making
- Budgeting
- Technical support
- Compliance support

c) Community Level

- Adherence to the policy
- Owning projects
- Public participation
- Community sensitization and preparedness on disaster

Institutional Arrangements and Policy Frameworks Promoting Mitigation and Adaptation

a) Policy Documents, Plans and Acts

- Water Policy and Act
- Housing and Physical planning Act
- Gender Act
- 2010 Constitution
- SDGs; on water and sanitation
- Emergency fund set aside specifically for climate adaptation especially for landslide hotspot areas.

b) County roles

- Ensuring compliance
- Budgeting allocations
- Monitoring and Evaluation
- Liaison between county, national and development partners
- Data collection and compilation
- Development of CIDPs and Annual Development Plans

c) Community Roles/Management Structure

- Compliance and adherence of legal framework
- Owning water and sanitation projects for sustainability
- In charge of security of projects
- Community Monitoring and evaluation of water and sanitation projects

6.2 Flooding

Hazard	Flooding
<p>Hotspot Areas</p> <ul style="list-style-type: none">• Kenol katipanga area• Zabka area -methi dam• Gathuri- Mutoho area• Maranjau area• Kagurumo -kaharati area• Maragua town area• Mirira- tana power area• Gikuu area Mbiri ward• Rapid camp area• Gakonya- kabuta area• Kabuku -makenji area• Migingo area - Muranga town• Rubiru in ithanga	

From the hotspots listed above, which areas should the consultant visit for further on-the-ground assessment?

- Maragua town
- Gathuri -mutoho areas
- Kagurumo -kaharati area
- Migingo- muranga town
- Kenol katipanga area
- Rubiru in ithanga
- Riandegwa methi area

Frequency and Duration

The floods always occurs when we have heavy rains mostly in March – May and October, November, December

Vulnerable Groups

- Women
- School going children
- PLWDS
- Elderly
- Farmers
- WSPS

Why Vulnerable (social factors)

- Displacement
- Waterborne diseases
- Transport is also affected
- Destruction of water infrastructure
- Destruction of crops

Impacts observed/recorded

- Insecurity
- Food insecurity
- Destruction of shelter
- Diseases (mental health issues, water borne)
- Loss of livelihood/income
- Loss of revenue
- Destruction of water infrastructure

Gender and Cultural Norms Influencing Adaptation

- Women cannot access market
- Women cannot access the firewood

- Women experience limited access to proper sanitation
- Inadequate shelter for the affected population
- Limited access to health care facilities
- Women are excluded in some decision making process

Adaptation Measures

a) Design Level

- Proper drainage construction
- Construction of high water intake/dams structures
- Anchoring water supply structures on solid grounds using reinforced concrete

b) County Level

- Enforcing proper design of dams, water structures, ensure compliance of engineering design standards and regulations.
- Construction of water retaining structures such as dams and water pans
- Proper maintenance of existing water retaining structures
- Prevention/ sensitization against encroachment of riparian areas

c) Community Level

- Soil conservation structures at the farms
- Tree planting
- Protection of riparian areas

Institutional Arrangements and Policy Frameworks Promoting Mitigation and Adaptation

a) Policy Documents, Plans and Acts

- Water act 2016
- Devolution act 2012
- Climate change fund act 2021
- EMCA
- Wetland and riparian area act
- Alien and invasive species policy

b) County roles

- Sensitization of the community on conservation/ encroachment
- Enforcement structural design and planning

c) Community Roles/Management Structure

- Compliance to the laws and regulation on climate change
- Providing necessary support during implementation and sustainability of donor funded projects
- Planting trees

- Ownership of the projects

6.3 Drought

Hazard	Drought
<p>Hotspot Areas</p> <ul style="list-style-type: none"> • Kambiti • Ithanga • Kakuzi • Kabirwa • Maragua ridge • Kimorori/wempa • makuyu • gaichanjiru/mariani/karugia • gaturi • Gwa thamaki • G3/Iyego kangema 	
<p>From the hotspots listed above, which areas should the consultant visit for further on-the-ground assessment?</p> <ul style="list-style-type: none"> • All the above 	
<p>Frequency and Duration</p> <ul style="list-style-type: none"> • Twice per year (Jan-Mar, Jun-Oct) • Also during severe drought years 	
<p>Vulnerable Groups</p> <ul style="list-style-type: none"> • Women, Children, PLWDs, Elderly, Minority Groups e.g. Kambas in Ithanga 	
<p>Why Vulnerable (social factors)</p> <ul style="list-style-type: none"> • Ethnic Boundaries (boarder btw Murang'a / Machakos) • Lack of piped waters • Women& children travelling long distances in search of water • PLWDs challenge in farming • Poor hygiene in Menstrual Hygiene Management • Over-reliance on rain fed agriculture/livestock farming 	
<p>Impacts observed/recorded</p>	

- Hygiene related diseases e.g cholera, typhoid, diarrhoea. Pneumonia
- Open defecation
- High Poverty levels
- Poor nutrition and hunger leading to malnutrition
- Increased insecurities/theft
- Poor early childhood development
- Early pregnancies

Gender and Cultural Norms Influencing Adaptation

- Should keep less livestock – not for prestige
- Cultivating lesser farms

Adaptation Measures

a) Design Level

- Water pans
- Water harvesting in tanks, reservoirs
- Kitchen gardens
- Irrigation farming

b) County Level

- Drought resistant crops
- Drilling boreholes
- Community sensitization
- Drought resilient technologies eg. mulching
- School feeding programs ECDEs
- Subsidized fertilizers
- Inua mkulima maize/fertilizers
- Kangata care health program
- Irrigation projects

c) Community Level

- Planting fruit trees
- Roof water harvesting
- Constructing water pans
- Soil conservation measures
- Planting drought resistant crops

Institutional Arrangements and Policy Frameworks Promoting Mitigation and Adaptation

a) Policy Documents, Plans and Acts

- Food and Nutrition Policy
- Water Act 2016

- Climate Change Policy
- County Integrated Development Plan (CIDP)

b) County roles

- Funding/resource mobilization
- Training and extension
- Implementation of policies/plans/acts
- Collaboration with development partners
- Public participation

c) Community Roles/Management Structure

- Adaptation and implementation of new technologies
- Provide land for projects
- Develop community management committees
- Identify challenges, risks and measures

6.4 Hazard Hotspot Selection for Field Assessment

Based on the group's listing of hazard hotspots for field assessment, the consultant and participants jointly agreed on a select number of sites to be visited as shown in the table below as it was not logistically feasible to cover all the recommended locations.

- Flooding
 - ▶ Rubiru in ithanga
 - ▶ Riandegwa methi area
 - ▶ Migingo- muranga town
 - ▶ Maragua, Mlimani Area
 - ▶ Kabuku -makenji area
- Land Slides
 - ▶ Gitugi in Mathioya SC
 - ▶ Kiairathe in Kangema SC
 - ▶ Gachocho in Kinyona Ward, Kigumo SC
- Drought
 - ▶ Kambiti
 - ▶ Ithanga
 - ▶ Kakuzi

The hazard hotspot assessments were conducted, and the findings are presented in this report.

7. CHALLENGES AND LESSON LEARNED

7.1 Challenge

A major challenge arose from the absence of representatives from most Water Service Providers (WSPs). Since WSPs manage and supply water on behalf of the County, their non-participation significantly hindered the identification of exact locations for the proposed investments. In their absence, County officials could only give general area descriptions, which lacked the precision necessary for detailed assessment.

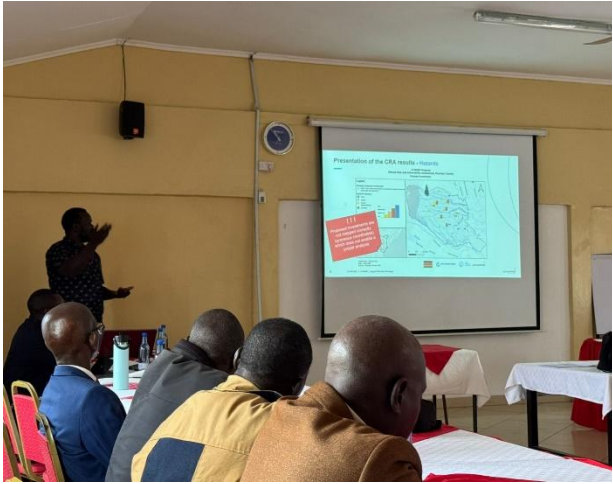
To mitigate this gap, it was agreed that during fieldwork, WSP representatives operating within the respective areas would accompany the consultant for hotspot assessment. The WSPs together with the county would thereafter submit a detailed project list, complete with accurate site locations to the consultant.

7.2 Lesson Learned

The experience demonstrated that active participation of WSP representatives is critical to the success of field assessments, as they are responsible for most of the proposed projects in the CWSSIP. Their involvement ensures accurate identification of hotspot areas and precise determination of project sites. Going forward, it is recommended that future assessments formally require WSPs to:

- ▶ Accompany consultants during fieldwork; and
- ▶ Provide project lists as per the submissions already forwarded for the CWSSIP (See Appendix 4) with accurate site coordinates immediately following the assessment.

ANNEX 2. WORKSHOP PHOTO GALLERY



Source: Consultant, 2025

ANNEX 3. FIELD HOTSPOT ASSESSMENT PHOTO GALLERY



ANNEX 4. LIST OF INVESTMENTS & THEIR LOCATIONS

Murang'a Urban Water and Sanitation Company Limited (MUWASCO)

Short Term						Project Coordinates
Interventions	Constituency	Ward	Areas Served	Estimated Budget (Kshs. M)	Remarks	
Kiawambeu Inflow Augmentation Project - 9km DN 300 HDPE raw water pipeline into Kiawambeu TW from Kayahwe river to augment the production	Kiharu	Township	Murang'a township ward	150	Add 5,000 m ³ /day to augment the treatment capacity at Kiawambeu TW and deal with increased demand	Eastings: 294953.27 m E Northings: 9920204.10 m S
Replacement of approximately 20km of asbestos and GI pipes (DN110-DN25) within Murang'a CBD	Kiharu	Township	Muranga CBD	90	Project objective is to eliminate the safety hazards associated with asbestos and reduce water losses	Eastings: 294953.27 m E Northings: 9920204.10 m S
Replacement of approximately 15km of asbestos and GI pipes (DN110-DN25) within Mukuyu market area	Kiharu	Township	Mukuyu	60	Project objective is to eliminate the safety hazards associated with asbestos and reduce water losses	Eastings: 294114.06 m E Northings: 9919108.52 m S
General rehabilitation of inaccessible pipelines in other parts of town and Mukuyu to reduce water losses	Kiharu	Township	Muranga CBD and Mukuyu	100	Reduce NRW	Eastings: 294953.27 m E Northings: 9920204.10 m S

Lower Maragua Last Mile connectivity	Kiharu	Mbiri	Kambirwa, Mirira	70	Last mile connectivity	Eastings: 299351.57 m E Northings: 9917885.08 m S
Medium term						
Karichiungu water project - DN 250 14km pipeline, rehabilitation of existing Kiharu TW and CFU at Embassy	Kiharu	Mbiri and Township	Murang'a township ward	100	Utilize idle Kiharu TW and serve Kiharu and Wangu area under Muwasco	Eastings: 293671.00 m E Northings: 9920832.00 m S
Kayahwe - Maragua bridge- Gwa thamaki - 15km DN 250 HDPE transmission and distribution main	Maragua	Ichagaki	Mbombo, Maragua Ridge, Kambiti	200	Project to cover unreserved areas of Mbombo, Maragua Ridge and Kambiti	Eastings: 289614.58 m E Northings: 9917644.61 m S
Long Term						
New Murang'a Municipality Bulk Water project - Intake structures, DN500 raw water main, treatment works and treated water transmission mains	Kiharu	Mbiri, Township, Wangu, Gatari	Mbiri, Township, Wangu, Gatari, Maragua Ridge,	2,000	Cater for increased supply demand from the expanded municipality. Feasibility study being undertaken by the Ministry of Water, Sanitation and Irrigation through M/s Bhudhia Associates	Eastings: 278732.25 m E Northings: 9913217.04 m S
St Mary's sewer extension project	Kiharu	Township	Township	82	Improve sanitation in the area – St. Mary', Kiharu and along Kangema road	Eastings: 293309.95 m E Northings: 9920325.08 m S
Kambwe and Mukuyu sewer extension project	Kiharu	Township	Township	98	Improve sanitation in the area – Mukuyu, Mashambani and Kambwe	Eastings: 295830.28 m E Northings: 9919236.92 m S

New Murang'a Municipality sewerage	Kiharu	Township, Mbiri, Gatari	Townshi, Mbiri, Gatari	1,700	The project seeks overhaul the current sewerage system and increase coverage into the fast growing suburbs	Eastings: 296975.00 m E Northings: 9919419.00 m S
Total				4,650		

	Interventions	Coordinates		Consti tuency	Ward	Areas Served	Estimated (Kshs. M)	Budget	Remarks
		Latitude	Longitude						
Short Term Interventions									
1	15km DN225 HDPE Makomboki - Gituru Pipeline	0°46'46.17"S	36°49'24.59"E	Kanda ra	Ruchu	Gituru, Kiawangenyee, Kiangari and Gacharage	50		Area currently served from an existing system from Gatanga WSP on rationing basis
2	13km DN250 HDPE Mareira - Karimamwaro Pipeline	0°48'12.44"S	36°56'9.41"E	Kanda ra	Ithiru	Karimamwaro, Nguthuru, Mathiuthi	65		Ommitted scope from the BMK project. The distribution already done by BMK does not have a water source.
3	Rehabilitation of Kandara Bulk water pipeline, laboratory works and rehabilitation of the treatment works	0°41'53.84"S	36°49'23.23"E	Marag ua, Kigum o	Kinyon a, Kigum o, Muthit hi	Summary, Iganjo, Kamahuha, Makuyu, Ciumbu	55		The mainline delivers low volumes than the designed capacity. Study already conducted by Losai Management Limited
4	Borehole Solarization within Muranga South Muiriini Borehole	0°55'25.06"S	37°0'22.51"E	Kanda ra	Kimor ori, Kigum o, Kahum bu,Mut hithi, Ithiru, Muruk a,	Muiriini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office,	30		Very high operational costs associated with power

					Kagundu-ini	Mwema, Turuturu, Kiiriangoro,		
5	Kariti Borehole	0° 52' 7.608" S	37° 1' 18.3" E	Kandara	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
6	Turuturu Borehole	0°50'16.29"S	37° 0'41.84"E	Kigumo	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
7	Kiiriangoro Borehole	0° 47' 41.8812" S	37° 0' 3.6108" E	Kigumo	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office,		Very high operational costs associated with power

					Kagunduni	Mwema, Turuturu, Kiiriangoro,		
8	Sabasaba office Borehole	0°52'41.68"S	37°8'14.11"	Kigumo	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagunduni	Muirini, Ngararia, Nguthuru, Karimamworo, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
9	Mwema Borehole	0° 52' 14.8044" S	37° 6' 20.592" E	Kigumo	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagunduni	Muirini, Ngararia, Nguthuru, Karimamworo, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
10	Kandani Borehole	0° 52' 30.126" S	37° 6' 12.1464" E	Kigumo	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagunduni	Muirini, Ngararia, Nguthuru, Karimamworo, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office,		Very high operational costs associated with power

					Kagundu-ini	Mwema, Turuturu, Kiiriangoro,		
1 1	PCEA Mangoto Borehole	0°58'32.04"S	37°9'38.76"E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
1 2	Kambiti Borehole	0°49'51.82"S	37°13'59.38"E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
1 3	Wempa chief Borehole	0°59'13.82"S	37°7'57.91"E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office,		Very high operational costs associated with power

					Kagundu-ini	Mwema, Turuturu, Kiiriangoro,		
14	Senior Gichohi Borehole	0°59'31.59"S	37° 9'45.45"E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
15	Kibage Borehole	0° 50' 24" S	36° 57' 13.1328" E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office, Mwema, Turuturu, Kiiriangoro,		Very high operational costs associated with power
16	Kangangu Borehole	0° 57' 36" S	37° 8' 60" E	Maragua	Kimorori, Kigumo, Kahumbu, Muthithi, Ithiru, Muruka, Kagundu-ini	Muirini, Ngararia, Nguthuru, Karimamwaro, Kiabage, Kaburugi, Kariti, Kangangu, Wempa chief, Senior Gichohi, PCEA Mangoto, Kambiti, Kandani, Sabasaba office,		Very high operational costs associated with power

					Kagunduni	Mwema, Turuturu, Kiiriangoro,		
17	Solar pumping system for the Ciumbu residents from Mugira Dam pumping system	0°51'41.26"S	37°13'18.35"E	Maragua	Makuyu, Kambiti	Ciumbu, Mihango	95	Ciumbu tank has no water yet the dam is about 2Km from the tank. there exists water distributions in the area
18	Solar pumping system for the Ciumbu residents from the MURI Dam water pumping system	0°52'34.80"S	37°13'23.18"E.	Maragua	Makuyu, Kambiti	Ciumbu		
19	Ciumbu-Mithini Project-15km HDPE Pipeline	0°56'12.19"S	37°7'23.87"E	Maragua	Makuyu	Makuyu, Miharati and Mithini	85	No pipeline at all, source of water from the Maragua Dam
20	Kiriciungu treatment works expansion and raising of the of the weir by 5m	0°49'9.91"S	36°52'30.05"E	Kandara	Ruchu	Githumu, Gacharage, Kiangari	68	Intake shared with irrigation system and low flows experienced during dry season. There is no scouring mechanism for the Treatment plant
21	Maragua Bulk water Pipeline extensions to Summary, Mbombo, etc	0°45'42.27"S	37°9'16.19"E	Maragua	Ichagaki, Kamahua	Maragua town and environs	150	Maragua Bulk is at 96% complete and the project lacks distribution networks to the the consumers
22	Replacement of Asbestos in Kinyona Treatment works	0°44'30.43"S	36°48'18.34"E	Kigumo	Kinyona	Kinyona	2	Staff houses and the Aministration Offices are all

								roofed with asbestos
2 3	Desalination of Sabasaba borehole	0°52'41.68"S	37°8'14.11"E	Kigumo	Kahumbu	Sabasaba	13	These boreholes have artesian aquifers but the water is not consumed due to salt levels.
2 4	Desalination of Karugia borehole	0°53'23.14"S	37°6'2.98"E	Kandara	Gaichanjiru, Kamahuha	Karugia areas		
2 5	Rehabilitation of Mareira - Mathare-ini - Githembe Pipeline with HDPE of 250mm diameter for 18Km	0°48'12.44"S	36°56'9.41"E	Kigumo	Kahumbu	Mareira, Mathareini, Kandiri, Githembe, Mugumo-ini, Kanguku, Kandani, Sabasaba	115	The line is of mixed diameters of 200mm, 160mm and even 110mm. This causes high NRW
2 6	Rehabilitation of Chathanda intake, CFU and system rehabilitation	0°47'0.76"S	36°53'44.02"E	Kigumo	Kigumo, Kahumbu	Kigumo, Muthithi	30	Existing water intake but not treated. Water is too turbid to be used
2 7	25.5Km of DN280 HDPE Maragua - Ichagaki Pipeline	0°47'19.18"S	37°5'18.45"E	Maragua	Ichagaki	Ichagaki	70	Pipeline already affected by road contractor and not replaced for 3 years now
2 8	Kigumo water distributions pipelines	0°44'28.62"S	36°48'19.60"E	Kigumo	Kangari	Nguku, Iriguini, Kaimiri, Githima, Migua-ini, Mathare-ini, Gathugu-Karambia, Gatune, Gitugu	21.58	Water available but currently no distribution for the said areas

29	Construction of a full equipped Lab in Kinyona Treatment Works	0°44'28.67"S	36°48'16.90"E	Kigumo	Kinyona	Kinyona	4	Currently, there is no Laboratory, so most tests are done in Kiriciungu
30	Completion of Kitui-Matuu pipeline	0°47'8.59"S	36°54'3.95"E	Kigumo	Kigumo/Kandara	Karimamwaro, Nguthuru, Makenji	Project under BMK	
Medium term								
1	Construction of Sabasaba Water Supply Project from Kiahiti/Sabasaba river	0°49'8.77"S	37°2'6.00"E	Maragua	Kamahuha	Sabasaba, Kamahuha	400	Sabasaba receives water on rationing basis and is not enough to supply the area
2	Construction of Gaichanjiru water project for Gaichanjiru ward and Kenol from Chathanda river	0°47'0.76"S	36°53'44.02"E	Kandara	Gaichanjiru	Kariua, Gaichanjiru, Maria- ini	800	To deliver enough water supply to Gaichanjiru ward and Kenol, Kabati area
3	Construction of 42KM of 315mm diameter mainline from Wanyaga intake to Kandara Tank and extension to Kahaini shopping centre	0°46'11.53"S	36°46'33.54"E	Kandara	Ruchu, Ithiru, Ngararia	Gituru, Rwathe, Mungaria, Kirigithu, Gwa Charagu, Kiguoya	850	The area is served by Kiriciungu treatment works which delivers very low volumes
4	Maragua Dam to Makuyu -Ciumbu water supply project-280mm diameter PN 16 for 40Km	0°46'45.44"S	37°1'15.63"E	Maragua	Makuyu	Summary, Iganjo, Kamahuha, Makuyu, Ciumbu	320	Makuyu has no flows currently yet the water systems are done
5	Construction of Nginda treatment works at Nginda primary and pipeline extension to maragua town.	0°47'20.05"S	37°5'18.73"E	Maragua	Nginda	Clean water Nginda, Ikundu, Gikindu and some parts of Maragua town	337	Water from Irati-Nginda is not treated

	(5000M3/day, 225m3 tank, 4.2Km pipeline of DN200-160mm, elevated tank at Maragua - 192m3)							
6	Kenol water supply distribution pipelines	0°57'15.66"S	37°6'27.78"E	Kandara, Maragua	Gitura, Kabati, Githunguri, Kimorori, Wempaa	Kenol town and environs	150	Last mile connectivity for the Makutano water project
7	Rerouting of Kinyona Old mainline to pass through Kangari-Ikumbi for a distance of 13Km	0°44'29.33"S	36°48'19.45"E	Kigumo	Kinyona, Kigumo	Kinyona, Karinga, Ikumbi, Gakira	180	Dillapidated infrastructure leading to high levels of NRW
8	Rehabilitation of Kigumo - Kambi - Kaharati Pipeline for 42Km	0°44'59.98"S	36°50'5.86"E	Kigumo	Kigumo, Muthithi	Kigumo, Ichagaki, Kambi, Kaharo, Sabasaba, Kaharati	335.57	Dillapidated infrastructure leading to high levels of NRW
9	Rehabilitation of Kandara - Kagundu-ini - Kenol/Kabati Mainline of 315-110mm with HDPE Pipe	0°53'47.65"S	36°59'40.92"E	Kandara, Maragua	Kagunduini, Kenol, Kabati	Gatitu, Kagundu-ini, Nduka Nguru, Githunguri, Kabati, Kaggia road	280	Dillapidated infrastructure leading to high levels of NRW
10	Rehabilitation of Mareira - Mathare-ini - Githembe Pipeline with HDPE of 250mm diameter for 18Km	0°48'12.44"S	36°56'9.41"E	Kigumo	Kahumbu	Mareira, Mathareini, Kandiri, Githembe, Mugumo-ini, Kanguku, Kandani, Sabasaba	115	Dillapidated infrastructure leading to high levels of NRW

1 1	Ruchu Ward distributions Pipelines	0°48'50.3 2"S	36°53'55. 10"E	Kanda ra	Ruchu	Kiangare, Gatia-ini, Kiandaguri, Karangi, Gichichi, Gichagini, Rwathe, Ichari, Mukuria, Gati-Iguru, Mukuria, Mungaria, Kangunu	167.5	Distribution pipelines for the Kangari town - Gitaimbuka and the environs
1 2	Construction of Maragua ridge water project of 250mm diameter HDPE Pipeline for 25Km	0°46'39.7 7"S	37° 6'42.22"E	Marag ua	Kambit i	Maragua Ridge, Mbombo, Samar	75	To offtake from the Gakoigo treatment works to feed Maragua ridge which currently recives raw water
1 3	Makuyu water distributions	0°50'54.0 0"S	37°10'45. 16"E	Marag ua	Makuy u, Thangi ra, Mithini,	Makuyu, Thangira, Mithini,	105	To be distributed once the water is delivered to Ciumbu tank
Long Term								
1	Construction of 35m High Dam Maragua 4 Dam with mainline from the dam - Kaguthi - Gakarara Tank and also for Gacharage area	0°45'4.12" S	36°51'24. 11"E	Kanda ra, Kigum o	Ithiru, Muruk a, Ngarar ia	Kaguthi, Kandara, Ngararia, Kahaini, Muruka, Ithiru	2,000	A line to be laid from Maragua 4 dam upto Kaguthi, a tank be constructed at Kaguthi and also distributed to Kandara
2	Development of 50M high Dam for Muranga South at Irati river for Kenol and Sabasaba water supply	0°46'42.1 0"S	36°55'5.6 8"E	Marag ua, Kanda ra	Marag ua, Kandar a, Kigum o	Machegecha, Kagunduini, Kabati, Methi, Mangoto, Kagumo-ini, Kaburunjui, Kaggia road, Kadiri,	3,200	To be done at the current Kinyona intake

						Githembe, Sabasaba		
3	Construction and operation of the Kabati - Methi - Makenji Sewerage infrastructure (Kenol-Makutano Phase 2)	0°59'55.56"S	37°13'57.85"E	Kandara, Maragua	Muruka, Kimorori	Kabati, Wempa	1,500	Housing Project to be done in Makenji and Kabati
4	Construction of Sewerage treatment infrastructure in Kangari,	0°47'1.65"S	36°52'17.62"E	Kigumo	Kigumo, Kangari	Kangari, Sabasaba and Maragua	1,200	Treatment plant is at Mareira Firm
5	Construction of Sewerage treatment infrastructure in Sabasaba	0°51'52.26"S	37°8'24.75"E	Maragua	Kamahu, Ichagaki, Nginda	Sabasaba town, Maragua town, Summary	3,000	Treatment plant to be done at Maragua-Samar area
6	Construction of Sewerage Treatment Infrastructure in Maragua	0°47'15.21"S	37°7'33.48"E	Maragua				
7	DTF-Kigumo	0°48'26.38"S	36°59'13.42"E	Kigumo	Kigumo	Kigumo, Muthithi and Kandara	100	The coverage is not very big to accommodate a full treatment plant and so DTF are proposed
8	DTF-Kandara towns	0°53'40.44"S	37°0'16.46"E	Kandara	lthiru			The coverage is not very big to accommodate a full treatment plant and so DTF are proposed
Total Kshs.							16,148.65	

Gatamathi Water and Sanitaitaion Company Limited

Coordinates for the projects under County Water and Sanitation Strategy and Investment Plan

Interventions	Constituency	Ward	Areas Served	Estimate d Budget (Kshs. M)	Remarks	coordinates
Short Term Interventions						
Hembe Treatment Works and replacement of raw water main (asbestos) to the treatment works	Mathioya	Gitugi, Rwathia	Gacharageini, Gatuguru, Nyakianga, Gitugi, Kihoya, Kiawambogo, Mihuti, Rwathia	300	Construction of a treatment plant to avoid supplying raw water	Hembe Treatment Works: -0.621589, 36.825066 Intake: 0.6215778, 36.8231408
Merereini intake and treatment works	Mathioya	Gitugi, Rwathia	Kiamuturi, Kagongo, Wanjerere, Miro, Kiawambogo, Gitugi, Karung'e.	550	There exists a 400m3 capacity storage tank that is not utilized as pumping costs from Hembe intake were not economical. This tank will be utilized by the proposed Merereini system.	Merereini intake: 0.634599, 36.780159 Treatment Works: 0.631383, 36.815763 Merereini Tank:

						0.630014, 36.816738
Replacement of 2km treated main from Kihari intake DN315mm and DN280mm HDPE pipes	Mathioya	Kiru, Kamacharia, Kiharu	Kairo, Kiambuthia, Kiriaini, Kora, Kanjama, Kagumoini, Kamune, Kamacharia, Iruri, Thuita, Gakurwe, Kiambuigi	10.55	Replacement of old delapidated pipeline. Component under M/s Riang International limited	New Kihari intake: - 0.5914507, 36.7979328 Old Kihari intake: - 0.592779, 36.805353 Kihari T/Works: - 0.589805, 36.820375
Mobility support	Mathioya, Kiharu, Kangema	Kiru, Kamacharia, Kiharu, Rwathia, Gitugi	Gatamathi supply area	6.47	10no. number motorcycle and 1no. double cabin vehicle for operations and management	Gatamathi HQ office, Nyakianga: - 0.642323, 36.957907
Completion of 1.5km main line DN160mm HDPE from Gikoe to Nyakianga tank	Mathioya	Gitugi	Ngutu, Kambara, Kanooro, Nyangiti	3.66	The works were under M/s Bainridge Limited. To facilitate water provision downstream Gitugi, Ngutu,	Gikoe/Njumbi: -0.64127, 36.945966 Nyakianga Tank: -

					Kanooro and Nyangiti.	0.643625, 36.958713
Last mile connectivity. (DN32mm - DN63mm HDPE pipes)	Mathioya, Kangema	Kiharu,	Gitugi (205km), Rwathia(150km), Kiru(110km), Kamacharia(250km), Gatari(300km)	Gatamathi supply area.	270.12	Increase water provision coverage. A shapefile containing the coordinates will be provided, as the last mile connectivity distribution lines are too numerous to list individually in this document.
Cold water meters (DN15mm, DN20mm, DN25mm)	Mathioya, Kangema	Kiharu,	Gatamathi Supply area	Gatamathi supply area.	47.86	To regulate and reduce non-revenue water. The coordinates will be provided upon installation of the meters at the respective connections

<p>Completion of the Kamagoko-Kiria-ini Main line and connection to existing 3 number tanks (Muriga,Gatundu,Kagiri) and extension of 160mm pipeline from Kagicha junction to Texas and from Kiria-ini Equity bank to Ngurwe-ini shopping centre</p>	<p>Mathioya</p>	<p>Kiru,Kamacharia,Gaturi</p>	<p>Wahundura, 5 Kamune, Thuita, Kamacharia , Kairi, Muirini</p>	<p>Under M/s</p>	<p>Visrom Company Limited</p>	<p>Kamagoko Junction: - 0.606569, 36.882154 Muriga tank: - -0.613981, 36.887568 Gatundu tank: - 0.613261, 36.906924 Kagiri tank: - 0.607124, 36.930157 Kagicha Junction: - 0.603422, 36.951307 Texas: - 0.601942, 36.962289 Kiria-ini Equity bank: - -0.602031, 36.957189 Ngurwe-ini shopping centre: - 0.597879, 36.963359</p>
---	-----------------	-------------------------------	---	------------------	-------------------------------	--

Kihari intake phase two	Mathioya	Kiru, Kamacharia, Kiharu, Rwathia	Kairo, Kiambuthia, Kiriaini, Kora, Kanjama, Kagumoini, Kamune, Kamacharia, Iruri, Thuita, Gakurwe, Kiambuigi	280	Water provision downstream supply areas of kigetuini, Kimathi and Nyakihai	New Kihari intake: 0.5914507, 36.7979328 Kihari T/Works: 0.589805, 36.820375
Extension of Gakurwe-Kiambuigi-Kigetuini main line (32km) DN 315mm - DN90mm	Kiharu	Gaturi	Kimathi, Kigetuini, Nyakihai, Mwirua, Mugeka, Wangeita, Mahuaini, Gakurwe	250.27	Water provision downstream supply areas of kigetuini, Kimathi and Nyakihai	Gakurwe tank: 0.628095, 37.020129 Kiambuigi tank: 0.636339, 37.071193 Mahua-ini Junction: 0.661339, 37.115183 Kigetuini: 0.652642, 37.154591
Mobility support	Mathioya, Kangema, Kiharu	Kiru, Kamacharia, Kiharu, Rwathia	Gatamathi supply area	4	One double cabin vehicle for effective mobility and effective customer service delivery	Gatamathi HQ office, Nyakianga: 0.642323, 36.957907



Office space (land), Office block and pipe storage yard.	Mathioya	Kiru	Gatamathi supply area	10	Existing office lies within the Nyakianga Health Centre space/compound. There is a proposal to advance the health centre to level 4.	Gatamathi HQ office, Nyakianga: -0.642323, 36.957907 The specific location of the land has not yet been identified.
Replacement of asbestos roofed buildings	Mathioya	Kiru, Gitugi		0.50	Asbestos are hazardous and harmful to human health hence need to change.	Gatamathi HQ office, Nyakianga: -0.642323, 36.957907 Mioro T/works buildings: -0.621589, 36.825066

Purchase of Non-Revenue equipment (Portable meter testing bench, Ultrasonic flow meter, pressure logger, pipe thickness gauge)	Mathioya	Gatamathi supply area	Gatamathi supply area	4.35	To control non-revenue water	Gatamathi HQ office, Nyakianga: - 0.642323, 36.957907
Kiriaini Sewerage system	Mathioya	Kiru	Kiria-ini and its environs (Kiria-ini Primary, Kiria-ini Girls, Secondary, Kiriaini Mixed Secondary Day school, Goshen Farm Hotel. Mathioya Sub County offices, Kiriaini Mission Hospital - Level 4 and dispensary.	950	Safe disposal of waste matter.	Kiria-ini town: - 0.602507, 36.952957

<p>30 number Decentralized Treatment Facility at 25,000,000.00</p>	<p>Mathioya,Kangema,Kiharu</p>	<p>Kiru,Kamacharia,Rwathia,Gitugi,Kamacharia</p>	<p>Gacharegeini, Gacharegeini, Gatunguru, Rwathia, Kihoya, Kiawambogo, Tuthu, Kihoya, Wanjerere, Kagongo, Miro, Kiamuturi, Gikoe, Gitugi, Mihuti, Kenyanjeru, Kairo, Kiambuthia, Kora, Kagumoini, Kiambuthia, Kamune, Kamacharia, Iruru, Thuita, Geitwa, Gakurwe, Gaitheri, Kiambuigi, Nyakihai, Kigetuiini, Muringa and Gakuyu.</p>	<p>750</p>	<p>Safe disposal of waste matter within the mentioned rapidly growing shopping centres</p>	<p>Gacharegeini: -0.629666, 36.877735 Gatunguru: -0.638799, 36.901569 Rwathia: -0.666437, 36.918665 Kihoya: -0.652522, 36.897576 Kiawambogo: -0.669899, 36.886235 Tuthu: -0.66784, 36.830543 Wanjerere: -0.660121, 36.848135 Kagongo: -0.63991, 36.841606 Miro: -0.627732, 36.836714 Kiamuturi: -0.61583, 36.851854 Gikoe: -0.63903, 36.935226,</p>
--	--------------------------------	--	--	------------	--	---



						Gitugi: 0.651915, 36.021119, Mihuti: 0.662188, 36.957279 Kenyanjeru: 0.659622, 36.937263 Kairo: 0.609706, 36.863389 Kiambuthia: -0.617439, 36.913481 Kora: 0.629193, 37.008724 Kagumoini: 0.620534, 36.987663 Kamune: 0.598765, 37.015773 Kamacharia: -0.604405, 36.99146 Iruri: 0.599386, 37.031878 Thuita: 0.614364, 37.046695
--	--	--	--	--	--	--

						Geitwa: 0.626432, 37.082044 Gakurwe: 0.628768, 37.020595 Gaiteri: 0.630354, 37.03978 Kiambuigi: 0.635977, 37.069577 Nyakihai: 0.688491, 37.122954 Kigetuini: 0.652642, 37.154591 Muringa: 0.6382447, 37.0410852 Gakuyu: 0.648494, 37.063061
Vacuum Truck/Exhauster	Mathioya,Kangema,Kiharu	Kiru, Kamacharia, Rwathia, Gitugi, Kamacharia	Gatamathi supply area.	20	Safe waste disposal.	Gatamathi HQ office, Nyakianga: 0.642323, 36.957907
Total				3,462.78		

COUNTY PROJECTS

S/No	Project Description	Longitudes	Latitude	Elevation (M.A.S.L)
1	Nguthuru -Muruka W/P-Laying of Gravity water distribution pipeline	37° 04'50" E	0°56'40" S	1505.14
2	Kamunyaka Kariara W/P- Laying of Gravity water distribution pipeline	36° 50'25" E	0°49'55" S	2021.24
3	Kiria -Githagara-Mugoiri W/P- Laying of Gravity water distribution pipeline	37° 05'53" E	0°45'53" S	1385.864
4	Nyagoti -Gatara -Murarandia w/p- Laying of Gravity water distribution pipeline	36° 57'29" E	0°39'00" S	1786.69
5	Githuri-Kareseni -Mbiri W/P- Laying of Gravity water distribution pipeline	37° 04'27" E	0°41'16" S	1494.76
6	Bore-Kiahuti-Kinyona W/P- Laying of Gravity water distribution pipeline	36° 51'55" E	0°44'13" S	2004.15
7	Ngurweni-Gatimu-Kangari W/P - Laying of Gravity water distribution pipeline	36° 49'54" E	0°45'50" S	2164.24
8	Gaichanjiru Borehole W/P- Laying of Gravity water distribution pipeline	37° 03'38" E	0°52'39" S	1548.62
9	Kigithu-Gathugu-Ithiru W/P- Laying of Gravity water distribution pipeline	37° 00'21" E	0°52'49" S	1673.43
10	Kirathani -Ithanga W/P- Laying of Gravity water distribution pipeline	37° 19'02" E	0°59'00" S	1345.40
11	Nanga -Nginyi-Kakuzi W/P- Laying of Gravity water distribution pipeline	37° 14'06" E	0°59'25" S	1372.76

12	Kiambuigi-Mugecha-Guri W/P- Laying of Gravity water distribution pipeline	37° 07'25" E	0°41'43" S	1394.29
13	Kaguti-Kiugu -Muthithi W/P- Laying of Gravity water distribution pipeline	37° 02'37" E	0°48'54" S	1581.93
14	Gikindu -Gachatha -Kigumo W/P- Laying of Gravity water distribution pipeline	37° 01'39" E	0°48'25" S	1638.81
15	Irembu-Hikuguru -Nginda W/P	37° 05'49" E	0°46'33" S	1407.39
16	Itaaga -Mugumoini -Ichagaki W/P- Laying of Gravity water distribution pipeline	37° 06'37" E	0°46'25" S	1347.16
17	Kamwenje -Mathingira - Laying of Kamahuha W/P- Gravity water distribution pipeline	37° 10'32" E	0°52'01" S	1359.51
18	Maranjau -Kambiti W/P- Laying of Gravity water distribution pipeline	37° 13'17" E	0°48'25" S	1174.21
19	Kagaa-Kimorori W/P- Laying of Gravity water distribution pipeline	37° 08'00" E	0°55'47" S	1490.46
20	Muirini-Ngararia W/P- Laying of Gravity water distribution pipeline	37° 01'06" E	0°56'00" S	1609.93
21	Kamaigua-Kihumbuini W/P- Gravity water distribution pipeline	36° 58'55" E	0°55'15" S	1654.35
22	Muthigiti -Gachonde -Gatanga W/P- Laying of Gravity water distribution pipeline	37° 59'22" E	0°57'46" S	1614.55
23	Gakurari B/H -Mugumoini W/P- Drilling of one production borehole, equipping it with solar power, pump, water Kiosk and storage tank.	36° 57'30" E	0°56'54" S	1622.67

S/No.	Project Name	Elevation (m.a.s.l)	Location	
			Longitudes	Latitudes
1	Mugira Dam Water Project-laying of water distribution pipelines and solar power installation	1380.09	37°13'00" E	0°51'40"S
2	Mukungugu Water Project-Drilling of one production borehole, equipping it with solar power, pump, storage tank, and laying of water distribution pipelines	1481.44	37°08'29" E	0°55'22"S
3	Silanga- Kaguduini water project-Laying of water distribution pipelines and installation of a solar power system	1545.61	37°02'08"E	0°55'23"S
4	Karuri – pipeline project -Kahumbu-Laying of water distribution pipelines	1545.53	37°04'14"E	0° 50'10"S
5	Yakerengo Nyakianga Mainline Water Project - Laying of water distribution pipelines, installation of plastic mold water storage tanks	1377.01	37°06' 56"E	0°41'56"S
6	Muthithi-Kiamatumbi water project-Laying of gravity water distribution pipelines	1588.7	37°02'25"E	0°49'34"S
7	Kakuzi- water project- Laying of gravity water distribution pipelines	1465.02	37°10'57"E	1°01'17"S
8	Ithanga last mile water project- Laying of gravity water distribution pipelines	1285.41	37°19'47"E	0°59'47"S
9	Mabanda - Gatanga water project- Laying of gravity water distribution pipelines	1715.74	36°56'29"E	0°55'46"S
10	Kahumbuini last mile water project- Laying of gravity water distribution pipelines	1594.21	37°00'29"E	0°56'54"S

11	Mugumoini last mile water - Laying of gravity water distribution pipelines project	1639.31	36°58'03"E	0°56'43"S
12	Kariara-gaturi last mile w/p- Laying of gravity water distribution pipelines	2000.78	36°50'36"E	0°50'51"S
13	Tutho Muthara Rwathia w/p-Construction of water intake structure	1945.56	36°54'28"E	0°38'25"S
14	Kimorori-Karung'ang'i w/p- Laying of gravity water distribution pipelines	1473.54	37°08'48"E	0°55'02"S
15	Kamahuha Last mile w/p- Laying of gravity water distribution pipelines	1406.8	37°07'39"E	0°53'34"S
16	Gaichanjiru Ngurweini water project- Laying of gravity water distribution pipelines	1565.5	37°03'19"E	0°52'01"S
17	Kahumbu last mile w/p- Laying of gravity water distribution pipelines	1482.75	37°05'17"E	0°50'02"S
18	Kanyenyaini last mile w/p- Laying of gravity water distribution pipelines	2054.58	36°53'07"E	0°41'16"E
19	Kamahuha-Gathuri B/H Project-Drilling of one production borehole, equipping it with solar power, pump , water tank and distribution pipeline	1382.49	37°07'23"E	0°54'11"S
20	Kitooni B/H- water project Ithanga – Installation of a water treatment facility and Laying of gravity water distribution pipelines	1358.05	37°20'50"E	1°04'05"S
21	Wahu B/H Ruchu w/p-Installation of water treatment facility		36°54'36"E	0°49'12"S
22	<u>Kangangu-Kimoroni W/P-</u> Laying of a water distribution pipeline	1471.69	37°08'40"E	0°55'02"S



23	Mihango B/H Water project -Installation of a water treatment facility	1382.0	37°13'20"E	0°51'40"S
24	Gitune-Ichichi Kanyenyaini w/p- Laying of gravity water distribution pipelines		36°53'07"E	0°41'16"S
25	Gathugu-Kiriaini -Muguru W/P- Laying of gravity water distribution pipelines	1741.21	36°58'07"E	0°40'57"S
26	Itherange-Mukangu-Wangu W/P- Laying of gravity water distribution pipelines	1552.06	37°01'25"E	0°42'26"S
27	Yakarengo-Gitugi W/P 2-Laying of a water mainline 225 mm diameter	1388.91	37°06'54"E	0°41'54"S
28	Mirichu-Kiru W/P- Laying of gravity water distribution pipelines	2000.09	36°52'22"E	0°37'04"S
29	Tuthu-Rwathia Water Project-Construction of a water intake structure	2271.79	36°50'38"E	0°40'44"S
30	Gikindu-Kandabibi Kamacharia w/p- Laying of gravity water distribution pipelines	11775.29	36°59'23"E	0°35'40"S
31	Kianduguri-Karangi -Ruch W/P- Laying of gravity water distribution pipelines	1885.46	36°55'30"E	0°48'54"S

ANNEX 5. HOTSPOT ASSESSMENT KEY INFORMANTS RESPONSE FORM



GLOBAL
CENTER ON
ADAPTATION



WORLD BANK GROUP



groupehuit
Développement urbain

CLIMATE RESILIENCE SUPPORT FOR KENYA
WATER, SANITATION, AND HYGIENE PROGRAM (K-WASH)

Key Informants Response

This form is designed to capture detailed but easy-to-share information from key informants on social safeguards during the Climate Risk and Vulnerability Assessment (CRVA). The questions are simple and non-technical, allowing everyone to contribute their lived experiences.

Stage 1: Data Collection

1. What hazards affect your community the most? (e.g., floods, drought, landslides, heat stress)

2. Which groups of people are most affected? (e.g., women, elderly, children, PWDs, farmers, informal workers)

3. How do these groups experience the hazard differently?

4. Are there groups who are usually left out of community discussions? Who are they?

pg. 1



GLOBAL
CENTER ON
ADAPTATION

Stage 2: Analysis

5. Why are the groups you mentioned more vulnerable? (e.g., lack of land rights, poverty, health problems, no voice in decisions)

6. Which areas or villages are most at risk, and why?

7. What resources or strengths does the community already have to cope with these hazards?

Stage 3: Reporting

8. If you were to explain the risks to a neighbor, how would you describe them?

9. What would be the easiest way for your community to understand and use this information? (e.g., maps, posters, meetings, radio)

10. How should this information be shared with leaders or decision-makers to make sure it helps?

pg. 2



Stage 4: Actionable Steps

11. What should be done immediately to help vulnerable groups? (short-term actions)

12. What long-term solutions would make your community safer and stronger?

13. Who should be responsible for taking these actions? (e.g., county government, local leaders, NGOs, community groups)

14. How can the community be involved in checking if these actions are working?

Thank you for your input. Your answers will help ensure that climate planning is fair, inclusive, and responsive to the needs of all community members.

pg. 3



ANNEX 6. FGD GROUP WORK – RESPONSE FORM



FGD Group Work - Response

Fill in the table below to show which hazards affect your area, who is most vulnerable, why they are vulnerable, what impacts are being seen, and what safeguard or action step can help protect Water and Sanitation investment projects.

Hazard
Hotspot Areas
From the hotspots listed above, which areas should the consultant visit for further on-the-ground assessment?
Frequency and Duration
Vulnerable Groups
Why Vulnerable (social factors)
Impacts observed/recorded

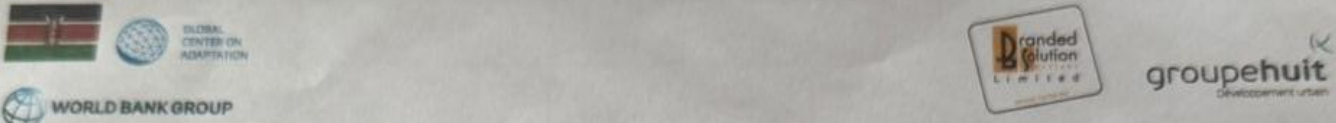
Institutional Arrangements and Policy Frameworks Promoting Mitigation and Adaptation

a) Policy Documents, Plans and Acts

b) County roles

c) Community Roles/Management Structure

ANNEX 7. WORKSHOP ATTENDANCE LIST



CLIMATE RESILIENCE SUPPORT FOR KENYA WATER, SANITATION, AND HYGIENE PROGRAM (K-WASH)
Murang'a County Technical Committee on Water & Sanitation

Workshop Attendance Register **Stanley Havens Hotel 1st September 2025**

No.	Names	Designation	Phone No	Signature
1.	Nelson Kisanya	GIS Expert & cc Groupe Huit	0700170888	KNel.
2.	David Liambila	Water Expert. Groupe Huit	0720115494	[Signature]
3.	Mutsa Masiyandima	GCA - Senior Water Specialist		[Signature]
4.	CHRISTOPHER MWANGI	TECHNICAL ASSISTANCE	0764446781	[Signature]
5.	Peter Mburu		0721983690	[Signature]
6.	JAMES MWANA		0727387163	[Signature]

7.	J.N. Wanyore	C.S.M	0728073034	Signature
8.	Paul Okech	Group Chief	0906 092 688	Signature
9.	Vincent M. Mushi	Director Livestock Pbn	0721595240	Mushi
10.	Faith E. Nyoroge	Asst. Dir. Gen. Serv.	0713386429	Signature
11.	BILHA WANJIA MUKHIA	FIRE CHIEF/DM	0722971416	BUM
12.	Phyllis Mwangi	Environment officer	0720990433	Signature
13.	Justin Gatitu	Asst. Dir. Economic Planning	077380304	Signature
14.	PAUL MURUBI	Environment officer	0725988674	Land
15.	Robert Mburu	S.W.E	0722295624	Signature
16.	Josphat Nduati	P.P	0720691330	JP
17.	Penniten Kaimau	Social Director	0720479183	Signature
18.	Sansun Nyutu	BO	0707933801	Signature



GLOBAL
CENTER ON
ADAPTATION

ANNEX 8. CLIMATE RISK ASSESSMENT PRESENTATION – MURANG'A



GLOBAL
CENTER ON
ADAPTATION



WORLD BANK GROUP

CLIMATE RESILIENCE SUPPORT FOR KENYA WATER, SANITATION, AND HYGIENE PROGRAM (K-WASH)

Murang'a Workshop (Field mission N°2)

1st September 2025



groupehuit
Développement urbain



GLOBAL
CENTER ON
ADAPTATION

01.

Workshop opening

2

01/09/2025 | K-WASH _ August Workshop Murang'a



Objectives of the CRA

What is a Climate Risk Assessment ? What is the purpose of a Climate Risk Assessment ?

Climate risk assessments identify the likelihood of future climate hazards and their potential impacts on communities. This is fundamental for informing the prioritization of climate action and investment in adaptation.

In this case the CRA should inform CWSSIP to ensure investment planning ensures adaptation through:

- Climate proofing of investments
- Due consideration of climate change when choosing investments location

02.

Presentation of the CRA results

4

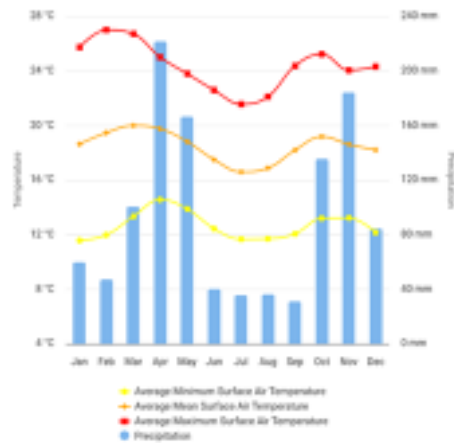
01/09/2025 | K-WASH _ August Workshop Murang'a



Presentation of the CRA results - Hazards

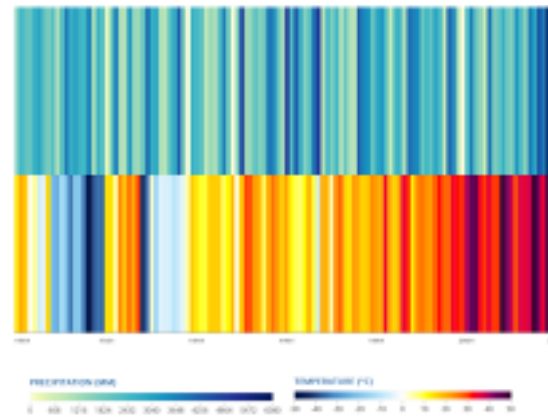
Our goal is to understand existing hazards and their evolution with climate change

Current Climatology



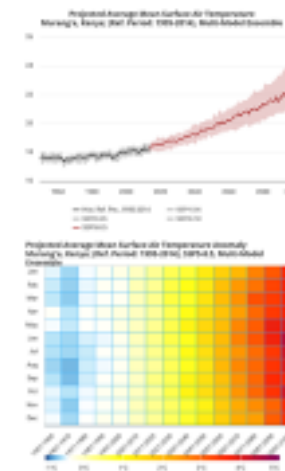
Monthly climatology, 1991-2023; Murang'a
Source: CCKP

Historical trends



Observed annual average precipitation (top) and mean surface air temperature in Murang'a
Source: CCKP

Projections



Projections of average mean temperature under SSP5-0.5 (Murang'a)
Source: CCKP

5

01/09/2025 | K-WASH _ August Workshop Murang'a



Presentation of the CRA results - Hazards

Physical parameter - Temperature

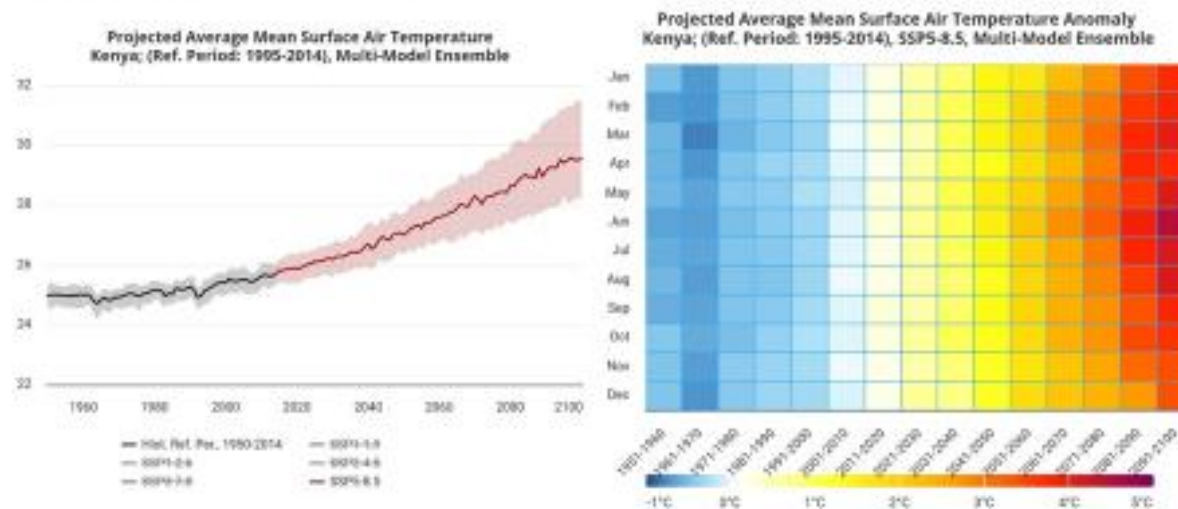
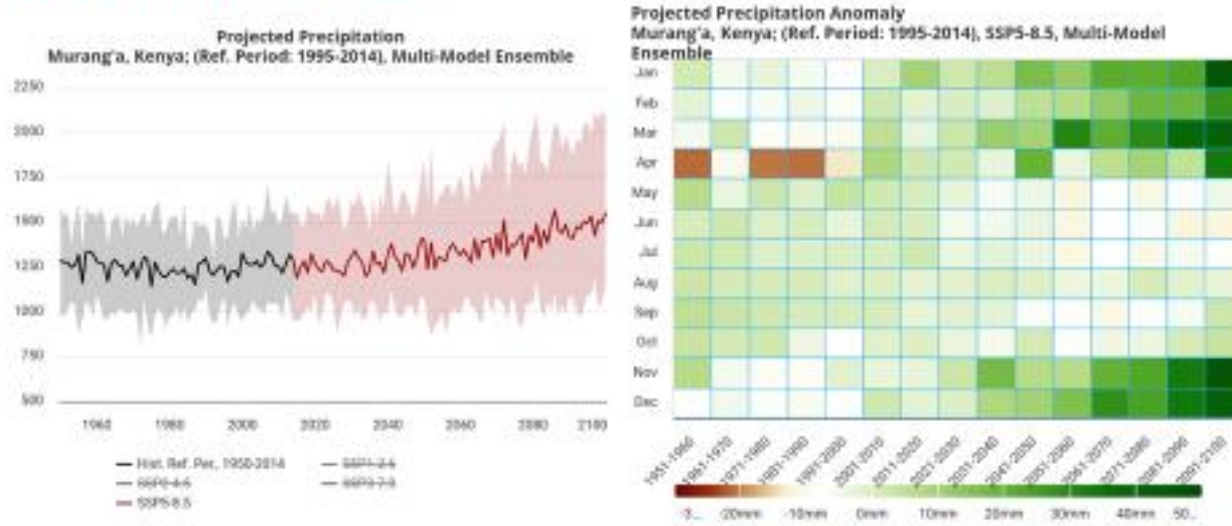


Figure 1: Projections of average mean temperature under SSP5-8.5

Source: (The World Bank Group 2025)

Presentation of the CRA results - Hazards

Physical parameter - Precipitation



Interannual precipitation changes projections
Source: (The World Bank Group 2025)

Presentation of the CRA results - Hazards

Main hazards exposure

- ▶ Floods:
 - Heavy rainfall floods (*limited exposure according to GIS data available*)
 - River floods (*limited exposure according to GIS data available*)
 - Rising water table floods (*not enough information to map this out*)
- ▶ Heat stress and droughts (*all the county*)
- ▶ Landslides (*western area of the county mainly*)
- ▶ Soil and water salinity (*eastern area of the county*)
- ▶ Sand and dust storms (*all the county*)
- ▶ Pest and diseases (*all the county*)

Part of these hazards' exposure have been mapped, this is what enables to identify to which hazards proposed investments of the county are exposed, it has to be put in parallel with local knowledge

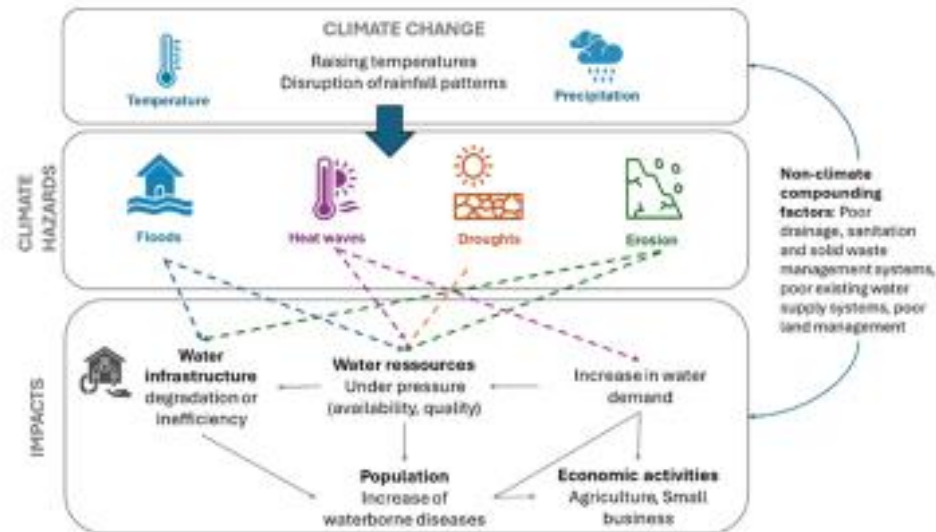
Presentation of the CRA results - Hazards

Major Climate Related Events Recorded in Murang'a

- ▶ Floods:
 - Maragua & Kiharu – intakes submerged, high treatment costs, 20–40% households affected
- ▶ Drought:
 - Severe in Ithanga/Kakuzi – up to 50% households affected; long treks for water, crop loss.
- ▶ Landslides
 - Frequent in Kangema, Mathioya, Kigumo – 2025 landslide in Kangema killed 6, cut off 980 HHs.
- ▶ Extreme Rainfall
 - Ndaka-ini station recorded 1,355 mm (among Kenya's highest seasonal totals).
- ▶ Heat Stress:
 - Outdoor workers & water pans/dams affected by evaporation and heat waves.

Presentation of the CRA results – WASH sector vulnerability

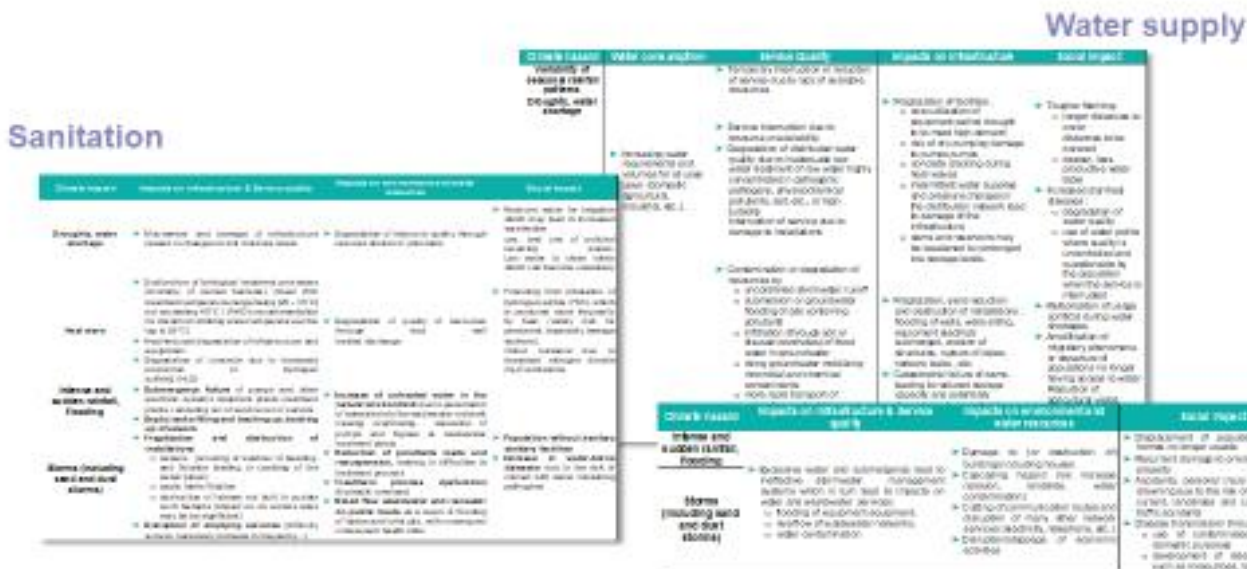
Physical system vulnerability – WATER RESOURCE



Water sector vulnerability to climate change

Presentation of the CRA results – WASH sector vulnerability

Physical system vulnerability – WASH & OTHER INFRASTRUCTURE



Climate hazard	Impacts on infrastructure & Service quality	Impacts on environment and water resources	Social impact
Droughts, water shortage	<ul style="list-style-type: none"> Movement and damage of infrastructure related to changes in soil moisture levels 	<ul style="list-style-type: none"> Degradation of resource quality through reduced dilution of pollutants 	<ul style="list-style-type: none"> Reduced water for irrigation which may lead in increased wastewater use, and use of polluted receiving waters. Less water to clean toilets which can become unsanitary
Heat wave	<ul style="list-style-type: none"> Dysfunction of biological treatment processes (mortality of certain bacteria). (Ideal WW treatment temperature range being [20 - 35°C] not exceeding 40°C / WHO's recommendation for maximum drinking water temperature at the tap is 25°C) Heat-induced degradation of infrastructure and equipment. Degradation of concrete due to increased production of hydrogen sulfide (H₂S) 	<ul style="list-style-type: none"> Degradation of quality of resources through less well treated discharge 	<ul style="list-style-type: none"> Poisoning from inhalation of hydrogen sulfide (H₂S), which is produced more frequently by heat (safety risk for personnel, especially sewage workers). Odour nuisance due to increased nitrogen dioxide (N₂O) emissions
Intense and sudden rainfall, flooding			
Storms (including sand and dust storms)	<ul style="list-style-type: none"> Submergence failure of pumps and other electrical systems treatment plants, rendering out of service out of service Septic tanks filling and backing up, backing up of sewers Fragilization and destruction of installations <ul style="list-style-type: none"> sewers: (scouring or washout of bedding, and flotation leading to cracking of the sewer pipes) septic tanks flotation destruction of latrines not built to sustain such hazards (impact on access rates may be significant) Disruption of emptying services (difficulty access, necessary increase in frequency...) 	<ul style="list-style-type: none"> Water in the network causing overflowing, saturation of pumps and bypass at wastewater treatment plants Reduction of pollutants loads and resuspension, leading to difficulties in treatment process Treatment process dysfunction (hydraulic overload) Mixed flow wastewater and rainwater on public roads as a result of flooding of latrine and toilet pits, with consequent health risks Inundation of soakaway or pit from below, increased potential for contamination of groundwater. 	<ul style="list-style-type: none"> Population without sanitary facilities Increase in water-borne diseases due to the risk of contact with water containing pathogens
Erosion and landslides	<ul style="list-style-type: none"> Exposing and damaging pipe work, especially simplified sewerage. 		

Example on Sanitation

Presentation of the CRA results – WASH sector vulnerability

Physical system vulnerability – WASH & OTHER INFRASTRUCTURE

Once impacts are identified it is necessary to adapt infrastructures and practices
→ this is why we will work on adaptation options this afternoon !

03.

Consideration on vulnerability

15

01/09/2025 | K-WASH _ August Workshop Murang'a



GLOBAL
CENTER ON
ADAPTATION

Consideration on vulnerability

County Context

- **Area & Population:** 2,558.9 km²; 2019 Census – 1,056,640 people; projected 1.13M (2025) and 1.20M (2030).
- **Urbanization:** 27% urban (2025) with 4.3% annual growth; >50% projected by 2050.
- **Economy:** Agriculture-driven (tea, coffee, dairy, avocados, bananas, maize). Poverty rate 26.7%.

Consideration on vulnerability

Understanding the socio-economic baseline and identifying vulnerable groups

Tool: PCRA

There is a **global vulnerability as some resources are stressed** (water) and well-being, food supply, and livelihoods rely on the latter, in addition extreme events (landslides, floods) damage infrastructures reducing adaptation capacity.

Lack of infrastructures increase global vulnerability as well : inequal piped water supply, WASH, damages roads, etc.

Groups or communities identified as vulnerable / Social inequalities identified :

- ▶ Women (multifaceted vulnerabilities, access and control over resources, social norms)
- ▶ Kids/Youth, elders, disabled people (mobility issues, dependency, health fragility)
- ▶ Marginalized communities and minorities → it is not clear which communities should be considered
- ▶ Poverty increases these vulnerabilities

Consideration on vulnerability

Understanding the socio-economic baseline and identifying vulnerable groups

On this basis, **it is interesting to look at how the WASH sector impacts these identified vulnerabilities and inequalities, but also how WASH practices contribute to these vulnerabilities** (either positively or negatively).

PCRA's enable to identify gender gaps quite clearly : women's reproductive role, unequal ownership and control over resources and propensity to incur debt during a crisis

It would be relevant to :

- ▶ better characterize vulnerabilities of other groups (Kids/Youth, elders, disabled people, Marginalized communities and minorities)
- ▶ question how to promote gender and vulnerable groups inclusion throughout K-WASH (not only mitigating risk and bridging gaps but contributing to social inequalities reduction)

→ This is why we will focus on these aspects this afternoon !

05.

Participatory work

19

01/09/2025 | K-WASH _ August Workshop Murang'a



Main Objective: Focused Group Discussion

Hazards: **Flooding | Landslides | Drought**

1. Hotspot Areas Identification & Mapping
2. Duration & Frequency
3. Impacts on Water Supply and Sanitation
4. Adaptation Measures
 - Design
 - County Level
 - Community Level
5. Gender and Cultural Norms Influencing Adaptation
6. Institutional Arrangements and Policy Frameworks Promoting Mitigation and Adaptation
 - Policy Documents, Plans and Acts
 - County roles
 - Community Roles



groupehuit 



Group Presentations

06.

Workshop closure

22

01/09/2025 | K-WASH _ August Workshop Murang'a



Contact



Paul Okech

Deputy Team Leader – Stakeholder Engagement Expert
okechpo@gmail.com



Nelson Kisanya

GIS Expert
nelsonkisanya2010@gmail.com



David Liambila

WSS / WASH Expert
dliambila@gmail.com



Romain VIAVANT

Team Leader
romain.viavant@groupehuit.com



Emma GUILLOT

Project Coordinator
emma-guilLOT@groupehuit.com



groupehuit.com

GRUPE KERAN