Integrating Resilience into Municipal Infrastructure Delivery in Kenya: Guidance Note for Municipal and County Engineer and Planners

Urban Resilient Infrastructure Guideline

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1. Introduction

1.1 Background

This **Resilient Urban Infrastructure Guidelines** (Guidance Note) forms one of a suite of reports developed by AECOM for the World Bank Group under the **'Enhancement of Resilient Urban Planning and Infrastructure Investments in Urban Areas in Kenya'** assignment ("the Assignment") and constitutes **Deliverable 2 under Contract #7205751** of the Assignment. This Deliverable may be read in conjunction with other Deliverables produced under this Assignment, as summarised below.

Deliverables Produced under this Assignment

No.	Title	Purpose
Component 1: Resilient Urban Infrastructure		
2	Urban Resilient Infrastructure Assessment Report	Summary of design and delivery process for municipal infrastructure, overview of main climate change and physical hazards in urban areas in Kenya, analysis of status of delivering resilience in municipal investments, key resilience issues in relation to KUSP II.
3	Resilience Checklist for KUSP II Investment Eligibility	Checklist with criteria to enable incorporation of resilience within potential infrastructure investments under KUSP II.
4	Resilient Urban Infrastructure Guidelines	Step-by-step guidance aimed at municipal and county engineers to support increasing the resilience of municipal infrastructure projects and communities to physical risks, notably impacts of climate change.
Capacity-building and Institutional Strengthening		
5*	Priority Areas for Capacity Building and Institutional Strengthening for Resilient Urban Infrastructure Design and Resilience-Based Urban Planning	Identify the capacity building challenges encountered for mainstreaming climate change resilience considerations in infrastructure design and urban planning systems, and a set of recommendations and opportunities to enhance resilience under KUSP II.
Component 2: Resilience-based Urban Planning		
6	Resilience-Based Urban Planning Practices and Legal Framework Report	Detailed baseline survey and analysis of the extent to which relevant legislation and urban planning practice in Kenya is already mainstreaming resilience
7	Guidance Note on Mainstreaming Resilience into Urban Planning	Step-by-step guidance aimed at municipal-level planners in Kenya on activities, considerations, and examples of good practice from other contexts to support municipal governments with mainstreaming resilience within the urban planning system.

** Deliverables 5.1 and 5.2 were combined into a single deliverable that consolidates capacity-building and institutional strengthening recommendations across both components*

This guidance note is based on a diagnostic assessment (***Urban Resilient Infrastructure Assessment Report***) of municipal infrastructure investments under the Kenya Urban Support Program (KUSP) 2018 – 2023. It is also based on a literature review and stakeholder consultations that were used to identify realistic interventions to increase the resilience of municipal infrastructure delivery. The complementary ***Guidance note on Mainstreaming Resilience into Urban Planning Practices*** can be read as a companion document as it provides guidance on mainstreaming resilience into project prioritisation, location, planning and compliance.

1.2 Purpose of this document

This guidance note provides simple guidance for increasing the resilience of municipal infrastructure projects, and of communities, to physical risks, notably impacts of climate changes. This will increase the sustainability of investments under KUSP2, enabling them to perform their

required function for their proposed design life, in a changing climate. It follows, roughly chronologically, the project development and design process.

For the purposes of this note, **resilient urban infrastructure** is defined as *infrastructure that is designed to deliver essential services now and in the future. It is prepared for and can withstand, adapt and recover positively from the physical (and climatic) shocks and stresses it may face over its lifetime. This is both with regards to the assets themselves, as well as the wider system that these assets are part of, which could include: the natural environment, the urban system, the operators, and the communities that interact with them.*

Some practical examples of resilient urban infrastructure from the above definition are included below:

- A water supply system that can withstand more severe droughts by having back-up storage.
- A stormwater system that can handle more severe rainfall intensities due to climate change. Such stormwater systems increase not only the safety of the community but also their economic activity by allowing them to continue travelling to and from work.
- Planting trees along roadsides to provide cooling of the urban environment and thus a healthier, more resilient community.

1.3 When to use this document

This guidance note was designed for projects under the Second Kenya Urban Support Program (KUSP2) but can be used beyond KUSP2 projects and timelines if/as useful.

This document should be used alongside existing national and local planning, EIA, and design standards and regulations to increase the resilience of municipal infrastructure projects in urban areas in Kenya. It does not replace any regulations related to infrastructure planning and design or mandatory requirements within them.

Municipal infrastructure included under KUSP2 is shown in Table 1. Note that the list provided is indicative as of November 2022 and may change, but the projects are all low and medium risk with no land acquisition requirements, and no complex environmental or social issues.

Table 1: Indicative eligible municipal infrastructure investments under KUSP2 (as of November 2022)

Urban functional area	Indicative eligible investments
Connectivity, Mobility and Accessibility	• County urban roads, pedestrian walkways and bicycle paths, street and security lights (solar) and road furniture (Land acquisition is excluded) • Universal access adaptations in main transport stations including access, internal circulation, ticketing, toilets, access to platforms and specialized services. • Street improvements to meet the needs of all users (pedestrians and cycles lanes). • Converting roundabouts to Signalized junctions (traffic lights). • Piloting NMT means of transport (cycling and pedestrian walkways).
Municipal Solid waste management (MSWM)	• Solid waste: collection equipment, collection bins, transfer stations, collection points (construction of sanitary landfill, incinerators and decommissioning of dumpsites are excluded). • Community sensitization campaigns on improved MSWM.
Wastewater and fecal sludge management	• Safe and emptiable public toilets/latrines, community septic tanks, emptying and transportation services and equipment e.g. vacuum trucks, vacuum

Urban functional area	Indicative eligible investments
	handcarts, and others (construction of wastewater treatment facility is excluded)
Water supply	• Community connections (kiosks and storage tanks not exceeding 10m3), water reticulation systems (water treatment facility and private connections excluded).
Storm water drainage	• Urban drainage systems; flood control methods (along existing channels e.g protection of drainage channels). • Rehabilitation of storm water drainage (drainage must have compliant outfall).
Urban social and economic infrastructure	• Urban greenery and public open spaces, social retail markets, community halls, childcare facilities.
Fire and Disaster Management	• Fire control stations and disaster management equipment (firefighting trucks, rehabilitation and/or construction of new firefighting station and facilities)

Source: World Bank May 2023

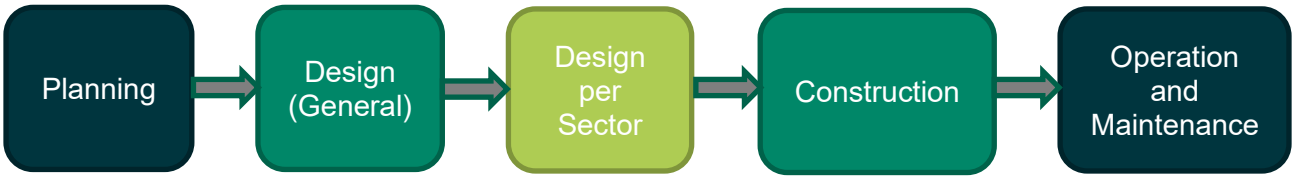
1.4 Who should use this document

This document should be used by Municipal and County Engineers (and consulting engineers where design is procured externally), as well as Municipal and County Planners, Environmental Assessment Experts, and other practitioners to guide municipal infrastructure projects under KUSP2. The document is also suitable for use by municipalities not participating in KUSP2 but investing in their own infrastructure and any other organisation carrying out municipal projects.

1.5 How to use this guideline

This guideline follows the project development and design process chronologically. An infographic of those phases and the relevant section is shown in Figure 1 below. Review this entire guideline when first considering a project and then review each section on each project step prior to starting that step. Doing so will help to deliver a successful and resilient project that meets the criteria of KUSP2.

Figure 1 Project phases



2. Project planning

2.1 How is a project identified?

Urban problems- and the related infrastructure priorities- are generally identified through a) consultative urban planning process, including evidence gathering, b) sectoral analysis, or c) identified by the affected community. This section provides a summary of the importance of aligning infrastructure projects to wider planning processes.

2.2 Integrated urban investment planning

Delivering resilient urban infrastructure to support resilient urban areas requires phased and prioritised investment planning across infrastructure sectors. This investment planning process should respond to urban challenges identified through a) consultative urban planning process including relevant evidence, b) sectoral analysis, or c) identified by the affected community. Where possible, it should be informed by technical expertise across environmental, social, urban planning, climate change/ risk analysis and engineering sectors.

The enactment of the Urban Areas and Cities Act (UACA) of 2011 requires that urban areas should have an Integrated Urban Development Plan (IDeP), forming the basis of its budgeting and spending. Similarly, the County Government Act (CGA) of 2012 demands that county public funds must be appropriated under a framework that integrates economic, social, physical, environmental and spatial planning. The Act outlines the specific plans to be developed at the county level that include County Integrated Development Plan (CIDP), County Sectoral Plan, County Spatial Plan and the Cities and Urban Areas plans.

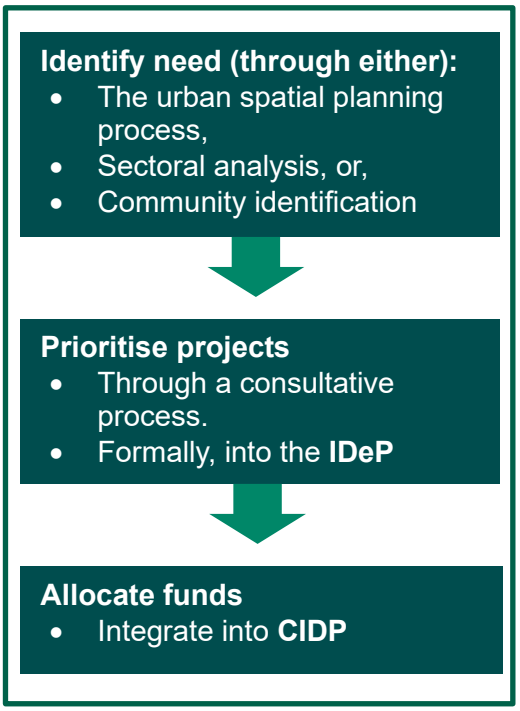


Figure 2: Planning processes

The CIDP provides the overall social and economic development strategy for the county for a period of five years and identifies investments across the municipal infrastructure sectors, linking to County wide sector plans. **Municipal infrastructure investment projects should be identified in CIDPs and fully budgeted before detailed design of municipal infrastructure commences**. Inclusion in the CIDP should ensure that a consultative approach has been followed and means that the county and municipality have prioritised the investment and allocated budget for its delivery in the short term.

2.2.1 Urban planning

The urban planning process which results in municipal spatial plans should be consultative and based on relevant technical evidence. This process is likely to identify community needs, or challenges (including hazards) that might be resolved through municipal infrastructure provision. The spatial planning process is therefore one source area for the development of resilient municipal infrastructure investment projects.

More detail on how to mainstream resilience considerations into urban planning in Kenya is provided in the ***Guidance Note on Mainstreaming Resilience into Urban Planning Practices***.

2.2.2 Sectoral planning

There is a risk that ad hoc projects that are developed outside of the planning process often do not meet resilience objectives in the context of a whole town or city. Isolated investments, for example,

in transport, stormwater management, or solid waste management, may create problems elsewhere (downstream or upstream) in the system if the 'capacity' and 'loading' (demand) of the system is not considered as a whole.

By identifying the needs (and challenges) of an urban infrastructure system as a whole and prioritising investments within this framework to meet demands (or requirements) in the short, medium, and long term, infrastructure investments will be more resilient to existing and future shocks and stresses.

To increase the resilience of municipal infrastructure investments, as a minimum, **the process of developing IDePs should include sectoral planning across transport, stormwater and waste management**, and IDePs should consider and include projects which support sectoral development in water and sanitation services – requiring close consultation with the relevant Water and Sanitation Company (WASCO) or water service provider to the municipality.

A simple phased process for sectoral analysis and planning should consider (examples provided are for stormwater master planning):

1. Establishing baseline coverage (map the existing stormwater system)
2. Establishing current issues, constraints, and gaps in coverage (map areas of recurrent flooding, maintenance issues, gaps in the stormwater system – this is best performed through stakeholder consultation)
3. Fieldwork to validate issues, constraints and gaps
4. Estimate future demand (based spatial growth rates)
5. Development of conceptual solutions (to address current issues, constraints and fill gaps, and cover short/medium term growth areas)
6. Prioritisation of investments (through a multi-criteria analysis, focused on benefits rather than costs)
7. Preparation and agreement of an investment plan, to deliver on key objectives
8. Development of parallel programmatic investments to support maintenance of the system ('capital' maintenance programs – larger scale maintenance and repair, beyond just e.g., annual drain clearance)

This sectoral planning should be undertaken as part of the urban planning and evidence gathering process which informs the IDeP. As stated above, priority investments across sectors should be incorporated into IDePs, and then funnelled up into CIDPs at a county level, as this is where county funding is allocated.

In instances where sectoral plans are not yet in place these resilience guidelines can still be implemented by focussing on known issues (e.g. roads that regularly flood).

2.2.3 Community led projects

Projects are sometimes identified by communities and brought to the attention of the municipality. This is a valuable process for encouraging demand-led responses to community vulnerabilities.

Public consultation should be prioritized as part of the IDeP and CIDP process to ensure that the needs of vulnerable communities are being actively considered. Where communities have identified a specific vulnerability in responding to IDeP consultations, these projects, conceived by the beneficiaries, should be considered with a high priority due to the high resilience outcomes offered by bottom-up project development. Where possible, they should be incorporated into sectoral development plans, and thus into IDePs, as above, creating a bottom-up and top-down approach to investment planning. Figure 3 provides guidance on the participatory process required to deliver projects for communities from inception to completion from the County Public Participation Guidelines prepared by the Ministry of Devolution and Planning & Council of Governors.

Figure 3: Approach to participatory project development and implementation

- ***Identification of priority needs:*** Identification and prioritization of community needs shall be accorded sufficient time. The root cause of the problem shall be identified. For example illness in children might be due to malnutrition or poor quality of water rather than lack of medical facility.
- ***Project identification:*** Projects shall be identified that will address the priority needs. Prioritized projects shall be forwarded from the Ward Citizens Forums to the Sub-county Citizen Forum for consensus building. The Sub-county Citizen Forum shall review and recommend annual prioritized projects. A consensus dialogue towards the development of the final list of prioritized projects shall be done at county level where the principal of equity shall be observed. The final prioritized project list shall constitute the annual county development plan, which shall be transmitted to the county budget and economic forum for approval.
- ***Project design and costing:*** The projects identified during consultative meetings and agreed upon shall be designed and cost estimates done by the county technical committee.
- ***Project implementation:*** The objective of implementation is to deliver the projects and activities prioritized by citizens and to meet the needs identified during the consultation process. County governments shall delegate implementation powers and responsibilities to Sub-county and ward levels. Volunteer Project committee members will be elected from the community. The County shall assign an officer at the ward level known as the Community Development Officer. This shall be the officer responsible for ward level planning, implementation and monitoring.
- ***Project Monitoring and evaluation:*** Monitoring is defined as the process of collecting and analysing data to measure the actual performance of the program, process or activity against expected results. The purpose is to identify whether implementation is undertaken according to projects plans and design. The county will undertake its monitoring and evaluation through the county monitoring and evaluation department; the project technical committee; project committee; and the citizen's committees.

Source: County Public Participation Guidelines[1]

Good practice in community project development, Landless stormwater project, Thika

This is a community project, which was developed by the local community and proposed to the Municipal Board to reduce their exposure to (annual) flooding in a poorly drained area of Thika Municipality. The community has been involved at all phases and the project been well designed to relieve flooding in the area, reducing vulnerability to flood risk and providing other benefits, including raising local land value.

[1] county-public-participation-guidelines.pdf (devolution.go.ke)

Good practice in community participation, Refurbishment of Oloitptip Market, Kilifi

The project was identified by the community due to poor sanitary conditions in the Market. A community lobby was present during planning meetings. Traders have formed a market committee responsible to ensure that the facility is well maintained. The market generates revenue, part of which maintains the market's solid waste management.

Good practice in community resilience, Refurbishment of Oloitptip Market, Kilifi

The old market was prone to flooding, and subject to poor waste management. Following a high demand for space by traders, the market has increased its capacity to accommodate 160 traders up from the previous 100, providing economic opportunities to the local community. The access road to the market has been improved, with speed bumps and solar street lighting improving security at night. The access road has been widened to enable access by fire engines in case of an emergency, fire hydrants and fire extinguishers are appropriately distributed across the market.

2.3 Environmental / social risk assessment

The requirements for environmental and social impact assessment for projects are set out in the Environmental Management and Coordination Act (EMCA), 2018[2]. The second schedule and its amendment[3] state that the investment types under KUSP2 (Table 1) are not high risk and they would be classified as low or medium risk projects requiring preparation of a **Project Report** rather than a full EIA. The requirements of a Project Report are set out in the EMCA and should *state (the most relevant sections for resilience are **highlighted bold** and expanded on in the sub-sections below):*

a) the nature of the project;

b) the **location** of the project including, proof of land ownership where applicable, the Global Positioning System (GPS) coordinates and the physical area that may be affected by the project's activities;

c) the activities that shall be undertaken during the project construction, operation and decommissioning phases;

d) a description of the international, national and county environmental legislative and regulatory frameworks on the environment and socio-economic matters;

e) the **preliminary design** of the project;

f) the **materials to be used**, products and by-products, including waste to be generated by the project and the methods of their disposal;

g) the potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project;

h) **analysis of alternatives including project site**, design, technologies and processes and reasons for preferring the proposed site, design, technologies and processes;

[2] EMCA EIA Regulations (nema.go.ke)
[3] Legal Notice No. 31-32.doc (nema.go.ke)

i) an action plan for the prevention and management of possible accidents during the project cycle;

j) a plan to ensure the health and safety of the workers and neighbouring communities;

k) the economic and socio-cultural impacts to the local community and the nation in general;

l) a plan to ensure the relocation or resettlement of persons affected by the project;

m) a strategic **communication plan to ensure inclusive participation during the study** and provide a summary of issues discussed at the public participation forum;

n) an environmental management plan;

o) **integration of climate change vulnerability assessment, relevant adaptation and mitigation actions**;

p) the project cost; and,

q) any other information the Authority may require.

The Project Report is to be prepared by a registered environmental assessment expert registered with NEMA (National Environment Management Authority)[4], and submitted to NEMA. For low and moderate risk sub-projects, the project reports are submitted directly to County NEMA offices for review and licensing, while for high-risk projects they are submitted at the National NEMA office. NEMA is a regulatory body that is responsible for promoting and coordinating environmental management in Kenya. NEMA's role during projects includes assessing the Project Report and issuing a permit for construction of the infrastructure if the Project Report shows an acceptable level of environmental and social impacts.

Once satisfied with project report and the proposals within it - NEMA then issues a licence. **Construction should not commence until the licence is received.**

Lessons learned in construction of wastewater wetland and bio digester resulted in the Environmental licences not being granted, Vihiga

The project has stalled because there was a budget shortfall. The timing of completion of environmental impact assessment processes meant that all risks and mitigation measures were not considered in original budgeting. Additional design components were required to mitigate impacts to obtain environmental approvals and no contingency was allocated for this.

The lessons learned are that (a) that EIA should be complete before signing off designs and commencing construction, and (b) adequate contingency should be budgeted for unforeseen issues, or additional funds from County or Municipal budgets should be available to cover contingencies.

2.3.1 Project location

The project location should consider hazards posed to the project, as well as the potential benefit of the project to build resilience of project beneficiaries. Hazard mapping of some kind (whether community derived maps or modelled hazard maps, such as floodplain hazard mapping) should be included in the Urban Spatial Plans, to identify hazard zones.

[4] National Environment Management Authority (NEMA) - Licensed Experts

Where possible, investments should be located outside of high hazard zones. **If the project is located in an area of high hazard risk, alternatives should be considered and discounted before the proposed location is deemed acceptable.** However, for most municipal infrastructure investments under KUSP2, the project location will be determined by the infrastructure requirements and the existing site (many projects are upgrading projects), and therefore the proposition of alternative sites is not possible. In these instances, hazards which the site is exposed to should be mitigated through design. Generally, the resilience benefit will be determined by the project type. For example, stormwater projects need to be located in areas of existing flood risk to deliver benefits in terms of reduced flood risk (which in turn increases resilience), while road, park, and buildings projects can incorporate measures to reduce the vulnerability of the local community.

Community buildings, such as markets, **can provide resilience benefits to the community** during disasters where shelter may be required. Buildings such as fire stations, can provide resilience benefits to the community as a location for disaster response and coordination. Given the importance of public buildings as providing potential resilience benefits to a community- it is imperative that where possible, **public buildings should not be located in high hazard zones** and alternative locations must be considered. If the existing location of a building identified for upgrades under KUSP2 is in a high hazard area, further investment in this project should be withdrawn unless the level of hazard is fully evaluated and understood mitigation measures can be incorporated into design of the project.

2.3.1.1 Riparian land

Riparian land[5] should be safeguarded, where possible, as it provides resilience to local and downstream communities by creating urban green/blue corridors, regulating urban temperatures, improving water quality and freshwater ecology, and reducing flood/erosion risk posed to development. Sites which are adjacent to, or incorporate, watercourses and waterbodies should adhere to national legislation related to riparian land in the National Water Act 2016. It is further required, in terms of resilience, that all infrastructure be placed at least outside the 1 in 100-year floodplain. It is recommended that critical infrastructure, such as fire stations or power stations, use a higher return period than 1 in 100 years, that is recommended by a flood engineer.

Project Reports should identify impacts to riparian land and waterbodies and set out mitigation measures, including the maintenance of a riparian reserve, limitation of modification on the riparian reserve and adjoining watercourse as well as planting of suitable trees on the riparian reserve to intercept and contain surface runoff in addition to liaising with the proper authorities in the maintenance of the riparian reserve.

2.3.2 Design

Designing for resilience is covered in Chapter 3 below. Further sectoral design considerations for resilience, including appropriate material specification is covered in the sector guidance provided in Chapter 4.

2.3.3 Climate change vulnerability assessment

Climate change vulnerability assessments provide information that can be used to support project planning and design. The assessment should determine the degree to which the project and its beneficiaries are susceptible to the impacts of climate change, including climate variability and climate extremes. This will enable designers to consider the key impacts of climate change and design project elements that respond to and mitigate these impacts.

Fundamental to climate change vulnerability assessments are projections of future climate. Guidance on incorporating specific impacts (related to engineering design for rainfall intensity and maximum temperature) into project design is provided in Section 3.2 (supported by regional projections provided in Appendix B). However, analysis of a broader range of climate projections may be useful in determining the sensitivity and vulnerability of the infrastructure assets, the local community, and the beneficiaries of the project to future climate scenarios. This enables

[5] Riparian land is the land that runs along rivers, creeks, estuaries, lakes and wetlands.

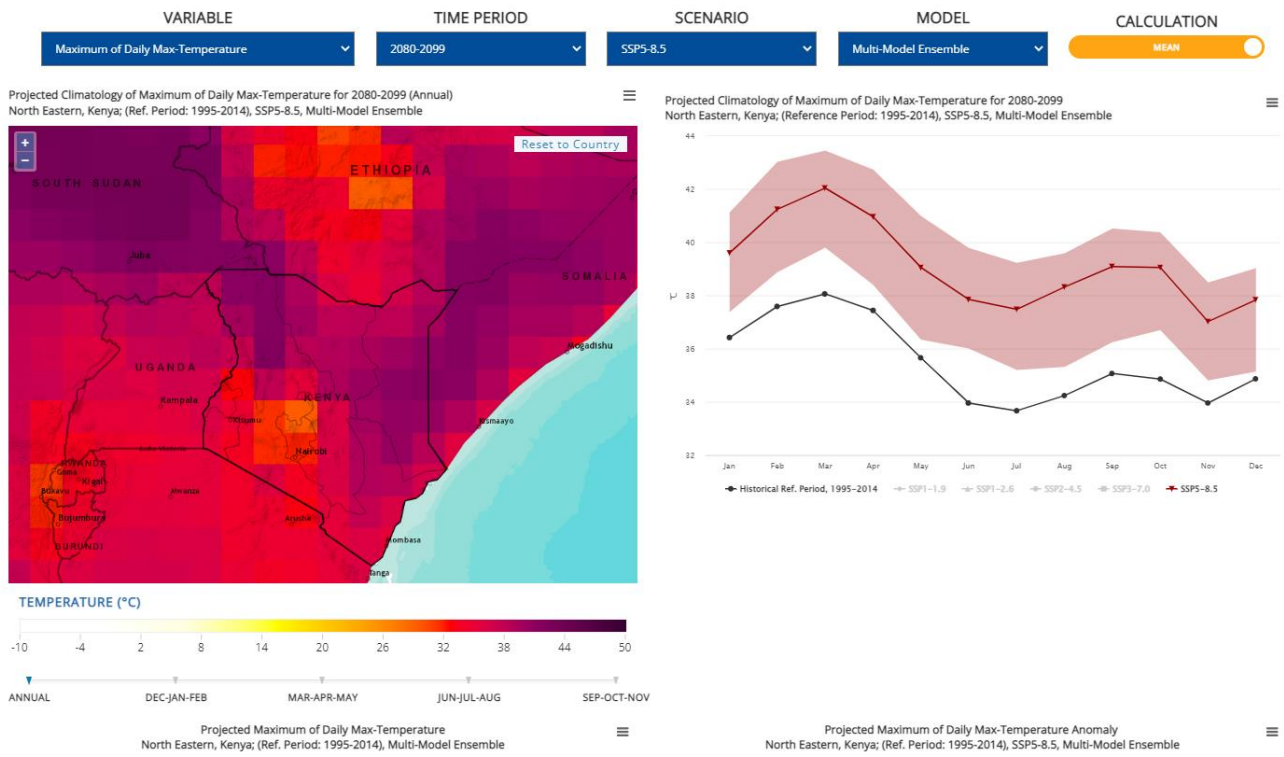
environmental professionals and engineers to incorporate broader adaptive strategies into the project design, such as planting, water efficiency measures, temperature regulation. Climate change projections for each region in Kenya can be accessed through the World Bank's Climate Change Knowledge Portal[6] (CCKP), which includes climate change indicators (variables) for maximum temperatures (use *maximum of daily max temperature*), rainfall intensity (use *average largest 1-day precipitation*), meteorological drought (use *annual SPEI drought index*). Tables of regional climate projections to 2100 are provided in Appendix B. Estimates of sea-level change can be found using World Bank's Climate Change Knowledge Portal[7] (CCKP) and is shown in Appendix B in the table for the coastal area. NASA also has a Sea level projection tool. Section 3.2 provides guidance on how to use these estimates when designing for resilience.

Figure 4 provides a screenshot of World Bank's Climate Change Knowledge Portal. The region can be selected in the map, select a relevant climate change indicator (variable), the appropriate time period based on the project design life, as a default select the most conservative global emmissions scenario (SSP5-8.5), and the multi-model ensemble results.

An overview of the impacts of climate change (both specific impacts on engineering design, and broader impacts) and the adaptation measures proposed should be included in the Project Report.

The planners and engineers should also liaise with Disaster Management Unit's in the relevant counties to align with the disaster risk plans at a county level and to avoid addressing issues in silos.

Figure 4: Screenshot of World Bank's Climate Change Knowledge Portal



Source: World Bank

2.3.4 Community engagement and participation

In preparing a Project Report under EMCA, **there is a requirement to hold at least one public meeting with the affected parties and communities (including women, youth, persons with disability and other vulnerable groups) to explain the project, its social, economic, and environmental impacts, and to receive oral or written comments on the proposed project**.

[6] Kenya - Mean Projections Expert | Climate Change Knowledge Portal (worldbank.org)
[7] Kenya - Mean Projections Expert | Climate Change Knowledge Portal (worldbank.org)

Evidence should be attached of this public participation in the form of a signed attendance register, minutes, and photographs.

A notice of the meeting to consider the specific project should be made widely available through posters, invitation letters to affected and interest groups, letters through the local public administration officials or any other relevant channels is to be sent at least seven days before the meeting informing them of the date, time, venue and purpose of the meeting. A copy of the meeting notice should be attached to the project report.

Strategies for succesful stakeholder engagement and thus successful projects include:

- Start as early in the project as possible.
- Clearly explain the benefits of the project to the community.
- Include a complaint redress mechanism.
- Provide warning with adequate notice of any disruptions that might affect their daily life.
- Providing employment opportunities to the local community through the project if possible.

Best practice in community resilience through public participation and community outreach, Sewer Distribution System in Kiganjo, Thika

The municipality have provided main sewers and each street has raised their own funding to connect their street to the main. All sewers are to be owned and operated by Thika Water and Sewer Company. This illustrates that the community understand the value of the project and provides some level of community ownership of the system. It also illustrates the value of good public participation and community outreach. The area previously relied on poorly maintained septic systems. The project has increased community resilience as heavy rainfall events would mix with septic tank water creating a public health hazard on the streets and in public areas.

2.3.4.1 A recommended approach to stakeholder meetings

The primary objective of these meetings is to hear the views of stakeholders and incorporate local knowledge and specific vulnerabilities and/or impacts into project development and design. It is therefore important to enable all stakeholders to participate. Mechanisms should be put in place to invite and hear the views of youth, women, older members of society, persons with disability, and marginalised groups.

Depending on the number and diversity of people present at the meeting, the facilitators may decide to have one meeting or break out into smaller groups – the advantage of smaller groups is that it can produce more effective participation from stakeholders with weaker voices, who may be the most impacted or vulnerable to project activities. Presentations from break-out groups back to the plenary enable these voices to be effectively heard.

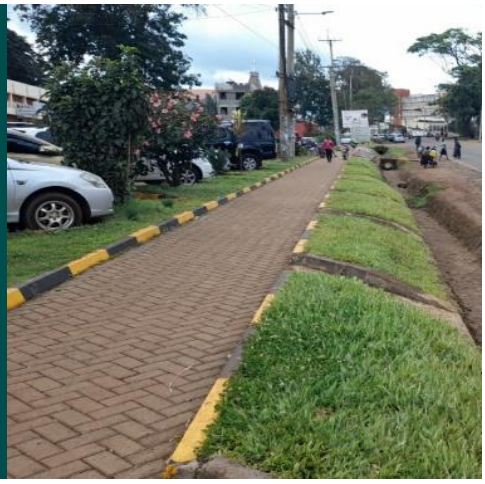
The facilitators should conclude with a summary of the input given, including any additional impacts that have been identified through the process, and design alternatives proposed or to be considered. They will then indicate the way forward, including how the views tabled will be incorporated into project planning and design. Additional meeting(s) may need to be held in the event alternatives are proposed and/or a final consensus is not reached.

Further guidance on public participation is provided in the County Public Participation Guidelines prepared by the Ministry of Devolution and Planning & Council of Governors[8]. This sets out conditions for meaningful public participation, which are summarised below:

- *Capacity to engage*: Both the agencies and the public should have the knowledge and communication skills required to participate effectively in the process.
- *Clear structure and process*: Before public participation takes place, clear rules need to be set defining the conduct of the process, tools to be used and how final decisions will be reached.
- *Access to information*: Facilitators should provide information in acceptable, easy to use formats.
- *Opportunity for balanced influence*: The engagement rules should ensure a balance of opinion and avoid dominance or bias by a section of the public.
- *Inclusive and effective representation*: Mechanisms must be established to reach out to all relevant stakeholders.
- *Bear in mind standing conditions of the participants*: It is critical that facilitators understand their audience well. They should clearly discern the; social and economic status, religious beliefs, ethnicity, and clan of those engaging in public participation. Knowledge levels, incomes and power wielded will influence the deliberations and ultimately have a bearing on the conclusion and subsequent outcomes.
- *Complete transparency*: The timely sharing of easily understandable and accessible information to educate the public about the issues and options.
- *Commitment to the process*: Proponents of public participation must be willing to obtain and consider public input in decision making and to ensuring that public participation works.
- *A climate of integrity*: For the public to fully participate, government agencies and decision makers must be credible, honest and trustworthy.
- *A belief in the value of public input*: Public input should result in better decision-making and better governance.

Urban regeneration and Improvement of Kerugoya/Kutus Municipality

A stakeholder mapping exercise was undertaken to identify potentially affected people: fruit vendors, boda-boda motorbike riders and automotive mechanics operating in and around the area. Public participation was done in line with EIA requirements. Traders and mechanics initially resisted the implementation of the project but relented as public consultation intensified and the benefits were elaborated – improved working conditions, improved parking and non-motorised transport, greater footfall (more trade), and new investment in the area.



[8] county-public-participation-guidelines.pdf (devolution.go.ke)

3. Designing for Resilience

The below design considerations apply to all sectors (water, solid waste etc.). The professionals required for design include engineers, architects, urban designers, and landscape architects. It is recommended that the Climate Mainstreaming Guidelines developed for the purpose of Second Kenya Informal Settlement Improvement Project also be consulted for guidance on design standards.

Not your sector? Think again…

Design standards are not always sector specific. For example, drainage design is relevant to any project which creates impermeable surfaces, and the guidelines on universal accessibility and landscaping in the street design manual and building codes can be applied across sectors.

3.1 Relevant design standards or guidelines

Table 2 provides a list of the relevant design standards and manuals in Kenya. It has been compiled through stakeholder engagement with the engineering community in Kenya. All finalised and draft standards and manuals are mandatory until superseded. Best practice guidelines are recommended but not mandatory. Links are included in the table where a reputable online source exists for the document. If not, engineers are advised to either conduct a web search (new sources may become available) or contact the relevant government authority. Also note that new guidelines might be published at any time and a general search for relevant design standards is advised whenever starting a project.

Table 2: Relevant design standards for resilience

Sector and Design Element	Design standard used in practice	Comment
	Drainage design	
Drainage Design	Kenyan Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT)	In 2009 Egis were commissioned to update the Road Design Manual. These drafts were completed but never adopted. However, this draft document on Drainage Design represents a useful update of the original Drainage Design part of the Road Design Manual.
Stormwater design	Neighbourhood Planning and Design Guide of South Africa: Stormwater 2019	A comprehensive guide to stormwater in urban areas that can fill any gaps not answered by the Kenyan Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT)
	Road design	
Street geometry; safety; landscaping, furniture, and green infrastructure; and universal access.	Street Design Manual for Urban Areas in Kenya, 2022	The 2022 Street Design Manual provides broad guidance in design of urban roads and can be applied widely to municipal projects, in terms of landscaping, universal access and project development (including stakeholder engagement.
Pavement design and specification	Road Design Manual for Roads and Bridges: Part	In 2009 Egis were commissioned to update the Road Design Manual.

Sector and Design Element	Design standard used in practice	Comment
	3 - Materials and Pavement Design for New Roads, 2009 (DRAFT)	These drafts were completed but bever adopted. However, this draft document on Pavement Design represents a useful update of the original Pavement Design part of the Road Design Manual. It includes aspects of pavement design related to designing for extreme temperatures, and use of modified bitumen and binders to provide resilience to extreme heat.
Culverts	Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT)	The 2009 Draft provides guidance on hydraulics of culverts, geometry, length and slope, maximum and minimum velocity, materials, selection criteria, debris control and scour.
Bridges	Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT)	The 2009 Draft provides guidance on hydraulics of bridges, freeboard, backwater calculations and inundation, geometry, foundation, and survey requirements.
Building design		
Access; glazing lighting, and ventilation; special requirements for people living with disabilities; firefighting; landscaping	The Current National Building Code (2022 draft was in circulation at the time of writing)	Provides useful simple guidance for layout, design and material specification of buildings.
Structural Design – buildings and bridges		
Resilience to wind and temperature	Eurocode 1: Actions on structures	Since the Eurocodes were gazetted in 2012, Kenya has been transitioning to a new building code based on the Eurocodes, the New Building Code has not yet been adopted but the Eurocodes are in practice.
Geotechnical design	Eurocode 7: Geotechnical design	
Earthquake resilience	Eurocode 8: Design of structures for earthquake resistance	
Waste management		
Solid waste management	The Draft National Building Code 2022	There are no design standards for solid waste management. This a draft code but includes some guidance on waste containment and management for buildings
Community sanitation, toilets, septic systems, septage management	National Urban Public Health Sanitation Guideline 2022	Recent publication by the Ministry of Health

Sector and Design Element	Design standard used in practice	Comment
Wastewater collection systems (sewers)	See Section 7.3 of Draft Practice Manual for Sewerage and Sanitation Services in Kenya	Remains a draft, published by the Ministry of Water and irrigation, 2008
Water		
Water reticulation system design including hydraulic design, material selection, cover and slope of pipes, pressure management and	Chapter 7 Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya (October 2005)	Published by Ministry of Water and Irrigation, 2005
Social infrastructure		
Markets		Markets development and management guide (2016, 2021 draft available). Also see building design and structural design in this table.
Parks	The Draft National Building Code 2022 Street Design Manual for Urban Areas in Kenya, 2019	There is no specific design guidance for parks in Kenya, the Street Design Manual for urban areas in Kenya and the Draft National building code set out some useful design parameters for access, lighting/safety, landscaping, furniture.
Disaster Risk Management		
Fire stations		See building design and structural design.
Fire hydrant system design	Chapter 7.8 1. Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya (October 2005)	Published by Ministry of Water and Irrigation, 2005

3.2 Incorporating climate projections into design

This section provides guidance on how to estimate and include climate change into design calculations. This is essential because significant increases, in sea level, extreme (design) rainfall and temperature, are expected in Kenya and will have an effect on municipal infrastructure.

Summary

- Increase design rainfall and temperature in your design calculations to account for climate change
- Use this Section (3.2) and Appendix A and B to obtain the percentage increases

3.2.1 Background

The projections of climate indicators presented in this document are extracted from the World Bank's Climate Change Knowledge Portal (CCKP)[9] and from the NASA Sea level projection tool. The CCKP models a range of climate indicators for a range of future 'Shared Socioeconomic Pathways' (SSPs). SSPs provide insight into future climates based on defined emissions, development, and carbon reduction efforts. To ensure a conservative approach to

developing climate change allowances, the projections presented are for SSP5-8.5[10].The CCKP presents climate projections for a range of indicators for eight geographical regions of Kenya. Appendix A provides a table to look up the region for each urban area in Kenya to select the appropriate climate projections.

3.2.2 Sea-level rise

Sea-level rise is relevant to all infrastructure adjacent to the coast. The sea-level rise can be found using World Bank's Climate Change Knowledge Portal[11] (CCKP) and is shown in the table for the coastal area in Appendix B. NASA also has a Sea level projection tool showing the rise at more locations along the coast. If designing near coastlines, the sea level for SSP5-8.5 and the design lifetime of the project should be used. In the absence of a design lifetime, 50 years should be used as default.

3.2.3 Extreme rainfall intensity

Surface water drainage is potentially relevant for all infrastructure types under KUSP2. When designing drainage for any roof, site, road, or stormwater system, an appropriate climate change allowance, based on regional climate change projections and project lifetime must be selected and applied to design rainfall.

To estimate rainfall intensity with climate change:

- Look up the relevant region in Appendix A
- Find the relevant graph for the region in Appendix B
- Look up the percentage change using the line for average largest 1 day precipitation and the design lifetime of the project. In the absence of a design lifetime, 50 years should be used as default.
- Increase current design rainfalls by this percentage to obtain a new design rainfall to be used in designs.

What is "Design rainfall, extreme rainfall, IDFs and rainfall intensity" and how are they linked?

The name for the extreme rainfall value that is included in design calculations is called design rainfall. Design rainfall provides a rainfall intensity for various return periods (e.g. the 1 in 100 year storm). Design rainfalls can also be supplied as an Intensity-Duration-Frequency curves.

Need **current design rainfall or historical rainfall?**

Contact the Kenya Meteorological Department (KMD)

3.2.4 Maximum temperature

Maximum temperatures are relevant for specification of materials resilient to heating resulting from climate change, as well as structural design.

Maps for maximum shade air temperature in Kenya are based on historic data and do not account for climate change. Therefore, once maximum shade air temperature has been determined for the location of the project, an appropriate climate change allowance (%) should be applied directly. To estimate the maximum temperature with climate change:

[11] Kenya - Mean Projections Expert | Climate Change Knowledge Portal (worldbank.org)

- Look up the relevant region in Appendix A
- Find the relevant graph for the region in Appendix B
- Look up the percentage change using the line for average for temperature and the design lifetime of the project. In the absence of a design lifetime, 50 years should be used as default.
- Increase current temperatures by this percentage to obtain a new design temperature.

Need **current isotherms of maximum temperature?**

Contact the Kenya Meteorological Department (KMD)

3.2.4.1 Example of maximum temperature in design: Structural design

Eurocodes 1 – Actions on structures – Part 1-5: General actions – Thermal actions [EN 1991-1-5] gives the principles and rules for calculating thermal actions on buildings, bridges and other structures, including their structural elements. Thermal actions on a structure (or a structural element) are those actions that arise from the changes of temperature fields within a specified time interval. EN 1991-1-5 requires the application of maximum shade air temperature through the use of maps of isotherms of national maximum shade air temperatures.

3.2.4.2 Example of maximum air temperature in design: Material specification

Material specification should consider maximum temperatures, this could be in specifying materials, particularly plastics for public furniture or for waste management, but is most pertinent to pavement design for roads.

The *Road Design Manual for Roads and Bridges: Part 3 - Materials and Pavement Design for New Roads, 2009 (DRAFT)* outlines the methodology for designing road pavement and specifying materials for road surfacing with various calculations including temperature (e.g. bitumen binders for asphalt concrete). Although climate change is not in the manual, it can be included using the method in Section 3.2.4 and applying the new temperatures in the calculations.

3.3 Structural resilience

Structural design is critical to the resilience of buildings and other structures, to withstand environmental shocks and stresses during the project's lifetime. In terms of physical resilience, in addition to changes in temperature resulting from climate change, structural design should also take into account actions of wind, and seismic design. The frequency and magnitude of high wind events, or earthquakes, in Kenya are not anticipated to be impacted by climate change and thus 'normal' application of the relevant design codes will provide structural resilience.

Summary

- Follow the draft National Building Code 2022
- Any gaps? – the National Building Code should be updated to reflect the Eurocodes

The following codes should be applied for structural resilience:

- The draft National Building Code 2022
- Where there are gaps in the National Building Code, the Code itself should be updated to reflect Eurocodes to make it easier for municipal officials and local builders to understand standards and the requirements. The following Eurocodes in particular may be relevant:
    - Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions, the existing wind map for Kenya is valid, climate change is anticipated to have limited impact on maximum gust speed. Wind data, as necessary, can be provided by KMS.

- Eurocodes 1 – Actions on structure – Part 1-5: General actions – Thermal actions [EN 1991-1-5]
- Eurocode 8: Design of structures for earthquake resilience, existing seismic maps for Kenya are valid.
- Eurocode 7: Geotechnical design - Part 1: General rules
- Eurocode 7: Geotechnical design - Part 2: Ground investigation and testing

3.4 Incorporating green and blue infrastructure into design

3.4.1 Background: Why blue and green infrastructure is important

Summary

- Follow the draft National Building Code 2022 (mandatory) and Street Design Manual for Urban Areas in Kenya)
- Add swales and rain gardens, where possible.

Due to rapid growth and urban expansion, Kenya's cities are rapidly losing green space, for example, Nairobi has lost 22% of its green space between the period 1988 and 2016.[12] This results in increased urban vulnerabilities with respect to both urban heating and flood risk.

The population residing in the informal settlements are potentially highly vulnerable to heat exposure due to lack of information on heatwave occurrence and risk, lack of access to health services, limited access to potable water, limited householder ventilated and access to cooling.[13] Walking and public transport are the dominant forms of mobility in Kenyan cities, and therefore urban heating will impact connectivity, creating economic impacts, and put the public at risk. Urban flooding is widespread across Kenya due to increases in impermeable urban areas, insufficient investment in drainage to keep up with urban expansion, and poor waste management – which increases flood risks by blocking drains.

Both rainfall intensity and maximum temperatures are projected to rise significantly across Kenya in the next century, and the frequency of extreme heat and flooding are set to continue to rise, exacerbating the vulnerabilities described above.

Provision of green (and blue) infrastructure in the urban environment can help manage these vulnerabilities by shading road surfaces and supporting interception and infiltration of rainfall. Green infrastructure also improves urban liveability, and has the potential to improve both air quality and water quality, and increase urban biodiversity.

Tip for success

Tree species and other plants selected should be native and tolerant of extended dry periods and period inundation. Kenya Forest Service can provide guidance on species selection for each region of Kenya. Tree species should also be low pollen producing to reduce hay fever complaints in citizens

3.4.2 How to include green and blue infrastructure into design

To include green and blue infrastructure into designs use the Street Design Manual for Urban Areas in Kenya and the National Building Code which set out guidelines for landscaping. These guidelines are mandatory for all public spaces, including road corridors, non-motorised transit lanes, and around public buildings, particularly at their entrances and other high pedestrian traffic areas. Parks are an exception and should include significant tree cover, but do not have to deliver 'continuous shade'.

[12] Langsdale, M., 2017. A comparison of greenspace loss and urban expansion over time in London and Nairobi
[13] Ibid.

The following best practices should be included where possible.

- Where the space allows, **raingardens** should be incorporated into street corridors and public spaces to capture and store clean runoff from local roofs and pedestrian areas. Raingardens are landscaped and planted areas, lower than surrounding areas, where rainwater is stored and (soils permitting) infiltrated. They should be planted with species which can tolerate occasional inundation. Outlets take excess runoff to the storm drainage system. These should be considered in parks taking runoff from the local area. In other urban areas they can be bounded with street furniture.
- **Swales** should also be considered where space allows. Swales require a disproportionately larger width than conventional stormwater drainage due to the shallow depth but provide benefits. Swales are shallow vegetated stormwater channels which reduce stormwater runoff rate, promote infiltration, and improve water quality.
- As noted in Section 2.3.1.1 in relation to project location, **riparian reserves should always be preserved**, as these act as urban green/blue corridors and support temperature regulation.

Green infrastructure requires considerable maintenance in the first months of establishment, after which the maintenance burden is reduced. After planting, extra provision (beyond usual urban landscaping maintenance) must be given to tend and replant immature vegetation until well established. For this reason, partnership with local communities should be considered to assist in the maintenance of green infrastructure. Further, consideration should be given to understanding what would incentivise local communities to maintain such infrastructure (e.g. revenue generation from trash collection, opportunities for urban agriculture, performance-based grants to local communities for regular maintenance, jobs etc).

3.5 Incorporating universal access and safety into design

Universal access is the ambition to design infrastructure for public services and public environments in such a way so that as many people as possible can use them, regardless of age or ability. Prioritising universal accessibility to services provided by municipal infrastructure such as public transport, economic infrastructure and parks increases the opportunities for the most vulnerable members of communities including persons with disabilities to benefit from and contribute to community resilience. When investing in new infrastructure- or when making significant improvements to existing infrastructure- there is a benefit in making improvements that will achieve multiple social, and climate objectives.

Streets and public spaces designed according to universal access principles accommodate assistive devices for persons with disabilities (e.g., wheelchair), which can benefit other groups such as the elderly.

Article 54 of the Constitution of Kenya recognises the needs of persons with disabilities, stating that persons with disabilities are entitled to reasonable access to places and transport services. The Persons with Disabilities Act of 2003 further entitles persons with disabilities “to a barrier-free and disability-friendly environment to enable them to have access to buildings, roads and other social amenities.”

Some of the activities that may enhance universal accessibility and need to be mainstreamed in the program design include;

- respect for design /technical standards that promote universal access.
- advocacy, and awareness raising.
- meaningful participation of the vulnerable groups
- capacity development to the technical staff and contractors

The Street Design Manual for Urban Areas in Kenya states that:

An accessible environment has ample, well connected pedestrian facilities with unobstructed space for movement, consistent pavement surfaces, appropriately sloped ramps, and safe pedestrian crossings. Multiple elements of the streetscape must be designed in an integrated manner in order for the space to work. People with small children, people carrying heavy shopping or luggage, people with temporary accident injuries and older people can all benefit from an inclusive transport environment.

The current requirements for universal access and safety of the Street Design Manual for Urban Areas in Kenya and the Draft Building Code are summarised in Table 3 below. The table also includes additional best practice. Reference can also be made to the World Bank's Technical Note on Accessibility – Fact Sheet 4.

Table 3: Summary of universal access requirements and good practice

Footpaths
Footpaths are integral to urban transport in Kenya. They should be accessible to all.
▪ Minimum clear width of 2 m. For areas with high pedestrian volumes, wider footpaths should be provided ▪ Elevation over the carriageway of +150 mm ▪ Constant height at property entrances ▪ Continuous shade through tree cover ▪ Continuous 2 m high head clearance along pathways ▪ No railings or barriers ▪ Ramp slopes are no steeper than 1:12 ▪ Cross slope of 1:50 for drainage ▪ Tactile pavers for people with visual impairments ▪ Bollards should be installed to prevent vehicles from parking on footpaths, with spacing of 0.9 m between at least one set of bollards to allow wheelchairs to pass. ▪ Where feasible design closed drains to allow ease in access for persons with a disability and the elderly.
Crossings
A formal pedestrian crossing should be located wherever there is a concentrated need for people to cross the street (e.g., at a bus stop, at an entrance to a shopping mall, or school, or where a path intersects the street).
▪ Located at pedestrian desire lines. This should be clearly delineated with appropriate ground markings and with signs for vehicular traffic ▪ The entire crossing should be accessible to persons with disabilities with curb cuts located at transitions between sidewalk and crosswalk. ▪ Unsignalised crosswalks should be elevated to the level of the adjacent footpath (i.e., 150 mm). ▪ For signalised crossed in urban centres where noise may be a hazard, auditory cues for safe crossing can be provided in addition to visual indicators ▪ For tabletop crossings, a height of +150 mm above the carriageway and ramps for vehicles with a slope of at least 1:10 to reduce vehicle speeds to 20 km/h ▪ Width of 3 m or equivalent to the adjacent footpath, whichever is larger ▪ Footbridges and subways are to be avoided
Cycle tracks
For cycling to be safe and comfortable, major streets require cycle tracks that are physically separated from mixed traffic. Dedicated facilities are needed to encourage cycling among people of all ages and abilities. The cycling network should offer a dense set of routes serving all city areas and key destinations through the shortest possible routes. Specifically, all residents should be able to access a dedicated cycle facilities near their homes.
▪ Positioned between the footpath and carriageway ▪ A minimum width of 2 m for one-way movement, and 2.5 m for two-way movement ▪ Elevated +150 mm above the carriageway ▪ Physically separated from the carriageway—as distinguished from painted cycle lanes, which offer little protection to cyclists. Swales and other drainage related infrastructure could be designed into such spaces to increase level of safety provided by buffer zones. The buffer should be at least 0.5 m wide and should be paved if it is adjacent to a parking lane. ▪ One bollard placed in the middle of the cycle track, to allow for cyclists to pass on either side ▪ A smooth surface material—asphalt or concrete. Paver blocks are to be avoided
Bus stops

Bus stops must be accessible to all, providing ease of access to public transport.

- On streets with one carriageway lane per direction or at terminal locations, the stop may incorporate a bus bay provided that there is sufficient clear space for walking behind the shelter.
- Bus stops require shelters with adequate lighting; protection from sun and rain; and customer information
- Cycle tracks should be routed behind bus shelters
- Buses should also be accessible

Space for Vendors

Space for vendors should be included in public spaces, including road corridors, parks, and other public spaces, where there is a demand for their services. By defining and managing these spaces in the design process, their impact on accessibility can be reduced. Street vending provides essential goods and services to a wide range of population groups. It also makes public space safer by contributing “eyes on the street”.

- Street vendors should be accommodated where there is demand for their goods and services—near major intersections, public transport stops, parks, and so on
- Supporting infrastructure, such as cooperatively managed water taps, electricity points, trash bins, and public toilets, should be provided
- Vending areas should be positioned to ensure the continuity of cycle tracks and footpaths. The furniture zone of the footpath is an ideal location.

Lighting

Lighting should be provided in all public areas to improve safety, including road corridors, parks, and other public spaces, such as adjacent to public buildings, such as markets.

- The spacing between two light poles should be approximately three times the height of the fixture
- Poles should be no higher than 12 m. Especially in residential areas, they should be significantly lower than 12 m to reduce undesirable illumination of private properties Additional lighting should be provided at conflict points
- The placement of street lighting should be coordinated with other street elements so that trees or advertisement hoardings do not impede proper illumination
- The placement of street lighting should also be coordinated to provide lighting at changes in condition (street crossings, elevation changes, irregular obstacles, etc)

Street furniture

Furniture and amenities should be located where they are likely to be used. Furniture is required in larger quantities in commercial hubs, market areas, crossroads, bus stops, BRT stations, and public buildings. Furniture provides rest areas, promoting universal access.

- Street furniture, especially benches and tables, should be placed where it receives natural shade
- Supplementary space should be provided at spaces adjacent to select benches and tables to accommodate wheel chair users and persons with disabilities.
- Furniture should be located where it does not obstruct through movement
- On streets with large numbers of pedestrians and commercial activity – especially eateries – trash bins should be provided at regular intervals

Traffic calming

Traffic calming measures ensure pedestrian and vehicle safety by reducing at least speed and potentially also the volume of motor vehicles. Traffic calming slows down vehicles through vertical displacement, horizontal displacement, real or perceived narrowing of carriageway, material/colour changes that signal conflict points, or the complete closure of a street.

- Speed restrictions, incorporating physical traffic calming measures, should be applied near schools and on any shared streets.
- Shared lanes are safe for pedestrians, cyclists, and motor vehicles to travel together if speeds are restricted to 15 km/h.
- For speeds up to 30 km/h, separate footpaths should be provided but cyclists can travel in the carriageway.
- Speed bumps must be at least 900 mm in length, and the gradient of the speed bump must be 1:10.
- Speed bumps must be a minimum height of 5 cm and maximum height of 1 0cm. This then means that drivers must slow down to less than 10 kph to navigate a road speed bump without damage.
- Speed bumps should be placed between 20 metres and 150 metres apart depending on the desire to reduce speed.

Buildings

Public buildings should be accessible to all

- Access shall be provided from a point on the plot boundary to at least one entrance. The access shall not have a step, kerb, steep ramp, door or doorway which would impede the passage of a wheelchair, or other form of barrier which would prevent access by a person living with a disability. If the accessible entrance is a secondary entrance, way finding signage should direct building visitor from the primary entrance to the accessible entrance.
- Access ramps to buildings should be at least 1.5m wide. It should be provided with handrails on both sides. If the ramp has a gradient greater than 1 in 20, a landing that is 1.5m long is provided for each 10m length of horizontal run.
- Disabled cubicles should be provided at all toilet facilities provided in public buildings and in public spaces.

•

Figure 5. Good practice in universal access: A wheelchair accessible ramp at the Homa market

3.6 Gender considerations

3.6.1 Background

Women and men do not always benefit equally from improvements in urban infrastructure and services. They may have different requirements, vulnerabilities, expectations and perceptions of security. Inclusive and safe transport and social infrastructure provides access to education, work, health care, cultural, and other important activities that are crucial to women's participation in the society. Of particular concern in the design of public infrastructure is the level of safety and security that female users experience.

3.6.2 Requirements for gender consideration in design

The following is mandatory:

- Inclusive engagement with women and girls. Designers should attend participation meetings (see Section 2.3.42.3.4 on Community engagement and participation) to lay out designs and consider design alternatives that enhance the participation, safety and

access of women and girls to public spaces and infrastructure. As noted in Section 2.3.4, Community engagement and participation it is critical to have balanced input in public consultation.

- All designers must consult the case studies in the *World Bank Handbook for Gender Inclusive Urban Planning Design 2020* and consider whether any of the recommendations could be implemented in designs.
- Designers should at least consider and design the following (or justify why they cannot be designed for that particular project):
  - Increase security by providing lighting (Street Design Manual for Urban Areas in Kenya).
  - Reduce dead spaces (e.g. abandoned buildings where criminals might hide).
  - Increase accessibility for women with children by providing ramps or walkways wide enough for prams (see Table 3 for summary).
  - Create mixed-use zones that promote home-based economic activity and access to services close to home.
  - Provide suitable areas for childcare.
  - Provide bathrooms that women can use in private but are close enough to busy areas for women to seek help.

3.7 Design documentation

Designs should be undertaken, or overseen, by a registered professional engineer, and **Design Reports must be signed off by a registered professional engineer** under / approved by the Engineers Board of Kenya.

Design documents should be stored in hard copy and soft copy, and should include:

- Site plan.
- Drawings.
- Relevant design reports and/or calculation sheets.
- Material specification and Bill of quantities.

4. Sectoral Design Considerations for Resilience

4.1 Connectivity, Mobility and Accessibility

Connectivity, mobility and accessibility can be threatened by hazards such as floodwaters and if poorly designed can become hazards themselves. Connectivity projects should incorporate design elements that increase the resilience of the public users of the systems. To increase the resilience of assets related to connectivity, mobility and accessibility, designs should incorporate the criteria shown in Table 4 below.

Table 4 Resilience measures for connectivity design

Hazard & Impact	Required or best practice	Resilience measure
Designing for resilience		
Various	Required	Follow the Street Design Manual for Urban Areas and Road Design Manuals (2022)
Concrete can become damaged and cause accidents	Required	Ensure that all concrete structures have sufficient concrete over reinforcing to protect the steel from erosion and other harmful impacts, e.g. chlorides and vehicle traffic. This will decrease road damage that leads to accidents and decrease long term durability.
High groundwater tables can damage roads and can be further exacerbated by high rainfall due to climate change. Damaged roads are accident hazards	Required	Determine the level of groundwater where roads or non-vehicle access ways are to be built. Design to ensure that groundwater remains below the sub-base level of the road (e.g., by designing subsurface drains)
Designing for better operation and maintenance		
Accessibility can be decreased if street furniture is stolen or damaged	Required	Design street furniture (e.g., benches) such that they are difficult to steal and resilient against high temperatures (e.g. cast in place pre-cast concrete benches rather than moveable wooden benches). Ensure street furniture does not obstruct pedestrian or bicycle traffic or cause a hazard to vehicle traffic.
Green Infrastructure		
The hazard of flooding can be increased by the paved surfaces used to provide connectivity and accessibility	Best practice	Consider the use of permeable surfaces for parking areas, walkways and any other paved area to increase infiltration and reduce flooding (e.g., permeable interlocking blocks or grass blocks).
The hazard of high temperatures can be addressed in connectivity designs	Required	Retain and add trees next to roads and NMT routes wherever possible for shade and cooling of the urban environment in line with Urban Street Design Manual. Ensure trees do not obstruct traffic or the vision of drivers. Ensure tree species are resilient to predicted climate changes (able to survive in droughts and high temperatures). Ensure trees are not high pollen producing which could cause another health hazard (allergies)
The hazard of high temperatures can be addressed in connectivity designs	Required	Develop a plan for ensuring tree survival especially in the first few years including watering and fertilizer. Guidance on the selection of appropriate species in different regions can be provided by Kenya Forest Service
Access		
Crime can decrease use of access ways reducing connectivity	Required	Include lighting in designs to improve safety. Preferably use power sources that are resilient against power outages (e.g., solar with mains backup).
Access can be increased	Required	Design for universal access. In particular, designs need to make provision for walking as it is the dominant means of transport in Kenya.

4.2 Solid Waste Management

The goal of solid waste management is to address the hazard of disease, contamination and impacts on fauna and flora due to solid waste (usually called litter, trash or rubbish). Consequently, solid waste management inherently provides resilience, and reduces the potential for trash blocking stormwater and drainage systems, reducing the likelihood of urban flooding and ultimately reduce public health and environmental impacts. To increase the resilience of solid waste management assets against hazards and prevent assets from becoming hazards, designs should incorporate the criteria shown in the Table 5 below. The incorporation of criteria below for solid waste should also help in promoting the segregation of waste and enhancing the community's participation in Reduce, Reuse, Recycle.

Table 5 Resilience measures for solid waste management

Hazard	Required or best practice	Resilience measure
Designing for resilience		
Solid waste	Required	Designs should specify dustbins (trash receptacles) on every city block, along pedestrian walkways and public open spaces such that people have easy access to these, especially the elderly and the disabled who cannot walk long distances.
Designing for better operation and maintenance		
Solid waste	Required	Design dustbins (trash receptacles) that are difficult to remove, steal (e.g., cast-in-place concrete) and where possible in a way that prevents or minimises vandalism. Ensure that any such dustbins do not create a traffic hazard. It is noted that the incorporation of dustbins in all blocks will require a level of maintenance and enforcement to ensure that the trash is regularly collected and to prevent the area from becoming a dumping ground.
Flooding	Required	Design dustbins that are flood resistant (e.g., cannot easily be knocked over and have a top cover to limit rainwater entering the bin).
Wind	Required	Design dustbins that won't blow over even in high winds (e.g. concrete)
Flooding	Required	Design drainage for transfer stations such that contaminated runoff is separated and contained and any clean runoff is diverted around the station and can reach watercourses or existing drains

4.3 Wastewater

The goal of wastewater systems in cities is to safely collect, treat and discharge wastewater to the environment. Consequently, waste management inherently provides resilience. However, hazards exist that can affect how well systems perform and, if badly designed, systems themselves can become hazards. To increase the resilience of systems against hazards and prevent assets from becoming hazards, designs should incorporate the criteria shown in the Table 6 below.

Table 6 Resilience measures for wastewater

Hazard and Impact	Required or Best Practice	Resilience measure
Designing for resilience		
Various	Required	The National Urban Public Health Sanitation Guideline 2022 and the Draft Practice Manual for Sewerage and Sanitation Services in Kenya should be followed as a minimum.
Various	Best practice	Another useful reference in the Sanitation section in the Neighbourhood Planning and Design Guide of South Africa
Ingress of stormwater and groundwater in small volumes but in many locations can overwhelm systems, causing overflow and a health hazard	Required	Design sewers to allow for some amount of stormwater and groundwater ingress (manuals provided recommended percentage increases. E.g., Neighbourhood Planning and Design Guide of South Africa). Add a further the percentage to account for increased water due to climate change
Flooding of system components	Required	Planning of retention and safety basins to avoid overflow to the drainage network and pollution spills downstream
Stormwater entering sewer systems can overwhelm systems and cause flooding	Required	Solid manhole covers could prevent stormwater entering sewers.
Vehicles and swift water can damage sewers where they cross roads and rivers. Damaged sewers can leak creating a health hazard	Required	Ensure careful design where sewers cross roads or rivers and consider encasing sewers in concrete at these points.
Designing for better operation and maintenance		
Flooding of system components	Required	Elevate mechanical and electrical equipment in operations or maintenance facilities
Illegal connections to sewers (e.g., to drain stormwater) can overwhelm systems and cause flooding	Best Practice	Design sewers to allow cameras (e.g., limit bends) to be used to find illegal connections or leaks in the future is also recommended. Where the system allows, intensify connection of households to sewerage systems to reduce illegal sewer connections.
Stolen manhole covers can allow stormwater to enter wastewater systems, potentially overwhelming them and causing flooding and a health hazard	New, existing	Use concrete or HDPE manhole covers to decrease the likelihood of theft. Ensure all manhole covers in roadways are sufficiently strong to withstand traffic loads. Promote routine inspection of sewer lines and ensure manhole covers are secured to limit health and safety risks.
Water quality concerns associated with soakaways which drains to watercourses	Best Practice	Soakaways to be regularly cleaned and maintained to avoid pollution of downstream watercourses.
Inaccessible sewers are difficult to maintain. If leaks occur they can cause a health hazard	Best practice	Design sewers to run through public, accessible land or ensure easements are in place such that sewers can be easily accessed for maintenance at a later stage.
Sewers can pose a hazard to water supply lines if they leak	Existing	Install sewer lines below water pipes to prevent contamination of water supply if any leakage of wastewater occurs. Create awareness amongst the public to report sewer leakages along the pipelines.

4.4 Water

The goal of water supply in urban areas is to provide residents and businesses with the water required to live, be healthy and conduct business. Consequently, water supply projects inherently increase the resilience of a city. However, hazards exist that can affect how well systems perform. To increase the resilience of systems against hazards and prevent assets from becoming hazards, designs should incorporate the criteria shown in the Table 7 below.

Table 7 Resilience measures for water systems

Hazard and impact	Required or Best Practice	Resilience measure
Designing for resilience		
Various	Required	The Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya (2005) should be followed as a minimum.
Floods and vehicles can damage water supply systems causing damage and interruption of water supply	Required	Design protection for water supply systems against floods and any other hazards Encase pipes under roads and rivers in concrete and install or retrofit lines across streams sufficiently below the streambed to reduce the potential of erosion. Elevate or relocate finished water tanks Reinforce the foundation and supports of elevated tanks that are in a floodplain Elevate pump stations above the design flood level. Waterproof electrical components
Various, consult manuals	Required	Carefully consider the material used for pipelines (HDPE, steel) as each has very specific applications (a good summary is provided in the water supply section in the Neighbourhood Planning and Design Guide of South Africa). If in doubt, for small diameter pipes, use HDPE and electrofusion welding because HDPE is resistant to sunlight and flexible. Design bedding of pipes carefully to the requirements in manuals and guidelines
Designing for better operation and maintenance		
Water supply interruption	Required	For small water storage tanks engineer a by-pass around the tank so that supply can continue even if tank has a problem (e.g., A leak)
Water supply interruption	Required	Wherever pumps are part of the system (e.g., at small storage tanks), have standby pumps in case a pump fails.
Leaks can contribute to water shortages and interrupted supply	Required	Include district meters, section meters, shutoff valves and pressure sensors in design to allow for easier leak and stress detection when the system is operational.
A lack of access can prevent maintenance and repair due to other hazards	Best Practice	Design water pipelines to run through public, accessible land or ensure easements are in place such that pipes can be easily accessed for maintenance at a later stage.
Leaks for sewer lines can enter water supply lines causing diseases	Required	Ensure that water pipelines are installed above sewer lines and with sufficient space between the two (as per standards and manuals).
Crime can damage water supply systems leading to water supply interruption	Best practice	Consider theft and vandalism in the design (e.g., fencing, use of HDPE rather than copper piping).
Animals, if present, can contaminate water or damage infrastructure	Required	Prevent animals contaminating the water supply by fencing tanks and collection areas with humans-only access via a gate.

4.5 Stormwater

Stormwater projects are likely to be prioritised in areas where urban flooding problems have been identified. Stormwater systems inherently provide resilience to communities by preventing flooding. However, hazards exist that can affect how well stormwater systems perform and, if badly designed, stormwater systems themselves can increase hazards. To increase the resilience of stormwater assets against hazards and prevent stormwater assets from becoming hazards, designs should incorporate the criteria shown in Table 8.

Table 8: Resilience measures for stormwater design

Hazard & Impact	Required or best practice	Resilience measure
Designing for resilience		
Various	Required	When designing stormwater infrastructure, follow the Kenya Draft Drainage Manual 2006
Climate change could increase rainfall intensity overwhelming stormwater systems and causing flooding	Required	Design for resilience against climate change 1. Increase design rainfalls as specified in Section 3.2 and using the values for your region in Appendix B. 2. Estimate flow rates for stormwater infrastructure (e.g. drains and culverts) using the design rainfall and the methods in the Kenya Draft Drainage Manual 2006 3. Size the stormwater infrastructure using the flow and the methods in the Kenya Draft Drainage Manual 2006
Erosion due to high velocities needs to be mitigated through design	Required	Estimate velocity in designs and use materials that are resistant to erosion including allowance for climate change (general guidance: Kenya Draft Drainage Manual 2006, climate change: Appendix B). Consider options that are erosion resistant and permeable (e.g. Armorflex paving or grass blocks). Consider options to slow flows such as stone pitching or drop structures (note that erosion of concrete line channels has been observed in areas with slopes exceeding 10%)
Downstream flooding could result if designs don't consider where stormwater is flowing and how it will reach rivers	Required	Design without causing increased flooding downstream Ensure that surface escape routes are left open for urban stormwater to reach nearby rivers and streams for at least the 1 in 100 year flood. If impossible, design pipes or small drainage channels (typically less than 1m width) to take stormwater to nearby rivers and streams
New areas: Designing stormwater infrastructure without causing increased flows downstream of the project	Required	Design attenuation in new areas to mimic pre-development flows for the full range of flood recurrence intervals Consider options such as attenuation basins, infiltration basins, permeable paving and other attenuation methods, also making provision for attenuation as close as possible to the source of stormwater runoff Size the attenuation infrastructure so that peak flow rates up to the 100-year storm with climate change is not increased by the development
Brownfields areas (already built up): Designing stormwater infrastructure without causing increased flows downstream of the project	Best practice	Design attenuation in built up areas, if possible For areas that are already very built up (e.g., where a drain is being added beside a busy road) seek attenuation opportunities if space allows Look for small areas of open land that can be used for attenuation Increase attenuation in these areas by designing small attenuation basins, infiltration basins, vegetated infiltration areas, tree pits or swales
Flooding due to pipes becoming undersized because of blockages	Required	Assume that pipes or culverts will be 50% blocked when carrying out sizing estimates.
Erosion hazards exist where stormwater transitions from concrete to overland flow	Required	Add dissipators and other appropriate erosion protection structures where drains flow into natural streams or channels or onto open ground.
Designing for better operation and maintenance		
Stormwater drains can become damaged if	Required	Design grades for stormwater drains to ensure that stormwater does not scour but also does not allow sediments to collect. Target self- cleaning

Hazard & Impact	Required or best practice	Resilience measure
high flow velocities causes erosion		velocities of no less than 0.75 m/s as per Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT). For steep areas, drop structures should be considered or appropriate lining of drains to prevent erosion
Culverts and pipes can become blocked by trash	Required	Use a minimum culvert size of 450 mm to reduce the chance of blockage as per the Road Design Manual for Roads and Bridges: Part 2 - Drainage Design, 2009 (DRAFT) Design covers for manholes or catchpits to prevent litter entering piped systems. Specify HDPE manhole covers to discourage theft Design trash capture in drains before water reaches culverts or pipes (e.g., grates on upstream side of culvert) Use a trash grate wherever open channels transition to buried pipe to reduce blockage by litter
Green Infrastructure		
Temperatures in cities are raised and climate change can increase temperatures further leading to heat illnesses in residents	Best practice	Where possible use designs that can be vegetated (e.g., raingardens, swales and vegetated infiltration basins for attenuation)
Access		
Access/Trip/Fall	Best practice	Design small bridge crossings over open channels (e.g., concrete rafts). The bridge should be level and extend sufficiently onto each side of the drain such that it cannot become dislodged or damaged due to flooding. The bridge should not obstruct storefronts.

4.6 Parks

Parks can form part of the resilience of an urban area to both heat stress and flooding. Both these hazards could be worsened by climate change.

Table 9 Resilience measures for parks

Hazard and Impact	Required or Best Practice	Resilience measure
Designing for resilience		
Flooding park and surrounding area	Best practice	Using park space for vegetated stormwater attenuation via swales, rain gardens, vegetated basins, infiltration basins and tree pits
Disaster relief	Best practice	Parks can be used as spaces of refuge, safety and assembly during disasters (except for flooding if the park is used for flood attenuation). Providing space and relatively flat areas and some high ground for vehicles to access the community during disasters (e.g. water tankers when water supplies are cut-off).
Designing for better operation and maintenance		
High temperatures in general and due to climate change which can create health hazards	Required	A plan for planting and supporting the growth of vegetation, especially in the first few years, when vegetation is vulnerable.
Various	Required	Maintenance should be included into design plans and costed such that budgets can be set aside. Maintenance should include at least the following: • Watering and fertilizer for plants, if needed • Removal of tall vegetation periodically • Security personnel or police patrols • Removal of litter especially from stormwater basins or other infrastructure
Green Infrastructure		
High temperatures in general and due to climate change which can create health hazards	Required	Including trees in designs which will provide shade and relief from the heat hazard in urban areas.
Flooding hazards can be turned into an opportunity	Best practice	Including rainwater harvesting from the roofs of buildings in the park. Water can be used for community gardens or to water vegetation in general.
Access and gender inclusivity		
Crime and feelings of insecurity	Required	Lighting in line with the Street Design Manual for Urban Areas in Kenya and the Kenyan Building Code. The spacing between two light poles should be approximately three times the height of the fixture. Power should preferably be from an onsite renewable source (e.g., a solar panel) with a mains back up so that the power is less affected by both mains supply outages and rainy days. Clear sight lines must be included in parks such that criminals cannot easily hide and surprise their victims (E.g., use of trees with little under brush and not using dense bushes that can providing hiding spaces)
Accessibility	Best Practice	Include way finding signage
Lack of accessibility to public spaces	Required	Include universal accessibility features such as roads and pavements that are accessible for people with disabilities (e.g. wheelchair

accessible). Toilets that women can use in privacy and that are accessible for people with disabilities

4.7 Markets and other social infrastructure

For any structures built as part of a market the relevant Eurocode (e.g. Eurocode 1,7 and 8) should be followed until the Kenyan Building Codes have been released. Markets development and management guide of Kenya should also be consulted (2016, 2021 draft available).

Table 10 Resilience measures for markets and other social infrastructure

Hazard and Impact	Required or Best Practice	Resilience measure
Designing for resilience		
Temperature and flooding	Required	Roofs and floors such that goods are neither in the mud on rainy days or the sun on sunny days. Consideration should be given to roofing material, as corrugated iron (which is commonly used in many developing country markets) can significantly contribute to high inside temperatures).
Disaster relief	Required	Markets to be designed considering their potential function as a disaster management centre. Therefore, market locations outside floodplain areas should be prioritised, as should road access. This is important because markets can form part of the resilience of an urban area by acting as a public shelter or safe space during disasters. The space in the market could be used for storing or distributing food.
High temperatures in general and due to climate change, which can create health hazards	Required	Specify suitable a roof material that does not magnify high temperatures (e.g., roofs should not be corrugated iron sheets). Providing adequate natural ventilation measures to increase resilience to extreme heat. Methods could include high roof clearance, ventilated roof spaces to allow free air circulation, spinning vents on roof tops or louvered blocks.
High temperatures in general and due to climate change, which can create health hazards	Required	Include engineered joints in concrete to allow for concrete expansion and contraction due to temperature. Consider temperatures due to climate change during design
Fire risk	Required	Specify fire hydrants along market corridors.
Designing for better operation and maintenance		
High temperatures in general and due to climate change, which can create health hazards	Required	Include in designs a plan for supporting the growth of trees, especially in the first few years, when vegetation is vulnerable.
Flood risks	Required	Designing adequate surface water drainage for the market and ensuring drainage connects into the larger urban stormwater system or a river or stream.
Better operation and maintenance and flood risks	Required	Designing floors that are easy to wash (e.g., smooth concrete floor that slope gently towards drains).
Pollution risks	Required	Including many solid waste bins or trash cans that are difficult to steal and don't blow away in high winds and don't collect rainwater (e.g., cast-in-place concrete bins with covers).
Green Infrastructure		
High temperatures in general and due to climate change, which can create health hazards	Required	Including the planting of trees to reduce urban temperatures and provide shade, where space allows.
Flooding	Best practice	Including rainwater harvesting from the roofs of buildings in the market.
Access and gender inclusion		
Accessibility	Required	Alternative ramps for people with disabilities to access the market from street level and to access upper floors of the market.

Gender inclusion	Required	Include infrastructure that is suitable for use as childcare facilities.
Gender inclusion		Include a security plan and security features such as adequate lighting with an independent power supply (e.g., solar).
Accessibility and Gender inclusion	Required	Public toilets including male and female and toilets for people with disabilities

INFRASTRUCTURE DIAGNOSTIC BOX 5:

Good practice in resilient design, construction of Homa Bay municipal market

A stormwater drainage system is provided, which discharges to an existing road rain (although climate projections were not considered in its sizing). Steep earth faces stone pitched for protection against soil erosion. Natural ventilation is provided, and expansion joints have been included to cater for volumetric changes due to temperature variations (in line with design standards).

Electric lighting for security has been enhanced. Trees planting along access roads and landscaping included in the design. Rooftop rainwater harvesting has been provided, in line with new regulations on water harvesting, to provide an alternative water supply and reduce the pressure on existing water resources systems during drought.

4.8 Firefighting stations and facilities

Firefighting stations and facilities can form part of the resilience of an urban area including to climate change. At a minimum, guidance on firefighting water provided in Chapter 7.8 of the Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya (2005) should be used. For any structures built as part of a fire station the relevant Eurocode (e.g. Eurocode 1,7 and 8) should be followed until the Kenyan Building Codes have been released.

Table 11 Resilience measures for firefighting stations and facilities

Hazard and Impact	Required or Best Practice	Resilience measure
Designing for resilience		
Water supply reliability and volumes	Required	Assessing whether water is available for firefighting if rising demand in the area reduces supply volumes available from water sources. Design measures to increase supply or consider alternative supplies (e.g., boreholes) if needed.
Flooding that could prevent access during disasters	Required	Being located well outside of any area that may flood in an extreme storm event.
Flooding	Required	Designing adequate drainage and ensuring drainage connects into the larger urban stormwater system or a river or stream.
High temperatures	Required	Specify suitable roof material that does not magnify high temperatures (e.g., roofs should not be corrugated iron sheets)
Designing for better operation and maintenance		
Better operation and maintenance	Required	Designing floors that are easy to wash (e.g., smooth concrete floor that slope gently towards drains).
Better operation and maintenance	Required	Including many solid waste bins or trash cans that are difficult to steal and don't blow away in high winds and don't collect rainwater (e.g., cast-in-place concrete bins with covers).
Green Infrastructure		
High temperatures	Required	Including the planting of trees in the design of fire stations, where space allows, to reduce urban temperatures and provide shade.
High temperatures	Required	Including a plan supporting the growth of trees, especially in the first few years, when vegetation is vulnerable
Flooding	Best practice	Including rainwater harvesting from the roofs of buildings of the fire station.
Access and gender inclusivity		
Crime and feelings of insecurity	Required	Including a security plan and security features such as adequate lighting as per the Kenyan Building Code and Street Design Manual for Urban Areas in Kenya with an independent power supply (e.g., solar with a back up to mains).

5. Construction and maintenance for resilience

This is not an exhaustive guide to commissioning infrastructure delivery, but some highlights based on lessons learned and best practice identified under review of KUSP investments. As best practice, it is recommended that county and municipal engineers determine the performance standards the proposed intervention should adhere to on a project-by-project basis.

5.1 Contracting design work

The majority of design work under KUSP and under KUSP2 is done 'in-house' by county and municipal engineers, but some design work was contracted out under KUSP. Some guidance in developing tender documents for design work under KUSP2 is provided below:

- Specify the design standards to be followed.
- Include provisions for incorporating resilience measures into design based on the project typology, using this report as a guide, this should include but should not be limited to:
  - Consideration of climate change in design, most importantly increased temperatures, increased sea level and increased rainfall intensity over the lifetime of the project, as described in this document.
  - Consideration of other hazards, wind, temperature, seismic hazards on structural design.
  - Provision for appropriate landscaping and green infrastructure design, as described in this document.
  - Provision for applying universal access principles in design, as described in this document.
- Include provisions for designers to budget to attend meetings with representatives of the community and beneficiaries to develop solutions to increase community resilience.
- Designs should be reviewed for compliance with the above using this document as a guide. Designers should be made aware of this document and use it as a basis for resilient design. Note that this document is not a replacement for existing design codes and other best practices.
- Where the capacity to review detailed design within the county or municipal engineering offices, due to its complex nature, this function can also be contracted to a registered professional engineer.

5.2 Contracting construction

Based on lessons learned under KUSP investments, improved resilience outcomes for construction of KUSP2 investments can be realised by following the below guidance. Consideration should be given to incorporating the below as requirements into tender documentation:

- Strict adherence to the Environmental Management Plan prepared under the Project Report. This should include but not be limited to providing temporary access as necessary, managing site surface water runoff, managing dust, noise, etc.
- Ensure that procurement documents include:
  - A contract specifically for construction (consider NEC, FIDIC or other similar standard contracts)

- A set of criteria to ensure that a contractor with the necessary skills and experience is selected (e.g. requiring references from similar projects)
- Provisions for reinstating roads and other public areas affected by construction as existing or better.
- Provisions for the contractor, or the contractor's representative, to attend monthly meetings on site with the community to resolve design issues, or hazards relating to construction.
- And provision for some flexibility for the design to be amended based on community considerations which were not captured before commencement of works. For example, using a re-measurable bill of quantities where contractors provide rates for each item rather than just one fixed cost for the entire project.

- Provision of as-built drawings in hard and soft copy.
- Specification of a retainer to be paid on satisfactory completion of works and a further retainer to be paid after a defect's liability period.
- Certificates of materials testing from approved public works (or other suitable) laboratories.
- As built drawings provided in hard and soft copy, with reports describing variances from design drawings.

To ensure appropriate resilience measures are incorporated into projects, supervision of works and coordination between the builders and regulators is recommended throughout construction, particularly in the case of technically complex projects.

5.3 Community engagement during construction

Monthly meetings should be held with community representatives, environmental/social safeguards specialists, the designer or work supervisor, and the Contractor. These meetings with community representatives can identify design or construction risks which and not been foreseen in planning and design. These meetings build local ownership of the project, and build awareness of resilience, design and operations, safety, theft and vandalism reduction, and community maintenance aspects. The community can provide useful additional 'eyes on the ground' to support supervision of construction works in accordance with design and environmental management plan.

Community partners should be encouraged to establish a documentation system to facilitate more efficient monthly meetings and communication.

A meeting after completion of the works but before the end of the defect's liability period should be included with the community so that the community can add any snag list items prior to the final retention being paid out.

5.4 Operation and maintenance

All infrastructure will require some operation and maintenance (O&M). O&M is critical to the asset continuing to function effectively and also helps to minimise health and safety risks and maximise universal accessibility. To that end, every project should have a plan for operation and maintenance- which usually would form an asset management plan (Note: monitoring is key to this plan but is covered in Section 5.5 of this report). Responsibilities and budgets for operation and maintenance of projects must be established at design stage. The following operation and maintenance guidelines apply to all projects:

- Design with operation and maintenance in mind by incorporating the design guidelines in this document (Section 4).

- Ensure that designs are issued with an operation and maintenance manual that includes a schedule for when maintenance should be performed. Manuals should specify annual (minor) inspection and maintenance schedules and longer term 'capital' maintenance schedules.
- Manuals should include clear diagrams to assist personnel not involved in the design to understand the design and its maintenance clearly.
- For legacy infrastructure or the extension of existing infrastructure, maintenance and operation manuals must integrate with the overall maintenance and operation of the system. Note that this might require creation of a maintenance and operation manual for the whole system if one does not already exist.
- Ideally, plans should be incorporated into GIS based asset management systems.
- Monitor infrastructure (See Section 5.5) and respond to problems identified during monitoring with timely maintenance.
- For water and wastewater, ownership is transferred directly to water companies on completion, along with O&M responsibilities. The same approach as above should be applied by those water companies.
- The community should be involved in maintenance and operation. To facilitate this the municipality should:
    - Create a complaints mechanism so that the community can alert the municipality to maintenance and operation issues;
    - Create public education campaigns to educate the public on how they can contribute to better operation and maintenance (e.g., by putting only toilet paper and human excrement in toilets and not trash or fat which can block the system)
    - By assisting with monitoring (See Section 5.5)

5.5 Monitoring and Evaluation

Monitoring involves activities such as inspections and data collection to determine whether a system is performing and wherever possible quantify that performance. Evaluation involves assessing and analysing monitoring results to understand what is going right or wrong with a system.

Monitoring and evaluation (M&E) can increase the resilience of municipal infrastructure. It can:

- serve as an early warning system to identify problems and provides the data necessary to identify the root cause of issues;
- measure a system's resilience and be used as yard-stick for increasing resilience (if good criteria are developed) over time; and
- be used to track and share the success of a project and fully understand that success so that it can be repeated in future projects.

Section Summary

Develop a monitoring and evaluation system because:

- Well thought-out Monitoring and Evaluation criteria for general good practice will increase resilience
- M&E criteria for system resilience will drive system resilience because of the old adage: What is measured, improves

Several steps should be taken to effectively monitor and evaluate the resilience of municipal infrastructure. Firstly, measurable indicators should be established to evaluate infrastructure resilience. These indicators should be **specific, measurable, achievable, relevant, and time-bound (SMART).**

To develop monitoring indicators, consider the following:

- What was the **core problem** that the infrastructure sought to solve and how can solving it be measured? For example, if a new stormwater system was put in place to solve flooding then is that flooding problem solved or has flooding been experienced in the same area and if so, how often?
- What risks exist to the infrastructure and its performance. For example, how often is the new sewer system generating a smell (indication of potential blockages)?
- Review *Building Resilience: New strategies for strengthening infrastructure resilience and maintenance (OECD 2021) and Resilience Rating System: A methodology for building and tracking resilience to climate change (World Bank Group 2021)* for ideas for M&E criteria.
- Read through the operation and maintenance measures in Section 4 and consider whether any have an element of monitoring and evaluation that can be modified into a criteria.
- Review the KUSP2 Eligibility Criteria (Appendix C) to see if any items can be modified into M&E criteria.
- Review the operation and maintenance manual from the design phase as a source of ideas for monitoring criteria.
- Remove any redundant or non-relevant criteria. It's easy when generating ideas to generate too many ideas to reasonably monitor with limited municipal budgets. Once a full list of criteria ideas has been compiled, assess it and remove any ideas that won't be relevant or achievable or essentially monitor the same aspect.

Example of using SMART Criteria to increase resilience by monitoring and evaluating general good practice.

Background: On a particular major urban road flooding occurred on several occasions in every wet season. New culverts were put in place, with climate change considered, to alleviate flooding

M&E Plan: Quarterly during the dry season and monthly during the wet season **(time-bound)** for the new stormwater system. For each culvert in the system:

1. Was the culvert inspected for blockages? **(Specific, relevant, measurable & achievable)**
2. Was the culvert cleaned out if blocked? **(Specific, relevant, measurable & achievable)**
3. Was any flooding noted around infrastructure or have the community complained about any **(**i.e, is it resolving the **Core problem)**

Evaluate the data and trends in the data in a annual report (**Regular Evaluation).** Recommend changes, if any, to the M&E system in the annual report (**continuous improvement)**

The community can also be engaged to provide ideas on what constitutes performance and to contribute to monitoring by alerting the municipality to faults. To facilitate community engagement, design a simple mechanism for feedback (e.g., a complaints box at the municipal office or an internet-based complaints form). Remember to allow budget for personnel resources to compile complaints into a database and distribute complaints to the relevant departments

Once monitoring data has been agreed, a system of **regular evaluation** should be created. For example, monitoring data could be evaluated once a year. Evaluation should identify trends, challenges, and opportunities for **continuous improvement**.

The results of the M&E should be communicated to stakeholders, including policymakers, infrastructure planners, and the public. This communication should be transparent and help to inform decision-making on future infrastructure investments.

Example: M&E Criteria measuring resilience

Every year collect and evaluate the following data:

1. Number of trees in the area
2. Number of trees over 10 years old in the area
3. Number of culverts that include a climate change allowance in their design
4. Square metres of infrastructure below estimate sea-level in 2100

If urban designs include resilience measures, the above metrics should improve as time goes by.

Appendix A: Region lookup table

The following table provides a list of the urban areas of Kenya and their regions, in Alphabetical order. The relevant region can also be determined by using the map on the World Bank Knowledge Portal website.

Urban Area	Region
Awendo	Nyanza
Bomet	Rift Valley
Bungoma	Western
Busia	Western
Eldoret	Rift Valley
Embu	Eastern
Garissa	North-eastern
Hola	Coastal
Homa Bay	Nyanza
Isiolo	Eastern
Iten/Tambach	Rift Valley
Kabarnet	Rift Valley
Kajiado	Rift Valley
Kakamega	Western
Kangundo-Tala	Eastern
Kapenguria	Rift Valley
Kapsabet	Rift Valley
Karuri	Central
Kathwana	Eastern
Kericho	Rift Valley
Kerugoya/	Central
Kiambu	Central
Kikuyu	Central
Kilifi	Coastal
Kimilili	Western
Kisii	Nyanza
Kisumu	Nyanza
Kitale	Rift Valley
Kitui	Eastern
Kutus	Central
Kwale	Coastal

Urban Area	Region
Limuru	Central
Lodwar	Rift Valley
Machakos	Eastern
Malindi	Coastal
Mandera	North-eastern
Maralal	Rift Valley
Marsabit	Eastern
Mavoko	Eastern
Meru	Eastern
Migori	Nyanza
Mokowe	Coastal
Mumias	Western
Muranga	Central
Mwatate	Coastal
Nairobi	Nairobi
Naivasha	Rift Valley
Nakuru	Rift Valley
Narok	Rift Valley
Ngong’	Rift Valley
Nyamira	Nyanza
Nyeri	Central
Ol Kalou	Central
Rongo	Nyanza
Ruiru	Central
Rumuruti	Rift Valley
Siaya	Nyanza
Thika	Central
Vihiga	Western
Wajir	North-eastern
Wote	Eastern

Appendix B: Regional climate projections

Climate change allowance curves

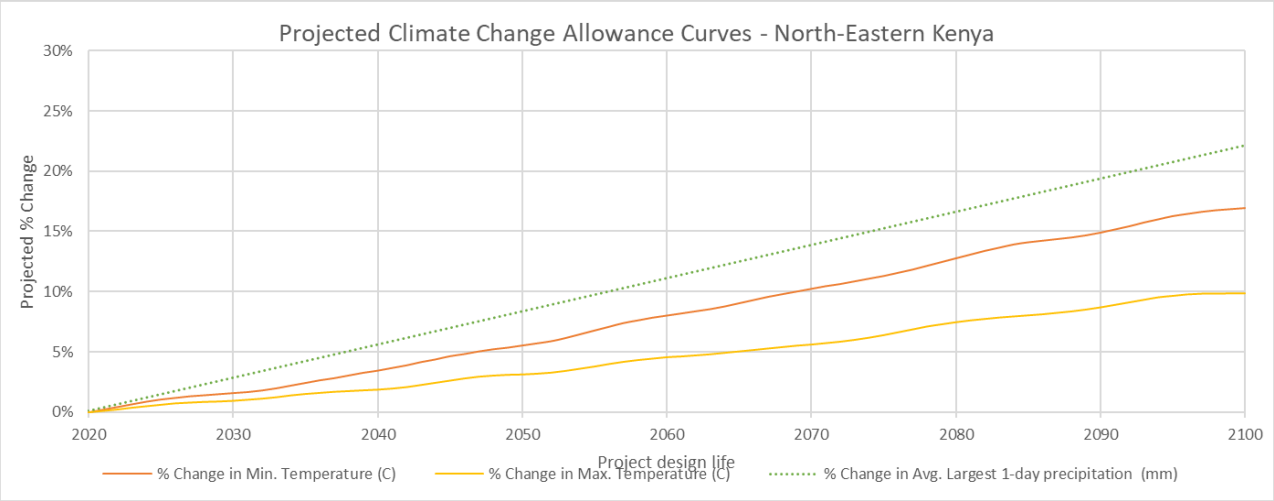
(Source: World Bank Climate Change Knowledge Portal)

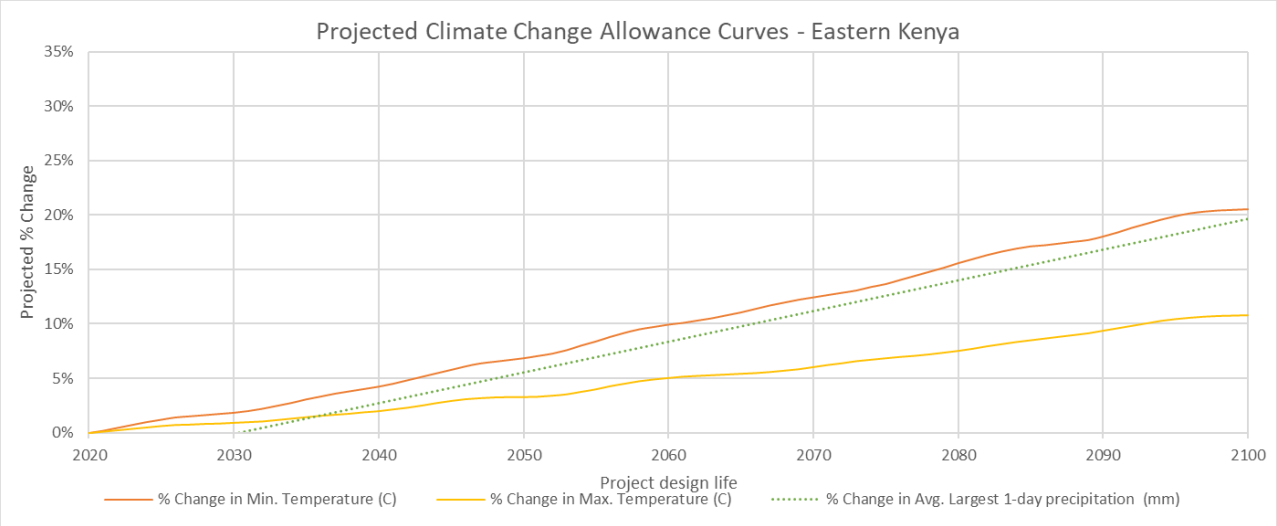
Rainfall intensity (% change) [using Max 1 day rainfall as a proxy] V design life (to 2100)

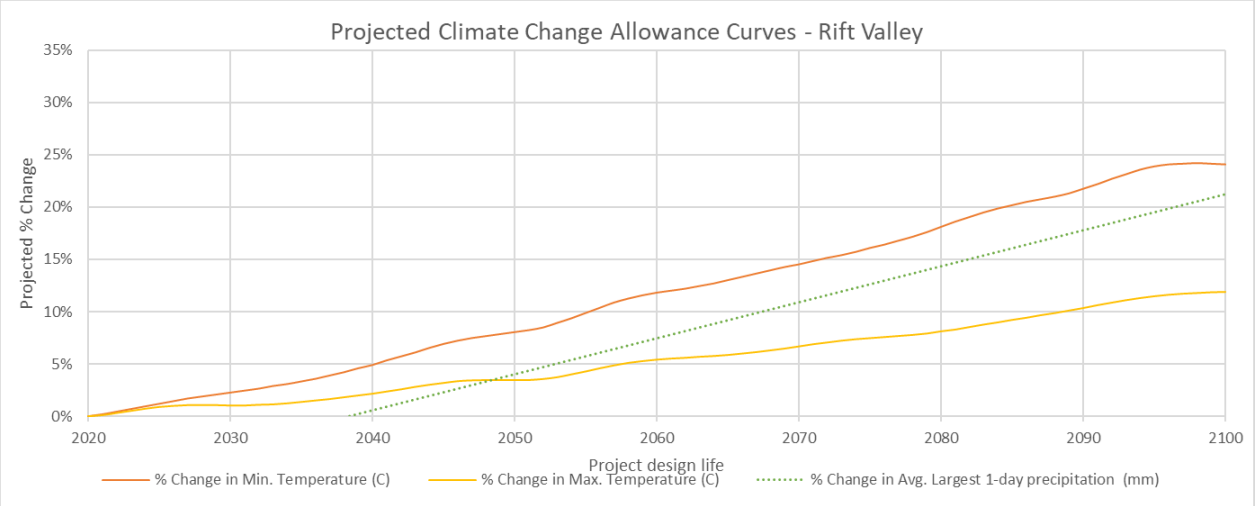
Max temp (% change) V design life (to 2100)

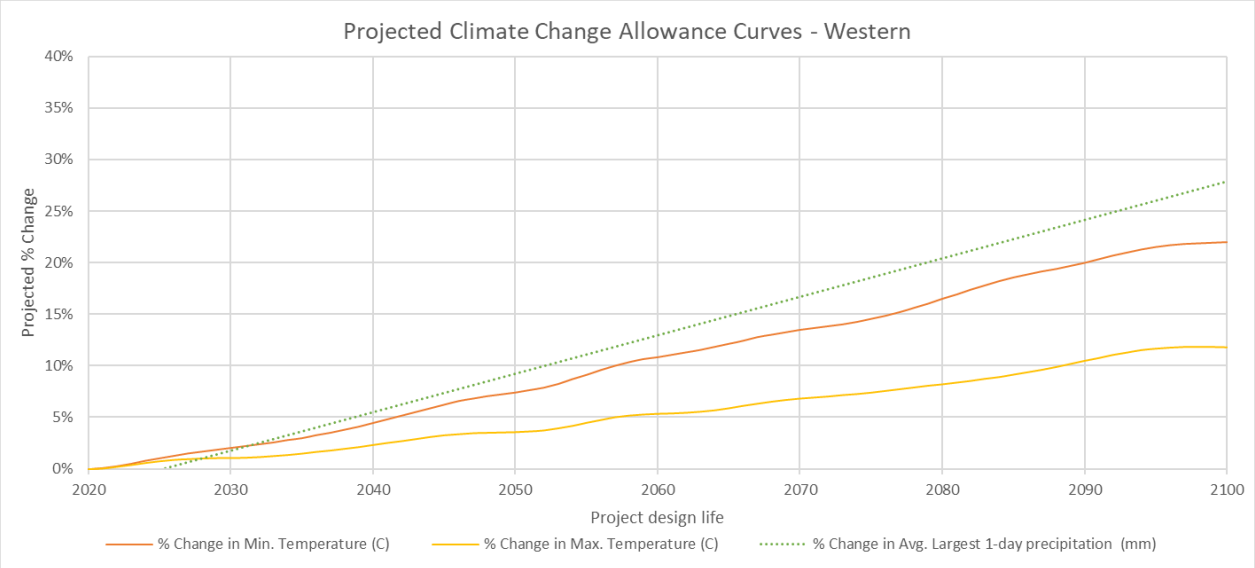
Min Temp (% change) V design life (to 2100)

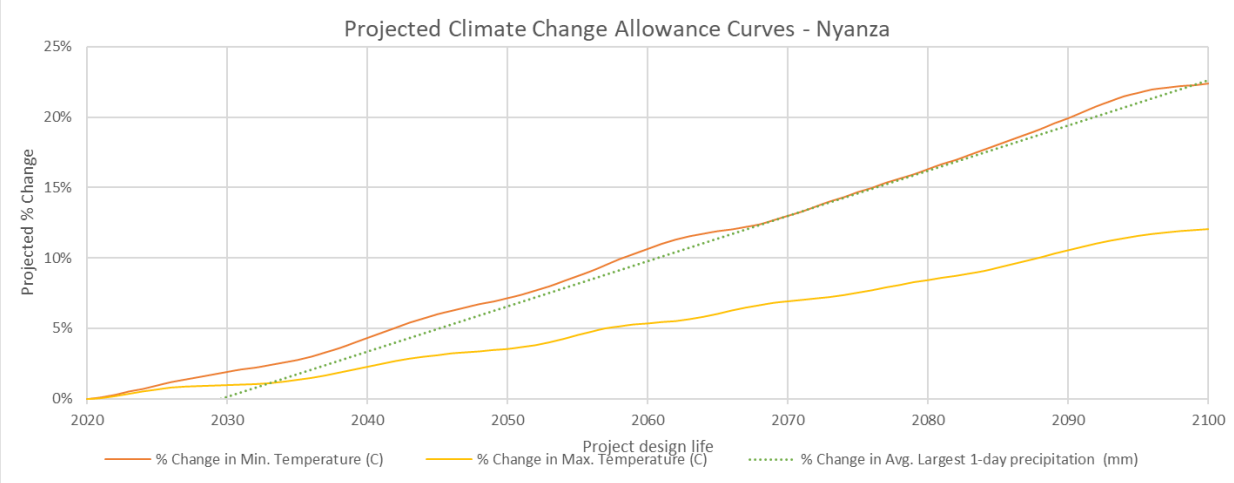
Using a 2020 baseline

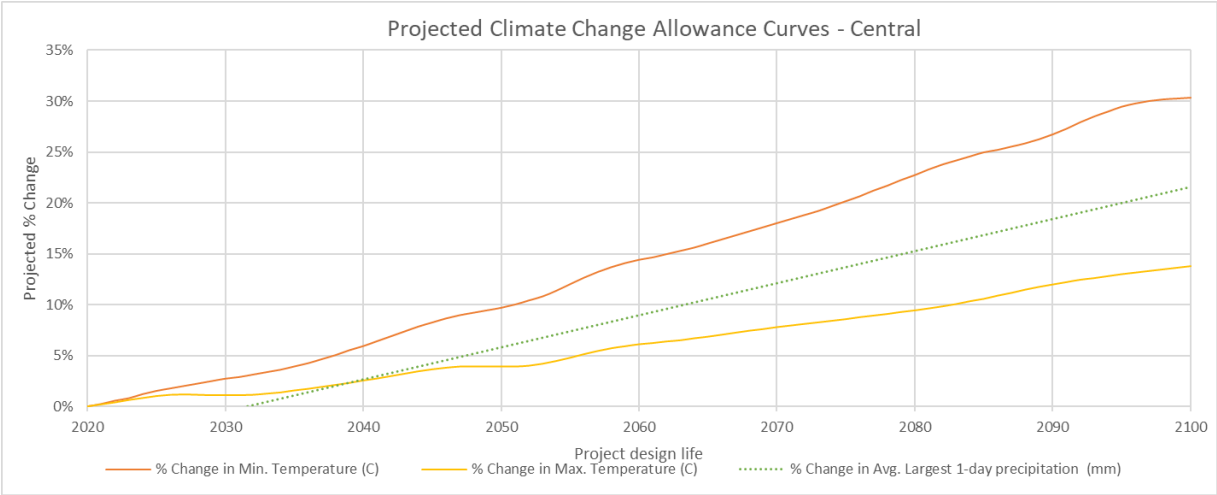


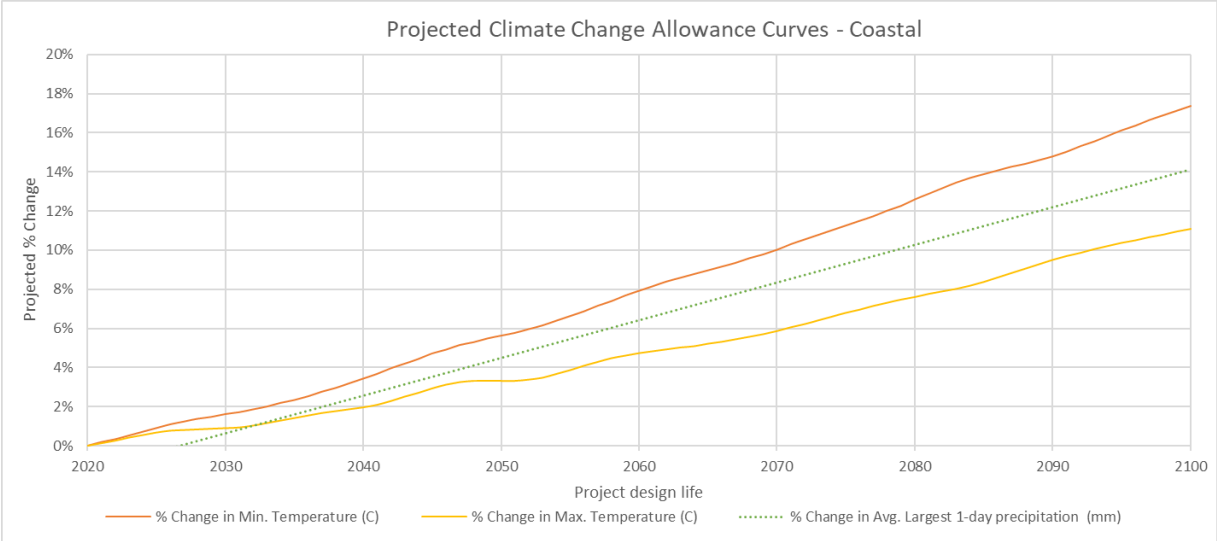


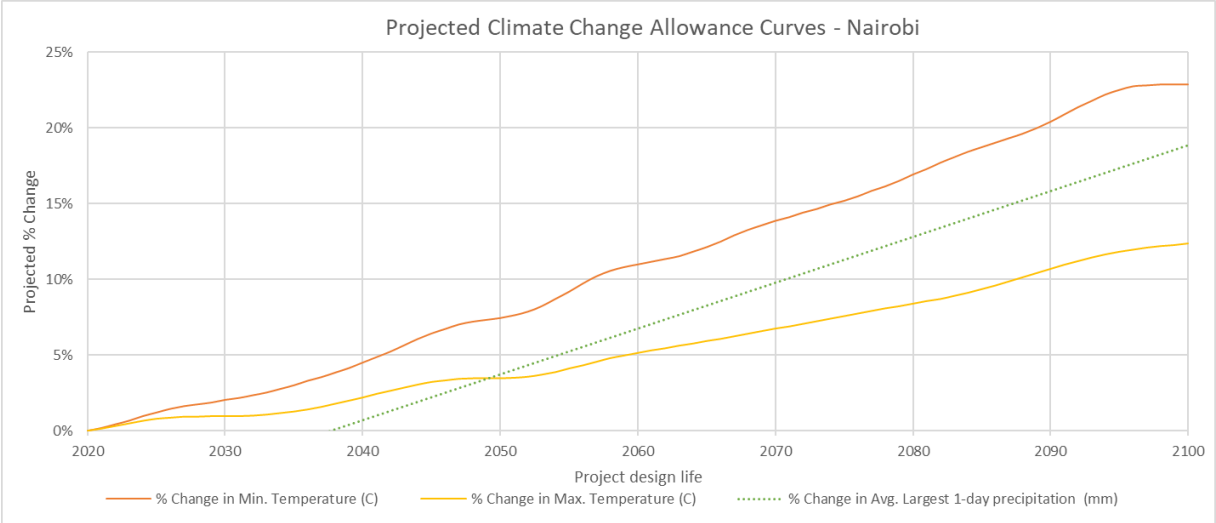

Projected Climate Change Allowance Curves - Rift Valley
35%
30%
25%
20%
15%
10%
5%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)


Projected Climate Change Allowance Curves - Western
40%
35%
30%
25%
20%
15%
10%
5%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)


Projected Climate Change Allowance Curves - Nyanza
25%
20%
15%
10%
5%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)


Projected Climate Change Allowance Curves - Central
35%
30%
25%
20%
15%
10%
5%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)


Projected Climate Change Allowance Curves - Coastal
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)


Projected Climate Change Allowance Curves - Nairobi
25%
20%
15%
10%
5%
0%
Projected % Change
2020
2030
2040
2050
2060
2070
2080
2090
2100
Project design life
% Change in Min. Temperature (C)
% Change in Max. Temperature (C)
% Change in Avg. Largest 1-day precipitation (mm)

Regional tables of climate projections

(Source: World Bank Climate Change Knowledge Portal)

North-eastern region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	28.03	31.62	12.81%
Projected Precipitation (mm)	503.89	729.59	44.8%
Annual SPEI Drought Index	0.02	-0.1	Limited change
Projected Max Number of Consecutive Dry Days	85.23	66.89	-21.51%
Average Largest 5-day cumulative rainfall (mm)	58.87	76.59	30.11%
Average largest 1-day precipitation (mm)	20.79	29.1	39.98%
Projected Maximum of Daily Temperature	38.66	43.02	11.28%
Number of Hot Days (Temperature>30C)	106.36	270.8	154.61%

Eastern region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	24.8	28.38	14.44%
Projected Precipitation (mm)	531.23	829.81	56.21%
Annual SPEI Drought Index	0	0.01	Limited change

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Max Number of Consecutive Dry Days	68.62	49.72	-27.54%
Average Largest 5-day cumulative rainfall (mm)	62.09	82.89	33.5%
Average largest 1-day precipitation (mm)	22.32	31.68	41.94%
Projected Maximum of Daily Temperature	30.69	34.19	11.41%
Number of Hot Days (Temperature>30C)	48.58	165.53	240.74%

Rift Valley region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	22.51	26.23	16.53%
Projected Precipitation (mm)	806.7	1166.59	44.62%
Annual SPEI Drought Index	0	0.02	Limited change
Projected Max Number of Consecutive Dry Days	45.85	34.07	-25.69%
Average Largest 5-day cumulative rainfall (mm)	74.99	100.15	33.56%
Average largest 1-day precipitation (mm)	27.92	40.88	46.42%
Projected Maximum of Daily Temperature	29.14	32.73	12.32%

Number of Hot Days (Temperature>30C)	34.78	106.32	205.69%

Western region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	23.36	27.08	15.93%
Projected Precipitation (mm)	1547.77	1910.086	23.41%
Annual SPEI Drought Index	0.03	0.04	Limited change
Projected Max Number of Consecutive Dry Days	23.85	20.91	-12.32%
Average Largest 5-day cumulative rainfall (mm)	98.04	128.68	31.26%
Average largest 1-day precipitation (mm)	33.04	45.85	38.78%
Projected Maximum of Daily Temperature	29.8	33.4	12.08%
Number of Hot Days (Temperature>30C)	1.42	100.12	6950.75%

Nyanza region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	22.91	26.68	16.46%
Projected Precipitation (mm)	1531.64	1909.95	24.7%
Annual SPEI Drought Index	0.01	0.07	Limited change
Projected Max Number of Consecutive Dry Days	34.73	33.18	-4.46%

Average Largest 5-day cumulative rainfall (mm)	108.8	137.38	26.27%
Average largest 1-day precipitation (mm)	36.68	48.11	31.17%
Projected Maximum of Daily Temperature	29.18	32.83	12.51%
Number of Hot Days (Temperature>30C)	0.12	60.2	50066.67%

Central region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period
Projected Mean-Temperature (°C)	18.92	22.68	19.88%
Projected Precipitation (mm)	801.98	1144.11	42.67%
Annual SPEI Drought Index	-0.01	0.04	Limited change
Projected Max Number of Consecutive Dry Days	38.55	35.99	-6.64%
Average Largest 5-day cumulative rainfall (mm)	77.82	104.07	33.74%
Average largest 1-day precipitation (mm)	27.69	38.8	40.13%
Projected Maximum of Daily Temperature	25.31	29.06	14.82%
Number of Hot Days (Temperature>30C)	0.03	8.64	28700%

Coastal region of Kenya climate change indicators – median projections

Indicator	Baseline year data (2020)	Projected year data (2100) under scenario SSP5-8.5	Projected change within period

Projected Mean-Temperature (°C)	25.97	29.5	13.6%
Projected Precipitation (mm)	754.28	937.02	24.23%
Annual SPEI Drought Index	0.04	0.01	Limited change
Projected Max Number of Consecutive Dry Days	51.88	49.56	-4.47%
Average Largest 5-day cumulative rainfall (mm)	70.66	90.93	28.69%
Average largest 1-day precipitation (mm)	24.55	33.39	36.01%
Projected Maximum of Daily Temperature	30.87	34.45	11.60%
Number of Hot Days (Temperature>30C)	23.02	150.81	555.13%
Projected Sea-Level Rise	0	0.79	0.79m Increase

Nairobi region of Kenya climate change indicators – median projections

Indicator	Reference (2020)	Projected 2100 (SSP5-8.5)	Projected change within period
Projected Mean-Temperature (°C)	22.82	26.57	16.44%
Projected Precipitation (mm)	764.94	1071.28	40.05%
Annual SPEI Drought Index	0	0	No change
Average largest 1-day precipitation (mm)	30.11	40.27	33.75%
Average Largest 5-day cumulative rainfall (mm)	81.66	100.15	22.65%
Projected Max Number of Consecutive Dry Days	57.68	51.43	-10.83%

Indicator	Reference (2020)	Projected 2100 (SSP5-8.5)	Projected change within period
Projected Maximum of Daily Temperature	29.81	32.76	13.32%
Number of Hot Days (Temperature>30C)	0.24	166.36	69216.67%

Appendix C: KUSP2 Eligibility Criteria

No	Mandatory or Recommended	Criteria	Evidence required to meet eligibility criteria
1	Mandatory	The Project is included in the Urban Integrated Development Plan (IDeP)	Plans are available, and the project is included.
2	Mandatory	A site-specific Project Report has been completed, describing site specific environmental and social impact assessment, and NEMA license is obtained before commencement of works.	An approved Project Report is available which fulfils its requirements (see guidance note). And NEMA approvals and license documentation are available. Project Report has been prepared by an Environmental Assessment Expert, with a current license from NEMA.
3	Mandatory	Public was consulted during project planning/design stages.	An approved Project Report is available which details evidence of comprehensive public consultation including duly signed minutes of consultation meetings with project affected persons and key stakeholders, attendance lists and filled questionnaires during planning and design stages.
4	Mandatory	Identification of environmentally sensitive areas has been included in the Project Report.	An approved Project Report is available which identifies any environmentally sensitive areas that could be affected by the project, and any potential impacts to them should be detailed and mitigated. These (environmentally sensitive) areas support urban resilience and provide future adaptation potential.
5	Mandatory	The project is located outside of riparian zones, or, when unavoidable, measures are included to enhance riparian corridors.	The evidence is based on the project location. The project should be sited outside of riparian zones (as per the Water Act 2016), apart from where unavoidable (for example, at a crossing).
6	Mandatory	Climate Change Projections have been integrated into the project design.	Climate change projections have been incorporated into the design. This includes: • All roof/site/road/storm drainage calculations have applied an appropriate climate change factor, based on regional rainfall intensity projections and project lifetime. • Maximum temperatures for material specification have incorporated climate change projections. This is most relevant for roads, in the specification of pavement

No	Mandatory or Recommended	Criteria	Evidence required to meet eligibility criteria
			materials. Other materials specified (incl. plastics) should consider extreme surface temperatures in their specification. • Maximum temperatures for structural design have incorporated climate change projections. Structures could include buildings under urban economic and social infrastructure and disaster risk management. • Sea-level rise – all infrastructure is above the sea-level with climate change or protection has been designed. Evidence of the design considerations and assumptions (including climate projections) should be included in the Project Design Report. The EIA (Project Report) should also highlight these climate change risks and detail relevant climate projections within the 'climate change vulnerability assessment'. Refer to the Guidelines for further information on climate projections.
7	Mandatory	Relevant design codes and guidelines for Kenya have been applied (or where not available Eurocodes, South African guidelines or other international guidelines). Other relevant design codes for structural resilience have been used. *Note: Kenya guidelines mandatory, other guidelines recommended*	Evidence: Design report details the application of relevant design codes and guidelines have been applied. Design report details the application of the below, where relevant. Relevant to buildings and structures across sectors: • Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions (existing wind map is valid, climate change had limited impact) • Eurocode 8: Design of structures for earthquake resilience (existing seismic map is valid, climate change had no impact)
8	Mandatory	Demonstrated no third-party flood risk.	The ultimate discharge point of all roof/site/road/storm drainage must be to an existing watercourse or drain. This should be identified in the Project Report and in the Project Design to ensure there are no increased local flood risks to any third-party property. Surface water drainage is potentially relevant for all sectors.

No	Mandatory or Recommended	Criteria	Evidence required to meet eligibility criteria
9	Mandatory	Demonstrated application of Universal Design	Designs Report and Drawings illustrate the incorporation of universal access elements in line with existing design guidelines and standards. For streets and urban areas (parks, other public spaces around public buildings) the 'Street Design Manual for Urban Areas in Kenya' should be followed. For accessibility to buildings, the Draft National Building Code should be followed.
10	Mandatory	Demonstrated inclusion of Green Infrastructure in urban design	Designs report and drawings illustrate the incorporation of Green Infrastructure elements in line with existing design guidelines and standards. Green infrastructure must be incorporated into all public spaces – road corridors, NMT areas, around public buildings, and in parks, in line with the 'Street Design Manual for Urban Areas in Kenya'
11	Mandatory	Demonstrated design Quality Compliance	Design reports, which include design considerations and assumptions and design drawings, have been prepared and signed off by a Professional Engineer registered with / approved by the Engineers Board for Kenya. Professional Engineers - Engineers Board of Kenya (ebk.go.ke)
12	Mandatory	The project is fully costed, including contingency, and budget is available, before commencement of construction.	Project budget, including contingency, has been included in Annual Development Plan or annual budget allocation for County or Municipality.
13	Mandatory	Demonstrated completion of works	A Project Completion Report (or similar) is available including verification that all ESMP/NEMA license conditions have been completed. Records on all grievances received from all uptake channels and their resolution have been achieved.
14	Mandatory	Demonstration that the project has been constructed in line with detailed design and specification.	Project Completion Report outlines materials testing and any design variances.
15	Mandatory	As built drawings are available	Appended to the Project Completion Report and available in both hard and soft copy.
16	Mandatory	Operation and maintenance plan and	An O&M plan should be included in the Project Completion Report or evidence should be shown

No	Mandatory or Recommended	Criteria	Evidence required to meet eligibility criteria
		responsibility AND budget for operation and maintenance of infrastructure and services. All are to be identified before the commencement of construction. Where the asset is part of the existing system the existing plan, responsibilities and budget should be updated.	of an updated O&M plan for the existing infrastructure showing the new asset.
17	Mandatory	The Project is included in the County Integrated Development Plan (CIDP)	Plans are available, and the project is included.
18	Mandatory	Gender and inclusion have been considered in the social impact assessment in the Project Report	There is evidence of a gender balance in the documentation of public consultation within the Project Report (related to criteria 3) The Project Report includes a Gender assessment that identifies the impacts of the project on women, men, children, disadvantaged groups, and on the economic and social fabric of the communities; as well as measures to incorporate into the design to mitigate these impacts.
19	Recommended	The project is integrated into strategic sectoral plans	Where sectoral investment plans or sectoral masterplans, are available, the Project is prioritised under the broader strategy for investment in that sector, based on a baseline assessment, and projected demand. (Sectoral plans are often included or appended to the urban spatial plans or IDePs. There are also County sector plans where capital investments may be prioritised)
20	Recommended	A location hazard assessment is included in the Project Report	An approved Project Report is available which includes a climate change vulnerability assessment. This should include an assessment of local hydrometeorological hazards, on or near the site, and measures to mitigate hazard risk. Where high-resolution hazard mapping is not available, this hazard 'data' can come from public consultation. Hazard risks should be mitigated on site only after alternative (lower hazard) locations have been considered and rejected. The Project Report must consider alternative locations, in high hazard areas.

No	Mandatory or Recommended	Criteria	Evidence required to meet eligibility criteria
21	Recommended	Inclusion of Green Infrastructure in stormwater design	Design reports and Drawings illustrate incorporation of Green Infrastructure elements in stormwater infrastructure, including potentially, swales, raingardens, attenuation ponds, permeable paving, etc.
22	Recommended	At least two stakeholder's consultations with Project Affected Persons (PAPs) were undertaken during construction.	Evidence included in the PAP plan and the Project Completion Report. Additional concerns raised during stakeholder consultations are addressed.