GREENBOOK
adapting settlements for the future

King Sabata Dalindyebo Local Municipality Adaptation Action Plan

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List of Acronyms and Abbreviations

CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DFFE	Department of Forestry, Fisheries and the Environment
DHS	Department of Human Settlements
DRR	Disaster risk reduction
HDA	Housing Development Agency
IPCC	Intergovernmental Panel on Climate Change
KSDLM	King Sabata Dalindyebo Local Municipality
LRT	Let's Respond Toolkit
PHDA	Priority Housing Development Area
PHS	Priority Human Settlement
PHSHDA	Priority Human Settlement and Housing Development Area
SPLUMA	Spatial Planning and Land Use Management Act, 2013 (Act No.16 of 2013)

Glossary of Terms

Adaptation actions	A range of planning and design actions that can be taken by local government to adapt to the impacts of climate change, reduce exposure to hazards, and exploit opportunities for sustainable development (CSIR, 2019).
Adaptation planning	The process of using the basis of spatial planning to shape built-up and natural areas to be resilient to the impacts of climate change, to realise co-benefits for long-term sustainable development, and to address the root causes of vulnerability and exposure to risk. Adaptation planning assumes climate change as an important factor while addressing developmental concerns, such as the complexity of rapidly growing urban areas, and considers the uncertainty associated with the impacts of climate change in such areas – thereby contributing to the transformational adaptation of urban spaces. Adaptation planning also provides opportunities to climate proof urban infrastructure, reduce vulnerability and exploit opportunities for sustainable development (National Treasury, 2018; Pieterse, 2020).
Adaptive capacity	"The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC, 2022, p. 2899).
Climate change adaptation	"In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects" (IPCC, 2022, p. 2898).
Climate change mitigation	"A human intervention to reduce emissions, or enhance the sinks, of greenhouse gases (GHGs)" (IPCC, 2022, p. 2915). The goal of climate change mitigation is to achieve a reduction of emissions that will limit global warming to between 1.5°C and 2°C above preindustrial levels (Behsudi, A, 2021).
Climate hazards	Climate hazards are a sub-set of natural hazards and a grouping of hydrological, climatological, and meteorological hazards. This includes the spatial extent and frequency of, among others, floods, fires, and extreme weather events such as extreme rainfall and extreme heat. Sometimes referred to as hydrometeorological hazards. The potential occurrence of a climate hazard may cause loss of life, injury, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources (IPCC, 2022). Climate hazards can increase in intensity and frequency with climate change (Pieterse et al., 2023).
Climate risk	Risk implies the potential for adverse consequences resulting from the interaction of vulnerability, exposure, and a hazard. Relevant adverse consequences include those on "lives and livelihoods, health and well-

	being, economic and sociocultural assets, infrastructure and ecosystems" (IPCC, 2022, p. 144). In the IPCC's 6th Assessment Report, it is confirmed that risks may result from "dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system" (IPCC, 2022, p. 132).
Coping capacity	"The ability of people, institutions, organizations and systems, using available skills, values, beliefs, resources and opportunities, to address, manage, and overcome adverse conditions in the short to medium term" (IPCC, 2022, p. 2904).
Disaster risk reduction	"Denotes both a policy goal or objective, as well as the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard or vulnerability; and improving resilience" (IPCC, 2022, p. 2906).
Exposure	Exposure implies the physical exposure of elements to a climate hazard. It is defined as the "presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected [by climate hazards]" (IPCC, 2022, p. 2908).
Mainstreaming	The process of integrating climate change adaptation strategies and measures into existing planning instruments and processes as opposed to developing dedicated adaptation policies and plans (Pieterse et al., 2021).
Resilience	"The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation" (IPCC, 2022, pp. 2920–2921).
Sensitivity	"The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise)" (IPCC, 2022, p. 2922).
Vulnerability	Vulnerability is defined as the "propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including, sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC, 2022, p. 2927). Vulnerability refers to the characteristics or attributes of exposed elements, i.e., elements that are exposed to potential climate-related hazards. Vulnerability is a function of sensitivity and (coping or adaptive) capacity (Pieterse et al., 2023).

1. Introduction

Climate change impacts vary widely from region to region in South Africa, and are reflected by floods, droughts, heatwaves, and coastal erosion, among others. These impacts directly threaten life, economic well-being, property, infrastructure, and ecosystems as well as the ability of local government to provide public services. It is local government's responsibility and duty to provide leadership in planning and preparing to manage these risks for the sake of the well-being, safety, and security of individuals within their jurisdiction (SABS, 2023). The purpose of this document is to strengthen the capability of local government to prepare for climate change threats and associated risks.

The Climate Change Adaptation Plan and its accompanying Risk Profile report have been specifically drafted for the King Sabata Dalindyebo Local Municipality (KSDLM) with the aim of strengthening its strategic response to climate change. These documents derive their insights from the GreenBook (www.greenbook.co.za), a freely accessible online planning support system. The GreenBook is a unique and invaluable resource, providing quantitative scientific evidence to assist local governments in comprehending their climate risks. It plays a pivotal role in guiding the adaptation of settlements to withstand the impacts of both current and future climate challenges.

Designed as an information-rich tool, the GreenBook caters to South African local governments, offering insights into risks and vulnerabilities associated with population growth, climate change, exposure to hazards, and the vulnerability of critical resources. Moreover, the GreenBook not only diagnoses these challenges but also provides practical adaptation measures. These measures are essential for cities, towns, and settlements, empowering local government to mitigate the impacts of climate hazards on communities, the environment, the economy, and municipal assets and infrastructure, while aligning with broader developmental goals (refer to Green Book | Adapting settlements for the future).

The Climate Risk Profile and the Climate Change Adaptation Plan serve distinct yet interlinked purposes and strategic objectives. They aim to:

1. Drive and advance the local climate change response agenda.
2. Provide a foundational framework for strategy and planning within the Local Municipality, with a specific focus on Priority Human Settlements or Priority Housing Development Areas (PHSDAs).
3. Systematically identify and prioritise risks and vulnerabilities.
4. Pinpoint and prioritise targeted interventions and responses.
5. Facilitate the integration of climate change response, particularly adaptation, into mainstream policies and practices.

In essence, these documents are instrumental in equipping King Sabata Dalindyebo Local Municipality with a comprehensive strategy to navigate the complexities of climate change, reduce vulnerability and exposure, and champion sustainable development.

The Adaptation Action Plan briefly outlines the policies constituting the framework for adaptation in South Africa. It then goes on to describe generic adaptation principles, approaches, pathways, and various categories of actions. Subsequently, the plan suggests a specific adaptation strategy for King Sabata Dalindyebo LM by aligning it with adaptation goals, programmes, and actions designed to address priority risks. Finally, the document concludes with recommendations aimed at facilitating the integration of the proposed actions into broader initiatives, ensuring their effective mainstreaming.

2. Policy Framework

South Africa's institutional policy and legislative framework makes provision for climate change adaptation at all levels of government, with local government increasingly identified as the primary driver of climate change adaptation. For instance, there exists various national policy and legislative mechanisms that promote, necessitate, guide and/or regulate climate change adaptation at the local level. These include the Disaster Management Amendment Act, i.e., Act No. 16 of 2015, the Spatial Planning and Land Use Management Act (SPLUMA), i.e., Act No. 16 of 2013, the Climate Change Bill (B9 of 2022), the 2011 National Climate Change Response White Paper, as well as the 2019 National Climate Change Adaptation Strategy.

While the Disaster Management Amendment Act requires each organ of state, as well as provincial and local government to identify measures for, as well as indicate plans to invest in, disaster risk reduction (DRR) and climate change adaptation; SPLUMA identifies the principles of (1) spatial resilience – which involves accommodating "flexibility in spatial plans, policies and land use management systems, to ensure sustainable livelihoods in communities most likely to suffer the impacts of economic and environmental shocks" (Republic of South Africa., 2013, p. 20) – some of which may be induced by the impacts of climate change, and (2) spatial sustainability, which sets out requirements for municipal planning functions such as spatial planning and land use management to be carried out in ways that consider protecting vital ecosystem features such as agricultural land, i.e., from both anthropogenic and natural threats, including the impacts of climate change, as well as in ways that consider current and future costs of providing infrastructure and social services in certain areas (e.g., uninformed municipal investments may lead to an increase in the exposure of people and valuable assets to extreme climate hazards) amongst the key principles intended to guide municipal planning and development. The Climate Change Bill (DEA, 2018) sets out requirements for every District Intergovernmental Forum to serve as a Municipal Forum on climate change that coordinates climate response actions and activities in its respective municipality, while also requiring every municipality to report on their climate change response needs and draft resultant climate risk assessments, as well as climate change response and -implementation plans.

Moreover, the National Climate Change Response White Paper identifies local governments as critical role players that can contribute towards effective climate change adaptation through their various functions, including human settlement planning; urban development; municipal infrastructure and services provision; water and energy demand management; and local disaster response, amongst others. The National Climate Change Adaptation Strategy (DEA, 2019) outlines several actions that are applicable at local government level, including the development and implementation of adaptation strategies and vulnerability reduction programmes for communities and individuals that are most at risk to the impacts of climate change; the development of municipal early warning systems; as well as the integration of climate change adaptation into municipal development plans and relevant sector plans.

In response to the national call to advance spatial transformation and consolidation in human settlement development, the National Department of Human Settlements (DHS) has identified and gazetted a total of 136 Priority Human Settlements and Housing Development Areas (PHSHDAs). The PHSHDAs were declared to ensure that housing delivery is used to restructure and revitalise towns and cities, strengthen the livelihood prospects of households, and overcome apartheid spatial patterns by fostering integrated urban forms (DHS, 2020). PHSHDAs were designated using national criteria which includes an area or settlement's potential to support sustainable environmental management (which plays a critical role in mitigating the negative impacts of climate change, particularly through nature-based adaptation

solutions), as well as its potential to accommodate the integration of land uses and amenities, i.e., in addition to other criteria.

The DHS has identified two key objectives for PHSHDAs, including (1) targeting and prioritising areas for integrated housing and human settlements development to ensure the delivery of housing for a diverse range of income groups within an integrated mixed-use development, as well as (2) transforming spatial patterns which have historically exacerbated social inequality and economic inefficiency (PLM, 2021). As part of the second objective, this initiative aims to develop post-apartheid cities and city patterns that ensure urban access, as well as achieve a balance between spatial equity, economic competitiveness and environment sustainability (PLM, 2021). As the impacts of climate change become more severe, the latter outcome (i.e., ensuring and maintaining environmental sustainability) will become increasingly important.

Furthermore, as part of the implementation approach for housing and human settlement development in PHSHDAs, the DHS has identified the provision and maintenance of ecological infrastructure to support development in priority areas as a key avenue for integrating climate considerations and mainstreaming climate responses, including climate change adaptation.

3. Adaptation Principles, Approach, Programmes & Actions

Climate change mitigation and adaptation refer to the two primary strategies aimed at addressing the adverse effects of climate change, i.e., by either delaying, reducing, redistributing, or avoiding the impacts. Although disaster risk reduction and climate change mitigation form part of the overall climate change response agenda, the focus of this plan is on adaptation.

Climate change adaptation aims to reduce climate-related risks by adjusting a system to the actual or anticipated climate and seeking "to moderate or avoid harm [and] exploit beneficial opportunities" (IPCC, 2022, p. 2898) that may derive from unavoidable impacts of climate change such as extreme hazards. The climate change adaptation agenda is concerned with adapting species, people, places, assets, and systems, to the impacts of actual or anticipated climate-related risks and implements various measures or actions to achieve this (Behsudi, 2021; C40, 2020).

This section of the report outlines adaptation principles, drawing from the recommendations by the South African Bureau of Standards. It also presents a structured approach to selecting adaptation options, categorises adaptation actions, and explains the concept of an adaptation pathway.

3.1. Adaptation principles

The Bureau for Standards recently proposed the following principles that apply to local government when adapting to climate change (SABS, 2023):

i. Accountability: Local governments not only acknowledge but also assume responsibility for their climate change adaptation efforts. They willingly subject themselves to appropriate scrutiny and accept the duty to respond to this scrutiny.
ii. Continual learning and improvement: Recognising the uncertainties in knowledge and the dynamic nature of drivers of change, available knowledge and evidence, and the contextual factors, continual learning and improvement are essential for effective climate change adaptation.

iii. Mainstreaming and embedding: The effectiveness of climate change adaptation is maximised when integrated into local government operations, encompassing policies, plans, procedures, risk management, and implementation strategies.
iv. Flexibility: Embrace a flexible approach that considers technical, social, administrative, political, legal, environmental, and economic circumstances. This allows for the accommodation of a diverse range of data availabilities and technical and institutional capacities to meet goals and objectives.
v. Practicality: Set practical and achievable goals and objectives. Impractical targets may hinder the successful realisation of climate change adaptation benefits. Focus on easily measurable indicators/metrics with available underlying data and compare them across scales to avoid imposing additional burdens.
vi. Prioritisation: During the identification of adaptation plans and measures, prioritise areas based on the relative characteristics of climate change impacts (magnitude, likelihood, and urgency). Consider the capacities of stakeholders and the local government and community's ability to act.
vii. Proportionality: Undertake actions that are most effective under the current circumstances, including economic, social, cultural, and political contexts, capabilities, knowledge, and evidence base. Aspire for continual improvement in identifying and assessing adaptation measures.
viii. Relevance: Facilitate assessments that provide decision-makers and practitioners with meaningful information for adaptation planning, considering appropriate spatial scales and relevant time durations.
ix. Transparency: Ensure that reports and communications on climate change adaptation are openly, comprehensively, and understandably presented, providing accessible information for all interested parties (SABS, 2023).

These principles should be considered when formulating adaptation goals, programmes, and measures.

3.2. Adaptation approach

The approach that was followed to develop this adaptation plan revolves around comprehending the climate-related risks and implementing adaptive measures in response to these risks. Climate-related risk encompasses the potential for adverse consequences arising from the interplay of vulnerability, exposure, and the occurrence of climate hazards (IPCC, 2022). The components of risk are dynamic, with the occurrence of climate hazards influenced by both natural climate variability and anthropogenic climate change. The exposure of individuals, the built environment, and the natural surroundings to climate hazards is driven by both planned and unplanned development and growth. Vulnerability is the inherent characteristics that make systems sensitive to the effects and impacts of climate hazards.

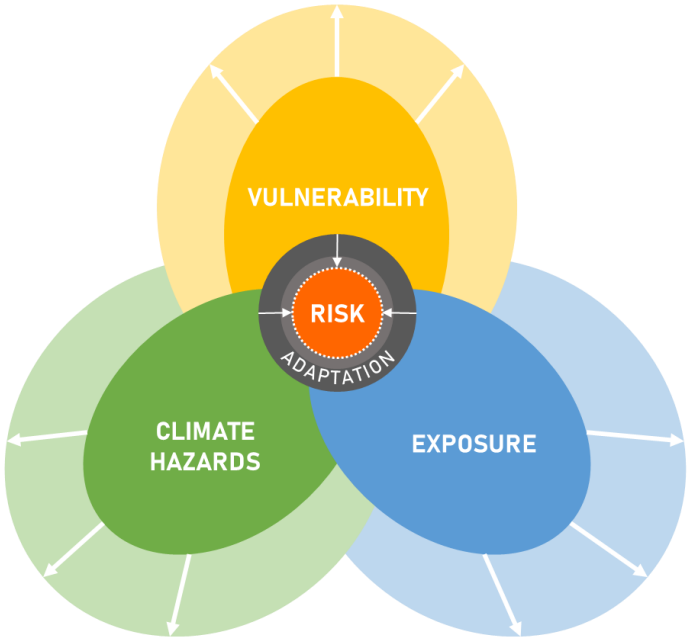

Figure 1 – The interplay between climate hazards, vulnerability and exposure that determines risk (based on IPCC, 2014 and IPCC, 2021)

The inherent uncertainty in future climate trends underscores the necessity for a flexible response and the formulation of adaptable, medium to long-term adaptation strategies.

The approach followed in this plan involves the following steps:

i. Gain an understanding of climate risk in a specific geographic area.
ii. Identify priority climate hazards/zones based on the risk profile.
iii. Establish adaptation goals to mitigate the risk associated with priority hazards/zones.
iv. Develop adaptation programmes with measures/actions to achieve these goals.
v. Integrate climate considerations into other sector plans/instruments/strategies.

Refer to Table 1 for a more detailed description of this approach.

Table 1: The adaptation approach

Understand climate risk for a specific geographic area	A climate risk profile assesses risk by determining – in a specific geographic area and at a specific scale – the likelihood of a hazard to occur, the inherent vulnerability of various systems, and exposure of these systems to specific climate hazards. To be able to develop an appropriate adaptation plan, it is important to understand what contributes to risk and vulnerability.
Identify priority climate-related risks/zones	Identify the climate hazards and impacts that pose the greatest risk at present and in the future within a geographic area. If possible, also identify climate risk zones that need to be prioritised for intervention.

Establish adaptation goals	Identify adaptation goals to address priority risks/zones that speak to policy goals.
Develop adaptation programmes and actions	Develop adaptation programmes that speak to the identified adaptation goals and identify appropriate adaptation actions under each of the programmes that are mutually supportive. Adaptation actions should: • Be specific to a climate hazard/vulnerability/exposure. • Suggest a target or an indicator to measure progress. • Be assignable to a primary implementer. • Consider co-benefits and other possible implications. • Include mitigation as far as it builds resilience or reduces exposure and vulnerability.
Mainstream climate considerations into planning	Integrate evidence of climate risk, adaptation goals, programmes, and actions into existing instruments and processes. The aim is to ensure that climate change considerations are an integral part of all that local government is doing.

The primary aim of an adaptation plan is to address both current and anticipated future risks and vulnerabilities while also leveraging opportunities for long-term transformation and sustainable development.

3.3. Adaptation programmes and actions

An adaptation programme is a structured and systematic set of actions, initiatives, and interventions that can be used to adapt to the impacts of climate change. It involves the practical implementation of specific goals identified in the plan.

Broadly, adaptation actions include anticipatory and reactive measures. Anticipatory adaptation involves proactive measures taken in preparation for anticipated climate change impacts, while reactive adaptation entails responding to climate change effects as they are experienced. Furthermore, it facilitates the integration and prioritisation of climate change adaptation and resilience measures into various planning mechanisms and processes (CSIR, 2019).

A spectrum of adaptation actions is at the disposal of local municipalities to enhance resilience and mitigate risks posed by changing climatic patterns and extreme weather events. Some of the categories of actions include:

- Infrastructure development, encompassing the construction of, for example, seawalls, levees, and storm surge barriers to protect against rising sea levels and extreme weather events. These engineered solutions provide immediate protection and buy time for longer-term adaptation efforts but are mostly very expensive to build.
- Green infrastructure initiatives offer sustainable and nature-based solutions. Municipalities can implement urban green spaces, green roofs, and permeable pavements to absorb excess water, reduce flooding, and mitigate the urban heat island effect. Such approaches not only enhance climate resilience but also contribute to improved air quality and overall urban liveability.

- Environmental protection such as restoring ecosystems like mangroves, dunes, and wetlands, not only provides natural buffers but also supports biodiversity.
- Integrated urban planning is essential to create climate-resilient municipalities. Land-use regulations should be adapted to consider climate risks, prioritising construction practices that enhance resilience. Elevating structures above projected flood- and sea levels and using climate-resilient materials in building design can minimise the impacts of flooding and storm damage.
- Early warning systems and emergency preparedness plans are critical tools to ensure swift responses to extreme weather events, minimising the impact on vulnerable communities.
- Innovative water management strategies are essential for municipalities facing changing precipitation patterns and increasing water scarcity. Diversifying water sources, implementing water efficiency measures, and investing in advanced stormwater management systems contribute to water security and sustainable resource use.
- Engagement and education are pivotal components of successful adaptation strategies. Empowering officials, and residents, to understand and respond to climate risks through awareness campaigns, education programmes, and participatory planning initiatives can enhance local adaptive capacity (CSIR, 2019).

Local governments must embrace a combination of structural, natural, and community-based approaches to build resilience and adaptive capacity, protect vulnerable communities, while ensuring long-term sustainability in the face of evolving climate challenges.

4. Summary of Climate Risk Profile

A Climate Risk Profile Report was prepared by the team, designed to complement this Plan. The comprehensive Climate Risk Profile serves as an essential resource for understanding the risks associated with climate change in King Sabata Dalindyebo Local Municipality. Presented to representatives of the Municipality during a series of nationwide stakeholder engagements in late 2023, these workshops served as forums to not only validate the risks outlined in the report but also to confirm the adaptation goals proposed.

This section of the Plan summarises the climate risk profile for King Sabata Dalindyebo, drawing from the GreenBook Risk Profile Tool at https://riskprofiles.greenbook.co.za/. Consult the accompanying Climate Risk Profile Report for more detailed information.

4.1. Climate projections, vulnerabilities and impacts

Average annual temperature in the KSD LM is expected to increase by between 1.9 °C and 2.3°C in future. This also translates into an increase in heatwave days in parts of the municipality. Rainfall projections indicate a general increasing trend with the most significant increases expected in the northern parts of the municipality. The southwestern part of the LM is however expected to become somewhat drier with indications of increasing drought tendencies extending further beyond the western border of the LM. Concomitant with the increase in rainfall is an expected increase in extreme rainfall days over the entire municipality. A significant increase in extreme rainfall days is projected, especially over the north and northwestern parts of Mthatha.

KSD LM has both a high economic and physical vulnerability scoring 7th and 5th highest respectively in the province. The high economic vulnerability score can be ascribed to the limited economic base of its economy, lack of diversification and high unemployment due to lack of job opportunities which causes many people to rely on government social grants. Its physical vulnerability is influenced by the geographic isolation due to Mthatha's inland location and distance from major economic hubs like Durban and Johannesburg that limit access to markets, investment, and trade opportunities. These economic and physical vulnerabilities will be exacerbated by population growth which is projected to increase by 50% between 2011 and 2050.

Severe multi-year droughts are common in the Eastern Cape. These have a significant negative impact on the region, affecting everything from agriculture and water resources to the economy and people's livelihoods. Increased frequency and severity of droughts will reduce surface water availability and water shortages could become more common, threatening households and sanitation. Reduced water availability can also lead to crop failures and livestock losses, affecting food security and farmer incomes. Reduced water availability can also lead to increased competition for limited water resources between households, agriculture, and industry, leading to potential conflicts, especially as population growth pressure increase.

4.2.Priority climate-related hazards

More intense rainfall events and associated flooding pose the greatest threat to the KSD LM. These can have significant negative impacts on infrastructure, settlements, and agriculture in the KSD LM. Increased heavy downpours can displace residents and cause loss of property. It also overwhelms drainage systems, leading to flash floods that can damage roads and isolate communities. It can also contaminate water sources and damage sanitation infrastructure, posing health risks and disrupting access to clean water. Heavy rainfall can damage crops directly, but also cause significant soil erosion, especially on sloping land. This washes away topsoil, reducing soil fertility and productivity.

More frequent and intense droughts are also a significant threat to the KSD LM. In combination with the predicted significant population growth, this will lead to increased pressure on service delivery and competition for resources. Under current climate conditions, water demand is already higher than water supply. High population growth coupled with increasing temperatures will further increase water supply vulnerability.

5. Adaptation Goals, Programmes and Actions

The section outlines the adaptation plan using goals and measures designed to help King Sabata Dalindyebo LM to adapt to the impacts of climate change. Based on the assessment of the potential risks and vulnerabilities posed by climate change, this plan was developed as a proactive strategy to mitigate these risks and enhance resilience.

5.1. Adaptation goals

Drawing upon the assessment of the current and projected climate-related risks and vulnerabilities outlined in the preceding section, the following adaptation goals for King Sabata Dalindyebo LM were identified, prioritising those risks with the highest potential impact. These goals were validated by stakeholders during the nationwide engagements:

- Goal 1: To protect and increase the resilience of critical municipal infrastructure.
- Goal 2: To ensure water security and protect water resources under a changing climate.
- Goal 3: To invest in green infrastructure, rehabilitate and protect natural resources and biodiversity to improve ecosystem services.
- Goal 4: To build capacity of the public health sector and protect human health.
- Goal 5: To support resilient commercial, small-scale and subsistence farming systems (these contribute to food security and employment in the area).

5.2.Adaptation programme: Goal 1

Goal 1: To protect and increase the resilience of critical municipal infrastructure

Programme 1.1: Identify and protect vulnerable communities, infrastructure and systems
This programme aims to protect property, infrastructure and life from climate risks by identifying and prioritising infrastructure and communities facing the most severe risks and those with limited capacity to adapt.

Actions:

- Conduct comprehensive vulnerability assessments to identify infrastructure and communities most susceptible to climate hazards like droughts, floods, heatwaves, and wildfires. Utilise spatial data analysis tools like Geographic Information Systems (GIS) to map vulnerable areas based on factors like elevation, proximity to water bodies, and historical climate data.
- Based on the vulnerability assessments, prioritise infrastructure and communities facing the most severe risks and those with limited capacity to adapt. Develop a risk matrix that considers the likelihood and severity of climate hazards, as well as the potential consequences for specific infrastructure and communities. Prioritise critical infrastructure like hospitals, power plants, and water treatment facilities that require immediate attention. Identify vulnerable communities based on factors like poverty levels, access to essential services, and reliance on climate-sensitive livelihoods.
- Develop and implement an early warning system to help communities prepare for and respond to climate change risks.
- Raise awareness and educate communities on climate change risks. This involves collaboration with communities, businesses, and other stakeholders to develop and implement adaptation strategies. Organise workshops and public meetings to raise awareness of climate risks and encourage participation in adaptation planning.

Programme 1.2: Manage stormwater runoff appropriately
Climate change is bringing more frequent and intense rainfall events, leading to increased stormwater runoff. A key adaptation goal for stormwater runoff management is to upgrade traditional drainage systems to handle increased flow during heavy rain events and mimic natural systems to lessen the burden on traditional drainage systems.

Actions:

- Implement regular inspection, and maintenance programs for stormwater and road infrastructure.

- Upgrade stormwater drainage systems, including culverts, channels, and retention ponds, to accommodate increased stormwater runoff resulting from extreme weather events.
- Adopt water-sensitive urban design (WSUD) principles and practices to integrate stormwater management with urban planning and design, incorporating features such as water-sensitive streetscapes, green corridors, and sustainable drainage systems to enhance water quality and mitigate urban heat island effects.

Programme 1.3: Integrated fire management for climate resilience

This programme aims to minimize the occurrence and impact of wildfires, protect communities, ecosystems, and infrastructure, and enhance resilience to increasing fire risk.

Actions:

- Develop wildfire risk maps to prioritise areas for mitigation measures and emergency preparedness planning. These should be based on areas prone to wildfires, considering factors such as climate conditions, vegetation types, topography, and human activities.
- Implement measures to prevent wildfires, such as enforcing fire bans during periods of high fire danger, regulating land-use practices, and conducting prescribed burns to reduce fuel loads. Implement fuel management strategies, such as creating firebreaks, thinning dense vegetation, and removing flammable debris, to reduce the intensity and spread of wildfires.
- Develop and implement wildfire response plans that outline roles and responsibilities, communication protocols, evacuation procedures, and coordination mechanisms among relevant stakeholders.
- Protect key infrastructure by implementing land-use planning measures to allow for defensible space around structures, avoid locating critical infrastructure and residential developments in high-risk wildfire areas.

5.3.Adaptation programme: Goal 2

Goal 2: To ensure water security and protect water resources under a changing climate

Programme 2.1: Reducing water demand

The programme aims to implement strategies and measures to decrease the amount of water consumed by individuals, communities, industries, and agriculture, thereby enhancing water efficiency, resilience, and sustainability. It addresses water scarcity and stress exacerbated by climate change impacts such as altered precipitation patterns, increased evaporation rates, and prolonged droughts.

Actions:

- Promote and implement water conservation practices through the adoption of water-saving behaviours and technologies to reduce water wastage and optimise water use efficiency in households, businesses, and public institutions.
- Develop and enforce leak detection and repair programmes for water infrastructure.
- Encourage water-efficient landscaping practices in urban, suburban, and rural areas to reduce outdoor water demand. This could include promoting drought-tolerant native plants, mulching, soil moisture retention techniques, and efficient irrigation systems, as well as implementing landscaping ordinances and incentives to support water-wise landscaping practices. Encourage the adoption of water-smart urban planning practices like rainwater harvesting and greywater reuse.

- Implement public awareness campaigns to encourage water-saving practices at home and in businesses. Educate and raise awareness among stakeholders about the importance of reducing water demand as a climate change adaptation strategy. This includes providing information and resources to the public, businesses, and policymakers about the benefits of water conservation, as well as offering training and outreach programs to promote water-saving behaviours and practices.

Programme 2.2: Clear alien invasives species

This programme includes the prioritisation of specific invasive species to be removed, the best methods as well as the ecological restoration activities after clearing and prevent re-invasion by the alien species. Clearing them allows native vegetation to return, which helps stabilise the banks, reduces erosion, and naturally filters pollutants, leading to cleaner and more plentiful water.

Actions:

- Initiate and implement invasive alien plant clearing programs targeting priority areas within water catchment zones, riverbanks, and wetlands.
- Conduct ecological restoration activities following invasive alien plant clearing efforts.
- Engage local communities, stakeholders, and landowners in invasive alien plant clearing initiatives.

Programme 2.3: Protect, maintain and improve water services infrastructure

The programme aims to increase the resilience of water services to climate change, by improving infrastructure reliability, reducing downtime, and minimising service interruptions, thereby ensuring sustainable water supply for municipalities.

Actions:

- Implement regular maintenance schedules for water infrastructure, including pipelines, treatment plants, reservoirs, and pumping stations. Conduct routine inspections to identify and address potential issues before they escalate into larger problems. All water provision infrastructure should be maintained to ensure that it will be able to deal with extreme events such as flooding and drought and remain in functioning condition.
- Invest in upgrading aging infrastructure to improve reliability, efficiency and resilience to climate change impacts.
- Address human resources constraints for effective water infrastructure management by providing training, capacity building, skills development and promoting equal opportunities for women, minorities and underrepresented groups.

5.4. Adaptation programme: Goal 3

Goal 3: To invest in green infrastructure, rehabilitate and protect natural resources and biodiversity to improve ecosystem services

Programme 3.1: Tree planting

Tree planting can be helpful in adapting to the increased wind speeds and extreme weather events expected with climate change. Trees act as windbreaks, absorbing some of the wind's energy and reducing its speed near the ground. It can protect buildings and infrastructure by lessening the risk of damage to

buildings, power lines, and other infrastructure from strong winds or flying debris during storms. Co-benefits of tree planting includes soil conservation, improvement of local microclimates and air quality.

Actions:

- Conduct a thorough site assessment to identify areas most vulnerable to strong winds. Consider factors like prevailing wind direction, topography, soil conditions, and existing vegetation cover.
- Choose indigenous tree species that are well-adapted to the local climate and soil conditions. Prioritise wind-resistant species with strong root systems.
- Involve local communities in the planning process. This fosters ownership and ensures the project aligns with community needs and preferences.

Programme 3.2: Restoration and rehabilitation

The programme aims to enhance the provision of ecosystem services such as water purification, soil retention, carbon sequestration, and flood regulation. Restoration efforts can help improve water quality, regulate water flow, and enhance groundwater recharge. These efforts contribute to water security by ensuring a reliable and sustainable supply of water for municipalities, particularly in the face of climate variability and increasing water stress.

Actions:

- Develop comprehensive plans for the restoration of degraded natural areas, focusing on restoring ecological functions and native biodiversity.
- Engage local communities in restoration efforts, fostering a sense of ownership and promoting environmental stewardship.
- Undertake initiatives like tree planting, wetland restoration, and stream bank stabilisation to improve the health and functionality of natural spaces.

Programme 3.3: Integrate nature into urban planning

The programme aims to integrate natural features such as green spaces, urban trees, wetlands, and green infrastructure into urban planning to enhance the resilience of cities to climate change impacts such as extreme heat, flooding, and storms. Nature-based solutions like green roofs, permeable pavements, and bioswales can help absorb excess rainwater, reduce urban heat island effects, and mitigate flooding. It also enhances public health and well-being by providing opportunities for recreation, exercise, and relaxation. Green spaces, trees, and vegetation in urban areas helps mitigate urban heat island effects by providing shade, reducing surface temperatures, and cooling the surrounding environment.

Actions:

- Integrate green infrastructure principles into urban planning and development, promoting the incorporation of natural elements into the urban landscape. This can include creating green corridors, parks, and recreational areas.
- Advocate for building practices that utilise natural ventilation, reduce energy consumption, and promote rainwater harvesting, contributing to climate change adaptation.
- Encourage the creation of green infrastructure like rooftop gardens, bioswales (rain gardens), and planting trees to enhance biodiversity within urban areas.

5.5.Adaptation programme: Goal 4

Goal 4: To build capacity of the public health sector and protect human health

Programme 4.1: Protect human health

This programme aims to enhance the resilience of communities and health systems to climate change impacts, reducing vulnerability and protecting human health from climate-related hazards.

Actions:

- Conduct assessments to identify climate-related health risks and vulnerabilities in communities, including exposure to extreme heat, air pollution, vector-borne diseases, waterborne diseases, and food insecurity.
- Improve water sanitation and hygiene practices to reduce the risk of waterborne diseases, such as cholera and diarrheal diseases, by ensuring access to clean water, promoting handwashing, and improving sanitation infrastructure.
- Engage with communities to raise awareness about climate-related health risks, empower individuals to take preventive measures, and promote community-based adaptation actions.
- Provide health education and outreach programs to vulnerable populations, including children, the elderly, and people with chronic illnesses, to build resilience and reduce health risks associated with climate change.

5.6.Adaptation programme: Goal 5

Goal 5: To support resilient commercial, small-scale and subsistence farming systems (these contribute to food security and employment in the area)

Programme 5.1: Protect high value and urban agricultural land

This programme aims to ensure the long-term sustainability and functionality of high-value agricultural land and urban land in the municipality amidst a changing climate. This translates to protecting these lands from the negative impacts of climate change, while also promoting practices that ensure their continued productivity and value.

Actions:

- Implement zoning regulations that restrict development on high-value agricultural land, prioritising its use for sustainable food production.
- Develop and enforce spatial development frameworks (SDFs) that clearly delineate areas designated for agriculture and discourage urban sprawl onto these lands.
- Support local food production by supporting small-scale farmers, urban agriculture initiatives, and community gardens.
- Create markets and improve market infrastructure and access for farmers. Support local farmers, fresh produce markets, and food hubs. Invest in the development and improvement of market infrastructure, e.g. storage facilities, cold storage, and transportation networks.

Programme 5.2: Provide information and assistance to farmers

This programme aims to provide technical assistance, and information regarding climate hazards as well as information on climate smart agricultural practices.

Actions:

- Provide small-scale farmers with access to timely and localized climate information, weather forecasts, and agronomic advisories through mobile technology, extension services, and community-based networks to support informed decision-making and risk management.
- Organise workshops and training programmes on climate-smart agriculture practices like drought-resistant crops, water conservation techniques, and soil health improvement.
- Advocate for sustainable land management practices like no-till farming and cover cropping. This reduces soil erosion, improves water retention, and enhances soil health, leading to increased long-term productivity.
- Work with communities to develop disaster risk reduction plans for extreme weather events. This could include early warning systems, evacuation plans, and training on how to prepare for and respond to floods, droughts, or heatwaves.

6. Implementation Framework

The implementation framework summarises the adaptation plan and indicates responsibilities, timeframes, and priorities.

6.1. Implementation framework: Goal 1

Goal 1: To protect and increase the resilience of critical municipal infrastructure

Adaptation programme 1.1: Identify and protect vulnerable communities				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Conduct detailed assessments to identify infrastructure and communities most susceptible to climate hazards like extreme wind, droughts, floods, heatwaves, and wildfires.	Extreme wind, flooding, heat stress, drought	KSDLM Human settlements	Short term	High
ii. Prioritise infrastructure and communities facing the most severe risks and those with limited capacity to adapt.	Extreme wind, flooding, heat stress, drought	KSDLM Human settlements	Medium term	High
iii. Develop and implement an early warning system to help communities prepare for and respond to climate change risks.	Extreme wind, flooding, heat stress, drought	KSDLM Human settlements	Medium term	Medium
iv. Raise awareness and educate communities on climate change risks. This can be done by organising workshops or public meetings to raise awareness of climate risks and encourage participation in adaptation planning.	Extreme wind, flooding, heat stress, drought	KSDLM Human settlements	Short term	Medium

Adaptation programme 1.2: Manage stormwater runoff appropriately				
Adaptation Actions	Key risk or vulnerability addressed	Responsible department	Timeframe	Priority level
i. Implement regular inspection, and maintenance programs for stormwater and road infrastructure.	Floods	KSDLM technical services	Short term	High
ii. Upgrade stormwater drainage systems, to accommodate increased stormwater runoff	Floods	KSDLM technical services	Medium term	Medium
iii. Adopt water-sensitive urban design principles and practices such as permeable pavements, green roofs and rain gardens to enhance water quality and mitigate urban heat island effects.	Floods	KSDLM technical services	Long term	Medium

Adaptation programme 1.3: Integrated fire management for climate resilience				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Develop wildfire risk maps to prioritize areas for mitigation measures and emergency preparedness planning.	Fire risk	KSDLM Fire Services	Medium term	High
ii. Implement measures to prevent wildfires, such as enforcing fire bans during periods of high fire danger, regulating land-use practices, and conducting prescribed burns to reduce fuel loads	Fire risk	KSDLM Fire Services	Short term	High
iii. Develop and implement wildfire response plans that outline roles and responsibilities, communication protocols, evacuation procedures, and coordination mechanisms among relevant stakeholders.	Fire risk	KSDLM Fire Services	Medium term	Medium

iv. Implement land-use planning measures to allow for defensible space around key infrastructure structures.	Fire risk	KSDLM Fire Services	Medium term	Medium

6.2. Implementation framework: Goal 2

Goal 2: To ensure water security and protect water resources under a changing climate.

Adaptation programme 2.1: Reducing water demand				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Promote and implement water conservation practices through the adoption of water-saving behaviours and technologies to reduce water wastage and optimize water use efficiency in households, businesses, and public institutions.	Drought	KSDLM Technical Services	Short term (<5 years)	High priority
ii. Develop and enforce leak detection and repair programs for water infrastructure.	Drought	KSDLM Technical Services	Medium term	
iii. Clear invasive alien plants and prevent invasions. Removal and early detection of invasive alien plants will contribute to improved water quantity and quality and more productive wetlands and aquatic ecosystems.	Drought	KSDLM Technical Services	Medium to long term	High
iv. Implement public awareness campaigns to encourage water-saving practices at home and in businesses. Educate and raise awareness among stakeholders about the importance of reducing water demand as a climate change adaptation strategy.	Drought	KSDLM Technical Services	medium term (5-10 years	High

Adaptation programme 2.2: Clear alien invasives species				
Adaptation Actions	Key risk or vulnerability addressed	Responsible department	Timeframe	Priority level
i. Initiate and implement invasive alien plant clearing programs targeting priority areas within water catchment zones, riverbanks, and wetlands.	Drought, flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Medium term	High
ii. Conduct ecological restoration activities following invasive alien plant clearing efforts.	Drought, flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Medium term	Medium
iii. Engage local communities, stakeholders, and landowners in invasive alien plant clearing initiatives.	Drought, flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Medium	Medium

Adaptation programme 2.3: Protect, maintain and improve water services infrastructure				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Implement regular maintenance schedules for water infrastructure, including pipelines, treatment plants, reservoirs, and pumping stations. Conduct routine inspections to identify and address potential issues before they escalate into larger problems.	Drought, Flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Short, medium and long term	High
ii. Invest in upgrading aging infrastructure to improve reliability, efficiency, and resilience to climate change impacts.	Drought, Flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Long terms	
iii. Address human resources constraints for effective water infrastructure management by providing training, capacity building, skills development and promoting equal opportunities for	Drought, Flooding	KSDLM technical services Department of Water and Sanitation (DWS)	Short term	High

women, minorities, and underrepresented groups.				

6.3. Implementation framework: Goal 3

Goal 3: To invest in green infrastructure, rehabilitate and protect natural resources and biodiversity to improve ecosystem services.

Adaptation programme 3.1: Tree planting				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Conduct a thorough site assessment to identify areas most vulnerable to strong winds. Consider factors like prevailing wind direction, topography, soil conditions, and existing vegetation cover.	Extreme wind, flooding, heat stress	KSDLM Community Services	Short term	High
ii. Choose indigenous tree species that are well-adapted to the local climate and soil conditions. Prioritize wind-resistant species with strong root systems.	Extreme wind, flooding, heat stress	KSDLM Community Services	Medium term	High
iii. Involve local communities in the planning process. This fosters ownership and ensures the project aligns with community needs and preferences.	Extreme wind, flooding, heat stress	KSDLM Community Services	Medium term	Medium

Adaptation programme 3.2: Restoration and rehabilitation				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Develop comprehensive plans for the restoration of degraded natural areas, focusing on restoring ecological functions and native biodiversity.	Flooding, heat stress, drought	KSDLM Community Services	Short term	High
ii. Engage local communities in restoration efforts, fostering a sense of ownership	Flooding, heat stress, drought	KSDLM Community Services	Medium term	High

and promoting environmental stewardship.				
iii. Implement rehabilitation initiatives such as tree planting, wetland restoration, and stream bank stabilisation to improve the health and functionality of natural spaces.	Flooding, heat stress, drought	KSDLM Community Services	Medium term	Medium

Adaptation programme 3.3: Integrate nature into urban planning				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Integrate green infrastructure principles into urban planning and development, promoting the incorporation of natural elements into the urban landscape. This can include creating green corridors, parks, and recreational areas.	Flooding, heat stress, drought	KSDLM Community Services	Short term	High
ii. Advocate for building practices that utilize natural ventilation, reduce energy consumption, and promote rainwater harvesting.	Heat stress, drought	KSDLM Community Services	Medium term	High
iii. Promote urban greening by encouraging the creation of green infrastructure like rooftop gardens and planting trees to enhance biodiversity within urban areas.	Flooding, heat stress, drought	KSDLM Community Services	Medium term	Medium

6.4.Implementation framework: Goal 4

Goal 4: To build capacity of the public health sector and protect human health.

Adaptation programme 4.1: Protect human health				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level

i. Conduct assessments to identify climate-related health risks and vulnerabilities in communities.	Flooding, heat stress, drought	KSDLM Community Services	Short term	High
ii. Develop heatwave early warning systems to alert communities and health authorities to extreme heat events.	Heat stress	KSDLM Community Services	Medium term	High
iii. Improve water sanitation and hygiene practices to reduce the risk of waterborne diseases, such as cholera and diarrheal diseases.	Flooding	KSDLM Community Services	Short term	High
iv. Provide health education and outreach programs to vulnerable populations, including children, the elderly, and people with chronic illnesses.	Flooding, heat stress, drought	KSDLM Community Services	Medium term	High

6.5.Implementation framework: Goal 5

Goal 5: To support resilient commercial, small-scale and subsistence farming systems

Adaptation programme 5.1: Protect high value and urban agricultural land				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Implement zoning regulations that restrict development on high-value agricultural land, prioritizing its use for sustainable food production.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	High
ii. Develop and enforce spatial development frameworks (SDFs) that clearly delineate areas designated for agriculture and discourage urban sprawl onto these lands.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	Medium
iii. Support local food production by supporting small-scale farmers, urban agriculture initiatives, and community gardens.	Flooding, heat stress, drought	KSDLM rural and economic development.	Long term	Medium

		Department of Agriculture and Rural Development		
iv. Create markets and improve market infrastructure and access for farmers. This could be done by providing and investing in infrastructure for fresh produce markets e.g. storage facilities and cold storage.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	High

Adaptation programme 5.2: Provide information and assistance to farmers				
Adaptation Actions	Key risk or vulnerability addressed	Responsible entity	Timeframe	Priority level
i. Provide small-scale farmers with access to timely and localized climate information, weather forecasts, and agronomic advisories through mobile technology, and extension services.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	High
ii. Organize workshops and training programs on climate-smart agriculture practices like drought-resistant crops, water conservation techniques, and soil health improvement.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	Medium
iii. Advocate for sustainable land management practices like no-till farming and cover cropping.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development	Medium term	High
iv. Work with communities to develop disaster risk reduction plans for extreme weather events.	Flooding, heat stress, drought	KSDLM rural and economic development. Department of Agriculture and Rural Development		

7. Implications for the PHSHDA

An increase in average rainfall and associated extreme rainfall events are projected over the entire KSD LM, with Mthatha and Sheshego settlements projected to experience a significant increase in exposure to flooding in future. This could lead to substantial damage within these settlements as well as the surrounding agricultural lands. Floods can disrupt transportation, water and electricity supply, and sanitation systems, causing widespread economic losses. These events are often associated with severe storms and strong winds, which could lead to soil erosion, landslides, and the collapse of poorly constructed structures. In these settlements, poor drainage systems can exacerbate the flooding, leading to waterlogging and more damage. Flooding and storms would not only cause direct physical damage to property, buildings and infrastructure within Mthatha but could also lead to business interruptions, displacement of people and health effects. Floods can lead to reduced economic activity, force people to leave their homes and increase the risk of waterborne diseases. The economic burden of repairing and rebuilding after storms places a significant strain on the local economy and public resources.

Although Mthatha and Sheshego are not projected to experience an increased exposure to drought, water supply vulnerability within these settlements will still increase. This is due to the expected increase in population growth, especially in Mthatha, as well as the increase in temperatures which will drive evaporation. Inadequate water supply can strain existing infrastructure and services, while informal settlements are particularly vulnerable, as they may already lack reliable water access. Limited water availability also affects sanitation and hygiene, leading to poor living conditions and health issues. An increase in temperature will also increase the exposure of Mthatha and Sheshegu settlements to wildfires. Wildfires can cause extensive damage to homes, businesses, and infrastructure, and leaving many people homeless.

The planning and development of the PHSHDAs in the KSD LM should consider a mix of strategies to adapt to the increasing frequency and intensity of flooding, severe storms, water supply vulnerability and wildfire risk to protect vulnerable communities. Ease of implementation of adaptation actions plays a significant role in the success of climate adaptation strategies. Strategies that are practical, cost-effective, and aligned with existing policies and regulations are more likely to be implemented successfully. The suggested adaptation strategies in this document include a combination of approaches including the integration of climate risk into spatial planning, infrastructure maintenance and upgrading, implementing green or nature-based approaches in climate change adaptation and collaborative planning with local communities. Regular monitoring, evaluation, and adaptive management are also essential to ensure that adaptation measures remain relevant and effective in the face of evolving climate impacts.

8. Recommendations for Mainstreaming

Mainstreaming is the process of integrating climate change considerations into existing sectoral plans, other instruments and decision-making processes across various sectors and levels of governance. It involves recognising that climate change impacts and risks cut across multiple sectors and require a holistic approach to address effectively.

Mainstreaming climate change involves several key elements:

- Policy integration: Embedding evidence of climate change, as well as climate change adaptation and mitigation considerations into sectoral policies and strategies, such as those related to disaster risk

management, energy, water resources, transportation, and urban planning. This ensures that climate change is not treated as a standalone issue but is instead integrated into broader development agendas.

- Institutional integration: Incorporating climate change responsibilities and expertise within departments. This may involve establishing a dedicated but decentralised climate change unit, as well as fostering collaboration and coordination among departments and relevant external stakeholders. Incorporating climate response outcomes in the KPIs of all relevant departments, will ensure that progress towards climate goals can be tracked and measured.
- Capacity building: Enhancing the knowledge, skills, and capacities of politicians, decision-makers, and practitioners to understand and address climate change effectively. This includes providing training, technical assistance, and access to relevant information and tools, such as the GreenBook. By improving their understanding of climate change and the need for adaptation, these groups can better integrate climate considerations into their work.
- Budgeting and financing: Allocating resources and funding to support climate change adaptation and mitigation activities within existing budgets and financing mechanisms. This may involve reallocating funds from other priorities, leveraging external sources of finance, or integrating climate considerations into budget planning processes.
- Establishing networks and partnerships: Establishing networks and partnerships with civil society organisations, research councils, the private sector, different spheres of government, and other relevant entities could bolster climate adaptation efforts.
- Monitoring and evaluation: Establishing systems for monitoring and evaluating the effectiveness of mainstreaming efforts and tracking progress towards climate-related goals and targets is essential. This helps ensure accountability and facilitates learning and adaptation over time.

Climate change mainstreaming is essential for building resilience and promoting sustainable development in the face of climate change. By integrating climate considerations into decision-making processes and actions across sectors, mainstreaming helps minimise future risks, maximise opportunities for adaptation and mitigation, and enhance overall resilience to climate change impacts.

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