NATIONAL FRAMEWORK FOR WATER AND CLIMATE SERVICES MALAWI 2024 - 2029

SEPTEMBER 2024

Foreword

We are delighted to introduce the "National Framework for Water and Climate Services (NFWCS) for Malawi." This crucial document highlights our dedication to enhancing the nation's ability to address climate-related risks and improve resilience against climate variability and change. Its creation reflects our united efforts to tackle the urgent challenges posed by climate change, which continue to affect the livelihoods, infrastructure, and overall well-being of our people. The framework aligns with national policies and strategies, including the Malawi Vision 2063, which advocates for the integration of disaster risk reduction and the promotion of climate change adaptation and mitigation to sustain livelihoods through Green Economy initiatives.

Given Malawi's susceptibility to climate-related hazards, a coordinated and strategic approach is essential for improving the provision and utilization of hydrometeorological services. The NFWCS acts as a guiding framework to achieve this aim by promoting collaboration among key stakeholders, such as government agencies, research institutions, non-governmental organisations, private sector partners, development allies, and local communities. By harnessing the diverse strengths of these actors, we strive to foster a resilient and adaptable society capable of effectively managing the impacts of climate change.

To ensure the success of the NFWCS, resource mobilization is imperative. Securing funding from national budgets, international donors, and private partnerships will facilitate the procurement and installation of advanced hydrometeorological equipment, guaranteeing accurate and reliable data collection. Additionally, capacity-building efforts through training and workshops will empower technical staff with the necessary skills for the effective operation and maintenance of this equipment, thereby enhancing hydrometeorological services across various sectors in Malawi. The framework lays out a clear vision and actionable steps to improve these services, with a total estimated budget of USD 63,413,706.01 required to achieve the prioritized outcomes and outputs for the period from 2024 to 2028.

Let us unite in our efforts to realize the vision of a safer, more resilient, and prosperous Malawi for both current and future generations. Through our collaborative actions, we can build a nation that is well-equipped to confront the challenges presented by climate change and emerge stronger and more resilient.

Dr. Yusuf Mkungula
Secretary for Natural Resources and Climate Change

Elias Chimulambe
Secretary for Water and Sanitation

Preface

The National Framework for Water and Climate Services (NFWCS) for Malawi is an extensive initiative aimed at bolstering the country's resilience to climate variability and change by enhancing the delivery and application of hydrometeorological services. This framework aligns with both national objectives and international strategies, including the Global Framework for Climate Services (GFCS) and the United Nations Early Warning for All Initiative. The rising frequency and severity of climate-related disasters, such as floods, droughts, and severe winds, pose significant challenges to Malawi's socio-economic progress, affecting critical areas like agriculture, water resources, health, energy, and disaster risk management.

To tackle these challenges, the NFWCS focuses on fostering collaboration among diverse stakeholders, improving the co-production and dissemination of climate services, and strengthening the capabilities of institutions and communities to address climate risks effectively. This document outlines the strategic framework and key activities associated with the NFWCS, serving as a roadmap for establishing a robust and sustainable management plan for hydrometeorological stations. It is organized around the five pillars of the GFCS: observation and monitoring, hydrometeorological information systems, user interface platforms, research, modeling, and prediction, with capacity building as a fundamental cross-cutting element.

The process commences with a thorough assessment of the current hydrometeorological services in Malawi, which includes inventorying existing stations, evaluating their performance, and identifying gaps and needs. By conducting a detailed gap analysis, we can pinpoint the areas where additional stations or enhancements are necessary to ensure comprehensive coverage and reliable data collection.

Engaging with stakeholders is a critical aspect of the NFWCS. By consulting with government agencies, research institutions, non-governmental organisations, private sector actors, and local communities, we can gather essential insights and foster broad-based support for the network management plan. Stakeholder coordination committees will be formed to facilitate ongoing feedback and collaboration.

Capacity building is also a primary focus. Technical personnel will receive comprehensive training on the operation, maintenance, and calibration of hydrometeorological equipment. Additional workshops and training sessions on data management, quality control, and analysis will further develop the skills of those involved in the network.

Effective data management and integration with early warning systems are essential for the success of the NFWCS. Establishing robust data management protocols, which include data collection, storage, quality control, and dissemination processes, will ensure the reliability of the information provided. Integrating the network with national and regional early warning systems will enable timely and effective communication of weather and climate information to stakeholders and the public.

Sustainability planning is also a crucial component of the NFWCS. Developing long-term sustainability strategies, encompassing routine maintenance schedules, equipment lifecycle management, and ongoing capacity-building initiatives, will ensure the network's effectiveness over time. Continuous engagement with stakeholders and adaptability to technological advancements and changing environmental conditions will help maintain the system's relevance and efficiency.

In summary, the NFWCS marks a significant advancement in Malawi's efforts to improve climate resilience and foster sustainable development. By addressing the challenges posed by climate variability and change through a coordinated and strategic approach, we can enhance the nation's preparedness to manage and mitigate climate-related risks.

We express our heartfelt gratitude to all individuals and organisations who contributed to the development of the NFWCS. Your dedication and hard work have been vital in establishing a framework that will serve as a foundational element for Malawi's climate resilience initiatives. Moving forward, it is essential that we remain committed to implementing the strategies outlined in this framework, continually adapting to emerging challenges and opportunities.

Dr. Lucy Mtilatila
Director for Climate Change and Meteorological Services

Eng. James Chitete
Director for Water Resources

Acknowledgments

The creation of the "National Framework for Water and Climate Services (NFWCS) for Malawi" is the result of collaborative efforts from a diverse group of individuals and organisations. We express our deepest gratitude to the Government of Malawi for its unwavering support, which has been crucial in advancing this initiative.

We wish to recognize the significant contributions from our international partners, whose technical and financial assistance has been vital. Our sincere thanks go to the World Meteorological Organisation (WMO) for its guidance through the Global Framework for Climate Services (GFCS) and the CREWS initiative projects, which have greatly influenced the development of this framework. We are also grateful to UNDP through DG-ECHO Project for its financial support in finalizing the document. We appreciate the support from The Development Fund of Norway for printing and dissemination of the framework.

Our appreciation extends to the various government ministries and departments, non-governmental organisations (NGOs), research institutions, and private sector stakeholders involved in the consultation process. Their valuable insights, feedback, and collaborative efforts have enhanced the NFWCS, helping make it more comprehensive and inclusive. We specifically thank the Civil Society Agriculture Network (CISANET), the Farmers' Union of Malawi (FUM), and the Christian Health Association of Malawi (CHAM) for their active participation. Furthermore, we acknowledge our technical experts and consultants, whose expertise and dedication have been essential in the framework's formulation, with special thanks to the Leadership for Environment and Development (LEAD) and the Lilongwe University of Agriculture and Natural Resources (LUANAR) for their research and capacity-building support.

We are particularly thankful to the local communities across Malawi who engaged in consultations and shared their experiences and expectations. Their voices are vital to ensuring that the NFWCS effectively addresses the actual needs and challenges of those most impacted by climate variability and change.

Our heartfelt thanks also go to the editorial team from DCCMS and DWR, as well as everyone else who worked diligently behind the scenes to compile, review, and finalize this document. Your hard work and meticulous attention to detail have been instrumental in realizing this framework.

In conclusion, we extend our profound appreciation to all who contributed to the success of this endeavor in any capacity. The NFWCS stands as a testament to what can be accomplished through collaboration, commitment, and a shared vision. Together, we have established a strong foundation for a resilient and adaptable Malawi, ready to confront the challenges posed by climate change and to secure a sustainable future for all.

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Abbreviation

AWS	**Automated Weather Stations**
CBO	Community Based Organisation
CHAM	Christian Health Association of Malawi
CISANET	Civil Society Agriculture Network
DAES	Department of Agriculture Extension Services
DCCMS	Department of Climate Change and Meteorological Services
DCOF	District Climate Outlook Forum
DHRMD	Department of Human Resources Management and Development
DFID	Department for International Department
DG-ECHO	Directorate General European Civil Protection and Humanitarian Aid Operations
DODMA	Department of Disaster Management Affairs
DWF	District Water Forum
DWR	Department of Water Resources
ENACTS	Enhancing National Climate Services
FAO	Food and Agriculture Organisation
FUM	Farmers' Union of Malawi
GIZ	German Agency for International Cooperation
GFCS	Global Framework for Climate Services
ICAO	International Civil Aviation Organisation
ICT	Information Communication Technology
IEC	Information Education and Communication
IPCC	Intergovernmental Panel on Climate Change
IVR	Interactive Voice Response
JICA	Japan International Cooperation Agency
LEAD	Leadership for Environment and Development
LUANAR	Lilongwe University of Agriculture and Natural Resources
MASA	Meteorological Association of Southern Africa
MLGRD	Ministry of Local Government and Rural Development
MoA	Ministry of Agriculture
MoH	Ministry of Health
MoU	Memorandum of Understanding
NHF	National Hydrometeorological Forum
NFWCS	National Framework for Weather and Climate Services
NGO	Non-Governmental Organisation
NTCDRMCC	National Technical Committee on Disaster Risk and Climate Change
NWF	National Weather Forum
ODSS	Operation Decision Support System
PICSA	Participatory Integrated Climate Services for Agriculture
PSP	Participatory Scenario Planning

SADC	Southern Africa Development Community
SOP	Standard Operating Procedures
TOR	Terms of Reference
TWG	Technical Working Group
UIP	User Interface Platform
UNICEF	United Nation International Children's Emergency Fund
UNEP	United Nations Environment Programme
UNFCCC	United Nation Framework Convention on Climate Change
WMO	World Meteorological Organisation
WFP	World Food Programme
WRA	Water Resources Areas

Key Messages

National **Commitment**: Malawi's strong national commitment to climate change, disaster risk management, and livelihood programs is evident. This commitment aligns with the goals of the Global Framework for Climate Services (GFCS), providing a solid foundation for the NFWCS.

Funding: The Government of Malawi is expected to be the primary source of funding for the NFWCS implementation through various ministries. Additionally, the NFWCS will seek funding from international mechanisms like the Green Climate Fund, Global Environment Facility, Development Partners and other multilateral financial institutions. The estimated total amount required to implement this framework is USD 63,413,706.01.

Stakeholder **Engagement**: Key stakeholders, including government agencies, NGOs, and international partners, are willing to cooperate in the development and delivery of hydrometeorological services. Continuous collaboration and advocacy are crucial.

Institutional **Strengthening**: Competent and experienced institutions at national and sub-national levels are essential for undertaking hydrometeorological service initiatives. Capacity building through training and sharing good practices is necessary.

Data **Safety and Management**: Ensuring data safety through backups, developing data management infrastructure, and building data management capacity are critical to mitigate risks such as data loss and unstable power supply.

Security: Reinforcing security mechanisms to reduce vandalism of observation network and ensure safety of hydrometeorological equipment.

Public Awareness: Public awareness is necessary to reduce vandalism of observation equipment, enhance usage and application of hydrometeorological data and services by the public to make informed decisions that promote resilience.

Training **Opportunities**: Adequate training opportunities for stakeholders, including DCCMS, DWR, academia, and other partners, are vital for the successful implementation of climate services.

Sustainable **Collaboration**: Continued cooperation and coordination among stakeholders, including the government, NGOs, international partners, and the private sector, are essential for the sustainability and effectiveness of the NFWCS.

1.Introduction and Background

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1.1 Introduction

Malawi, like many other African and least developed countries, is highly vulnerable to the impacts of climate variability and change. These challenges continue to hinder the country's socioeconomic development. Natural disasters, such as tropical cyclones, droughts, strong winds, and floods, are becoming more frequent, intense, and impactful globally in the 21st century. In Malawi, rapid population growth, unsustainable urbanization, climate variability and change, and environmental degradation have compounded the challenges in managing these natural disasters.

Vulnerability to climate change is exacerbated by inequity and marginalization linked to gender, ethnicity, low income, and other social and economic factors. The disasters affected women, youth, and men differently, rapid gender analysis and other assessments show that women are disproportionately impacted, children form the biggest percentage of the affected population, persons with disability and the elderly are not spared from the impacts of climate-induced disasters. They face factors such as restrictive gender norms, increased time poverty, and exclusion from decision-making processes. Gender-specific barriers in prevention, preparedness, and recovery hinder women and girls from acquiring and accessing the means and capacities needed for resilience.

Over the past five decades, Malawi has experienced more than nineteen (19) major floods and seven (7) droughts, with these events increasing in frequency, magnitude and scope over the years. These disaster events have had a significant impact on people’s lives, livelihoods and socio-economic infrastructure in the affected areas, pushing a large number of people into poverty and food insecurity.

To address these issues, Malawi has embraced initiatives such as the Early Warning for All Program. This program aims to enhance early warning systems and preparedness for disasters, helping communities respond effectively and reduce the impacts of climate-related disasters. Additionally, Malawi's Vision 2063 strategy outlines a long-term development plan that includes strategies for building resilience to climate change and reducing the country's vulnerability to natural disasters.

Despite these efforts, Malawi continues to face weather-related shocks such as droughts, strong winds, hailstorms, and floods, which are often associated with heavy and persistent rains. Addressing these challenges requires holistic and sustained gender-responsive efforts to strengthen resilience, improve early warning systems, and implement sustainable development practices.

Hydrometeorological data and services are essential for humanity, providing crucial information that supports water management and development for socio-economic growth. This includes climate information for early warning, decision-making, and other purposes to various sectors and stakeholders nationwide. The observational data from hydro-met

stations feed into models for weather and hydrological analysis, enabling an understanding of current weather patterns, future weather predictions, and effective water resource management.
In addition, hydrometeorological data is used for the design of infrastructure such as bridges and dams, which facilitate transportation and ensure a reliable water supply for various uses. It also informs the planning of water resource activities by guiding the allocation of water among competing needs like supply, irrigation, and hydropower. This is vital for maintaining available water resources amid increasing demand due to population growth and development.

Moreover, hydrometeorological services play a key role in sustaining environmental flows necessary for supporting ecosystem services. They also foster peace among nations through data sharing for managing trans-boundary waters. Furthermore, these services contribute to sanitation sustainability, particularly in wastewater management, promoting good health within communities.
In managing extreme weather events, such as floods and droughts, hydrometeorological data aids decision-making by enhancing understanding of how to mitigate these challenges. This includes promoting early warning systems and constructing flood protection structures, ultimately leading to communities that are more resilient to the increasing frequency of such events due to climate change.
Given these multifaceted roles, it is essential to establish a framework that provides strategic direction on the management of hydrometeorological data and services. This framework links hydrological services to climate services, recognizing their interconnected nature and the shared goal of supporting socio-economic development.

1.2 Global Framework for Climate Services

Malawi started implementing the Global Framework for Climate Services Adaptation Programme in Africa (GFCS -APA) in 2014 focusing on climate services provision to agriculture, disaster risk reduction and health sectors in the co-production of sector specific climate services. Since then, there has been improvement in the coordination and dialogue between producers and users of climate services in Malawi. However, as a project-based initiative, the interactions are limited to the few selected sectors and areas that are participating in the project. There is therefore a need to broaden the user engagement so that as many sectors and institutions are involved in the processes for production and utilization of climate services. The Global framework for climate services has five components which are known as pillars. These pillars are as follows:

- Engagement between users and providers of climate services which can make users have their voice heard and make sure climate services are relevant to their needs.
- Climate services information system responsible for the production and distribution system for climate data and information products addressing user needs.
- Observations and monitoring which is essential infrastructure for generating the necessary climate data.
- Research, modelling and prediction. This will advance the science needed for improved climate services that meet user needs.
- Capacity development that supports the systematic development of the institutions, infrastructure and human resources needed for effective climate services.

The goal of the GFCS is to “enable better management of the risks of climate variability and change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale”. The Global Framework for Climate Services (GFCS) aims to enhance the management of climate-related risks and support adaptation to climate change by integrating science-based climate information and predictions into planning, policy, and practice at the global, regional, and national levels. By providing accessible and actionable climate services, the GFCS contributes to building climate resilience and promoting sustainable development worldwide

1.3 National Framework for Water and Climate Services (NFWCS)

The National Frameworks for Water and Climate Services (NFWCS) serve as multi-stakeholder platforms facilitating the development and delivery of hydrometeorological services at the country level. This critical mechanism, aligned with the Global Framework for Climate Services (GFCS), focuses on enhancing the co-production, customization, delivery, and utilization of science-based climate predictions and services in key areas such as agriculture and food security, disaster risk reduction, energy, health, and water. NFWCSs play a crucial role in supporting the objectives of the Paris Agreement by assisting its signatories in preparing, maintaining, and communicating their Nationally Determined Contributions (NDCs). Through the provision of climate services that assess vulnerabilities, identify adaptation options, enhance understanding of climate impacts, and bolster the capacity for adaptation planning and implementation in climate-sensitive sectors, NFWCSs complement National Adaptation Plans (NAPs).

The World Meteorological Organisation (WMO) has recommended that National Meteorological and Hydrological Services (NMHSs) establish and implement NFWCSs through a national consultative process. This framework serves as a coordinating mechanism between hydrometeorological service producers and users, facilitating the production and delivery of timely, effective, and tailored climate services at the national level. The NFWCS involves key national institutions responsible for collecting and compiling hydrometeorological observations and datasets, conducting relevant research, and providing tailored information products and expert advice. Additionally, it includes institutions and sectors that demand and utilize climate hydrometeorological services, such as Non-Governmental Organisations (NGOs), community-based organisations (CBOs), private institutions, the general public, and government policy and decision-makers responsible for resource allocation to entities involved in the climate services value chain.

Establishing the NFWCS is crucial for enhancing climate risk management through the development and utilization of country-specific climate information and services. This framework informs coordinated and integrated action, decision-making, and policy formulation based on national contexts. Decision-makers at all levels and across sectors require hydrometeorological information and services for short-, medium-, and long-term planning. Effective development and delivery of hydrometeorological services at the national level necessitate close collaboration among service providers, researchers, and users, including governments, civil society, communities, the private sector, technical partners, and donors. The NFWCS will play a pivotal role in ensuring the effective

implementation of strategies in National Policies reliant on climate services, while also enhancing the understanding and utilization of these services.

1.3.1 The Pillars of National Framework for Water and Climate Services (NFWCS)

The National Framework for Water and Climate Services (NFWCS) is aligned with the pillars of the Global Framework for Climate Services (GFCS), which guide its approach to enhancing hydrometeorological services at the national level. These pillars serve as the foundation for NFWCS's efforts to improve the management of climate-related risks and support adaptation to climate change.

The first pillar of NFWCS emphasizes engagement between users and providers of hydrometeorological services. This engagement ensures that services are tailored to the specific needs of users, allowing for more effective decision-making and risk management. The second pillar focuses on the establishment of a robust Hydrometeorological Services Information System (HSIS). This system serves as the backbone for the production and dissemination of hydrometeorological data, information and products, ensuring that they are accessible, reliable, and relevant to user needs. Observations and monitoring is the third pillar of NFWCS, providing the essential data and infrastructure for generating accurate and timely hydrometeorological information. These efforts are crucial for understanding and predicting water-related climate risks. The image below offers a glimpse of the pillars.

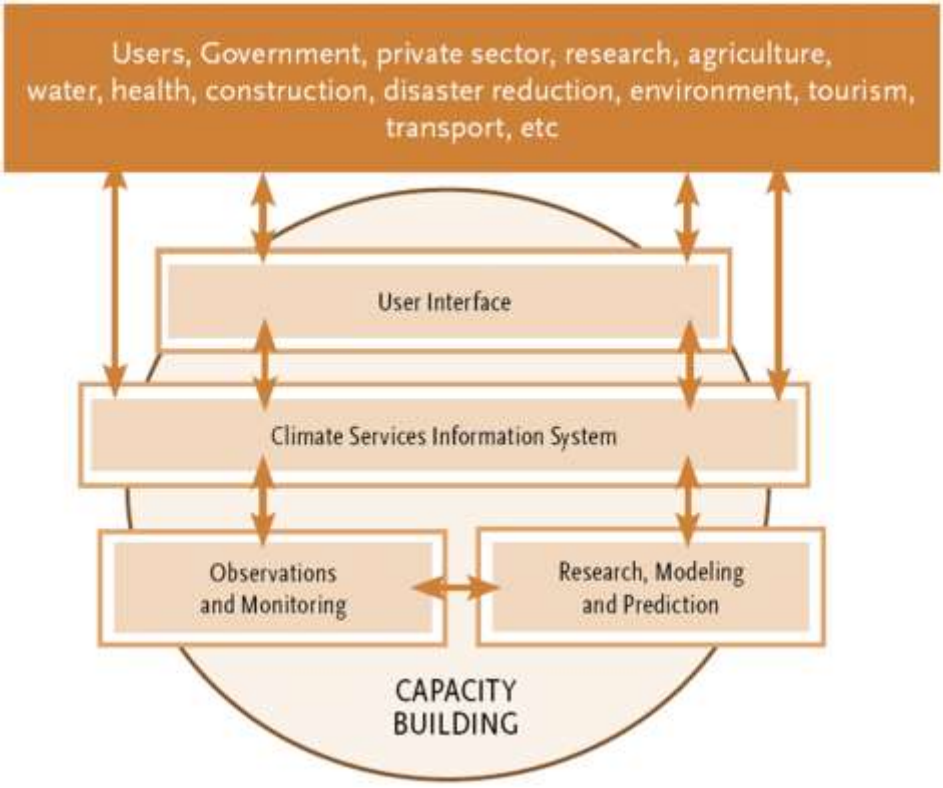


Figure 1:Organizational Structure for the Implementation of GFCS

The fourth pillar highlights the importance of research, modelling, and prediction in advancing the science behind hydrometeorological services. By investing in research and innovation, NFWCS aims to improve the accuracy and reliability of its services. The fifth and final pillar of NFWCS is capacity development, which focuses on strengthening the skills and capabilities of individuals and organisations involved in water and climate services. This pillar aims to ensure that the workforce is equipped to deliver high-quality services that meet the needs of users.

1.3.2 Purpose of National Framework for Water and Climate Services (NFWCS)

The main purpose of the NFWS is to establish an institutional mechanism to coordinate, facilitate and strengthen collaboration among national institutions to improve the co-production, tailoring, delivery and use of science-based hydrometeorological predictions and services that meet the needs of all.

1.4 Country Background on hydrometeorological Services in Malawi

1.4.1 Climate Services in Malawi

Meteorological data collection in Malawi dates back to the early 1890s when the country became a British Protectorate. Data were recorded by administrators at the BOMAs, Missionaries, farmers and a few interested individuals. The station network then merely reflected the logistics of the recorders or owners of the stations rather than technical aspects. A good number of stations were located along the Shire River and a concentration existed over the Shire Highlands in the tea estates.

The establishment of a systematic network of stations under a meteorological authority began in the mid-1940s. It was the need for aviation weather services that prompted the opening of the first few stations but soon other needs came in. Since then, the logistics for siting a station have changed and several technical aspects are considered. During the past few years, stations were opened to cater for the needs of development projects in Agriculture, forestry, water resources, fisheries, wildlife, education and many more.

The Department of Climate Change and Meteorological Services aims at providing reliable, responsive and high-quality weather, climate and climate change services to meet national, regional and international obligations through timely dissemination of accurate and up-to-date data and information for socio-economic development.

1.4.2 Hydrological Services in Malawi

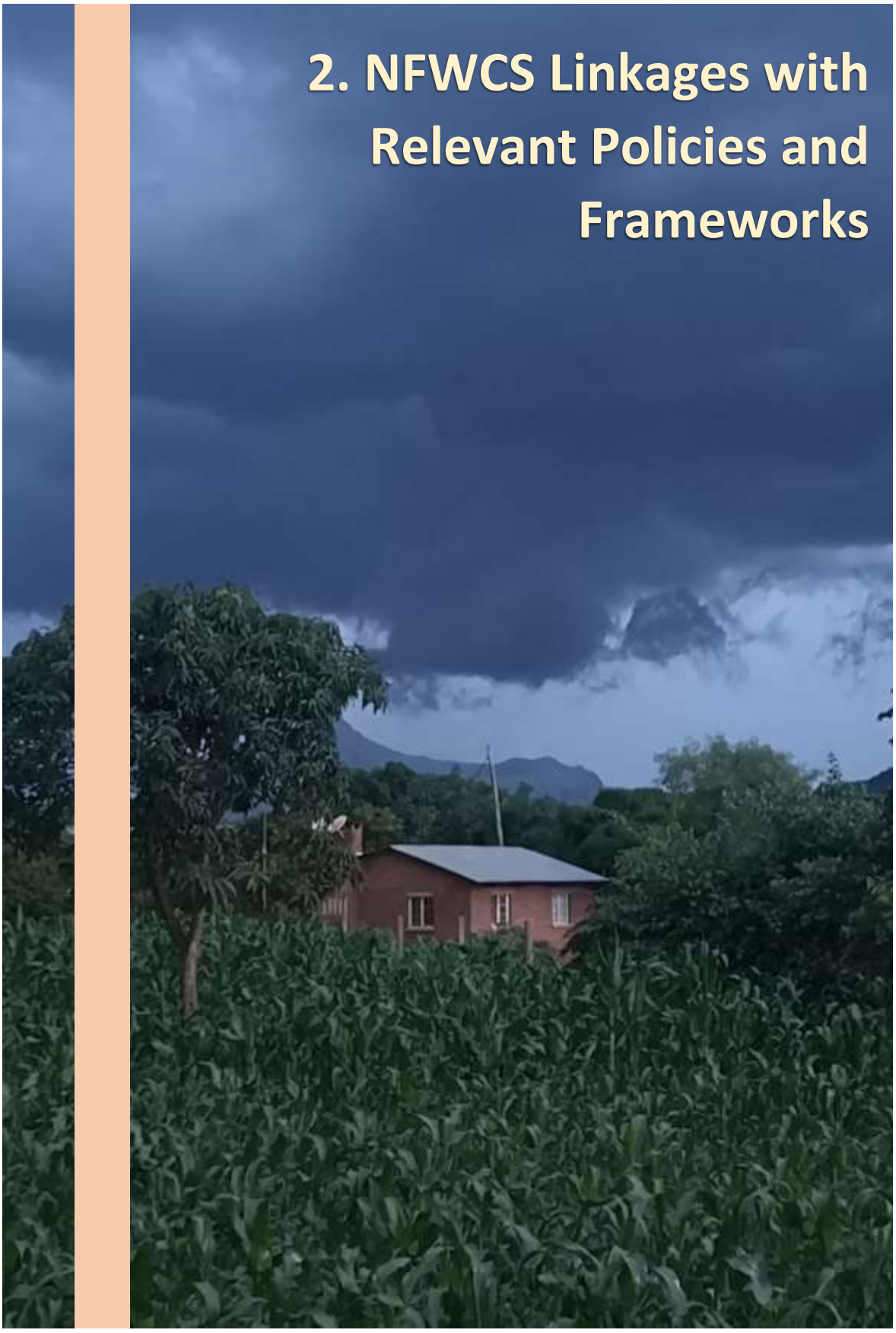
Hydrological services in Malawi are managed by the Department of Water Resources within the Ministry responsible for water affairs. Malawi boasts a relatively extensive network of hydrological stations. The Hydrological Network in Malawi is divided into 17 Water Resources Areas, also referred to as major catchments, which are further segmented into 78 sub-catchments or Water Resources Units. Monitoring of water resources is systematically

conducted to meet specific objectives. In Malawi, the primary aim of monitoring surface water resources is to furnish decision-makers at all levels with high-quality data, enabling them to make informed decisions regarding the development, protection, and management of surface water resources. Utilizations of hydrological data encompass water resources assessments, planning, research, and the design of infrastructure such as bridges, dams, and flood forecasting.

The majority of stations possess a hybrid configuration comprising both manual and automated gauging stations. In manual stations, data is collected by gauge readers who record water levels twice daily. Conversely, automated gauging stations are equipped with sensors that collect and transmit data to the server through a data logger. The overarching goal of the Department of Water Resources is to maintain the existing hydrological network to ensure the availability of reliable and accurate data to support various applications such as water resources assessment, plan development, hydraulic structure design, and flood forecasting.

In addition, the Department of Water Resources oversees the management and operation of flood forecasting models tailored for specific catchments, as well as the implementation of Community-Based Flood Early Warning Systems (CBFEWS) nationwide. Presently, the department is diligently working towards expanding the flood forecasting model to cover all catchments and implementing CBFEWS comprehensively to meet the Early Warning for All targets by 2027.

2. NFWCS Linkages with Relevant Policies and Frameworks



2. NFWCS Linkages with relevant Policies and Frameworks

The National Framework for Climate Services (NFWCS) will operate to support and complement several existing national policies such as: National Meteorological Policy (2019), National Forest Policy (2016), National Environmental Policy (2004), National Resilience Strategy (2018), National Climate Change Management Policy (2016), National Agricultural Policy (2016), National Disaster Risk Management Policy (2015), National Water Policy (2023), National Energy Policy (2018) and National Irrigation Policy (2016). The NFWCS will also complement the National Adaptation Plan (NAP) when it is fully developed.

The framework will also support the implementation of the vision of the Government of Malawi through MW2063. Effective hydro-meteorological services will be required in the realization of MW2063, visibly impacting Pillars 1 (Agricultural Productivity and Commercialization), 2 (Industrialization) and 3 (Urbanization); and Enablers 5 (Human Capital Development), 6 (Economic Infrastructure) and 7 (Environmental Sustainability). These pillars and enablers fall under sectors that are sensitive to climate change and variability, and have the potential to strive by integrating hydro and climate services and information.

At the international level, the NFWCS will aid to ensure that Malawi's hydro-meteorological services conform to the requirements and obligations of international protocols, conventions and frameworks that are defined and regulated under the World Meteorological Organisation (WMO), International Civil Aviation Organisation (ICAO), United Nations Convention Framework on Climate Change (UNFCCC), The Paris Agreement, Sustainable Development Goals (SDGs) and Sendai Framework for Disaster Risk Reduction, among others. The Climate Action SDG includes Promote mechanisms to raise capacity for climate planning and management; Strengthen resilience and adaptive capacity to climate-related disaster; Build knowledge and capacity to meet climate change; and Integrate climate change measures into policies and planning.

Filho et al. (2023)[1] emphasizes that SDG 13 is crucial for the attainment of all the Sustainable Development Goals (SDGs). This goal encompasses the integration of climate change initiatives into policies and planning, thereby influencing the implementation of all other SDGs (Figure 2).

The capacity to adapt to climate change and enhance resilience impacts both health (SDG 3) and water service provision (SDG 6). Additionally, SDGs 7, 9, and 12 play significant roles in promoting sustainable practices that help reduce greenhouse gas emissions through methods such as renewable energy, energy efficiency, and innovative production and consumption strategies. Climate change affects a wide range of ecosystems, including terrestrial and aquatic environments, leading to issues like desertification, ocean acidification, and threats to biodiversity. Consequently, a stronger focus on climate change in local and national plans and strategies is also anticipated to benefit SDGs 14 and 15 (Filho et al. 2023)[1].

Figure 2[1] The central role of climate action in achieving the United Nations' Sustainable Development Goals

2.1 NFWCS Linkages with UN Early Warning for All Initiative

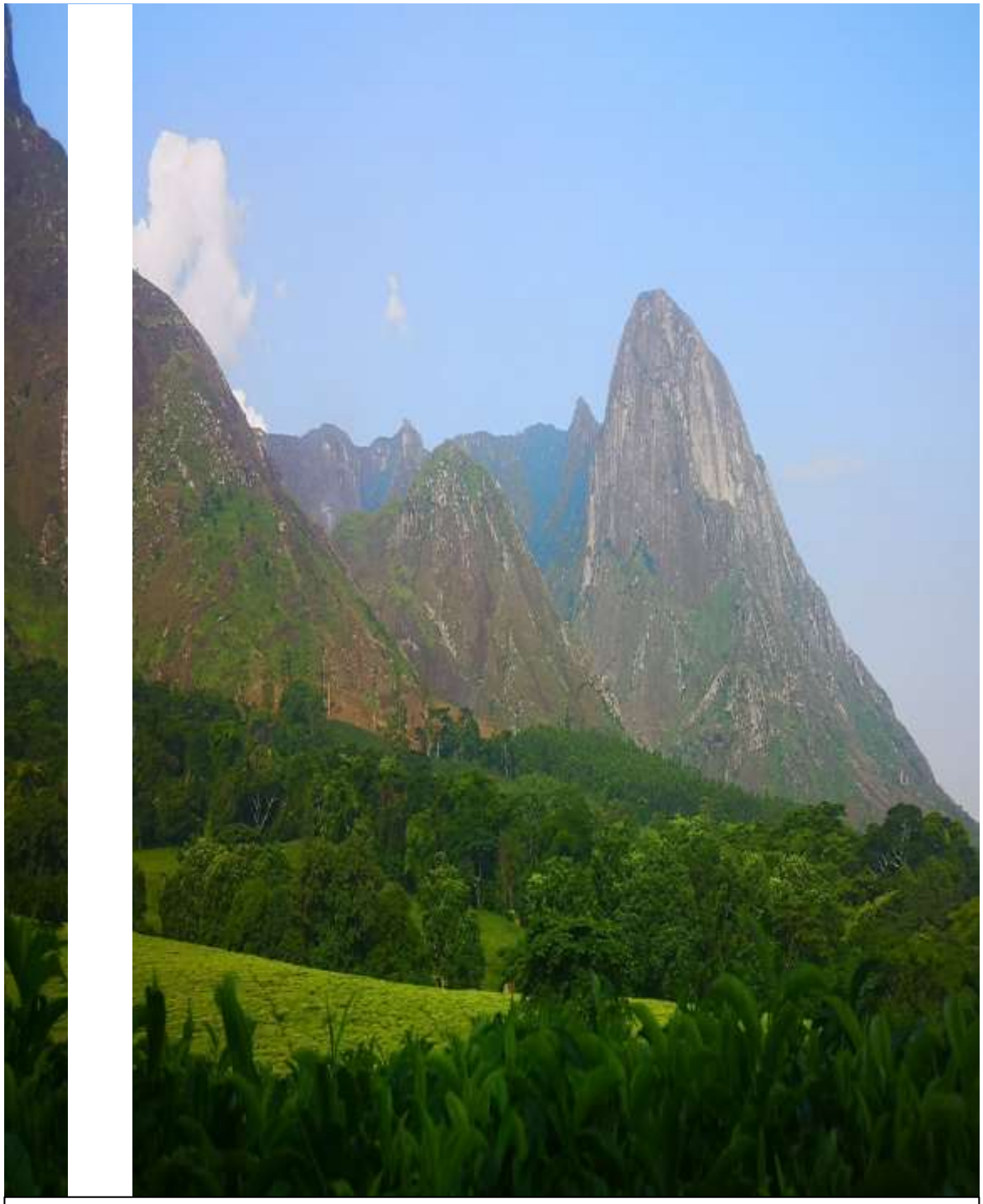
The Early Warnings for All is a groundbreaking initiative whose goal is to ensure that everyone on Earth is protected from hazardous hydro-climatic events through life-saving early warning systems by 2027. This is as declared by United Nations Secretary-General, António Guterres on the commemoration of the World Meteorological Day in 2022.

Early warning systems are widely regarded as the “low-hanging fruit” for climate change adaptation because they are a relatively cheap and effective way of protecting people and assets from hazards, including storms, floods, heat waves and tsunamis to name a few.
“Early warnings save lives and provide vast economic benefits. Just 24 hours’ notice of an impending hazardous event can cut the ensuing damage by 30 per cent,” said WMO Secretary-General Prof. Petteri Taalas.

[1]Filho, W.L., Wall, T., Salvia, A.L. *et al.* The central role of climate action in achieving the United Nations' Sustainable Development Goals. *Sci Rep* **13**, 20582 (2023). https://doi.org/10.1038/s41598-023-47746-w

The Early Warnings for All initiative is based on four pillars in the establishment of effective and inclusive multi-hazard early warning systems. The pillars are (i) Disaster risk knowledge which is led by the United Nations Office for Disaster Risk Reduction (UNDRR), (ii) Detection, observation, monitoring, analysis, and forecasting, which is led by the World Meteorological Organisation (WMO), (iii) Warning dissemination and communication, led by International Telecommunication Union (ITU), and (iv) Preparedness to respond, led by the International Federation of Red Cross and Red Crescent Societies (IFRC).

This NFWCS is expected to support the early warning for all initiative by addressing the various challenges associated with weather and climate hazards through the provision of a framework that supports systematic generation and provision of risk knowledge and early warning information to enhance resilience and adaptation to climate change impacts. The framework will also support the enhancement of coordination among stakeholders in the national early warning system, which is a critical factor to achieve the Early Warnings for All initiative.



3. Rationale for the establishment of the NFWCS

3. Rationale for the establishment of the NFWCS

The rationale for NFWCS is rooted in the need to improve hydrometeorological services provision and utilization as a means to address climate change impacts and improve early warning systems, to foster collaboration and empower evidence-based decision-making for sustainable development. Climate change impact many sectors of the economy;

3.1 Agriculture and Food Security:

This is a critical sector of the economy where weather and climate change are creating massive impact. Increase in extreme weather events has led to recurrent floods and drought, increased incidences of pests and diseases resulting in substantial reduction in crop yield and quality. About 85% of Malawi population depends on agriculture which is mainly rain-fed, implying that extreme weather and climate impacts will exacerbate other pressures on food production and supply leading to the most vulnerable groups of people (women, children, the elderly, persons with disability) at a subsistence level being trapped in poverty. These impacts can be reduced through timely provision, access and utilization of weather and climate information that would help farmers to timely prepare their livelihood strategy and plan ahead of the season, thereby reducing the risk of low or no production when they are hit by climate shocks.

3.2 Water Resources and Irrigation

Water Resources is one of the most important sectors in Malawi as it supports other sectors such as energy and agriculture. An increase in weather and climate extremes such as shifts in precipitation patterns, increases in temperatures and likely increases in flood frequencies will continue to have a negative effect on water supply and irrigation practices in the country impacting the vulnerable groups more. Climate change can affect the demand for water as well as supply including its quality. The scarcity of fresh water has led to increased competition for shared water resources for different uses in some areas including energy, commercial, and agricultural uses. Furthermore, changes in water demand, and irrigation practices will enhance groundwater exploitation.

3.3 Health:

Climate change will likely increase the frequency and strength of extreme events such as floods, droughts, heavy rainfall, extreme temperatures and storms. This would in turn affect the seasonality of many infectious diseases influenced by changes in spatial and temporal occurrence of weather elements like temperature, rainfall and humidity. Protection of people from diseases increasingly influenced by weather and climate becomes a high priority for the health sector in Malawi. Linking health to hydrometeorological information is now crucial for planning intervention measures and taking appropriate decisions to reduce health risks of all groups of people, men, women, and youth emanating from climate change.

3.4 Energy:

Changes in energy demand will likely be affected by changes in weather and climate extremes whose effect on energy sector would be enormous. Extended periods of intense droughts may result in severe reduction of water availability for hydropower generation and cooling of thermal electric power plants. This would result in affecting energy production, transmission and supply. Recent impacts of extreme weather and climate events have had a very negative effect on the energy sector affecting men, women and youth differently. The protection of energy sector from an increasingly variable and changing weather and climate is a priority for the sector. Hydrometeorological information is crucial in supporting effective exploitation and use of renewable energy sources for climate resilience community.

3.5 Disaster Risk Management:

Increase in extreme weather events due to climate variability and change in recent years have increased the vulnerability of people in Malawi particularly due to exposure and vulnerability to droughts and floods. As a result of climate change, the intensity, duration, and frequency of weather-related shocks are likely to increase.

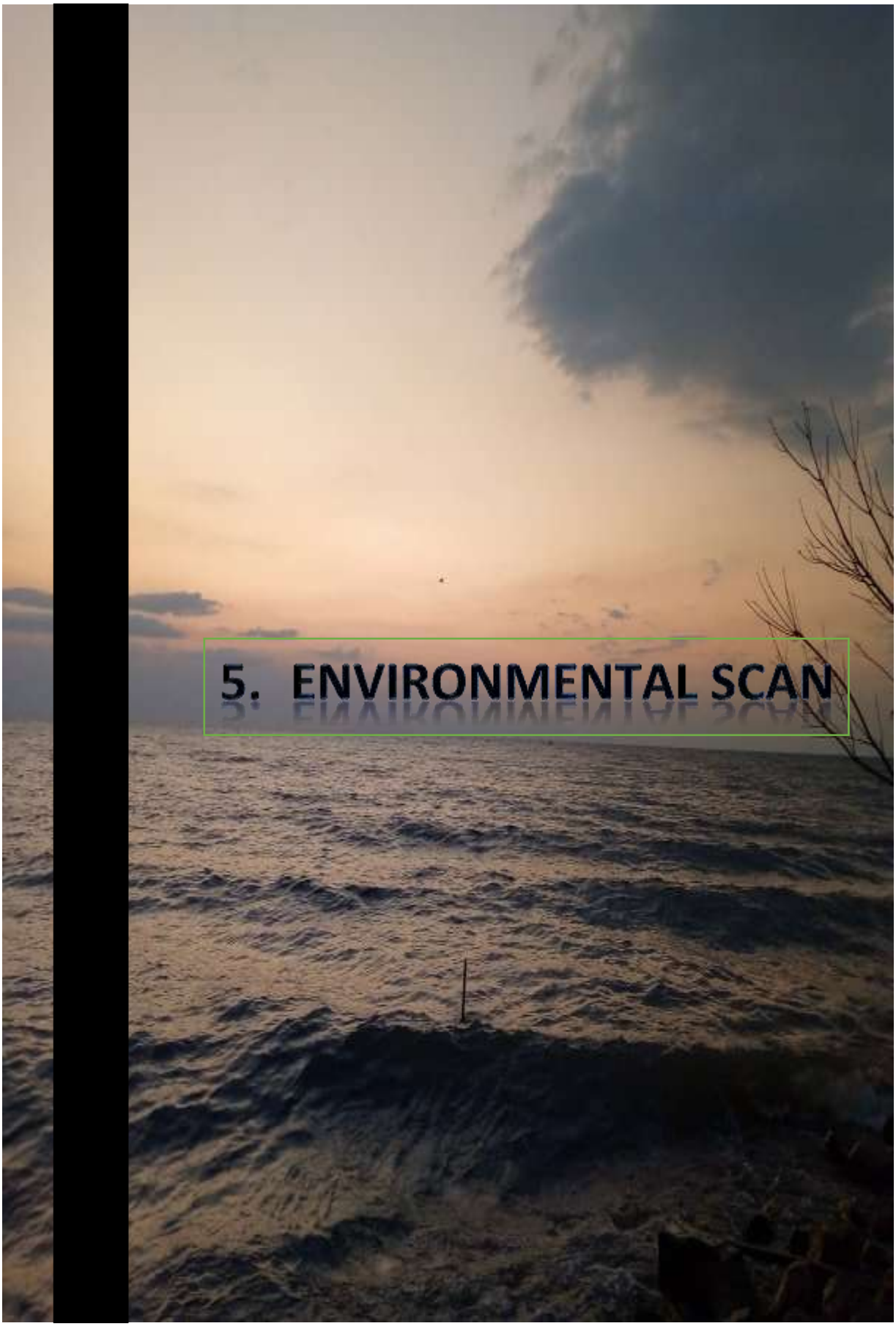
With these events following the floods in 2015 and the drought in 2016, the impact on the affected population has been cumulative. In the pre-disaster period, about 3.3 million people in the flood affected districts were already categorized as food insecure. In 2016/2017, the national poverty rate stood at 51.5 percent, with most of the poor (59.5 percent) living in rural areas. In Malawi, the level of inequality is high, with the Gini coefficient standing at 0.433 in 2017. Thus, disruptions to livelihoods resulting from disasters and other causes are likely to widen the gap between the poor and the well off, left many households exposed to and in need of reconstruction.

4. Stakeholder Analysis

4. Stakeholder Analysis

The Department of Climate Change and Meteorological Services and Water Resources Department conducted stakeholder analysis to ensure that all relevant hydrometeorological service actors available in Malawi are identified, engaged and consulted in order to know their various roles in the hydrometeorological services value chain. Stakeholders were consulted in the development of this strategy and they will also be involved in the implementation of the same. The views and interests of all stakeholders were taken into consideration for the implementation of the strategy to be effective and sustainable. A table containing the range of stakeholders and their sectors in Malawi is given in Annex I.

The institutional analysis observed that at the time, the Department of Climate Change and Meteorological and the Department of Water Resources were the main producers of hydrometeorological information which tended to be too technical for use by the end user. The assessment proposed the establishment of a forum for co-production of hydrometeorological services with sectors involved in the interpretation of hydrometeorological information and development of hydrometeorological advisories for their end users. A key proposal in the NFWCS is also the reduction of the time taken between production and dissemination through the hydrometeorological services value chain.


5. ENVIRONMENTAL SCAN

5. Environmental Scan

5.1 Strengths, Weaknesses, Opportunities and Threats (SWOT)

This SWOT Analysis considers the internal (strengths and weaknesses) and external (opportunities and threats) factors that are most pertinent to climate services sector.

Strengths	Weaknesses
● Existing interventions to improve hydrometeorological service delivery from a variety of development actors ● Commitment to implement new reforms in the delivery of hydrometeorological services ● Possibility of generating revenue from the hydrometeorological services ● Availability of an initial pool of expertise (qualified and skilled human resource) ● Availability of established infrastructure (hydrometeorological monitoring networks) across the country for collection, production and dissemination of hydrometeorological services ● Affiliation to hydrometeorological services sector in the regional and international bodies which offer guidance on delivery of the hydrometeorological services ● Availability of relevant policies and legislations such as the National Meteorological Policy, National Climate Change Policy, National Water Policy, Water Resources Act, Disaster Risk Management Act. ● Existing Climate Change and Meteorological strategy for the next 3-5 years for the provision of observations, data management, development of ICT capabilities and delivery of services and information. ● SOPs have been developed (for hydrometeorological warnings) to guide services. ● Good working relationship with the media for dissemination of information. ● Development of a websites to ease access	● Inadequate human resources especially in new technologies e.g. modelling country-based climate change projections, impact studies on the water sector, and also use of latest tools for data collection and analysis e.g. programming related tools like Google Earth Engine for analysis of remote sensed data ● Lack of some critical legal frameworks such as the National Climate Change Act and National Meteorological Act ● Inadequate infrastructure for the provision of hydrometeorological services ● Dependence on donor funding for human resource and infrastructure development ● Inadequate financial resources for sustenance of hydrometeorological services and infrastructure ● Inadequate collaboration among stakeholders in climate services sector for effective implementation of the components of the value chain ● Limited capacity to establish and implement Quality Management Systems ● Inadequate socio-economic related studies to derive the benefits hydrometeorological information, products and services ● Lack of national strategy to govern explicitly the process for hydrometeorological observation, data processing, modelling and forecasting ● Limited interactions with end-users of

to hydrometeorological information.	the hydrometeorological services which also affect the user satisfaction assessment on the provided hydrometeorological services ● Competency requirements not fully adopted in the Aeronautical Meteorology field ● Lack of customer or user profile information. Lack of formal system to monitor drought ● Limited observational stations ● Inadequate training in social aspects of the hydrometeorological services by hydrologists and meteorologists e.g. stakeholder engagement, mass communication skills, child protection, gender & inclusion (PGI) which are important in effective delivery of climate services
Opportunities	Threats
● Recognition of Climate Change issues at a global level and prioritization of the same in Malawi Growth and Development Strategy (MGDS) and SDGs ● Support from international organisations e.g. WMO, ICAO, UNFCCC, IPCC, MASA ● Increased demand on hydrometeorological related research from academia ● Technological advances leading to delivery of better services ● Potential to operate on cost recovery basis ● Increased demand for hydrometeorological services ● Availability of sectoral platforms on hydrometeorological issues ● Availability of electronic, print and social media for dissemination of hydrometeorological services ● Association with critical public and private institutions for public and private partnerships ● Multi-sectoral engagement with other stakeholders in the provision and improvement of information and services including youth-based and gender-	● Rapid population growth increasing the population vulnerable to impacts of climate change. ● High exposure to climate related risks e.g. high frequency occurrences of natural disasters e.g., extreme floods, cyclones, lightening, wind among others ● Vandalism of climate services infrastructure ● Rapid technological advances ● Availability of a multiplicity of climate products (online and from other sources) which may confuse end-users and negatively affect the provision of climate services ● Misconception on climate services ● Inadequate funding for the provision of hydrometeorological services ● Limited access to ECMWF and other products due to lack of a license ● The high expectation of accurate and reliable services from end-users of hydrometeorological services ● Dissemination of weather information from unauthorized dissemination

oriented organisations ● The need for global access to hydrometeorological data	sources

6. Situation, Gaps and Recommendations

6. Situation, Gaps and recommendations

This section describes the situation, gaps and recommendations for each of the 4 pillars of the GFCS shown in the Figure 2 below:

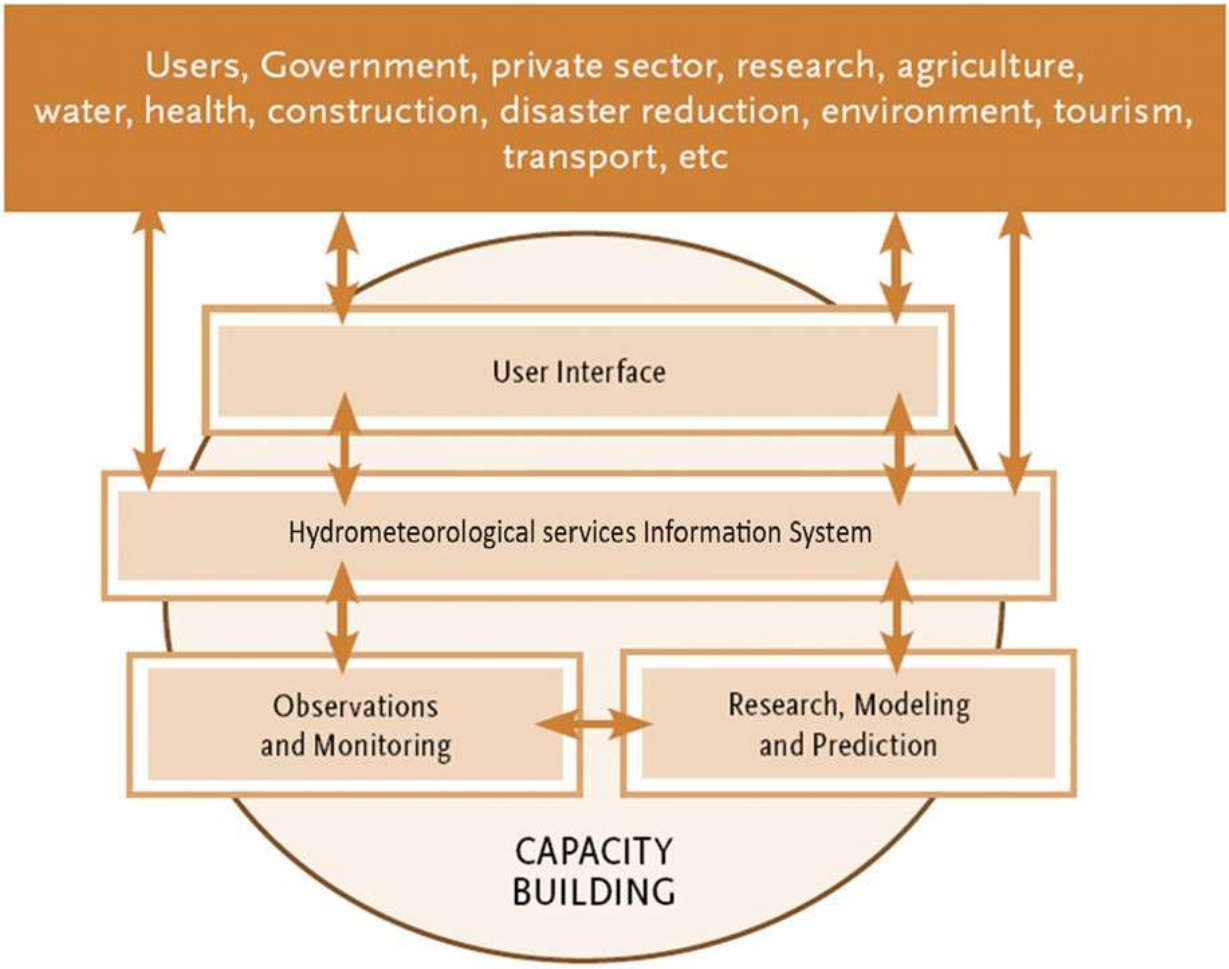


Figure 3: Organisational Structure for the Implementation of NFWCS

6.1 Observation and monitoring

Observation and monitoring imply the examination of the state of the earth's atmosphere and its underlying surface in a particular area at a particular time of the day by using instruments and eyes within a given short period of time. Hydro meteorological observation and monitoring in Malawi comprise systems such as automatic weather stations, conventional meteorological stations, automatic and manual hydrological monitoring stations and lake-based buoys on Lake Malawi; while upper air observations include use of accessible satellite imagery and upper air balloons. The use of the latter is limited by resources.

The aim of this pillar is to ensure that the hydrometeorological observations and other sector specific data necessary to meet the needs of all end users are collected, managed, and disseminated and are supported by relevant metadata.

6.1.1 Current Status

The observing system is divided into two main sub-systems; Surface-based, which refers to the systems that observe weather on the surface (conventional/Manned and automated), and Space-based Observation Systems for remote sensing. In Malawi, the observation stations are not adequate and well distributed over the national territory. There are 21 principle meteorological conventional stations which observe full range of weather elements including temperature, wind speed and direction, rainfall, sunshine hours, cloud cover, visibility, humidity and atmospheric pressure. These are also working as climatological stations supported by 21 subsidiary Agro-meteorological stations, over 400 rainfall stations and over 81 Automatic Weather Stations. Some of the subsidiary Agro-meteorological stations are no longer operational due to other factors. Currently, there is no upper air observation station and weather radar, and there is only one satellite observation station.

An ideal situation would be to have a station covering a radius of about 20km in flat areas and smaller radius in hilly areas. Although this is the ideal situation, a minimum of one station per district would be very useful to improve the spatial resolution. The 21 full meteorological stations available are representing wider areas, thereby affecting precision and reliability of the data. Furthermore, data transmission to the responsible departments is not automated and the availability of data capturing staff is not adequate. There is also no backup for the data management system available. As such, this increases data backlog and risk of losing data. Meanwhile, the use of various types of rain gauges in the rainfall stations affects the quality and comparability of data, because installation of rain gauges is not fully regulated. There is need therefore to procure and install additional conventional and Automatic Weather stations and to adequately service them. It is also recommended that on installation of rain gauges and other observation equipment by stakeholders, regulations and standards be implemented and that DCCMS approves the rain gauges to be used and that distribution is regulated. There is need to improve the collaboration in procurement and installation of weather/ climate monitoring equipment in the country.

DCCMS at present has technicians based at its headquarters in Blantyre. However, with the distribution of meteorological equipment across the country, this arrangement presents a challenge when there is need for inspection and servicing of the observation equipment and Automatic Weather Stations, which may result in loss of valuable observation data. Currently, not all the 81 Automatic weather stations are operational. It is recommended that some of the functions of DCCMS are decentralized so that technicians are available at regional or district level to attend to the AWS and other observation equipment on a regular basis.

The Department of Climate Change and Meteorological Services works is already collaborating with the Ministry of Agriculture, Ministry of Local Government and Rural Development and Ministry of Education, Science and Technology, but in the future the collaboration among these stakeholders would need to be further strengthened.

For water management purposes, Malawi is divided into 17 water resource areas (WRAs) based on river basins. Some WRAs consist of one river basin and others are composed of

several small river basins. WRAs are divided into water resource units (WRUs). Lake Malawi is the largest water body in Malawi, and is the dominant control on the surface water drainage network in the country with the Shire River being the only river flowing out of the Lake Malawi. The Shire River flows south into Mozambique, and eventually drains into the Zambezi River. The main rivers flowing into Lake Malawi are the Songwe, South Rukuru, North Rukuru, Dwangwa, Linthipe and Bua. The Songwe River marks Malawi's northern boundary with Tanzania, and flows into Lake Malawi at its northern end. The South Rukuru River is the main river in the Northern region of Malawi, flowing though the Nyika Plateau to the lake. The Bua and Dwangwa rivers flow through central Malawi into the lake.

These major rivers typically drain wide 'dambos' in the plateau areas, which have steep valley sides that become less steep as they reach the rift valley. The upper Shire Valley has a wide alluvial plain, changing to a narrower valley with gorges and rapids in the lower part. The next largest lake in Malawi is Lake Chilwa, which forms an internal drainage basin and mainly drains the northern uplands. Rivers flowing into the Chilwa basin tend to be ephemeral in their lower courses, losing water to permeable valley alluvial deposits.

Department of Water resources manages about 270 hydrological monitoring stations covering all the 17 water resource areas and out these almost 140 stations are functional with about 75 of them being both automated and manual.

6.2 Hydrometeorological Services Information Systems

The Hydrometeorological Services Information System is the pillar in the Framework that is designed to routinely generate hydrometeorological information which users need for decision making. It is the part in which climate data and information are processed and delivered for application, at the same time ensuring that both production and delivery of services are in line with agreed national, regional and international standards and protocols. The pillar is supported by the two pillars of observation and monitoring and research modelling and prediction. Production is guided by the user interface platform pillar. At national level, hydrometeorological services information system will include human resources, physical and other processing infrastructure and systems, pre-determined climate products requirements, data and database management systems, and communication and dissemination systems.

6.2.1 Climate products

Climate products are mainly generated at the National Meteorological Centre, and specialized products are also generated at aviation meteorological offices at Kamuzu and Chileka International Airports. Climate products are generated using both near real-time weather observational data and archived climatic data which is managed by the Climate station of DCCMS. Climate products provided so far are down-scaled seasonal rainfall forecasts, short and medium range national weather forecasts and warnings, agro-meteorological bulletins, and tailored short-range forecasts to specific users on demand. Sourcing feedback to inform products generation is not systematically done.

Climate services in Malawi also have data archive and database management systems for climatic and hydrological data. Guidelines for data management exist for climatic data. In terms of communication and dissemination of climate products and information, Malawi

uses the DCCMS website, Malawi Weather-Chasers WhatsApp, National and Community Radio, TV, Information, Education and Communication (IEC) materials- brochures, mobile text messages, 321 Interactive Voice Response (IVR), Malawi Weather accounts on Twitter and Facebook, Zanyengo mobile APP, agriculture and health extension workers and Press Releases. The services will be making use of interactive platforms such as enhancing National Climate Services (ENACTS) online Interactive platform, dissemination meetings and Participatory Integrated Climate Services for Agriculture (PICSA) which is an approach for enhancing uptake and application of climate information in agricultural activities.

6.2.2 Water Resources products

Hydrological products encompass a range of tools and datasets that provide critical information about water resources. These products assist in tracking and forecasting surface water dynamics such as river flows, lake levels, and flood occurrences. Here are some key products include:

- Streamflow Data: This includes measurements of water quantity flowing through rivers and streams at various points. Streamflow data, often collected by the Department of Water Resources are essential for flood forecasting, water supply management, and ecosystem health assessments.
- Flood Forecasting Models: These predictive models use hydro-meteorological data, terrain data and hydrological algorithms to forecast potential flood events. Products like the Shire River Basin ODSS offer real-time flood monitoring and forecasting, aiding in disaster preparedness and response.
- Lake Levels: Lake level monitoring is a crucial hydrological product that provides information on the water level of Lake Malawi. This data is essential for various applications, including regulation of water at Liwonde Barrage. Ground-Based water level gauges have been installed at strategic points i.e. Monkey-bay in Mangochi District, Chilumba in Karonga district and Nkhatabay Boma measure the water surface elevation manually. These gauges provide a daily and accurate data, which is essential for water resources management.
- Hydrological Yearbook: A hydrological yearbook is an annual publication that compiles comprehensive data and analyses related to hydrological conditions in all major catchments in Malawi over the past year. This document is crucial for understanding and managing water resources, and it serves various stakeholders, including scientists, policymakers, water resource managers, and the general public. Key features and components of a hydrological yearbook include, hydrological trends and analysis, hydrological events and Visual representations of data, including precipitation maps, streamflow hydrographs, and groundwater contour maps.

These hydrological products collectively enable a comprehensive understanding of water dynamics, supporting effective management and sustainable use of water resources in various sectors, Hydropower generation, urban development, environmental conservation, and disaster management.

6.2.3 Gaps

Provision of hydrometeorological services in Malawi is affected by several gaps and limitations. Limitations exist in available human resources, linkages to specific sectors for

impact-based products, capacity to follow guidelines for best practices in hydrometeorological services provision, and limited access to communication and dissemination channels by the population. Limitations in power and telecommunications also affect the services provision.

There are notable gaps in generation of more area-specific information, ability to verify forecasts and products, capacity to downscale and generate past and future climate projections, data rescue and management, integration of data from automated hydro-meteorological stations into weather information generation systems, hydrological and climate database management systems, and in the level of public awareness on available hydrometeorological products. The gaps also exist in getting real-time data for a robust Operation Decision Support System (ODSS) that requires enhancing the modernized hydrological and meteorological monitoring network.

Weak of coordination among sectors to allow co-production and integration of hydrometeorological sectoral information to enhance production of user driven services is another gap in hydrometeorological services information systems. This gap results in limited availability, uptake and application of hydrometeorological information in various socio-economic sectors of Malawi.

6.2.4 Recommendations

There is a need to fill vacancies that exist in institutions providing hydrometeorological services in Malawi. Capacity building interventions are required to enhance the hydrometeorological services delivery. These include regular and specialized trainings in modelling, data management, tailored products generation and use of modern technology in products generation.

There is a need to raise institutional, public and sectoral awareness on available hydrometeorological services and dissemination channels, enhance resource mobilization for customized products, develop guidelines and best practice in data management and sharing.

Development of a quality management system to guide customer driven services in line with standard and recommended practices for hydro-meteorological services delivery and enhancement of sector engagement and collaboration in the value chain of climate services will benefit both users and producers of hydrometeorological services.

Other recommendations include decentralization of the climate services information system to district level and institutionalization of PISCA and participatory scenario planning (PSP) as awareness raising tools in the mainstream of climate services through government entities. Finally, the establishment of sub sectoral committees that focus on specific areas of interest will enhance collaboration and coordination with stakeholders.

6.3 User Interface Platforms

According to the Step-by-step Guidelines for Establishing a National Framework for Climate Services by the World Meteorological Services, WMO-No 1206 of 2018, User Interface Platform (UIP) is a structured means for users, hydrometeorological researchers and

hydrometeorological information providers to interact at all levels. UIPs represent Level of formalized interactions among providers and users of hydrometeorological services. UIP can be a coordination mechanism providing space for sharing of information, advisories and feedback.

Examples of UIPs that already exist at region level include the Sothern African Regional Climate Outlook Forum (SARCOF), while at national level it includes the National Technical Committee on Climate Change (NTCCC), whose membership includes sectoral UIPs such as the National Agriculture Content Development Committee (NACDC), the National Technical Committee on Disaster Risk Management (NTCDRM), Health and Climate Change Core Team (HCCCT), Civil Society Network on Climate Change (CISONECC), Civil Society Agriculture Network (CISANET), Network for Climate Journalist (NCJ), Association of Environmental Journalists (AEJ), Basis Risk Committee (BRC), Church and society among others.

Formalized UIPs for hydrometeorological do not currently exist in Malawi. Currently, there is a gap in cross sectoral dialogue which needs to be quickly solved. A National Hydromet Forum (NHF) is proposed to be set up and can play the role of facilitating cross-sector dialogue. NHF will act as a platform for interface between producers and users of hydrometeorological services in general. Through the NHF regular capacity building and interaction sessions will be conducted to enhance the understanding and utilization of hydrometeorological services in general.

The current practice is that the dialogue among existing platforms is mostly project based and do not include the participation and engagement of the private sector, e.g., tobacco industry, sugar, tea, mobile companies and in addition to this, feedback mechanisms are not formalized: currently the most used mechanisms are weather chasers WhatsApp group, feedback mechanism log and off the cuff comments.

To bridge the identified gaps, the following recommendations were made:

- Mechanisms for resource mobilization need to be established and implemented, including the operationalization of the climate fund.
- There is need to review the mandates of the committees to incorporate discussions on user needs.
- The robustness of the UIP will depend on the reliability of the data.
- The interface will bring back the commitment of the users to be part of co-producers of hydrometeorological services.
- There is a need to strengthen/ formalize the already existing interface for climate other than creating new committees/groups.
- There is a strong and urgent need to establish NHF.
- Establish/ strengthen NHF forums at the district level.
- The private sector needs to be engaged so that they can be brought on board.
- Due to limited understanding by practitioners and communities of direct linkages between hydrometeorological and other sectors such as health, forestry, fisheries, among others, there is need to establish regular interfaces between the producers and users of hydrometeorological services, as well as endeavoring in deliberate capacity building initiatives of the users to recognize the hydrometeorological information linkage to different sectors.

- Another area of concern that requires urgent addressing is the vandalism of hydrometeorological observing equipment. Targeted equipment includes river and rain-gauges (especially the copper parts), automatic hydrometeorological stations (solar panels), etc. One of the suggested ways of dealing with this vice is to create sense of ownership in the communities by engaging them in sensitization sessions on usefulness, benefits of hydrometeorological monitoring equipment in their livelihoods. These engagements must also include sessions on care and basic maintenance of the equipment to selected few members of the communities.
- In order to strengthen feedback mechanisms, there is need to adopt what is termed as student journalism. It involves training community volunteers on how to identify a particular need in the community and record the observations including pictures to share and archive for future use in the communities and beyond.

6.4 Research, Modelling and Predictions

Implementation of research, modelling and prediction in Malawi requires resources, technologies and innovative solutions and skills to develop science-based information to enable effective adaptation, mitigation and risk management activities associated with climate variability and change. This pillar aims at advancing the development of national science and related skills required for improved hydrometeorological services that meet all users' needs at all levels within priority sectors. The pillar will also foster research towards continually improving the scientific quality of hydrometeorological information, assess and promote the needs of hydrometeorological services development and implementation within research agendas.

Despite the importance of research, modelling and predictions in developing, packaging and appropriate use of hydrometeorological services being evident, their current status limits research implementation. Inadequate computing power and human capacity to conduct such research are some of the limiting factors. There is still inadequate capacity to produce specialized hydrometeorological products that can inform decisions. In the recent years, there have been interventions through various projects that are supporting hydrological, weather and climate modelling and design capacity as well as improving computing capacity in hydrometeorological services delivery. Such interventions include capacity building in the down-scaling of seasonal forecasts and acquisition of high-performance computers that have enabled Climate Change and hydrometeorological Services to be issuing and packaging area specific forecasts. There is need to support these efforts in addition to building human capacity to undertake meaningful research in hydrometeorological services delivery. Therefore, effective implementation of the NFWCS will support research, modelling, design and improved hydrometeorological prediction for sustainable socio-economic development. Furthermore, this framework will build on the existing technology, achievement made in scientific prediction and modelling to improve b hydrometeorological services in Malawi.

Although various stakeholders within Malawi hydrometeorological services landscape are involved in research related to water, weather, climate variability, climate change and their potential impacts, there exists a big gap particularly in coordinating and conducting such research. The existing gaps in research, modelling and predictions have contributed to challenges in addressing uncertainties in predictions of seasonal forecasts as well as limiting delivery and uptake of water, weather and climate information. Additional gaps include

research that focuses on water resources, weather and climate impacts on social development of the country and vulnerability studies using hydrometeorological data. NFWCS will strengthen research to assess and promote the needs of climate services through collaborations with other institutions to better improve on existing research gaps and needs. It will also strengthen the capacity in modelling and predictions which would result in the provision, access and utilization of reliable hydrometeorological services.

It is therefore recommended that this framework should strengthen delivery of hydrometeorological services through awareness on climate-resilient livelihoods, generation of appropriate measures to develop and improve hydrometeorological products through application of appropriate techniques. It would be required to build capacity of both scientists and users to improve the user interface and development of hydrometeorological services and products. Since the existing research does not take into account non-climatic factors when modelling the potential impacts of a change in climate on various sectors, further implications of research quantification of possible climate change implications on various sectors is required. The framework should also establish a Centre of excellence in climate research and modelling, provide tailor-made trainings to stakeholders such as researchers, scientists, and users in different sectors, promote coordination of climate research, modelling and prediction including, documentation of climate research and existing expertise in climate research, modelling and prediction at national level. The framework should also leverage on the existing research collaboration through the meteorological society of Malawi.

7. Vision, Mission and Values of NFWCS

7. Vision, Mission and Values of NFWCS

7.1 Vision

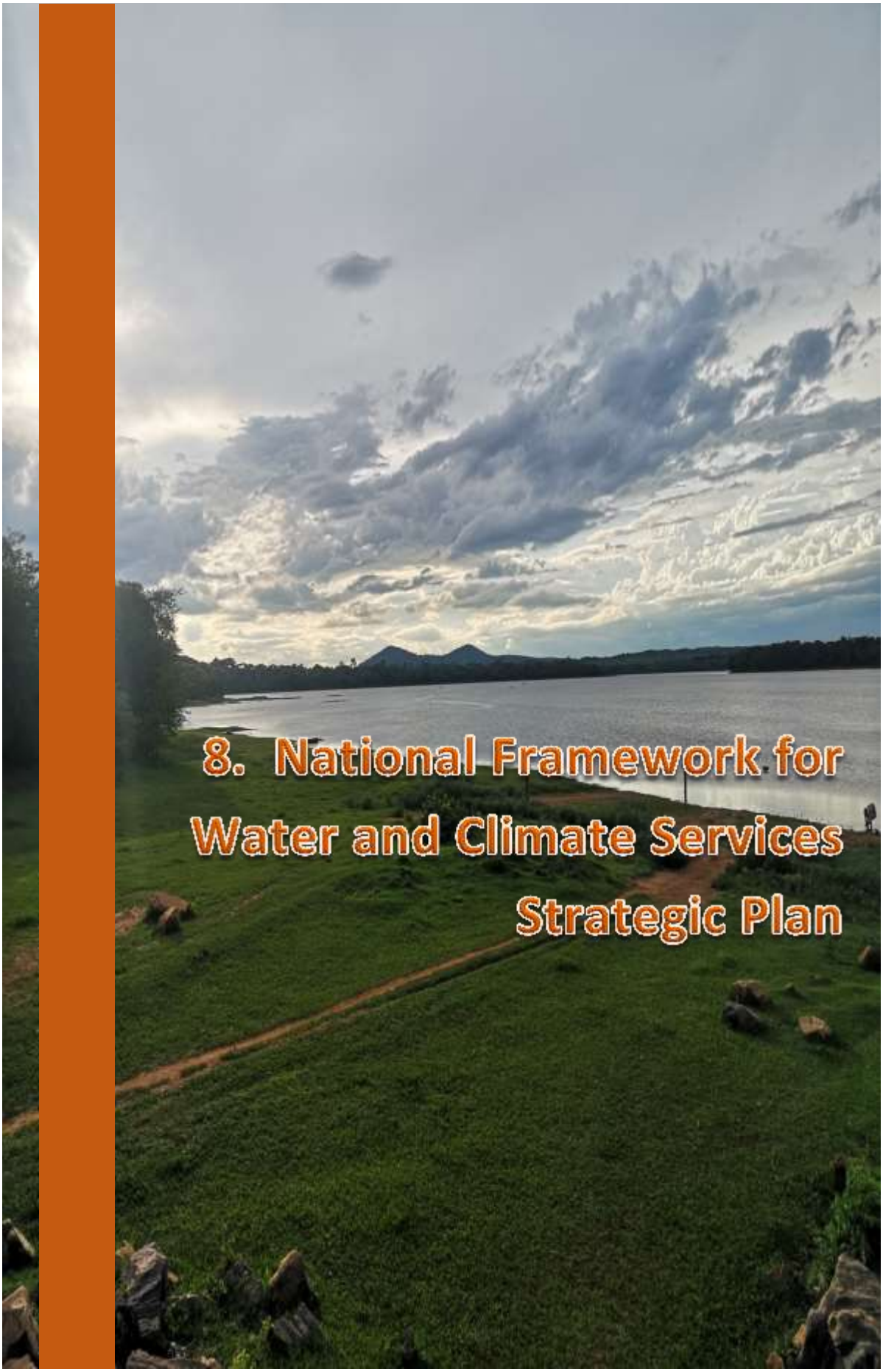
Reliable hydrometeorological services for all

7.2 Mission

To create an enabling environment for the generation and provision of tailor-made hydrometeorological services for socio-economic development of Malawi

7.3 Values

Credible – reliable for the user to confidently apply in decision making
Collaborative – working together / teamwork
Multi-sectoral – inclusiveness, inter-disciplinary,
Robust – standing the test of time, strong and in good condition


8. National Framework for
Water and Climate Services
Strategic Plan

8. National Framework for Water and Climate Services Strategic Plan

8.1 Purpose of the strategic plan

The purpose of the strategic and action plan is to guide the coordination and collaboration in the co-production, delivery and utilization of efficient and effective hydrometeorological services. It will also guide in the resource mobilization for the National Framework for Water and Climate Services (NFWCS).

8.2 Strategic Plan Framework

This section highlights the strategic direction that Malawi seeks to take in ensuring reliable hydrometeorological services for all in the country. It is organized around the structure of the five pillars of the GFCS; observation and monitoring, hydrometeorological information systems, user interphase platforms, research, modeling and prediction with capacity building as a cross cutting pillar.

8.2.1 Observation and monitoring

Strategic Outcome 1 Improved collection, management and dissemination of hydrometeorological observations and other sector specific data and relevant metadata.						
Outcome Target 1.1. Adequate national observing systems maintained and operated						
OUTPUT DESCRIPTION		**Output Indicator**	**Baseline**	**Target**	**Timeframe**	**Responsibility**
Output 1.1	*Developing national hydrometeorological station network management plan*	Number of hydrometeorological plan developed	0	1	By end 2029	DCCMS, DWR, MOA, PRIVATE SECTOR
Output 1.2	Increased station network as recommended in national hydrometeorological station network management plan	Number of full meteorological, agro-meteorological, hydro-meteorological stations in a district.	3 reliable stationsper district	At least 10 per district (depending on network mgt plan)	By end 2029	DCCMS, DWR
Output 1.3	Assorted observation and monitoring equipment	Radar system acquired, ceilometers acquired, upper	Radar 0, ceilometers 0, upper air 0, air	Radar 3, ceilometers 3, upper	By end 2029	DCCMS, DWR MOA, PRIVATE

	purchased, installed and are operational	air, air quality, observing systems acquired, Data loggers aquifer, ADCP acquired	quality 0, , Data loggers 50 ADCP 1	air 3, air quality 10, Data loggers 150 ADCP 4		SECTOR
Output 1.4	90% of hydrometeorological observation and monitoring systems automated	Network of Automated Hydrometeorological Station expanded, data transmission from conventional observing stations automated	AWS (60) AHS (60)	AWS (126) AHS (243)	By end 2029	DCCMS, DWR MOA, PRIVATE SECTOR
Output 1.5	Technicians at national and district level recruited and trained	Number of technicians recruited and trained	3 (National Hydro) 12 (district hydro) 5 (National Climate) 1 (district Climate)	10 (National Hydro) 28 (district hydro) 9 (National hydro) 28 (district)	By end 2027	DCCMS, DWR, MLGRD
Output 1.6	Additional hydrometeorological observers recruited and trained	Number of hydrometeorological observers recruited and trained	77 climate 60 hydro	135 climate 270 hydro	By end 2027	DCCMS, DWR, MLGRD
Output 1.7	Assessments and reporting of monitoring systems status conducted	Number of stations inspected per year	130 hydro 70 climate	270 hydro 240 climate	By end 2027	DCCMS, DWR
Output 1.8	Mercury based meteorological instruments replaced with digital	Number of mercury thermometers replaced and disposed,	10 10	28 28	By end 2026	DCCMS

	instruments	Number of mercury barometers replaced and disposed				
Output 1.9	Awareness and education outreach in schools	Number schools reached	0	90	By 2027	DCCMS, DWR, Min Education
Outcome Target 1.2 Improved collaboration among stakeholders on hydrometeorological observation and monitoring						
Output 1 .10	Increased public and private sector engagement	Number of public and private sectors engaged and involved in data observations	8	15	By end 2027	DCCMS, DWR, PRIVATE SECTOR
Output 1.11	Standards for guiding selection and installation of observation equipment by stakeholders distributed and enforced	Guidelines for observation equipment by stakeholders developed and implemented	0	2 (1 hydro, 1 climate)	By end 2027	DCCMS, DWR
Outcome Target 1.3 Improved data management						
Output 1 12	Establish data backups	data backups established	0	2 (1 hydro, 1 climate)	By end 2027	DCCMS, DWR
Output 1.13	Data rescue conducted	Number of stations with rescued data	60 (hydro) 40 (climate)	270 (hydro) 240 (climate)	By end 2026	DCCMS, DWR, MOA, PRIVATE SECTOR
Output 1.14	Additional Data entry clerks recruited and trained	Number of data entry clerks recruited and trained	0 (climate) 1 (hydro)	4 (climate) 3 (hydro)	By end 2026	DCCMS, DWR
Output 1.15	Incorporation of remote sensing data into historical data enhanced	Number of stations with composite data	82 climate 25 hydro	240 270	By end 2027	DCCMS, DWR

Output 1.16	Data from other sectors incorporated	Type of data incorporated	8	15	By end 2029	DCCMS, DWR, MOA, PRIVATE SECTOR
Outcome target 1.4 Reduced vandalism of observing and monitoring equipment to 10%						
Output 1.17	Additional security guards recruited	Number of security guards recruited	30	50	By end 2027	DCCMS
Output 1.18	Public and institutional awareness campaigns conducted	Number of awareness campaigns conducted	2 Hydro 2 Climate	4 Hydro 12 Climate	By end 2029	DCCMS, DWR, MOA, PRIVATE SECTOR
Output 1.19	Automated monitoring devices installed on hydrometeorological observing equipment	Number of equipment with devices installed	60 hydro 60	270 Hydro 240 Climate	By 2029	DCCMS, DWR, PRIVATE SECTOR
Outcome Target 1.5 Capacity of key stakeholders to provide hydrometeorological services strengthened						
Output 1.20	Training needs assessment undertaken	Assessment reports	0	2 (1 hydro, 1 Climate)	By end Mid 2025	DCCMS, DWR, MOA, PRIVATE SECTOR
Output 1.21	Annual refresher courses for hydrometeorological observers conduct	Training reports	1 Hydro 1 Climate	4 Hydro 4 Climate	By end 2029	DCCMS, MOA, PRIVATE SECTOR
Output 1.22	Annual refresher courses for volunteer observers conducted	Training reports	1 Hydro 1 Climate	4 Hydro 4 Climate	By end 2029	DCCMS, DWR MOA, PRIVATE SECTOR
Output 1.23	Function review	Number of management	0	1 Hydro	By end 2026	DCCMS, DWR,

	undertaken	study reports		1 Climate		DHRMD

8.2.2 Hydrometeorological Information Systems

Strategic Outcome 2 Improved information systems for reliable, accessible and usable hydrometeorological services by 2029						
Outcome Target 2.1 Capacity to co-produce demand driven climate products and services improved						
OUTPUT	**OUTPUT DESCRIPTION**	**Output Indicator**	**Baseline**	**Target**	**Timeframe**	**Responsibility**
Output 2.1	Training of staff on production of tailored hydrometeorological services conducted	Number of staff trained	15 (hydro) 23 (climate)	50 Hydro 70 Climate	2024 - 2029	DCCMS, DWR
Output 2.2	Recruitment of additional staff	Number of staff recruited	169 Climate 35 Hydro	310 Climate 70 Hydro	2024 - 2029	DCCMS, DWR
Output 2.3	Multi-sectoral data integration undertaken	Number of products using sectoral data	20 Climate 7 Hydro	40 Climate 15 Hydro	2024-2029	DCCMS, DWR MOA, MoH,
Output 2.4	Sector specific user needs assessments conducted and harmonized	Needs assessment reports	1 Climate 1 Hydro	2 Climate 2 Hydro	2024-2029	DCCMS, DWR DoDMA, MoH, MOA
Output 2.5	Child centered needs assessment on	Number of assessment reports	0	1	2026	DCCMS, Save the Children, MRCS Education

	hydrometeorological services and research conducted					
Output 2.6	Gender-based needs assessment on hydrometeorological services and research conducted	Number of assessment reports	0	1	2025	DCCMS, Save the Children, MRCS, Education
Output 2.7	Tailor-made products developed	Number of tailor-made products	10 Climate 7 Hydro	20 Climate 15 Hydro	2024 - 2029	DCCMS, DWR, MOA, MoH, NGOS, Academia, Pvt Sector
Output 2.8	Indigenous knowledge incorporated	Number of sessions on IK incorporation	0	15 Climate 15 Hydro	2024 - 2029	Academia, DCCMS, DWR, Local Authorities, communities
Output 2.9	Protection of Climate Information Systems enhanced	-No of power backup systems installed -No of data backup installed -No of computer systems safeguarded with antivirus	2	5	By 2029	DCCMs. DWR
Output 2.10	ISO based Quality management systems establishe	Number of quality management systems established and	0	1	2024-2029	DCCMS

	d for aviation meteorological services	sustained				
Output 2.11	ISO 748:2021 Hydrometry -- Measurement of liquid flow in open channels Determination of the stage-discharge relationship certified	Number of Hydrometry -- Measurement of liquid flow in open channels Determination of the stage-discharge relationship certified	0	1	2025-2029	DWR
Output 2.12	Stakeholders engaged on co-production and tailoring of hydrometeorological services	Number of stakeholders	10 Climate 7 Hydro	20 Climate 15 Hydro	By end 2025	DCCMS, DWR, stakeholders
Outcome Target 2.2 Effective hydrometeorological data management systems for high quality data that caters for multiple user needs enhanced						
Output 2.13	Hydrometeorological data from automated Hydro-Met stations data integrated into existing databases	Number of automated stations integrated into existing databases	60 hydro 60 Climate	270 Hydro 240 Climate	2024-2029	DCCMS, DWR

Output 2.14	Data from all hydro-meteorological stations rescued and digitized	Number of stations with digitized data	60 (hydro) 40 (climate)	270 (hydro) 240 (climate)	2024-2026	DCCMS, DWR
Output 2.15	Develop/procure/upgrade Data Management system for Hydrometeorological data and information	Data Management system developed	1 Climate 2 Hydro	1 Climate 2 Hydro	2024-2029	DCCMS, DWR
Output 2.16	Data management training conducted	Number of staff trained	24 Climate 16 Hydro	80 Climate 45 Hydro	2024-2029	DCCMS, DWR
Outcome Target 2.3 Access and utilization of hydrometeorological information increased						
Output 2.17	Create awareness raising on existing hydrometeorological services	Number of awareness campaigns/ events	2 Hydro 2 Climate	5 Hydro 12 Climate	2024 - 2029	Media, Academia, NGOs, MOA, DCCMS, DWR
Output 2.18	Translate products into local languages	Number of products translated to local languages	10 Climate 1 Hydro	40 Climate 15 Hydro	2024 - 2029	Academia, DAES, DCCMS, DWR
Output 2.19	Expand channels for disseminating for hydrometeorological products	Number of channels	11 Climate 3 Hydro	13 Climate 10 Hydro	2024 - 2029	DCCMS, Media, Academia, NGOs, MOA, DWR

Output 2.20	Institutionalize hydrometeorological Information decision making tools e.g. PICSA, PSP, ODSS	PICSA and ODSS integrated into tertiary curriculum	0 Climate 0 Hydro	2 Climate 5 Hydro	2024-2029	DCCMS, DWR MOA, MoH, NGOS, Academia
		PICSA and ODSS integrated into programs (institutions)	0 Climate 0 Hydro	2 Climate 2 Hydro		

8.2.3 User Interface Platforms

Strategic Outcome 3 User interface platforms for hydrometeorological services established and operationalized						
Outcome Target 3.1 National Climate Outlook Forum established by 2029						
OUTPUT DESCRIPTION		**Output Indicator**	**Baseline**	**Target**	**Timeframe**	**Responsibility**
Output 3.1	Terms of reference for NHF developed	Terms of reference for NHF in place	0	1	2024	Secretariat (DCCMS)/ Task Force
Output 3.2	NHF members trained on use of climate services	Number of trainings for NHF members conducted	0	3	2024-2027	NHF
Output 3.3	Advisories co-produced from Seasonal forecast through NHF platform	Number of advisories co-produced from seasonal forecast through NHF	0	4	2024-2029	NHF and Users
Output 3.4	Youth representation at National Climate Outlook Forums promoted	Number of youth attending National Climate Outlook Forums	0	50	2024-2029	DCCMS, Save the Children, MRCS, Education
Outcome Target 3.2 Sectoral committees strengthened by 2029						
Output 3.5	Sectoral committees UIP mandate	Updated sectoral committee	0	4	2024-2029	NHF, Sectors

	reviewed	Mandates				
Output 3.6	Sectoral committees trained on use of climate services including youth (PICSA for Youth Programme) and the disabled persons	number of sectoral committees trained	0	4	2024-2029	NHF and Sectors
Output 3.7	Advisories co-produced from seasonal forecast and historical climate information through Sectoral committees	Sector specific advisories developed through Sectoral committees; Seasonal forecast reviewed	0	4	2024-2029	NHF, Sectors
Output 3.8	Partnerships with child-centered organisations established	Number of partnerships developed	0	5	2024-2029	DCCMS, DWR
Output 3.9	Co-production of sector specific climate products to accommodate impact based forecasts including youth and the Disabled Persons	Number of sectors, number of hydrometeorological products	2	6	2024-2029	DCCMS, DWR, Energy, Health, Tourism, mining, education
Outcome Target 3.3 District user interface platforms on hydrometeorological services established by 2029						
Output 3.10	District consultations to establish	Number of DHF established	0	28	2024-2029	DCCMS, DWR and DHF

	District Hydromet Forum (DHF)					
Output 3.11	The district youth climate related forums established or enhanced e.g., school clubs, district youth parliament	Number of youth forums	0	28	2024-2029	DCCMS, DWR, Save the Children, Education
Output 3.12	DHF members trained on hydrometeorological services	Number of trainings for DHF members conducted	0	56	2024-2029	DCCMS, DWR and DHF
Outcome Target 3.4 Feedback mechanisms on hydrometeorological services formalized by 2029						
Output 3.13	Availability of Feedback mechanisms on climate services assessed	Assessment report	0 Climate 0 Hydro	3 Climate 3 Hydro	2024 - 2029	DCCMS, Sectors, NHF, DWR
Output 3.14	Feedback mechanisms established	National and Sector specific feedback mechanisms on climate services established	0 Climate 0 Hydro	3 Climate 3 Hydro	2024 - 2029	DCCMS, Sectors, NHF, DWR
Output 3.15	Feedback mechanisms strengthened	Sector specific feedback mechanisms strengthened	3	3	By 2029	DCCMS,DWR
Outcome Target 3.5 Capacity of users and producers of hydrometeorological services developed						
Output 3.16	Sensitization in interpretation and use of hydrometeorological	Sensitization report	0	2	2024-2029	DCCMS, Sectors, NHF, DWR

	services conducted including Youth and the Disabled Persons					
Output 3.17	Early Warnings systems for schools established	Number of Early Warnings systems for schools established	0	90	2024-2029	Education, SAVE the children, DCCMS, DWR
Output 3.18	Sensitization (quizzes, competitions, clubs) for the youth and marginalized	Number of sensitization campaigns for youth and marginalized conducted	0	224 (56 per year, 2 per district per year)	2024-2029	Education, SAVE the children, DCCMS, DWR

8.2.4 Research, Modelling and Prediction

Strategic Outcome 4: Improved hydrometeorological forecasting, prediction, information, technologies and innovations for evidence-based decision making						
Outcome Target 4.1 Capacity in conducting hydrometeorological related research enhanced by 2029						
OUTPUT DESCRIPTION		**Output Indicator**	**Baseline**	**Target**	**Timeframe**	**Responsibility**
Output 4.1	Training needs assessment conducted	Training needs assessment report	1	2	2025	DCCMS, DWR, universities and research institutions
Output 4.2	Staff trained in conducting hydrometeorological related research and data analysis	number of trainings conducted for researchers and scientists trained	1	4	By December, 2029	DCCMS, DWR, universities and research institutions
Output 4.3	Software for data analysis procured	Number of software for data analysis in place	1 Hydro 1 Climate	6 Hydro 6 Climate	2029	DCCMS, DWR, Universities, research institutions

Output 4.4	Centre of excellence in climate research and modelling established	Number of Centre of Excellence in hydrometeorological research and modelling	0	1	By December, 2029	DCCMS, DWR, Universities, research institutions
Outcome Target 4.2 hydrometeorological research plan developed by 2029						
Output 4.5	Stakeholder consultative meeting conducted	Number of stakeholder consultative meeting conducted	0	2	By Mid-2025	DCCMS, DWR, Universities, research Institutions, NCST
Output 4.6	Research plan drafted	Number of research plans in place	0	1	By December, 2025	DCCMS, DWR, Universities, research Institutions, NCST
Output 4.7	Validation meeting conducted	Number of validation meetings conducting	0	1	By March, 2026	DCCMS, DWR, Universities, research Institutions, NCST
Output 4.8	Dissemination meeting conducted	I dissemination meeting conducted	0	1	By May, 2026	DCCMS, DWR, Universities, research Institutions, NCST
Outcome Target 4.3: collaboration of hydrometeorological research strengthened by 2029						
Output 4.9	Existing researchers and scientists on hydrometeorological research identified and documented	Number of Mapping reports for researchers and scientists	0	1	By December, 2025	Universities, DCCMS, DWR
Output 4.10	Partnerships with universities and research institutions	MOU with universities and research institutions signed	1	4	By January, 2026	Universities, research institutions, DCCMS, DWR,

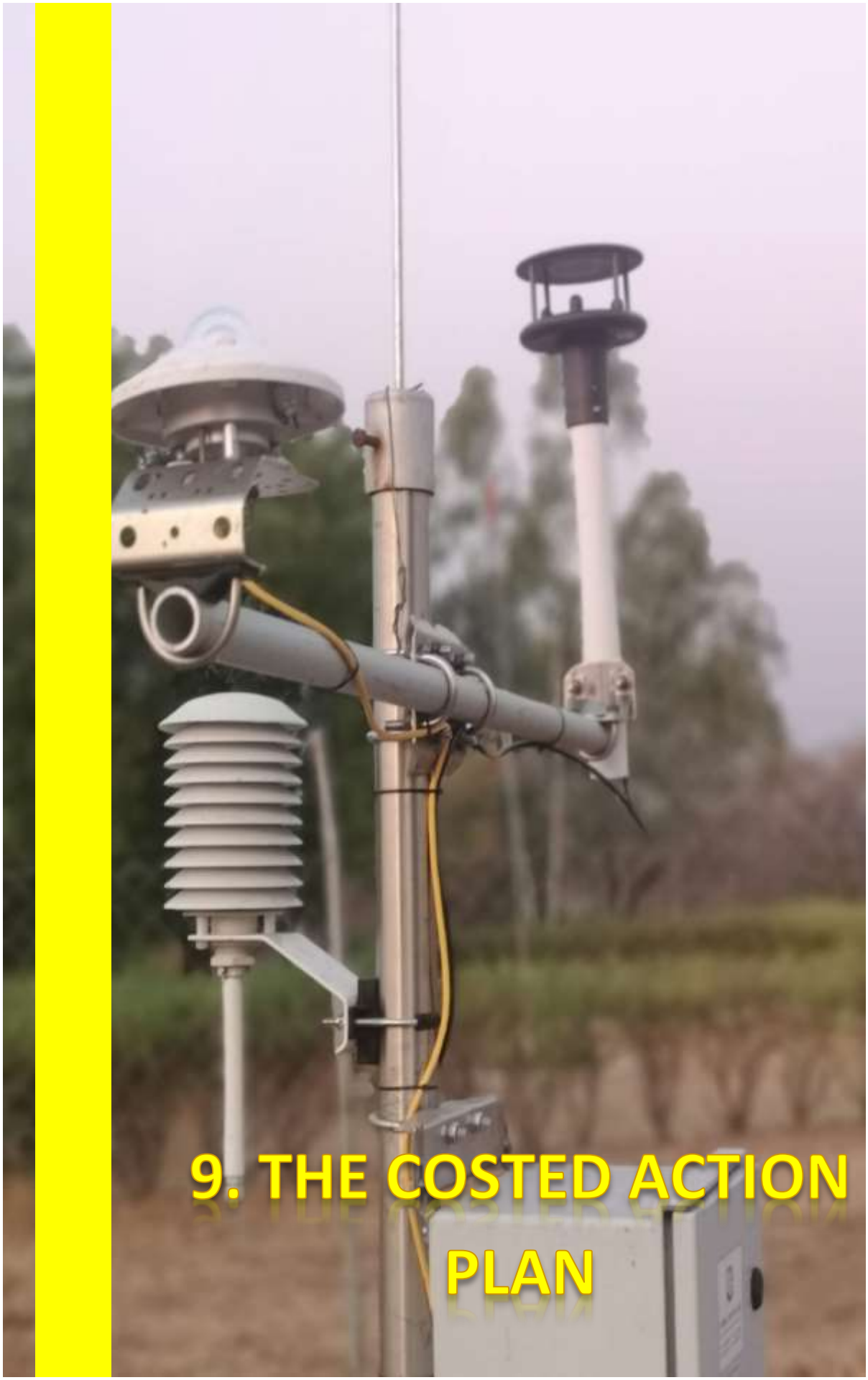
	improved					relevant sectors
Output 4.11	Forum for hydrometeorological research established	Number of forums for hydrometeorological research established	0	1	By March ,2026	DCCMS, DWR
Output 4.12	National Meteorological Society established and maintained	Malawi Meteorological Society operational	0	1	By 2029	DCCMS and partners
Outcome Target 4.4: Accuracy in data collection improved by 2029						
OUTPUT DESCRIPTION		**Output Indicator**			**Timeframe**	**Responsibility**
Output 4.13	Capacity of data collectors at district level enhanced	Number of trainings for data collectors at district level	1 Hydro (1 per year) 1 hydro (1 per year)	8 Hydro (2 per year) 8 Climate (2 per year)	2029	DCCMS, DWR
Output 4.14	Data collection decentralized	Number of districts conducting Data collection and management	12 Hydro 19 Climate	28 Hydro 28 Climate	2029	DCCMS, DWR
Output 4.15	Data quality control measures enhanced	Number of data cleaning and validation session conducted	1 climate (per year) 1 Hydro(per year)	2climate (biannual) 2 Hydro (biannual)	2029	DCCMS, DWR
Output 4.16	Data sharing protocols updated	Number of data sharing protocols updated	1 Climate 1 Hydro	1 Climate 1 Hydro	2026	DCCMS, DWR, Universities, research institutions and relevant sectors

Output 4.17	The use of USSD for warning dissemination explored	Road map on how to upscale the use of USSD developed	0	1	2029	DCCMS, DWR
Outcome Target 4.5: Capacity in hydrometeorological modelling, forecasting and prediction enhanced by 2027						
Output 4.18	Staff trained in modelling, forecasting and prediction	Number of trainings for Staff from relevant sectors in climate and hydrological modelling, forecasting and prediction	0	2	By December, 2027	DCCMS, Universities, research institutions, relevant sectors
Output 4.19	High performance computers and servers procured	Number of high-performance computers and servers in place	2 computers, 1 server (Hydro) 4computers, 3 servers (Climate)	5 computers,3 server (Hydro) 10 computers, 5 servers (Climate)	By December, 2027	DCCMS
Output 4.20	Data processing centres established at DWR and DCCMS	Number of data processing centres in place	0 Climate 0 Hydro	1 Climate 1Hydro	By December 2029	DCCMS, DWR

8.2.5 Capacity needs for systematic development of the institutions, infrastructure and human resources needed for effective climate services

Strategic Outcome 5: Strengthened institutional capacity, infrastructure, and human resources to ensure the effective delivery and advancement of climate services.						
Outcome Target 5.1: Improved office environments for the hydrometeorological services providers						
OUTPUT DESCRIPTION		**Output Indicator**	**Baseline**	**Target**	**Timeframe**	**Responsibility**
Output 5.1	Construction of DCCMS headquarters	Number headquarters complex	0	1	By 2029	DCCMS

	offices including a training school in Lilongwe	constructed				
Output 5.2	Principal manned synoptic station network expanded to all districts (8 districts remaining)	Number of new principal manned synoptic stations established	20	28	By 2029	DCCMS
Output 5.3	Rehabilitation of offices in the manned Meteorological stations	Number of offices rehabilitated	2	19	By March ,2026	DCCMS, DWR
Output 5.4	Rehabilitation of staff houses in all manned Meteorological stations	Number of staff houses rehabilitated	0	63	By Februar y, 2027	DCCMS, DWR
Output 5.5	Acquire motorcycles for meteorological stations operations in the districts	Number of motorcycles acquired	12	30	By Decemb er, 2026	DCCMS, DWR
Output 5.6	Acquire motor vehicles for operations at the Hydrometeorologic al Services	Number of motor vehicles acquire	8	16	By Novem ber, 2027	DCCMS, DWR
Output 5.7	Modernising the hydrometric data control room	Number of rooms modernised	0	1	By Decemb er 2025	DWR
Output 5.8	Construction of district office buildings	Number of offices constructed	4	28	By 2029	DCCMS
Output 5.9	Construction of district staff houses	Number of district staff houses	8	56	By 2029	DCCMS



9. THE COSTED ACTION PLAN

9. The Costed Action Plan

The strategic direction of the NFWCS for Malawi has been translated into a costed action plan which details the activities to be conducted under each strategic pillar to ensure the achievement of the goals of the NFWCS. This section, similar to the strategic plan, is also organized into the five pillars of the NFWCS with capacity building as a cross cutting theme in all the pillars.

9.1 Observation and monitoring

Strategic Outcome 1: Improved collection, management and dissemination of hydrometeorological observations and other sector specific data and relevant metadata.				
Outcome Target 1.1 Adequate national observing systems maintained and operated				
OUTPUT DESCRIPTION		**Output Indicator**	**ACTIVITY**	**USD**
Output 1.1	Develop a national hydrometeorological station network management plan	Number of National Hydrometeorological station network plan developed	Assessment and Gap Analysis	54,794.52
			Stakeholder Engagement and Planning	60,894.60
			Network Designing and Priority analysis	89,867.90
			Sustainability Planning	45,8978
Output 1.2	Increased station network as recommended in national hydrometeorological station network management plan	Number of full meteorological, agro-meteorological, hydro-meteorological stations in a district.	conduct site survey	54,794.52
			procurement and installation	465,752.41
			instrument calibration	27,397.26
Output 1.3	Assorted observation and monitoring equipment purchased, installed and are operational	Radar system and hydrometeorological equipment purchased, ceilometers for cloud base estimation purchased, upper air observing system purchased	conduct site survey for radar, upper air and hydrometeorological station	54,794.52
			procurement and installation	10,958,904.10
			Conduct end-user and administrator trainings	19,178.08

Output 1.4	90% of hydrometeorological observation and monitoring systems automated	Network of hydrometeorological stations expanded,	conduct site survey	54,794.52
			procurement and installation	5,479,452.06
Output 1.5	technicians at regional and district level Recruited and trained	number of technicians recruited and trained	Advertise	1369.86
			Shortlist	8219.18
			conduct interviews	19,178.08
			Deployment	41,095.90
Output 1.6	additional hydrometeorological observers Recruited and trained	Number of hydrometeorological observers recruited and trained	Advertise	1369.86
			Shortlist	8219.18
			conduct interviews	1,9178.08
			Deployment	41,095.90
Output 1.7	assessments and reporting of monitoring systems status conducted	Number of stations inspected per year	Baseline assessment report produced	54,794.52
			conduct annual station inspection	54,794.52
Output 1.8	Mercury based meteorological instruments replaced with digital instruments	Number of mercury thermometers replaced and disposed, Number of mercury barometers replaced and disposed	Procurement and installation	50,000
Outcome Target 1.2 Improved collaboration among stakeholders on hydrometeorological observation and monitoring				
Output 1.9	Awareness and education outreach in schools	Number schools reached	Outreach programmes, school clubs, educational equipment	200,000
Output 1.10	Increased public and private sector engagement	Number of Private sectors engaged and involved in data observations	conduct collaborative meetings	41095.90
Output 1.11	standards and distribution of observation equipment installed by stakeholders	Guild lines for observation equipment by stakeholders developed and implemented	conduct collaborative meetings	41095.90
			conduct a working session to develop guidelines	41095.90

	enforced			
Outcome Target 1.3 Improved data management				
Output 1.12	Establish off site data back up	off-site data backup established	procure and install backup server	54794.52
Output 1.13	data rescue conducted	number of stations with rescued data	conduct data inventory	19178.08
			conduct data rescue	54794.52
			digitise data	41095.90
			Perform paper archiving	41095.90
Output 1.14	Additional Data entry clerks Recruited and trained	Number of data entry clerks recruited and trained	Advertise	1369.86
			Shortlist	8,109.59
			conduct interviews	19,178.08
			Deployment	41095.90
Output 1.15	incorporated remote sensing data to enhance station observations	amount of satellite data incorporated to reduce data gaps	conduct a working session to incorporate remote sensing data	19,178.08
Output 1.16	Data from other sectors incorporated	type of data incorporated	conduct collaborative meetings	41095.90
			conduct a working session to incorporate siloed data	41095.90
Outcome Target 1.4 Reduced vandalism of observing and monitoring equipment to 0%				
Output 1.17	additional security guards recruited	Number of security guards recruited	Advertise	1,369.86
			Shortlist	8,219.18
			conduct interviews	19,178.08
			Deployment	41,095.90
Output 1.18	public awareness campaigns conducted	number of awareness campaigns conducted, and number of people reached	conduct public awareness campaigns	54,794.52
Outcome Target 1.5 Capacity of key stakeholders to provide climate services strengthened				
Output 1.19	Automated monitoring devices installed on	Number of equipment with devices installed	Procurement and installation	200,000

	hydrometeorological observing equipment			
Output 1.20	training needs assessment undertaken	Number of assessments undertaken	undertake training needs assessments	19,178.08
Output 1.21	annual refresher courses for meteorological observers conduct	Number of observers refreshed	conduct annual refresher for observers	54,794.52
Output 1.22	annual refresher courses for volunteer observers conducted	Number of volunteer observers refreshed	conducted annual refresher for volunteer observers	95,890.42
Output 1.23	function review undertaken	Number of functional reviews undertaken	undertake function review	19,178.08

9.2 Hydrometeorological Information Systems

Strategic Outcome 2 : Improved climate information systems for reliable, accessible and usable climate services by 2029				
Outcome Target 2.1 Capacity to co-produce demand driven climate products and services Improved				
OUTPUT DESCRIPTION		**Output Indicator**	**Activities**	**Budget (US$)**
Output 2.1	Training of staff on production of tailored climate services conducted	- Number of staff trained - No. of training reports. - No. of Standard Operating Procedure	- User climate services specifications documented - SOP developed for production -Conduct trainings on tailoring climate services -	273,972.60
Output 2.2	Recruitment of staff for data generation done	Number of staff recruited	- Engage Government (DHMRD) - Conduct functional review - Lobbying for recruitment -conduct interviews	54,794.52

			-train new recruits(induction)	
Output 2.3	Multi-sectoral data integration undertaken	Number of products using sectoral data	Development of MOUs, meetings, engagements	40,000
Output 2.4	Sector specific user needs assessments conducted and harmonized	Needs assessment reports/ Consolidated Climate Services User Needs assessment report	Review of different climate services user needs assessment reports - Undertake climate services user needs assessments	136,986.30
Output 2.5	Child centered needs assessment on hydrometeorological services and research conducted	Number of assessment reports	-Assessment of Child Vulnerability to Hydro-Meteorological Hazards -Analysis of Child-Centered Early Warning Systems -Research on the Impact of Hydro-Meteorological Events on Child Development	200,988.30
Output 2.6	Gender-based needs assessment on hydrometeorological services and research conducted	Number of assessment reports	-Gender-Sensitive Vulnerability and Risk Assessment -Evaluation of Gender Inclusivity in Hydrometeorological Services -Research on Gendered Impacts of Hydro-Meteorological Events	300,200.00
Output 2.7	Tailor made products produced through Multi-sectoral data integration undertaken	Number of tailor made products from data	- Collection of data from other sectors - production of tailor-made products/services	342,465.76

Output 2.8	Indigenous knowledge incorporated	Number of sessions on IK incorporation	- Conduct meetings -Documentation of IK -Verification of IK climate services	109,589.04
Output 2.9	Protection of Climate Information Systems enhanced	-No of power backup systems installed -No of data backup installed -No of computer systems safeguarded with antivirus	Procure and Install power backups -Procurement of computer accessories (antivirus etc.) -Create data backup (Cloud & External storage)	123,287.68
Output 2.10	ISO based Quality management systems established for aviation meteorological services	Number of quality management systems established and sustained	-conduct awareness trainings and development training - develop manuals and documents - train auditors and conduct internal audits - management review meetings - certification audits - certification	205,479.46
Output 2.11	IS0 748:2021 Hydrometry -- Measurement of liquid flow in open channels Determination of the stage-discharge relationship certified	Number of Hydrometry -- Measurement of liquid flow in open channels Determination of the stage-discharge relationship certified	-conduct awareness trainings and development training - develop manuals and documents - train auditors and conduct internal audits - management review meetings - certification audits - certification	100,000

Output 2.12	Stakeholders engaged on co-production and tailoring of hydrometeorological services	Number of stakeholders	Coordination meetings	50,000
Outcome Target 2.2 : Effective climate data management systems for high quality data that caters for multiple user needs enhanced				
Output 2.13	Hydrometeorological data from automated Hydro-Met stations data integrated into existing databases	Number of automated stations integrated into existing databases	Data integration Software/hardware procurement	100,000
Output 2.14	Data from all hydro-meteorological stations rescued and digitized	Number of stations with digitized data Number of aviation stations with climatological summaries	-Data rescuing -Data cleaning (QC) -Data digitization -Importing data into the data base -Insure data	131,506.84
Output 2.15	Develop/procure/upgrade Data Management system for Hydrometeorological data and information	Data Management system developed	Procure and install	100,000
Output 2.16	Data management training conducted	Number of staff trained	- Conduct trainings on database management systems and computer programming - Conduct data management training for hydro-met officers and volunteer observers	150,684.94
		No. of Automatic station with data integrated in data base	-Integrate data into data base	16,438.36
Outcome Target 2.3: Access and utilization of climate information increased				

Output 2.17	Create awareness raising on existing climate and hydro services	Number of awareness campaigns/ events No. of campaigns/sensitization/awareness sessions reports No. of stakeholders involved	-Produce an inventory of climate services Conduct sensitization meetings -Conduct campaigns -Production of IEC materials for awareness -Production of radio/TV jingles/documentaries /adverts/Press release	342,465.76
Output 2 .18	Translate products into local languages	Number of products translated to local languages	-Material development (Translation) -Pre-testing of translated materials -Final production	95,890.42
Output 2.19	Expand channels for disseminating for CI products	Number of channels Number of Communication strategies produced	-Review existing channels -Develop and promote existing channels -Develop climate services communication strategy	47,945.21
Output 2.20	Institutionalize CI decision making tools e.g. PICSA, PSP	PICSA integrated into tertiary curriculum PICSA integrated into programs (institutions)	-Consultative meetings on institutionalization of PICSA/PSP -Develop TORs for engagement of the consultant -Engage a consultant on institutionalization and mainstreaming of PICSA/PSP into institutions -Mainstream PICSA/PSP into sectoral activities	328,767.12

9.3 User Interface Platforms (UIPs)

Strategic Outcome 3: User Interface platform for climate services established and operationalized				
Outcome Target 3.1: National Climate Outlook Forum established by 2025				
OUTPUT DESCRIPTION		**Output Indicator**	**Activities**	**Budget (US$)**
Output 3.1	Terms of reference for NHF developed	Report; Terms of reference for NHF in place	Put in place a task force to develop NHF ToRs; Develop NHF ToRs; Validation workshop	20,000.00
Output 3.2	NHF members trained on use of climate services	Training report; Number of NHF members trained	- Training needs assessment - Develop and print training materials - Training of NHF members on use of climate services	40,000.00
Output 3.3	Advisories co-produced from Seasonal forecast through NHF platform	Sector specific advisories developed through NHF; Seasonal forecast reviewed	- Review previous season forecast - Presentation of the seasonal forecast by DCCMS -Discussions and developing sector specific advisories	280,000.00
Output 3.4	Youth representation at National Climate Outlook Forums promoted	Number of youth attending National Climate Outlook Forums	-Establishment of Youth Climate Networks -Youth Capacity Building and Training -Youth Involvement in Agenda Setting	280,000.00
Outcome Target 3.2 Sectoral committees strengthened by 2024				
Output 3.5	Sectoral committees UIP mandate reviewed	Updated sectoral committee Mandates	Workshop on review of sectoral committee UIP mandate, Validation and approval of the revised mandate	30,000
Output	Sectoral committees	Training report;	Conduct capacity	50,000

3.6	trained on use of climate services	number of sectoral committees trained	needs assessment, Conduct training for sectoral committee members on use of climate services	
Output 3.7	Advisories co-produced from seasonal forecast and historical climate information through Sectoral committees	Sector specific advisories developed through Sectoral committees; Seasonal forecast reviewed	- Review previous season forecast - Presentation of the seasonal forecast by DCCMS -Discussions and developing sector specific advisories	240,000
Output 3.8	Partnerships with child-centered organisations in hydrometeorological services established	Number of partnerships developed	-Identification of Child-Centered Organisations with Interest in hydrometeorological and Disaster Risk -Development of Collaborative Frameworks	280,000
Output 3.9	Co-production of sector specific hydrometeorological products to accommodate impact based forecasts including gender, youth and the Disabled Persons	Number of sectors, number of products	-Stakeholder Engagement and Needs Assessment Workshops - Collaborative Design and Customization of hydrometeorological Products -Testing and Validation of hydrometeorological Products with Targeted User Groups	300,100

Outcome Target 3.3 District user interface platforms on climate services established by 2025				
Output 3.10	District consultations to establish DCOF conducted	Number of meetings conducted; Number of DCOF established	Develop materials required for consultation process, Conduct consultation meetings to establish DCOF	280,000
Output 3.11	The district youth hydrometeorological related forums established or enhanced e.g., school clubs, district youth parliament	Number of youth forums established	-Formation and Strengthening of School-Based hydrometeorological Clubs -Establishment of District Youth hydrometeorological Parliaments -Capacity Building and Networking for Youth hydrometeorological Leaders	460,000
Output 3.12	DCOF members trained on climate services	Number of DCOF members trained by district	Conduct capacity needs assessment, Conduct training for DCOF members on use of climate services	180,000
Outcome Target 3.4 Feedback mechanisms on climate services formalised by 2026				
Output 3.13	Availability of Feedback mechanisms on climate services assessed	Assessment report	Develop an assessment matrix for the feedback mechanism assessment process, Conduct assessment on the availability of feedback mechanisms on climate services	60,000
Output 3.14	Feedback mechanisms established	National and Sector specific feedback mechanisms on	Develop National feedback mechanisms; Develop specific	46,000

		climate services established	feedback mechanisms; Validate the feedback mechanisms that have been developed.	
Output 3.15	Feedback mechanisms strengthened	Sector specific feedback mechanisms strengthened	Review the existing feedback mechanisms, Validate the revised feedback mechanisms	34,246.58
Outcome Target 3.5 Capacity of users and producers of climate services developed				
Output 3.16	Sensitisation/ training in interpretation and utilization of climate services conducted	Sensitisation/ training report	Sector assessment to identify sectors that need support to understand linkage between climate services and sectors, Develop sensitization materials, Sensitization sessions with sectors	5000,000
Output 3.17	Early Warnings systems for schools established	Number of Early Warnings systems for schools established	Establishing MOU with Min of Education Training teachers	200,000
Output 3.18	Sensitization (quizzes, competitions, clubs) for the youth and marginalized	Number of sensitization campaigns for youth and marginalized conducted	Establishing MOU with Min of Education Training teachers	200,000

9.4 Research, Modelling and Prediction

Strategic Outcome 4: Improved hydrometeorological forecasting, prediction, information, technologies and innovations for evidence-based decision making				
Outcome Target 4.1: Capacity in conducting climate related research enhanced by 2024.				
OUTPUT	**DESCRIPTION**	**Output Indicator**	***Activities***	**Budget (US$)**

Output 4.1	Training needs assessment conducted	Capacity needs assessment report	-Conduct training needs assessment, - hiring consultants	140000.00
Output 4.2	Staff trained in conducting climate related research and data analysis	20 researchers and scientists trained	*- Conduct long term trainings (25 Undergraduates, 15 Masters and 10 PhD) - Conduct short term courses (15 courses) - conduct refresher courses (20 refresher courses)*	2100000
Output 4.3	Software for data analysis procured	5 software for data analysis in place	*- Procure data analysis software (SPSS, Matlab, Genstat, Stata, Systat, ArcGIS)*	8000.00
Output 4 .4	Centre of excellence in climate research and modelling established	1 Centre of Excellence in climate research and modelling	-establish center of excellence in climate research and modelling '-Recruit staff both technical and clerical	2,060,000
Outcome Target 4.2: Master plan for climate research developed by 2027				
Output 4.5	Stakeholder consultative meeting conducted	2 stakeholder consultative meeting conducted	-Conduct stakeholder's consultative meeting	102000.00
Output 4.6	Research Master plan drafted	I master plan in place	-Hire a consultant to draft Master Plan	200000.00
Output 4.7	Validation meeting conducted	1 validation meeting conducting	-Conduct validation meeting	42000
Output 4.8	Dissemination meeting conducted	I dissemination meeting conducted	-Conduct dissemination	50000.00
Outcome Target 4.3: Coordination of climate research strengthened by 2024				

Output 4.9	Existing Researchers and Scientists documented	Mapping report for researchers and scientists	-Hire consultant	120000.00
Output 4.10	Partnerships with universities and research institutions improved	MOU with universities and research institutions signed	- Conduct stakeholder review meeting	300000
Output 4.11	Forum for climate research established	I forum for climate research established	-Establish a forum for climate research - Conduct Quarterly review meetings and Annual Review Meetings	340000
Output 4.12	National Meteorological Society established and maintained	Malawi Meteorological Society (MMS) operational	-Establish MMS -conduct annual meetings/dissemination meetings	400,000
Outcome Target 4.4 : Accuracy in data collection improved by 2024				
OUTPUT	**DESCRIPTION**	**Output Indicator**	**Activities**	**USD**
Output 4.13	Capacity of data collectors at district level enhanced	data collectors at district level trained	-conduct trainings of data collectors at district level	71,500.00
Output 4.14	data collection decentralised	Data collection and management in every district	-establish positions for meteorologists at district level -Implement functional review by posting officer to district	240,000
Output 4 .15	data quality control measures enhanced	data cleaning and validation measures reinforced	-Conduct refresher courses on data quality control -conduct data control checks	80,000
Output 4.16	Data sharing protocols updated	Number of data sharing protocols updated	Conduct the process of developing the data sharing protocols	160,000
Output 4.17	The use of USSD for warning dissemination explored	Road map on how to upscale the use of USSD developed	-Feasibility Study and Stakeholder Consultation -Prototype Development and Testing -Integration with Existing Early Warning Systems	350,000

Outcome Target 4.5: Capacity in climate modelling, forecasting and prediction enhanced by 2024				
Output 4.18	Staff trained in modelling, forecasting and prediction	Staff from relevant sectors trained in climate modelling, forecasting and prediction	- *Conduct long term trainings (25 Undergraduates, 15 Masters and 10 PhD)* - *Conduct short term courses (15 courses)* - *conduct refresher courses (20 refresher courses)*	280000
Output 4.19	High performance computers and servers procured	2 high performance computers and 1 server in place	-Procure high performance computers and servers	300,000
Output 4.20	Data processing centres established at DWR and DCCMS	Number of data processing centres in place	- *Procure data quality control software*	1000,00

9.5 Capacity needs for systematic development of the institutions, infrastructure and human resources needed for effective climate services

Strategic Outcome 5: Strengthened institutional capacity, infrastructure, and human resources to ensure the effective delivery and advancement of climate services.				
Outcome Target 5.1 : Improved office environments for the hydrometeorological services providers 2029				
OUTPUT	**DESCRIPTION**	**Output Indicator**	**Activities**	**USD**
Output 5.1	Construction of DCCMS headquarters offices including a training school in Lilongwe	Number headquarters complex constructed	Prepare bid document	10,000.00
			Advertise	8,219.18
			Bid evaluation	10,000
			Construction of headquarters complex	19,000,000
			Occupy the offices	400,000
Output 5.2	Principal manned synoptic station network expanded to all districts (8 districts remaining)	Number of new Principal manned synoptic stations established	Prepare bid document Advertise Bid evaluation Establishment of new Principle manned synoptic stations	10,000.00 8,219.18 10,000 170,000
Output 5.3	Rehabilitation of offices in the	Number of offices rehabilitated	Prepare bid document	10,000.00
			advertise	8,219.18

	19 manned Meteorological stations		Bid evaluation	10,000
			Rehabilitation of offices	200,000
Output 5.4	Rehabilitation of staff houses in all 21 manned Meteorological stations	Number of staff houses rehabilitated	Prepare bid document	400,000
			advertise	10,000.00
			Bid evaluation	8,219.18
			Rehabilitation of staff houses	300,000
Output 5.5	Acquire 10 motorcycles for meteorological stations operations;	Number of motorcycles acquired	Prepare bid document	400,000
			advertise	10,000.00
			Bid evaluation	8,219.18
			Procurement of motorcycles	25,000
Output 5.6	Acquire at least motor vehicles for operations at the DCCMS and DWR HQs and international airports' offices;	Number of motor vehicles acquire	Prepare bid document	400,000
			advertise	10,000.00
			Bid evaluation	8,219.18
			Procurement of motor vehicles	460, 000
Output 5.7	Modernising the hydrometric data control room	Number of rooms modernised	Development of ToRs Procurement of equipment supplier for equipment Installation and training Commissioning	2,000 200,000 8,000 5,000
Output 5.8	Construction of district office buildings	Number of offices constructed	-acquire land -design -bidding -construct -inspect	1 million
Output 5.9	Construction of district staff houses	Number of district staff houses	acquire land -design -bidding -construct -inspect	2 million

10. Monitoring Evaluation and Reporting

10. Monitoring, Evaluation and Reporting

10.1 Evaluation and reporting mechanisms

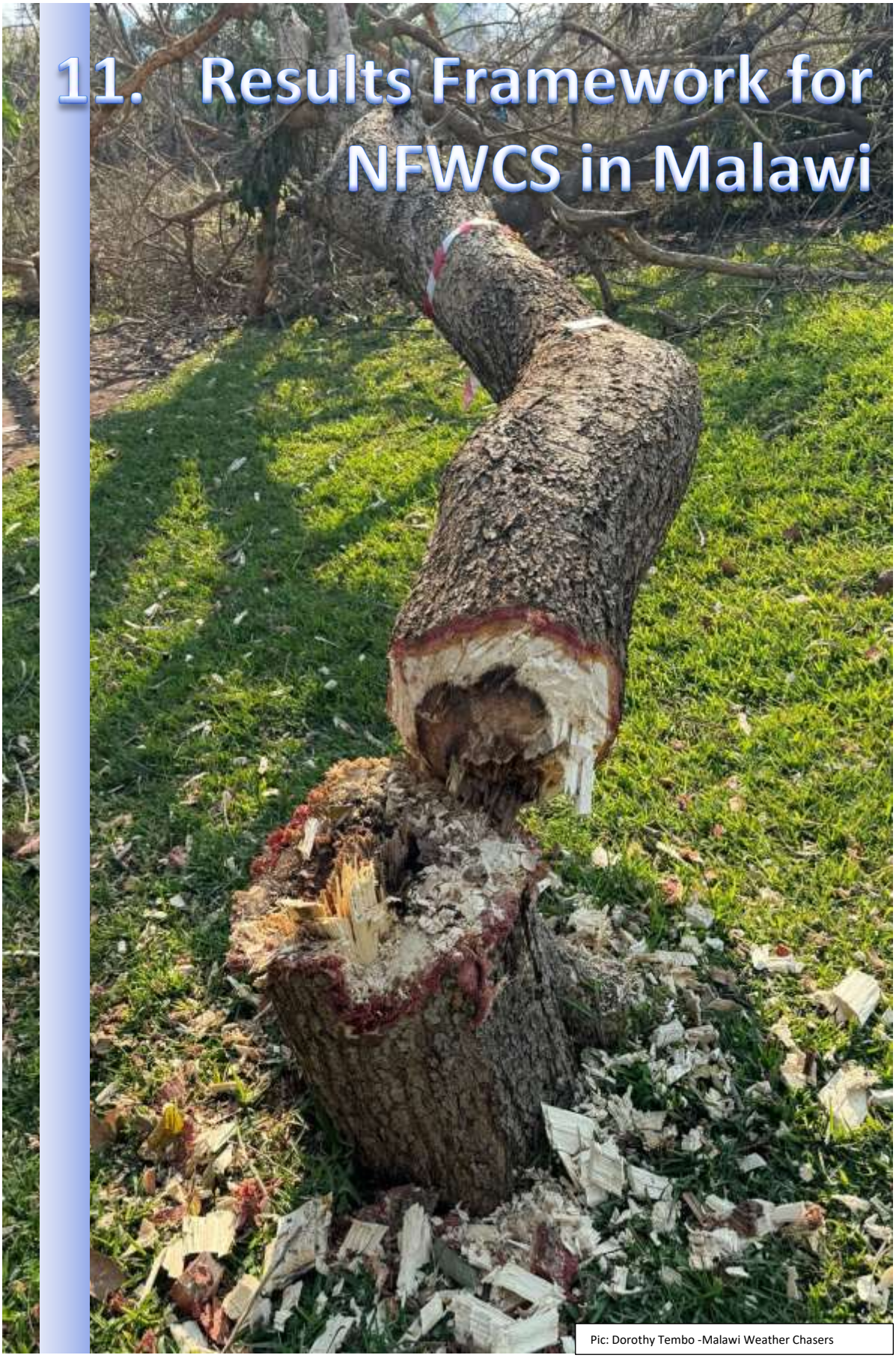
The NFWCS results as outlined in the results framework will be monitored and reported annually and evaluated periodically during implementation to ensure the framework effectively achieves the results. The monitoring and evaluation processes will follow Malawi Government as well as GFCS's Results Based Management approaches. The monitoring and evaluation process will be guided by the institutional arrangement as set out above.

DCCMS/Secretariat will coordinate all M&E functions ensuring the performance indicators are tracked annually in time for evidence-based reporting in the Annual Performance Report, and that the monitoring of risks and the various plans/strategies developed to support the frameworks implementation occur on a regular basis.

The National Technical Working Group (TWG) will take corrective action as needed to ensure the framework achieves the desired results. Planning and review meetings will be conducted to assess the performance of the framework and appraise the annual work plan for the following year.

In the final implementation year, the TWG will hold review workshop to capture results, lessons learned and discuss opportunities for scaling up activities with relevant audiences.

11. Results Framework for NFWCS in Malawi



Pic: Dorothy Tembo -Malawi Weather Chasers

11 Results framework for the NFWCS in Malawi

Strategic Outcome	Output	Output Indicator	Target	Baseline	Means of Verification	Frequency	Responsibility
1. Improved collection, management and dissemination of hydrometeorological observations and other sector specific data and relevant metadata.	Adequate national observing systems maintained and operated	Percentage coverage of the national hydro met observation network (fully operational) Number of hydrometeorological stations established	10% 10 (Climate) 27 (Hydro)	50% (Hydro) 70% (Climate) 100 (Climate) 270 (hydro)	Annual Performance Report Evaluation Reports	Annually	DCCMS, Projects
	Improved collaboration among stakeholders on hydrometeorological observation and monitoring	Number of stakeholders participating in data observations	20	5	Annual Performance Report Proceedings from meetings/workshops /reports	Annually Quarterly?	Technical Working Group (TWG)
	Improved data management	Proportion of stations with digitized data Data management system functional	100% 2 (Hydro) 2 (Climate)	10% 1 (Climate) 1 (Climate)	Annual Performance Report Evaluation Reports	Annually	DCCMS, DWR

	Reduced vandalism of observing and monitoring equipment to 0%	Percentage of stations (AWS) operational Percentage of automated hydro stations operational	100% 100%	20% 50%	Updated inventory of hydrological and meteorological infrastructure Procurement report	Annually Quarterly?	DCCMS, DWR
	Capacity of key stakeholders to provide hydrometeorological services strengthened	Proportion/number o of staff/volunteer observers trained	100%	50% (Climate) 33% (Hydro)	Training reports	Biannually	DCCMS, DWR, Academia, NGOs,
2. Improved hydrometeorological forecasting, prediction, information, technologies and innovations for evidence-based decision making	Capacity in conducting climate related research enhanced by 2024	Number of Staff, Researchers and Scientists trained 1 Center of excellence in Climate research and modelling established	50 1	Need for comprehensive capacity assessment 0	Training reports Annual performance report Evaluation Reports	Annually	Academia, DCCMS, Research Institutions
	Master plan for climate research developed by 2020	Climate research Master plan in place	1	0	Finalised Master plan document Annual Performance report	Annually	Academia, DCCMS, Research Institutions
	Coordination of climate research strengthened by	MoU on Climate Research among Academia/ Research	5 to 10	0	MoU Annual Performance	Annually	Academia, DCCMS, Research

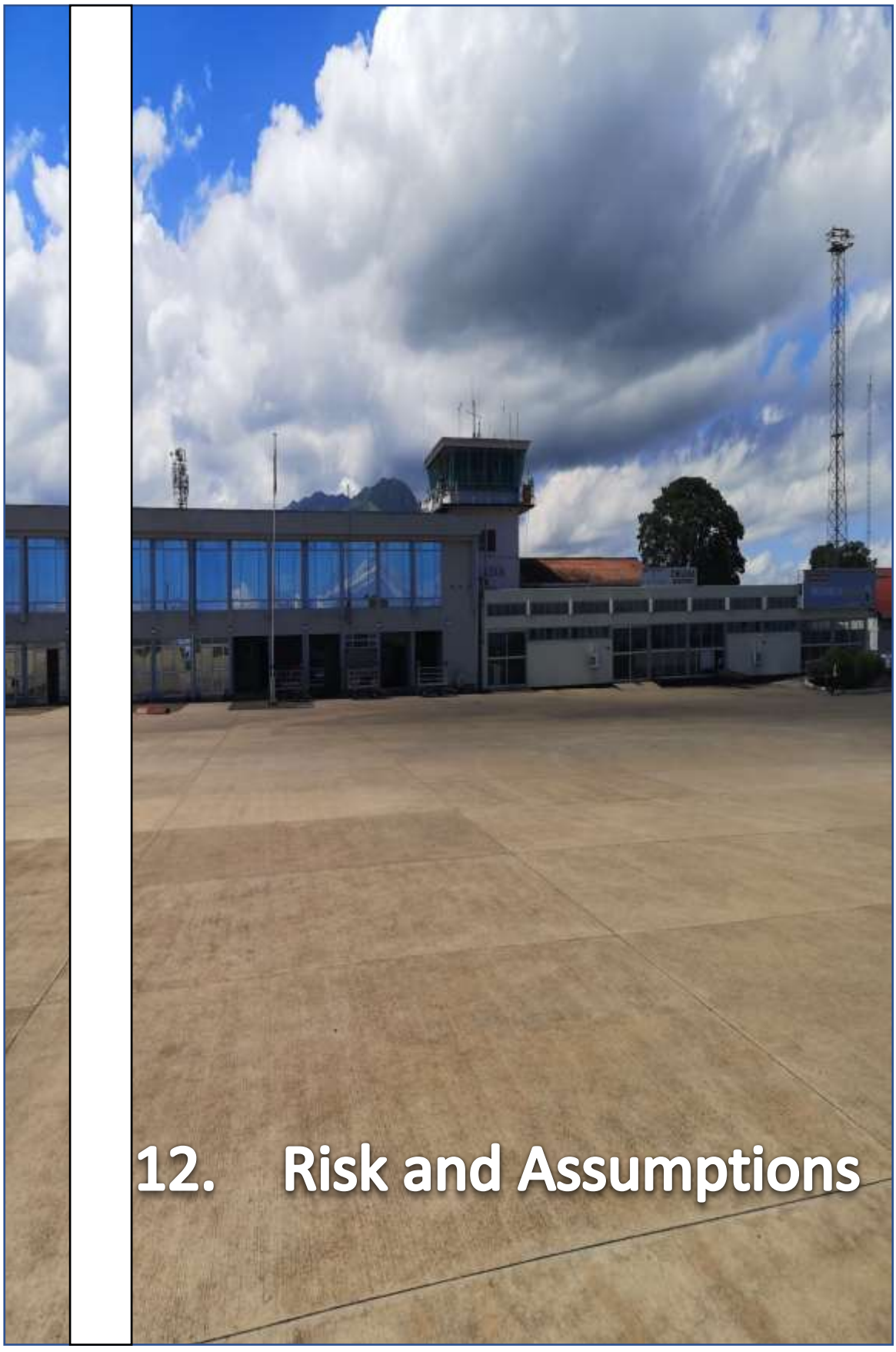
	2024	Institutions/ DCCMs signed			report Evaluation Reports		Institutions,
	Accuracy in data collection improved by 2024	Data collection and quality controls decentralized to district level Open data policy functional	28 districts 1	0 0	Annual Performance report Policy documents Evaluation Reports	Biannually Annually	DCCMS, DWR
	Capacity in climate modelling, forecasting and prediction enhanced by 2024	Number of staff from relevant sectors trained in climate modelling, forecasting and prediction Forecasting software, high performance servers and workstation in place	50 3 2	 1 1	Training reports Evaluation Reports Inventory of Equipment	Annually Quarterly?	DCCMS, Academia, DWR DCCMS. DWR
3. Improved hydrometeorological Information systems for reliable, accessible and usable hydrometeorological	Capacity to co-produce demand driven climate products and services Improved	Number of staff/stakeholders trained on production of tailored products Number of relevant	10 (Hydro) 10 (Climate)	0 (Hydro) 1 (Climate)	Training reports Annual performance reports	Annually	DCCMS, DWR, Academia

services by 2024		technical staff recruited /year Percent population receiving tailored products			Survey reports		
	Effective hydrometeorological data management systems for high quality data that caters for multiple user needs enhanced	Proportion/Number of AWS & hydro stations integrated with existing databases Data Management System functional	100 (Hydro) 100 (Climate)	0% (Hydro) 60% (Climate)	Annual performance reports	Annually	DCCMS DWR
	Access and utilisation of climate information increased	Percentage of National Awareness campaigns conducted Percent population accessing and utilizing Hydrometeorological services Information Systems PICSA institutionalized in tertiary curriculum	100% (Climate) 100% (Hydro)	40% (Climate) 10% (Hydro)	Training reports Survey reports Annual performance reports	Annually	Academia, Projects, DCCMS, DWR

4. User interface platform for climate services established and operationalised	NCOF and NWF established by 2025	NHF and NWF functional in line with its ToRs Number of sector specific advisories developed	1 1 10 (Climate) 10 (Hydro)	0 (Hydro) 0 (Climate) 2 (Climate) 2 (Hydro)	NHF and NWF reports Annual performance reports	Annually	DCCMS, DWR
	Sectoral committees strengthened by 2024	Number of stakeholders trained on preparation of tailored products. Number of sector specific advisories developed	10 10 (Climate) 10 (Hydro)	0 2 (Climate) 2 (Hydro	Training reports Annual performance reports	Annually	DCCMS, DWR, NGOs, Academia, etc.
	District user interface platforms on hydrometeorological	Number of DCOFs and DWFs established	28	0	DCOF meetings proceedings Annual performance reports	Biannually	TWG, DCCMS, DWR

	services established by 2021	Number of DCOF and DWF members trained	20 (DCOF) 20 (DWF)	0	Training reports		
	Feedback mechanisms on hydrometeorological services formalised by 2026	Feedback mechanism functional	3 (Climate) 3 (Hydro)	1 (Climate) 0 (Hydro)	Annual performance reports	Annually	DCCMS, DWR
	Capacity of users and producers of hydrometeorological services developed	Percentage of users (in various sectors & communities) trained on interpretation of hydrometeorological services	100% (Climate) 100% (Hydro)	30% (Hydro) 40% (Climate)	Training reports Evaluation Reports	Annually	DCCMS, DWR, Projects
5. Improved office environments for the hydrometeorological services providers	Construction of DCCMS headquarters offices including a training school in Lilongwe	Number headquarters complex constructed	1	0	Availability of Hq complex	Annually Biannually	DCCMS
	Principle manned synoptic station network expanded to all districts (8 districts remaining)	Number of new principle manned synoptic stations established	28	20	Principle manned synoptic station expansion reports	Annually Biannually	DCCMS
	Rehabilitation of offices in the	Number of offices rehabilitated	19	2	Rehabilitation reports	Annually	DCCMS

	manned Meteorological stations					Biannually	
	Rehabilitation of staff houses in all manned Meteorological stations	Number of staff houses rehabilitated	63	0	Rehabilitation reports	Annually Biannually	DCCMS
	Acquire motorcycles for meteorological stations operations;	Number of motorcycles acquired	22	12	Procurement reports	Annually Biannually	DCCMS
	Acquire motor vehicles for operations at the Hydrometeorological Services	Number of motor vehicles acquire	16	8	Procurement reports	Annually Biannually	DCCMS, DWR
	Modernising the hydrometric data control room	Number of rooms modernised	1	0	room modernizing report	Annually Biannually	DWR



12. Risk and Assumptions

12. Risk and Assumptions

As part of the NFWCS formulation process, partners assessed the fundamental conditions necessary for success. Chief among these is a strong national commitment, which Malawi has demonstrated through its initiatives in climate change, disaster risk management, and livelihood programs, particularly in the agricultural sector and public health. This commitment aligns with the goals of the GFCS-APA Phase I, showcasing explicit political support for the development and coordination of climate services. This political commitment provides a solid foundation for the NFWCS's development, assuming that these favorable conditions will persist throughout its implementation. The NFWCS makes a number of assumptions related to achievement of its objectives, as contained in **Annex II**.

13. Financing the Strategic Plan

13. Financing the Strategic plan

It is expected that the government of Malawi through its allocation within various ministries will be the main source of funding for the implementation of the NFWCS. While the government puts in place mechanisms for this funding, it is proposed that the NFWCS apply for funding through mechanisms such as Green Climate Fund (GCF) Readiness funds, Global Environment Facility (GEF), Adaptation Fund (AF), Special Climate Change Fund (SCCF) and Least Developed Countries Fund (LDCF), Bilateral Country Funds and other development cooperation missions such as NORAD and the Norwegian Embassy, DFID, GIZ, Flanders, Qatar fund, Kuwait fund, EU, ECHO, REDD+, Indian government, Irish Aid, USAID, Bill Gates Foundation, AfDB, Arab, Development Bank, JICA, China Aid, Australian government, and other multilateral financial institutions such as the World Bank and United Nation (UN) agencies; UNDP, UNEP, FAO, WFP, UNICEF and WMO. Funds will also be mobilized through private sector through Public-Private-Partnerships with mobile telecommunications companies, construction companies, energy and water boards, aviation among others. The country will also continue participating in various initiatives of regional blocks such as SADC and the AU in support of the NFWCS.

14. Governance Mechanisms

14. Governance Mechanisms

14.1 Institutional arrangement (national)

The implementation will occur at three levels, establishing sector and user platforms for hydrometeorological services at both the national and district levels. These platforms will report to the National Platform for Climate Services, which will, in turn, report to the Hydrometeorological Services Experts Working Group. This group primarily includes members from DCCMS, DWR, and other key sectors including academia. The National Technical Committee on Disaster Risk Management and Climate Change will serve as the governing body overseeing this framework.

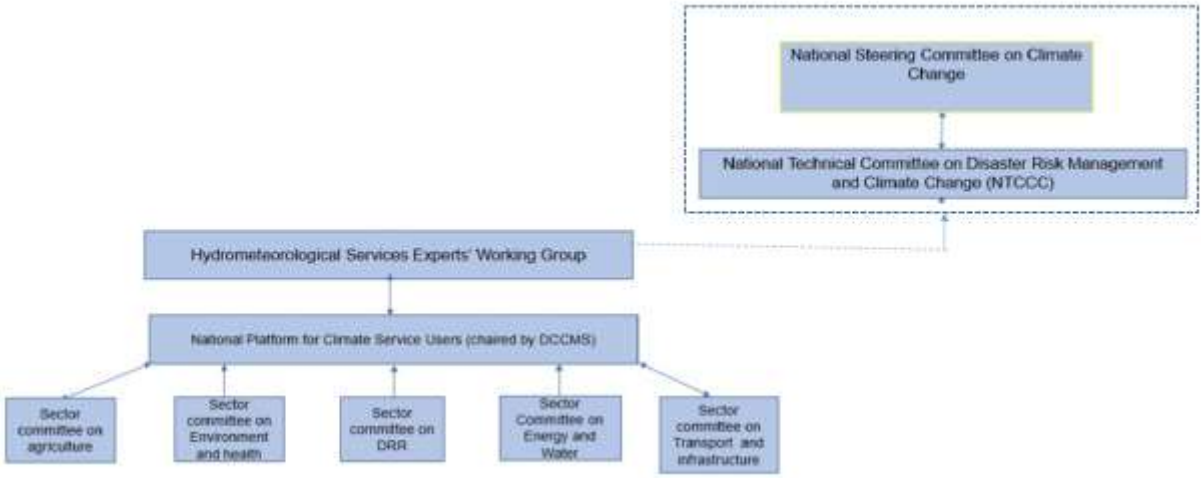
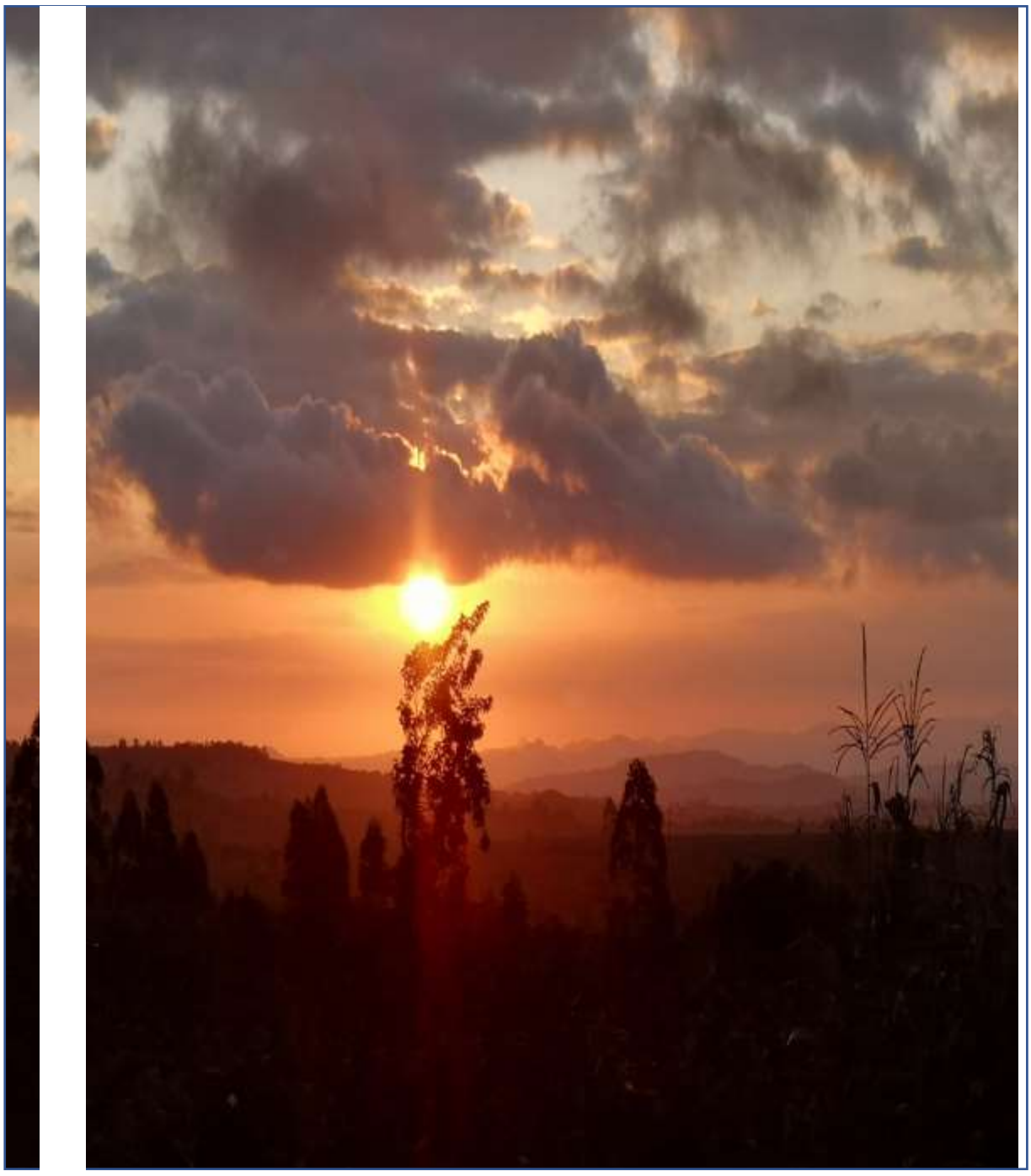


Figure 4:NFWCS governance structure



5. Implementing Partners/ Role of stakeholders

15. Implementing partners/Role of stakeholders

The implementation of the National Framework for Water and Climate Services will be the responsibility of climate services producers, users, policy makers and decision makers who have a role in resources mobilization and allocation for climate services provision in Malawi. Among other roles, climate services producers will have the task championing consultative engagement with users to continually raise awareness on available climate service, identifying sector specific services, and discussing to find solutions to challenges being faced in climate services delivery.

Roles of stakeholders are implied within Annex I but it is paramount to note the overlapping roles stakeholders could play. As such a directory of climate service actors will be developed and classified according to their main roles but not excluding them in participating on climate services development and delivery as necessary.

16. Communication and Advocacy

16. Communication and advocacy

A communication and advocacy strategy for the NFWCS will be developed separately but will address communication messaging and targeting across the climate services value chain. The goal of the NFWCS communication and advocacy strategy will be to raise awareness about the NFWCS, promote partnerships in climate services and advocate for resources for successful implementation. The accountability framework will be developed to assess the impact, feedback and measure the performances of communication/advocacy initiatives. Linkages between communications and programmes/activities shall be clarified and strengthened, as well as included in programmes funding.

17. Conclusions

17. Conclusions

The establishment of the National Framework for Water and Climate Services (NFWCS) in Malawi represents a significant and courageous initiative aimed at bolstering the country's ability to withstand and adapt to various climate-related challenges. The framework that has an estimated budget of 63,413,706.01 for implementation is designed to enhance the nation's resilience to climate risks, thereby safeguarding both the environment and the well-being of its citizens. By arming the population with the necessary tools and information, the NFWCS endeavors to ensure that individuals and communities are not only prepared for the adverse effects of climate change but are also equipped to recover swiftly and effectively from any climatic shocks they may encounter.

As has been indicated earlier, the overarching goal of the NFWCS is to create a comprehensive system that integrates climate data, research, and risk management into the decision-making processes at all levels of society. It is therefore anticipated that through the successful implementation of this framework, Malawi will experience a transformative impact on its economic and social development. The NFWCS aims to facilitate risk mitigation strategies that prevent potential climate-related disasters from occurring while also enhancing response mechanisms that can be activated in times of crisis.

In essence, the NFWCS is not just about managing risks; it is about fostering a proactive culture of resilience that empowers communities and enhances their capacities to address environmental challenges. By integrating climate considerations into various sectors—such as agriculture, health, infrastructure, and water management—the NFWCS is expected to promote sustainable growth and development. This initiative holds the promise of cultivating a more equitable society, where all segments of the population have access to the resources and support they need to thrive in the face of ongoing climate fluctuations.

Ultimately, the success of the NFWCS will rely on collaboration among government institutions, development partners, civil society organizations, the private sector, and local communities. By working together, stakeholders can create a unified approach to climate resilience, ensuring that the benefits of the framework are felt broadly across the nation. Through the concerted efforts of all involved, Malawi can look forward to a future where its people live in harmony with their environment, confident in their ability to navigate the challenges posed by climate change and emerge stronger than before.

Annex I: List of stakeholders for DCCMS and DWR

List of Stakeholders for DCCMS and DWR by Sector

Agriculture

- Ministry of Agriculture
- National Smallholder Farmers' Association of Malawi
- Farmers' Union of Malawi (FUM)
- Civil Society Agriculture Network (CISANET)
- Department of Land Resources Conservation
- Local communities

Aviation

- Ministry of Transport
- Civil Aviation Authority
- Airport Development Limited

Construction

- Ministry of Transport
- District and City Councils
- National Roads Authority
- National Construction Industry Council

Disaster Risk Reduction

- Department of Disaster Management Affairs
- Malawi Red Cross Society
- World Vision
- Goal Malawi
- Evangelical Association of Malawi
- Concern World Wide

Energy

- Ministry of Energy
- Energy generation company (EGENCO)
- Electricity Supply Commission
- Mpatamanga Hydro Power Limited

Fisheries

- Department of Fisheries
- Local fishing community

Insurance

- The Insurance Association of Malawi
- One Acre Fund
- Pula

Industry

- Illovo Sugar Company
- Salima Sugar Company

Transport

- Ministry of Transport
- Civil Aviation Authority
- Rail
- Marine

Water

- Department of Irrigation
- Local communities
- National Water Resources Authority
- Water Boards

Cross-cutting sectors (multiple sector relevance)

- Ministry of Natural Resources and Climate Change
- Department of Environmental Affairs
- Department of National Parks and Wildlife
- Forestry Department
- District and City Councils
- Ministry of Tourism
- Leadership for Environment and Development (LEAD)
- Farm Radio Trust
- Ministry of Information and Civic Education
- Ministry of Gender, Children and Social Welfare
- Non-Governmental Organisations
- Development Partners
- Civil Society Organisations

Media

- Radio
- Televisions
- Print
- Social media

Telecommunication

- Malawi Communication Regulatory Authority
- TNM
- Airtel
- Access
- MTL

Health

- Christian Health Association of Malawi (CHAM)
- Ministry of Health & Population (MH)
- Wellcome Trust
- WHO

Academic and research institutions

- Ministry of Education, Science and Technology
- University of Malawi
- Malawi University of Science and Technology
- Kamuzu University of Health Sciences (KUHeS)
- Lilongwe University of Agriculture and Natural Resources
- Mzuzu University

- Malawi University of Business and Applied Sciences

Annex II: Risks and Assumptions

Assumption (including how it will affect the NFWCS)	How to monitor it (e.g. Indicators)	Possible Strategy to deal with external factor
The Government of Malawi and the stakeholders remain committed to the development and delivery of hydrometeorological services	● The number of Ministerial statements being made on climate services ● Number of hydrometeorological services initiatives being undertaken by the stakeholders in the country ● Number of other ministries that integrate hydrometeorological services into their policies and programmes where appropriate	The NFWCS will continue to support and encourage the production of research and other studies on hydrometeorological services and disseminate these through an advocacy strategy at both the national and local level as well as at international platforms.
The government of Malawi allocates funding for the implementation of the NFWCS.	Government allocation to hydrometeorological services through climate change, DRR, health, agriculture, and other relevant ministries was maintained or increased.	NFWCS steering committee to advocate for budget allocations to hydrometeorological services
Relevant responsible government agencies ready to participate in the validation of the NFWCS	Number of relevant government institutions participating in consultations on hydrometeorological services	Through ongoing consultations and collaborative work
Other key cooperating partners, international NGOs and programmes at the national and district level are willing to cooperate in the development and delivery of hydrometeorological services	Linkages made between the NFWCS and other programmes being run by the international NGOs and others particularly those that benefit the targeted beneficiaries on hydrometeorological services	Advocacy for continued cooperation with all relevant stakeholders
There are competent and experienced institutions	Number of competent and experienced institutions	▪ Capacity of institutions strengthened through

at national and sub-national levels to undertake the hydrometeorological services initiatives.	identified at national and sub-national level	training and sharing of good practices
Adequate training opportunities are available for DCCMS, DWR, Academia and other stakeholders for implementing climate services	Number of stakeholders that are provided with opportunities for hydrometeorological services study, research	Advocacy targeted at the Ministries of Natural Resources and Climate Change, and Water and Sanitation.
Humanitarian emergencies	Number of sectoral and risk-specific contingency plans in place	Advocacy towards risk assessment, early warning and monitoring of climate risks as well as other risks that may impact implementation.
Vandalism	Number of observation equipment destroyed	Reinforce security mechanisms and locate the observation stations in secured areas Enhance public awareness and accountability
Data safety (loss of data), unstable power supply and internet connectivity	Number of months for which hydrometeorological service production is disrupted	Data backup Development of data management infrastructure Data management capacity building

MALAWI NFWCS