ZAMBIA NATIONAL DROUGHT PLAN

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REPUBLIC OF ZAMBIA

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ACKNOWLEDGEMENT AND DISCLAIMER

The author of this report would like to acknowledge the support of UNCCD and the Copperbelt University for the provision of the resources which were necessary in the completion of this plan.

I would also like to affirm that the content, expressions and all other materials presented in this document must not be ascribed to The United Nations Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa (UNCCD) nor that of the Government of the Republic of Zambia.

SUMMARY

Drought, which is the focus of this document, is stated as one of the major natural hazards threatening people's livelihoods and socio-economic development. It is a slow-onset hazard providing time to consider and address its complex root causes, such as understanding people's vulnerabilities and identifying unsafe conditions related to poverty; fragile local economy; livelihoods at risk; lack of strategies and plans; limited institutional capacities and resources; and gender and social exclusion. Understanding the root causes and addressing them is the basis for formulating and undertaking effective drought mitigation and preparedness measures by governments and the public. Zambia has experienced several disasters from time to time with the common disasters that include drought, floods, human epidemics, livestock epidemics, refugee influxes, crop pests, road traffic accidents, famine, fires, and industrial accidents. The country has already recorded increases in temperature and reduced rainfall in the last few decades, with temperatures estimated to increase at 0.6^{o}C every ten years. The frequency of occurrence, magnitude and intensity of extreme events including drought, extreme temperatures and dry spells have also increased, and that future scenarios for the period 2010-2070 indicated that temperature will increase further by 2^{o}C and rainfall is projected to decrease by 8-10%.

In its efforts to respond to these challenges, Zambia has developed a range of policies related to climate change, land, water resources management, social protection and disaster management. Each of these policies have an institutional framework key amongst which are the Water Resources Management Authority (WARMA) and the Disaster Management and Mitigation Unit (DMMU). However, the country has no drought plan, drought policy, legislation and institutional framework to strategically facilitate drought management. The National Drought Plan is intended to contribute to the protection of Zambia's land from over-use and drought for it to be able to provide the required ecosystem services. Given the impacts of climate change and variability that include drought, especially in western and southern Zambia, unpredictable rainfall patterns and flooding in some areas, it is imperative that Zambia builds its capacity to particularly achieve drought resilience at national level. The drought resilience capacity includes (i) drought preparedness, (ii) national and regional (provincial) efforts to reduce drought vulnerability and risk, and (iii) boosting the resilience of people and ecosystems to drought. This drought plan is therefore developed in order to contribute to risk reduction and preparedness.

This drought plan has reviewed national policies, international and regional conventions, and the national institutional framework for sectors related to issues of drought. Arising out of this analysis, the gaps that have been identified have necessitated the recommendations below that will enable Zambia to integrate drought management in its national development strategic framework in order to effectively manage drought and its consequences:

1. Appoint a national drought policy or legislation team

The process for creating a national drought management policy and legislation should begin with the establishment of a national task team to oversee and facilitate policy development. Given the complexities of drought as a hazard, and the cross-cutting nature of managing all aspects of monitoring, early warning, impact assessment, response, mitigation and planning, it is critical to coordinate and integrate the activities of the many agencies, government and non-government such as the private sector, including key stakeholder groups; and civil society. In Zambia, DMMU has been mandated to play such a coordination role especially in the context of disaster management.

2. State or define the goals and objectives of a risk-based national drought management policy and legislation

After the formation of the national task team headed by a senior official, the first official action should be to establish specific and achievable goals for the national drought policy and legislative framework and a timeline for achieving the

goals. Several guiding principles should be considered as the task team formulates a strategy to move from crisis management to a drought risk reduction approach.

3. Stakeholder participation

Institutions such as WARMA and Department of Water Resources Development (DWRD) become key players in helping define and resolve conflicts between key water use sectors, considering also transboundary implications through the International Waters Section in the DWRD under MWDSEP. Therefore, participation of all key stakeholders during the formulation of the national drought policy and legislation is an important process because of the complexities of drought as it intersects with society's social, economic and environmental sectors, and the dependence of these sectors on access to adequate supplies of water in support of diverse livelihoods.

4. Inventory data and financial resources available and identification of groups at risk

An inventory of natural, biological, human and financial resources, including the identification of constraints that may impede the development of drought policy and legislation may need to be initiated by the national task team. In many cases, information already exists about natural and biological resources through various provincial and national agencies/ministries. It is important to determine the vulnerability of these resources to periods of water shortage that result from drought. The most obvious natural resource of importance is water (i.e. location, accessibility, quantity, quality), but a clear understanding of other natural resources such as forests, aquatic resources and soils are also important. Human resources include the labour needed to develop water resources, lay pipelines, haul water and feed livestock, process and respond to citizen complaints, provide technical assistance, provide counselling and direct citizens to available services. It is also important to identify constraints to the policy development process and to the activation of the various elements of the policy and preparedness plans as drought conditions develop. These constraints may be physical, financial, legal or political. The costs associated with policy development must be weighed against the losses that are likely to result if no plan is in place (i.e. the cost of inaction).

5. Prepare the national drought management policy, legislation and preparedness plans

Drought preparedness/mitigation plans are the instruments through which a national drought policy is carried out. It is essential for these plans to reflect the principles of the national drought policy, which is centred on the concept of risk reduction. In support of a risk-based national drought policy, mitigation planning is the best choice if risk reduction is the goal of the planning process. The process can include planning for monitoring, awareness creation, early warning and prediction; risk and impact assessment; and mitigation and response. Preparedness plans must contain clear guidelines on costs of preparedness and how the financial resources will be raised to support the preparedness plans.

6. Identify research needs and fill institutional gaps

The national drought policy task team should identify specific research needs that would contribute to a better understanding of drought, its impacts, mitigation alternatives and needed policy instruments, leading to a reduction of risk. These needs are likely to originate from the state-level drought task forces that are established to develop mitigation plans. It will be the responsibility of the task team to collate these needs into a set of priorities for future action and funding.

7. Integrate science and policy aspects of drought management

An essential aspect of the policy and planning process is integrating the science and policy aspects of drought management. Institutions such as the Ministry of Science, Technology and Vocational Training (MSTVC) and higher learning institutions such as the University of Zambia (UNZA), Copperbelt University (CBU), Mulungushi University, and Natural Resources Development College (NRDC) become key in providing the scientific component for sound drought policy development and implementation. This is because policy makers' understanding of the scientific issues and technical constraints involved in addressing problems associated with drought is often limited. Likewise, scientists and managers may have a poor understanding of existing policy constraints for responding to the impacts of drought.

8. Establish an institutional framework and oversight organisation

In order to effectively implement the developed strategies, an institutional framework anchored within an existing institution such as WARMA or the MWDSEP has to be established through national legislation. WARMA is better placed as it already manages Zambia's water resources. A body such as a National Drought Management Advisory Council can be anchored within WARMA. In the event that it is established within MWDSEP, it can be termed the National Drought Management Agency or the Zambia Drought Management Authority/Agency which is semi-autonomous or autonomous but made up of a Technical Advisory Board composed of stakeholders including meteorology, DMMU, fisheries, forestry, social, water, wildlife and welfare services sectors of government and non-government organisations.

9. Publicize the national drought management policy and preparedness plans and build public awareness and consensus

If there has been good communication with the Zambian public throughout the process of establishing the drought policy, legislation and plans, there may already be an improved awareness of goals of the drought policy, the rationale for policy implementation, and the drought planning process by the time the policy is ready to be implemented. Public information specialists such as Zambia News and Information Services (ZANIS) in the Ministry of Information and Broadcasting, Zambia National Broadcasting Cooperation (ZNBC) and private media houses become vital in this regard if they were involved at the early stages of the policy and legislative development process. Throughout the policy development process, it is imperative for local and national media to be used effectively in the dissemination of information about the process as first steps to implementation.

10. Develop education programmes for all ages and stakeholder groups

Working in close collaboration with the Ministries of General and Higher Education in Zambia, a broad-based education programme focused on all age groups is necessary to raise awareness of the new strategy for drought management, the importance of preparedness and risk reduction, short- and long-term water supply issues, and other crucial prerequisites for public acceptance and implementation of drought policy and preparedness goals. This education programme will help ensure that people know how to manage drought when it occurs and that drought preparedness will not lose ground during non-drought years. It would be useful to tailor information to the needs of specific groups (e.g. primary and secondary education, small business, industry, water managers, agricultural producers, homeowners, commercial utilities).

11. Evaluate and revise the national drought management policy and supporting preparedness plans

The tenets of a national drought policy and each of the preparedness or mitigation plans that serve as the implementation instruments of the policy require periodic evaluation and revision in order to incorporate new technologies, lessons

learned from recent drought events, changes in vulnerability and so forth. The final step in the policy development and preparedness process is to create a detailed set of procedures to ensure an adequate evaluation of the successes and failures of the policy and the preparedness plans at all levels. Oversight of the evaluation process would be provided by the national drought policy task team.

The provided strategies only provide a generic framework for which the drought policy, legislation and institutional framework can be developed in Zambia but depending on our unique needs and capabilities, more strategies could be introduced or the proposed ones rephrased depending on capacities or constraints.

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LIST OF ABBREVIATIONS AND ACRONYMS

7NDP	Seventh National Development Plan
CBO	Community Based Organization
CC	Climate Change
CCFU	Climate Change Facilitation Unit
CITES	Convention on International Trade in Endangered Species of Wild flora and fauna
COP	Conference of the Parties
DDCC	District Development Coordinating Committee
DJF	December, January, February
DMMU	Disaster Management and Mitigation Unit
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
ENSO	El Niño/Southern Oscillation
EPPCA	Environmental Protection and Pollution Control Act
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FNDP	Fifth National Development Plan
GCM	General Circulation Models
GDP	Gross Domestic Product
GEEREF	Global Energy Efficiency and Renewable Energy Fund
GEF	Global Environment Facility
GHG	Greenhouse gas
GIS	Geographic Information Systems
GRZ	Government of the Republic of Zambia
IK	Indigenous knowledge
ILO	International Labor Organization of the United Nations
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JI	Joint Implementation
JJA	June, July, August
MAM	March, April, May
MASA	Meteorological Association of Southern Africa
MCT	Ministry of Communications and Transportation
MDGs	Millennium Development Goals
MoF	Ministry of Finance
MRV	Monitoring Reporting and Verifications
MTENR	Ministry of Tourism, Environment and Natural Resources
MWDSEP	Ministry of Water Development, Sanitation and Environmental Protection
NAI	National Agriculture Investment
NAMA	Nationally Appropriate Mitigation Action

NAP	National agriculture policy
NAPA	National Adaptation Programme of Action
NAPA	National adaptation program of action
NC	National Communications
NCCRS	Nationally Climate Change Response Strategy
NCF	Nordic Climate Facility
NDC	National Determined Contribution
NDF	Nordic Development Fund
NEAP	National Environmental action Plan
NGO	Non-Governmental Organisation
NPCC	National program on climate change
NPE	National Policy on Environment
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OVP	Office of the Vice President
PDCC	Provincial Development Coordinating Committee
PPCR	Pilot Programme for Climate Resilience
PPP	Public Private Partnership
PRSP	Poverty reduction strategy paper
REDD+	Reducing Emissions from Deforestation and Degradation Plus
SADC	Southern Africa Development Community
SDGs	Sustainable Millennium Development Goals
SNC	Second National Communication
SNDP	Sixth National Development Plan
SON	September, October, November
UN	United Nations
UNCDD	United Nations Convention to Combat Desertification and Degradation
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNREED	United Nations
UNZA	University of Zambia
V&A	Vulnerability and Adaptation
VAC	Vulnerability Assessment Committee
WARMA	Water Resources Management Authority
WWF	World Wide Fund for Nature
ZEMA	Zambia Environmental Management Authority
ZFAP	Zambia Forestry Action Plan
ZMD	Zambia Meteorological Department

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1 INTRODUCTION

1.1 Overview of Drought in Zambia

Zambia is increasingly vulnerable to climate change and variability as evidenced by increased frequencies of extreme events such as drought, seasonal floods and flush floods, extreme temperatures and dry spells and the country's inadequate preparation and response mechanism to the ensuing disasters. The disasters have, to varying extents, adversely affected sectors such as agriculture, wildlife, forestry, water and energy, and human health, thereby significantly affecting livelihoods and national socio-economic development. According to the National Climate Change Response Strategy or NCCRS (MTENR, 2010), "climate change is a significant development challenge globally and locally", and "it is likely that current extremes and challenges of climate variability (manifested often as floods and droughts) will be experienced for decades to come". Coupled to this is the fact that the country's economy is predominantly based on the exploitation of the country's natural resources (such as land, water, forests and wildlife) which experience the adverse effects of the climatic hazards stated above. Each year, disasters originating from prolonged drought not only affect tens of millions of people, but also contribute to famine and starvation among millions of people, particularly in some African countries (UNISDR, 2009), Zambia being among these.

According to Bwalya (2010), the country has already recorded increases in temperature and reduced rainfall in the last few decades, with temperatures estimated to increase at 0.6^{o}C every ten years. The author also stated that the frequency of occurrence, magnitude and intensity of extreme events including drought, extreme temperatures and dry spells had also increased, and that future scenarios for the period 2010-2070 indicated that the temperature will increase further by 2^{o}C and rainfall is projected to decrease by 8-10 percent.

Drought, which is the focus of this paper, is stated as one of the major natural hazards threatening people's livelihoods and socio-economic development communities. It is a slow-onset hazard, which provides time to consider and address its complex root causes, such as understanding people's vulnerabilities and identifying unsafe conditions related to poverty; fragile local economy; livelihoods at risk; lack of strategies and plans; limited institutional capacities and resources; (UNISDR, 2009) and gender and social exclusion. Understanding these issues and bringing them to the fore is the basis for formulating and undertaking effective drought mitigation and preparedness measures by government authorities and the public.

Drought is categorized as a hydro-meteorological hazard and according to the UNISDR (2009), "hazard" is defined as "a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage". The Disaster Management Act No. 13 of 2010 defines a "hazard" as means "a potentially damaging physical event such as an earthquake, a hurricane, flood, drought, fire, epidemic, phenomenon or human activity, which may cause injury or the loss of life, damage to property, social and economic disruption or environmental degradation, and includes latent conditions that may represent future threats and can have different origins, natural and human induce." Qualitatively, drought is often described as the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis. UNISDR (2009) broadly defines drought as a deficiency of precipitation over an

extended period of time, usually a season or more, which results in a water shortage for some activity, group, or environmental sectors, and further gives classes of droughts as meteorological, agricultural, hydrological, and socio-economic. Meteorological drought is a natural event that results from climatic causes, which differ from region to region. Agricultural, hydrological, and socio-economic drought, however, place greater emphasis on the human or social aspects of drought. They highlight the interaction between the natural characteristics of meteorological drought and human activities that depend on precipitation to provide adequate water supplies to meet human and environmental demands.

Multilateral Environmental Agreements such as the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC) are strongly linked to drought risk reduction frameworks and practices. The UNCCD has its specific definition of "drought" as "the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems". Exposure to the natural hazard and the vulnerability of the society to an event is the risk associated with drought for any region or group. UNISDR (2009) defines "vulnerability" as "the characteristics and circumstances of a community, system or asset that makes it susceptible to the damaging effects of a hazard". Vulnerability is perceived to be "The degree of susceptibility to the negative effects of climate change. It is a function of the type, magnitude and frequency of climate events to which a system is exposed to (exposure) as well as the sensitivity of the system and its capacity for adaptation (adaptive capacity)" by the National Climate Change Policy of 2016. Therefore, risk assessments are conducted to better understand the drought hazard and identify the factors and processes concerning who and what is most at risk to drought, and why. In line with the priorities of the Hyogo Framework, UNISDR (2009) presents the main elements of a drought risk reduction framework, as i) policy and governance, ii) drought risk identification and early warning, iii) awareness and education, iv) reducing underlying factors of drought risk, and v) mitigation and preparedness, as well as cross-cutting issues. UNISDR (2009) further states that drought risk reduction is a long-term commitment that should complement long-term sustainable development planning efforts, such as meeting the Sustainable Development Goals (SDGs) and in the Poverty Reduction Strategies.

Mainstreaming drought risk reduction into national development frameworks requires political commitment, high-level engagement, strong institutions and appropriate governance. The process of drought risk reduction and its mainstreaming into national development frameworks should be participatory, involving a diverse range of stakeholders key amongst which should be national and local governments, community-based and civil society organizations, regional and sub-regional organizations, multilateral and bilateral international bodies, the scientific community, the private sector and the media. Capacity development for drought risk reduction is another important cross-cutting aspect considered. Capacity development can be conceived at three different levels, namely individual, group, institutional and systematic levels. Capacity development for drought risk reduction can be coordinated, implemented and monitored under holistic and nationally owned coordination mechanisms for disaster risk reduction such as multi-sectoral national platforms for disaster risk reduction. In addition to national and provincial drought policies, importance should be placed on local/community level drought policy and planning, emphasizing self-reliance and drought resilience.

1.2 Purpose of the National Drought Plan

The National Drought Plan is intended to contribute to the protection of Zambia's land, water and other environmental resources from over-use and drought for them to be able to provide the required ecosystem services and well as to mitigate against compromising Zambia's food security. Given the impacts of climate change and variability that include drought especially in western and southern Zambia, unpredictable rainfall patterns and flooding in some areas, it is imperative that Zambia builds its capacity to particularly achieve drought resilience at national level. The drought resilience capacity includes (i) drought preparedness, (ii) national and regional (provincial) efforts to reduce drought vulnerability and risk, and (iii) boosting the resilience of people and ecosystems to drought. This drought plan is therefore developed in order to contribute to risk reduction and preparedness.

3 NATIONAL INSTITUTIONAL FRAMEWORK FOR DROUGHT MANAGEMENT AND THE IMPACT OF DROUGHT ON PEOPE AND ECOSYSTEMS

2.1 Introduction

Drought in Zambia and the region can be seen as a complex natural hazard which is usually associated with the outcomes of the numerous climatic and other social factors that define the level of societal resilience. The common factors that define vulnerability of a region, economic sector or population group in Zambia include population growth and redistribution and changing consumption and production patterns that are employed by the affected populations. There are however, other factors such as poverty and rural vulnerability, weak or ineffective governance, and changes in land use, environmental degradation, environmental awareness and regulations, and outdated government policies which contribute to changing vulnerabilities. Zambia like many other African countries has experienced several disasters from time to time which has commonly included drought, floods, human epidemic out breaks, livestock epidemics, refugee influxes, crop pests, road traffic accidents, famine, fires, and industrial accidents among others.

Naturally, when drought occurs, the government and donors usually respond with impact assessment, recovery and reconstruction activities to return the region or locality to a pre-disaster state. Although the country is making efforts to embark on preparedness, mitigation or prediction/early warning actions, there is need to enhance these efforts.

These disasters have negatively affected mainly poor communities in different parts of the country, particularly rural and peri-urban communities, as they are not able to cope with such disasters with their own resources. There has been an increase in the nature of recurrent disasters in Zambia which have mainly been droughts, floods, pest infestation, fires, industrial accidents, epidemic (Cholera) outbreaks, and other pandemics etc. The management activities being employed are limited in nature to the mitigation effects of these particular disaster occurrences.

2.2 Impacts of Drought on Different Sectors of the Economy

Some of the impacts of the past droughts in Southern Africa and Zambia in particular, include the ones described in the sections below.

2.2.1 Economy

Drought relief is costly when recovery and social support schemes become a necessity which force government to re-channel financial resources from development projects to, for example, food imports.

2.2.2 Agriculture

Widespread crop failure, livestock deaths (consequently loss of draught power for the ordinary farmers), income loss and famine are the result of most droughts. To many farmers, it is the income loss that matters when drought occurs during the farming season. The resulting poverty traps small scale farmers find themselves in is made worse by each drought that occurs, which have adverse implications on the farmers' ability to maintain and/or improve soil fertility thus production.

2.2.3 Environment

A series of droughts in most cases result in general environmental degradation which is compounded in situations of inappropriate land use patterns. Soils in these areas have been left 'exhausted' and costly to restore production potential. Natural resources including fisheries, forests, water and wildlife are impact by the reduction of environmental flows, inadequate soil moisture to facilitate natural recruitment, increased incidences of wild fires and thus destruction of forests, reduced water quality and availability for animal consumption.

2.2.4 Hydrological

Some rivers, dams and lakes either dry out or water volumes shrink thereby paralyzing the fish, hydro-electric power generation, and recreation industries.

2.2.5 Industry

Some industries are threatened with closure or relocation to areas better supplied with water. The supply of electricity in Zambia has been previously impacted due to reduction in the volume of water required for hydro-electricity generation. This has resulted in regular load shedding which impacts industrial output.

2.2.6 Society

The general welfare of a society is usually adversely affected by the advent of each drought.

To effectively manage the effects of drought and other disasters, Zambia has put in place intuitional frameworks for managing these disasters. The country also subscribes to regional and international instruments for managing drought and other related disasters. The Disaster Management and Mitigation Unit (DMMU), Zambia Meteorological Department (ZMD), Ministry of Agriculture, Ministry of Water Development and Sanitation are key actors responsible for monitoring and coordinating the Government response to drought effects in Zambia.

2.3 National Institutional Framework

The National Disaster Management Policy of 2005 defines drought as a period of abnormally dry weather that persists long enough to produce a serious hydrologic imbalance (for example crop damage, water supply shortage, etc.). The severity of the drought depends upon the degree of moisture deficiency, the duration and the size of the affected area. It further defines a disaster as an event that is associated with the impact of a human induced, natural hazard or a complex emergency which causes a serious disruption in the functioning of a community or society, causing widespread human, material or environmental losses which exceed the ability of the affected community or society to cope using only its own resources.

The Disaster Management Act of 2010 defines a disaster as an event that is associated with the impact of a human induced or natural hazard, which causes a serious disruption in the functioning of a community or society, causing widespread human, and material or environmental losses which exceeds the ability of the affected community or society to cope with the hazard using its own resources. The Act further defines a hazard as a potentially damaging physical event such as an earthquake, a hurricane, flood, drought, fire, epidemic, phenomenon or human activity, which may cause injury or the loss of life, damage to property, social and economic disruption or environmental degradation, and includes latent conditions that may represent future threats and can have different origins which could be natural and human induced.

2.3.1 Institutional Arrangement for Drought Management in Zambia

In Zambia drought has been experienced as one of the common disasters that threatens the communities. In this regard, the Government has been making efforts to create a permanent response mechanism to deal with these threats. These efforts have continued to transform as the magnitudes of these disasters keep on changing with changing climate. The response to drought has evolved accordingly. In the first and second Republics (1964-2010), the co-ordination of response to emergencies was with the *Contingency Planning Unit* which was located in the then Office of the Prime Minister from 1966 to 1992.

The occurrence of the major drought of 1991/92 that affected most of the Southern African region which called for major relief operations, four key ministries of Health, Agriculture, Energy and Water Development, and Community Development formed an ad-hoc committee which was responsible for managing different aspects of response to drought. The Management Committees were co-chaired by ministries of Agriculture and Health. However, the Ministries did not coordinate effectively and operated in isolation which led to unnecessary overlaps, wastage of resources and bureaucratic delays.

At the time, there were no formal relief frameworks which prompted Government to form new structures to manage the logistics of bulk imports and relief programmes, which bypassed existing government channels. These structures were created at national, district and village levels and became known as the Programme to Prevent Malnutrition (PPM) to which the Programme Against Malnutrition (PAM) provided secretariat and technical backstopping services.

In 1994, the Government saw the fragmented disaster framework that existed, found it necessary to create a permanent unit in the office of the Republican Vice President to initiate, facilitate the implementation and coordinate disaster management policies and programmes. This Unit which is called the Disaster Management and Mitigation Unit (DMMU) and was given the mandate for overall disaster management and co-ordination which was in line with the Public Service Reform Programme.

The formation of the DMMU necessitated the formulation of a National Disaster Management Policy to deal with the weaknesses identified in the by then disaster management regime. The policy was formulated to deal with the ad-hoc management of crisis situations and to provide a legal framework that gives legal authority to the operations of the current and future disaster management system. The policy provided a coordination mechanism of efforts among key players to effectively address the way Zambia was going to manage its hazard risks, vulnerable populations and the environment at risk. The Institutions involved include the ones described in the sections below.

2.3.1.1 The Disaster Management and Mitigation Unit (DMMU)

The overall responsibility for national disaster management remains in the Office of the Vice-President and implementation of disaster management activities and programme are done through the Disaster Management and

Mitigation Unit (DMMU), which exercises its responsibilities through the National Disaster Management Committee, Disaster Management Technical Committee and appropriate broad-based committees at Provincial, District and Satellite levels.

National Disaster Management Committee (NDMC)

Under the OVP, there is the National Disaster Management Committee which is the supreme policy-making body for national-wide disaster management in the country. It is chaired by the Vice President, and Minister of Defence as Vice Chairperson and comprises Cabinet Ministers responsible for: Home Affairs; Communication and Transport; Agriculture; Cooperatives; Energy; Water Development; Finance; National Development Planning; Local Government; Housing; Community Development; Social Services; Works and Supply; Mines and Mineral Development; Health; Tourism, Environment; Natural Resources; Education; Information and Broadcasting Services. The committee co-opts other Ministers and/or Provincial Deputy Ministers when need arises while the Secretariat is the Cabinet Office.

The functions of NDMC include:

- Formulation of National Disaster Management Policy;
- Directing line Ministries to take up their portfolio responsibilities as they relate to disaster management activities;
- Endorsing national plans and regulations;
- Recommending declarations of national disasters; and
- Facilitation of the mobilization resources for disaster management
- Activities.

National Disaster Management Technical Committee (NDMTC)

There is a Disaster Management Technical Committee which is a multi-sectoral Team, acting on behalf of the National Disaster Management Committee and is chaired by the national Coordinator. It is the overall technical supervisory body of disaster management activities in the country and comprises of the Permanent Secretaries responsible for: Home Affairs; Communication and Transport; Agriculture; Cooperatives; Energy; Water Development; Finance; National Planning; Local Government; Housing; Community Development; Social Services; Works and Supply; Mines and Mineral Development; Health; Tourism, Environment; Natural Resources; Education; Information and Broadcasting Services.

The Committee whose Secretariat is the DMMU co-opts other Ministries, Provincial Permanent Secretary, private sector or civil society organisation as ex-officio members when need arises. The.

The functions of NDMTC include:

- Recommending Disaster Management Policy direction to the National Disaster Management Committee;
- Overall Co-ordination of the implementation of the decisions of the National Disaster Management Committee;
- Supervising the work of the DMMU in the preparation, monitoring and regularly reviewing of National Disaster Management Plans;
- Supervising the work of the DMMU in the monitoring and regularly reviewing of Sectoral Disaster Management Plans and;
- Overall management of the National Disaster Trust Fund (NDTF).

NDMTC Sub-Committees

There are NDMTC Sub-committees which assist DMMU with technical inputs in order to improve co-ordination, programme planning and implementation. The chairmanship and membership (drawn from technical officers, disaster managers in line ministries, UN System, NGOs, private sector and other stakeholders) of the sub-committees vary

according to the nature of particular subject areas under consideration. The Working Groups also hold regular meetings to address issues and problems from provincial and district committee levels. The Key sub-committees include:

- Sub-committee on Health, Water, Sanitation and Nutrition;
- Sub-committee on Finance and Tender
- Sub-committee on Infrastructure, Relief and Logistics;
- Sub-committee on Agriculture and Environment;
- Sub-committee on Security;
- Sub-committee on Early Warning Systems;
- Sub-committee on Training and Public Education.

The main functions of the Sub-Committees are;

- Generating portfolio information through DMMU to NDMTC for timely decision making;
- Serving as fora for updating skills, reviewing case studies, promoting and setting agenda for trainings;
- Creating awareness on respective subject matter;
- Participating in risk analysis and vulnerability assessment;
- Playing a technical advisory role and not duplicate the roles of the executive committee at any level;
- DMMU shall facilitate the nomination and appointment of members of the technical sub-committees from the various stakeholder institutions and;
- Help DMMU coordinate and supervise the implementation of portfolio activities and Programmes.

Provincial Disaster Management Committee (PDMC)

There are Provincial Disaster Management Committees which are sub-committees of the Provincial Development Coordinating Committee (PDCC) and comprise of; Heads of those Departments and other stakeholders that are likely to be involved in disaster management. Officers in Charge of the overall management of districts are co-opted into the PDMC. It is a forum for disaster prevention, preparedness and mitigation activities in the province and an essential link between national objectives and local priorities. The Committee is chaired by the Permanent Secretary and comprise **all** Heads of Department, NGOs, Private Sector and Church and the **Secretariat is the** Provincial Disaster Management Coordinator.

The main functions of the PDMC include:

- Preparing and consolidating provincial disaster management plans;
- To act as clearing house for information related to early warning;
- Monitoring the preparation and implementation of district disaster management plans and evaluating their impact;
- Participate in Risk Analysis and Vulnerability Assessments;
- Mobilizing provincial resources for implementation of mitigation prevention, preparedness and response activities;
- Coordinating provincial level multi-sectoral input into national disaster management plans;
- Collecting and disseminating information on provincial disaster management issues;
- Acting as a channel for information and resources between central government and districts;
- Promoting and implementing disaster management training at provincial level and ensuring that training programs are carried out at district level;
- Promoting public awareness at provincial and district levels; and
- Performing emergency operations for the province in times of disasters.

The Chairperson is obliged to identify and appoint new or co-opted members as need arises upon consultations with the general membership of the PDMC. The Secretariat of the committee operates and updates a database on disaster related information.

District Disaster Management Committee (DDMC)

There are District Disaster Management Committees which directly deal with the impact of a disasters and will coordinate operations of disaster preparedness, prevention and mitigation at the district level. All NGOs dealing with disaster management, assessment and early warning information work through these DDMCs of which all relevant Government Departments are members. These are sub-committees of the District Development Coordinating Committee. They comprise Heads of those Departments and other stakeholders that are likely to be involved in disaster management as determined by the DDMC. They are chaired by the Officers in charge of overall management of a District (District Administrators) and comprises all Heads of Department, NGOs, Private Sector, and Church. The Secretariat for these committees are District Administrative Officers.

The main functions of the DDMC are:

- Ensuring that the flow of information from community to provincial levels is running smoothly;
- Participate in Risk Analysis and Vulnerability Assessments;
- To act as clearing house for information relating to early warning;
- Coordinating district disaster management activities;
- Preparing and updating district multi-sectoral disaster preparedness, prevention and mitigation plans for slow- and rapid-onset disasters;
- Reviewing and updating district disaster plans during times of nonemergency;
- Mobilizing resources for district disaster management and preparation of budgets;
- Implementing disaster management training programs at district level; and
- Implementing public information and public awareness programs in the district.

Satellite Disaster Management Committee (SDMC)

The Officer in Charge of the overall administration of the district ensures that each village or cluster of villages within each chiefdom has a permanently established Satellite Disaster Management Committee. The local community elect their representatives to SDMC. The SDMC through the chairperson reports to the District Disaster Management Committee which shall facilitate, co-ordinate and supervise its work. The Committee is composed of ten (10) members distributed as follows:-

- A representative of traditional leadership;
- At least three local persons trained in any sector (e.g. teacher, extension officer, health worker or any skilled person, etc.);
- Representatives of major religious groups operating in the area;
- Two men and two women selected to represent the community;
- At least one youth to represent the youth population in the area;
- A prominent businessman or farmer and;
- A local representative of an NGO involved in disaster management or relief work.

The functions of the SDMC include:

- Overseeing disaster preparedness, relief and post-disaster recovery activities of individuals and households in its area;
- Identification of vulnerable households and individuals;
- To act as clearing house for information related to early warning;

- Acting as primary responding and mitigation agent within the existing capacities of the community;
- Participate in Risk Analysis and Vulnerability Assessments;
- Acting as information and reporting channel for the community with regard to disaster management issues at the local level;
- Sensitizing local community on the effects of disasters and appropriate responses;

The Secretariat of the committee is elected by the committee and maintains a database on disaster management related information. Gender concerns are incorporated into the composition, responsibilities, roles and activities of committees and efforts shall be made to ensure equal representation of men and women in committees at all levels.

2.3.1.2 Roles of the Institutions

(a) Disaster Management and Mitigation Unit (DMMU)

The DMMU which is a permanently established government institution within the Office of the Vice-President is the Secretariat to the entire National Disaster Management structure, and primary driver of all disaster management activities in the country, guided by the committees. Its management focuses on goal-setting, controlling and directing of programme design. DMMU acquires, mobilizes and manages resources, and shall maintain minimum levels of relief materials to facilitate primary and immediate response to a disaster situation. It maintains a small but efficient organizational unit to perform the functions of coordination.

The Emergency Operations Centre (EOC) is a suitably equipped facility of DMMU and remains in a state of preparedness and it is the nerve centre to monitor emergencies and their possible responses at all times and feed into the normal operations of DMMU. The EOC is the primary location from which the mobilization and coordination of responses and resources shall be carried out in the event of a disaster.

The Early Warning System (EWS) is broad-based covering all sectors and hazard sources. The DMMU maintains close links with the different institutions that provide early warning services. There is an Expert Group forming the core of the Early Warning System Sub-Committee which co-ordinates Early Warning activities from different institutions, to feed into the EOC.

(b) Provincial Disaster Management Office (PDMO)

All provinces maintains a Provincial Disaster Management Office (PDMO) managed by a Provincial Disaster Management Coordinator who provides technical advisory support to Provincial Disaster Management Committees, District Disaster Management Committees as well as community-level satellite committees.

2.3.1.3 Role of other stakeholders in Disaster Management

The stakeholders include Non- Governmental Organisations, Donors, UN Disaster Management Country Team and the UN System in general, the private sector, the church and the community. The Government plays a coordinating role of the inputs of the different stakeholders before, during and after emergencies. The Stakeholders declare to Government through DMMU their work plan and budgets including resources and their sources meant for disaster management related activities. This is for purposes of capturing information relating to mitigation, prevention, preparedness, and response activities so that the Government knows with precision the types and scales of interventions being under taken, as well as resources required to implement them.

Non-Governmental Organizations (NGO)

The government through DMMU ensures that NGOs are familiar with the disaster management policy and strategies. NGOs shall be encouraged to provide relief and early warning information quickly and appropriately. Effective links with NGOs shall be promoted at all levels of disaster management and mitigation framework. Government and NGOs shall forge partnerships to serve vulnerable and affected communities. A forum between Government through DMMU and NGOs at national, provincial, district and community levels shall be formed to address areas of mutual interest.

Donors

Donors play a pivotal role to supplement government efforts in the area of strengthening capacities for disaster management and supplementing efforts in mobilizing resources for disaster management. They work with Government at various levels of national Governance.

The National Disaster Management Policy addresses the way Zambia shall manage its hazard risks, vulnerable populations and the environment at risk and provides a framework for disaster management in future. The policy recognises the provisions of international conventions and United Nations Resolutions, African Charters and SADC Disaster Management Strategy that provides a Global Framework for Disaster Management.

2.3.1.4 Major Strengths of the Current System

The Disaster Management Unit being Office of the Vice President ensures a very high level of advocacy for disaster policy and operational decisions. The participation of donor agencies, private sector and NGOs at all levels of functional Committees provides and promotes a broad based national strength. This fosters an inclusive approach and harmonised approach in the management of disaster in the country. The effective and increased involvement of key stakeholders like civil society, NGOs, private sector, and Donors has brought about non-partisan and non-political approach to disaster management and mitigation in the operational committees. This further promotes effective partnership among stakeholders, effective functional participation of all key stake holders and promote objectivity, credibility, and operational efficiency in disaster management and mitigation programmes.

Despite some of the shortcomings in drought prediction, meteorology has come a long way in its endeavour to give usable seasonal or long range weather forecasts. The government has invested in upgrading the weather station and a good number of private firms are involved in providing in seasonal climate prediction. The existing long range rainfall predictions allows an understanding of large scale climatic anomalies lasting for several months which are likely result in large scale and long-lasting anomalies in the ocean-atmosphere behavior such as the El-Nino/Southern Oscillations.

2.3.1.5 Current System's Major Weaknesses

The system is open to excessive political interference, which tend to undermine the credibility of programmes and smooth implementation of well-meant programmes. The lack of a stand-alone Policy and Plan on drought management brings about weak coordination systems and the duplication of efforts making the efforts costly. The absence of the above legislation and the absence of clearly defined roles and responsibilities of all stakeholders weakens the collaborative meetings among key players at national, provincial, district and community levels though there is substantial potential for joint planning of programmes at all levels. Information is one key resource for efficient planning and implementation of drought management and mitigation programmes, though information sharing is another serious problem. For collaboration to be effective among all stake holder's basic information must be reliable and credible. Especially that information gathering is always an expensive exercise, the working in silos make institutions duplicate efforts.

2.4 Recommendation of an Institutional Framework, Roles and Responsibilities for Drought Mitigation

2.4.1 Policy Framework

Drought is one of the leading impediments to development in Africa and Zambia in particular. Many communities are dependent on rain-fed agriculture, which makes them particularly susceptible to climate variability. The prolonged and frequent occurrences of droughts has presented significant challenges to agriculture, forestry, water resources management, urban planning, and food security in Zambia. It is a well-known fact that, drought contributes to food insecurity, malnutrition, famine and increased mortality with women and children especially those living in rural areas particularly affected. Mitigating the impacts of droughts and hunger is one of the primary aims of the 7-NDP and the Zambia Vison 2030 and SDG 1 and 15 (more than 6 SDGs) however, without the clear policy on national drought management makes mitigation efforts ineffective due to poor understanding of the causes and characteristics of drought events and processes.

Since the country is experiencing increasing incidences and increased vulnerability to drought, greater attention should not only be targeted at reducing risks associated with its occurrence through planning, but also to improve operational capabilities (e.g. climate and water supply monitoring, building institutional capacity) and mitigation measures that are aimed at reducing drought impacts. This will require the use of all components of the cycle of drought management, rather than only the crisis management portion of this cycle.

Therefore, there is need to develop a National Drought Policy and a National Drought Plan. The development of the National Drought Plan will significantly address the issues related to community resilience to drought and other climatic shocks. The establishment of a National Drought Policy will create a clear set of principles or operating guidelines to govern the management of drought and its impacts. The overriding principle of drought policy should be an emphasis on risk management through the application of preparedness and mitigation measures. The policy should be directed toward reducing risk by developing better awareness and understanding of the drought hazard and the underlying causes of societal vulnerability, along with developing a greater understanding of how being proactive and adopting a wide range of preparedness measures can increase community resilience. The NDP should be consistent and equitable for all regions, population groups and economic sectors, and consistent with the goals of sustainable development.

In view of the above, there is need to adopt and establish a framework for Integrated National Drought Plan (INDP) with a purpose of providing a common framework for the protection and enhancement of all surface waters (rivers, lakes, and transitional waters) and groundwater. The INDP will be an important legislative tool for water protection and drought management in Zambia which will be based on the principles of integrated water management.

The National drought plan will be developed basing on the following principles:

- There is need to pursue a proactive approach with an emphasis on drought risk management which will be associated with developing a preparedness plan in advance with the aim to prevent or minimize drought impacts.
- The Drought Management Plan will be used as an administrative tool for the enforcement of preventive and mitigation measures in order to achieve a reduction of drought impacts on society, environment, and economy.
- The Water Framework Directive provides the legislative framework for the development of Drought Management Plans focused on the reduction of drought impacts in affected areas and the enhancement of resilience against droughts.

- A Drought Management Plan is an additional planning document that supplements a River Basin Management Plan developed as a part of planning cycles in accordance with Article 13.5 of the WFD. According to chapter 10 of the UNCCD, the relevant chapters of a Drought Management Plan are included in the National Action Plan to combat desertification.
- The development of drought policy and the production of the Drought Management Plan are consistent with policy documents issued by the European Commission and other technical and methodological documents developed and adopted within the process of the Common Implementation Strategy for implementation of the WFD. A link between the Drought Management Plan and national/local development plans/programmes/ strategies should be ensured.
- Professional experiences and scientific knowledge on drought risk management from other regions are utilised.
- Three main elements are crucial for effective drought management: drought indicators and thresholds for the classification of drought stages (i.e. normal, pre-alert, alert and emergency) and a drought early warning system; mitigation measures to achieve specific objectives in each drought stage; and an organizational framework to deal with drought.
- A key factor for establishing effective and integrated drought management is ensuring the involvement of key sectors, decision-makers, professionals, stakeholders from impacted sectors, and the public in the process of developing and implementing a Drought Management Plan.

2.4.2 Institutional framework

In order to operationalise the above goal, the following must be attained, there is need to create and ensure there is an effective system in place for integrated water development and management and drought management at national, provincial, district and community levels. The system should also include the active participation of civil societies, private sector, NGOs and ordinary members of the community in the process. This will require that a potential and reliable framework is identified in good time and efficient mechanisms are put in place to address vulnerabilities. This will also require that development policies and frameworks are harmonised to improve preparedness and ensure that investment is made available to enable responsible institutions predict, mitigate possible impact and effects and improve response capacity.

3 POLICIES, LEGISLATION AND STRATEGIES RELATED TO DROUGHT MANAGEMENT IN ZAMBIA

3.1 Introduction

Desertification and drought have been among the main and long standing environmental problems that has been recognized globally to affect social economic development. The effects of climate change has compounded the problem resulting in land's biological potential and economic ability to sustain life becoming compromised. This has serious knock-on effect on poverty and livelihood. The objective of this consultancy was to review sector policies and strategies that have potential to affect or contribute to drought and drought management/mitigation and its impacts on peoples and ecosystems. This work is supported by the United Nations to Convention to Combat Desertification (UNCCD) as the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. The aim is to protect land from over-use and drought.

The approach to the assignment involved collecting information from sector policies, plans, strategies and relevant legislations. Three interrelated processes were involved: 1) collecting; 2) organising and compiling and 3) reviewing and synthesizing available necessary resources for each sector identified in terms of reference. An assessment of each policy in the sector was undertaken to provide an indication of the robustness and reliability of the data/information giving a short holistic summary of the policy focus, score description and linkage to the drought management/mitigation aspects (Table 1).

Table 1 Sector policies review assessment

Indicator to drought relevance	A: Contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear and unambiguously assigned. B: Contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear but implementation is ambiguous. C: Contribution to drought management/mitigation are not identified in this policy/strategy
Proposed ranking: A, B. C or D	

3.2 National Development Planning Sector

3.2.1 The Seventh National Development Plan

The Seventh National Development Plan (7NDP) was developed following the revision of the 2013-2016 6th National Development Plan (SNDP) (GRZ, 2017). The 7NDP aims at achieving the objectives of the Vision 2030 of becoming a

"*prosperous middle income country by 2030*" themed "*Accelerating development efforts towards the Vision 2030 without leaving anyone behind*". The goal of the Multi-sectoral 7NDP is to create a diversified and resilient economy for sustained growth and social-economic transformation driven, among others by agriculture, tourism, manufacturing and mining. The integrated approach recognizes the multi-faceted and interlinked nature of sustainable development which calls for interventions to be tackled simultaneously through a coordinated approach to implementing development programmes.

Through the use of the integrated multi-sectoral development approach, the 7NDP has the advantage of considering the comparative and competitive advantages of the regions in allocation of resources towards implementation of the multi-sectoral strategies and setting in motion a series of mutually supporting activities in different sectors with the general objective of delivering the national agenda. Therefore, the 7NDP aspires to respond to the Smart Zambia transformation agenda 2064 and embeds in it the economic stabilisation and growth necessary for the actualisation of a Smart Zambia. This is in support of the UN 2030 Agenda for Sustainable Development and the African Union Agenda 2063. The drought elements in the plan include: climate change, agriculture, Disaster risk reduction, Water harvesting and protection, human development among others as described below.

3.2.1.1 Climate change

The 7NDP plan states that Zambia has been experiencing the effects of climate change resulting in extreme weather conditions, such as droughts, rising temperatures and unpredictable rainfall patterns (Section 4.9 of 7NDP) (GRZ, 2017). The frequency and intensity of climate events is expected to rise in future, with negative impact on the economy and consequently people's livelihoods. The Policy estimates that the impact of climate change will cost Zambia approximately 0.4 percent of annual economic growth. It is further estimated that without action, rainfall variability alone could lead to losses of 0.9 percent of GDP growth over the next decade, thereby keeping a significant section of Zambia's population below the poverty line. For example, the fall in the country's hydro-power generation in the recent period by about 600 MW was mainly attributed to poor rainfall patterns. The lower supply of electricity has hampered growth prospects of Zambia's productive sectors of the economy, including agriculture, manufacturing, mining and services. Other adverse effects have led to increased costs of treating climate-related diseases such as malaria and the loss of natural environments, damage to infrastructure and disruption of biodiversity.

3.2.1.2 Agriculture

As rains become more erratic and less predictable due to climate change, the 7NDP articulates the need for agriculture diversification strategies. Integrating climate smart techniques, as necessary tools to buffer against natural shocks, such as droughts and the weakening of seed and animal varieties due to the impact of climate change. Agro-diversification and development will thus be based on comparative and competitive advantages in line with the Government's Green Revolution agenda.

3.2.1.3 Disaster risk reduction

In view of the increased frequency and intensity of climate change the 7NDP aspires to develop strategies that aid affected communities to adapt to its effects through climate proofing their livelihoods, production and assets. The plan explains that over the last three decades, floods and droughts cost Zambia more than US$13.8 billion in disaster losses, which is equivalent to a 0.4 percent loss in annual economic growth. Currently, apart from emergency response to disasters and promoting integrated early warning strategies, disaster risk reduction is being enhanced through partnerships with key stakeholders who have contributed in reducing the impact of disasters. The issue of food security is important and the threats of floods, drought, cattle diseases, low agricultural technologies, refugees and internally displaced persons will be reduced through mainstreaming of disaster risk reduction in all key sectors of the economy.

3.2.1.4 Rain water harvesting and catchment protection

In this strategy, the plan intends to focus on water resources infrastructure development through construction of small, medium to large dams to meet various water needs particularly for domestic, agriculture and hydropower generation. This is because increasing water resources availability through increased storage will in the long run mitigate the impact of climate change and help to build resilience. These initiatives will also serve rural communities, thus supporting productive use of water and livelihoods and increasing resilience to the adverse effects of climate change, such as floods and droughts.

3.2.1.5 Human development

The 7NDP plan highlights that Zambia's achievement of enhanced human development can be harnessed through, among others, addressing various aspects that constitute binding constraints. These binding constraints are related to a weak decentralised administrative and fiscal system of governance, coupled with weak coordination among various institutions that contribute to enhancing human development. As a result, the country has registered high poverty levels due to stagnating per capita incomes, especially in the 1990s, decreased fiscal expenditure in health, education and social protection, inadequate access to social services and drought, which has constrained incomes of the majority of the country's workers in the agriculture sector. Social protection is one of the target goals under social investment and human development outlined in **annex 1** in which the vulnerable communities are protected against risks and shocks such as droughts and ensuring that they sufficient livelihood security to meet basic needs.

3.2.2 Vision 2030

The Vision 2030 is a long-term plan developed to prepare a shared and commonly understood dream for the country (GRZ, 2006). The vision expresses the aspirations of the Zambian people to live in a strong and dynamic, middle income industrial nation that provides opportunities for improving the wellbeing of all. It embodies values of socio-economic justice underpinned by the principles of: Gender-responsive, sustainable development; Democracy; Respect for human rights; Good traditional and family values; Positive attitude towards work; Peaceful co-existence; and Public-private partnerships (PPPs). The Vision 2030 outlines long-term national and sector goals for attaining desirable socio-economic indicators, to fulfil the Zambian people's aspirations.

The Vision highlights three scenarios outlining development options, namely the baseline, the preferred and the optimistic. The socio-economic development objectives enshrined in the preferred scenario are: to attain and sustain annual real growth of 6 percent (2006-2010), 8 percent (2011-2015), 9 percent (2016-2020), and 10 percent between 2021 and 2030; to attain and maintain a moderate inflation rate of 5 percent; to reduce national poverty head count to less than 20 percent of the population; to reduce income inequalities measured by a Gini coefficient of less than 40; to provide secure access to safe potable water sources and improved sanitation facilities to 100 percent of the population in both urban and rural areas; to attain education for all; and, to provide equitable access to quality health care to all by 2030.

3.2.3 Poverty reduction strategy paper

The poverty reduction strategy paper (PRSP) developed in 2002 (GRZ, 2002b) for the realisation that the country's poverty levels were increasing. The implementation of strategy was done largely through the fifth national development plan (FNDP) which was formulated on the basis of two major assumptions: (a) accelerated growth and poverty reduction through the scaling-up of implementation of the FNDP programmes in the key sectors of the Plan; and (b) an increase in the resource envelope based on an anticipated scaling-up of donor aid over the baseline projections. The formulation of the PRSP was participatory and covered all the sectors of the economy. In this paper, the country made an attempt of addressing poverty in more structured and holistic fashion since mining, which was the driving force in the Zambian

economy, declined pulling down other sectors that depend on it. Among the sectors, Agriculture was identified as a priority sector that would contribute to a meaningful reduction in poverty. The abundance arable land coupled with abundant water resources were identified as key strengths and it was planned that given the right Conditions, long-term innovative improvement of the productivity of agricultural resources in the country would be enhanced.

The PRSP address drought in Chapter 5 for irrigation potential under agriculture linking this to Chapter 11 covering the water sector. Irrigable land was estimated at 423,000 hectares but less than 40,000 hectares (or 9 percent) was irrigated, mostly by commercial farmers cultivating sugar, wheat, and plantation crops. Therefore, in PRSP the government aspired to increase irrigable land to 14% through construction of dams and rain water harvesting. The review and updating of all sector policies was highlighted in the PSRP (e.g. National Environmental Policy was proposed in the PRSP) (Appendix 3-14).

3.2.4 Summary of the Relationship of National Development Sector Policies and Strategies to Drought Management

The seventh national development plan is the current link document to government policies, plans and strategies in Zambia that hinges on the long term vision 2030 of becoming a "prosperous middle income country by 2030" and the Poverty reduction strategies of 2002. The goal of the seventh national development plan is to create a diversified and resilient economy for sustained growth and social-economic transformation driven, among others by agriculture, tourism, manufacturing and mining. The plan outlines measures related to climate change, agriculture diversification, poverty, reduction of disaster risks and water harvesting. As a hindsight to implementation, the plan describes effects of drought on the economy, the people and the ecosystem.

3.2.5 Assessment of the Relationship of the National Development Policies and Strategies Relative to Drought Management

The score of the national planning development policies (i.e. 7NDP, the vision 2030 and the Poverty Reduction Strategy) plan is **B** in that, the contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear particularly in the 7NDP and PRSP. However, even though the 7NDP mentions measures to reduce environmental risks such as shortage of water by rain water harvesting strategies, poverty reduction among others, a concrete strategy on how to deal with drought in a more structured way is lacking and implementation is ambiguous.

3.3 Environmental Sector

3.3.1 National Environmental Action Plan (NEAP)

The 1985 National Conservation Strategy that aimed at incorporating environmental management in the national development processes of the country was recognised to have a few inadequacies which included the none integration of environmental concerns into the social and economic development process of the country and inconsistency with the country's new market economic orientation as the economy was undergoing liberalisation. These formed the main guiding objectives for the NEAP which was developed in 2013 (GRZ, 2013). Against these, the NEAP provided for new opportunities for involvement of local communities, the private sector, NGOs and CBOs in the management of the environment while at the same time recognising the important role for government in monitoring, regulation and enforcement of appropriate resource-use in the interest of sustainable development.

The NEAP at the time was a comprehensive document that was developed through the participatory analysis of the environmental situation and management, which resulted in the identification of key environmental issues that Zambia was facing. The five major environmental problems isolated in the NEAP were land degradation, deforestation, air pollution in the mining areas, water pollution and inadequate sanitation, and wildlife (game and fish) depletion. It reviewed the weaknesses in the then existing legislation and institutions and provided strategy options for improvement of environmental quality. The NEAP also provided for updated environmental policy actions and formed the basis for the future development of an investment plan for its implementation. The need for supporting the public, the private sector and community based approaches in environmental and natural resources management were strongly recommended.

There were some areas which, did not come out prominently in the NEAP, but which are of great concern when dealing with drought and desertification. These include the strengthening of the early warning systems, utilisation and development of indigenous knowledge, transfer of appropriate technology to the community level and the area of information collection, management and exchange including the aspect of impact indicators. These gaps are very important areas of entry and support.

3.3.2 The National Policy on Environment

The national policy on environment (NPE) was developed through a comprehensive research and consultative process and is fully integrated in principles of decentralisation, community participation and privatisation that underpin sustainable development (GRZ, 2007). The overall vision of the NPE was to provide a framework management guide for the management of Zambia's environment and natural resources so as to ensure that they are managed on a sustainable basis and retain their integrity to support the needs of the current and future generation without compromising either of the two. The aim of the Policy was to ensure sound environmental management within a framework of sustainable development in Zambia. The Policy is supported by many other policies and strategies developed for other sectors and has continued to provide a holistic approach based upon cross-sectoral consensus for care of the environment. The Policy emphasises that it is the duty of any institution, Government or Non-Governmental Organisation, any community group or people's organisation or any individual that uses or otherwise carries out activities that affect the environment in any way, to exercise proper control to maintain the productivity and integrity of the environment. The Policy is set against a background that includes macroeconomic issues, the Millennium Development Goals and National Poverty Reduction Strategy and Highly Indebted Poor Countries (HIPC) initiative and it considers economic incentives for improved environmental management.

The NPE identified the challenges that the country had been facing such as: de-forestation; land degradation in many places verging on desertification; wildlife depletion especially in the protected areas and all accompanied by soil erosion, loss of productivity, inadequate sanitation and air and water pollution. The NPE was designed to create a comprehensive framework for effective natural resource utilization and environmental conservation and which will be sensitive to the demands of sustainable development, thereby filling the existing vacuum. It was expected that the vision of a holistic, adequately funded approach, that will create a critical mass of public support throughout the economic sectors in particular and the nation as a whole, will help overcome deficiencies and will usher in a period of coordination that will reverse prevailing trends of over-utilization, waste and environmental degradation. The NPE recognised that Zambia's wealth of natural and cultural resources are in danger of further widespread depletion and degradation, sometimes irreversibly as in the case of misuse of some soils.

Section 41 of Environmental Management Act outlines that the Minister shall in consultation with the Agency and relevant authority prepare guidelines for the management of environmental emergencies such as natural and climate change related to disaster like floods, cyclones, droughts and major pest infestations or the introduction and spread of invasive alien species among others (Table 2).

Table 2 Sector environmental issues included in the National policy on environment

Sector	Environmental issue
Agriculture	• Increase in land degradation through inappropriate use of chemical agents and improper agricultural practices. • Inadequate concern for environmental issues and farm expansions in response to low production on existing land. • Inadequate land use planning and lack of attention to an integrated water resource management policy in agricultural policy and developments.
Forestry	• widespread forest clearance and degradation and the reduced biodiversity • over harvesting, unplanned clearance for farmland, uncontrolled burning, destructive harvesting methods, unsustainable charcoal production.
Fisheries	• over fishing in nearly all wild fisheries due to population increase and use of unsustainable fishing method. • reduced production of fish due to sedimentation in rivers and streams caused by seasonality of flow on account of land cover change • Fisheries Policy implementation not being carried out effectively to manage and monitor the resource adequately.
Water	• at least 56% of the population do not have access to safe water supply • sedimentation of rivers and streams, • impeded drainage lines through uncontrolled fishing weirs and small-scale irrigation, pollution and resultant changes in local biodiversity • altered flow regimes through hydro-electric dams and irrigation dams, • inadequate management of water resources and catchments as some of the major challenges.

In addition, NPE proposed the need for national policies to coordinate measures that are designed to curb atmospheric pollution that are the responsibilities of the respective sectors, especially, industrial, mining, energy and forestry. As for water management, civic authorities and those agencies that control emissions from motor vehicles and industries and line agencies concerned with control of bush fires, need to coordinate their awareness and extension programmes, control, enforcement and management arrangements through inter-ministerial and inter-departmental sharing of responsibilities and exchange of ideas and viable strategies.

Although the policy articulates more on issues of environmental management, it recognises that formal institutional mechanism should be put in place in order to enhance monitoring and weather forecasting function to buttress development and resource management activities and addressing drought related problems

3.3.3 The Environmental Management Act of 2011

The environmental management Act (EMA) was developed to provide for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources (GRZ, 2011). It provides or the preparation of the State of the Environment Report, environmental management strategies and other plans for environmental management and sustainable development; provide for the conduct of strategic environmental assessments of proposed policies, plans and programmes likely to have an impact on environmental management; provide for the prevention and control of pollution and environmental degradation; provide for public participation in environmental decision making and access to environmental information; establish the Environment Fund; provide for environmental audit and monitoring and; facilitate the implementation of international environmental agreements and conventions to which Zambia is a party.

Under the Act, the Minister shall, in consultation with the ZEMA and relevant appropriate authority, prepare guidelines for the management of environmental emergencies including: *(a)* oil spills and gas leakages; *(b)* spills of toxic substances; *(c)* industrial accidents; *(d)* natural and climate change related to disaster such as floods, cyclones, droughts and major pest infestations or the introduction and spread of invasive alien species; *(e)* the influx of refugees; and *(f)* fire. The act also provides for *(a)* take such action as will prevent the continuation or cause of pollution; *b)* restore land, including the replacement of soil, the replanting of trees and other flora and the restoration as far as may be, of outstanding geological, archaeological or historical features of the land or the area contiguous to the land or area as may be specified in the particular order; *(c)* take such action to prevent the commencement or continuation or cause of environmental hazard; *(d)* cease to take any action which is causing or may contribute to causing pollution or an environmental hazard; *(e)* remove or alleviate any injury to land or the environment or to the amenities of the area; *(f)* prevent damage to the land or the environment, aquifers beneath the land and flora and fauna in, on or under or about the land specified in the order or land or the environment contiguous to the land specified in the order.

3.3.4 National Adaptation Program of Action

The primary goal of the national adaptation program of action (NAPA) was designed to broadly communicate to the international community priority activities that address Zambia's urgent needs for adapting to the adverse impacts of climate change (GRZ, 2007). NAPA process consultative, participatory and team building whose objective is developing a plan of action for addressing issues of the impacts of climate change in Zambia. Climate change affects agriculture and food security, human health, water and energy sector, natural resources (forestry and wildlife) among others. Example to adapt to drought conditions in relations to wildlife there is need to find other water harvesting methods such as sinking boreholes to water wildlife.

Table 1.1 summarizes the effects drought impacted on key sectors of the economy such as agriculture, energy and water, natural resources, wildlife, forests and health. Section 2. 3. 1 provides a detailed discussion of the effects drought on these sectors. It outlines that during the 2004- 2005 agriculture season, two thirds of the country faced serious droughts which occurred the same time the cereal crops where flowering. This resulted in the country needing according to the Vulnerability Assessment Committee (VAC) report of June 2005 about 120,000 tons of food to feed some 1.2 million vulnerable people in drought-prone rural areas of Zambia who were starving before the following harvest which was in March 2006. It goes on to say that Zambia experiences about 2 to 3 drought outbreak in a decade and during these outbreaks even cotton and tobacco plants which are drought resistant are affected. In addition, drought affects animal population like cattle production in that under drought conditions there is no plant growth and availability of pastures declines leading to poor nutrition of animal and as a result there reduced reproductive capacity. In the energy sector, hydro-electric power generation is negatively affected by droughts leading to devastating effect on the hydropower generation with significant economic reduction in the power potential.

Furthermore, natural resources such as wildlife and forests are threatened by extended droughts which lead to land degradation and loss of soil fertility and forest fires. It was reported that in 1992 drought caused deaths in many hippopotamuses in South Luangwa National Park and most animals migrated from the Park. In 2005 the drier conditions induced Elephants to having skinnier bodies, not wide as they normally are and foraged closer to the river reflection of quality of range. Droughts also affect regeneration of Miombo forest which normally regenerates easily and fast. Reducing the pace of deforestation (land clearing for agriculture and charcoal production) to allow adjustments to the lower precipitation is the suggested intervention to allow forests to recover fully.

This program has addressed key issues related to drought and is among the key relevant documents for drafting the national drought policy.

3.3.5 National Appropriate Mitigation Action

The National Appropriate Mitigation Action (NAMA) refers to a set of policies and actions that countries undertake as part of a commitment to reduce greenhouse gas emissions. The term recognizes that different countries may take different nationally appropriate action on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities. It also emphasizes financial assistance from developed countries to developing countries to reduce emissions. NAMA was first used in the Bali Action Plan as part of the Bali Road Map agreed at the United Nations Climate Change Conference in Bali in December 2007, and also formed part of the Copenhagen Accord issued following the United Nations Climate Change Conference in Copenhagen (COP 15) in December 2009. Zambia developed five NAMAs namely:

- *Integrated Waste Management* : This NAMA has the aim of contributing to the Zambia's NDC through increasing the collection and disposal of municipal solid waste up to 80% by the year 2030 in Lusaka, Kitwe, Ndola and Livingstone; promoting the practice of solid waste segregation to enhance recyclable materials recovery at source; improving solid waste treatment, disposal and GHG emission reduction in the four selected cities through development of Mechanical Biological Treatment (MBT) and anaerobic digestion infrastructure for biogas capture to generate electricity; installation of sludge digesters for each of the mechanical treatment plants. This NAMA seeks to contribute to sustainable land management through improved, efficient and aggregated waste management which will reduce the impacts of inefficient waste management on land.

- *Increasing Efficiency in Harvesting, Processing and Use of Charcoal*: This NAMA has the aim of contributing to the Zambia's NDC through implementation of sustainable charcoal production and use in Zambia. The proposed activities include; promoting sustainable wood harvesting through introduction, and promotion of coupe system in selected customary areas; promoting sustainable charcoal production through introduction and promotion of charcoal retort kilns in selected customary areas; promoting use of improved cook stoves in selected areas aimed at reducing energy losses thereby contributing to reduction in deforestation and GHG emissions; establishing the institutional systems needed for the coordination, implementation, and MRV of the NAMA; building local capacity in sustainable wood harvesting, charcoal production (retort kilns) and use technologies (improved cook stoves).

- *Small Hydro Projects Development*: This NAMA was developed with the aim of contributing to the Zambia's NDC through the implementation of six small hydro sites namely Chavuma and Chanda Falls, Chikata Falls, West Lunga, Zengamina and Kasanjiku in North Western Province and Chilinga in Eastern Province.

- *Sustainable Agriculture through Integrated Crop and Livestock Farming* : This NAMA has the aim of contributing to the Zambia's NDC through reduction of GHG emissions from agriculture through promotion of use of fertilisers with high nutrient efficiencies and use of improved varieties and improved management practices through conservation agriculture; reduction of GHG emissions from livestock through introduction and promotion of pasture conservation and through improved breeds coupled with integrated pest and disease control; reduction of GHG emissions through use of improved manure management (i.e. biogas production); and engagement of relevant stakeholders on policies issues related to scaling up sustainable agriculture and GHG emissions reduction.

Although the country has developed policies and actions that countries undertake as part of a commitment to reduce greenhouse gas emissions, the NAMAs on drought and how it connects to emissions reduction are lacking.

3.3.6 The National Policy on Climate Change

The national policy on climate change (NPCC) (GRZ, 2016) identifies climate change as one of the most pressing issues in Zambia affecting socio economic development and the country's experiencing of climate induced hazards, which include drought and dry spells, seasonal and flash floods and extreme temperatures. Some of these hazards, especially the droughts and floods have increased in frequency and intensity over the past few decades and have adversely impacted on the food and water security, water quality, energy and sustainable livelihoods of rural communities.

It is widely recognized that climate change constitutes a significant and serious threat to sustainable development of any country, including Zambia. Evidence shows that Zambia has over the past years experienced a number of climate related hazards including droughts and dry spells, seasonal and flash floods, and extreme temperatures. Some of these, especially droughts and floods have increased in frequency and intensity over the last two decades and have adversely impacted on food and water security, energy and livelihoods of communities. Temperatures also indicate a rising trend with potential for increased heat stress, land degradation and desertification. Such impacts are likely to compound the daunting economic and social challenges the country already faces. Therefore, actions to minimize the potential future impacts of climate change are critical.

The Policy has made some Adaptation and Disaster Risk Reduction measures in order to promote and strengthen the implementation of adaptation and disaster risk reduction measures to reduce vulnerability to climate variability and change through: Strengthening the mechanism for identifying risks and hazards in order to facilitate planning and early warning; Strengthening surveillance and control of climate change related pests and diseases; Strengthening the resilience of infrastructure, ecosystems and promote innovation, knowledge and education; Promoting community-based risk management activities and use of social safety nets for the most vulnerable; Promoting the use of financial instruments such as weather-indexed insurance, carbon instruments and catastrophic bonds to enhance resilience and cover climate related risks; Promoting the adoption of appropriate Climate Smart Agricultural (CSA) technologies for different agro-ecological zones; Promoting landscape based livelihood diversification; Promoting monitoring and management of wildlife habitats; Establishing and/or strengthening mechanisms for monitoring networks and information systems for improved utilization of climatic data and information; Promote climate change related public health plans and interventions; Promoting the communities' ability to develop physical and social infrastructure that are resilient to the adverse effects of climate change; and Promoting the protection of water catchment areas, including the development of environmentally friendly infrastructure for bulk water transfer (water ways), storage, management and utilization of water resources.

The policy also provided the mitigation and Low-Emission Development-Related Actions to promote investments in climate resilient and low carbon development pathways in order to generate co-benefits and provide incentives for addressing climate change more effectively. These will be achieved through: Promoting sustainable land use planning to protect key ecosystems and related services such as carbon sinks; Promoting landscape based livelihood diversification; Promoting the development and implementation of Nationally Appropriate Mitigation Action (NAMAs) in the sectors; Ensure that investments adhere to sustainable development principles and are in line with low-carbon development principles; Promoting scaling up of alternative energy sources, energy efficiency and conservation; Reducing forest degradation and loss of forest ecosystems; and Strengthening the fire management and soil conservation.

The policy provides measures related to crosscutting Issues (capacity Building) in order to strengthen the institutional and human resource capacity in order to effectively and efficiently address all aspects of climate change at, national, provincial, district and local levels. These will be achieved through: Promoting stakeholders participation and partnerships that integrate climate change in natural resources management at all levels; Enhancing the capacity of rural economies to diversify, by promoting alternative income generating activities that are climate resilient; Promoting capacity building

in climate change response actions; Facilitating the implementation of capacity development programmes in modelling and systematic observation; Enhancing the capacity of institutions to mobilize and utilize external and domestic climate financial resources; Enhancing the monitoring and review of the effectiveness of capacity-building programmes; Promoting consideration of gender aspects and the role and needs of youth and persons with disabilities in capacity-building activities; Promoting public education and awareness to enhance the capacity to address climate change; Building capacity in developing innovations and technologies and adoption and utilization of external technologies; and Strengthening the capacity of local technological innovation centres to help strengthen institutional technology generation and transfer through a learning-by-doing approach.

The policy provides for Research and Development to foster research and development in order to improve understanding and decision making in responding to climate change. This will be achieved through: Promoting research and development (R&D) to address climate change/ variability in all sectors; Promoting the use of prediction models and technologies to determine regional vulnerability of the sectors to climate change; Supporting higher learning and research institutions on climate related applied research; and Facilitating research, development and demonstration of new climate-friendly technologies for mitigation and adaptation.

The Policy provides for education and public awareness to promote communication and dissemination of climate change information to enhance awareness and understanding of its opportunities and impacts. These will be achieved through: Facilitating climate change advocacy, communication and awareness; Strengthening climate change education, training and public awareness at all levels; Developing and implementing an information generation, sharing and exchange mechanism for climate change; Promoting involvement of local authorities and traditional leaders in climate change education, public awareness including the use of indigenous knowledge; and Promoting dissemination of research findings at all levels.

The policy provides for technology development and transfer in order to develop and promote appropriate technologies and build national capacity to benefit from climate change technological transfer. This shall be achieved through: Facilitating the development, deployment, diffusion, transfer, and promotion of access to affordable environmentally sound technologies; Promoting identification and utilization of available climate-friendly technologies for mitigation and adaptation that meet low-carbon and climate-resilient development needs; Promoting use of indigenous knowledge and local innovation on climate change; Encouraging protection of local innovation and intellectual property rights; Facilitating establishment and strengthening of climate technology centres/networks; and Providing incentives for development and transfer of appropriate climate-related technologies.

The policy provides for promotion of Green Investments in order to promote investments in climate resilient and low carbon development pathways in order to generate co-benefits and provide incentives for addressing climate change more effectively. This will be achieved through: Promoting investments in renewable energy resource development and increase the proportion of renewable energy in the total energy mix; providing incentives for low emission technologies; Promoting investments in non-motorized modes of transport (NMT); and Promoting environmentally friendly investments in all relevant sectors.

The policy provides for Mainstreaming climate change in order to promote mainstreaming of climate change into policies, plans and strategies at all levels in order to account for Climate Change risks and opportunities in decision making and implementation. This will be achieved through: Strengthening the effective mainstreaming of climate change, response and sustainable recovery from climate related disasters; Promoting Strategic Environmental Assessments (SEAs) as a tool for integration of low emission principles; Promoting mainstreaming of gender into all climate change programmes; Facilitating mainstreaming of climate change into school curriculum; Developing and implementing codes and standards to promote adaptation and mitigation in infrastructure development; and Promoting integration of climate change

considerations by Local Authorities. This policy highlights in chapter 1 that the country is already facing droughts which have increased in frequency and intensity of occurrence and summarised as follows:

- In section 2. 3. 1, the policy indicates increased outbreaks of water borne diseases and drought spells resulting in increased labour required to draw water from long distances and women are the ones who draw water rural and peri-urban areas. Drought reduces water flows and quickens drying up of water bodies which can lead to degradation of aquatic habitats and disruption of aquatic ecosystem functions and services.
- Similarly in section 2. 3. 2 the policy spells out that the agriculture sector is affected by droughts which have led to crop failure, reduced livestock production and these lead to food insecurity.
- Drought affect wildlife in that it conditions reduces soil moisture and give rise to poor quality fodder, cause stress in animals, uncontrolled migration and wildlife-human conflicts as outlined in section 2. 3. 4.
- It is identified in section 2. 3. 5 that droughts affect tourism sector in that the water levels of the different waterfalls including the Victoria Falls which is known world-wide, thus affecting the flow of tourists visiting the country.
- In the energy sector under section 2. 3. 7, says that frequent drought conditions negatively affect the availability of fuel wood and result in a reduction in the availability of fuel wood.

Matters of drought are fully addressed in this policy providing a good basis for drought policy development

3.3.7 The Zambia Nationally Determined Contributions 2015

The Zambia's Nationally Determined Contribution (NDC) to the 2015 Agreement on climate change was developed in response to decisions adopted at the 19th and 20th sessions of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). This NDC includes both mitigation and adaptation components based on Zambia's national circumstances and is in line with decisions 1/CP.19 and 1/CP.20.

The NDC provides measure for adaptation and mitigation to the negative impacts of climate change on key economic sectors which include water, agriculture, forestry, wildlife, tourism, mining, energy, infrastructure and health. The NDC reveals that mitigation policies/actions/programs converge into three programs which have mitigation and adaptation effects including: Sustainable Forest Management, Sustainable Agriculture and, Renewable Energy and Energy Efficiency. The adaptation measures identified based on vulnerability assessment of seven key economic sectors (agriculture, water, forestry, energy, wildlife, infrastructure and health) comprise three goals/programs that have strong synergies with mitigation. These are: Adaptation of strategic productive systems (agriculture, forests, wildlife and water); Adaptation of strategic infrastructure and health systems; and Enhanced capacity building, research, technology transfer and finance. Below are the three adaptation measures:

Adaptation of strategic productive systems (agriculture, wildlife, water) number one:

- Guaranteed food security through diversification and promotion of Climate Smart Agricultural (CSA) practices for crop, livestock and fisheries production including conservation of germplasm for land races and their wild relatives.
- Develop a National Wildlife Adaptation Strategy and ensure its implementation through supportive policies, local community, civil society and private sector participation.
- Protection and conservation of water catchment areas and enhanced investment in water capture, storage and transfer (linked to agriculture, energy, ecological, industrial and domestic use purposes) in selected watersheds.

Adaptation of strategic infrastructure and health systems number two:

- Institutionalize integrated land use planning compatible with sustainable management of natural resources and infrastructure development
- Mainstream climate change in the National Health Policy, Environmental Health (EH) Policy, and Water and Sanitation Policy.
- Enhance decentralized climate information services for early warning and long-term projections on the effects of climate change to support sustainable management of the production systems, infrastructure development and public health.

Enhanced capacity building, research, technology transfer and finance for adaptation number three:

- Capacity building in Climate Smart Agriculture (CSA), Sustainable Forest Management (SFM),
- Sustainable Fisheries and Aquaculture (SFA), Renewable Energy Technologies (RET), and Early Warning Systems (EWS), Change management and climate change planning.
- Water technologies for savings, recycling, irrigation and sustainable management for household, agriculture and industrial purposes
- Development of an insurance market against climate change induced risks related to agriculture and infrastructure
- Mainstream climate change adaptation into country development plans and strategies

NDC has provided measures for adaptation and mitigation to the negative impacts of climate change on key economic sectors and forms a basis for developing drought mitigation measures

3.3.8 Summary of the Relationship of the Environment Sector Policies, Legislation and Strategies to Drought Management

The scope of the environmental policies cuts across all economic and social sectors and are designed to harmonize sectorial strategies, and rationalize legislation that concern the use and management of environment in order to attain an integrated approach to development through a national consensus. The major environmental problems such as land degradation, deforestation, air pollution in the mining areas, water pollution, inadequate sanitation, and wildlife depletion are described in National Environment Action Plan. The National Policy on Environment provides a framework for sustainable management of Zambia's environment and natural resources while NAPA was designed to broadly communicate to the international community priority activities that address Zambia's urgent needs for adapting to the adverse impacts of climate change and MANA deals with policy and actions committed by Zambia aimed at reducing greenhouse gas emissions. The NAPA, MANA and NDC are plans and commitments that address issue of climate change.

3.3.9 Assessment of the Relationship of the Environment Sector Policies, Legislation and Strategies to Drought Management

The score of the plans, policies and strategies in the environmental sector is **A**. The contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified in the plans, policies and strategies and responsibility is clear and unambiguously assigned. The NPCC and NDC in particular are very important documents. However, overall there are some gaps including the weak early warning system with regards to drought and lack of NAMAs on drought management/mitigation among others.

3.4 Agriculture Sector

3.4.1 Agriculture Policy

The Second National Agriculture Policy (SNAP) was developed by Ministry of Agriculture and Ministry of Fisheries and Livestock in February 2016 (GRZ, 2016). It is a product of extensive consultations between Government and other stakeholders in the agriculture sector. The Policy guidelines for the development of the agriculture sector in Zambia was formulated in order to take into account current trends and issues in the agriculture sector and address the challenges that were observed during implementation of the 2004-2015 National Agricultural Policy (NAP). The vision of the agriculture policy is having "***An efficient, competitive and sustainable agricultural sector, which assures food and nutrition security, increased employment opportunities and incomes***." The overall objective of agriculture policy is to accelerate reduction of food and nutrition insecurity and poverty and to increase agriculture sector growth and employment and item 6 further discusses in detail the objectives and measures to be undertaken in this policy. The Ministry is optimistic that if this is operationalized and implemented effectively the agriculture sector will register optimum production and productivity and will address the challenges that were encountered in the previous policy.

The revised NAP 2012-2030 provides policy recommendations and action areas to enable agribusiness to produce and commercialise in an environment with clear rules that are predictable and stable, with the government focusing on facilitating, supporting and providing incentives for productive activities. The Policy highlights that in addition to the vast expanse of arable land, Zambia also has extensive surface and underground water resources which can be used to irrigate nearly 2,750,000 hectares of which 423,000 hectares is readily available for development. Based on the Ministry of Agriculture and Cooperatives (MACO) estimates in 2004, only 155,912 hectares (37%) of the readily available land was actually irrigated. The factors affecting the utilisation of irrigation potential include inadequate access to long-term credit, poor extension services, inadequate involvement of farmers in management of irrigation projects, poor understanding of farming systems; dependence on government and donor assistance; marginalisation of marketing and production support services; inadequate efforts in the strengthening of relevant institutions, and poor land tenure arrangements.

The Policy outlines that even though there is a general upward trend, crop production varies from year to year due to the effects of climate change, such as droughts and floods that lead to reduction in crop yields. The agriculture sector contributes to climate change through gas emissions and unsustainable production practices, such as shifting cultivation practices that result in approximately 2.4% deforestation per year, and using late fires to clear land, etc. Therefore, the agriculture sector policy aspires to promote production practices that minimise contribution to climate change, such as conservation farming, tree planting, etc. It is estimated that crops contribute approximately 65% of the Agriculture GDP Between 2004 and 2009, the agriculture share (crop, livestock, fisheries and forestry) of the GDP decreased from 15% to 12.5% at an annual average rate of approximately -3.82%. The decrease in agriculture GDP was largely due to the relatively higher growth rates in other sectors of the economy, especially the mining sector. Over this period, the average annual agricultural sector growth rate of 1.3% was lower than the population growth rate (2.8% in 2010) and the targeted growth rate of at least 6% per year in the Millennium Development Goal 1 (MDG1) to reduce food insecurity and poverty.

The policy was to be implemented participatory Implementation and commitments where the Government of Zambia was to ensure that vulnerable populations have the opportunity to contribute to and benefit from agricultural growth as the best way of achieving sustainable food security and to reduce the vulnerability of households to economic and climatic shocks that often erode assets, coping mechanisms, and deepen poverty, hunger, and malnutrition. Item 2.2.1 highlights that the crop sector which is dependent on rainfall is largely affected by adverse weather conditions such as droughts and floods. Item 7.3 discusses that Zambia experiences incidences such as droughts and floods due to the change in climate which is considered as a serious threat to sustainable agriculture development in that resources which are meant for national development especially for agriculture development are diverted towards mitigating impacts of climate change.

It further discuses that there is need for the country to address challenges brought about by climate change which negatively impacts on livestock, fisheries and crop production in general. The policy also highlights the need to invest in irrigation systems to mitigate drought.

The policy recognises that climate change, the resulting in droughts and floods threaten sustainable agriculture development in that resources which are meant for national development especially for agriculture development are diverted towards mitigating impacts of climate change. This implies that the need for policy and strategies to manage drought are paramount.

3.4.2 National Agriculture Investment Plan

The National Agriculture Investment Plan (NAIP) 2014-2018 was developed by the Ministry of Agriculture and Livestock (GRZ, 2013). The overall objective of the NAIP is "to facilitate and support the development of a sustainable, dynamic, diversified and a competitive agricultural sector that assures food security at household and national levels and maximizes the sector's contribution to GDP" (NAP, 2012). The four NAIP investment programs include: sustainable natural resources management, agricultural production and productivity improvement, market access, and food and nutrition security and disaster risk management.

NAIP hinges on the national agriculture policy objectives 2012-2030 and its objectives are to: promote sustainable increase in agricultural productivity of major crops with comparative advantage; continuously improve agricultural input and product markets so as to reduce marketing costs and increase profitability and competitiveness of agribusiness and; increase agricultural exports as a way of fully utilising the preferential markets (regional and international) and increase contribution to foreign exchange earnings; improve access to productive resources and services for small scale farmers, especially women and young farmers and; continuously strengthen public and private sector institutional capabilities to improve agricultural policy implementation, resource mobilisation, agriculture research, technology dissemination, and implementation of regulatory services.

Although the policy articulates on areas needing investment, it does not fully address how drought can be mainstreamed in investment programmes such as accelerated irrigation systems, investment in winter crops among others

3.4.3 Summary of the Relationship of Agriculture Policies, Legislation and Strategies to Drought Management

Over the years the agriculture sector policies attempted to take into account current trends and issues in agriculture to ensure national food security. The policies and plans are well documented in the second national agriculture policy (SNAP) of 2016 (GRZ, 2016) and the national agriculture investment plan.

3.4.4 Assessment of the Relationship of the Agriculture Policies, Legislation and Strategies to Drought Management

The score of the agriculture sector policies is B because although climate change and the resultant droughts and floods that threaten sustainable agriculture development in the country are identified in the policies and plans, implementation is ambiguous. Strategies are weak resulting in resources which are meant for national development especially for agriculture development area diverted towards mitigating impacts of climate change in way that is not structured.

3.5 Fisheries Sector

3.5.1 Fisheries policy

Zambia's rich endowment of water resources provides the foundations for supporting significant economic growth and development. However, water area, including rivers, lakes, swamps, flood plains and streams accounts for approximately 145,194 km^2 (19 percent of total territory) in the country. The Fisheries policy is still under draft and cannot be cited. However the SADC Protocol on Fisheries aims at "promoting responsible and sustainable use of the living aquatic resources and aquatic ecosystems of interest to State Parties, in order to: (i) promote and enhance food security and human health, (ii) safeguard the livelihood of fishing communities, (iii) generate economic opportunities from nationals in the region, (iv) ensure that future generations benefit from these renewable resources; and (v) alleviate poverty with the ultimate objective of its eradication".

The Policies affecting the Fisheries resources are in the Ministry of Agriculture and Livestock previously Ministry of Agriculture and Cooperatives. The National Agriculture Policy of 2004 and 2012 (GRZ, 2004, GRZ, 2012a) have been the main documents guiding the fisheries subsector of Agriculture which have been implemented through the Fisheries Act, Cap. 200, the Water Act, Cap. 198, the Environmental Protection and Pollution Control Act, Cap. 204 and other related pieces of legislation that provide for, or impact on, the fishing industry in Zambia. The agricultural sector is guided by the National Agricultural Policy which has undergone several periodic reviews to ensure its relevance to prevailing climatic, social and economic conditions in Zambia. Agriculture sector has a number of pieces of legislation some of which are outdated and have been repealed, reviewed, amended and enacted into new legislation aimed at providing a legal framework that will maximize sector development and growth in pursuit of economic diversification. The on-going reforms include the strengthening of the Agricultural Credit Act of 2003 to facilitate quick redress for credit defaulters, and the Agricultural Lands Act of 1994 to shorten the land allocation and title deed processing period. Furthermore, the Agricultural Products Levy Act of 1994 requires amendment as it could be abused, while the Agricultural Fertilizers and Feeds Act of 1994 requires amendment to recognise fertilizer blends and other forms of fertilizer and to establish an institution to monitor grades and standards.

3.5.2 Fisheries Act of 2011

The fisheries act No. 22 of 2011 provides for the promotion of the sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilization and development. It also provides for establishment of fisheries management areas and fisheries management committees as well as regulating the commercial fishing and aquaculture. The Minister of Livestock and Fisheries in consultation with the Minister responsible for environmental protection and management, national heritage conservation and management and wildlife management and with the Director and the local riparian community, by statutory order, declare any area of water to be a fisheries management area for the management and sustainable utilization of such species of fish as may be specified in the order. According to this Act, if a fisheries management area is in a Local Forest, National Forest or National Park, the exercise or enjoyment of any fishing right or interest in the area shall be consistent with sustainable forest management or wildlife conservation and management, as the case may be. Under the fisheries act, each fishery is designated a fisheries management area and run by a fisheries management committee which over seers the implementation of the fisheries management plan. Fisheries policy encourages co-management of fish and other resources in common lands.

3.5.3 Summary of the Relationship of the Fisheries Policies, Legislation and Strategies to Drought Management

The fisheries act of 2011 provides for establishment of fisheries management areas and fisheries management committees as well as regulating the commercial fishing and aquaculture. The policy is still in draft form but relevant plans on fisheries can be found in the national agriculture policy.

3.5.4 Assessment of the Relationship of the Fisheries Policies, Legislation and Strategies to Drought Management

The score of this policy is C because there is not active policy direction on the contribution to drought management/mitigation and how the fisheries sector is impacted by drought.

3.6 Forestry and Protected Forest Areas Sector

3.6.1 National Forest Policy

The National Forestry Policy of 2014 aligns the forestry sector to current trends and to meeting the national strategies as enshrined in the National Policy on Environment, the Millennium Development Goals (MGDs) and other global conventions and treaties to which Zambia is a signatory (GRZ, 2014a). The policy address issues such as climate change, bio-energy development, and prioritization of agriculture, eco-tourism and environment as engines for Zambia's development and the need for devolution of management systems have necessitated the review of the National Forestry Policy of 1998. It also encourages participatory forest management which is anchored on the active participation of local communities, traditional institutions, private sector and other stakeholders in the management and utilization of forest resources at all levels of decision making, implementation, monitoring and evaluation.

The policy acknowledges that forests are affected by droughts and if extended lead to land degradation, loss of soil fertility and forest fires and as a result affect regeneration of forest species. Low-income families who depend on biomass fuel for their lighting and cooking are greatly impacted by drought effect on forests. Droughts also affect regeneration of vegetation in that they prolong the recovery of forests. The suggested intervention to conserve forest species is to reduce the pace of deforestation so as to conserve the natural resources already existing in the forestry. In section 1.1 of 1998, pin points that deforestation is a major factor in soil erosion, siltation of lakes, rivers, dams and other Water bodies, loss of biodiversity and climate change and the 2014 was designed to reduce deforestation and forest degradation ensuring increased forest cover and enhanced carbon stocks through integrated participatory forest management, improved law enforcement and private sector investment (section 06). Section 1.1. 2 in 1998 policy highlighted that forests play a crucial role in climate change impacts. It further goes on to say that the United Nations identifies forests in mitigating climate change impacts in that forest and trees play various ecosystem functions such as carbon sequestration. Carbon sequestration can be achieved by promoting the establishment of plantation forests and improving the management of degraded forest land to encourage the regeneration of degraded areas thereby increasing the amount of carbon stocks stored in tree biomass (section 6 in 2014 national policy).

Change in climate is one of the factors that led to the review of the 1998 National Forestry Policy. Section 2.2.3 highlights that despite forests producing goods and services that benefit the majority of rural communities, it is however faced with numerous challenges. It has been recognized that unsustainable harvesting systems such as charcoal and fuel-wood production, increasing forest clearance for farmland, forest degradation, uncontrolled annual burning, have led to reduced biodiversity and have greatly contributed to climate change. It recognises further that poor management of forests contributes to climate change and therefore there is need to put up measures that aimed at adapting or mitigating

climate change. Reduction of climate change is one of the principles in the implementation of this policy. Improving the role of forests in addressing climate change and contribute to reducing its impact through mitigation and adaptation measures is the main objected highlighted under item 6.3. This will be achieved through conducting public awareness on the causes and effects of climate change, developing strategies aimed at increasing capacities of local communities to adapt to climate change impacts and provide a framework for undertaking initiatives aimed at adaptation and mitigating against the impacts of climate change.

3.6.2 The Forest Act of 2015

The Forestry Act of 2015 was established to provide for the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; provide for the participation of local communities, local authorities, traditional institutions, non-governmental organisations and other stakeholders in sustainable forest management; provide for the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity; establish the Forest Development Fund; provide for the implementation of the United Nations Framework Convention on Climate Change, Convention on International Trade in Endangered Species of Wild Flora and Fauna, the Convention on Wetlands of International Importance, especially as Water Fowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa and any other relevant international agreement to which Zambia is a party. The Act further calls for the protection of ecosystems, particularly the protection of land and water supplies of local strategic importance and the control of water, including storm water, drainage water and floods.

3.6.3 Summary of the Relationship of the Forests Policies, Legislation and Strategies to Drought Management

The forest policy 2014 and the forest act of 2015 are the two main instruments in the forestry sector. The 1998 policy was replaced by the 2014, and details regarding issues of climate change how forests are affected by droughts have been addressed including deforestation, land degradation, loss of soil fertility and forest fires among others.

3.6.4 Assessment of the Relationship of the Forests Policies, Legislation and Strategies to Drought Management

The score is B in that although the contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear in the policy but implementation is ambiguous. National forests, local forests, community forests, joint forest management areas, game management areas forests are clearly identified and responsibility for use is clearly defined, however implementation is ambiguous because of the shortcomings in the land tenure system, particularly how policies and strategies on drought management/mitigation can be domesticated a local level is lacking.

3.7 Water Sector

3.7.1 National water policy

Water plays a crucial role in socio-economic development and it is vital for sustaining different forms of life. Water in needed in various sectors such as mining, agriculture, tourism, health etc. The water of Zambia is yet to be fully exploited for enhancement of the livelihood of the people of Zambia through productive capacities. Government in 1994 formulated the National Water Policy for the first time in view of exploring its full potential. The National Water Policy (NWP) was published by Ministry of Energy and Water Development in February 2010 (GRZ, 2010). The revised NWP embraces

modern principles of water resources management and deals with challenges of poverty reduction; it takes into account also the National Decentralisation Policy. The vision of the water policy is *"To optimally harness water resources for the efficient and sustainable utilisation of this natural resource to enhance economic productivity and reduce poverty."*

The NWP under environmental management section 1.5 recognises that change in the environment causes some areas experiencing unpredicted floods and droughts in other areas. Information on water resources is necessary for planning and managing the resource as its quality, quantity, and availability varies over time and location. Providing timely information on the availability of water is important in providing early warning against immediate disasters such as drought that affect life, economic production and property as outlined in Section 2.10. One of the strategies outlined in section 2.11 is, "promoting a state that prepares mitigating measures against disasters like droughts". In section 7.8, drought management is identified as one of the measures to be undertaken so as to mitigate impacts of extreme occurrence of flood and drought that causes water borne diseases by supplying of clean and safe water to communities. The Policy realizes, Zambia's water resources are yet to be fully exploited for the benefit of its people to enhance their productive ability for improved livelihood. The Policy also seeks to address cross-sectoral interests in the water sector with particular focus on water resources planning, development, management and utilisation. Integrated water resource management will address cross-sectoral issues such as land use, irrigation, wetland conservation, climate change, and conflict management.

The policy explained the rainfall situation in Zambia that ranged from an annual average of approximately 600 mm in the south of the country to 1335.9 mm per year in the north. The country's annual average rainfall, based on a 30 year period from 1976 to 2006, was 967.3 mm. In the last two decades, most parts of the country have generally received below average annual rainfall. This has been punctuated in some cases by above average annual rainfall. The poor rainfall has generally resulted in the lack of access to water for populations, especially in the south of the country.

The policy also describes surface water situation with trends in most cases following the rainfall trends because of surface water's quick response to the seasonal rainfall pattern. In a normal hydrological year the country generates sufficient surface water to meet current demand. However, its spatial distribution over the season is particularly very poor in the southern parts of the country. Nevertheless, the southern part of the country has more surface water flows only because of the presence of large rivers such as, the Zambezi, the Kafue and the Luangwa. The Policy highlight that Zambia has a good amount of well distributed groundwater resources. These resources however are not fully developed to contribute to increasing demands for different uses. In many areas, particularly in rural areas, ground water is the most reliable source for safe drinking water and other economic activities. The estimated annual groundwater potential is based on an estimated annual recharge with very little variations from year to year. Currently there is inadequate data to make an accurate assessment of the groundwater availability. Unregulated exploitation and exposure to pollution may threaten this important source of water.

Water policy identifies drought management as one of the measures to be undertaken so as to mitigate impacts of extreme of drought that causes water borne diseases by supplying of clean and safe water to communities but holistic measures to manage/mitigate impacts of drought is lacking.

3.7.2 The Wetlands Policy

A wetland is a transitional area between terrestrial and aquatic systems in which the water table is usually at or near the surface or the land is covered by shallow water. National Policy on Wetlands Conservation, 2002 aimed at "promoting conservation and sustainable use of wetlands in order to sustain their ecological and socio-economic functions for the benefits of the present and future wellbeing of the people". Based on the Convention on biological diversity (CBD), the wetland policy is aimed at ensuring the wise use of wetlands and their resources and to create a comprehensive,

stakeholder-based institutional and legal framework for their management. The objectives of the policy are conserving and manage wetlands so as to protect their biodiversity because they contribute to the local and national economy, to restore degraded wetlands and to promote community participation and ensure equitable sharing of benefits from wetlands. This goal is yet to be domesticated in Zambia.

3.7.3 Summary of the Relationship of the Water and Wetlands Policies to Drought Management

The changing environment due to climate change is recognised in the Water policy 2010 particularly with regards to floods and droughts. The policy advocates for the state of preparedness outlining mitigating measures against disasters like droughts. For example, drought management is identified as one of the measures to be undertaken so as to mitigate impacts of extreme occurrence of flood and drought that causes water borne diseases by supplying of clean and safe water to communities. The need to invest in irrigation systems is also emphasized.

3.7.4 Assessment of the Relationship of the Water and Wetland Policies to Drought Management

The score is B. Although the contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear policy on wetlands management which connects well with water is lacking. Even though there is no updated information on the wetland policy, droughts affect wetland animals like the Lechwe and Puku in that there is reduced soil moisture and this gives rise to poor quality fodder and causes stress and uncontrolled migration of animals.

3.8 Wild Life, Protected Wildlife Areas, Private Wildlife Sanctuaries Sector

3.8.1 Policy for National Parks and Wildlife in Zambia

The Wildlife Policy of 1998 provides for the establishment, control and management of National Parks and for the conservation, protection, and enhancement of wildlife ecosystems and biodiversity. It provides for the sustainable use of resources in National Parks and Game Management Areas (GMAs). A GMA is a protected area comprising mostly communal land that is used primarily for the sustainable utilization of wildlife through hunting or tourism but can be used for other land uses such as settlement, mining, and agriculture. The government of Zambia acknowledges the importance of wildlife to the economy for its high economic, social- cultural and biological values. Wildlife industry is important in that it allows conservation of biological diversity which is important for humans due to resource scarcity and economic forces. Wildlife management is more profitable than other uses of land. The government of Zambia is determined to explore the full potential market of wildlife for the benefit of the country and its people especially those living near national parks. “The Zambia Wildlife Authority (ZAWA) was established to conserve wildlife” whose roles are promoting and developing tourism programs, allow local communities to participate in the management of wildlife and recognize the importance of wildlife in the country (GRZ, 1998).

3.8.2 Zambia Wildlife Act

The policy was implemented through the Zambia wildlife Act which was created provide for the establishment, control and management of National Parks, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and among others.

Three legal instruments, the Game Management Area Declaration Order of 1971, the National Parks Declaration Order of 1972, and Statutory Instrument No. 44 of 1972, established the current network of wildlife protected areas. Game management areas were created with the overall objective of providing a framework within which to integrate wildlife management into the rural economy (Lungu, 1990). The Zambia Wild Life Act, No. 14 of 2015 (GRZ, 2015) provides, among

other things, for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas. It also provides for the development and implementation of management plans. It also provide for the regulation of game ranching.

The President may, after consultation with the Minister and the local community, by statutory order, declare an area of land within the Republic to be a Game Management Area for the sustainable utilisation of wildlife and for the purposes of the Act, and may, in like manner, define or alter or extend the limits of the area or order the area to cease to be a Game Management Area except land held on leasehold. However, the Minister responsible may granting concession agreements within a Game Management Area and land user-rights fees shall be payable to the Ministry by an investor within the Game Management Area which shall be shared between the Ministry and the local community, on such terms as may be prescribed.

3.8.3 National Tourism Policy

The national tourism policy was aimed at strengthening linkages and coordination between tourism development and key resource sectors such as transportation, education, environment, energy, forestry, wildlife, water, fisheries, agriculture and infrastructure. They also work towards promoting the increased use of sustainable waste disposal, green packaging and recycling, water and energy conservation, renewable energy, energy monitoring technology, integrated environmental management, social and environmental audits.

The first attempt to review the Tourism Policy of 1997 was made in 2011 so as to take into account new developments in the tourism industry. The National Tourism Policy was revised so as to provide a strategic framework for the sustainable development of tourism in Zambia and to ensure that the sector realizes its full potential. Tourism sector contributes to the country's job creation and to foreign exchange earnings. The tourism sector faces a number of challenges hence the tourism policy provides objectives, measures and guidelines to address the challenges. The vision of the policy is to "*Make Zambia an exciting and growing destination that realizes its full potential and rewards tourists with unique, authentic and treasured experiences".* In line with the vision Government aims at making tourism in Zambia to be among the top five (5) tourist destinations of choice in Sub-Saharan Africa by 2030.

3.8.4 Summary of the Relationship of the Wildlife and Tourism Sector Policies and Legislation to Drought Management

The Wildlife Policy of 1998 provides for the establishment, control and management of National Parks and for the conservation, protection, and enhancement of wildlife ecosystems and biodiversity. The policy provides for the sustainable use of resources in National Parks and Game Management Areas.

3.8.5 Assessment of the Relationship of the Wildlife and Tourism Sector Policies and Legislation to Drought Management

The score is C because the ccontribution to drought management/mitigation are not identified in this policy/strategy. Policy is silent on how the institution intends to manage and develop water resources effectively in order to sustain wildlife and the ecosystem in the event of drought. Information on how wetlands in national parks and GMA are to be managed in the event of droughts.

3.9 Land Sector

3.9.1 The Lands Policy

The draft of the National Land Policy 2017 is a working document and hence the final draft of the policy is yet to be released. From the working document in the land policy, the policy will ensure that all citizens will have equal rights in accessing both customary and state land in all parts of the country. This land policy will ensure that all the people in the public and private sectors plan and efficiently manage land because land is important and is a limited resource. Although the Land Act vests power over land in the President, most of the land in Zambia (62%) is practically owned and managed by customary authorities.

Since the enactment of the 1995 Lands Act, allowing for conversion of customary land to state land with private leasehold interests, at least 10% of land held under customary tenure has been privatized through conversion to leaseholds. In some cases resulting in needed investment in rural areas and creating varied employment opportunities. However, the conversion of customary land to large areas under leaseholds has in many cases eroded local rights to forests and common lands, limiting access to water resources, grazing land and forest products.

3.9.2 Mineral Development Policy

Zambia has a variety of mineral resources available and has been mining these mineral for over a hundred years. Mining sector contribute and will continue contributing to the economic development of the country. The objective of the mining policy is creating an environment which accommodates small and large exploration mining and ensure that value addition industries operate efficiently and profitably so as to contribute to economic growth and wealth creation. In line with the vision for the mining policy, the mine sector aims at having a vibrate and well organised private sector and private-public partnership led mining sector which contributes to excess of 20% towards Gross Domestic Product (GDP) and achieving a sustainable economic growth by 2030.

The new mines and minerals Act No.11 of 2015 provides for exploration, for mining and processing of minerals. It also provides for safety, health and environmental protection in mining operations. There are mining rights and non-mining rights. Mining rights include exploration license and a mining licence. Surface rights are obtained through a separate licence issued by other authorities following appropriate legislations such as Urban and Regional Planning Act and National Heritage Conservation commission acts. Other restrictions include getting authority upon land occupied as a village, or other land under customary tenure without the written consent of the chief and the local authority for the district in which the village is situated; parks, railways, forest areas, Zambia wild life and Water. The non-mining rights include: (a) mineral processing licence; (b) a mineral trading permit; (c) mineral import permit; (d) mineral export permit; and (e) gold panning certificate.

3.9.3 Summary of the Relationship of the Land Sector Policies and Legislation to Drought Management

The Lands act 1995 provides for the need for transparency in land use and management through the regulations which are achieved by informing the public of the implementation of land-use plans and changes in these plans. However the President cannot give customary land away to either a Zambian or a Non Zambian unless he/she consults the Local Chief, local authority and if the land is in a game Management consults those currently occupying/using the land in question. Therefore since a large tracts of land in customary hands, chiefs play a big role when it comes to land management and unfortunately, land tenure system of land management is not adequately addressed in the policy and legal instruments.

3.9.4 Assessment of the Relationship of the Land Sector Policies and Legislation to Drought Management

The proposed ranking is C because regulations exist that are generally serving a public purpose but are not enforced. The Lands Act (1995), stipulates that leasehold tittles can be issued on customary land but not without taking into account of the customary laws and approved by the chief and the relevant council. For example most small scale farmers cultivate customary land held in common ownership with the community although the rights of farmers are individualized even when it comes to transferring such land. In addition the land has no formal documentation and the landholders do not pay land tax. This makes any plans, policies and strategies on drought management mitigation difficult to implement in customary lands.

3.10 Disaster Management

3.10.1 National Disaster Management Policy of 2015

The policy highlights that for a long time, Zambia has experienced a number of disasters and the frequency of their occurrence and magnitude has been increasing. For example, drought-induced crop failures between 1986 and 1996 occurred in six out of ten farming seasons. These disasters have had a negative impact on the economy, having caused loss of life, damage to property and degradation of the environment. Tremendous setbacks in economic growth and development have also been the main result, as scarce national resources have had to be redirected from productive investments to relief and emergency operations. The disaster management policy therefore, was developed as a set of measures designed to implement and achieve a significant reduction in loss of life and material damage caused by disasters.

The policy describes the evolution of Disaster Management in Zambia. In view of the common hazards and vulnerabilities in the country such as floods, droughts, epidemics, environmental degradation, human/animal conflicts, food insecurity, animal and plant diseases and pests, and road and water accidents in Zambia, the Government has been making efforts to create a permanent response mechanism to deal with these threats. In the first and second Republics, the co-ordination of response to emergencies was with the *Contingency Planning Unit* located in the then Office of the Prime Minister. The Unit was established in 1966 and phased out in 1992. Following the major drought of 1991/92 that affected most of the Southern African region, and the major relief operation that followed, four key ministries of Health, Agriculture, Energy & Water Development and Community Development formed an ad-hoc committee which was responsible for managing different aspects of response to drought. Management Committees were co-chaired by Ministries of Agriculture and Health. Despite attempts at co-ordination, the ministries tended to operate their own elements or response in isolation. This led to unnecessary overlaps, wastage of resources and bureaucratic delays.

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In the absence of a formal relief framework, new structures were set-up by Government to manage the logistics of bulk imports and relief programmes, which by passed existing government channels. These structures were created at national, district and village levels and became known as the Programme to Prevent Malnutrition (PPM) to which the Programme Against Malnutrition (PAM) provided secretariat and technical backstopping services. As a result of the

fragmented disaster framework that existed, it became necessary to create a Permanent Unit within government establishment to initiate and facilitate the implementation and coordination of disaster management policies and programmes. The mandate for overall disaster management and co-ordination was vested in the Office of the Republican Vice-President. Consequently, and in line with the Public Service Reform Programme (PSRP), Government created the *Disaster Management and Mitigation Unit (DMMU)* within the Office of the Vice-President in 1994.

The formulation of the Policy of 2005 was intended to address the way Zambia would manage its risks, hazards, disasters, vulnerable populations and the environment at risk and provide a framework for disaster management in the country. The 2005 policy recognized the provisions of international conventions, United Nations Resolutions, African Charters and SADC disaster management strategy that provide a global framework for disaster management. This revised policy takes into consideration, among others the following International, Regional and National instruments such as Convention to combat Desertification in that Countries Experiencing Serious Drought and/or Desertification in Africa, International Decade for Natural Disaster Reduction (IDNDR), International Strategy for Disaster Reduction of 2000 (ISDR), Hyogo Framework for Action (2005-2015), United Nations Framework Convention on Climate Change, United Nations Convention on Disaster Reduction, United Nations Millennium Goals Declaration, World Summit on Sustainable Development, SADC Disaster Management Strategy and AU Kampala Convention on Internally-Displaced People.

Some of the common Disasters and their Impact in Zambia include: deforestation from indiscriminate charcoal burning and poor farming practices; floods; poor drainage, solid waste management and sanitation; soil degradation and erosion from poor farming practices; fires; human/animal conflicts from encroachment into game management areas and forestry resources; food insecurity and hunger; air, water and noise pollution (e.g., mines) and; illegal mining for building sand and illegal quarrying. Other common disaster include: climate variability (e.g., earthquake, lightning and heavy rainy storms); livestock and crop diseases and pests; frost; diminishing grazing pastures due to floods; and siltation from floods.

The policy highlights some of the underlying causes of vulnerability in Zambia which include negative beliefs, attitudes and practices (customs and norms), poor farming practices, degradation of the environment, lack of access to resources, disintegration of social safety nets such as extended family systems and weak institutional structures to promote social welfare. Other factors contributing to vulnerability are lack of access to information and knowledge, lack of access to political power and representation, lack of public awareness, weak buildings/infrastructure and limited food diversity. It further describes the remedial measures to these causes which include the devising of interventions to promote a shift towards a more proactive approach involving emphasis on mitigation, preparedness, response, restoration and prevention measures, including linking disaster management to development activities. In addition, this proactive approach would also require Life Skills-Based Disaster Prevention Education. The policy provides measures and actions to be undertaken for Disaster Risk Management which include the following:

Building Capacity for Disaster Preparedness

These actions shall be taken to promote disaster risk reduction in order to safeguard lives and property in a timely, effective and orderly manner through the following three successive phases: before-disaster phase, during-disaster phase and post-disaster phase.

Building Capacity for Response

The main activities during response will be tailored towards ensuring quick, timely and effective actions by activating and operationalizing the response capacity within acceptable reaction time to save lives and property during any disaster situation.

Building Capacity for Disaster Prevention

In order to build capacity for Disaster Prevention, actions and measures shall be taken to avoid, eliminate, prevent or reduce the impact of adverse effects and/or hazards from causing or resulting in a disaster. The process of prevention shall, therefore, be directed at the formulation and application of long-term and permanent measures to develop disaster resilience with which to withstand and or recover from negative effects of disasters. This will be done through mainstreaming of disaster risk management activities into development programmes at community, district, provincial and national levels.

Building Capacity for Disaster Mitigation

Disaster mitigation measures shall include activities aimed at minimizing the destructive and disruptive effects of hazards and thus lessen the impact of any disaster. The approach to mitigation shall address the underlying causes of vulnerability, make mitigation a developmental activity.

Building Capacity for Coordination

Effective Disaster management requires concerted efforts among all stakeholders as well as a holistic approach to the design and implementation of disaster management programmes. To achieve this, effective vertical and horizontal coordination is critical. Coordination is complex as it involves many players and stakeholders at different levels. The coordination of disaster management activities is an important component of effective disaster management.

Building Capacity for Disaster Risk Management Information and Communication System

The policy emphasises on the need to develop capacity for remote sensing, geographic information systems, hazard modelling and prediction, weather and climate modelling, forecasting and early warning.

Building Capacity for Monitoring and Evaluation

The Policy explains the need to put in place a Monitoring and Evaluation System in order to ensure prudent utilization of resources and effective tracking of progress in the implementation of Disaster Risk Reduction Programmes.

Building Capacity for administrative, logistical and management support services

The policy realises that in order to enhance effective and timely response to disasters, there is need to build capacity for administrative, logistical and management support services.

Building Capacity for resilience to climate change

The policy emphasises on the need to build resilient and adaptive communities in order to withstand the effects of climate change. It further stresses that disasters that have cross border effects will be handled in line with existing bilateral or regional protocols. Where such protocols are non-existent, bilateral, tripartite or regional memorandum of understanding should be entered into. These should address issues relating to establishment of a command post, joint operations and safe havens for evacuations during a disaster impact.

3.10.2 Disaster Management Sector Legislation

The Disaster Management Act was created to establish and provide for the maintenance and operation of a system for the anticipation, preparedness, prevention, coordination, mitigation and management of disaster situations and the organisation of relief and recovery from disasters; establish the National Disaster Management and Mitigation Unit and provide for its powers and functions; provide for the declaration of disasters; establish the National Disaster Relief Trust Fund; provide for the responsibilities and involvement of the members of the public in disaster management; and provide for matters connected with, or incidental to, the foregoing.

In the Act a hazard means a potentially damaging physical event such as an earthquake, a hurricane, flood, drought, fire, epidemic, phenomenon or human activity, which may cause injury or the loss of life, damage to property, social and economic disruption or environmental degradation, and includes latent conditions that may represent future threats and can have different origins, natural and human induced. In the Act, mitigation means structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazard. The Act provides for the establishment of an early warning system covering all sectors and hazard sources and maintain close links with the different institutions that provide early warning services. The Act calls for the establishment of the Trust Fund the provision of essential commodities and other relief to victims of any disaster, hazard or emergency; the restoration, reconstruction and rehabilitation of areas affected by any disaster, hazard or emergency.

3.10.3 Summary of the Relationship of the Disaster Policies and Strategies to Drought Management

Policies, plans and strategies have gone through refinements providing a very good starting point drafting the drought management/mitigation strategies.

3.10.4 Assessment of the Relationship of the Disaster Policies and Strategies to Drought Management

The assessment score is A in that the contribution to drought management/mitigation and its impacts on people are clearly identified and responsibility is clear and unambiguously assigned. However, the impacts on the ecosystems is not addressed while the holistic approach remain unclear.

3.11 Financial Management Sector

3.11.1 National Financial Sector Development Policy 2017

Financial sector handles economic growth and development of the country. Effective financial sector must include all other sectors in financial allocation for development of the country. The National Financial Sector Development Policy 2017 was formulated so as to have well developed financial policy that includes all sectors in financial systems for supporting resource mobilisation efficiently and investment for sustainable economic development and it represents both the vision 2030 and the seventh national development plan. The policy addressees the weaknesses in the Zambian financial system and focuses on five core pillars: “legal reforms and corporate governance, payment systems, market efficiency and contractual savings, financial education, and access to finance and financial markets”. The implementation of the financial policy will be supported by National Financial Inclusion Strategy (NFIS), National Strategy on Financial Education (NSFE), and the Rural Finance Policy and Strategy, and other strategies and action plans such as the 10-year Capital Market Master Plan.

3.11.2 Investment Policy

Zambia has achieved important progress in terms of strengthening the investment policy over the past few years. The investment policy aims at transitioning from a state-dominated to a private sector-driven economy. The government of Zambia has taken various measures in ensuring that investment laws are clear, transparent and accessible. Under the Private Sector Development Reform Programme (PSDRP), the Zambia Development Act of 2006 merged institutions to form the Zambia Development Agency (ZDA). The Act aimed at rationalizing investment and trade promotion activities, and to operationalize the concept of a one-stop-shop for investment facilitation. The ZDA is also responsible for promoting complementarities between government and private sector investment through Public-Private Partnerships (PPPs) in infrastructure projects.

The investment policy provides for investment laws that are clear, transparent and accessible through reforms which included: abolition of price controls, liberalization of interest rates, and abolition of exchange rate controls, 100% repatriation of profits, no restrictions on investment in virtually all sectors of the economy, privatization of state-owned enterprises, trade reforms aimed at simplifying and harmonizing the tariff structure and removal of quantitative restrictions on imports among other measures.

3.11.3 Social Protection

Social protection policies are policies and rules that look after the lives and welfare of people, especially poor people those that are living in extreme poverty and as detailed in the easy read policy (GRZ, 2014b). The government of Zambia aims at reducing the number of people living in poverty in line with the vision 2030 and ensuring that everyone feels supported in hard times. People are more vulnerable if they cannot get food, shelter, education or medication and healthcare. It is also harder for them to get protection from bad things like drought and diseases. "Social protection helps people by giving people money to buy food and access other essential goods and services, helping people to get better health care and education, giving support for farming, giving training to people so they learn new skills to help them get a job or become entrepreneurs". Many stakeholders take part in setting social protection programmes e.g. ministries, judiciary, co-operating partners, the private sector, non-governmental organisations, faith-based organisations and civil society. In ensuring that the social protection policy works there is to ensure that funds are available and the government is determined to provide enough human labour to work for social protection and check that the policy is working effectively and it is reaching the targeted people.

3.11.3 Summary of the Relationship of the Financial Management and Investment Policies to Drought Management

The national financial sector development support resource mobilization efficiently and investment for sustainable economic development and it represents both the vision 2030 and the seventh national development plan. Even though the financial sector does not directly concern drought management, the vision and objective of the policy is towards providing a stable, resilient, competitive, innovative, and inclusive financial sector that is wide, inclusive of all sectors in financial systems and world class financial sector that supports the country's development aspirations.

3.11.4 Assessment of the Relationship of the Financial Management and Investment Policies to Drought Management

The score is C has drought not directly included in financial programs for planning its adaption and mitigation plans. There are strategies to addresses issues of climate change and responsibility is lacking.

3.12 Public Health

The vision of the National Healthy Policy which was written in 2012 is **'***A Nation of Healthy and Productive People'* (GRZ, 2012b). The overall objective of the National Health Policy is" to reduce the burden of disease, maternal and infant mortality and increase life expectancy through the provision of a continuum of quality effective health care services as close to the family as possible in a competent, clean and caring manner". The National Healthy Policy does not address drought challenge but the National Healthy Strategic Plan briefly talks about drought. Like the healthy policy, strategic plan's vision is having 'A Nation of Healthy and Productive People', the mission is 'To provide equitable access to cost effective, quality health services as close to the family as possible'. The goal is 'to improve the health status of the People in Zambia in order to contribute to increased productivity and socio-economic development'. The National Health Strategic Plan 2017-2021 agenda transforms from focusing on building robust and resilient health systems, its plan focuses on delivering quality health services across the series of care which includes promotive, preventive, curative, rehabilitative

and palliative care provided as close to the family settings as possible. The universal health coverage will be made possible through primary health care with a focus on community health. The National Health Strategic Plan adopts mechanisms for dealing with epidemics and other disease outbreaks to enhance its preparedness in the country and has taken into consideration emerging issues at both the national and international levels such as communicable and non-communicable diseases, health systems strengthening, gender equality, globalisation, and climate change.

3.12.1 Summary of the Relationship of the Public Health Policies to Drought Management

The overall objective of the National Health Policy is" to reduce the burden of disease, maternal and infant mortality and increase life expectancy through the provision of a continuum of quality effective health care services as close to the family as possible in a competent, clean and caring manner". The National Healthy Policy does not address drought challenge but the National Healthy Strategic Plan briefly talks about drought.

3.12.2 Assessment of the Relationship of the Public Health Policies to Drought Management

The score is C because although the National Health Strategic Plan explains the mechanisms for dealing with epidemics and other disease outbreaks to enhance its preparedness in the country and even though the policy spells out that the need to strengthen the national capacity to respond to effects of climate change, drought has not been discussed in detail in relation to public health.

3.13 Urban and Regional Planning Sector

3.13.1 The National Decentralization Policy

The National Decentralization Policy 2002 is aimed at empowering the people of Zambia (GRZ, 2002a). The government of Zambia has designed and developed measures aimed at achieving full democratic governance and economic dependence for all the citizens. The National Decentralization Policy strengthens local government in facilitating more and effective citizen participation in governance and accountable, delivery of public services as the basis for decentralization. The long term vision of the policy is that the Government aims at "achieving a fully decentralized and democratically elected system of governance" which will be open, predictable and transparent policy making and implementation processes at all levels of the public service. The policy will insure that local community participate effectively in decision-making and in development of administration while maintaining sufficient linkages between central and local government in ensuring that the vision is achieved.

3.13.2 Summary of the Relationship of the Urban and Regional Planning Sector to Drought Management

Through this policy the Government aims at "achieving a fully decentralized and democratically elected system of governance" characterized by open, predictable and transparent policy making and implementation processes at all levels of the public service.

3.13.3 Assessment of the Relationship of the Urban and Regional Planning Sector to Drought Management

The score is B since the policy will insure that local community participate effectively in decision-making and in development of administration while maintaining sufficient linkages between central and local government in ensuring that the vision is achieved.

3.14 Overall Assessment of the Policies, Legislation and Strategies Related to Drought Management in Zambia

There were 12 sectors identified in this review among which the Environment and Disaster management sector policies scored "A" for being highly relevant to the subject under review. Policies in some sectors were either outdated or did not directly address issues of drought and climate change (Table 3).

Table 3 Policy assessment for relevance to drought management and mitigation in Zambia.

Criteria for assessment	Sector/policy/plan
A: Contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear and unambiguously assigned B: Contribution to drought management/mitigation and its impacts on people and the ecosystem are clearly identified and responsibility is clear but implementation is ambiguous C: Contribution to drought management/mitigation are not identified in this policy/strategy	1. *Environmental sector*: NPCC, NAPA, MANAs and NDC 2. *Disaster management sector*: DMMU 3. *National planning sector:*7NDP, PRSP 4. *Agriculture sector:* NAP 2016 5. *Forestry sector:* NFP 2014 6. *Water sector:* NWP 2010 7. *Urban and regional planning:* DP 2002 *8. Fisheries sector* *9. Lands (Lands Act of 1995)* *10. Wild life and Protected areas* *11. Finance and Management* 12. *Public health sector*

3.15 Conclusion

The objective of this consultancy was to review sector policies and strategies that have potential to affect or contribute to drought and drought management/mitigation and its impacts on peoples ecosystems. All the policies had the potential to contribute but those with direct contribution were in the Environmental sector. The main gaps in the policies were related to lack of clearly identified responsibilities when it comes to implementation and channeling of resources. Some policies were not responsible to current trends while others were too general in content.

4 REGIONAL AND INTERNATIONAL PROTOCOLS AND STRATEGIES ON DISASTERS AND ITS IMPACTS ON PEOPLE AND ECOSYSTEMS

4.1 Regional Protocols and Strategies

4.1.1 Sub-regional Action Programme (SRAP)

There is a Sub-Regional Action Programme (SRAP) to Combat Desertification by the Member States of the South African Development Community (SADC). The SADC SRAP has been revised and aligned to the 10-year strategy for the UNCCD and 21 actions have been identified to be implemented to satisfy the five operational objectives of the UNCCD Strategy. For each identified action the SRAP identifies indicators for improved monitoring, required resources, the source of such resources, and the lead agency to drive the implementation of the actions. The Operational Objectives and actions are as follows:

Operational Objective 1: Advocacy, awareness raising and education

i) Development of a communication strategy at regional level
ii) Awareness raising for policy makers
iii) Development of training modules and education at all levels, including for media
iv) Revise and implement the proposed SADC Environmental Information Systems Programme
v) Establishment of information exchange and dialogue mechanism/platform

Operational Objective 2: Policy framework

i) Promote awareness among all relevant SADC sectors of their responsibilities in implementing the UNCCD, including enhancing synergies between the 3 Rio Conventions.
ii) Strengthen and harmonize policy and legal frameworks for sustainable land management of transboundary natural resources by providing assistance to Member States
iii) Mainstreaming Desertification, Land Degradation and Drought (DLDD) into existing related SADC Protocols/Policies e.g. RBOs and the SADC Water Policy (2005).

Operational Objective 3: Science, technology and knowledge

i) Strengthening of early warning systems
ii) Promote and facilitate transboundary management of shared natural resources including up scaling the KNP Action Plan to other countries of similar ecosystem
iii) Development and transfer of appropriate technology and best practices on SLM
iv) Establish a scientific advisory body to ensure the acquisition and development of appropriate technologies and their adaptation to the needs of local communities
v) Promote the use of alternative energy sources through, inter alia, acquisition and dissemination of data, information and experiences on appropriate low-cost technologies.

Operational Objective 5: Financing and technology transfer

i) Establish an environmental unit/department and strengthen the capacity at SADC Secretariat
ii) Establishment and operationalization of a Regional Integrated Financing System (IFS)
iii) Development of guidelines for the establishment of a harmonized green tax
iv) Lobbying for continued political and financial commitment of Member States
v) Strengthen the capacity of the Secretariat for mobilisation of financial resource.

4.1.1.1 Implementation of the SRAP

The implementation of the SRAP in SADC is a collaborative initiative which involves various role players which include amongst others the Member states and the SADC Secretariat.

4.1.1.2 Role of Member States

The implementation of the SRAP calls for the following roles and responsibilities from the SADC Member States:

i) drive national activities and projects that respond to National Action Plans which in turn contributes to the Sub-regional Action Programme (SRAP);
ii) report to SADC on the implementation of the SRAP and provide information on successes and deficiencies;
iii) mobilise funds and other resources for the implementation of SRAP;
iv) engage in transboundary initiatives; and
v) facilitate joint implementation with other relevant conventions.

4.1.1.3 Role of SADC Secretariat

As the regional coordinating body the role of SADC Secretariat in the implementation of the SRAP would include the following:

i) mobilize funds for implementation of the SRAP on behalf of Member States;
ii) undertake the monitoring, evaluation and reporting on the implementation of the SRAP;
iii) provide technical backstopping;
iv) ensure continuity in implementing the SRAP in the case of institutional restructuring;
v) mobilize sub-regional institutions for the implementation of the SRAP;
vi) facilitate the sharing of lessons and learning (e.g. periodic forums); and
vii) establish partnerships with institutions capable of supporting SRAP implementation.

The framework for implementation of the SRAP is similar to the framework for the SADC Biodiversity Action Plan. In this regard the SADC SRAP provides a shared agenda to combat DLDD in the region by

i) guiding the SADC Community in protecting and restoring the region's natural resources and the invaluable benefits it provides across national (political) boundaries;
ii) providing a tool/roadmap through which the regional structures, Member States, relevant stakeholders and relevant partners can mobilise resources and work together to combat DLDD;
iii) providing intervention areas and actions where there is regional consensus on key issues and will enable SADC to articulate unified positions at international fora;
iv) assisting Member States to cooperate in realising regional and national obligations to the UNCCD;
v) providing a platform for cooperating with relevant international instruments such as the UNFCCC, UNCBD, the Convention on Migratory Species, Convention on International in Endangered Species of Wild Fauna and Flora (CITES) and Ramsar Convention on Wetlands.

4.1.2 The Strategic Framework for Drought Management and Enhancing Resilience in Africa

The framework recognises that drought is a complex natural hazard that is global in nature and has cross-cutting impacts on many sectors of society (e.g., agriculture, energy and food security, health, and water resources). It points out that drought affects Africans' lives and threatens decades of development progress by making communities less able to absorb and adapt to a changing climate. In addition, population growth in Africa is a challenge multiplier on the impacts of drought.

Drought response in Africa reflects the social and economic situation of the countries in the continent. Drought must be seen as a normal natural disaster that needs to be planned for and taken into account in the policies of African governments. The recurrent droughts in Africa associated with climate change necessitate the need for more effective drought planning and the development and implementation of appropriate mitigation strategies. New measures to anticipate and cope with drought by focusing on both short-term drought-response and long-term drought-resilience are needed in light of the evolving climate conditions. The integration of a drought risk management approach allow long-term development interventions to adapt to the changing climate and undertake preventative humanitarian work on the basis of improved drought monitoring tools and forecasts.

The strategy realizes that even though several activities have taken place (nationally, regionally, and internationally), making substantial progress towards a paradigm shift to drought risk management and efficient proactive actions, collective and collaborative efforts are needed now more than ever. It calls for African nations to establish a drought risk management and resilience strategy framework that is more focused on the human dimensions of drought and proactive drought risk reduction measures. Such a strategic framework that considers the socioeconomic and gender asymmetries of drought impacts will help Africa to reduce the likelihood of losses of lives, the severity of economic losses, and also to identify and prioritize drought risk management instruments and mitigation activities.

The overarching goal of DRAPA is strengthening drought risk management, resilience, and sustainable development in Africa. The DRAPA strategic framework will have six main elements:

i) Drought policy and governance for drought risk management;
ii) Drought monitoring and early warning;
iii) Drought vulnerability and impact assessment;
iv) Drought mitigation, preparedness, and response;
v) Knowledge management and drought awareness; and
vi) Reducing underlying factors of drought risk.

Figure below shows the proposed strategic framework structure of "Drought Resilient and Prepared Africa" (DRAPA) for drought risk management and enhancing resilience in Africa.

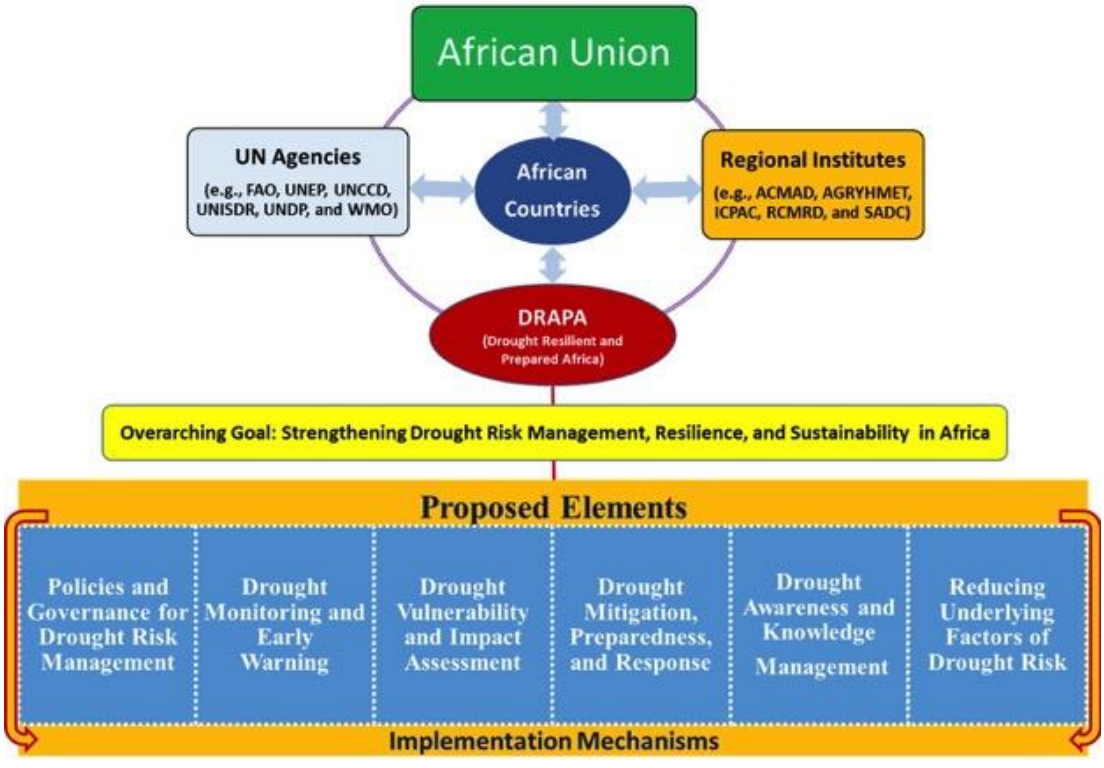


Figure 1. Structural elements of drought governance of the African Union

4.1.3 Drought Resilient and Prepared Africa (DRAPA)

In leveraging past and present experiences and lessons learned in Africa, in line with the global disaster reduction frameworks such as the Sendai Framework a new strategic framework called Drought Resilient and Prepared Africa (DRAPA) was formulated.

The DRAPA was designed to build an effective drought risk management and enhanced resilience at continental, regional, national, or local/community levels for Africa. The DRAPA strategic framework has six main elements of a drought risk management framework in line with the priorities of African regional networks (e.g., IDRISI) and the global disaster risk reduction frameworks such as the Sendai Framework. The elements include: (i) drought policy and governance for drought risk management, (ii) drought monitoring and early warning; (iii) drought vulnerability and impact assessment, (iv) drought mitigation, preparedness, and response, (v) knowledge management and drought awareness, and (vi) reducing underlying factors of drought risk, as well as cross-cutting issues such as capacity development and reducing gender and income inequality.

The DRAPA proposes to develop and implement integrating regional institutes in Africa under African Union leadership in collaboration with the international community including United Nations agencies. The outcome of the development and implementation of this strategic framework will be people-centered (including women and minorities) so that droughts in Africa no longer (i) lead to famine and human suffering/deaths; (ii) aggravate poverty resulting in low nutritional standards of poor people;(iii) affect women and children disproportionately; (iv) distress selling of family assets; and (v) cause the migration of large numbers of people. Implementing efficient proactive management through DRAPA will increase understanding and awareness and emphasize planning ahead, and it will subsequently have major impacts on economies, the ecosystem, and the environment. These expected outcomes need coordinated efforts at all levels.

4.1.4 Sustainable Groundwater Management in SADC Member States

A regional project to build Sustainable Groundwater Management in SADC Member States is under preparation by the SADC Secretariat with the support of the World Bank. With the challenges of climate change, pollution and rapidly growing water demand in southern Africa, the project will aim to strengthen the management and development of groundwater for social and economic development. The project will support activities at regional, basin and national levels. There are over 30 shared aquifer systems identified across southern Africa and Member States often share similar groundwater challenges. The project will implement priority actions in the work-programme for groundwater in the SADC Regional Strategic Action Plan for Integrated Water Resources Management (RSAP III, 2011–2015).

The project will be strategically managed by the SADC Secretariat's Water Division in Gaborone, Botswana. The SADC Groundwater Management Institute (GMI) and the project will be hosted by the University of the Free State (through its Institute for Groundwater Studies) on behalf of the SADC Secretariat.

4.1.5 Regional Infrastructure Development Master Plan Energy Sector Plan (2012)

This Energy Sector Plan (ESP) is part of the SADC Regional Infrastructure Development Master Plan (RIDMP) whose aim is to define regional infrastructure requirements and conditions to facilitate the realisation of key infrastructure in the energy, water, transport, tourism, meteorology and telecommunications sectors by 2027. Such infrastructure would enable the SADC region to attain regional integration, economic growth and poverty eradication.

4.1.6 Regional Infrastructure Development Master Plan Meteorology Sector Plan (2012)

With infrastructure central to its goals of poverty eradication and regional integration, SADC developed the Regional Infrastructure Development Master Plan as a strategic framework guiding infrastructure development in Southern Africa. The Meteorology Sector Plan component of the Master Plan aims to ensure that meteorological services play an integrated and effective role in socioeconomic development of the SADC region.

4.1.7 Regional Infrastructure Development Master Plan Tourism Sector Plan (2012)

With infrastructure central to its goals of poverty eradication and regional integration, SADC developed the Regional Infrastructure Development Master Plan as a strategic framework guiding infrastructure development in Southern Africa. The Tourism Sector Plan component of this Master Plan aims to outline an approach for development of trans-frontier conservation areas – key drivers of tourism in the SADC region.

4.1.8 Regional Infrastructure Development Master Plan Water Sector Plan (2012)

With infrastructure central to its goals of poverty eradication and regional integration, SADC developed the Regional Infrastructure Development Master Plan as a strategic framework guiding infrastructure development in Southern Africa. The Water Sector Plan component of this Master Plan aims to further the development of water resources infrastructure in the SADC region, with particular regard for those projects already authorised by Member States.

4.1.9 SADC Policy Paper on Climate Change

The paper provides a summary of the observed and expected climate change in SADC countries. The observed impacts of global warming and climate change on sectors and the challenges for climate change adaptation and mitigation are discussed to provide a background to the growing need of the SADC region to develop policy strategies in response to climate change. Possible adaptation and mitigation options in different sectors are argued. While adaptation remains a

priority for SADC, it is also clear the voluntary mitigation activities can provide benefits to promote regional integration and socio-economic development in the SADC region.

4.1.10 Southern Africa Framework of Sub-regional Climate Change Programmes

Due to Southern Africa's dependency on climate-sensitive sectors such as agriculture and coastal zones, the increased frequency of extreme climate events in the region has contributed to its vulnerability. In order to emphasise the importance of adaptation to this changing climate, the SADC Experts Group prepared the Southern Africa Sub-Regional Framework of Climate Change Programmes in 2010.

4.1.11 Regional Water Infrastructure Programme brochure

The Regional Water Infrastructure Programme for the Southern African Development Community (SADC) is aligned with regional goals of regional economic integration and poverty eradication, the principles of Integrated Water Resources Management (IWRM) and supporting one of the priority intervention areas under the Regional Indicative Strategic Development Plan (RISDP).

4.1.12 SADC Communication Strategy for Water Sector (2008)

The Regional Awareness and Communication Strategy for the Southern African Development Community (SADC) Water Sector fulfils the call for establishing sector specific strategies and crafting, packaging and dissemination of messages and themes, which should be based on but not limited to SADC priority intervention areas.

4.1.13 SADC Multi-country Agricultural Productivity Programme (MAPP) Document

Agriculture in the SADC region is the primary source of subsistence, employment and income for 61 percent of the peoples of the region. Despite a diversified natural resource base, overall agricultural growth and productivity have remained low over the past twenty years. The urgent implementation of broad-based programmes to reverse the overall decline in the productivity of the agriculture sector is a central priority in setting SADC Member States on the path of fast economic growth and poverty reduction. The diversity of the region's farming and livelihood systems presents great challenges to policymakers in formulating sound agriculture development strategies. But, even given this diversity, many countries in the region share similar problems and opportunities. Cooperation in some of these key areas can yield significant benefits – as can greater economic integration by taking advantage of natural comparative advantages.

SADC MAPP is designed as a comprehensive 15-year programme of change, arranged around three 5 year phases. The overall programme goal is to bring about pluralistic and strengthened agricultural technology generation and dissemination, together with strengthening linkages among agricultural institutions in the SADC region in order to accelerate smallholder productivity. The result will be market- and smallholder-responsive and accessible agricultural technologies which will create agricultural growth, and increase incomes especially amongst the rural poor.

4.1.14 SADC Regional Biodiversity Strategy

Southern Africa is home to abundant biodiversity, which contributes to the livelihoods of many people in the region. Therefore, this biodiversity is central to SADC's objective of improving socioeconomic development. In order to foster this biodiversity in the face of regional underdevelopment and environmental challenges, SADC has devised a Regional Biodiversity Strategy.

The Regional Biodiversity Strategy aims to provide a framework for cooperation and implementation of provisions toward sustaining the region's biodiversity. Noting practical constraints on sustaining biodiversity in the region, the Strategy outlines tactics for addressing focal areas that cut across several sectors – forestry, wildlife, agriculture, and others. These tactics are based on a scope of developing programmes to enhance economic development without compromising sustainable use. The Strategy also suggests activities for its funding and implementation, encouraging SADC Member States to develop projects in biodiversity focal areas.

4.1.15 SADC Regional Vulnerability Assessment and Analysis (RVAA) Synthesis Report 2013

The SADC Protocol on Forestry of 2002 aims to promote the development, conservation, sustainable management and utilisation of all types of forest and trees; trade in forest products and achieve effective protection of the environment, and safeguard the interests of both the present and future generations.

4.1.16 Revised Protocol on Shared Watercourses (2000)

As much of Southern Africa relies on agriculture for its subsistence, water is of special concern for SADC. Many watercourses in the region are shared among several Member States, a situation that demands their development in an environmentally sound manner. To this end, SADC initially passed its Protocol on Shared Watercourses in the Southern African Development Community on 28th August 1995, which was revised on 7th August 2000.

The Protocol aims to foster closer cooperation among Member States for protection, management, and use of shared watercourses in the region. Member States agree to cooperate on projects and exchange information on shared watercourses, consulting with each other and collaborating on initiatives that balance development of watercourses with conservation of the environment. The Protocol also contains an institutional framework that sets out a Water Sector Organ, its committees and units, and its duties for joint protection and development of shared watercourses in Southern Africa.

4.1.17 Protocol on Wildlife Conservation and Law Enforcement (1999)

Wildlife resources in Southern Africa have the potential to affect the region's economic development and environmental protection – two primary concerns of SADC. Therefore, SADC passed its Protocol on Wildlife Conservation and Law Enforcement on 18th August 1999 to establish a common framework for conservation and sustainable use of wildlife in the region.

4.1.18 Protocol on Fisheries 2001

SADC recognises the important role of fisheries in the social and economic well-being and livelihood of the people of the region, in ensuring food security and alleviating poverty. Therefore to support national initiatives taken and international conventions for the sustainable use and protection of the living aquatic resources and aquatic environment of the region, SADC Member States signed the Protocol on Fisheries in 2001.

The Protocol emphasizes the responsibilities of Member States, international relations as well as the effective management of shared resources. In signing this Protocol the Member States agree to harmonise their domestic legislation with particular reference to fisheries and the management of shared resources, to take adequate measures to optimize fisheries law enforcement resources and thus protect aquaculture and the aquatic environment and safeguard the livelihood of fishing communities.

4.1.19 Declaration on Agriculture & Food Security (2004)

Agriculture and food security contribute to a region's quality of life, making them top priorities for SADC. The Declaration on Agriculture and Food Security in the SADC Region sets out SADC Member States' commitment to enhancing agriculture as a means of improving access to food for people in the region.

Member States agree to implement short, medium, and long-term objectives to advance the state of agriculture and food security in Southern Africa. Short-term plans focus on raising the level of agriculture and food security through such means as ensuring small farmers access agricultural inputs, improving fertilizer usage in the region, and increasing production of drought-resistant crops and short-cycle livestock. Medium- to long-term approaches concentrate on maintaining sustainable agriculture and food security measures through environmental conservation, disaster preparation, and research into modern agricultural technologies. The Declaration instructs the SADC Integrated Committee of Ministers to implement the related Plan of Action, reviewing its progress every two years.

4.1.20 SADC Strategic Framework and Programme of Action 2008-2015

The impact of poverty, food insecurity, and disease on Southern Africa is most evident in its effects on orphans, vulnerable children, and youth. Although policies throughout the region in support of vulnerable young people are strong, SADC has identified a need for a strategic framework to support these policies, setting out actions for change that complement national and community efforts for development. For this reason, SADC initiated its Strategic Framework and Programme of Action for Orphans, Vulnerable Children and Youth in 2008.

4.1.21 Declaration on Poverty Eradication and Sustainable Development 2008

With poverty eradication in Southern Africa as a chief objective, SADC addresses the current state of development and its areas of priority through the Declaration on Poverty Eradication and Sustainable Development, signed on 20th April 2008.

This Declaration advises Member States to redouble their efforts in meeting Millennium Development Goals by highlighting areas of focus such as food insecurity, climate change, and underdevelopment of infrastructure. Along with the long-term strategies for poverty eradication outlined in the Regional Indicative Strategic Development Plan and the Strategic Indicative Plan of the Organ, the Declaration urges Member States to deepen Regional Integration and to liberalise their economies as a means of improving the regional standards of living. Among other strategies, the Declaration also calls for the establishment of a taskforce on food insecurity, mitigation plans for climate change, and microfinance systems for small- and medium-sized enterprises. Through all of these plans, SADC encourages Member States to mobilise resources for its poverty eradication programmes and to promote private sector investment that spurs the region's economic development.

4.1.22 The Regional Poverty Reduction Framework

The Regional Poverty Reduction Framework seeks to elaborate and translate SADC's Regional Indicative Strategic Development Plan priority intervention area on poverty eradication into an implementation framework. This has the effect of fine-tuning the regional agenda for poverty eradication and provides a bridge to align national poverty reduction strategies to regional interventions.

The framework selectively covers critical and high impact areas where a regional approach is expected to complement and bolster the national interventions in the fight against poverty across the region. The framework therefore focuses on the regional dimensions of national poverty reduction interventions including cross-border issues which need to be identified and addressed collectively. This must dovetail with the poverty dimensions of regional integration and

cooperation policies and programmes (RISDP) and Strategic Indicative Plan for the Organ (SIPO) in order to maximise synergies between regional and national interventions.

The Regional Poverty Reduction Framework also pays more attention to cross-border issues in order to improve consistency between national strategies and programmes on one hand and the regional strategies and programmes on the other with a view to enhance the visibility and relevance of regional interventions to country policy makers.

4.1.23 Southern Africa Framework of Sub-regional Climate Change Programmes

Due to Southern Africa's dependency on climate-sensitive sectors such as agriculture and coastal zones, the increased frequency of extreme climate events in the region has contributed to its vulnerability. In order to emphasise the importance of adaptation to this changing climate, the SADC Experts Group prepared the Southern Africa Sub-Regional Framework of Climate Change Programmes in 2010.

The Framework provides an overview of Southern Africa's climate situation and programmes aimed at climate change adaptation, mitigation, or capacity building. It collates and analyses existing regional initiatives as a means of facilitating greater synergies between the SADC Secretariat, coordinating body, and national governments. Along with projections for regional climate change, the Framework identifies gaps in current initiatives and suggests steps for further progress toward a comprehensive programme of adaptation and mitigation actions, including training, policy review, and funding mechanism for further initiatives.

4.1.24 Protocol on Science Technology and Innovation (2008)

Science and technology are cross-cutting issues for the SADC region, affecting all aspects of the region's socioeconomic development. Recognising that these factors play an important role in the future of Southern Africa, SADC Member States signed the Protocol on Science, Technology and Innovation on 17th August 2008 to foster cooperation and to promote development of science and technology in the region.

In signing the Protocol, Member States agree to cooperate on institutional mechanisms for science, technology, and innovation. The Protocol sets out these institutions, as well as their committees and subcommittees, composition, functions, systems of financing their initiatives, and methods of monitoring progress. The aim is to promote development and harmonisation of science, technology, and innovation policies, advocating investment in research and development and promoting public awareness of science and technology.

4.1.25 Regional Agricultural Policy (2014)

The Regional Agricultural Policy sets out the principles that guide SADC agricultural policy, notably subsidiarity, additionality, complementarity, proportionality, coherence, partnership and consultation, environmental sustainability, solidarity and market integration. Key policy objectives set out in the document include:

- enhancing "sustainable agricultural production, productivity and competitiveness";
- improving "regional and international trade and access to markets of agricultural products";
- improving "private and public sector engagement and investment in the agricultural value-chains";
- reducing "social and economic vulnerability of the region's population in the context of food and nutrition security".

The policy identifies a range of success factors essential for regional agricultural policy implementation. Importance is attached to:

- identifying those areas which yield the most immediate returns;
- establishment of an Agricultural Development Fund to support the Regional Agricultural Investment Plan (RAIP), which should be consistent with National Agricultural Investment Plans (NAIPs) under the Comprehensive Africa Agriculture Development Plan (CAADP);
- establishment of a strong monitoring and evaluation system.

4.2 International Conventions and Strategies on Disasters and Its Impacts on People and Ecosystems.

4.2.1 Africa Consensus Statement to Rio+20

Prior to the Rio+20 United Nations Conference on Sustainable Development, the Ministers of African States held a preparatory meeting to deliberate the objectives and themes of the conference and to determine a consensus for key priorities and concerns affecting Africa. The Consensus Statement addresses the state of development in Africa and reaffirms States' commitment to sustainable development moving toward the Millennium Development Goals.

The Consensus Statement calls on the Rio+20 Summit to reinvigorate political will and international commitments to sustainable development. States acknowledge the progress of Africa since the 1992 Rio Summit and call for increased action in critical areas such as agricultural productivity, biotechnology research, and others. The Statement recognises new challenges to sustainable development, such as climate change and the energy crisis, but also notes the opportunities these challenges provide, such as spurring transition to a green economy. States urge the international community to accelerate support for the region and encourage concrete measures based on participation by major groups at all levels in order to successfully implement.

4.2.2 International Conventions

The country is also party to various conventions that deal with drought issues and they include:

- Convention on Biological Diversity
- Convention on the Elimination of all forms of Discrimination Against Women
- Convention to combat Desertification in those Countries Experiencing Serious Drought and/or Desertification in Africa
- International Cooperation to reduce the impact of El Nino phenomenon
- International Decade for Natural Disaster Reduction (IDNDR)
- International Strategy for Disaster Reduction of 2000 (ISDR)
- International Year of Mountains
- Natural Disasters and Vulnerability
- United Nations Conference on Environment and Development
- United Nations Millennium Declaration
- World Climate Change Conference
- World Conference on Human Rights
- World Summit for Social Development
- UN General Assembly Resolution 2034 of 1965 on natural and technological disasters
- Framework Convention on International Civil Defense assistance
- World Summit on Sustainable Development
- SADC Disaster Management Strategy
- African Ministerial Conference on Environment (AMCEN)

4.2.2.1 The Rio+20 Framework

The Rio+20 Framework calls for measures that seek to address: poverty eradication; food security, nutrition and sustainable agriculture; water and sanitation; energy; sustainable tourism; sustainable trans- port; sustainable cities and human settlements; health and population; promoting full and productive employment, decent work for all and social protection; disaster risk reduction; climate change; forests; biodiversity loss; desertification, land de- gradation and droughts; mountains; chemicals and waste; sustainable consumption and production; mining; education; gender equality and the empowerment of women and oceans and seas.

4.2.2.2 UNESCO

As its contribution to address drought challenges in the SADC region and in line with the SADC Water Initiative, UNESCO is supporting the establishment and strengthening of drought monitoring systems in Southern Africa. It is also promoting the implementation of national drought mitigation plans and policies for all countries in the region. So far, UNESCO has done a review and analysis of existing drought mitigation policies, strategies and plans within the SADC regions at regional, national and basin levels. The specific objectives are to: map all existing drought mitigation documents at regional, national and basin levels within the seven SADC countries; conduct an analysis of the various documents against normative and exiting standards following the World Meteorological Organization (WMO) and the Global Water Partnership (GWP) drought management policy guidelines; identify capacity gaps for proper implementation of drought policies; identify best practices at country and basin level; and provide recommendations.

5 DROUGHT MONITORING, FORECASTING AND IMPACT ASSESSMENT

5.1 Introduction

Drought monitoring in Zambia is implemented mainly through the Zambia Meteorological Department (ZMD) in the Ministry of Transport and Communication (MTC). Other relevant institutions are the Disaster Management and Mitigation Unit in the office of the Vice President; and the Water Resources Management Authority (WARMA) under the Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP). ZMD work together with the above institutions; regional bodies (e.g., Southern Africa Development Community or SADC); international bodies (e.g., World Meteorological Organisation or WMO, United Nations Framework Convention on Climate Change or IPCCC); non-governmental and international non-governmental organisations (e.g., Red Cross, Famine Early Warning System Network or FEWSNET) and other Civil Society Organisations (e.g., Zambia National Farmers' Union or ZNFU, Caritas Zambia, Catholic Relief Services or CRS); United Nations System in Zambia (e.g., World Food Programme or WFP, United Nations Development Programme or UNDP); Academic/Research institutions (e.g., University of Zambia or UNZA, Copperbelt University or CBU, Mulungushi University or MU); Cooperating Partners (e.g., World Bank, African Development Bank, GIZ); and the public. Again the same list of stakeholders above, in collaboration with ZMD, is instrumental in drought forecasting, impact assessment and dissemination of pertaining to drought and other climatic hazards such as floods.

5.2 Framework for Drought Monitoring, Forecasting and Impact Assessment

Arising from the stakeholders indicated above, the framework for drought monitoring, forecasting and impact assessment in Zambia is provided by policies, legislation and institutional arrangements; and collaboration at the international, regional, national, local and individual level. It is also clear that drought management is cross-cutting and requires multi-sectoral and integrated approaches.

5.2.1 National Policies

The key guiding policies are the National Meteorology Policy (NMP) 2014; Revised National Water Policy (NWP) 2010; Disaster Management Policy (DMP) 2015 and the National Policy on Environment (NPE). The Seventh National Development Plan (7NDP), which is linked to the 2030 Vision, also provides further guidance. The 7NDP is the third medium-term planning instrument under Vision 2030 and it departs from sectoral-based planning to an integrated (multi-sectoral) development approach under the theme "Accelerating development efforts towards the Vision 2030 without leaving anyone behind".

5.2.1.1 National Meteorology Policy

The development and implementation of a National Meteorology Policy in Zambia facilitates the application of weather and climate information in national development. In articulating the policy issues, focus is on the cross-cutting nature of meteorological and climate applications. The policy seeks to achieve the following:

i. Create a favourable political, socio-economic, legal and regulatory environment for the meteorology sector;

ii. To progressively harness investment in the sector for purposes of generating meteorological data and information, and its application by the users in their everyday life;
iii. Positively contribute to poverty reduction strategies, attainment of the Strategic Development Goals and sustainable social economic development among Zambians through the application of weather and climate information in all sectors;
iv. Promote the use of Information Communication Technologies to effectively generate and disseminate weather and climate information;
v. Layout a coordinated human resources development plans to support the meteorology structure for effective service delivery to clients;
vi. Create institutional mechanisms to support the effective implementation of the National Meteorology Policy;
vii. Strengthen the meteorological service delivery in terms of early warning systems and contribute to a climate resilient society and economy, thereby enhancing climate change adaptation and mitigation measures.

The policy also recognizes the need to holistically invest in the basic meteorological infrastructure across the country to support the provision of weather and climate services to the public. This shall contribute significantly to the creation of a climate resilient national economy and communities with a high climate change adaptive capacity. The successful implementation of the National Meteorology Policy will require a legislative and regulatory framework which is yet to be enacted. Equally addressed in this policy are the roles of government and stakeholders; the need for monitoring and evaluation; and the cross cutting issues of information communication technology (ICT), Gender and HIV/AIDS.

5.2.1.2 The National Water Policy

The National Water Policy (2010) recognizes the fact that water plays a cardinal role in socio-economic development and that it is fundamental for sustaining all forms of life. Productive activities ranging from agriculture, mining, tourism and other industries are dependent on water. It supports integrated water resource management which addresses cross-sectoral issues such as land use, irrigation, wetland conservation, climate change and conflict management. Thus the Policy seeks to optimally harness water resources for the efficient and sustainable utilisation of this natural resource to enhance economic productivity and reduce poverty. It calls for the preservation and maintenance of the water resources at acceptable quality standards through undertaking comprehensive water resources assessments and monitoring (including forecasting) of surface and groundwater resources in terms of quality and quantity; identifying ecosystems at risk and recommending remedial measures; and also ensuring that water resources development is done in an environmentally sustainable manner.

The measures to be carried out that relate to the drought monitoring, forecasting and impact assessment are to:

i. Establish a comprehensive legal, institutional and regulatory framework for effective management of the country's water resources in an equitable and sustainable manner with strong stakeholder participation by undertaking an integrated water resource management (IWRM) system approach;
ii. Undertake comprehensive water resources assessments and monitoring;
iii. Identify ecosystems at risk and recommend remedial measures;
iv. Introduce an integrated catchment water management system that allows the local people, particularly women and children, to effectively participate in the management of water resources in their areas;
v. Contribute to the minimization of the impact of water-related disasters such as droughts and floods through the provision of early warning systems and put in place emergency management systems;
vi. Strengthen the human, technical and financial capacity for addressing the water resources management needs in the water sector;
vii. Establish mechanism for collaboration, coordination and consultation in the water sector;
viii. Establish an integrated water resources management information system and monitoring network including information dissemination mechanism;

ix. Develop national water resources strategy and plan;
x. Declare water shortage areas;
xi. Promote regional collaboration in areas of research, data collection and information exchange;
xii. Establish early warning systems in collaboration with other relevant institutions;
xiii. Promote preventive measures through community education and awareness; and
xiv. Collaborate with regional and international bodies in dealing with emergency situations.
xv. Subject water resources development programmes and projects to strategic environmental assessment and environmental impact assessment;
xvi. Install or facilitate the installation of metering systems on all hydraulic structures.

5.2.1.3 National Disaster Management Policy

The National Disaster Management Policy envisages DMMU as the hub of coordination mechanism for the realisation of the national vision which is, "a 'safety net' for protection of the citizenry, their assets and the environment against disasters through a pro-active, community-based, developmental and multi-sectoral approach that combines disaster preparedness, prevention and mitigation, and integrates disaster management into national development". It provides guidance and an enabling environment within which DMMU and other organizations/agencies within the integrated national disaster management structure will operate. It aims at minimizing duplication of efforts and wastage of resources.

Specifically the policy seeks:

i. To put in place appropriate preparedness measures in order to manage disasters efficiently and effectively;
ii. To activate response mechanism for effective and timely search and rescue operations in order to save life and damage to property;
iii. To put in place measures to restore livelihoods and other life support systems of the affected communities;
iv. To mitigate the destructive and disruptive effects of hazards and all disasters in order to reduce their impact on vulnerable communities, assets and the environment;
v. To put in place preventive measures in order to reduce the negative effect of hazards and strengthen the national capacity for disaster management in order to avoid the adverse impact of hazards; and
vi. To effectively coordinate disaster management activities through a body of procedures and practices in order to avoid duplication of efforts and resources at all levels.

5.2.1.4 The National Policy on Environment

The National Policy on Environment (NPE), 2009 is a policy that creates an umbrella for the welfare of the nation's environment with respect to sound and sustainable socio-economic development. Like its predecessor de facto 'policy' the National Environmental Action Plan (NEAP), the NPE is also founded on three fundamental principles. These are: the right of citizens to a clean and healthy environment, local community and private sector participation in natural resources management and obligatory Environmental Impact Assessments (EIAs) for major project undertakings in all sectors of the economy. This policy is housed in the Ministry of Water Development, Sanitation and Environmental Protection and implementable by various natural resources related Government Departments, Commissions, Local Authorities and Agencies.

5.2.2 National legislation

Without the relevant national legislation, the above policies cannot be implemented effectively to support drought management in the country. This section lists and briefly explains the relevant pieces of legislation pertaining to drought

monitoring, forecasting and impact assessment. They need to be reviewed during the development of the Drought Management Plan.

5.2.2.1 Zambia Meteorological Legislation

Transformation of the meteorological sector to achieve the aims of the National Meteorological Policy is underway. A legislative and regulatory framework will come into force through enactment of a new Meteorological Act by Parliament. ZMD was recently restructured in preparation of the new functions and regulatory powers that will be conferred to the institution under the new Act (*Personal communication*).

5.2.2.2 The Disaster Management Act, 2010

The Act establishes and provides for, among other things, the maintenance and operation of a system for the anticipation, preparedness, prevention, coordination, mitigation and management of disaster situations and the organisation of relief and recovery from disasters; establishes the National Disaster Management and Mitigation Unit and provides for its powers and functions; provides for the declaration of disasters; establishes the National Disaster Relief Trust Fund; and provides for the responsibilities and involvement of the members of the public**.**

Under this Act DMMU shall act as a repository of, and conduit for, management information concerning disasters and disaster management, and is required to develop and maintain an electronic database; and take steps to disseminate information, especially to communities that are vulnerable to disasters.

The electronic database shall contain information concerning disasters that occur or may occur in Zambia and disaster management issues, including information on:

a) phenomena, occurrences, activities and circumstances that cause or aggravate disasters;
b) risk factors underlying disasters and ways and means to reduce such risks;
c) recurring occurrences that result in loss, but which are not classified as disasters under this Act;
d) prevention and mitigation;
e) early warning systems;
f) areas and communities that are particularly vulnerable to disasters;
g) indigenous knowledge relating to disaster management;
h) the directories and records;
i) emergency response resources and capacity in the national, provincial and local institutions of Government and among the private sector and the non-governmental organisations;
j) emergency response resources and capacity in Zambia, neighbouring countries and relevant international relief agencies;
k) emergency preparedness in the different institutions of Government;
l) each disaster, including the assessment of the Unit of the disaster; and
m) research and training facilities for disaster management disciplines.

DMMU is also expected to:

- take reasonable steps to ensure that the database is electronically accessible to any person free of charge;
- establish security safeguards to protect the database from abuse; and
- classify parts of the database as restricted areas, and to limit access to those parts to authorised persons.

5.2.2.3 The Environmental Management Act (EMA), No. 12 of 2011

It's the principal environmental law in Zambia that provides for integrated environmental management and the protection; conservation and sustainable management and use of natural resources. It establishes the Zambia Environmental Management Agency (ZEMA) whose function is to implement measures in order to ensure the sustainable

management of natural resources and protection of the environment, and the prevention and control of pollution. Among these measures the relevant ones to this Environmental and Social Management Framework (ESMF) are:

- developing and enforcing measures aimed at preventing and controlling pollution;
- collaborating with Government agencies, appropriate authorities and other bodies and institutions to control pollution and protect the environment;
- requesting information on projects proposed, planned or in progress and advising stakeholders on projects, programmes, plans and policies for which environmental assessments are necessary.

In this regard the law's objective is to ensure the undertaking of an environmental and social assessment for the Hydro-Met project and its sub-projects due to their potential environmental and social impacts on the general environment.

5.2.2.4 The Environmental Impact Assessment (EIA) Regulations

The Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1987 state that:

"A developer shall not implement a project for which a project brief or an environmental impact statement is required under these Regulations, unless the project brief or an environmental impact assessment has been concluded in accordance with these Regulations and ZEMA has issued a decision letter."

These regulations will be applicable to the Hydromet sub-projects and hence this ESMF.

5.2.2.5 The Environmental Management (Licensing) Regulations SI No. 112 of 2013

This regulation has integrated Air, Water, Waste (including hazardous waste), Pesticides and toxic substances and Ozone regulations. It has replaced previous regulations which include Statutory Instrument No. 71 of 1993 Waste Management Regulations, Statutory Instrument No. 141 of 1996 Air Pollution Control, Statutory Instrument No. 72 of 1993 Water Pollution Control (effluent and waste water), Statutory Instrument No. 125 of 2001 Hazardous Waste Management regulations.

5.2.2.6 The Water Resources Management Act

The Act Water Resources management Act was enacted to:

(a) Establish the Water Resources Management Authority and define its functions and powers;
(b) Provide for the management, development, conservation, protection and preservation of the water resource and its ecosystems;
(c) Provide for the equitable, reasonable and sustainable utilisation of the water resource; ensure the right to draw or take water for domestic and non-commercial purposes, and that the poor and vulnerable members of the society have an adequate and sustainable source of water free from any charges;
(d) Create an enabling environment for adaptation to climate change;
(e) Provide for the constitution, functions and composition of catchment councils, sub-catchment councils and water users associations;
(f) Provide for international and regional cooperation in, and equitable and sustainable utilisation of, shared water resources;
(g) Provide for the domestication and implementation of the basic principles and rules of international law relating to the environment and shared water resources as specified in the treaties, conventions and agreements to which Zambia is a State Party; and
(h) Repeal and replace the Water Act, 1949.

Drought is considered under Emergency Situations (Part XVI) in Sections 143 to 146 of the Act. In Section 143, "early warning system" in relation to water, means any system where information is obtained by, and transmitted to, the Authority and made available to the public, in an appropriate manner, in respect of an imminent emergency. An "emergency" means a disaster or incident connected with water, resulting suddenly, either from natural causes or from human conduct, and which causes or poses an imminent threat or causes serious harm or damage to a water resource, the people, property or to an area, and includes— (a) a flood which is likely to occur or has occurred; (b) a drought which is likely to occur or has occurred. Drought is defined as an emergency.

The Act further provides for declaration of national disaster by the President and emergency situation by the Minister with respect to a geographical area affected by drought. The Authority (WARMA) is mandated to make recommendations leading to the emergency declarations. The legislation provides for what should be done in such emergency situations.

WARMA may, during the period of the declaration of a national disaster due to general drought or an emergency relating to a drought in a specific area in Zambia:

a) suspend or amend any permit granted under this Act;
b) determine the amount of water that may be used by any person for any purpose;
c) define places from which and times at which water may be used; and
d) give any necessary and practicable orders or take any action suitable to ensure equitable allocation and use of water.

WARMA may also work with relevant appropriate authorities like DMMU or ZMD in the establishment and operation of an early warning system.

5.2.2.7 The Forest Act No 4 of 2015

The Act provides for, among other things: the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; the participation of local communities, local authorities, traditional institutions, non-governmental organisations and other stakeholders in sustainable forest management; the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity; the establishment of the Forest Development Fund; and the implementation of the United Nations Framework Convention on Climate Change, Convention on International Trade in Endangered Species of Wild Flora and Fauna, the Convention on Wetlands of International Importance, especially as Water Fowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa and any other relevant international agreement to which Zambia is a party.

5.2.2.8 The Local Government Act, 1991 Cap 281

The purpose of the Act is to permit implementation and operation of the new developments which are subject to the procedures laid out by the local authorities. By-laws may be formulated for drought and water shortage situations.

5.2.2.9 The Urban and Regional Planning Act, 2015

The Act's key elements are to provide for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; provide for a framework for administering and managing urban and regional planning for the Republic; provide for a planning framework, guidelines, systems and processes for urban and regional planning for the Republic; establish a democratic, accountable, transparent, participatory and inclusive process for urban and regional planning that allows for involvement of communities, private sector, interest groups and other stakeholders in the planning, implementation and operation of human settlement development; ensure functional efficiency and socioeconomic integration by providing for integration of activities, uses and facilities; establish procedures for integrated urban and regional planning in a devolved system of governance so as

to ensure multi-sector cooperation, coordination and involvement of different levels of ministries, provincial administration, local authorities, traditional leaders and other stakeholders in urban and regional planning; ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives and controls at all levels of urban and regional planning; ensure uniformity of law and policy with respect to urban and regional planning.

5.2.2.10 The Lands Act and Lands Acquisition Act, Cap 184, 1995

Enforced and implemented by the Local Authority with respect to land acquisition and land use change as read with the Local Government Act of 1991. It is relevant because impacts from disasters and interventions occur on land which falls under either the Customary Land tenure or statutory tenure (applicable in the case of State Land) which are the two land tenure systems in Zambia. People may need to be resettled in emergency situations and so procedures for land acquisition need to be adhered to.

5.2.2.11 The Zambia Wildlife Act, 2015

The Act is designed to provide for the establishment, control and management of National Parks, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and objects of aesthetic, pre-historic, historical, geological, archeological and scientific interest in National Parks; provide for the promotion of opportunities for the equitable and sustainable use of the special qualities of public wildlife estates; provide for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education; provide for the sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas; enhance the benefits of Game Management Areas to local communities and wildlife; involve local communities in the management of Game Management Areas; provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Wetlands of International Importance especially as Waterfowl Habitats, the Convention on Biological Diversity, the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora and other international instruments to which Zambia is party.

5.2.2.12 The Public Health Act, 1930 Cap 535

The Public Health Act, Cap 535 of the Laws of Zambia; as amended from time to time, whose objective is to prevent and suppress diseases and generally regulate all matters connected with public health in Zambia, is critical in drought situations. This law may be read together with the Local Government Act, Cap 281 of 1991 of the laws of Zambia. During drought, the health of workers and the public may be put at risk due to water borne or water related diseases such as bilharzia, malaria, cholera and others.

5.2.2.13 The Occupational Health and Safety Act – 2010

The Act among, others things, provides for the establishment of health and safety committees at work places and the health, safety and welfare of persons at work; duties of manufacturers, importers suppliers of articles, devices, items and substances for use at work; and for the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work. Humanitarian and other workers will need to be protected and to protect other people connected to the work area. Moreover the activities related to drought mitigation projects might cause accidents.

5.2.2.14 The National HIV/AIDS/STI/TB Act of 2002

The Act provides for the establishment of the HIV/AIDS/STI/TB Council whose functions include the coordination and provision of support to development, monitoring and evaluation of multi-sectoral response for the prevention and combating of the spread of HIV/AIDs/STI and TB in order to reduce the personal, social and economic impacts of

HIV/AIDS/STIs and TB. Drought mitigation projects are likely to attract more people seeking employment and business opportunities, thus putting project employees and local communities at risk of contracting HIV/AIDS and related STIs.

Other institutions and their legislative responsibilities that have a bearing on the project are summarized in Annex 1-Relevant National Legislation. Depending on the nature of the sub-projects designed under this Project, representatives of these institutions may provide technical assistance at National, Provincial and District level or Catchment level (in the case WARMA) in the preparation and implementation of sub-projects and Environmental and Social Management Plans (ESMPs) where required. More substantial details addressing environmental and social management processes and concerns are further elaborated and linked to the sub-project preparation and approval process outlined later in Chapter 7 of this report.

5.2.3 International Conventions

Zambia is a party to many international agreements, including the following that are relevant to the Hydromet Project:

a) The Convention on the Law of Non-Navigational Uses of International Watercourses.
b) Convention Concerning the Protection of the World Cultural and Natural Heritage which is concerned with the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic, historical, pre-historical, archaeological or scientific interest.
c) Convention on Biological Diversity (CBD) which requires the country to conserve genetic, species and ecosystem diversity.
d) United Nations Convention to Combat Desertification (UNCCD) which is concerned with the conservation of the productivity of land and the control of land degradation, such as soil erosion.
e) United Nations Framework Convention on Climate Change (UNFCCC) which is concerned with the reduction in emissions of greenhouse gases into the atmosphere.
f) Ramsar Convention which is concerned with the conservation and management of wetlands Zambia presently has 8 sites (Bangweulu Swamps, Busanga Swamps, Kafue Flats, Luangwa Flood Plains, Lukanga Swamps, Mweru WA Ntipa, Tanganyika Zambezi Floodplains designated as Wetlands of International Importance, with a surface area of 4,030,500 hectares.
g) SADC Protocol on shared Water Resources which is concerned with basin wide cooperation in the development and use of water resources derived from shared water courses and the application of principles of equitable and reasonable utilization.
h) Zambezi River Commission agreement which is concerned with cooperation in the Development and use of water in the Zambezi River Basin.

It worth mentioning that ZMD and WARMA participate in the Southern African Regional Climate Outlook Forum (SARCOF) convened by the Southern Africa Development Community (SADC) Climate Services Centre (CSC) which is the specialized SADC regional climate institution and carries its mandate through development, generation and dissemination of meteorological, other environmental and hydro-meteorological products. The products make valuable contribution to increasing the region's disaster preparedness for and efficient management of weather and climate-induced disasters. The CSC also trains SADC national Meteorological/Hydrological Services (NMHSs) Climate Experts in climate prediction and the user communities in the application of climate products and services for optimum socio-economic development which is highly sensitive to vagaries of weather and climate.

5.3 Drought Monitoring and Forecasting

Drought monitoring and forecasting, as seen above, fall largely within the mandates of ZMD and WARMA. The meteorological and hydrological services provided by the two institutions, respectively, are the basis for drought management (including monitoring and forecasting). The context in which the meteorological and hydrological (or hydrometeorological) services are being provided and a description of the current situation and what is planned to improve these services is given in this section.

5.3.1 Climatic Situation

Zambia lies in the tropical region south of the equator between latitudes 8°and 18° but experiences subtropical weather throughout the year owing to the influence of altitude. According to Aurecon (2018) the country has two main seasons, the rainy season from November to April, which corresponds to summer and the dry season from May to October/November, corresponding to winter. Furthermore the dry season is subdivided into a cool and dry season (May to August) and a hot and dry season (September to October/November). The summer average temperature is 30.1°C and the winter average temperature is 9 °C but may be as low as 5°C.

Rainfall is mainly influenced by the movement of the Inter-tropical Convergence Zone (ITCZ). The mean annual rainfall in 1995 was reported by YEC (1995) as ranging from 700mm in southwest Zambia to 1,400mm in the north and in 2018 Aurecon (2018a) reported an average of 600 mm in the south and 1,200 mm in the north and a possible variation from 508 to 1,270 mm per annum.

Aurecon (2018a) records that Zambia is divided into five climate-ecological zones based on the amount of annual rainfall and land form. The zones are classified as plateau with higher rainfall, plateau with medium rainfall, montane; Kalahari sand with higher rainfall, Kalahari sand with medium rainfall, and the valley. The Koppen climate classification further simplifies the climate into four zones, which highlights the limited diversity of the climate within Zambia (see Figure 2).

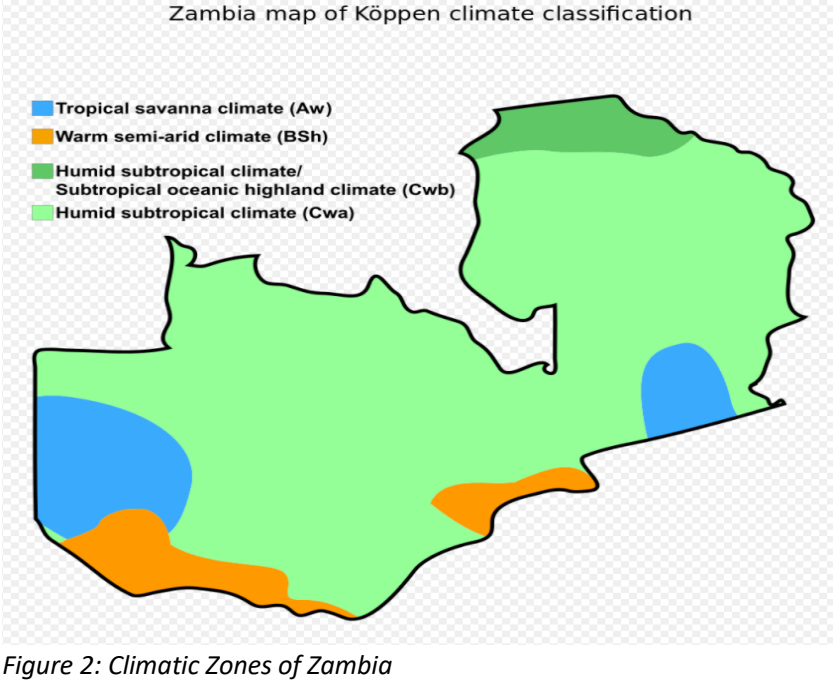


Figure 2: Climatic Zones of Zambia

Seasonal variations in river flow, following rainfall distribution, peak between March and April with low flow periods between October and November. Extreme inter-annual variations are observed and there is a high probability that at least one agro-ecological zone will experience extreme weather events in any given year. Annual runoff can be as high as 130 cubic kilometres (Km^3) per year in a high rainfall hydrological year, in contrast to severe drought years where average runoff has been recorded as low as 68 Km^3 per year. Global Circulation Models of climate change predict that over the next 20 to 30 years, Zambia will experience increasing temperatures, with longer dry periods, more intense rainfall and increased storm events (*Zambia CWRAS background study: WB / IFPRI, 2008)*.

5.3.2 Hydrometeorological Situation

The hydrometeorological network (combination of meteorological and hydrological measurement systems) covers the full extent of Zambia's six water management areas, as shown in Figure 3, namely Tanganyika, Chambeshi, Luapula, Luangwa, Kafue, and Zambezi river catchments. These six river basins represent Zambia's water resources and lie within the Zambezi River basin and the Congo River basin which are major transboundary river basins.

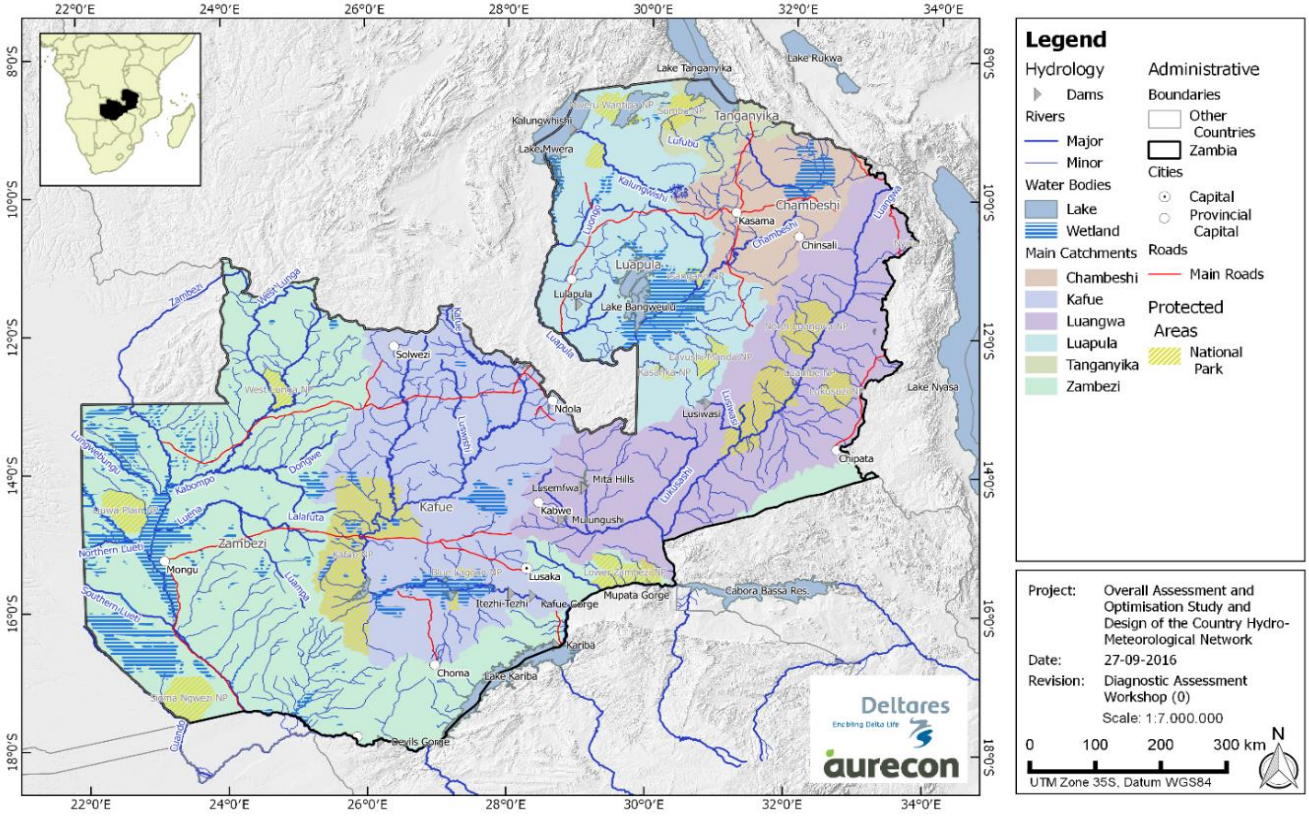


Figure 3: Six Major River Catchments – Zambia (Source: Aurecon, 2018)

5.3.2.1 Meteorological Network

ZMD operates a total 69 automatic weather stations, which according to Aurecon (2018a) provide adequate coverage for Zambia with minor additions to improve coverage in the northeast region of the country and so recommended that Kasama, Chinsali, Mpika, Mbala, Mfuwe and Chipata be upgraded to AWS first to improve the coverage. In addition a new station at Shiwang'andu was proposed to be opened for the same purpose. The network will be further enhanced as the remaining manual stations are upgraded through replacement of manual instruments with automatic instrumentation. The meteorological stations network may be divided into four sub-networks namely; (i) Synoptic, (ii) Climate, (iii) Agro-

climate, and (iv) Rainfall. The rainfall sub-network covers stations from all the three sub-networks plus the 164-automatic hydrometric network to be established.

By the end of 2017, 16 of the 38 manual ZMD synoptic and agro-climate stations had been upgraded to automatic weather stations (AWS) under the SASSCAL, COMESA, CIEWS and WFP projects (Aurecon, 2018). Table 5 shows the suite of sensors installed under each donor funded project. The projects aim to strengthen climate monitoring capabilities as well as to increase the availability of information to plan for and adapt to climate shocks and climate change in Zambia; and also for agriculture purposes.

Table 4: Installed Sensors for Measuring Meteorological Parameters by Donor Project

Project	Sensors									
	Temperature	Rainfall	Pressure	Relative Humidity	Wind Speed	Wind Direction	Evaporation	Radiation	Soil Temperature	Soil Moisture
SASSCAL	√	√	√	√	√	√		√	√	
CIEWS	√	√	√	√	√	√		√	√	√
COMESA	√	√		√	√			√		
UNDP/MAL	√	√		√	√	√				
WFP	√	√		√	√	√		√		
SADC	√	√	√	√	√	√		√	√	

Gaps have been identified in the existing network and the above donor funded interventions, and these include:

a) Limited specific geographical coverage of the weather stations in the north-eastern part of the country, more so the AWSs. However this is reported to be a minor issue.
b) Where AWSs are installed there are sensors for key climatic and agricultural parameters that are missing. For example the agro-climate stations upgraded under UNDP/MAL and WFP require additional sensors for radiation, soil temperature, and soil moisture.
c) While WARMA desires a more wide-spread network of automated rainfall stations for its optimal network requirements, ZMD can only install automated gauges at its priority stations which are few in number for flow forecasting and hydrological modelling.
d) Inadequate capacity for data analysis and modelling for improvement of forecasts and for realising products and services

The rainfall network forms the largest single meteorological sub-network and is currently largely operated by volunteers, and the volunteer operators include WARMA, agricultural and learning institutions, missionaries, power utilities (ZESCO and Lunsemfwa Hydro), and Zambezi River Authority or ZRA (Aurecon, 2018a). WARMA operates the largest number of rainfall stations among the volunteer partners in order to meet its own operational needs but very few of the rainfall stations report in real-time, whereby observers make daily observations at 8:00am and send at the end of month as hard copy records.

ZMD alternatively and in parallel to rain gauges, uses Geo-stationary satellites such as the Meteosat and polar orbiting satellites such as the NOAA series, in order to provide data at a resolution sufficient for monitoring of rainfall events at a much wider scale (Nawa, 2009). Currently rainfall information is produced by ZMD and disseminated to various users including farmers, researchers, water resource managers, water utility companies, decision makers, private sector players and the public.

Aurecon (2018a) reports that Zambia, as a WMO member country, can access a suite of satellite and modelled products from the European Centre for Medium Range Weather Forecasts (ECMWF) which cover short range to seasonal forecasts and that all the products are available in a digital graphic chart format. Furthermore, ECMWF forecast products are considered to be one of the best in the world, but validations reported for rainfall newscasts (zero lead time) gave a poor 20% fit to daily values. Similarly, satellite estimates of stream flow exhibited a wet bias in the winter due to uncertainty in evaporation and the recent history of non-reporting in Zambia. So the need for AWS is critical to improve monitoring and forecasting capabilities in the responsible institutions.

Particularly ZMD needs:

- strengthening in data analysis and modelling capacity to improve its operations and to provide reliable and timely services;
- to better use remote sensed and globally modelled products for forecast improvements and for the generation of products and services over the medium –term (2-3 years).

The recent improvements of the meteorological network under the SASSCAL, CIEWS, COMESA, UNDP, WFP, and RANET supported projects have substantially increased the coverage, reliability, and availability of data being provided by the meteorological network but further investment in modernizing the network should be directed towards addressing network gaps and ensuring key stations are automated and reporting reliable data in near real-time.

5.3.2.2 Planned improvement of the meteorological network

According to Aurecon (2018a), the planned improvement of the meteorological network is part of the project, "*The Overall Assessment and Optimization Study and Design of the Country Hydrometeorological Network* (referred to as the *HydroMet project*) aimed to support the operationalisation of the Water Resources Management Authority (WARMA) and its Catchment Councils. The study is supported by the World Bank under its Zambia Water Resources Development Project (ZWRDP) running from 2013 to 2018. The project has done detail design of the establishment of a modernized meteorological monitoring network in tandem with the hydrological network.

Strategic considerations include:

- the need for the modern observational network to continue observations at stations associated with long periods of records, to preserve long term climate data and information, and the need for observations reported in near real-time to support operational numerical weather prediction models. The numerical models have been shown to be capable of interpolating between observations to provide improved spatial weather information as well as reliable forecasts. However, the timeliness of weather observations is critical in the calibration of satellite estimates of rainfall, evaporation, and run-off.
- strategies related to sustainability and capacity, core functions that have a broad influence on the effectiveness of other functions, pressing priorities that must be immediately addressed, and investments that will generate service improvements.
- strategies related to sustainability by ensuring that development of the optimal meteorological network matches the available institutional capacity to operate and maintain the network, to manage and protect the data, to process and analyse the data, and to use the processed data and information for decision making.
- need for a representative and reliable data observational network supported by an effective collection and transmission system to support a well-functioning meteorological program. The core of a well-functioning meteorological network is the data management system. The data management system links the field observations to a common data system for data processing, quality control, and data archiving. It provides the common entry point for data analysis, the generation of information, and data access to the broader user community.

The actions proposed for implementation during Phase E of the HydroMet Project support the need for an improved data collection and transmission system followed by the enhancement of weather and climate analysis, modelling, and forecasting capability.

- further investment in modernizing the network should be directed towards addressing network gaps and ensuring key stations are automated and reporting reliable data in near real-time.

- priority in the first 6 months of implementation, should be to improve the reliability and utility of the data being supplied by the network through investments in maintenance and servicing training, the onward transmission of data to WMO, and the use of remote sensed and globally modelled products. Priority must be given to resolving the non-availability of data for Zambia on WMO's Global Telecommunication System (GTS).

- The SASSCAL network with 19 AWS, two of which are for research purposes and do not meet WMO standards, is mainly a synoptic-climate network. Its coverage is however skewed, with gaps in the north-eastern part of the country. Additional auto-stations are required in the Kasama area to address the gap.

The details of the refurbishment and modernisation plan of the meteorological network, following a phased approach, were developed using a desk study approach. The identified actions take in to account short (1 year), medium (2-3 years), and long-term (4-5 years) needs. According to Aurecon (2018), the scope of work required to achieve the optimal hydrometeorological network program includes:

1. Procurement of additional automation equipment and rehabilitation of observational sites
2. Installation and commissioning of AWS equipment with telemetry for real-time reporting
3. Engagement of an ICT software development expert to address the non-reporting of Zambian data on the WMO GTS and help with the data migration from CLICOM to CLIMSOFT database
4. Training of ZMD service staff in fault detection and diagnostic of AWS and in the maintenance of auto meteorological sensors
5. Training in data management and data quality control of the CLIMSOFT database system
6. Training in the use of a numerical weather prediction model for improved local forecasts
7. Training in the use of satellite derived meteorological products and analysis tools for improved rainfall estimation and forecast services

Required actions are listed below.
Short-term Actions (Year 1):

- ZMD's data availability to WMO Centres
- Data migration from CLICOM to CLIMSOFT
- Capacity building workshop for servicing and maintaining the AWS network
- Development and capacity building strategy for ZMD

Medium-term Actions (Year 2 to 3):

- Rehabilitation of manual stations
- Procurement and Installation of equipment
- Upgrading of Existing AWS
- Community awareness

Long-term Actions (Year 4 to 5):

- Continued use of the community sensitization program on the importance of meteorological stations

- Continued data rescue support to ensure all historical climate data is captured in the database management system
- Updates to operational Standard Operating procedures (SOPs), as required
- Review of the network distribution and preparation of recommendations on adjustment to the number of stations, the need for new stations, and the need for operational improvements.

Although satellite coverage is vast compared to surface observations, without real-time observations reported to WMO the sub-daily rainfall errors exceed 50% for satellite and for model forecast products. Therefore, to improve the reliability of the modelled rainfall estimates, there is a need to automate the reporting of rainfall observations in near real-time. Once the rainfall reports are received in real-time for operational data assimilation, then global Numerical Weather Prediction centres can offer a wide range of valuable products to support weather forecasts, flood and drought warnings, and seasonal to hourly gridded meteorological and climate datasets. These products can significantly enhance meteorological services without major investments in meteorological observing networks, but only if they are initialized with local data from the observing networks.

5.3.2.3 Surface Water Quantity Network

In addition to the Surface Water Quantity network and Meteorological, the HydroMet Network Optimisation Study by Aurecon (2018c) included the design of the initial Groundwater Monitoring network, Surface Water Quality network and the Sediment network as key parts of the national hydrometeorological network. For purposes of the topic at hand (drought), only the surface water and groundwater networks are considered. A total of 65 out of 164 optimal hydrometric stations were upgraded by the end of 2017 under the KfW and Southern Africa Development Community (SADC)-HYCOS projects after a period of decline during the past 30 years. The 164 were prioritised out of the 334 stations in the Master Stations Register in consultation with key stakeholders.

5.3.2.4 Planned improvement of the Surface Water Quantity Network

Various factors or challenges that have hindered the achievement of a well-functioning and sustainable hydrometric network in Zambia were stated by Aurecon (2018b) as follows:

- Declining number of monitoring sites over the past 30 years
- Inadequate spatial coverage of operational monitoring stations
- Lack of maintenance and / or significant time delays to fix problems at monitoring stations
- Infrequent and irregular visits to monitoring sites by responsible officials
- Too few permanent gauge readers due to inadequate and irregular government funding
- Unmotivated gauge readers due to non-payment or lack of visits by responsible officials
- Stream-flow gauging station rating curves often missing or outdated
- Data quality control procedures lacking or inadequate
- Accessing hydro-meteorological data is awkward, slow and inefficient
- Poor collaboration between monitoring institutions leading to duplication and ineffective data-sharing

The strategies considered for the surface network are similar to the ones under the meteorological aspects stated above but on the ones specific to surface water network is [for Phase E (6 months' time)] *to improve the Operation and Maintenance of the upgraded network with emphasis on improved reliability and utility of the data being supplied through support to on-the-job training and the development of rating curves.* The recommended actions:

Short-term Actions (Year 1):

- Ensure that the 67 ZHP stations upgraded under the KfW and SADC-HYCOS projects are functional and all stations with poor communications be upgraded to satellite telemetry

- Procure a consultancy to support WARMA with a comprehensive review and update of all rating curves for the existing network of 108 operational stations
- Prepare SOPs for the operation of auto-hydro stations and the conduct of discharge measurements
- Implement a community sensitization program on the importance of gauging stations
- Improve operations at the manual stations within the network of 108 operational stations through maintenance and repairs of the manual stations
- Consider implications of the KfW Phase 2 project on the rehabilitation of the proposed optimal network

Medium-term Actions (Year 2 to 3)

- Continue with the updating of rating curves for the existing network of 108 operational stations and the new sites installed
- Rehabilitate 28 ZHP Priority-1 stations not included in the KfW project with a number of sites equipped with rain and meteorological sensors
- Continue with community sensitization program on the importance of gauging stations.

Long-term Actions (Year 4 to 5):

- Rehabilitate 59 ZHP Priority-2 and Priority-3 stations and the 10 new stations to bring the network to an operational status of 164 station reporting in real-time with a number of sites equipped with rain and meteorological sensors
- Continue with the development and updating of rating curves for the full network, as required
- Continue with community sensitization program on the importance of gauging stations
- Update operational SOPs, as required
- Complete a review of the network distribution and prepare recommendations on adjustment to the number of stations, the need for new stations, and the need for operational improvements

The optimal network includes 27 stations operated by ZRA, ZESCO, and LHPC, plus one new transboundary station, three new water balance stations, five new Hydrology Response Unit (HRU) reference stations, and one dual HRU-transboundary station. The optimal network is further grouped according to a number of categories as shown in Table 5. Of the 164 sites, discharge data will be collected at 96 sites.

Table 5: Description of Optimal Surface Water Quantity Network

Description of stations	No
Stations rehabilitated with KfW support	57
Stations rehabilitated with KfW and/or SADC-HYCOS support	6
Stations to be rehabilitated with SADC-HYCOS support	4
ZHP 1 stations that have not yet been rehabilitated	28
ZHP 2 and ZHP 3 stations that have a functional score of more than 0.5	59
New stations representing unique HRUs	5
New stations for monitoring of transboundary flows, and water quality	1
New dual (HRU/Transboundary) function stations	1
New water balance stations	3
Total number of stations	164

The network of 164 stations were further classified into three key network functions: National Reference, Basin Hydrology, and Operational/Project. Stations (23 existing and 2 new ones) that make up the National Reference network

satisfy international and transboundary requirements or represent large basin and have a long period of record. The Basin Hydrology network stations are those which have a long period of record, represent medium size basins, and satisfy water balance, water quality, and sediment information needs. Basins identified through the HRU analysis are part of this network. Thirty-six existing stations and five new stations have been identified as being part of the Basin Hydrology Network. Stations that make up the Operational/Project network are those that provide information to address ongoing operational or short term informational needs with respect to issues in the catchment. Ninety-five existing and three new stations have been identified as being part of the Operational/Project network.

It is important to note that auto-rain gauges will be installed at all hydrometric sites that have suitable exposure for the placement of a rain gauge and that complement the rainfall observing network by increasing spatial resolution. As well, a select number of hydrometric sites, most likely those sited near reservoirs or have good open exposure as required by WMO, will be equipped with a suite of meteorological sensors for the determination of potential evaporation and climate information. The rainfall and meteorological data will be shared with ZMD and will supplement ZMD's rainfall and meteorological network.

The surface water quantity monitoring network is benefitting from the countrywide increase of cell phone coverage or GSM/3G/4G network in terms of mode of data and information transmission from remote gauging stations, especially in the pre-urban and rural areas. As a result, currently 125 out of the 164 existing optimal network stations are covered by cell phone, representing 81% coverage of the station network. It is important to note that the satellite telemetry coverage using the EUMETSAT system provides 100% coverage and is provided freely to government agencies of WMO member countries.

5.3.2.5 Groundwater Network

Currently groundwater monitoring is limited to specific areas of the country, for example, in Lusaka Province, Central Province and Copperbelt Province with limited coverage. Owing to limited availability of reliable ground water data and limited access to hydrogeological information for aquifer identification, the development of an informed national ground water network at this stage is difficult and so, as a starting point for the design and implementation of a national network, an initial ground water network was been designed by Aurecon (2018c). The design of the initial national ground water network is focused on priority areas with existing ground water issues, where agriculture and mining developments are of concern, and urban areas dependent on ground water for water supply.

The designed initial ground water network consists of 206 ground water level and 276 ground water quality monitoring locations of which there are 119 new GW-level observational wells and 70 additional GW-quality wells. For the new GW-quality wells, existing production wells are proposed. For every province a minimum of 17 GW-level and 22 GW-quality monitoring wells have been assigned.

The proposed development steps of the ground water programme are:

1) Undertake an extensive data recovery programme
2) Field assessment of the ground water systems of Zambia
3) Design a national ground water monitoring network
4) Implement the national ground water monitoring network
5) Improved information access: web-portal and graphical user interface (GUI) to assess new permit applications
6) Set up a conceptual ground water model for evaluating new permits.

The prime strategy for implementing developments steps 1 to 4, which lead to an operational national ground water network, will be use a stepwise 'hotspot' approach. This means that these development steps will be carried for each 'hotspot' one at the time and not for the entire country all at once.

Furthermore, the report provides information and details on the logistics plan, institutional plan, capacity strengthening plan, and SOPs needed for the implementation of the national ground water programme.
Phase E of the project will involve support to the Government in and supervision of all aspects for the establishment of the preferred option, including information management and technology, thereby delivering a modernized hydrometeorological monitoring system for all of Zambia and one which serves the region's data needs.

5.4 Drought Analysis

Drought may be considered as a period in which rainfall consistently falls short of the climatically expected amount, such that the natural vegetation does not flourish and agricultural crops fail while low rainfall more seriously affects industrial and domestic water supply (YEC, 1995). YEC (1995) used the Herbst Method of evaluating drought from rainfall data which confines the definition of droughts specifically to periods in which rainfall deficits were in excess of average deficits. Thus the sequences of months with extremely dry conditions are identified beyond the shortfalls in monthly rainfall amounts that are normally experienced in some months of each year. The method was applied to long-term rainfall records at all meteorological stations in Zambia.

The analysis revealed top ten droughts according to their severity index shown in Table 6. Livingstone had the highest drought severity which lasted 107 months from January 1979 to November 1987 but the drought intensity was not so high compared to other stations. Mbala (not in the table) was reported to have the highest drought intensity with 42% of mean rainfall for the 19 months duration.

Table 6: Ten maximum droughts in Zambia

No.	Station Name	Province	Period	Duration (months)	Intensity	Severity	% of Mean Rain
1	Livingstone	Southern	79/01–87/11	107	1.54	165.3	84.4
2	Kasama	Northern	48/11-55/10	84	1.64	137.4	83.2
3	Mongu	Western	81/04-88/12	93	1.26	117.5	81.6
4	Lundazi	Eastern	69/01-77/11	107	1.02	108.6	80.6
5	Mpika	Northern	89/06-94/09	64	1.54	98.7	77.5
6	Kasempa	N/Western	80/12-85/12	61	1.4	85.7	82.6
7	Zambezi	N/Western	81/04-87/08	77	1.09	83.7	82.8
8	Kabwe	Central	86/11-92/10	72	1.13	81.6	77.5
9	Kasama	Northern	56/05-61/10	66	1.10	72.6	89.1
10	Kafironda	Copperbelt	85/03-90/12	70	1.01	70.4	85.4

Source: YEC (1995)

Regional variations of droughts based on rainfall records at 24 meteorological stations from 1963/64 to 1992/93 were investigated by YEC (1995) and it was found that drought severity was:

- very high in the southwest area from Mongu to Livingstone (80-160) and high near Lundazi (100) to the east;
- moderate (60-80) in the centre of Zambia from east to west; and
- low northward (less than 60).

The Zambian average of the severest droughts at each meteorological station was found to be:

- Drought duration, 58 month
- Drought intensity, 1.36
- Drought severity, 68.7

5.5 Drought Impact Assessment

Drought impact assessment can be approached from various angles depending on the societal or environmental element that is affected.

YEC (1995) relates drought impact to water availability. For example, the surface water potential or the total amount of water produced in a given area in drought year with a 10-year return period was assessed to be 57% (136.2 million cubic metres or Mm^3/day) on average compared to the amount in an average year (237.3 Mm^3/day). Regional variations in surface water potential are shown in Figure 4 and Figure 5. In Central, Lusaka and Southern provinces the ratio was found to be much lower (23-34%). Parts of these provinces lie in Agro-ecoregion I, which covers the drought prone areas in Zambia. Another example, Southern, Lusaka and Copperbelt provinces have relatively low surface water resources potential, 5.3, 10.8 and 13.0 Mm^3/day (million cubic metres/day) in the case of average year; and 1.2, 3.7 and 6.6 Mm^3/day in the case of drought year, respectively. Given the high populations in these provinces the situation worsens in terms of per capita water potential which drops from 6-11 m^3/ day/capita in the case of average year to 1-5 m^3/day/capita in the case of drought year. A further comparison is provided of the provinces with the highest water potential in Zambia (Northern and North-Western provinces) which have 67.5 and 38.9 Mm^3/day in the case of average year and 44.8 and 21.5 Mm^3/day in the case of drought year. Water bodies in the north, namely, Luapula River, Chambeshi River and Lake Tanganyika have more surface water resources potential per unit area of $1km^2$, ranging from 478 to 632 m^3/day/km^2 in the case of average year; and 323 to 345 m^3/day/km^2 in the case of drought year, compared to rivers in the south (Zambezi, Kafue and Luangwa). The rivers in the south have water potential of 189 to 396 m^3/day/km^2 in the case of average year and 93 to 198 m^3/day/km^2 in the case of drought.

The above examples shows that the impact of drought with a 10-year return period results in more reduction of surface water availability in the southern half of the country than in the northern half. This in turn has a knock-on effect in terms of the economic sectors (agriculture, hydropower, manufacturing and construction industry, mining and tourism) and social sectors (water supply and sanitation, navigation, culture) that are heavily dependent on water and have most of the investments in the south and in the Zambezi, Kafue and Luangwa river basins. Kafue basin alone hosts about 40% of Zambia's population and most the industrial development.

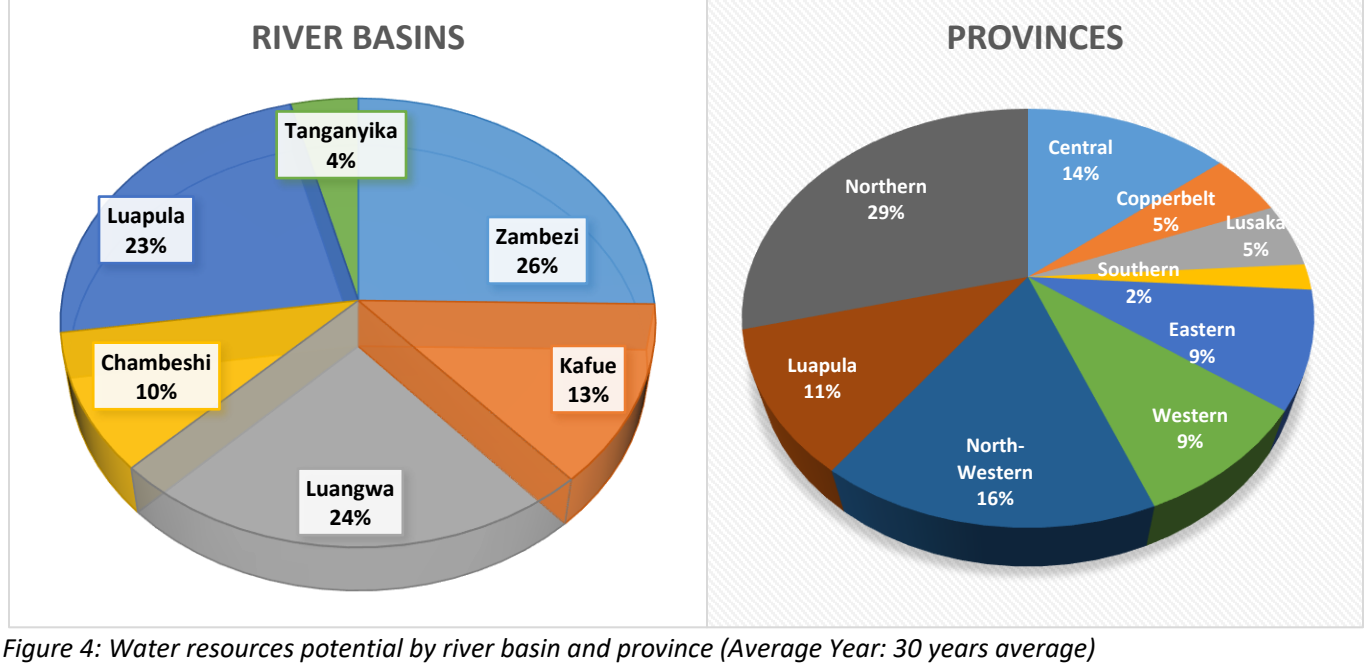


Figure 4: Water resources potential by river basin and province (Average Year: 30 years average)

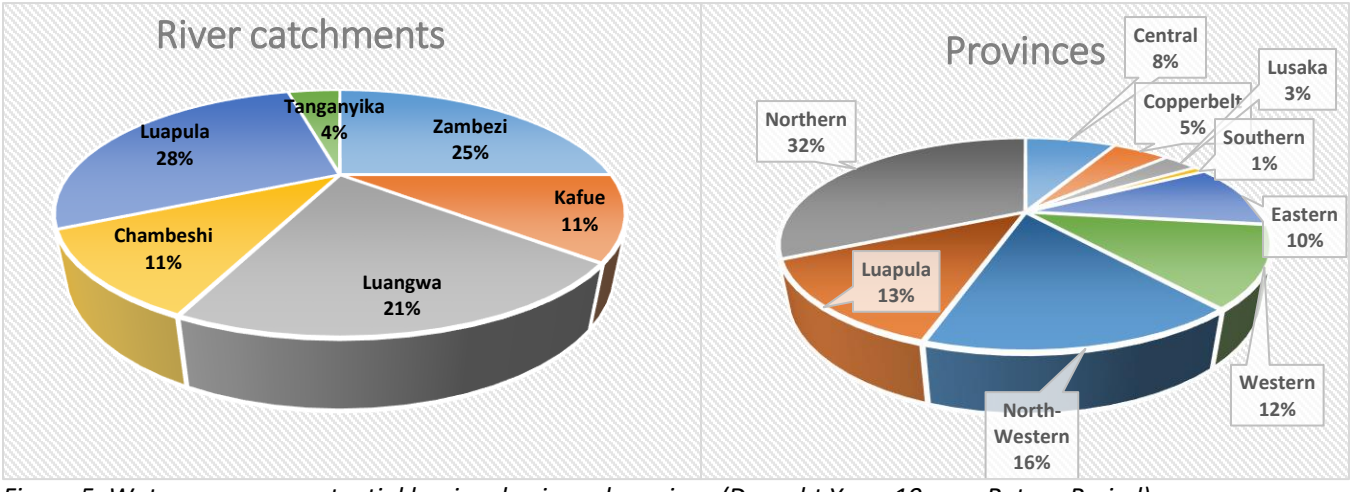


Figure 5: Water resources potential by river basin and province (Drought Year: 10-year Return Period)

The assessment of impact of drought is mainly coordinated by DMMU involving a number of government and stakeholder institutions and organisations already stated in this document. A notable vehicle in this regard is the Zambia Vulnerability Assessment Committee (ZVAC) which carries out assessment of impacts arising from extreme weather events mainly in the form of floods and droughts. Various instruments are used to generate the information required in disaster management interventions and these include the Rapid Vulnerability Assessment; In-depth Vulnerability Assessment; and the Comprehensive Vulnerability Assessment and Analysis.

An example of the information generated is provided in 8 which shows that two drought- and three dry spell - events were recorded from 2003 to 2016 which affected an average 335,000 households each year of the event.

Table 7: Number of households affected by extreme weather events in Zambia

YEAR	2003	2005	2007	2008	2009	2010	2012	2013	2014	2015	2016
HAZARD	DRAUGHT	DRAUGHT	FLOODS	FLOODS	FLOODS	FLOODS	FLOODS/ DRY SPELLS	DRY SPELL	FLOODS	DRY SPELLS	DRY SPELLS
CENTRAL		277,632		32,232	18,174	3,258		53,637		4,573	12,063
COPPERBELT				23,582							
EASTERN	10,349	118,643		32,352		9,800	10,661		26,461	60,498	32,498
LUSAKA	2,655	49,677		211,066		3,753		19,016			8,967
LUAPULA				9,024				18,094	3,436		
SOUTHERN	46,935	429,132		130,086		19,024	47,097	87,490			75,366
NORTH WESTERN		23,774	71,548	14,490	67,115	2,445	5,084		748	5,249	
NORTHERN/ MUCHINGA			244,715	74,028	25,361			16,071	6,128		
WESTERN		333,804	124,603	96,592		34,459		15,188	18,252	29,805	42,732
TOTAL	**61,942**	**1,234,667**	**442,873**	**625,460**	**112,659**	**74,749**	**64,854**	**211,509**	**57,039**	**102,140**	**173,642**

(*Source: ZVAC, 2016*)

5.5.1 Documented impacts of climate change related to drought and water resources

The National Climate Change Strategy or NCCRS (MTENR, 2010) quoted the Global Environment Outlook 2000 (GEO 2000) which stated that "Zambia is one of the very few Sub-Saharan Countries that is water-secure". The NCCRS notes that although Zambia has abundant water resources, it is not shielded from climate change challenges related to the water sector and indicates that pockets of semi-arid areas can be found within the country. It is also stated in the NCCRS that

the current as well as projected shifting in rainfall patterns (e.g., decreases in SON rainfall and increases in DJF rainfall particularly in the northeast of the country as depicted by McSweeney *et al*. (2008) have a major influence on the country's socio-economic development. The inadequacy of water capture and storage infrastructure in the country is yet another challenge in the water sector (World Bank, 2009.

The NCCS further illustrates the potential climate change impacts in the water sector related to drought as depicted below:

- The impacts of climate change on Zambia's water resources can be summarised as "either too much or too little rain"15. This translates into either floods or droughts, with the former being the more frequent and more devastating in Zambia.
- Similarly, an increase in the frequency and severity of ENSO-linked drought episodes has been observed. It is not possible to state with certainty that all droughts are brought about by the ENSO phenomenon alone. It is also not possible to predict that each El Niño event would result in a drought (Clay *et al*. 2003). What has been observed is that severe droughts in Zambia, especially those experienced in the 1990s, coincided with ENSO events.

If this trend continues (as projected with the rising atmospheric GHG concentrations), then we are likely to see a reduction in the volume of water bodies. The NCCRS quotes Nkomoki *et al*. (1999) model prediction of a decrease in the annual precipitation throughout Zambia by the year 2075, with drought episodes projected to become more frequent in Region I (southern Zambia). High evaporation rates due to the rising atmospheric temperatures would only worsen the situation.

The main impacts of drought as identified by local communities in Zambia include:

a) Crop damage/loss, leading to food scarcity and hunger
b) Water shortages
c) Reduced fish stocks
d) Income loss
e) Reduced charcoal business
f) Increase in diseases (affecting humans and animals)
g) Decreased water quality
h) Increased soil erosion
i) Decreased soil fertility
j) Increased honey production (if drought is not too severe)

5.6 Drought risk and vulnerability

Zambia's economy is the vulnerability and faces increasing constraints presented by frequent droughts and floods (MTENR, 2010), hydrological variability and seasonal water shortages, compounded by growing water demand from the major sectors of the economy and limited water infrastructure. Mitigating the negative impacts of floods and droughts through development of a sound infrastructure platform to secure the productive use of water resources is central to continued economic development and safeguarding sustainable livelihoods. The lack of infrastructure in the water sector currently exposes the economy to significant risks that have the potential to undermine the recent gains. Recurrent floods and droughts over the past three decades are estimated to have cost Zambia US$13.8 billion, a 0.4 percent annual loss of economic growth. Climate change is expected to increase the intensity of these events and further impact on the national economy. In the absence of investments in adaptation measures and an appropriate infrastructure platform, rainfall variability alone could keep an additional 300,000 more people below the poverty line and cost Zambia US$4.3 billion in lost GDP over the next decade, reducing annual GDP growth by 0.9 percentage points (World Bank, 2010).

The Zambia Vulnerability Assessment Committee (ZVAC) analyses risk and vulnerability resulting from hazard events like drought at national, district, community and household levels using district-, community- and household- questionnaires; and focus group discussions with key informants. The use of the Livelihood Zone approach by ZVAC is recommended for disaster risk reduction purposes. A representation of Zambia's livelihoods is given by the Zambia Livelihood Map Rezoning and Baseline Profiling (2004) prepared by the ZVAC (Table 8). The zones are profiled against agro-climatic peculiarities and a total of 16 are given. Livelihoods are defined as the means by which households obtain and maintain access to essential resources to ensure their immediate and long term survival. In Marxian terms, livelihoods are defined as the way society generates social values; in product and labour forms.

The Zambia Livelihood and Profiling system employs a household economy approach, organised around the concept of Disaster Risk Reduction framework. Accordingly, risk is understood as being dependent on an array of hazards and vulnerabilities that households face, underpinned by their coping strategies. Hazards are derived from information related to either natural or social and economic factors. Thus, hazards range from climatic elements, such as rainfall; floods or droughts, production and market (failure) factors; policy and institutional factors and access to information and services. Risk therefore is the combination of the information related to these factors, revealing the likelihood of gaps in food or income at household levels. Using information available from the Central Statistical Office (CSO) on household sources of food and income for each zone, it is possible to assess vulnerability to particular events (that is, which stresses will impact which populations and how).

Table 8: Population of Zambia by Livelihood Zones

Zone	Code	Zone name	Population	Pop.%
4A	Central	Maize-Cotton	332,952	0.03
4B	Chama-Lundazi	Rice	413,905	3.17
12A	Chiawa-Zambezi	Lowlands	138,404	1.06
7B	Chongwe-Nyimba	Plateau	117,513	0.90
2A	Copperbelt	Mining	2,173,983	16.66
5B	Eastern province	Cash crop	1,053,696	8.08
11A	Gwembe	Valley	362,983	2.78
16B	Kaputa	Rice	39,171	0.30
7A	Kazungula-Mwandi	Plains	257,222	1.97
11B	Lake Kariba	Fishing	16,974	0.13
5A	Line of rail	Commercial Farming	3,137,586	24.05
15C	Luangwa-Mfuwe	Valley	117,513	0.90
7C	Luano	Valley	244,165	1.87
15B	Luapula	Valley	322,507	2.47
16A	Luapula	Northern wetlands	212,828	1.63
12B	Mambwe-Petauke	Valley	154,072	1.18
13	Mkushi	Commercial Farming block	90,093	0.69
3B	Muchinga	Escarpment	82,259	0.63
3A	Mufumbwe	Kasempa	385,180	2.95
9	Mulobezi	Woodlands	23,503	0.18
2B	Northern province	Plateau	1,278,276	9.80
1A	Northwest	High rainfall	262,445	2.01
6	Sioma	Plain	488,330	3.74
1B	Tuta-Luapula	Corridor	778,194	5.96
10B	Zambezi	East	129,264	0.99
14	Zambezi	Floodplain	91,399	0.70
10A	Zambezi	West bank	342,092	2.62
Total	Total population	0	13,046,508	100.00

Source: Zambia Livelihood Map Rezoning and Baseline Profiling (2014). Population estimates by Study team (CSO, 2011)

Figure 6: Livelihood Zone Map of Zambia (source: DMMU, 2014)

5.7 Gender: risks and vulnerability of women and children

The paper by Lwando (2013) highlights the risks and vulnerability of women to climate variability in form of droughts. Most of the considerations similarly apply to children. The following key issues are derived from Lwando (2013):

a) Drought affects the livelihoods of both men and women, but women are the hardest hit. Children are equally hardest hit, and may be more vulnerable

b) The adaptive capacity of mostly women is quite low due to a number of factors such as low economic status, low education levels, lack of skills and lack of access to assets, all these factors have not been gender neutral. Children's adaptive capacity is equally affected like the women

c) Drought results in the reduced availability of natural resources such as water, fish, trees, timber, mushrooms, honey, fuel wood and medicinal plants. The reduction in forest cover and non-availability of natural resources affects mostly women since they have to walk long distances to fetch valuable natural resources and increased their work burden, limited time available for food production and preparation and has also reduced their participation in income generating activities as well as educational opportunities.
d) Drought leads to reduction in water resources availability and with the likely deterioration in ambient quality of water bodies and water supplied due to high dissolved solids. Thus women and children who are the managers of water in households are more likely to get sick if they consume or come in contact with water of poor quality.
e) Arising from d), children especially the girl child is likely to be forced to miss classes in order to fetch water for the household.
f) Due to water shortage, and hence people (especially women and children) not having enough water to clean up and wash food, public health is threatened and there is a high risk of diarrhoea and other water borne and related disease epidemics or infections. And when there is an epidemic lives may be lost before interventions take effect.

Way Forward (Proposed actions)

a) A gender perspective has been an integral part of climate change thinking and policy in Zambia. The impacts of climate variability have not been gender neutral, and the government has recognized that policies cannot be effective unless they are gender aware, taking into consideration the different needs of women and men, the inequalities that compound the impacts of climate change for women and the specific knowledge women and men can contribute to solutions for adaptation and building resilience but has however lacked a gender responsive funding allocation and disbursement.
b) There is need for the government to put up a consolidated implementation plan as a follow up to the policies and work out measures for sustainability instead of entirely depending on donor support. Donors should consider supporting civil society organizations both at local and national level to hold climate change related policy makers to account for their political commitment to gender equality.
c) Given the strategic dependence of women and men's livelihoods on natural resources in the country, efforts will be required to implement effective and longer-term agro-meteorological programs to adapt production systems to climate variability (droughts).
d) Multi-disciplinary institutional capacity is needed to develop local level analytical frameworks to provide sound practical guidelines for longer-term investment in food security related infrastructure for disaster mitigation at district level and for evolving livelihood adaptation strategies and risk management at local level.

6 DROUGHT MITIGATION AND PREPAREDNESS STRATEGIES

6.1 Introduction

Drought mitigation and preparedness approaches in Zambia are both sectoral and cross-sectoral in nature. The former approach has been found to be largely ineffective over the years and hence the policy to bring drought and other disaster management issues under one institution to coordinate all such activities. The Disaster Management and Mitigation Unit (DMMU) in the Office of the Vice President was formed to handle this coordination. However this role needs further strengthening along with the role of institutions such as the Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP), Water Resources Management Authority (WARMA), Department of Water Resources Development (DWRD); Department of Water Supply and Sanitation (DWSS), National Water and Sanitation Council (NWASCO), Zambia Meteorological Department (ZMD); Zambia Environmental Management Agency (ZEMA), Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Local Government, Ministry of Ministry of Infrastructure and Housing and other government and quasi-government institutions; Non-governmental and other civil society organisations; and the private sector.

Weaknesses in the above stated framework with respect to drought preparedness and mitigation are similar to the ones identified in the EU policy, institutional and legislative framework according to the paper by Rossi and Castiglione (2011):

- Tools missing with respect to:
  - Advanced water stress monitoring indices
  - Identification of areas vulnerable at risk of drought and water scarcity
  - Assessment of the effects of quantitative measures (e.g., water saving and water reuse)
  - Organisation of initiatives to foster public awareness on water shortage issues
- Financial instruments are not adequate since:
  - Financial lending encourages water demanding crops (e.g., wheat) in water stressed areas
  - Allocation of funds is not at catchment (basin) or district level
  - Funding for disaster management is tilted towards flood damages recovery rather than drought
- Legislative Acts are missing with reference to:
  - Standards for non-conventional water use (e.g., treated wastewater)
  - Specific regulations for water resources management (surface and groundwater)
  - Water saving for water uses (municipal, irrigation, industrial)

Required criteria:

1. Develop a national drought monitoring system in order to support a pro-active approach towards drought risk management
2. Identify and implement adequate drought preparedness and mitigation measures able to avoid the most severe water shortages in supply systems and avoid harmful impacts on people, economic activities and the environment; and
3. Define the emergency actions to be implemented in the case of a drought declared as a natural disaster.

Therefore, the proposed strategies in this documents will address this weakness, guided by principles of disaster risk reduction and other best practices and experiences from countries that have successfully implemented drought emergency and mitigation programmes.

6.2 Proposed Strategies for Drought Preparedness and Mitigation

The following strategies are therefore proposed:

1. Improving water efficiency
    - Improving efficiency in agricultural use of water
    - Introducing water saving devices and practices in buildings and promoting water-efficient construction
    - Reducing water leakages in water supply distribution systems
2. Achieving better planning and preparedness to deal with droughts
    - Integrating actions against water scarcity and drought into other sectoral policies (agriculture, industry, domestic)
    - Assessing the adequacy of catchment management plans on drought and water scarcity issues
    - Developing an early warning system on drought
    - Defining a more comprehensive list of indicators of drought, water scarcity and of vulnerability of water resources
3. Developing adequate implementation instruments of financing, water pricing, water allocation research and education
    - Encouraging national funding of drought risk
    - Making more restrictive national rules to authorise water abstractions
    - Developing new research projects on vulnerability and increased drought risk
    - Introducing new educational programmes and awareness-raising campaigns.

6.2.1 Drought Institutional Arrangements

This section will highlight a brief background to drought institutional arrangements currently prevailing in Zambia and then focus on proposed strategies for drought institutional arrangements. In Zambia, the Zambia Metrological Department (ZMD) housed under the Ministry of Transport and Communications and the Disaster Management and Mitigation Unit (DMMU) housed in the Office of the Republican Vice President are key stakeholder institutions when it comes to drought management and mitigation. The other two are the Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP) and the Ministry of Lands and Natural Resources (MLNR). MWDSEP is the mandate holder for water resources development and management and water supply and sanitation services. Water Resources Management functions are executed by a regulatory body, WARMA, water development functions by the Department of Water Resources Development (DWRD) and water supply and sanitation functions by the Department of Water Supply and Sanitation and regulated by National Water Supply and Sanitation Council (NWASCO). The MLNR provides policy direction for the environment and manages the environment through the Zambia Environment Management Agency (ZEMA) so as to ensure integrated environmental management and the protection and conservation, sustainable management and use of natural resources. The proposed strategies for drought institutional arrangements will now be discussed.

6.2.1.1 Proposed Strategies for Drought Institutional Arrangements

The organizational structure for drought management (Figure 1) reflects the optimal composition of the Drought Committee and the principle interactions among key players at different levels. This ensures the use of a participatory approach and responsible reactions from society. The structure was developed as a universal model based on recommendations taken from general guidelines (mainly the Report 2007 and WMO/GWP IDMP Guidelines). In the case of Zambia, the Drought Competent Authority could be taken up by ZMD and DMMU. Institutions such as WARMA, NWASCO, ZEMA and all Commercial Utilities can constitute Drought Committee Working Groups responsible for monitoring and risk assessment. Governing level – Ministries, state administration and Professional level – hydromet services and sectoral institutions can feed into the work of the Drought Working Committee. Other stakeholders such as

farmers, fishers, civil society, environmentalists, industry and companies are major contributors to the process when it comes to policy advocacy, sensitization and demanding duty bearers to deliver on their mandates. Figure 1 illustrates the proposed setup.

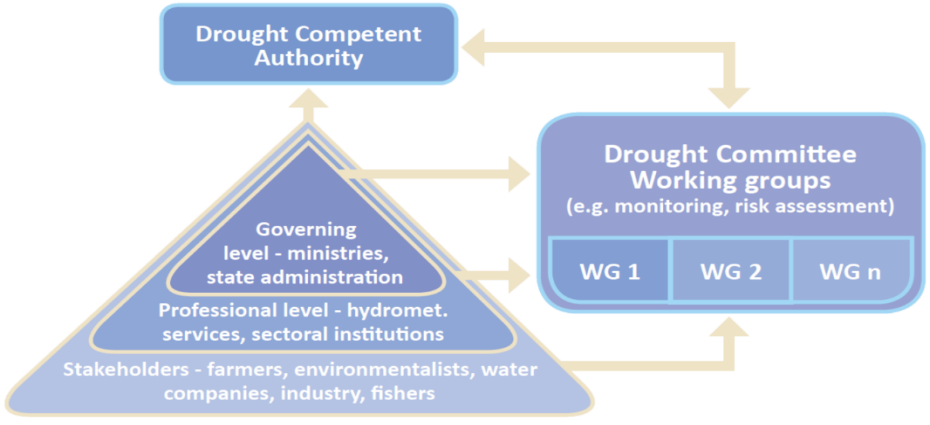


Figure 7: Organisational structures for integrated drought management (Source: Global Water Partnership Central and Eastern Europe, 2015)

In Zambia, the new thing that may need to come into place is the drought policy and relevant legislation but readiness of existing bodies to supervise and coordinate the national drought policy development process and implementation is very feasible. Global Water Partnership Central and Eastern Europe (GWP-CEE, 2015) has concluded that in most cases, there is no need to create new bodies for drought management, and that existing water management units should be utilized. In the existing institutional arrangement for Zambia, policy direction can be provided to monitoring and risk assessment by Government Ministries in which ZMD and DMMU are housed and the early warning/information delivery and risk assessment as illustrated in Figure 2, can be managed by regulatory institutions such as WARMA, ZEMA and NWASCO and supported by non-governmental organisations involved in water resources management such as Red Cross Society Zambia, World Wide Fund for Nature (WWF) Zambia and private companies involved in assessment of water resources such as Zambia Electricity Supply Cooperation (ZESCO), Lunsemfwa Hydro Power Company (LHPC) and Mining Companies such as Kansanshi Mine, Mopani Copper Mines, Lumwana and Konkola Copper Mines.

What will need to be critically addressed in the existing institutional arrangement in Zambia is the coordination of the operations of these key stakeholder institutions. This coordination role is given to DMMU but needs further strengthening as DMMU has not management to coordinate various proactive efforts related to disasters but has only mobilized resources to respond to disasters in a rather reactive approach. For successful implementation of mitigation and disaster risk reduction measures, DMMU will require strengthening in coordinating and harnessing financial and human resources from various stakeholder institutions involved in disaster risk reduction and mitigation of water related disasters such as drought.

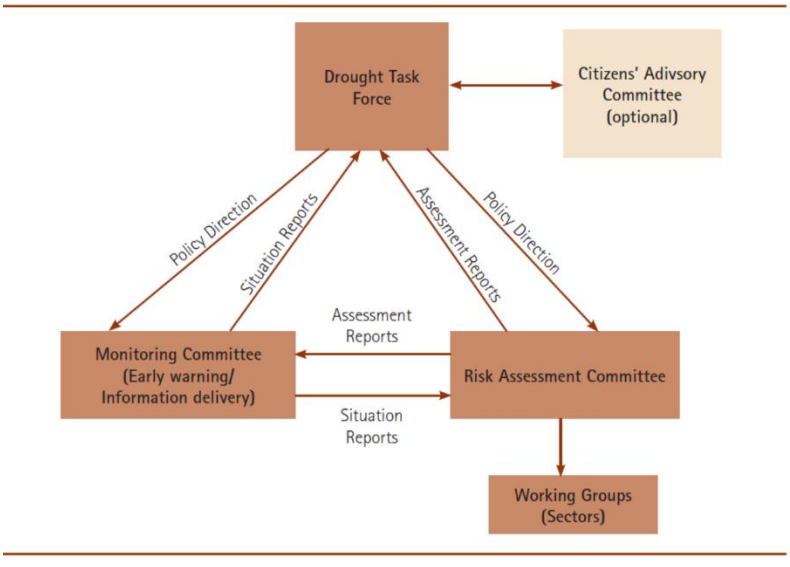


Figure 8: Drought preparedness and mitigation plan organizational structure (GWP-CEE, 2015)

Secondly, what could guarantee success in the current institutional arrangement would be the need for Central Treasury to make adequate budgetary releases which are requested by institutions responsible for managing disasters in the country. The current about 50% budget release rate from Ministry of Finance (Musumali *et al.*, 2009) cannot help institutions such as ZMD, DMMU, WARMA, NWASCO and ZEMA operate efficiently and effectively especially on aspects of water resources assessments which require capital infrastructure installed around the country to monitor various climatic indicators and thus establish effect early warning systems which have capacity to avert effects of disasters on the social economic sectors of Zambia.

6.2.2 Drought Strategy and Policy

The disaster management policy in Zambia aims to strengthen national capacities for effective disaster preparedness, response, mitigation, restoration, and prevention, in order to protect lives and livelihoods, property, environment and the economy at large. In the policy drought is treated as one of the natural hazards and is not specifically provided for in terms of its management. Despite noting the uniqueness of drought in terms of slow on-set; its difficulty to quantify; impacts being cumulative; its determination requiring multiple indices; and extending over longer periods of time, the Drought Code in the Disaster Operations Manual of 2015, is devoid of details in terms of drought monitoring, preparedness and what happens especially in other responsible government agencies. There is inadequate appreciation of the role of other key institutions that can greatly contribute to effective drought management.

6.2.2.1 Proposed Strategies for Drought Strategy and Policy

The Government, through DMMU, has borne the responsibility for risk management and has financed and delivered substantial relief programmes during drought. There is need to mobilise resources from wider stakeholder involvement and encouraging adopting risk minimizing practices in terms of farming and water conservation. The process of identification and targeting of vulnerable groups for relief interventions during drought must be clearly defined to ensure household food security. The impacts of drought (economic, environmental, and social) need to be well assessed and appropriately catered for in terms of policy and strategy. These include: *Economic impacts* **(**production losses in agriculture and related sectors, especially forestry and fisheries, because these sectors rely on surface and subsurface water supplies. Drought thus has a multiplier effect throughout the economy, which has a dampening impact on

employment, flow of credit and tax collections); *Environmental impacts* **(**lower water levels in reservoirs, lakes and ponds as well as reduced flows from springs and streams would reduce the availability of feed and drinking water and adversely affect fish and wildlife habitat); and *Social impacts* **(**lack of income due to migration of the population from the drought-affected areas, withdrawal of children from schools, selling of assets such as land or cattle, loss of social status and dignity, malnutrition, starvation, low access and use of water resources, conflict due to water scarcity).

The proposed strategies are therefore listed below:

- Develop a policy and strategies that explicitly deal with Drought Management in Zambia
- Strengthen the National Hydrometeorological Monitoring and Early Warning System in order to provide an integrated approach to drought management, covering all the aspects of drought: early warning and forecasting, response, and mitigation.

According to Government of India (2009), early warning systems:

1. Provide accurate, timely and integrated information on drought conditions at national, river basin or catchment, provincial and district level.
2. Detect drought early; it allows for activation of the drought management plan and evokes both proactive (mitigation) and reactive (emergency) responses.
3. Provide information on all the parameters of drought at the relevant spatial scale to the policy-makers, administrators, NGOs, and citizens. The decision support which the EWS provides can minimize the economic, social and environmental losses associated with drought.
4. Consist of information on a number of variables, such as climate data, soil moisture, stream flow, groundwater, and lake and reservoir levels.
5. Require gathering and integration of existing data as well as seeking new information through Government and national networks. It also requires a network of scientific institutions to maintain the physical observing system, collect and analyse the data, and to synthesize the information on drought impacts. For instance, it is necessary to collect and analyse information on stream flow, lake and reservoir levels, and groundwater status, as drought revolves around the supply of and demand for water.

The early warning system should function at three levels:

1. Receiving forecasts, early warning, and advice from scientific institutions;
2. Monitoring key drought indices at the National and Provincial (or Catchment) levels; and
3. Developing composite index of various drought indicators.
    - reorient long term development programmes in favour of poverty reduction as a means of mitigating the effects of drought.
    - Help farmers manage drought-induced income variability and reduce vulnerability to drought in the longer term through promoting the adoption of drought mitigating farming practices and the diversification of income generating activities.
    - Finance and manage targeted income transfer programmes to support household food security in times of disaster drought;
    - Establish and implement the National Drought Fund and provide limited financial assistance to farmers in disaster drought years. This is a more focused Fund than what is envisaged in the Disaster Management Policy (2005) - this disaster fund would be looking at all other disasters and may take away from funding planned drought related activities.
    - Ensure that short term relief programmes in times of disaster droughts, and long term strategies support sustainable natural resource use under conditions of climatic variability.
    - Draw up and implement appropriate post-disaster drought recovery and preparedness programmes.

- Encourage farmers to embrace sustainable and environmentally friendly agricultural practices; to invest in long term measures of reducing vulnerability to drought; and to contribute in normal rainfall years towards the cost of financial assistance during times of disaster drought, e.g., contributing to the Drought Fund.
- Promote food security in drought prone areas in terms of livestock; crop; wild fishery, aquaculture and water supply programmes.

6.2.3 Communication protocols

This section gives brief background to communication protocols and proposed strategies for communication protocols. The communication protocol strategies proposed in this section are largely based on the strategies for communication protocols which have been stipulated for Southern African Development Cooperation (SADC) member states. Zambia is a member of the Southern African Development Cooperation (SADC) which has developed communication protocols for climate change impacts and water related disasters such as droughts and floods. It is worth noting that climate change and variability has become a major influencing factor, among others, in the planning, development and utilisation of water resources in the SADC region in general and Zambia in particular due to increased vulnerability to drought and water scarcity. Therefore, understanding and appreciation of the vulnerability and adaptation measures to climate change and variability among stakeholders is of paramount importance. Objectives supporting disseminating and communicating climate change and variability phenomenon and water related disasters such as droughts should include the following: a) To raise awareness on provisions of appropriate national, regional and international instruments on drought and climate change impacts such as those provided UNFCCC and UNCCD; b) To ensure that the droughts, climate change phenomenon, scenarios, predictions, and impacts are understood among the general public, public and private sector and other stakeholders; c) To promote the available adaptation and mitigation strategies, measures and technologies necessary to minimise negative impacts and accentuate positive impacts with regards to water resource management; and d) To increase awareness about preparedness for water-related disasters such as floods and droughts.

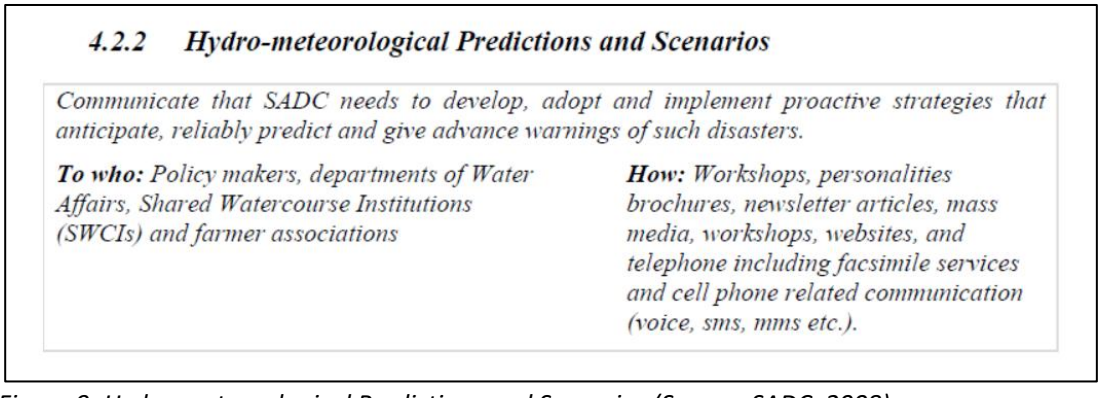
6.2.3.1 Proposed Strategies for Communication Protocols

Strategies for communication protocols which have been developed by SADC for water related disasters such as droughts and floods can be used to guide commutation protocols tailored to Zambia. A desk review of the Regional Awareness and Communication Strategy for the SADC Water Sector produced in May 2008 revealed Key Message Areas (KMAs) which can be applied in Zambia's strategies for communication protocols for drought and water scarce situations. KMAs which can be included in the strategies include the following; (a) Hydro-meteorological predictions and scenarios; (b) Floods and droughts; and (c) Adaptation and mitigation strategies for the region.

Hydro-meteorological predictions and scenarios

According to the Regional Awareness and Communication Strategy for the SADC Water Sector, disaster preparedness goes beyond national, regional and continental boundaries. It requires investment in human resources and physical infrastructure. It is recognised that some structures are in place to enable prediction and planning for droughts and other water-related disasters. These include the SADC regional early warning unit, Drought Monitoring Centre (DMC) and Famine Early Warning Systems (FEWS). The structures are however operating in an environment of complex challenges which include limited accurate long term predictions of some devastating weather related events. The inadequate human resources and poor communication infrastructure in some Member States are also considered challenges in communicating climate change and adaptation measures. It is very essential that proper and effective communication channels between these institutions and the target audience is established to minimise the impact.

At national level a closer collaboration between the ZMD and WARMA is strongly recommended to get a full picture of an impending weather related threat. This recommendation from the SADC communication strategy is fundamental in achieving meaningful communication of impending droughts and other water related hazards. The Strategies for communication protocols for hydro-meteorological predicts and scenarios in Zambia would cover the key grounds illustrated in Figure 9.



4.2.2 Hydro-meteorological Predictions and Scenarios

Communicate that SADC needs to develop, adopt and implement proactive strategies that anticipate, reliably predict and give advance warnings of such disasters.

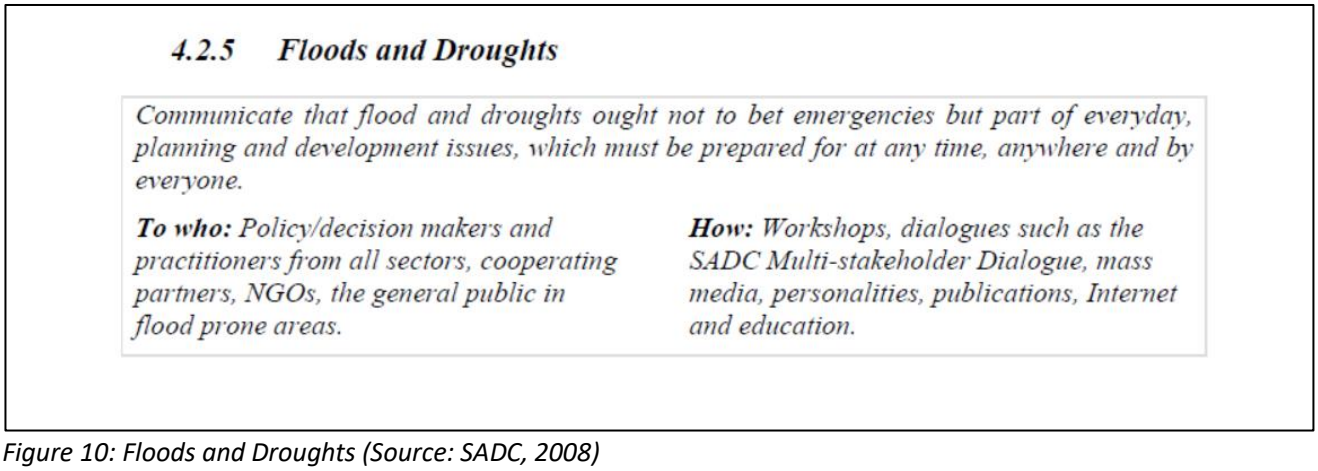
To who: *Policy makers, departments of Water Affairs, Shared Watercourse Institutions (SWCIs) and farmer associations*

How: *Workshops, personalities brochures, newsletter articles, mass media, workshops, websites, and telephone including facsimile services and cell phone related communication (voice, sms, mms etc.).*

Figure 9: Hydro-meteorological Predictions and Scenarios (Source: SADC, 2008)

Floods and Droughts

A further review of the Regional Awareness and Communication Strategy for the SADC Water Sector shows that floods and droughts in SADC are the major disasters that confront member states and its citizens. Floods are recurrent problems particularly in SADC member states with large rivers and having low lying and settled area along such rivers. Warnings are not effectively issued to all stakeholders and such warnings are one-way communication from forecasting authorities to the affected areas. Feedback or proactive responses from the affected areas do not find the mechanisms to reach the authorities or other affected areas either downstream or upstream. Initiatives of flood forecasting and warnings or water resources infrastructures that can mitigate effects of droughts or floods are not or may not be known among the stakeholders. There is need to bridge this communication gap. This observation from the SADC strategy needs critical consideration in Zambia where it is evident that communication is one way. ZMD particularly has no means of collecting feedback messages from affected areas. This feedback process would be very key in assisting institutions like ZMD and WARMA to refine their communication protocols over time. The Strategies for communication protocols for droughts and floods in Zambia would cover the key grounds illustrated in Figure 10.



4.2.5 Floods and Droughts

Communicate that flood and droughts ought not to bet emergencies but part of everyday, planning and development issues, which must be prepared for at any time, anywhere and by everyone.

To who: *Policy/decision makers and practitioners from all sectors, cooperating partners, NGOs, the general public in flood prone areas.*

How: *Workshops, dialogues such as the SADC Multi-stakeholder Dialogue, mass media, personalities, publications, Internet and education.*

Figure 10: Floods and Droughts (Source: SADC, 2008)

Adaptation and Mitigation Strategies

Additional key issues which the SADC (2008) report raised were that impacts of the climate change phenomenon are enormous and vary from one part of the region to another. Adaptation strategies to mitigate the impacts of droughts and other water related hazards are very crucial but need to be communicated to relevant target audience for effective implementation. SADC encourages member countries like Zambia who developed The National Programme of Action for Adaptation to Climate Change (NAPA) to conduct proper dissemination of the NAPA. This is because meaningful action against climate change and drought depends on awareness of mitigation and adaptation measures by the general public. Processes leading to NAPA should be well documented and communicated so that adaptation and mitigation measures, technologies and opportunities are shared among regional and national stakeholders. The SADC (2008) report suggests that key adaptation strategies that Members States like Zambia could implement include:

a) Development and implementation of early warning systems, including those on floods and droughts disasters;
b) Water resources infrastructure development for creating water security against droughts, flood protection and mitigation measures
c) Water Demand Management aimed at conserving and avoiding water wastage of any kind and maximizing the use of limited water resources;
d) Promotion of recycling waste water in order to use the limited water several times; and
e) Promotion of alternative production of goods and services other than the use of water e.g. use of solar and wind energy instead of hydropower.

Target Audience for Communication Protocols

In the development of strategies for communication protocols, Zambia can follow the target audiences suggested in the SADC (2008) report. The target audience suggested are

a. *The Zambian general public.* The Zambian public should be reached so that they know and appreciate institutions such as ZMD, DMMU, WARMA, ZEMA and other institutions dealing with issues concerning disasters, water and environmental management;
b. *Policy/Decision Makers, Senior Government Officials, Ministers, District Commissioners.* It is important for communication messages to reach these as the institutions where these officials work are essentially the pillars in the management of drought and water scarce situations. They initiate, direct and approve what institutions such as ZMD, DMMU do. This can only be done efficiently when these officials have an in-depth knowledge and appreciation of climate change related impacts and drought in Zambia. Senior government officials - over and above policy development -also play a critical role in the development of frameworks to engage and empower the communities to cultivate ownership and technical ability to maintain water supply schemes and get involved in water resources management;
c. *Politicians, Parliamentarians and Councillors.* The institutions where these Politicians, Parliamentarians and Councillors work are key institutions for successful formulation and implementation of drought mitigation and management efforts. They are also responsible for incorporating provisions of regional and international instruments in their spheres of influence and mandate;
d. *Government and Quasi Government Technocrats.* Technical experts within relevant Departments especially ZMD, DMMU, WARMA, NWASCO and ZEMA. Examples include engineers, hydrologists, climatologists, economists, sociologists as well as government extension workers who have direct contacts with other target audiences such as water users and farmers. The extension workers are in a better position to reach out to the farmers and other water users. They are in close contact with communities and, in most cases, they are change agents that are respected and accepted by communities;

e. *Private Sector/Civil Society, Non-Governmental Organisations (NGOs), Water Service Providers and the entire business and private sector.* The private sector and NGO institutions should be reached because they play a pivotal role in regional cooperation and integration in water resources management. NGOs also play an important role especially at grassroots level, hence their involvement and empowerment on issues outlined in this Strategy is vital. The service providers include government agencies involved in water supply, sanitation and hygiene, NGOs and Water Utility Companies. They should be reached because they generally play an implementation role in putting up water supply schemes to communities. Service providers are responsible for the actual delivery of water to the recipient communities thus have a big role to play in ensuring equitable access and utilisation of the resource;

f. *Schools and Training Institutions. School-going youth, School clubs, academics, curriculum developers.* The school is the best avenue for reaching the youth and influencing future leaders. This method employs both formal and non-formal types of education. The formal type targets the curriculum while the other targets extra-mural or extra-curricular activities. Entertainment (especially edutainment), publications and education should be deployed adequately for this target group;

g. *Water Users*. Recipient communities or beneficiaries and user communities such as farmers, irrigators, community water committees and other sectoral water users such industries, commercial undertakings and mines. This target audience should be reached and empowered to ensure ownership. These are the central role-players on issues of sustainability as they remain with the water supply on a day to day basis and are the ones who immediately pick the impact of a collapsing water supply scheme;

h. *Funding agencies*. Cooperating partners or donors, Ministries of Finance and other partners that provide technical assistance. These should be reached in order to increase their understanding of priority capacity gaps within the Water Sector;

i. *The Media and other Information Intermediaries, Media houses, media bodies and journalists (print, electronic and photojournalists).* The regional media institutions should be empowered enough to be effective communication intermediaries on water issues. With adequate capacity, the media can reach wider audiences and shape positive opinion. They also have the potential to move non-performing decision makers or service providers into action.

6.2.4 Drought response actions

Drought declaration signifies the beginning of Government response to a drought situation. Drought declaration should be a timely step so that relief assistance and other concessions can be provided to the people affected by drought at the right time. It is worth noting that drought declaration is only explicitly stated in the Water Resources Management Act 2011, Section 146 whereas in the Disaster Management Act it is covered under 'disasters'. There is no evidence of effort thus far between the two responsible institutions (WARMA through MWDSEP and DMMU under OVP) to harmonise the Acts and to detail the required collaboration leading to the declaration by the President of a national disaster due to general drought or an emergency due to drought by the Minister when it comes to drought in the case of the Water Resources Management Act. However the details of the response measures are not elaborated in this Act. Disaster Management Plans, which are supposed to deliver on response measures, have yet to be developed and implemented successfully. Few Disaster Preparedness Plans have been developed in some districts but never fully implemented.

6.2.4.1 *Proposed Strategies for Response Actions*

1. Improvement of vulnerability and risk assessment capacity at national, district and community levels. The Zambia Vulnerability Assessment Committee (ZVAC) which is essentially the Technical Committee of the Disaster Management Framework in Zambia needs strengthening in order to effectively respond to drought disaster situations.
2. Within the context of ZVAC or separately, create a Drought Task Force to monitor emergency situations while interacting with ZMD, WARMA and Early Warning Unit under the Ministry of Agriculture.
3. Supporting a well-equipped core team for early warning and forecasting system for drought management.
4. Designing contingency plans at district, provincial (river basin) and central levels of governance.
5. Update and implement communication strategy for promotion of public education and awareness and information systems at all levels.
6. Procurement and supply of relief requisites including keeping/maintenance of Inventory of potential sources of such requisites.
7. Building preparedness capacity through public and private facilities such as schools, hospitals, offices and homes.
8. Building preparedness at community level for self-help and reliance on local initiatives.
9. Develop and implement the National Disaster Fund to mobilize resources and stakeholders to facilitate the implementation of preparedness and response activities.
10. Supporting information databases about areas, stakeholders, resources and other issues related to drought management.
11. Designing and reviewing insurance packages to cover damage due to drought.
12. Operating a toll free telephone facility.
13. Promote mainstreaming of disaster risk reduction in line Ministries to give priority to installation of emergency capabilities.

6.3 Water Resources Development/Conservation Monitoring and Impact Assessment

This section introduces water resources development/conservation monitoring and impact assessment. The section also discusses proposed strategies for water resources development, conservation and impact assessment. The current policy, legal and institutional framework mainly requires financing to effectively address the issues of drought management in Zambia. Development of tools for water resources planning and development and conservation in a number of cases have not been developed. For example, the process leading of declaration of national disaster or emergency situation in a specific area due to drought has not been standardised or is not well documented.

6.3.1 Proposed Strategies for Water Resources Development, Conservation and Impact Assessment

i. Ensure that Zambia's water resources are effectively managed and contribute to wealth creation through increased access to safe drinking water and sanitation, increased food production and food security for all Zambians.
ii. Develop and implement the National Water Resources Strategy and Plan for Zambia.
iii. Regulate the development of water resources and integrate other sector needs such as agriculture, tourism, mining, manufacturing industry and hydro-power.
iv. Issue guidelines on the development of water resources.

v. Regulate the construction of all water resources development infrastructure.
vi. Register water resources development projects and programmes.
vii. Register and regulate water resources development construction companies; and monitor dam safety.
viii. Establish monitoring and early warning systems in collaboration with other relevant institutions.
ix. Collaborate with regional and international bodies in dealing with emergency situations.
x. Promote the construction of dams and provide guidelines on the operations by private or public dam owners and operators.
xi. Design and implement water resources development projects in coordination with other relative sectors;
xii. Establish a programme for construction and rehabilitation of dams and weirs with emphasis on multi-purpose use.
xiii. Subject water resources development programmes and projects in dam's development, rain harvesting schemes, water intake points, river diversions, pumping stations, water well drilling, groundwater abstraction and use and inter-basin water transfer to strategic environmental assessment and environmental impact assessment.
xiv. Establish an integrated water resources data and information acquisition and management system to meet all water resources management needs.
xv. Install or facilitate the installation of metering systems on all hydraulic structures.
xvi. Regulate infrastructure to ensure that water resources infrastructure benefits all sectors of society especially the disadvantaged and poor (women, children and people with disabilities).
xvii. Facilitate public private participation in water development.
xviii. Support the development of the agricultural sector through the establishment of a fair, efficient and transparent water allocation system.
xix. Facilitate conservation of national water resources through dissemination and awareness on sustainable water and soil conservation measures.
xx. Manage water resources quality and quantity in order to support sustainable fisheries development;
xxi. Protect water resources and aquatic environment from overexploitation and pollution caused by activities related to fishing or aquaculture.
xxii. Enter into bilateral or multilateral agreements with any foreign state or government regarding any shared water resources supporting shared fisheries.
xxiii. Develop national capacity for negotiation and management of shared watercourses.
xxiv. Develop a decision support system for management of shared water courses.
xxv. Promote the integrated planning, management and conservation of water resources which impact on wildlife and ecosystems.
xxvi. Promote a safe and clean maritime and inland waterways environment; and ensure availability of accurate information on water resources for water ways development.
xxvii. Ensure sustainable management of water resources.
xxviii. Increase public awareness on the conservation and protection of water resources and the environment.
xxix. Prevent and control pollution of ground and surface waters.
xxx. Collect, process, maintain and disseminate data and information on water quality and aquatic ecosystems as a basis for integrated and informed decision-making.

6.4 National Drought Governance

Although the development of national drought policies and legislation and preparedness plans can be a challenging undertaking, the outcome of this process can significantly increase societal resilience to climatic shocks such as droughts.

One of the primary goals of the guidelines presented is to provide a template in order to make the development of national drought policies and associated preparedness plans less daunting. Simply stated, national drought policy and legislation should establish a clear set of principles or operating guidelines to govern the management of drought and its impacts (WMO and GWP, 2014).

The overriding principle of drought policy should be an emphasis on risk management through the application of preparedness and mitigation measures. The policy should be directed toward reducing risk by developing better awareness and understanding of the drought hazard and the underlying causes of societal vulnerability, along with developing a greater understanding of how being proactive and adopting a wide range of preparedness measures can increase societal resilience (WMO and GWP, 2014).

This section outlines the guidance for the development and implementation of drought management policy and legislation based on the concept of reducing risks associated with drought occurrence. The process for designing a drought risk-based management strategy or policy must be linked with the production and implementation of a preparedness and mitigation plan. In the Zambian context, preparedness and mitigation plans can properly function as an administrative instrument through which national drought policy or legislation is executed if it became imbedded in Catchment Management Plans and the National Water Resources Strategy and Plan firmed in the Water Resources Management (WRM) Act No. 21 of 2011.

6.4.1 Proposed Strategies for National Drought Governance

Drought policy and legislation is based on a proactive approach with an emphasis on drought risk management. It is associated with developing a preparedness plan in advance with the aim to prevent or minimize drought impacts. A Drought Management Plan is an administrative tool for the enforcement of preventive and mitigation measures in order to achieve a reduction of drought impacts on society, environment, and economy. This therefore requires development of a legislative framework which will provide guidance in the development of Drought Management Strategies and Plans. A Drought Management Plan is an additional planning document which can supplement a Catchment Management Plan. In Zambia, these Drought Management Plans can be made as components of Catchment Management Plans which WARMA is mandated to develop for the six water catchments in the framework of the WRM Act No. 21 of 2011, namely; Kafue, Luangwa, Zambezi, Luapula, Chambishi and Tanganyika. Drought Management Plans would focus on the reduction of drought impacts in affected areas and the enhancement of resilience against droughts. Professional experiences and scientific knowledge on drought risk management from other regions can be utilised since other countries have been refining these Drought Management Plans for a longer time. For every Drought Management Plan, there are three main elements that are crucial for effective drought management: Firstly, it is drought indicators and thresholds for the classification of drought stages (i.e. normal, pre-alert, alert and emergency) and a drought early warning system. Secondly, it is mitigation measures to achieve specific objectives in each drought stage and thirdly, an organizational framework to deal with drought. The Section on Communication Protocols for drought management in this document emphasized the need for involvement of key sectors, decision-makers, professionals, stakeholders from impacted sectors, and the public in the process of developing and implementing a Drought Management Plan

A step-by-step approach is recommended for drought policy and legislative framework development. A list of suggested steps has been adopted from WMO and GWP (2014) – National Drought Management Policy Guidelines. The suggested 12 steps are discussed in the sections below.

6.4.1.1 Step 1: Appoint a national drought policy or legislation team

The process for creating a national drought management policy and legislation should begin with the establishment of a national task team to oversee and facilitate policy development. Given the complexities of drought as a hazard, and the cross-cutting nature of managing all aspects of monitoring, early warning, impact assessment, response, mitigation and planning, it is critical to coordinate and integrate the activities of the many agencies/ministries of government at all levels; the private sector, including key stakeholder groups; and civil society. In Zambia, DMMU has been mandated to play such coordination roles. To ensure a coordinated process, The Republican Vice President or other key political leader must take the lead in establishing a national drought policy task team. Otherwise, it may not garner the full support and participation of all relevant parties. Issues of policy formulation in Zambia are also coordinated through Cabinet Office and overseen by Secretary to the Cabinet.

6.4.1.2 Step 2: State or define the goals and objectives of a risk-based national drought management policy and legislation

After the formation of the national task team headed by the Republican Vice President, the first official action should be to establish specific and achievable goals for the national drought policy and legislative framework and a timeline for implementing the various aspects of the legislation, as well as a timeline for achieving the goals. Several guiding principles should be considered as the task team formulates a strategy to move from crisis management to a drought risk reduction approach. The measures which should be considered are those that should not discourage agricultural producers, municipalities and other sectors or groups from the adoption of appropriate and efficient management practices that help to alleviate the effects of drought. The measures should help to build self-reliance to future drought episodes and the protection of the natural and agricultural resource base.

6.4.1.3 Step 3: Seek stakeholder participation

Institutions such as WARMA and Department of Water Resources Development (DWRD) become key players in helping define and resolve conflicts between key water use sectors, considering also transboundary implications through the International Waters Section in the DWRD under MWDSEP. Therefore, participation of all key stakeholders during formulation of drought policy and legislation is an important process because of the complexities of drought as it intersects with society's social, economic and environmental sectors, and the dependence of these sectors on access to adequate supplies of water in support of diverse livelihoods. As drought conditions intensify, competition for scarce water resources increases and conflicts often arise. These conflicts cannot be addressed during a crisis and thus it is imperative for potential conflicts to be addressed during non-drought periods when tension between these groups is minimal. As a part of the policy development process, it is essential to identify all key stakeholders, including the private sector, that have a stake in the process and their interests. These groups must be involved early and continuously for fair representation to ensure an effective drought policy development process at all levels.

6.4.1.4 Step 4: Inventory data and financial resources available and identify groups at risk

An inventory of natural, biological, human and financial resources, including the identification of constraints that may impede the development of drought policy and legislation may need to be initiated by the national task team. In many cases, much information already exists about natural and biological resources through various provincial and national agencies/ministries. It is important to determine the vulnerability of these resources to periods of water shortage that result from drought. The most obvious natural resource of importance is water (i.e. location, accessibility, quantity, quality), but a clear understanding of other natural resources such as climate and soils is also important. Biological/ecological resources refer to the quantity and quality of grasslands/rangelands, forests, wildlife, wetlands and

so forth. Human resources include the labour needed to develop water resources, lay pipelines, haul water and livestock feed, process and respond to citizen complaints, provide technical assistance, provide counselling and direct citizens to available services. It is also imperative to identify constraints to the policy development process and to the activation of the various elements of the policy and preparedness plans as drought conditions develop. These constraints may be physical, financial, legal or political. The costs associated with policy development must be weighed against the losses that are likely to result if no plan is in place (i.e. the cost of inaction). As stated previously, the goal of a national drought policy is to reduce the risk associated with drought and its economic, social and environmental impacts. Legal constraints can include water permits, existing public trust laws, requirements for public water suppliers, transboundary agreements (e.g. specifying that a certain volume or share of river flow across the border has to be guaranteed) and liability issues.

6.4.1.5 Step 5: Prepare/write the key tenets of the national drought management policy, legislation and preparedness plans

Drought preparedness/mitigation plans are the instruments through which a national drought policy is carried out. It is essential for these plans to reflect the principles of the national drought policy, which is centred on the concept of risk reduction. It is important to point out that preparedness planning can take two forms. The first form: response planning, is directed toward the creation of a plan that is activated only during drought events and usually for the purpose of responding to impacts. This type of planning is reactive and the responses that are forthcoming, whether from national or state government or donor organizations, are intended to address specific impacts on sectors, population groups and communities and, therefore, reflect the key areas of societal vulnerability. This approach discourages the development of self-reliance and implementation of improved resource management practices that will reduce risk in the longer term. The second form of preparedness planning is mitigation planning. With this approach, the vulnerabilities to drought are identified as part of the planning process through the analysis of both historical and more recent impacts of droughts. These impacts represent those sectors, regions and population groups that are most at risk. The planning process can then focus on identifying actions and governmental or non-governmental authorities that can assist in providing the necessary resources to reduce the vulnerability. In support of a risk-based national drought policy, mitigation planning is the best choice if risk reduction is the goal of the planning process. The process can include planning for monitoring, early warning and prediction; risk and impact assessment; and mitigation and response.

6.4.1.6 Step 6: Identify research needs and fill institutional gaps

The national drought policy task team should identify specific research needs that would contribute to a better understanding of drought, its impacts, mitigation alternatives and needed policy instruments, leading to a reduction of risk. These needs are likely to originate from the state-level drought task forces that are implemented to develop mitigation plans. It will be the responsibility of the task team to collate these needs into a set of priorities for future action and funding.

6.4.1.7 Step 7: Integrate science and policy aspects of drought management

An essential aspect of the policy and planning process is integrating the science and policy aspects of drought management. Institutions such as Ministry of Science, Technology and Vocational Training (MSTVC) and Higher Institutions of learning such as the University of Zambia (UNZA), Copperbelt University (CBU), Mulungushi University, and Natural Resources Development College (NRDC) become key in providing the scientific component for sound drought policy development. This is because policy makers' understanding of the scientific issues and technical constraints involved in addressing problems associated with drought is often limited. Likewise, scientists and managers may have a poor understanding of existing policy constraints for responding to the impacts of drought. In many cases, communication

and understanding between the science and policy communities must be enhanced if the planning process is to be successful. This is a critical step in the development of a national drought policy and legislation.

6.4.1.8 Step 11: Establish an institutional framework and oversight organisations such as a National Drought Management Advisory Council

In order to effectively implement the developed strategies, an implementation framework anchored within an existing institution such as WARMA or the MWDSEP has to be established through national legislation. WARMA is better placed as it already manages Zambia's water resources. A body such as a National Drought Management Advisory Council can be anchored within WARMA. In the event that it is established within MWDSEP, it can be termed the National Drought Management Agency or the Zambia Drought Management Agency which is autonomous but composed of a Technical Advisory Board composed of stakeholders include the meteorology, DMMU, fisheries, forestry, social and welfare services.

6.4.1.9 Step 8: Publicize the national drought management policy and preparedness plans and build public awareness and consensus

If there has been good communication with the Zambian public throughout the process of establishing drought policy, legislation and plans, there may already be an improved awareness of goals of the drought policy, the rationale for policy implementation, and the drought planning process by the time the policy is ready to be implemented. Public information specialists such as Zambia News and Information Services (ZANIS) in the Ministry of Information and Broadcasting, Zambia National Broadcasting Cooperation (ZNBC) and other private media houses become vital in this regard if they were involved at the early stages of the policy and legislative development process. Throughout the policy development process, it is imperative for local and national media to be used effectively in the dissemination of information about the process. Themes to emphasize in writing news stories during the drought policy process could include: How the drought policy and plan is expected to reduce the impacts of drought in both the short and long term. Stories can focus on the social dimensions of drought, such as how it affects local economies and individual families; environmental consequences, such as reduced wildlife habitat; human health; and the impacts on the regional and national economy and the development process. Secondly, it is behavioural changes that will be required to reduce drought impacts; various aspects of state drought preparedness plan; new policies associated with water allocations and water management during the various stages of drought severity.

6.4.1.10 Step 9: Develop education programmes for all age and stakeholder groups

Working in close collaboration with the Ministries of General and Higher Education in Zambia, a broad-based education programme focused on all age groups is necessary to raise awareness of the new strategy for drought management, the importance of preparedness and risk reduction, short- and long-term water supply issues, and other crucial prerequisites for public acceptance and implementation of drought policy and preparedness goals. This education programme will help ensure that people know how to manage drought when it occurs and that drought preparedness will not lose ground during non-drought years. It would be useful to tailor information to the needs of specific groups (e.g. primary and secondary education, small business, industry, water managers, agricultural producers, homeowners, Commercial Utilities).

6.4.1.11 Step 10: Evaluate and revise national drought management policy and supporting preparedness plans

The tenets of a national drought policy and each of the preparedness or mitigation plans that serve as the implementation instruments of the policy require periodic evaluation and revision in order to incorporate new technologies, lessons

learned from recent drought events, changes in vulnerability and so forth. The final step in the policy development and preparedness process is to create a detailed set of procedures to ensure an adequate evaluation of the successes and failures of the policy and the preparedness plans at all levels. Oversight of the evaluation process would be provided by the national drought policy task.

The provided steps only give a generic framework for which drought policy and legislation can be developed in Zambia but depending on our unique needs and capabilities, more steps could be introduced or indeed reduced depending on available capacities or constraints.

7 CONCLUSION

In Zambia, there is no policy, legislation and institutional framework that explicitly and exclusively deals with drought. Drought is rather handled across various government agencies whose mandates, policies, legislation and institutional arrangements are concerned with other natural or manmade phenomena (e.g., floods, disease epidemics, climate change and variability, pollution) of a hazard nature that occur or are likely to occur in the country. Thus drought management issues are not thoroughly addressed in any single policy or legal or institutional document that can guide the nation to effectively prepare and mitigate drought and drought risk. Disaster risk is set to increase in Zambia in the light of climate change and other drivers of change such as population growth, agricultural expansion, urbanisation, rural development and pollution of water bodies. Consequently, vulnerability to drought is of interest to policy makers and water managers.

This National Drought Plan therefore recommends the establishment of a drought governance and management framework to guide Zambia in drought preparedness, mitigation and response which are to include aspects of drought related disasters.

Since Zambia has an established organisation, WARMA, dealing with water resources management and the only body with a drought declaration explicitly stated in the Water Resources Management Act 2011, Section 146 and Disaster Management strategy is covered under 'disasters'. There is no evidence of effort thus far between the two responsible institutions, WARMA (through Ministry of Water Development, Sanitation and Environmental Protection; and Disaster Management and Mitigation Unit under the Office of the Vice President), to harmonise the legislation and to detail the required collaboration. It is recommended that the proposed drought management organisation/unit to be created within WARMA or MWDSEP as it will mainly deal with drought management while collaborating with DMMU for the purpose of drought related disaster management.

BIBLIOGRAPHY

1. Aurecon. (2018a). Overall Assessment and Optimization Study and Design of the Country Hydrometeorological Network. *Volume 1: Detailed Design – Meteorological Network*. Lusaka: Ministry of Water Development, Sanitation and Environmental Protection
2. Aurecon. (2018b). Overall Assessment and Optimization Study and Design of the Country Hydrometeorological Network. *Volume 2: Detailed Design – Surface Water Quantity Network*. Lusaka: Ministry of Water Development, Sanitation and Environmental Protection
3. Aurecon. (2018c). Overall Assessment and Optimization Study and Design of the Country Hydrometeorological Network. *Volume 3: Detailed Design – Ground Water Network*. Lusaka: Ministry of Water Development, Sanitation and Environmental Protection
4. Chileshe, R. A., 2005. *Land Tenure and Rural Livelihoods in Zambia: Case Studies of Kamena and St. Jones*.http://etd.uwc.ac.za/xmlui/bitstream/handle/11394/235/Chileshe_PHD_2005.pdf?sequence=1
5. Convention Concerning the Protection of the World Cultural and Natural Heritage.
6. Convention on Biological Diversity (CBD).
7. Convention on the Law of Non-Navigational Uses of International Watercourses.
8. Davies, D. 2008. *Climate and Ecological Zones, http://parrottlab.uga.edu/Tropag/CR2010/Course%20Manual/Climate*
9. Disaster Management Act, 2010.
10. Disaster Management and Mitigation Unit, 2005. *Disaster Management Manual*.
11. Disaster Management Policy (DMP), 2015
12. Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1987.
13. Environmental Management (Licensing) Regulations SI No. 112 of 2013.
14. Environmental Management Act Cap 12 of 2011
15. Global Water Partnership Central and Easter Europe (2015). Guidelines for the preparation of Drought Management Plans. Development and implementation in the context of the EU Water Framework Directive, Global Water Partnership Central and Eastern Europe, 48pp
16. Government of India. (2009). Manual for Drought Management. New Delhi: Department of Agriculture and Cooperation, Ministry of Agriculture.
17. Grimes, D.G., E. Pardo and R. Bonifácio (1999). Optimal Areal Rainfall Estimation using rain gauges and satellite data, *Journal of Hydrology, 222*, p.93-108.
18. GRZ. (1998). Policy for National Parks and Wildlife. *In:* Ministry of Tourism Environment and Natural Resources (ed.). Lusaka, Zambia.
19. GRZ. (2002a). National Decentralisation Policy - towards empowering people. *In:* Office of the President (ed.). Lusaka, Zambia.
20. GRZ. (2002b). Zambia Poverty Reduction Strategy Paper: 2002-2004'. Lusaka, Zambia.
21. GRZ. (2004). The National Agriculture Policy 2004-2015 *In:* Ministry of Agriculture and Cooperatives (ed.). Lusaka, Zambia.
22. GRZ. (2006). Vision 2030. Lusaka, Zambia: Government Printers.
23. GRZ. (2007). Formulation of the National Adaptation Programme of Action on climate change. *In:* Resources, M. O. T. E. A. N. (ed.). Lusaka, Zambia: Lusaka, Zambia.
24. GRZ. (2007). National Policy on Environment. *In:* Ministry of Tourism Environment and Natural Resources (ed.). Lusaka, Zambia.
25. GRZ. (2007). *The National Adaptation Programme of Action (NAPA)*. Ministry of Tourism, Environment and Natural Resources (editor). Lusaka, Zambia, 2007.
26. GRZ. (2010). *National Climate Change.* Ministry of Tourism Environment and Natural Resources
27. GRZ. (2010). The National Water Policy. *In:* Ministry of Energy And Water Development (ed.). Lusaka, Zambia.
28. GRZ. (2011). Environment Management Act no. 12 of 2011. *In:* Zambia Environmental Management Agency (ed.). Lusaka, Zambia.
29. GRZ. (2012a). The National Agriculture Policy 2012-2030. *In:* Minsitry of Agriculture and Cooperatives (ed.). Lusaka, Zambia.
30. GRZ. (2012b). National health policy. *In:* Ministry of Health (ed.). Lusaka, Zambia.
31. GRZ. (2013). National agriculture investment policy. *In:* Ministry of Agricuture and Livestock (ed.). Lusaka, Zambia.
32. GRZ. (2013). National environmental action plan *In:* Minister of State - Vice Presidents Office (ed.). Lusaka, Zambia.
33. GRZ. (2014a). Forest Policy of 2014. *In:* Forestry Department (ed.). Lusaka, Zambia: Government printers.

34. GRZ. (2014b). National social protection policy. *In:* Zambia (ed.). Lusaka.
35. GRZ. (2015). Zambia wild life act, No. 14 of 2015. *In:* Ministry of Tourism Environment and Natural Resources (ed.). Lusaka, Zambia.
36. GRZ. (2016). National ppolicy on climate change. *In:* Ministry of Lands Natural Resources and Environmental Protection (ed.). Lusaka, Zambia.
37. GRZ. (2016). Second national agriculture policy *In:* Ministry of Agriculture and Ministry of Fisheries and Livestock (ed.). Lusaka, Zambia.
38. GRZ. (2017). Seventh national development plan 2017-2021 *In:* Ministry of National Development Planning (ed.). Lusaka, Zambia.
39. GRZ-Government of Republic of Zambia. (2007). *The National Adaptation Programme of Action (NAPA)*. Ministry of Tourism, Environment and Natural Resources (editor). Lusaka, Zambia.
40. Iglesias, A., Cancelliere, A., Gabi Gabina D., Lopez-Francos A., Moneo M. and Rossi G., (2007). Drought Management Guidelines and Examples of Application. Accessed on 19/08/2018 at https://www.iamz.ciheam.org/medroplan
41. Intergovernmental Panel on Climate Change (IPCC). 2007.
42. Intergovernmental Panel on Climate Change (IPCC, 1998), *Climate Change and Water*, http://www.ipcc.ch>technicalpapers.
43. Lands Act and Lands Acquisition Act, Cap 184, 1995,
44. Local Government Act, Cap 281of 1991 of the laws of Zambia
45. LUNGU, F. B. (1990). Administrative design for game management areas (ADMADE) and Luangwa integrated rural development project (LIRDP) in Kiss A. (ed); Living with Wildlife: wildlife resources management with local Pparticipation in Africa, World Bank, Washington.
46. Lwando, C. (2013). Climate Variability and Gender: Emerging Experiences from Western Zambia. *Environment and Natural Resources Research*; Vol. 3, No. 4; p133. http://dx.doi.org/10.5539/enrr.v3n4
47. McSweeney, C.; M. New & G. Lizcano (2008): "Zambia". UNDP Climate Change Country Profiles http://country-profiles.geog.ox.ac.uk
48. Ministry of Finance and National Planning (2017), *Seventh National Development Plan* (2017 – 2021) Lusaka, Zambia
49. Ministry of Tourism Environment and Natural Resources [(MTENR), 2010)], *National Climate Change Response Strategy*, Lusaka Zambia.
50. Musumali, M.M., Heck, S., Husken, S.M.C., Wishart, M. (2009) Fisheries in Zambia: An undervalued contributor to poverty reduction. The WorldFish Center/The World Bank. Policy Brief 1913
51. National Disaster Management Policy
52. National HIV/AIDS/STI/TB Act of 2002
53. National Policy on Environment (NPE). (2009)
54. National Water Policy. (2010).
55. Nawa, K (2000). Drought Monitoring in Zambia using Meteosat and AVHRR Data. Available at: https://www.geospatialworld.net/article/drought-monitoring-in-zambia-using-meteosat-and-noaa-avhrr-data/
56. Nkomoki et al. (1999). Estimating the Impact of Climate Change on Rainfed Agriculture. Pilot Environmental fund: Spedicoprint. Lusaka.
57. Occupational Health and Safety Act, 2010
58. Public Health Act, 1930 Cap. 535
59. Ramsar Convention
60. Revised National Water Policy (NWP), 2010
61. Rossi, G., and Castiglione L., (2011). Towards guidelines for drought preparedness and mitigation planning within EU water policy. *European Water* 36:37-51. Accessed on 18/08/2018 at https://www.ewra.net/ew/pdf/EW_2011_36_04.pdf
62. SADC Protocol on shared Water Resources
63. SADC Regional Awareness and Communication Strategy for the Water Sector, May 2008. SADC
64. Thurlow, J.; Zhu, T. and Diao X (2009), Impact *of Climate Variability and Change on Economic Growth and Poverty in Zambia*, International Food Policy Research Institute. Discussion Paper 00890; www.ifpri.org/pubs/otherpubs.htm#dp.
65. Thurlow, J.; Zhu, T. and Diao X (2009), Impact *of Climate Variability and Change on Economic Growth and Poverty in Zambia*, International Food Policy Research Institute. Discussion Paper 00890; www.ifpri.org/pubs/otherpubs.htm#dp.

66. UNISDR. (2009). *Drought Risk Reduction Framework and Practices: Contributing to the Implementation of the Hyogo Framework for Action*. United Nations secretariat of the International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland, 213 pp.
67. United Nations Convention to Combat Desertification (UNCCD).
68. United Nations Framework Convention on Climate Change (UNFCCC).
69. Water Resources Management Act No. 21 of 2011.
70. World Bank (2009). *Managing Water for Sustainable Growth and Poverty Reduction*: A Country Water Resources Assistance Strategy for Zambia. Washington: World Bank.
71. World Bank/IFPRI (2008), *Zambia CWRAS Background Study on Climatic Variability*. http://openknowledge.worldbank.org. Accessed 24th December 2016.
72. World Meteorological Organization (WMO) and Global Water Partnership (GWP) (2014) National Drought Management Policy Guidelines: A Template for Action (D.A. Wilhite). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden.
73. Zambezi River Commission Agreement (2004).
74. Zambia Meteorological Department, 2013. *National Meteorology Policy*, Ministry of Transport, Works, Supply and Communications, Lusaka.
75. Zambia Meteorological Department, 2013. *National Meteorology Policy*, Ministry of Transport, Works, Supply and Communications, Lusaka.
76. Zambia Vulnerability Assessment Committee (2016). *Multi-sectoral in-depth Vulnerability and Needs Assessment in Zambia*, ZVAC, Lusaka, Zambia.
77. Zambia Vulnerability Assessment Committee, 2014. *Zambia Livelihood Map Rezoning and Baseline Profiling.*

ANNEX 1: TEXT FOR DROUGHT PREPAREDNESS AND MITIGATION

Criteria to improve drought preparedness and mitigation in Zambia

A. Legislative decisions about the drought planning levels and competence sharing

i. Review existing legislation with the view to improve the development and implementation of plans and sub-plans at different territory levels including possible interventions against drought taking into account water shortage problems in water supply systems.

ii. Within a comprehensive drought management process Rossi et al (2008) identified three tools for implementation at different planning levels:

- Strategic Water Shortage Preparedness Plan at strategic level
  - As the Drought Management Plan the aim of this plan is to minimise the drought vulnerability of the catchment or district concerned. Besides the drought risk on the land (mainly rain-fed agriculture) and on the rivers (as prolonged drought, the SWSPP should be aimed at reducing the risk of water shortage due to drought in the water supply systems
  - Information required for drafting this Plan includes meteorological, hydrological, water resources and demands information, technical and management water supply systems information, historic droughts and water scarcity information
  - It should have emergency measures to reduce drought impacts; short-term measures to improve the management of the systems under drought conditions; and long-term measures to reduce the vulnerability of the system
- Water Supply System Management Plan at tactical level
  - The WSSMP contains operational measures in order to avoid water emergency situations within a specific watery supply system. Thus it falls under the competence of the management of the water supply system for the specific sector or multi-purpose supply.
- Drought Contingency Plan at emergency level
  - Prepared by WARMA (Catchment Offices) in collaboration with DMMU and should contain short-term measures that can be activated under water emergency conditions due to exceptional drought, when drought is declared to be a national disaster by the President.
  - The DCP should leverage public cooperation in order to be effective and implementable

B. Criteria for developing a drought monitoring system

i. Both the WSSMP and DCP are linked to the drought monitoring system that has to continuously monitor the hydrometeorological variables and water resources status and aim to identify crisis situations

ii. The efficient drought management depends on the capacity to monitor drought and its effects. So the legislation on drought should also include criteria for drought monitoring systems since they represent an important support tool for decision making, by enabling the identification of drought warning conditions and for providing timely and useful information for implementation of the WSSMP (under drought conditions) and for an objective declaration of national disaster.

iii. Emphasis should be placed on graphical and understandable presentation of the results of the monitoring

iv. It is of utmost importance that there is easy access to information by all water users (e.g., use of website, radio)

v. WARMA and ZMD should lead the drought monitoring while DWRD, Water Utilities, NWASCO should focus on monitoring water shortage in supply systems.

C. Recommendations for defining drought preparedness and mitigation measures

i. Proactive (risk management) approach better than being reactive
ii. Adopt appropriate (structural, management, administrative and economical) measures to face different drought phases
iii. Drought mitigation measures may be classified as:
    - Long term measures oriented to reduce vulnerability of water supply system to drought, namely to improve the reliability of each system to satisfy water demand under drought conditions, as well with structural and institutional interventions. Moreover such actions are included into the general water resources planning and could refer to drought events characterised by a fixed exceeding probability ("design drought")
    - Short term measures oriented to reduce the damages of a specific drought event after it has been forecasted or recognised as potential origin of severe impacts in the framework of the existing facilities and politics. Furthermore they aim at mitigating the effects of a drought that may overcome a "design drought" (considered in long term actions) and they are included both into the Water Supply System Management Plan under drought conditions and into the Drought Contingency Plan to face emergency situations.

D. Criteria for triggering actions in the operation of water supply system under drought conditions

There is need to establish specific triggering levels that should be linked to specific thresholds on available water reserves in order to avoid crises. Iglesias et al (2007) identified three threshold levels to individuate different drought phases and to select related mitigation measures, namely, pre-alert, alert and emergency.

i. The **pre-alert scenario** is declared when the monitoring system shows the initial state of a drought, corresponding to moderate risk (that is, 10%) of consuming water stored in the system and not being able to meet water demands. Since the objective of this phase is to prepare toward an oncoming drought, it needs to ensure public acceptance of actions to be implemented by increasing public awareness of the possibility of social impacts due to drought. The suggested measures for this situation, aimed at avoiding alert or emergency situations, are generally indirect, non-structural, of low cost and are to be implemented voluntarily by stakeholders.
ii. The **alert scenario** is declared when the monitoring shows that drought is occurring and will probably have impacts in the future if measures are not taken immediately: there is significant probability (that is, >30%) of forthcoming water deficits. In this phase, which aims at avoiding drought emergency situations by applying water conservation policies and mobilising additional water supplies, the suggested actions are generally not structural, coercive and low/medium implementation cost. They are directed to specific water-use groups and generally include partial restrictions for water uses other than drinking or water exchange between uses and can reallocate water for priority uses.
iii. The **emergency scenario** is declared when indicators show that drought impacts have occurred and water supply is not guaranteed if the event persists. Under emergency conditions, the main purpose is mitigating the impacts and minimising the related damages and the priority is satisfying the minimum requirements for drinking water. The suggested emergency measures are direct, restrictive and of very high economic and social costs. In addition they can be structural (for example new wells for overexploiting groundwater abstraction, water transfer facilities and so on) or not structural (for example, water restrictions for all users, subsidies and low-interest loans).
iv. In the case of a multipurpose water supply system, the choice of mitigation measures to be implemented depends also on priority of different water uses (for example, agriculture, municipal and industrial), besides the triggering levels. Therefore, a preliminary choosing of the priorities in water allocation under shortage conditions is necessary, also in order to distribute possible water

deficits. Two priorities levels (backed by law, for example, the Water Resources Management Act 2011) can be considered, one aimed at ensuring availability of adequate domestic water supply for public health, safety and welfare; and another oriented to minimising negative drought effects on the economy, the environment and social well-being.

E. Criteria for drought emergency actions

i. Under emergency conditions, the activation of the mitigation measures included in the Drought Contingency Plan should follow the declaration of drought as a national disaster. DMMU could greatly enhance the implementation of the DCP through the disaster management structures. However, massive improvement would be required in the existing process for development and implementation of the Disaster Management Contingency Plan.

ii. Another important issue during emergency situations concerns the appointment of suitable task forces (for example, within ZVAC) aimed at coordinating actions against drought. These should be formed by both representatives of regional government (Civil Protection, Provinces, District Councils, Land Reclamation Consortia) and environmental and public interest groups and representatives from the private sectors. Public involvement is necessary to obtain support for the implementation of emergency interventions and to establish cooperative relationships.

iii. Following the drought emergency phase, it could be taken into consideration the adoption of a responsive political strategy for choosing between damages recovery based on governmental support or on private insurance (eventually fostered by national funds).