United Nations Development Programme

Country: Ethiopia

PROJECT DOCUMENT[1]

Project Title: Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Ethiopia

UNDAF Outcome(s):

UNDAF Pillar 1 Outcome 4 By 2015, national and sub-national institution and vulnerable communities have systematically reduced disaster risks, impacts of disasters and have improved food security

UNDAF Pillar 1 Outcome 5 By 2015, the governance systems, use of technologies and practices, and financing mechanisms that promote local carbon climate resilient economy and society have improved at all levels

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: strengthened national capacities, including the participation of women to prevent, reduce, mitigate and cope with the impact of the systemic shocks form natural hazards.

UNDP Strategic Plan Secondary Outcome: Strengthened capacity of developing countries to mainstream climate change adaptation policies into national development plans.

Expected CP Outcome(s):

Outcome 1: Strengthened capacities of government and producer institutions to design, develop and deliver key services (Hydro-met services)
Outcome 2: Mainstreaming & operationalization of DRRM policy.
Outcome 4: LCCR & MEA compliance, access to climate finance and technology.

Expected CPD Outputs

Output 1: Integrated DRM systems and coordination mechanism at federal and regional levels

Output 2: Technical studies, consultations and proposals completed for LCCR and MEA compliance; national multi-donor climate trust fund established and operational.

Executing Entity/Implementing Partner: Federal NMA

Implementing Entity: National Meteorological Agency

Responsible Partners: Hydrology and Water Quality Department, Disaster Risk management and Food security Sector, Ministry of Agriculture, Ministry of Water and Energy, 11 Regional offices of the National Meteorological Agency, 11 Regional offices of the Hydrology and Water Quality Department, Addis Ababa University.

[1]For UNDP supported GEF funded projects as this includes GEF-specific requirements

Brief Description

The ability of decision-makers in Ethiopia to understand the likely impacts of climate change in the short and long-term is of critical importance to the countries' sustainable growth aspirations. Given Ethiopia's reliance on climate sensitive agriculture, natural resources management and energy, the impacts of warming that has already been experienced has had negative effects on the nation's land based productive sectors and existing urban infrastructure. This projects aims at strengthening the capacity of the Government of Ethiopia to observe, analyse and forecast climate information to enhance their early warning systems and for climate resilient development and adaptation to climate change.

LDCF funds will contribute to Ethiopia's NAPA priorities (Strengthening/enhancing drought and flood early warning systems in Ethiopia; Capacity building program for climate change adaptation in Ethiopia). This initiative will support the National Climate Resilient Green Growth Strategy, and will result in strengthening the observational and analytical capacity of the national hydro-met services and its early warning system, and supporting the disaster risk management and development planning agencies in their effort to adapt to climate change.

The following stakeholders will be involved:

- The National Meteorological Services Agency
- The Hydrology and Water Quality Directorate
- The Disaster Risk Management and Food Security Sector
- The 11 regional centers of the NMSA
- The 11 regional centers of HWQD
- The University of Addis Ababa and other research institutions
- The Ministry of Water and Energy, the Ministry of Agriculture, the Ministry of Finance and Economic Development.

The project outcomes are closely aligned and coordinated with baseline efforts already underway within Ethiopia to promote development which is resilient to climate change at the national and local levels.

Programme Period:	2013 - 2017
Atlas Award ID:	00073414
Project ID:	00086227
PIMS #	5095
Start date:	September 2013
End Date	September 2017
Management Arrangements	NIM
PAC Meeting Date	31st July 2013

Total resources required	$ 37,836,410
Total allocated resources:	$ 37,836,410
• Regular (GEF/LDCF)	$ 4,500,000
• Government	$ 600,000
• UNDP	$ 13,000,000
• Other	$ 19,736,410

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP): Date/Month/Year

Date/Month/Year

Table of Content

CONTENTS

List of Acronyms

AMESD	African Monitoring of the Environment for Sustainable Development
AWS	Automatic Weather Stations
BoARDs	Bureau of Agriculture and Rural Development
CC	Climate Change
CNCRE	Carbon Neutral Climate Resilient Economy
CPAP	Country Programme Action Plan
CRGE	Climate Resilient Green Economy
CSO	Civil Society Organisation
DHWQ	Directorate for Hydrology and Water Quality
DRMFSS	Disaster Risk Management and Food Security Sector
ELA	Enhanced Livelihood Application
EPA	Environment Protection Agency
EPACC	Ethiopian Plan for Adaptation to Climate Change
EWS	Early Warning Systems
FAO	UN Food and Agriculture Organisation
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GDI	Gender Differentiation Index
GEF	Global Environment Fund
GFDRR	Global Fund for Disaster Risk Reduction
GTP	Growth and Transformation Plan
HDI	Human Development Index
HWQD	Hydrology and Water Quality Department
IC	International Consultant
IPCC	Inter-governmental Panel on Climate Change
LDCF	Least Developed Countries Fund
MDG	Millennium Development Goal
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
MOWCA	Ministry of Women and Children's Affairs
MoWE	Ministry of Water and Energy
NAMA	National Appropriate Mitigation Actions
NAPA	National Adaptation Programme of Action
NC	National Consultant
NCCF	National Climate Change Forum
NMA/NMSA	National Meteorological (Service) Agency
NHMS	National Hydro-Met Services
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PB	Project Board

PIF	Project Identification Form
PPG	Project Preparation Grant
PRIME	Pastoral Resilience Enhancement and Market Expansion
PSC	Project Steering Committee
UN CDF	United Nations Capital Development Fund
UNDAF	UN Development Assistance Framework
UNDP	United Nations Development Programme

1 SITUATION ANALYSIS

1.1.Climate change– induced problem

1. Climate change and the limited availability of climate information are leading to increased challenges in managing, planning and coordinating the impact of, and response to severe weather events in Ethiopia. A combination of insufficient coverage of observational infrastructure (both automatic weather stations and hydrology gauging stations) with low capacity to analyse and model the climate and environmental data, leads to inadequate information to support the decision making processes. This weak observational and analytical capability compounds the difficulty to foresee and manage extreme weather events, and to mitigate long term impacts of climate change on various sectors of the economy.

2. The unfolding of climate change is of critical importance to Ethiopia. Its economy remains reliant on climate sensitive agriculture and natural resources management (42% of GDP emanates from and 85% of employment is in the agriculture sector) and rainfall and natural resource dependent energy (biomass and hydropower). Recent assessments have estimated that economic growth could be hit by up to 2.5% per year unless measures are taken up front to build the capacity for adapting to the opportunities and threats faced by climate change (World Bank 2008). Climate Change is also expected to further impact Ethiopia's income inequality, which is likely to further decrease economic growth and fuel poverty. Overall climate change is expected to increase the fraction of people in poverty (Mideksa 2010).

3. In Ethiopia's NAPA published in 2007, climate projections were included for three periods: 2030, 2050 and 2080. For the IPCC mid-range emission scenario, the mean annual temperature is predicted to rise between 0.9 and 1.1°C by 2030, between 1.7 and 2.1°C by 2050 and between 2.7 and 3.4°C by 2080 compared to the 1961-1990 normal scenario. A small increase in annual precipitation is also expected over Ethiopia.

4. Various studies published since the 4th IPCC Assessment report have used predictions of climate change and variability to understand the economic impacts facing Ethiopia as a result of climate change, in particular focusing on temperature changes, precipitation changes and impacts of CO_2 on crop production (Mideksa 2010; Arndt et al 2009; Jomg-Yun You & Ringler 2010). As such Ethiopia is seen as a country at high risk of climate change since a major portion of its GDP comes from climate sensitive sectors.

1.1.1 The impact on disaster risk management

5. Ethiopia has a history of experiencing severe weather that translates into flooding, landslides or droughts affecting large parts of the population both in the urban and rural areas. The unfolding of climate change will increase the variability and intensity of extreme weather events such as heavy rain or drought thereby further compounding the challenges of mitigating and managing these natural disasters. The increase in intensity and unpredictability of natural disasters due to extreme weather has a substantial impact on the economy, on human assets and human lives. One such disaster can cancel years of slow and hard earned development and asset accumulation by the poorest communities.

6. The NAPA of Ethiopia recognizes the risks brought by climate change and the need for mitigating action and investment in monitoring and understanding climate change. NAPA's second priority action states "Strengthening/enhancing drought and flood early warning systems in Ethiopia."

1.1.2 The Impact on the Agricultural Sector

7. Ethiopia's dependence on the agricultural sector was clearly demonstrated in 2002/3 when there was a sharp slip in food production due to droughts in certain parts of the country, which caused significant disruption to the economy. Nearly 15 million people were affected by food shortages and received emergency food supplies for some period during that year. Despite agriculture being at the centre of the government's development strategy, growth in this sector has been slow with the majority of improvements in the economic situation driven mainly by services and trade. Given the importance of the agriculture sector, the PASDEP focused on growth in the 2005-10 period, with a particular emphasis on commercialization of agriculture. This continues into the new PASDEP – the Growth and Transformation Plan (GTP 2010-2015), but this also recognizes that climate change will impact on the country's economy and will require investment and action to derive opportunity and mitigate risk from this impact.

8. A recent study looking at hydro-economic modelling (Conway & Schipper 2010) suggest that the major impact of climate change on Ethiopia's economy will result from more frequent occurrence of extreme hydrologic and weather events, which will cause losses in both the agricultural and non-agricultural sectors. The findings have serious implications for the agriculture sector in Ethiopia and also the relative weakness of Ethiopia's non-agricultural sectors in absorbing surplus labour. There needs to be a strengthening of the forecasting ability to anticipate these extreme weather events and mitigate them.

1.1.3 Impact on the Urban Economy

9. Addis Ababa, as with other cities in Ethiopia will be affected both directly and through its changing relationship with its hinterland. It is envisaged that there will be a gradual increase in temperature (as indicated above) and small increase in annual precipitation over the next 50 years but a changing seasonal pattern: a likely increase of rainfall during *Kiremt* up to 2080s, reduction in rainfall in April to June and significant increase of rainfall in October to December (Semu 2010 International Water Management Institute). It is projected that this will result in: increases in flooding and vulnerability of drainage infrastructure, residents and businesses to flood damage; increases in water borne and insect disease vectors. The ecology of the region is likely to change and within the city itself, management of sensitive catchments will be needed to maintain ecological services that the urban economy depends on – particularly water and sediment management, water quality and quantity, and bio energy resources.

10. Addis Ababa Region relies on water resources, energy and food from its hinterland and as the environment changes in these areas, the supply chains of rainfed crops, of water and of energy that may be at risk.

1.1.4 Development Impacts

11. Preliminary climate change assessments predict GDP losses of as much as 8% per year based on current climate projections. Reductions of this level will inevitably negatively affect the Government's ability to invest in the nation's development; increasing the responsibility for adaptation on society as a whole. In such a situation, it will be the poorest communities who will be the least able to adapt. Amongst these groups, it is recognised that women are the most vulnerable. Ethiopia's Policy on Women acknowledges that women have lacked the opportunities provided to men and as a result they fall behind men in all fields of self-advancement. Climate change will affect the socially constructed role dynamics between men and women and may undermine efforts to build more equitable access to development. These role dynamics may need to be changed to enable men and women to improve their responsive and adaptive capacity. If under climate change-induced stress, institutional structures place unequal emphasis on responding to the needs of men and women, they risk weakening the adaptive capacity of one group over another. The project aims to build strengthened EWS and long term planning capacity, so that severe

weather events that can have catastrophic consequences on livelihoods and food security are better forecasted and long term adaptation to climate change is improved.

1.1.5 Policy Responses

12. The Ethiopian Government has acknowledged the climate change risk the country faces and has stated it as a priority issue for the country (NAPA, 2007; and the Growth and Transformational Plan). The process for national planning and strategy development is in place. As a part of this plan the need for enhanced weather forecasting and analysis is recognised as crucial both for short term warnings and long term planning for adaptation. There remains a need to consolidate these interventions, ensure they are climate-proofed and integrated into comprehensive adaptation action.

1.2 Long-term solution

13. The Government of Ethiopia's long term preferred solution is to enhance Ethiopia's capacity to gather and analyse climate and environmental information in order to inform its population about severe and extreme weather events as well as long-term systemic change triggered by climate change. The expectation is that this increased capacity will contribute towards all ongoing efforts to strengthen the resilience of the country to expected climate risks.

1.2.1 Enhanced observational and forecasting capacity for hydro-met information

14. Based on consultations with various stakeholders (Government ministries and departments such as NMA, HWQD, DRMFSS, farmer association and women representatives in two consultation meetings - see stakeholder analysis in section 2.1.3 below) improving the resilience of Ethiopia to climate change and to better manage severe weather related disasters, food security and agricultural production, scarce and dwindling water resources and make their socioeconomic development process less vulnerable to climate-related risks it is important to:

- Enhance the capacity of hydro-meteorological services and networks for predicting climatic events and associated risks;
- Develop a more effective, efficient and targeted delivery of climate information to farmers, pastoralists, and other sectors of the economy including early warnings;
- Support improved and timely preparedness and response of the DRMFS to forecast climate-related risks and vulnerabilities.

15. From bilateral discussions with Government departments(NMA, HWQD, DRMFSS, farmer association and women representatives in three consultation meetings see stakeholder analysis below) and other multilateral and bilateral actors, the following measures need to be brought together to enhance and strengthen existing early warning systems:

- Rehabilitation and procurement of hydrological gauging stations to monitor lakeand river levels (especially lake Tana and the Awash rivers), enabling early warnings of rising flood levels;
- Rehabilitation of existing weather stations and procurement of Automatic Weather Stations (AWS),especially located in lowlands of Afar, southern Oromia, (see Annex IV for details) to improve the data gathering capacity and monitoring of drought and extreme weather;
- Strengthen coverage of upper air monitoring stations(e.g. located at Bahir Dar) to provide forecasters with improved knowledge of atmospheric conditions;

- Secure access and enhanced use of satellite-based observations (e.g. Rainfall estimates (RFE) RFE and Normalised Difference Vegetation index (NDVI)), as well assoftware for satellite data access and analysis, to extend the areas covered by observations/monitoring;
- Enhanced human capacity to operate and maintain newly rehabilitated and procured equipment.

1.2.2 Strengthened capacity of NMA and HWQD to disseminate hydromet tailored products to specific sectors of the economy

Improved observational infrastructure needs to be utilized to make and disseminate tailored and targeted hydromet products such as agromet advisories, flood early warnings and alerts, model based rainfall predictions and forecasts, and severe weather warnings. These alerts and forecasts need to be tailored and designed so that they are easily understood and useable by different sectors. This involves:

- Strengthening of the capacity of the NMA to make and use climate forecasts (on daily to seasonal, as well as medium- to long-term timescales).
- Identifying user needs to provide tailor made sector specific early warning products that link climate, environment and socio-economic information on a range of timescales.
- Strengthen the national capacity to assimilate forecasts and incorporate them into long term planning and poverty reduction strategies.
- Enable and improve communication channels for disseminating early warnings to the concerned population.
- Private public partnerships created for the long-term sustainable financing of the EWS infrastructure.

16. Such a weather and climate monitoring system can provide Ethiopia with the capacity to develop: (i) an early warning system for severe weather; (ii) real-time weather and hydrological monitoring; (iii) weather forecasting capabilities (Numerical Weather Prediction); (iv) agro-meteorological information and services (including integrated crop and pest management); (v) applications related to building and management of infrastructure; (vi) land, air transport management; (vii) integrated water resources management; and (ix) planning and policy making processes.

1.2.3 Adaptation planning and integrated adaptive management

17. To support improvements in weather forecasting in Ethiopia, EWS for floods and droughts, and long term planning for climate change adaptation, there is a need for effective institutional capacity to be developed for the National Meteorological Agency, the Disaster Risk Management and Food Security Sector and the Ministry of Water and energy. This involves:

- Increased technical assistance to improve weather predicting and forecasting techniques and practices.
- Linking meteorological and agricultural information more effectively and providing farmers with downscaled weather forecasts.
- Investment in early warning systems to empower the concerned institutions to better manage their infrastructure, and training on climate monitoring capacity for the local administration.
- Improved capacity building to adopt new technologies and use them to make more timely and accurate weather/climate forecasts in both the short term and the long term.
- support for cross sectoral coordinationof national administrations and experts to prepare long term adaptation plans.

- Enhanced technical capacity of NMA staff to maintain and manage equipment
- Public awareness and education in climate change issues, especially severe and extreme weather and long term impacts of climate change.

18. To enhance the planning and efficient management of improved climate information, linkages between institutions involved in issuing early warnings, disseminating the warning and taking mitigating actions will have to be strengthened and standardised. Standard operating procedures (SOPs) describing the processes, communication channels and responsibilities of each agency and institution involved in the early warning, dissemination and preparedness need to be developed and enacted to provide the country with a clear and effective system of early warning where each institution is aware of its responsibilities and can act accordingly.

19. Similarly for long term planning for climate change adaptation, special data sharing and modelling capacities need to be developed that link long term climate forecasts with environmental and socio-economic data to plan for adaptation in agriculture, forestry, water management, urban planning and transport infrastructure. The emphasis is on the integrated management and planning between the various concerned institutions and agencies and improved coordination mechanism in place as each agency will have to play its part as effectively as possible in collaboration with other institutions.

1.2.4 Integrating Gender in EWS and in designing hydromet products

20. Improving the EWS and the long term planning for climate change adaptation in Ethiopia should improve the resilience of both women and men to climate related shocks, and create opportunities for building resilience. Given women's often particular vulnerabilities (e.g. limited livelihood options, restricted access to education and information services, and insufficient means to recoup assets) to disasters and other climate change effects, especially in regions along the Abbay and Awash river basin, as well as the Wabi Shebelle and the GenaleDawa areas, it is critical to ensure that their roles, needs, priorities and contributions are explicitly taken into account in climate change responses. Engaging in both the informal and formal sectors, women also play a key role in their communities as entrepreneurs and community networkers. As such, they play a critical role in helping reduce and respond to climate change effects. Evidence has shown that women's involvement in early warning systems (EWS) has greatly contributed to the success of project outcomes.

21. When preparing sector-specific early warning products and responses for Ethiopia the project needs to ensure they are conducted in a gender-responsive manner, wherein they identify the climate risks, vulnerabilities, roles, needs, priorities and opportunities of all stakeholders/end-users within the identified communities, including both women and men. Such gender-responsive assessments encourage a gender approach from the outset, as well as provide baseline data for monitoring. The project impact must be gender sensitive and coordinate closely with the ministry for Women Affairs in Addis Ababa. Project outcomes and outputs have been designed to involve and benefit both women and men end-users. To ensure the project makes an equitable difference on the ground, it is critical that gender issues are identified in the planning process (i.e. via the assessments above) and carried through to implementation, monitoring and evaluation.

22. When defining and developing information, messaging, and capacity building tools on the identified EWS, the project needs to ensure they are created and communicated in consultation with end-users, including women and men, and in such a format which is accessible and understandable to them (for example in local language). To help ensure gender-responsive activities during project

implementation are effectively undertaken, gender expertise and/or gender experts who can provide technical support in this regard will be enrolled.

1.3 Barriers

23. From the situation analysis and preparatory phase several policy, institutional, financial, technological and informational barriers that prevent the desired situation from emerging have been identified. These need to be overcome in order to achieve the preferred long-term solution.

1.3.1 Limited weather, climate and hydrological monitoring infrastructure

24. Due to the limited climate monitoring infrastructure of the National Meteorological Agency, today Ethiopia has 1200 manual stations, out of which 200 are not functioning properly (According to WMO standards Ethiopia should have around 3000 automated weather stations) due to equipment failure and unavailability of calibration units. It also has 70 functioning AWS.

25. Existing infrastructure is often old (spare parts may be difficult to obtain), or dysfunctional because of insufficient maintenance and calibration. This leads to inaccurate data and gaps in measured time series (reducing the application for studies of long-term changes which may be due to climate change) and the need for good quality control procedures to reduce the impact of false readings etc. Understanding the reasons for this reduced functionality is key to avoiding similar problems within this LDCF-funded project. The main challenges in the operation and maintenance of climate observation infrastructure in Ethiopia are:

- Limited availability of trained manpower to maintain the equipment;
- Insufficient Information Communication and Technical personnel;
- Difficulty in accessing suitable and sufficient spare parts;
- Fast growing and changes of technology in the field of communication and observation leading to compatibility issues;
- Difficulty in communication and compatibility with other regional and international centers, e.g. satellite receiving systems, upper air observations;
- Increasing number of extreme climatic events which may damage equipment;
- Limited number of calibration units (these are used to calibrate sensors such as thermometers, humidity and atmospheric pressure sensors etc.)

26. Most weather stations in Ethiopia are manual and the data is often delayed in sending to central forecast centres and archiving facilities. Data may also be inaccurate, and many monitoring devices such as thermometers and rainfall gauges are broken. The data is recorded manually on paper, with a potential for errors and delays in transferring the information to the national center. In Ethiopia there has been a steady decline in infrastructure dedicated to monitoring the climate, hydrology, environment and severe weather (e.g. synoptic, agro-meteorological and hydrological observing stations, satellite receivers, upper air stations, automatic weather observing system (AWOS)) for the last 20-30 years. Whilst this situation has been ameliorated by specifically targeted project interventions, this has often benefited one particular aspect of the early warning system (e.g. African Monitoring of the Environment for Sustainable Development (AMESD) to improve use of satellite data or the "Weather for all" initiative to improve weather station coverage).

27. Recently the need for a systematic improvement of the observing network is recognized by the UNFCCC: "Developing Countries have made only limited progress in filling gaps in their in situ observing networks, with some evidence of decline in some regions, and capacity building support remains small in relation to needs". The installation of new infrastructure also requires several practical considerations: i) safety of the equipment; ii) power sources; iii) long term durability; iv) access for maintenance and v) transmission and archiving of data.

28. This assessment has been confirmed during the project design phase with manual weather stations needing rehabilitation. Most of them are conventional (manual), sparsely and unevenly distributed, concentrated along the main roads and urban regions, and often equipped with outdated instruments. Similarly Hydrology gauging stations are insufficient for monitoring lake and river levels and flows and triggering alerts when flash floods occur, not always functioning and often located in less than optimum locations according to the Directorate for Hydrology and Water Quality. The inability to calibrate the observational instruments, due primarily to insufficient calibration units, and accessibility issues for maintenance, contribute to the accuracy and reliability of collected data.

1.3.2 Limited knowledge and capacity to effectively predict future climate events

29. The understanding of climate change, its manifestation and its impacts is still limited to a few experts and decision-makers at NMA, at the Ministry of Finance and Economic Development and the Environmental Protection Agency. Both the National Meteorological Agency and the Directorate for Hydrology and Water Quality have reported during the project preparatory consultation phase that knowledge and capacity to effectively predict extreme weather events was limited and should be strengthened during project implementation.

30. The scientific and technical capabilities required to effectively identify hazards and forecast their potential impacts on vulnerable communities are often weak. This may be due to an insufficient infrastructure (i.e. computational equipment), software (model code and associated routines) or human capacity/skills to programme and run the model code. Running forecast models is a highly skilled task and requires many years of education and training.

31. In Ethiopia the Environmental Protection Agency, the National Meteorological Agency and the MoFED have limited awareness about the risks posed by climate change and how these relate to development priorities and the Growth and Transformational Plan. For example only limited reference to climate change risk and climate information is made in the GTP and other planning documents. This is a barrier to the necessary mainstreaming of adaptation in long-term national and sectoral development planning.

1.3.3 No systematic development of sector-specific information and timely dissemination of warnings

32. Even if climate hazards are forecast in Ethiopia by the NMA, they are not systematically combined with vulnerability analyses to identify the type of risks that are being faced. Such analyses help DRMFSS, Ministry of Agriculture, and the Ministry of Health to ensure adequate warnings are issued and action is taken to mitigate the effects in areas most at risk. When climate information is available (monitoring and forecasts), it should be translated by DRMFSS into specific hazards experienced by different sectors and users e.g. heat units or onset of the rainy season for agriculture. Additionally, the timely issuance of warning is critical for a robust EWS, and this has been a consistent weakness in the system.

33. During the project preparation phase both the DRMFSS and the MoFED mentioned that the information generated by NMA needs to be packaged in way that is easily understood by users, otherwise the information is unlikely to be used. This information should then be combined with known vulnerabilities to identify areas and communities at risk. This is currently not part of the process for issuing warnings in most cases. This is combined with limited awareness and trust among the population about weather forecasts and warning dissemination. Meteorological literacy and large scale awareness campaigns will contribute to improving the receptiveness of the end users in understanding and acting on severe weather warnings.

34. Currently, the National Meteorological Agency collects weather data from around 1200 weather stations across the country, but only about 120 stations have the required number of years of historic records needed to price index insurance. Risk management requires information with respect to the primary risks involved. In the case of weather and crop related risk management, more reliable seasonal and short-term early warning information is required, both by farmers and micro-finance insurance institutions, to assess risk and potential returns from their investments. For example, index-based drought insurance products simply use a measure such as rainfall, temperature, or soil moisture to insure against drought or other covariant shocks. To keep this remaining risk, known as basis risk, as low as possible, it is important that farmers are located near weather stations—no further than 20 kilometres, depending on terrain in the area. The inadequate infrastructure necessary to create and monitor weather indexes creates a barrier to the scale up of index insurance.

1.3.4 Limited environmental databases for assessing the risks posed by climate variability and change

35. Insufficient up-to-date data represents a constraint on more advanced and detailed research, analyses and informed decision-making. Major capacity requirements exist in relation to environmental data collection and analysis, requiring consideration during the preparatory phase as well as the implementation phase of this project. It was noted that much of the existing environmental data was not archived securely and awareness of what existed at different departments, institutions, NGOs and other stakeholders was limited. Focused efforts will be required to ensure reliable data collection, analysis and storage.

36. Baseline studies on environmental information (e.g. soil types, vegetation cover, slopes, etc.) and vulnerabilities to climate shocks are limited, discreet and most of the time held by different sectors and institutions (some data is with EPA, other data is held by the DRMFSS or the HWQD). Calculating risks for known vulnerabilities requires a comprehensive archive of information related to vulnerable communities, infrastructure, roads, access to markets, flood prone areas, cropping patterns etc. All the information required to assess vulnerability and calculate risks needs to be accessible, either through a central database/repository, or through distributed networks.

1.3.5 Long-term sustainability of observational infrastructure and technically skilled human resources

37. Insufficient recurring budgets and annual fund allocation by the Government has reduced the ability of the NMA and HWQD to operate and maintain the weather observational infrastructure. The maintenance of monitoring equipment, the human capacity to use and repair this equipment, process data and develop early warning packages, all require constant income streams and annual budgets. These are

needed for the sustainability of the system and therefore require suitable business models and financial mechanisms to be developed and used. Compounding this barrier is the need for improved institutional arrangements with clearer mandates and roles as well as more robust monitoring and evaluation systems. Increased technical skills alone will not address the problem unless it is accompanied by increased accountability, a vision of how institutions will grow and develop, and strong budget planning.

38. The NMA and DRMFSS often struggles to pay for the maintenance and upgrade of existing equipment which is recognized as a limiting factor and various levels of public-private partnership have been suggested, including the use of an intermediary organization (though NMA are resistant to a purely private arrangement). Regardless of the business structure it is clear that delivery of targeted services, such as those proposed here, are essential for generating products and revenue that both public and private clients will pay for. This revenue can then help support the maintenance of the observational infrastructure and the salaries of skilled staff to use it and generate the early warning products.

2 STRATEGY

39. LDCF financing will contribute towards helping Ethiopia become more resilient to climate change by improving its capacity to monitor and forecast extreme weather and long term climatic changes. This initiative will also support the planning authorities to routinely include climate risks into their planning processes. A detailed assessment of the existing climate observational infrastructure, the gaps and needs is presented in the key assessment report in Annex III.

40. Capacity building to enhance the analytical skills and capability of NMA and HWQD to analyse and package weather, climate and hydrological information is an essential part of this project. It will improve the effective and efficient functioning of these crucial monitoring and forecasting institutions to deliver their mandate, including the timely issuing of forecasts and warnings.

41. Part of this project is based on training and national capacity development in the hydro-met and DRM institutions to improve the effectiveness and efficiency of EWS performance to make it more consistent and climate resilient. Emphasis will be on encouraging **South-South cooperation for training and capacity development** as much as possible.

2.1 Project rationale and policy conformity

42. Ethiopia became a signatory to the United Nations Framework Convention on Climate Change on 13 June 1992, ratified the Kyoto Protocol on 08 September 1993 and entered into force on 21 March 1994.It is a Least Developed Country (LDC) and highly vulnerable to climate change. Ethiopia's NAPA was published in 2007. This project will build the capacity for climate change adaptation planning and implementation by addressing two NAPA priorities that are inter-connected:

Table 2: NAPA priorities addressed by the project

NAPA Priority Rank	Activity
2	Strengthening/enhancing drought and flood early warning systems in Ethiopia.
6	Capacity building program for climate change adaptation in Ethiopia

43. The link between this project strategy and the NAPA is centered on a common goal of informing climate resilient development planning and sector management through improved national systems that generate relevant climate information.

44. The NAPA identifies a number of existing national policy initiatives, sectoral policies, programs and strategies that may directly or indirectly address climate change adaptation. Accordingly, the most important policy and program documents that have relevance to climate change adaptation include the Plan for Accelerated and Sustainable Development to end Poverty (PASDEP), Environmental Policy of Ethiopia, Agriculture and Rural Development Policy and Strategy, Water Resources Management Policy, Health Sector Development Policy and Program, National Policy on Disaster Prevention and Preparedness, National Policy on Biodiversity Conservation and Research, Science and Technology Policy, Population Policy and National Agricultural Research Policy and Strategy.

45. The NAPA states that "From the policy perspective, the ultimate goal is to reduce climate change impacts through development programmes and projects that contribute towards the alleviation of the worsening natural resource depletion and environmental deterioration. Therefore, programmes that address climate change impacts (drought, flood, famine, etc), vulnerability and adaptation measures should be treated as an integral component of the overall development programmes that involve all the relevant sectors through short and long-term programmes particularly in the areas of natural resource management, utilization, development and conservation." This project is directly contributing to the above policy approach.

- Ethiopia's second adaptation priority action listed in the NAPA is "Strengthening/enhancing drought and flood early warning systems in Ethiopia." The NAPA states that "The National Meteorological services in Ethiopia do not have adequate capacity to provide accurate and timely user specific weather and climate forecast." Resources are requested to finance activities that will enable:
- Assessment of existing early warning systems needs and identify gaps in the country;
- Improve monitoring and prediction facilities;
- Improve the observational network;
- Upgrade the telecommunication network through modern technologies;
- Improve data processing systems and automation of date quality control, analysis and archival;
- Develop skilled human resources;
- Provide specialized training in Numerical weather prediction(NWP), climate modelling; information technology, meteorological equipment and instrument maintenance.

46. **The PASDEP** outlines some important policy measures related to climate change and mentions that "Developing a national strategy to enhance coping mechanisms regarding the adverse impacts of climate change" and "Capacity building, training & awareness creation of the community" are key expectations. This proposed project is consistent with this policy in that it seeks to develop and strengthen EWS and long term planning for climate change adaptation which will contribute to the country coping mechanism. An important component of this project is focused on capacity development and training at various levels of government and is aligned with the PASDEP policy.

47. The project by providing enhanced weather observational and forecasting capacity cuts across policies and sector and will benefits different sectors such the agricultural sector, with more accurate previsions, the environmental sector with improved understanding of weather patterns and other sectors like the health sector and urban planning.

48. **The Environmental Policy of Ethiopia** states as part of its adaptation options that "Awareness creation programs about the effects of GHGs emission, effects on climate change &natural environment" as well as "Establish & build national capacity to undertake climate monitoring programs" are important contribution to the overall strategy of mitigating climate change. This project by strengthening and improving climate monitoring capability and increasing awareness on the effects of climate change is consistent with this policy.

49. **Agriculture and Rural Development Policy** mentions as part of its adaptation options that "Improve farmers' knowledge about proper use of weather information in carrying out agricultural activities to avoid risks of climate change" and "Improved land management, moisture & soil conservation & flood control method in both the high &lowland areas" are crucial measures for its strategy on climate change adaptation. This project by providing "Tailored sector-specific early warning products that link climate, environmental and socio-economic information on a range of timescales are developed, based on identified user needs" (output 2, 2) and by enhancing the forecasting and communications capability of the country is well aligned with this policy.

50. **Water resources policies & strategies** states as part of its adaptation options that "Introduce methods to tackle & prevent flood protection, disaster prevention actions; and maintenance of flood control structures" and "Manage and tackle droughts as well as the associated slow on-set diseases" are significant contributions to tackling the impact of climate change. This project by strengthening the EWS for extreme weather events and enhancing long term planning capacity for climate change adaptation fits accurately within this policy.

2.1.1 LDCF conformity

51. This project is fully in line with LDCF/SCCF focal area objective 2 "Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level" and objective 3: Promote transfer and adoption of adaptation technology. It is specifically aligned with outcomes linked to these objectives including increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas, strengthened adaptive capacity to reduce risks to climate-induced economic losses, successful demonstration, deployment, and transfer of relevant adaptation technology in targeted areas and enhanced enabling environment to support adaptation related technology transfer.

52. The LDCF was created with the objective of funding urgent and immediate adaptation needs in the LDCs as identified in the NAPAs. The project conforms to the LDCF's eligibility criteria, namely: i) undertaking a country driven and participatory approach; ii) implementing the NAPA priorities; iii) undertaking a multi-disciplinary approach; iv) promoting gender equality; and v) undertaking a complementary approach, as described below:

- Country drivenness and undertaking a participatory approach: Activities to be undertaken by the project were selected through numerous stakeholder consultations of the NAPA and the PPG (see Section 1.5 Stakeholder baseline analysis for details) and thus are in line with country priorities. See Section 2.1 for information on country drivenness.
- Implement NAPA priorities: the project will address NAPA adaptation priorities 2, 6 and 9 as noted in Section 2.1.
- Multi-disciplinary approach: the project includes two main components, namely: technology transfers and institutional capacity development for integrated adaptation planning; Within each component and Outcome, the project will undertake a number of activities (see Project Objective, Outcomes and Outputs/activities Section) to ensure a multi-sector approach to building capacity for adaptation.

- Gender equality: project outcomes will contribute to an understanding of how adaptation responses can be designed to strengthen gender equality. To achieve this, the project will ensure that women attend workshops and are part of interventions and management committees.
- Complementary approach: In order to build upon existing plans and avoid the duplication of efforts, the project will work in conjunction with relevant on-going projects in Ethiopia (see Section 2.3 for details).

2.1.2 GEF conformity

53. The proposed project is aligned to the GEF Result-Based Management Framework for Adaptation to Climate Change and aims to contribute to Objectives 1, 2 and 3 by:

- Enhancing capacity for conducting climate risk and vulnerability assessments and building these into climate compatible development planning at national and sub national levels;
- Strengthening capacity for targeted local communities to use climate data to inform risk reducing land use decision-making;
- Identifying and transferring appropriate adaptation technologies (hydro –met observational infrastructure) that can support national and regional adaptation.

54. The design of the project has been articulated to meet overall GEF requirements in terms of implementation and design. For example, the following requirements will be addressed:

- **Sustainability:** An extensive programme of training and capacity building will accompany the transfer of hydro – met technology and weather observational infrastructure. This will build a cadre of skills and experience at national and regional level that will be able to support on-going EWS and climate change planning capacity for adaptation beyond the project period.
- **Replicability:** The project design and approach has been to deliver a package combining technology transfers and capacity building of key staff at national and sub-national level. This combinationenables and encourages replication by providing knowledge on climate observation and analysis that can be further shared within the country. The pool of trained personnel will act as trainers for the regional staff that will be able to benefit from further national training programs.
- **Monitoring and evaluation (M&E):** The project design includes an effective M&E framework, which will enable ongoing adaptive management, ensuring that lessons are learned and disseminated by producing regular progress reports for stakeholders. See Section 5 (Monitoring Framework and Evaluation) for more information. The indicators are consistent with selected indicators set out in the GEF LDCF/SCCF Results based Management Framework (e.g. Indicators **Error! Reference source not found.**6).
- **Stakeholder involvement:** The project design was formulated as a result of extensive stakeholder consultations (see Section 2.1). A plan is also included to ensure the involvement of stakeholders during project implementation and monitoring.

55. The Project is linked to country priorities of the UNDP Country Programme Action Plan (2012-2015) and by enhancing the EWS and long term planning for climate change adaptation capacity, it will support the implementation of policies, strategies and coordination mechanisms designed to lead to food and nutrition security and sustainable livelihoods protection of vulnerable populations and enhancement of their physical, human and social assets; ensuring a smooth transition between humanitarian responses and longer-term development.

56. The country is eligible to and already receives funding through UNDP. The implementing partner will be the National Meteorological Agency (NMA) in partnerships with other important directorates and government agencies, notably the Directorate for Hydrology and Water Quality (DHWQ) and the Disaster Risk Management and Food Security Sector.

2.1.3 Stakeholder Baseline Analysis

57. The project preparation phase consulted national agencies and stakeholders including: Federal EPA, National Meteorological Services Agency (NMSA), Ministry of water and energy, Disaster Risk Management and food security (DRMFS) as well as regional meteorological and hydrological offices, regional, zonal and woreda level DRM experts and different stakeholders and collaborators. To ensure the proposed project is grounded in local realities and aligned to national policy, the preparatory and design phase involved considerable stakeholder engagement. A series of three consultations at the inception stage, mid-way through the design phase and finally a consultation aimed at validation of the design took place. Additional focus group discussions took place within and among institutions such as Federal EPA, National Meteorological Services Agency (NMSA), Ministry of water and energy, Disaster Risk Management and food security (DRMFS) as well as regional meteorological and hydrological offices, regional, zonal and woreda level DRM experts and different stakeholders and collaborators. The stakeholder consultation covers governmental agencies, national and international NGOs (Oxfam America, Climate Change Forum Ethiopia), civil society (Ethiopian coffee farmers association), donors, UN agencies as well as research centres and universities.

58. The main activities undertaken during the preparation phase included, among others:

- Review and analysis of current and past activities by government, donors, NGOs and private sector institutions that are related to EWS and their intended objectives
- Successful and unsuccessful interventions in relation to EW
- Specific attention has been given to the limitations of current capacity and the weaknesses of existing data generation, analyse/interpretation and disseminationmeteorology and DRM systems, in order to determine the absorptive capacity for the types of activities initially proposed by Government (as per the Council approved PIF)
- Review of existing technologies for EWS at the country level including their capabilities, manufacturers, capacity of existing technical personnel for operation & management in order to identify capacity gaps and needs in the context of information useable for the planning purposes of different stakeholders (users).
- Consultations with both the providers and users of EWS information in the country to determine the most pressing information needs from EWS
- Gap analysis of the current EWS implemented by the government and achieving consensus on what this current opportunity could achieve in Ethiopia
- Assessments of potential locations for automatic weather stations, hydrological gauging stations, , and upper air stations based on historical records of hydro-meteorological hazards, projected changes in climate parameters, availability of land for installing equipment, and expected socioeconomic impacts has been undertaken and agreed by the major stakeholders through a focus group discussion and having workshops at different phases of the PPG.
- The Meteorlogical and hydrological stations which need Maintenace and rehabilitation; the type of equipmet missing/not functioning as well as the cost inorder for the station to function fully has been identified
- Assessment has been undertaken on the ability of the NHMS and other ministries/departments to budget and plan for the human and technical costs of operationally maintaining current and additional observation networks and systems

- Specification of planned activities in country and at the national level to be financed by the LDCF and their rationale
- Definition of a Strategic Results Framework and a Monitoring and Evaluation (M&E) system with quantifiable and verifiable impact indicators at the outcome level in each project document.

59. A matrix with names, affiliations and specific contributions from stakeholders and the role they played in the design can be found in Annex IX.

2.2 Country ownership: country eligibility and country drivenness

2.2.1 Alignment to National Strategy

60. The Growth and Transformation Plan (GTP 2010-2015) is Ethiopia's National economic development plan, it acknowledges that climate change will impact on the country's economy and the prospects for achieving MDGs targets. The GTP puts climate change centre stage in the country's development priorities, particularly in relation to disaster risk management, EWS and natural resource management. Of course it will have cross cutting impacts across all sectors of the economy either directly – as in disaster management and agricultural impacts or through second and third order impacts on demographics, economy and trade.

61. Ethiopia's leadership has acknowledged the risk from climate change and has stated it will require implementing both low carbon development options, build resilience and implement adaptation measures. Following the submission of the 2007 NAPA, a process for establishing a national level strategy was put in place and in 2010 a draft strategy the "Carbon Neutral Climate Resilient Economy" (CNCRE) was prepared by Federal EPA. This was further developed during 2011 to become the Climate Resilient Green Economy (CRGE) strategy.

62. The CRGE is based on the National Appropriate Mitigation Actions (NAMA) and Ethiopia's Programme of Adaptation to Climate Change (EPACC) within the context of the National Environmental Policy. The EPACC is built on the NAPA and seeks to deliver adequate responses through a set of selected best practices in a climate change context. The CRGE underlines the importance of building climate change resilience into the successful delivery of the country's growth strategy, the GTP. By strengthening the EWS and the planning capacity of the country for climate change adaptation, this project is consistent with this approach.

63. This project will also contribute towards Ethiopia's efforts in achieving the MDG 1 ("Eradicate extreme poverty and hunger") and will support its work forwarding MDG 7 ("Ensure environmental sustainability").

2.2.2 Relevant Institutional Frameworks

64. Since 2009, the Federal Environmental Protection Authority (EPA) has been given the overall responsibility for coordinating climate change initiatives. The EPA has a policy-making and regulating function and whilst providing the climate change oversight function, it is line ministries and regional governments who have the responsibility for planning and implementation. The EPA have prepared a draft guiding strategy for climate change entitled the carbon neutral climate resilient economy and has tasked each line ministry with preparing a climate change plan outlining their planned responses to climate change.

Table **3**below outlines the focus of work of relevant Ethiopian organisations currently involved in climate change related actions at a national level.

Table 3: National Institutional roles with respect to climate change

Organisation	Focus of Work
Ethiopian Development Research Institute	Policy research to support government decision making process; conduct research on development of the Ethiopian economy and disseminate results.
Federal Environmental Protection Agency	Ecosystem department; environmental impact assessment service; environmental policy and laws department. Secretariat of National Environment Council & chaired by P.M and national coordinating agency for climate change.
Ministry of Agriculture and Rural Development	Agriculture including fisheries, rural economic development, food security and disaster management and early warnings. Chair of National Climate Change Forum.
Ethiopian Institute for Agricultural Research	Research on agriculture; divisions on arid lands and forestry research working on climate change (IDRC focal point)
Ministry of Water Resources	Development of hydrological resources; floods
National Meteorological Service Agency	Collect, analyse and study data to provide weather forecasts and early warnings. Climate Change (the original focal point for the UNFCCC NAPA)
Non-Governmental Organisations	National, regional and international development, faith-based, humanitarian, environmental organisations working in Ethiopia. Convening of National Climate Change Forum with Ministry of Agriculture (Oxfam USA).

65. Within the Regional States, the Bureaus of the relevant sectoral Ministries are responsible for the development and implementation of plans that respond to national priorities within the context of regional realities. Line ministries are responsible for coordinating the design and implementation of public strategies and policies. At the federal level, the MoFED has overall responsibility for economic policies and strategies. In addition to budgetary and fiscal management, MoFED is responsible for financial accounting and reporting, including the management of public statistics. The Hoard has overall responsibility for agricultural and rural development policies, strategies and plans, including the management of agricultural research and extension services, natural resource management, input and output marketing, disaster risk management and food security sector (DRMFSS), and private investment support.

The relevant national legal frameworks and strategies

66. Relevant major enabling and substantive laws applicable to early warning purposes and the environmental Conventions to which Ethiopia is a party are:

- Environmental Protection Organs Establishment Proclamation (Proclamation No. 295/2002),
- Environmental Impact Assessment Proclamation (Proclamation No. 299/2002),
- Environmental Pollution Control Proclamation (Proclamation No. 300/2002),
- Environmental Policy of Ethiopia, 1997
- Proclamation No. 201/1980- National Meteorological Service Agency Establishment Proclamation
- Proclamation No. 380/2004 for Re-Organization of the executive organs of the Federal Democratic Republic of Ethiopia (Amendment) proclamation.
- Proclamation No. 197/2000 Ethiopian Water Resources Management Proclamation
- Council of Ministers Regulation No. 115/2005 The Water Resources Management Regulations which has been issued by the Council of Ministers as per article 30 of Proclamation No. 197/2000
- Proclamation No. 534/2007 River Basin Councils and Authorities Proclamation;

- Ethiopian Water Sector Policy, 2001
- The National Water Ressources Management Strategy (2001);
- The Water Sector Development Programme 2002-2016 (2002)
- Growth and Transformation Plan of Ethiopia (2010/11 - 2014/15),2010
- The Federal Democratic Republic of Ethiopia DRM Policy(Draft)
- National Adaptation Plan of Action of Ethiopia (NAPA), 2007
- Climate Resilient Green Economy Strategy(CRGE) of Ethiopia, 2011

The following legislative provisions, policies, strategies and programs have most significance in relation to this project:

Environmental Policy of Ethiopia

67. The Government of Ethiopia (GoE) issued the country's first ever Environmental Policy in 1997 which was approved by the council of ministers. The aim was to rectify the economic and social costs of environmental damage from widespread mismanagement of environmental resources, and to provide overall guidance in the conservation and sustainable utilization of the country's environmental resources. The policy covers a wide range of resource sectors: soil, forest, woodlands, biodiversity, water, energy, minerals, urban environment, environmental health, industrial pollution, atmospheric pollution and climate change, and cultural and natural heritage. It also encompasses other cross-sectoral issues such as population and the environment, community participation and the environment, tenure and access rights to land. From the perspective of climate change, the policy has considered in its sectoral environmental policy components atmospheric pollution and climate change as an important environmental, social and development challenge that has to be tackled. The policies consider the vulnerability of the country to climate variability and aim to promote a climate monitoring program, take appropriate mitigation measures, develop the energy sector, actively participating in protecting the ozone layer, and to maximize the standing biomass in the country through a combination of reforestation, agro-forestry, rehabilitation of degraded areas, re-vegetation, control of free range grazing (in the highlands) and seeking financial support for offsetting carbon dioxide emissions from such activities.

Proclamation on the establishment of environmental protection organs (Proclamation No. 295/2002),

68. The main aim of the law is to establish a system that fosters coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels so as to foster sustainable use of environmental resources, thereby avoiding possible conflicts of interests and duplication of efforts.

Environmental impact assessment proclamation (Proclamation No. 299/2002),

69. Environmental impact assessment is used to predict and manage the environmental effects that a proposed development activity might entail and thus helps to bring about intended development. Furthermore, assessment of possible impacts on the environment prior to the approval of a public instrument is recognized as providing an effective means of harmonizing and integrating environmental, economic, cultural and social considerations into a decision making process in a manner that promotes sustainable development. To this end the law is prepared to facilitate the implementation of the environmental rights and objectives provided by the Constitution and the maximization of their socio-economic benefits by predicting and managing the environmental effects which a proposed development activity or public instruments might entail prior to their implementation.

Proclamation No. 201/1980on the establishment of National Meteorological Service Agency

70. The provision of early warning duties has been explicitly stated on the establishment of the National Meteorological services Agency (NMSA) proclamation No. 201/1980. The then NMSA and now called NMA is Ethiopia's meteorological organization with a mission of collecting, analyzing and studying the atmosphere, and providing weather forecast and early warnings on the adverse effects of weather and climate change in Ethiopia. In the weather analysis and forecast, it provides weather forecasts that have data regarding temperature, rainfall and weather forecast for 24 hours, for three consecutive days over selected regions and urban centres. The national forecasts contain weather assessments and forecasts in text description, maps, and statistical outputs covering the whole country in different time scale. It prepares and disseminates monthly, seasonal and annual climate bulletins and seasonal and annual hydro-meteorological bulletins, agro meteorological bulletins and climatological maps.

Proclamation on Re-Organization of the executive organs (Ministry of Agriculture) of the Federal Democratic Republic of Ethiopia. (Proclamation (Amendment) No. 380/2004)

71. The then Ministry of Agriculture and Rural development (MoARD), now renamed as Ministry of Agriculture (MoA), has both development and natural resource management responsibilities (Proclamation 380/2004). Relating to natural resources management, the Ministry has the responsibility to prepare policy on land use and draft legislation on forestry and wildlife. The Agriculture and Rural Development Bureau (ARDB) is the key natural resource management institution at regional level. It is responsible for the management of land, forest, wildlife and biodiversity resources (Proclamation No 110/2007). The ministry is also responsible for monitor events affecting agricultural development and set up an early-warning system;

72. Agriculture-centered development strategy has been a central pillar of economic policy in Ethiopia and this has been particularly so in the recently completed five-year Plan for Accelerated and Sustained Development to End Poverty (PASDEP). The strategy is further developed, fine-tuned and well-integrated into the current five-year Growth and Transformation Plan (GTP) of Ethiopia. Given the high vulnerability of Ethiopian agriculture to climate shocks, MoA has the responsibility to promote climate-resilience and low-carbon development in the agricultural sector. In this regard, MoA's attention in the past few years has been on DRMFS (Disaster Risk Management and Food Security). In terms of climate change adaptation and environmental management, the Ministry has designed and an investment programme for Sustainable Land Management (SLM) which included massive soil and water conservation, re-vegetation, area closure and moisture harvesting projects. MoA is also in the process of finalizing preparations to pilot the implementation of REDD+ projects.

Ethiopian Water Resources Management Proclamation (Proclamation No. 197/2000)

73. The purpose of this Proclamation is to ensure that all surface and ground waters of Ethiopia are properly protected and managed. The text consists of 33 articles divided into 9 Parts including: Inventory of water resources and registry of actions; Water banks and harmful effect of water; Association of water users. Supply of water, transfer of water, release or discharge of water or construction of waterworks requires a permit to be issued by the supervising Body in accordance with articles 11 to 18. Article 12 lists water uses for which no permit is required.

74. Currently, the powers and duties given to the former Ministry of Water Resources and the Ministry of Mines and Energy, with respect to energy, by the provisions of other laws, currently in force, and with respect to rural electrification, to the Ministry of Agriculture and Rural Development and the Ethiopian Rural Energy Development and Promotion Center, under Proclamation No.317/2003 are hereby given to the Ministry of Water and Energy. Its specific mandates and duties in relation to water include: Promote the development of water resources and energy; Undertake basin studies and determine the

country's ground and surface water resource potential in terms of volume and quality, and facilitate the utilization of same; Determine conditions and methods required for the optimum and equitable allocation and utilization of water bodies that flow across or lie between more than one regional States among various uses and the regional States; Administer dams and water structures constructed by federal budget unless they are entrusted to the authority of the relevant bodies; Ensure the proper execution of functions relating to meteorological service.

Growth and Transformation Plan (GTP)

75. Ethiopia's five year GTP (2010/11-2014/15) aims at achieving rapid economic development through aggressively promoting agricultural investments, boosting industrial growth, expanding access to social service provisions, ensuring its equity as well as quality and meeting the MDGs. The plan aims to "ensure food security at the family, regional and national levels", by doubling domestic agricultural production. The GTP recognizes climate change as a threat as well as an opportunity for Ethiopia, and has thus considered both adaptation and mitigation issues. The plan clearly declares the government's commitment to pursue a low carbon development path, effectively implement existing environmental policies and laws of the country and build a climate resilient green economy by 2025.

National Adaptation Program of Action (NAPA)

76. As a Party to the UNFCCC, Ethiopia is obliged by several articles of the convention to address climate change through the preparation of a national adaptation document and the integration of climate change into its sectoral development policies and plans. Pursuant to this, the country prepared its NAPA in 2007. The NAPA represented the first step in coordinating adaptation activities across government sectors, but was not intended to be a long-term strategy in itself. The National Meteorological Agency (NMA) was the focal institution coordinating the NAPA process. The NAPA identified priority projects in human and institutional capacity building, improving natural resource management, enhancing irrigation agriculture and water harvesting, strengthening early warning systems, and raising awareness through the establishment of national climate science centre.

Climate Resilient Green Economy (CRGE)

77. While adapting to inevitable changes in the climate system, Ethiopia aims to use low carbon solutions to leapfrog and realize its ambitions set out in the Growth and Transformation Plan. Ethiopia's climate is likely to become more unpredictable in the coming years, with increased flooding and drought. This will impact on all aspects of Ethiopia's economy, but particularly on the health, transport, agriculture, natural resources and energy sectors. This makes the effort of building climate resilience a huge and urgent challenge for the country. Climate resilience is the ability to cope with, and manage the changes brought by climate stresses and shocks. A climate resilient economy is thus one which is protected against the adverse impacts of climate-change, and takes advantage of positive opportunities. Building a climate resilient economy is therefore about adapting effectively to climate change to minimize the potential damages and to maximize the potential benefits.

2.3 Design principles and strategic considerations

78. This project is one of a set of 10 country-led LDCF-funded projects that focus on strengthening climate information and early warning systems (EWS/CI) for climate resilient development and adaptation to climate change. The other countries receiving support include Benin, Burkina Faso, Liberia, Sierra Leone, Sao Tome and Principe, Uganda, Tanzania, Malawi and Zambia. These 10 EWS/CI initiatives will be backstopped by a regional team of technical specialists who together have specific thematic expertise, including: meteorological, climate and hydrological observation networks, weather, climate and hydrological forecasting, data management and archiving, disaster management, agricultural advisories, flood alerts, communication protocols and standard operating procedures, mobile

communications, private sector engagement, and development of weather and climate services. Additionally this project will benefit from UNDP experience managing other EWS/CI activities in Africa, Asia and the Pacific, funded through LDCF, SCCF and bi-lateral funds.

2.3.1 Links to other baseline initiatives

79. There are a number of national programmes/projects that address baseline related problems that the project will build on and seeks to influence.

80. The **Productive Safety Net Programme (PSNP)** which aims at serving the dual propose of helping bridge the income gap for chronically food insecure households, and engaging such households in community asset-building efforts to earn income, especially during the lean season and times of drought. PSNP is funded through budgetary support to the value of US$480 million by a wide range of donors, including DFID, World Bank, Sweden and Ireland. The PSNP is having a significant impact on building asset base of the poorest, and this project aims at providing national level capacity to reduce the destruction and damage caused by climate hazards to these built assets.

81. The UNFAO is implementing a project called "Strengthening Capacity for Climate Change Adaptation in Land and Water Management with focus on Sustainable Land Management in Ethiopia project" with the objective of reducing the impact of climate change and variability on smallholder farmers through sustainable land management and contribute to improvement of agricultural productivity, livelihood and ecosystem resilience in two sustainable land management (SLM) watersheds within the Awash Basin with a budget of US$550 000. Another FAO project that this LDCF initiative will build on is entitled "Managing the Rain: Making improved use of one of Ethiopia's most valuable resource" (US 1,061,410) and aims at improving rain water harvesting and management for agriculture and rural livelihoods.

82. USAID/Ethiopia's strategy seeks to address the underlying issues, which make communities and sectors most vulnerable to climate variability, while supporting and enhancing knowledge and information sharing. To contribute to this effort USAID/ Ethiopia's climate strategy focuses on adaptation with a goal of "reducing vulnerability of people, places and livelihoods". The main project is the "Pastoralists Resiliency Improvement and Market Expansion (PRIME)" ($10M) that just started implementation building on the experience on PLI II, Implemented by Mercy Corps. It aims to Identify and implement actions that can make people, places and livelihoods less vulnerable to climate change over the long term:

a. GoE and community institutions capacity built for better implementation of CCA activities
b. Introduce flood/drought management plans and responses to reduce vulnerability
c. Introduce livestock and crop insurance
d. Introduce conservation based agriculture
e. Introduce new methods for, pasture, soil and water conservation
f. Introduction of drought tolerant / resistant crops

83. Another important project that is currently being implemented by USAID is the Enhanced Livelihoods Application through the Livelihood Integration Unit which aims to support the Ethiopian Ministry of Agriculture and the DRMFSS to strengthen early warning systems. This is a 6.8M USD initiative that focuses on improved science, analysis and information sharing for decision-making and effective governance systems for coordination and response. It aims to:

a. Improve ability to understand impacts of climate variability and changes in long term food security

b. Improved climate information, prediction and diffusion of early warning information
c. Support information sharing and collaboration activities at national and regional level
d. Strengthening government and local communities' governance structures such as customary institutions' capacity to respond to and communicate on climate-related disasters, such as floods and droughts

84. UNDP - **Strengthening Capacities for Ethiopia's Disaster Risk Management System**. ($13m). UNDP is currently supporting the Government of Ethiopia to reduce disaster risk and impact of disasters through the establishment of a comprehensive and integrated disaster risk management system. More than $12m has been secured to-date for a programme that will run from 2012-2016. The programme is to support the DRMFSS led the development of the Disaster Risk Management Strategic Programme and Investment Framework (DRM-SPIF) which elaborates the new Government of Ethiopia (GoE) approach on DRM and is the sole government framework for the harmonization of government, donor, and development partner support and interventions on DRM. The DRM-SPIF supports the Growth and Transformational Plan (GTP) by maximizing the achievement of socio-economic targets and the preservation of social and economic gains by not allowing these gains to be translated into losses as a result of disasters. It also firms up the position of the GoE on its new DRM approach to shift from disaster response and food aid to the building of community resilience and reduction of vulnerabilities.

85. With the implementation of the current DRR and LR Programme, the Ministry of Agriculture, specifically the DRMFSS, requested UNDP to undertake a substantive revision of the current programme to capitalize on its significant achievements and direct it towards supporting the DRM-SPIF. The revised programme will work towards the reduction in the risks and impacts of disasters through the establishment of a comprehensive and integrated disaster risk management system within the context of sustainable development. As the main engine for UNDP to realize the intended GoE and UNDAF outcomes, the programme will work at achieving the intended UNDP contribution of making integrated DRM systems and coordination mechanisms functional at federal and regional levels.

86. The ACPC is undertaking two projects with a total budget of US$ 1, 202, 000. titled "Support to the National Meteorological Agency (NMA) of Ethiopia in Capacity Building of Climate Monitoring and Early Warning Activities for Climate Change Adaptation" in order to rescue historical meteorological data; reviewing the master plan of meteorological stations network; training users on how to use the map room of NMA website and developing the capacity of human resources of NMA in data management. And the second one on "Upgrading and Expansion of Stream flow Observing and Data Management Systems in Ethiopia" together with MoWE in order to upgrade manual water level stations to automatic stations; Install automatic hydrological observation instruments at new stations; Expand the pilot telemetry system of MoWE to enhance real time measurement of river water level; Upgrading the existing data storage, management and analysis system;

87. WFP - has three on-going projects which this initiative will build on with a total budget of $729,742. These are:

- The establishment of automated weather stations (AWS) to improve timely provision of weather data for LEAP Project in order to enhance monitoring of drought, flood & other weather risks through contributing to the development and refinement of LEAP, one of the DRM tools with a budget of US$ 362,700;
- Improving automated hydrological data for the flood model development, early warning based on a community based flood forecasting and early warning (CBFFEW) system as pilot in the Awash River Basin to strengthen the capacity in flood forecasting, warning and management with a budget of US$115,000

- Setting up of a Geonetcast infrastructure and application within the DRMFSS and NMA to Strengthen Early Warning Systems and Disaster Preparedness in order to support flood and drought forecasting and alert, climate change and early warning system in Ethiopia with a total budget of US$ 252,042

Table 4: Summary of Co-financing

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount ($)
National Government	Government of Ethiopia/NMA	In kind	600,000
National Government	Government of Ethiopia/FAO	Grant	1,611,410
National Government	ACPC	Grant	1,202,000
National Government	Government of Ethiopia/WFP	Grant	123,000
Bilateral agency	USAID/PRIME/ELA	Grant	16,800,000
GEF Agency	UNDP	Grant	13,000,000
Total Co-financing			**33,336,410**

2.3.2 National and local benefits

88. This LDCF initiative will improve the EWS and long term planning for climate change adaptation capacity of Ethiopia, particularly in support of enhancing the resilience of livelihoods and assets of some of the poorest communities. Providing accurate and timely early warning on severe weather and long term adaptation strategies has the potential to enable poor communities such as agriculturalist and pastoralists to make informed decision about their livelihood activities and protect their built assets.

89. This intervention will have tangible and direct benefits for the population in flood prone areas which represents about 20 to 25 Million people. In the Oromia and Afar regions lying along the mid- and downstream plains of the Awash River around 4 to 5 Million people will benefit from early warning for floods and flash floods. Similarly in the low-lying areas of Gambella (around 5 Million) along the Baro, Gilo and Akobo rivers are regularly flooded and will benefit from the improved accuracy and effectiveness of early warnings. Downstream areas along the Omo River and the extensive floodplains surrounding Lake Tana and the Gumara and Rib rivers in Amhara is a region of intensive agriculture because of the fertility of its soil, but is also prone to regular flooding. This LDCF financing will impact this area substantially by ensuring improved early warning and forecasting, this represents around 5 Million people. The project will indirectly benefit the entire population (around 80 Million people) of Ethiopia by creating capacity at the national level to produce more accurate weather forecasts and train government staff in planning long term strategies for climate change adaptation.

90. At household level, benefits will be most important for those living on banks of rivers and flood prone areas (around 5 million people) by receiving more timely, tailored and accurate severe weather forecasts and early warnings for floods. Similarly those living on the plains and prone to recurrent droughts (Afar and Somali regions) will benefit from the increased capacity of the national agencies to foresee the lack of rain for a given season and trigger adequate funds and mitigation measures. Close and strengthened partnerships and communication channels between the NMA and the DRMFSS will improve the efficiency and effectiveness of the disaster risk reduction systems to deliver coping and relief goods and services.

2.3.3 Linkages with other donor funded initiatives

91. The multi-lateral agencies also support a range of projects and initiatives that include non-climate related problems, which this project will complement, but have not been considered as co-financing.

92. In Ethiopia UNDP's Africa Adaptation Programme (AAP) project "Supporting integrated and comprehensive approaches to climate change adaptation in Africa - Supporting climate resilient sustainable development in Ethiopia" (which has recently been completed, though provides important lessons for this project) has strengthened existing leadership for climate change adaptation at national and local levels, by strengthening the capacity of line Ministries to develop technical advice on adaptation, the capacity of local managers for managing local adaptation planning and improving the understanding of climate change and its strategic implications amongst leaders themselves. The programme piloted approaches to managing climate change risks that integrated known methods of sustainable land management with adaptive practices that are informed by climate risk forecasting. Using the evidence and experience generated through the pilots the programme assisted line Ministries to collaboratively prepare a climate change strategy that supported the implementation of PASPDEP II and a linked investment facility which attracted and managed funds for integrated adaptation actions.

93. *The LDCF funded initiative (2011) on* **Promoting autonomous adaptation at the community level in Ethiopia** that aims to support local communities and administrations at the lowest level of government design and implement adaptation actions aimed at reducing vulnerability and building resilience. This intervention is supporting the development of territorial climate resilient plans at sub-national level and supporting the application of climate risk reducing techniques and practices in selected rural and urban sites.

94. The Government of Ethiopia and World Bank (GFDRR) – **Ethiopia Disaster Risk Management Country Plan.** This project seeks to reinforce risk and vulnerability assessments, early warning systems and contingency planning: The methodology for mapping vulnerabilities and risk at woreda level has been developed in earlier projects financed by GFDRR and shall now be rolled out in the entire country. Multi hazard forecasting systems combine the efforts to a comprehensive early warning system, including a further development of the LEAP Livelihood Early Warning and Protection system. The activities will be completed with a plan for contingency operation in case of drought and flood events in Ethiopia.

95. The USAID funded **Famine and Early Warning System Network**, FEWSNET, is a regional programme developing early warning systems for food security monitoring across Africa. The FEWSNET activity is a set of integrated activities intended to: 1) deliver early warnings of hazards, food insecurity, vulnerability to food insecurity, and famine; 2) increase the quantity and improve the quality of information used to make comparable food security and vulnerability monitoring, needs assessments, preparedness, and contingency and response planning; and 3) develop national and regional emergency early warning and food security monitoring and assessment capabilities. The overall goal of the activity is to help prevent food insecurity and famine through early identification and warning to decision-makers.

96. The UN FAO programme supports agricultural development and food security initiatives as well as agricultural production support (e.g. improved seeds, or livestock, pesticide management and control). With the Ministry of Agriculture, the FAO supported pilots of a Community based Integrated Watershed Development Approach to Soil and Water Conservation (US$371,880).

97. The World Bank has provided lending for over 130 projects in Ethiopia that have focused among other things on Infrastructure, Protection of Basic Services, Food Security, and Education. As of September 2009, there were 33 active projects with a net commitment value of over US$ 3.6 billion. Of this funding, 66% is being spent on Agriculture, 12% on public administration and 22% is being spent on industry and trade.

98. Relevant projects that are proposed, in preparation or implementation are:

- Ethiopia Forest Carbon Partnership Facility readiness;
- Flood Risks Prevention in Ethiopia;
- Electricity Access Rural Expansion Project II – to increase access to electricity in rural towns and villages with grid access;
- Tana&Beles Integrated Water Resources Development;
- WMO/IGAD Climate Predictions and Applications Centre (ICPAC) (GFDRR Track I);

99. This LDCF project is not a standalone project; it is part of a wider multi-country programme that will implement similar initiatives on climate information and Early Warning Systems in at least 10 countries in Africa (including Benin, Burkina Faso, Ethiopia, Liberia, Malawi, Sierra Leone, São Tomé & Príncipe, Tanzania, Uganda and Zambia). Synergies between these projects will be used to enhance the cost-effective hiring of specialized technical staff, coordination of data and information (including inter-country sharing where feasible), training (operations & maintenance of equipment; forecasting techniques; tailored advisories and warnings), and effective use of communications and standard operating procedures.

100. Being part of a multi-country programme means there is significant scope for many activities to be coordinated at the regional level thereby enabling economies of scale, which can reduce costs and increase effectiveness (especially in terms of knowledge generation and training). Details of outputs and the types of engagement, which will benefit through the regional approach, are presented in section B.3. In particular activities under Output 1.1 and 1.2, which will procure hydrological and meteorological equipment, will benefit from the core technical staff who will help design and identify appropriate cost-effective observing networks. Activity 1.5.1 of output 1.5 (as well as activities under outputs 2.1 and 2.2) can also be implemented in collaboration with other countries to provide training on infrastructure operations and maintenance, weather and climate forecasts and development of tailored warnings/advisories e.g. activity 2.1.1 which focuses on training of forecasters and modellers. These activities will be closely coordinated with other regional and international partners/centres e.g. WMO/GFCS, ICPAC etc. Further benefits of a regional approach can also be pursued through outputs 2.4 and 2.5, sharing knowledge on communication strategies and engaging multi-national corporations who can benefit from climate services.

2.3.4 UNDP Comparative Advantage

101. Anchored in the GTP, the UNDP Country Programme Document (CPD) 2012-2015 is guided by UNDP's comparative advantage in three of the four strategic pillars articulated in the United Nations Development Assistance Framework (UNDAF 2012-2015). The overarching strategic approach is strengthening capacities of national actors, systems and institutions, through targeted and catalytic interventions that accelerate broad-based development and safeguard development gains against endogenous and exogenous shocks. This is important for this LDCF funded initiative because a large part of the project is focused on building capacity of national actors, systems and institutions. The UNDAF is framed around three strategic priorities: enhanced economic growth and poverty reduction; democratic governance and capacity development; and development of a low-carbon and climate-resilient economy (LCCR). Gender equality is a crosscutting issue that is at the center of UNDP country programme. The two strategic priorities of relevance to this project are as follows:

Enhanced Economic Growth and Poverty Reduction

102. This programme component will support the Government's efforts to accelerate pro-poor economic growth, with agricultural and small- and medium-scale enterprises as the key drivers, anchored in a value-chain approach. This LDCF initiative fits in this strategy as it aims to strengthen EWS and the

capacity of Ethiopia to resist climate shocks and UNDP with its expertise in national capacity building is well placed to implement it. The focus will be on supporting policy and institutional capacity development at both the national and sub-national levels to build the knowledge, skills and systems that can enhance access to critical productive services, support efficiency of marketing systems, and leverage appropriate technology and practices to demonstrate sustainable options for boosting productivity and income in rural areas. UNDP will support policy and diagnostic work, knowledge networking, codification of knowledge, and testing of innovative practices that can facilitate solutions to practical bottlenecks in building effective value chains; and strengthen capacities of producer and private sector institutions to enhance access of the poor, especially women and youth, to better technologies, inputs, finance and markets. To build resilience against global financial and economic shocks, UNDP, in collaboration with World Bank and research institutions, will enhance national capacities for economic intelligence, policy and analytic work on the potential impacts of global developments and appropriate risk mitigation, as well as policy and institutional capacity development for expanding fiscal space, including by exploring and leveraging alternative sources of development financing.

Low-Carbon, Climate-Resilient Economy

103. This component will support Ethiopia's transition to a LCCR economy through: technical support in formulating a LCCR strategy and piloting its implementation; policy advice and technical support to mainstream mitigation, resilience and other environmental priorities into economic growth activities, particularly in the agricultural, infrastructure, water and energy sectors; and piloting of renewable energy initiatives. With this expertise and experience in hand UNDP has all the tools to successfully implement this LDCF funded complementary project which aims at procuring weather observational infrastructure and building capacity at national institutions like NMA and the MOWE. UNDP will support the establishment of a financing facility to enhance access to new and additional financial flows, support technology transfer for implementation of mitigation and adaptation and address other emerging environmental priorities. This programme component will also provide institutional capacity support to enhance compliance to and implementation of the provisions of domestic and multilateral environmental regulations. A further emphasis of this component will be the provision of policy and operational support to the implementation of a comprehensive Disaster Risk Management (DRM) system.

104. This LDCF funded initiative will be implemented complementarily with other UNDP implemented environmental projects and programmes including the Coping with Drought and Climate Change project. Additionally building on the AAP, which focused on building capacity for long-term planning and management of climate change risks and opportunities, on institutional frameworks for the management of climate change, the piloting of policy measures and on the development of options for financing climate change adaptation.

105. UNDP Ethiopia has undertaken multi-level and multi-sectoral support to help advance the disaster risk, early warning and environment agenda in the country. Notable projects are those that contribute to the achievement of food security in the country including disaster risk management and early recovery capacities. These disaster prevention and preparedness activities have sought to support Ethiopia's rural communities to cope with shocks and with strengthening resilience to shocks. UNDP has previously supported Ethiopia's early efforts in climate change; enabling Ethiopia to prepare its First National Communication in Response to its Commitments to UNFCCC; and its National Adaptation Programme of Action (NAPA). This project is in line with UNDP Ethiopia's ongoing commitments to support the country's EWS and adaptation to climate change: it will build on these complementary programmes and contribute to UNDP's global climate adaptation strategic outcome: "Strengthened capacity of developing countries to mainstream climate change adaptation policies into national development plans".

106. UNDP manages several GEF funded project and as a result of this work it has substantial experience and expertise in strengthening EWS and long term planning capacity for climate change adaptation and such experience can be brought to bear on the management and quality assurance of this LDCF project.

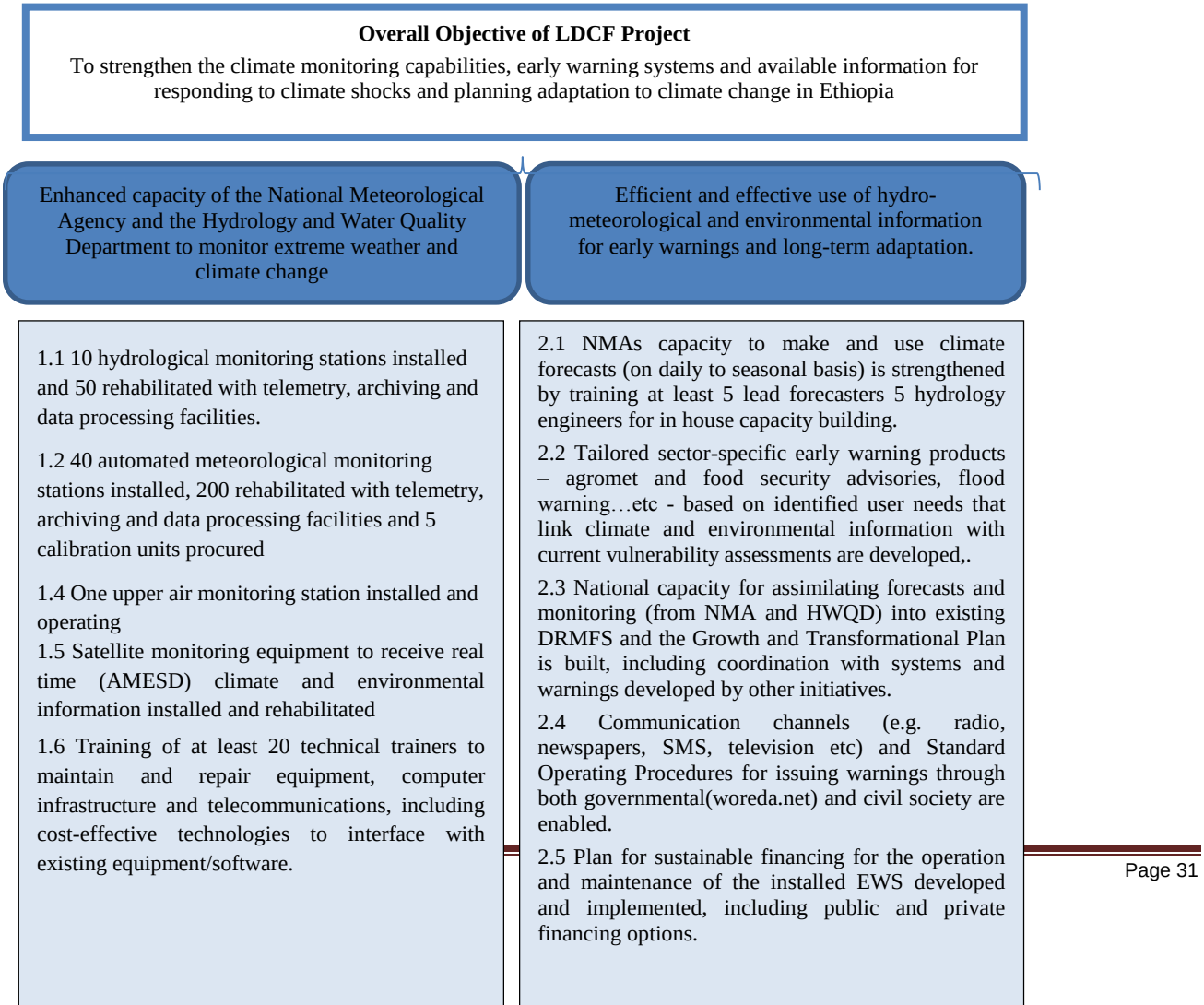
2.4 Project Objective, Outcomes and Outputs/activities

107. This project **objective** is to strengthen the climate monitoring capabilities, early warning systems and available climate-related information for responding to climate shocks and planning adaptation to climate change in Ethiopia. The project aims at transferring weather and environmental observational technology as well as build capacities for data analysis, modelling and communication of advisories/warnings by delivering two complementary outcomes. These are presented in figure 1 as a set of outcomes and outputs that together deliver a strengthened EWS and increase the capacity of early warning systems and long term planning for climate change adaptation.

The two complementary outcomes are:

1. Enhanced capacity of the National Meteorology Agency and the Hydrology and Water Quality Directorate to monitor extreme weather and climate change
2. Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term adaptation.

Figure 1: Complementary Outcomes and outputs.



Outcome 1: Enhanced capacity of National Meteorological Agency and the Hydrology and Water Quality Directorate to monitor extreme weather and climate change

Co-financing for this outcome is: 13,900,000 USD.

LDCF project grant request is: 3,136,100 USD

Without LDCF Intervention (baseline):

108. Now that the institutional arrangements for coordinating climate change action at a national level in Ethiopia have been clarified and the 2011-15 Growth and Transformation Plan is completed and the Climate Resilient Green Economy Strategy (CRGE) in place, the arrangements for effective action to implement these national commitments are needed. As part of these national plans Ethiopia needs more accurate and timely weather information to be able to forecast the damage and risks of extreme weather events, and plan for strategies for long term climate change adaptation. At present the capacity of the NMA and HWQD, the main institutions responsible for weather, climate and hydrological monitoring, is limited both in equipment and human capacity. Therefore too few planners and managers have the weather/climate information they need and fewer have the capacity to assess risk, evaluate trade-offs and integrate cross-sectoral initiatives using this information.

109. This is partly due to the limited ability of the NMA and HWQD to provide useful, accurate and timely weather, climate and hydrological information that can be integrated across sectors in developmental plans, both in the rural and urban context. This in turn is due to the limited environmental observational infrastructure available to the NMA and HWQD, coupled with a low level of skills and human capacity to analyse and use the data for forecasting risks.

110. Through discussions with government officials and other stakeholders during the Preparatory phase, equipment and information gaps were identified as well as training and capacity needs, which need to be resolved for effective disaster risk management and climate resilient planning to be improved (see Key assessment report, Annex III). In particular the report highlights the need to improve the current baseline situation through additional rehabilitation and procurement:

- 70 AWS and 1200 manual rainfall stations (10-47% functional);
- 489 manual hydrological stations reporting every 4 months; 10 stations with data loggers and 4 stations with telemetry capabilities;
- One partly- and one fully-functioning upper air monitoring stations;
- Functional satellite data systems (EUMETSAT) but with limited capacity to fully utilize and distribute the products;
- Insufficient calibration units to maintain existing and additional sensors.

111. Without improvements in the current observation network, disaster risk reduction initiatives, but also rural development, health and land conservation plans have very limited scientific and information to base their strategy and actions on. They will continue to be based on available weather/climate information, and past experience. The efforts will remain piecemeal, sectoral and unable to build strong mitigation measures to counter expected increases in extreme weather events, such as floods and droughts, landslides and cloudbursts.

112. The National Meteorological Agency of Ethiopia (NMA) prepares short-range (one-to-three days) weather forecasting based on the prognosis weather charts retrieved from Meteorological Satellite Second Generation (MSG), WRF-based Numerical Weather Prediction (NWP) products, which is currently run at the spatial resolution of 20km by 20km in the Agency and use other meson-scale model

products that generate local weather systems. Forecasts are prepared and disseminated both at the national and regional state levels. Weather forecasts are updated twice a day. It is disseminated to the general public through various audio, visual, electronic and printing media. In particular, NMA has a television broadcasting system, by which it disseminates the weather forecasts in four languages, namely; English, Amharic, AfaanOromoo and Tigrigna.

113. The WFP programme will continue to support chronically food-insecure communities participate in environmental rehabilitation and income generating activities designed to improve livelihoods through the sustainable use of natural resources. Whilst it provides support for installing weather monitoring infrastructure in support of LEAP as part of the PSNP, this is limited to 20 stations in three regions (ten are in the Somali Region, five in Eastern Oromia and another five in Afar)2. However, other regions will not benefit from this activity at present. WFP is also working to improve automated hydrological data collection and flood forecasting in the Awash River Basin, which involves setting up GEONETCast infrastructure within the DRMFSS and NMA, in order to receive satellite data, and using this data for flood forecasting.

114. Similarly the USAID funded PRIME and ELA projects aims at providing early warnings to avoid famine and strengthen livelihoods and food security. However this is done through the provision of support to local farmers and pastoralist by introducing flood and drought management plans and response to reduce vulnerability, introducing new methods for soil and water conservation and drought resistant crops. Other important products that are necessary for planning including additional meteorological products, such as weather forecasting, agro-meteorology advisories to farmers, early warnings for all extreme weather events, are currently insufficiently provided.

115. All the identified baseline projects contribute in some way to providing a platform to build Ethiopia's resilience to climate change, but little focus on building hydro-met infrastructure to improve the capacity to monitor the climate and the environment at the national level. The Government of Ethiopia, in an effort to strengthen its meteorology infrastructure for improved monitoring has recently approved a budget increase (66M Birr) to the National Meteorological Agency for operation and maintenance of existing and new observational infrastructure and the human capacities of these national institutions to perform more effectively and efficiently.

116. ACPC projects to support NMA are also undertaking a variety of activities including: rescuing historical meteorological data; reviewing plans for the expansion of the meteorological station network; training users how to use the map room of the NMA website and developing the capacity of human resources of NMA in data management. Also in partnership with MoWE they are upgrading manual water level stations to automatic stations (around 20 AWS); installing automatic hydrological instruments at new stations and expanding the pilot telemetry system of MoWE to enhance real time measurements of river water levels. These projects, whilst currently in their early stages3, provide key baseline activities that LDCF funds can be used to build upon, strengthening and expanding these efforts where necessary.

With LDCF Intervention (adaptation alternative)

117. Within this outcome, LDCF financing will be used to rehabilitate and transfer weather and environmental observation infrastructure by procuring new automated weather stations, gauging stations, computer software and new calibration units. This will build on the CRGE strategy and vision, on the Growth and Transformational Plan of individual ministries and on the findings of the Climate Change

[2] http://www.wfp.org/stories/automated-weather-stations-enhance-ethiopia-climate-risk-data

[3] http://climate-l.iisd.org/news/acpc-holds-workshop-on-meteorological-data-in-ethiopia/

Technology Needs Assessment developed by the Ethiopian government in partnership with UNDP and supported by GEF (2007). This initiative will complement the WFP programme that seeks to support poor rural communities with food security and climate resilient agriculture, as well other LDCF-funded sectorally-specific interventions - Promoting autonomous adaptation at the community level in Ethiopia – and the ACPC and USAID PRIME and ELA programmes.

118. The key assessment report in the annex III developed by the project design team during the preparatory phase details the procurement and rehabilitation plan for NMA and HWQD, identifying what equipment needs to be procured at what cost and what infrastructure already in place needs to be rehabilitated. LDCF financing of these identified needs will contribute to strengthening the technical capacity of the national and 11 regional NMA institutions responsible for monitoring the climate parameters to feed into integrated and cross sectoral planning. This will complement WMO activities as part of the Global Framework on Climate Services (GFCS) that are expected to start at the end of the year, focusing on increased climate information and capacities for supporting climate risk management at sub-national level.

119. This initiative will also build on FAO's intervention on improving capacity for climate change adaptation for small farmers at the community level, and the LDCF funded project on autonomous adaptation by contributing to the improved accuracy of meteorological bulletins. This in turn will improve the trust and reliability that farmers and pastoralists have in climate information.

120. During the preparatory and design phase the state of the weather and environmental observational infrastructure was assessed, see the key assessment report in Annex III. A wide range of stakeholders (Govt ministries, departments, donors, research institutions, civil society and NGOs - see stakeholder baseline analysis, section 2.1.3) during three national level consultations decided to maximise cost effectiveness by directing the funds and efforts on rehabilitating existing infrastructure (weather stations and hydro gauging stations) and in procuring more up to date technology like AWS, with telemetry, archiving and data processing facilities. The key assessment report in Annex III presents the needs and gaps identified during the preparatory phase and are clearly defined on maps and list. It provides Indicative locations and sites for the procurement and installation of 40 new automated weather stations and 10 new gauging stations which are subject to additional detailed feasibility during the implementation phase. It also provides a detailed plan for the 200 weather stations and 50 hydrology gauging stations that need rehabilitation or repair (which sensors need replacement).

121. Upper air monitoring stations, through either radiosonde ascents and remote sensing technologies, are useful for improving regional numerical weather predictions and global climate models run by international forecasting centres and will be procured and improved through this LDCF funding, Technical training on Operation and Maintenance (O&M) will also be provided to strengthen the technical capacity and sustainability of the NMA.

122. Building on the UNDP DRM programme this outcome will enhance the weather and environmental observational capacity of the country by rehabilitating existing infrastructure and by procuring and installing new AWS and gauging stations. It will also provide the foundation to guide the process of integrating climate change risks and adaptation into development plans at national, regional and local levels.

Outputs and Indicative Activities

123. Outcome 1 will deliver improved national coverage of weather and environmental observational capacity at the infrastructure level, by repairing the dysfunctional existing hydro-met equipment, rescuing as much data as possible and training staff in operations and maintenance of the apparatus. The improved data and information will then feed into the cross sectoral and integrated planning process for disaster risk management and climate change adaptation.

124. It is understood that under this component of the project the Government of Ethiopia will be able to use LDCF resources to procure, install and/or rehabilitate critical infrastructure required to build and/or strengthen the climate-related observational network. In all equipment purchases an assessment of existing equipment will be made, noting the manufacturer, whether it is still working and whether the NMA has an interest in continuing with particular makes/models. This will need to be weighed against the costs of potentially cheaper solutions and the added costs of training personnel to service different products.

Output 1.1 *10 hydrological monitoring stations installed and 50 rehabilitated with telemetry, archiving and data processing facilities.*

125. LDCF resources will be used for the procurement and installation of 10 new hydrological monitoring stations and the rehabilitation of 50 manual gauging stations with telemetry, archiving and data processing facilities, which will enable the HWQD to monitor river and lake levels. In turn this allows the HWQD to identify dangerous floods before they occur, issue warnings for dam/transport managers downstream and alert communities at risk. In cases where stations have been neglected but the site (fences, towers etc.) are still functional, LDCF resources will be used to replace existing sensors and data loggers as historical observations from the site can be used with newly acquired data to create longer time series for detecting climate changes. All stations will be fitted with appropriate means for relaying data to central servers (e.g. via GPRS or satellite telemetry).Indicative activities include:

1.1.1 A detailed analysis of the needs assessment identifying which existing gauging station needs to be rehabilitated or procured. Which brands, products, geographical locations and installation requirements provide the best cost-effective solution will be determined. This analysis will include an evaluation of the most cost-effective and sustainable data transmission procedures associated with delivering the data to a central server for archiving, as well as software for onward distribution to other EWS agencies. This will be done in collaboration with the Directorate for Hydrology, and Water Quality.

1.1.2 Participatory consultations with local representatives including women, to ensure that local ownership and knowledge is captured for the installation and safety of the equipment.

1.1.3 Adequate and cost effective communication systems to enable fast transmission of manually collected hydrological data is identified and installed.

1.1.4 Rehabilitation, procurement and installation of identified equipment including data transmission technologies, servers and software.

Output 1.2 *40 automated meteorological monitoring stations installed, 200 rehabilitated with telemetry, archiving and data processing facilities and 5 calibration units procured.*

126. Under Output 1.2, LDCF resources will be used for the procurement and installation of 40 automatic meteorological monitoring stations, and rehabilitation of 200 meteorological stations also with

telemetry, archiving and data processing facilities. In cases where stations have been neglected but the site (fences, towers etc.) are still functional, LDCF resources will be used to replace existing sensors and data loggers as historical observations from the site can be used with newly acquired data to create longer time series for detecting climate changes.

127. Undertake a systematic analysis of existing and planned synoptic, agro-meteorological stations and AWSs in Ethiopia to determine gaps in coverage and priority stations for data rescue and rehabilitation. This will include a plan to integrate new stations into the existing NMA network and to link these with the HWQD hydrological network and forecasting information systems. This Activity will be conducted in parallel with the Activity 1.1.1 above. A joint report will be generated. Indicative activities include:

1.2.1 Participatory consultations with local representatives including women are undertaken to ensure that local ownership and knowledge is taken into account for the installation and safety of the equipment.

1.2.2 Adequate and cost effective communication systems to enable fast transmission of manually collected meteorological data is identified and installed. Procure and install 40 automatic weather stations including solar panels, batteries, data transmission software packages, networking facilities and weather fences in 40 priority districts/locations covering all eleven regions in the country. Rehabilitate 200 manual weather stations.

1.2.3 Calibration Units procured and operationalized, and assessment of the cost of rehabilitating the defunct radar.

1.2.4 Data archiving and quality control systems are put in place along with standard operating procedures for data sharing with other institutions, for example DRMFS, MOFED and MOA to add to their food security monitoring on a daily basis.

Output 1.3 *One upper air monitoring station rehabilitated or procured and installed.*

128. Upper air monitoring stations, through either radiosonde ascents or other remote sensing technologies, are useful for improving regional numerical weather predictions and global climate models run by international forecasting centres. Through **Output 1.3** LDCF funds will be used to rehabilitate existing infrastructure, procure the equipment needed to make upper air soundings, or use observations obtained via the Satellite Distribution System (SADIS). The need for rehabilitation, procurement or SADIS, will be decided during the inception phase of the project, based on the availability of funds and given other equipment needs. None of the ongoing baseline projects suggest that new upper air stations are being implemented, but stations to monitor upper-air meteorology have been requested by the government. It is important that during the inception phase responsible discussions with the IP are undertaken to ensure that this item cannot be more cost-effectively replaced by the SADIS system. Indicative activities include:

1.3.1 Undertake a systematic analysis of the state of existing infrastructure and needs for rehabilitation or procurement. A technical assessment of costs (including long-term operations) and capacity gaps to operate by the NMA will be completed prior to procurement.

1.3.2 Repair or procurement is implemented along with training for operation and maintenance.

Output 1.4: *Satellite monitoring equipment to receive real time (AMESD and subsequent EUMETSAT programmes) climate and environmental information upgraded and data made available to other government departments*

129. LDCF resources will be used for the procurement/upgrading of satellite receiving equipment and establishment of data/image processing facilities. This output will build on the AMESD and EUMETSAT programmes at the regional level, as well as Ethiopia's current installation of satellite reception equipment. The details of the equipment needs can be found in the key assessment report, annex III. The potential uses of satellite data and imagery for planning and management purposes in the context of food security, and water management will be established based on country specific contexts, users of information, needs (in the short-term disaster management, medium-long term planning) etc. This will involve coordination with other projects such as PRIME and ensuring that all government departments have access to these data and their derived products e.g. rainfall estimates etc. Indicative activities include:

1.4.1 Identification of existing satellite receiving and analysis equipment and gaps and a detailed procurement plan on hardware and software along with required training needs to operate and maintain the equipment is completed.

1.4.2 Procurement and installation of hardware and software, along with initial technical support to ensure smooth operation

1.4.3 Skills to analyze, use and package the satellite data, such as rainfall proxies, NDVI, flood mapping are transferred.

Output 1.5 *Training of at least 20 technical trainers to maintain and repair equipment, computer infrastructure and telecommunications, including cost-effective technologies to interface with existing equipment/software*

130. LDCF resources will be used to develop the human technical capacity required to maintain and use the equipment made available through the LDCF. Personnel responsible for the running of the equipment and receiving/archiving the data that it produces (including manually operated stations where necessary) will be trained, along with back up personnel and replacements. 2 engineers per region for the 11 regions of Ethiopia except Addis Ababa will be enrolled in training programs. Those trained will be responsible for training others and in this way build a critical mass of skilled technicians. This includes ensuring that there is an incentive mechanism in place to sustain the system that is set up with the LDCF resources. Cost-effective technologies are utilized, which are able to interface with existing systems and which minimize dependence on external suppliers of hard and software. Indicative activities include:

1.5.1 Cost effective training opportunities will be identified both in country and abroad with an emphasis on South – South cooperation when possible. Options of using international experts to train the NMA staff will be explored.

1.5.2 A "learning by doing approach" (where the training programs are mostly done in Ethiopia in real conditions to ensure maximum uptake by the trainees) delivered.

1.5.3 Support and mentoring(retraining, online support) provided to ensure the capacity of the staff to maintain and repair the existing and newly procured equipment.

Outcome 2: Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans.

Co-financing amount for outcome 2: 17,871,640 USD
LDCF project grant requested: 1,138,900 USD

Without LDCF/SCCF Intervention (baseline):

131. The Environmental Protection Authority (EPA) has been mandated to co-ordinate the national response to climate change. Through Ethiopia's Programme of Adaptation to Climate Change (EPACC) and emissions abatement initiatives including the Nationally Appropriate Mitigation Actions (NAMAs) the country has made a strong start. The next step is to broaden and deepen this response.

132. NMA holds the responsibility to provide weather forecasts on a daily and seasonal basis. However, with the current system, the NMA is unable to ensure the accuracy, timeliness and reliability of its forecast due to limitations in observational infrastructure (as discussed and addressed under outcome 1) but also limitations in data analysis (calculating long term trends, combining satellite and surface observations, assessing regions experiencing accumulated moisture deficits) and forecasting skills (running numerical weather prediction and local area models to predict the weather and seasonal forecasts for medium-term outlooks). In the case of the latter, NMA technical capacity is also restricted in its ability to produce accurate and timely weather forecasts for use by the public, businesses and issuing warnings.

133. The World Bank funded GFDRR and a UNDP-financed Disaster Risk Reduction initiative (described in section 2.3), are contributing to the strengthening of the capacity of DRMFS and MoA to respond to and mitigate ongoing disasters, however, they do not specifically provide training and capacity building in the hydro-met sector to be able to improve the accuracy and frequency of early warnings and the analysis of historical climate data for long term planning.

134. Efforts currently underway by ACPC and FAO to help small-scale farmers improve their ability to interpret and respond to early warnings and consider adaptation options to longer-term climate change are important baseline activities. It is essential for farmers, pastoralists and other sectors of the economy that NMA, MoA and HWQD are able to collaborate to produce tailored and sector-specific early warning products that integrate weather/climate observations, environmental and socio-economic information on various timescales (ranging from the present to several months in the future) and based on user needs. For example, during deliberations at the national stakeholder consultation, experts from the Ministry of Agriculture mentioned that farmers and the agricultural sector are more interested to know when the rains will start rather than the intensity of the rain. The DRMFSS mentioned that on the other hand communities and regions affected by floods or landslides need information on rainfall quantity to be able to assess the risks of landslides. These sector specific and tailored early warning products require skills to analyse, and process a combination of datasets (including weather data, simple crop and flood models) that the NMA, DRMFS and HWQD presently does not have. Some of this expertise is held by FEWSNET at the regional level and by projects such as LEAP, but there is a need to increase transfer these skills to government departments.

135. Without this intervention, the current ability of MoFED, the MoA and their directorates to assimilate and use climate forecasts and monitoring is limited. The formulation of strategies for poverty reduction and disaster risk management do not presently make sufficient use of long term climate change

information to mitigate the risks and build on the opportunities. To facilitate cross-government engagement on this agenda, the Ethiopian Government has recently established a new CRGE ministerial committee. This committee is supported by a technical working group, itself delegated into a series of sub-sectoral working groups. These ad-hoc institutional arrangements will be replaced by permanent institutional arrangements to direct Ethiopia's efforts to achieve a climate resilient green economy. Building on the USAID efforts to strengthen the Government's ability to use climate information in planning, this LDCF financing will contribute to the enhanced capacity of the various government sectors to integrate climate information into their strategic planning process.

136. Although Ethiopia has built some of the components of an early warning system and response capacity, the preparatory and design phase identified clear opportunities to extend and improve the communications channels especially focusing on the last mile connectivity. The World Bank funded GFDRR project supports improved EWS and communications systems in Ethiopia which this initiative will build on to ensure Inter sectoral communications are enabled and rigorous, between the NMA and the DRMFSS, and strengthen timely issuance of early warning to remote and rural communities. The use of VHF radio, mobile phone and other innovative technology will potentially improve the Ethiopian governments' ability to reach out to the most remote and rural communities. Building on the WFP and FAO initiatives that focus on community level adaptation measures, and disaster risk management LDCF-funding will reinforce the communication system of early warnings and ensure that they reach the most remote locations.

With LDCF/SCCF Intervention (adaptation alternative)

137. Much of the value of early warnings (whether a user changes their actions or lives/assets are safeguarded) is dependent on the packaging, communication and dissemination of those warnings. The effectiveness of warnings can be improved either through improving the forecasts/monitoring information, communications or the decision-making process. This component is primarily concerned with improving these aspects of the EWS. Specific details on the exact type of EWS information and risk management tools (for flood warnings, agricultural extension advisories, weather index insurance, transport planning etc) will be determined during the project implementation phase as well as additional actions designed to meet those priority needs.

138. Building on current initiatives by the World Bank (GFDRR), the WFP's effort to improve the EWS for the rural farmers and the ACPC's project titled "Support to the National Meteorological Agency (NMA) of Ethiopia in Capacity Building of Climate Monitoring and Early Warning Activities for Climate Change Adaptation", the capacity of NMA will be strengthened to issue daily and seasonal forecasts. The capability of NMA and DHWQ staff to analyze, forecast and use weather and environmental information more effectively will include the ability to cooperate within the government as well as use forecasts and observations produced by international meteorological centres. Today NMA updates its weather forecast only once a day, with this LDCF-financing NMA will be able to update it four times a day because of improved infrastructure and forecasting capacity.

139. At present tailored meteorological products are limited and often produced by regional or international organisations which only have access to internationally available observation and monitoring data. Consequently these products often lack detailed observations, which the GoE has access to (improved partly through outcome 1) and can utilize to produce more targeted and effective tailored products. Building on the activities of the ACPC and the USAID PRIME and ELA projects, LDCF funding will be used to build capabilities within NMA to make use of satellite to forecast rainfall over large areas, to provide accurate flood warning at the local level and strengthen agricultural advisories.

Another improvement that this project will contribute to is the leap from analogue rainfall predictions to model based rainfall prediction thanks to the software procured and the technicians trained to use it.

140. In parallel, and building on the UNDP DRM initiative with the MoWE and the ACPC project aiming to upgrade manual water level stations to automatic stations, this LDCF initiative will strengthen the hydrology department of Ethiopia in its ability to monitor flow levels of the Abbay River basin and Tana Lake. Typically before any major flood there is a rise in the level of the water in lakes and rivers and if it goes unnoticed cannot serve as an indicator of an imminent flood. LDCF financing will reinforcing the ability of the hydrology department of Ethiopia to monitor river and lake levels by increasing the number of automated gauging stations and improving the technical skills of the engineers to understand and analyse the data in real time. Most of the flood prone areas of Ethiopia are along river basins and around lakes. See map of flood prone areas in the Key Assessment report, Annex III.

141. This LDCF initiative in close collaboration with the USAID PRIME project working on strengthening Ethiopia's planning (MOFED) and disaster management institutions (DRMFSS) in their ability to integrate climate information more routinely in their work, will contribute to further enhance the capability of the MOFED and DRMFSS to use climate information in the Growth and Transformational Plan and in the issuance of alerts. Building on the UNDP DRM programme, the collaboration of NMA with these important institutions will be improved through the signing of MoUs and Standard Operating Procedures for channeling climate information and long term climate projections.

142. The private sector too has an interest in more accurate and timely weather forecasts and tailored sector meteorological specific products. The civil aviation (Ethiopian airlines), insurance companies (Oromia insurance) and the hydropower industry for example are sectors that are eager to have access to these improved products and have expressed willingness to pay for weather services, thereby promoting public private partnerships and financial sustainability. This LDCF initiative will contribute to strengthening existing contracts between NMA and the Bole Airport and update the fees collected for these services. Public private partnerships between NMA and at least two important national insurance companies will be enabled to raise funds.

Outputs and Indicative Activities

Output 2.1 National Meteorology Agency's and the Hydrology department's capacity to make and use climate forecasts (on daily to seasonal basis) is strengthened by training at least 5 lead forecasters and 5 hydrology engineers for in house capacity building.

143. The capacity to make and use daily to seasonal climate forecasts will be developed. This will link to ongoing activities at the NMA and will ensure the capacity to run numerical weather prediction models, or be able to usefully generate and use data from these models run elsewhere with the region or at international centres. The data from these models should be linked to tailored products developed in output 2.2 and the decision processes in output 2.3.. Data sharing with regional NHMSs will be encouraged as this helps develop forecasts that can be used and shared regionally, and the observations from other countries collected through output 1.2 help understand the errors in the forecast models. Indicative activities include:

2.1.1 At least 5 forecasters trained in the use of numerical weather prediction models for daily forecasts and statistical and dynamical techniques for seasonal forecasting and 5 hydrology engineers trained in flood modeling.

2.1.2 Formalized collaboration of NMA with international centers (e.g., UK Met Office) and with regional centers (ACMAD, responsible for the African Early Warning and Advisory Climate Services, and for the ClimDevAfricaprogramme, and WMO) to build forecasting expertise in Ethiopia.

2.1.3 GIS, modelling and forecasting skills transferred to NMA and HWQD to map hydro-meteorological risks. Existing maps (e.g., World Bank GFDRR) built on and improved to identify vulnerable populations under-served by observations and warnings.

Output 2.2 Tailored sector-specific early warning products – agromet and food security advisories, flood warnings - based on identified user needs that link climate and environmental information with current vulnerability assessments are developed.

144. **Output 2.2** will develop new tailored products to serve the information requirements of users in different sectors and locations and will build on the USAID PRIME initiative. These products will be developed through consultations with the intended users of the information and appropriate research organizations. Information and data from the monitoring infrastructure (weather and hydrological stations, and satellite monitoring) will be combined with forecasts at a range of timescales to produce new user-relevant information. As an example, satellite and weather station observations can be combined to derive a spatially continuous dataset and estimate rainfall for locations which have no meteorological stations. Using these data the water balance of crops can be estimated (similar to the LEAP project) for wider regions and these can be used as part of agricultural advisories. The integration of forecasts into this framework allows the future risk of crossing critical thresholds (of soil moisture, crop production etc) to be assessed (building on the work of FEWS). Improved availability of data to generate these products will also be implemented e.g. where important climate records reside in paper format, they will be digitized and used to better describe local microclimates, hence improving the baseline hazard mapping. Indicative activities include:

2.2.1 A feasibility study using participatory consultations with sector specific users such as farmers associations, women groups and other sectors of the economy to identify user needs and possible tailored and sector specific early warning products. This will include household surveys of targeted users of climate information designed to understand the social and economic costs and benefits of using advisories.

2.2.2 Training programs for the NMA personnel to be able to design and deliver these products are sourced and implemented. Special efforts for South-South cooperation and in country cost effective training is encouraged.

2.2.3 SOPs formalized between the NMA, HWQD, the DRMFSS and the Ministry of Agriculture to ensure forecast bulletin or alert information is provided in useful quantitative units (e.g., crop yield, area of flood plain, wind velocity) for various economic sectors (e.g., agricultural) including the flood prone rural populations along the Abbay basin.

2.2.4 Tailored and sector specific early warning products (such as agromet advisories, flood early warning, and model based rainfall predictions) are integrated into EW and alerts and advisories disseminated by DRMFSS . This will include integrating satellite data with other observations and forecasts to produce flood agromet EW products

Output 2.3 National capacity for assimilating forecasts and monitoring (from NMA and HWQD) into existing DRMFS plans and the Growth and Transformational Plan is built, including coordination with systems and warnings developed by other initiatives.

145. Assimilating the forecasts from output 2.1 and tailored products from output 2.2 into existing EWS activities and processes will be the aim of **Output 2.3**. This will involve assessing the information needs of different decision-making processes e.g. for flood warnings, drought warnings, food security, water management etc and designing a set of information products that can be used as advisories and warnings. Existing EWS for particular sectors (e.g. Food security and floods) can be used to extend knowledge and skills to other sectors which need similar EWS and experience. Climate monitoring information from component 1 and forecasts from output 2.1 will be combined to identify regions where risks are currently high and likely to get worse. Where necessary satellite imagery will be used to assess the current extent of climate-related hazards and this information will be combined with agricultural (crop), flood risk or other sectoral models to help the decision making process. Training on the use of these technologies will be provided where needed. Indicative activities include:

2.3.1 A detailed analysis of the hydro-meteorological information needs of DRMFS, Ministry of Agriculture, Ministry of Finance and Economic Development and Prime Minister's Office for Early warning and long term planning.

2.3.2 Coordination mechanism between NMA and planning authorities for long term climate change adaptation strategies operationalised.

- Set up standard operating procedures for transfer of information to planning authorities with varying timescale (short term, seasonal and long term)
- Policy briefs presenting the economic costs/benefits of sectoral impacts using information from the new system on the medium and long term for Ethiopia designed by NMA and shared with finance and planning ministries for integration in the Growth and Transformational Plan and other national PRSPs.

2.3.3 A coordination platform that operates on a bi-annual basis and chaired by NMA to ensure all initiatives and stakeholders (World Bank, WFP, UNDP, IFRC, and Government of Ethiopia) complement and converge with each other is operationalised.

2.3.4 Policies that ensure the integration of environmental information into national policies and plans (e.g. Proclamation on the establishment of environmental protection organs (Proclamation No. 295/2002 and Proclamation No. 201/1980 on the establishment of National Meteorological Service Agency) are influenced and amended to include the implications of messages that emerge from hydro-met data analysis.

Output 2.4 Communication channels (e.g. radio, newspapers, SMS, television etc) and Standard Operating Procedures for issuing warnings through both governmental (woreda.net) and civil society are enabled.

146. **Output 2.4** will establish communication strategies and processes targeted to each identified sector and user. The aim is to effectively communicate early warnings, and advisory packages developed through Output 2.3, in the most useful way for different users/audiences. These strategies will vary between regions and users as communications technologies, language and cultural norms vary. Using software and technology in innovative ways will be explored e.g. Using SMS as a means for issuing warnings and promptly reach the most isolated. Lessons and experiences in other parts of Africa will be assessed for their potential to upscale e.g. using innovative techniques to communicate agrometeorological advisories[4]. This will build on the work undertaken by the UNDP DRR programme, with the potential to extend lessons learnt to other countries. Indicative activities include:

[4]http://www.rockefellerfoundation.org/what-we-do/current-work/developing-climate-change-resilience/grants-grantees/african-agriculture-climate-change

2.4.1 Review of lessons learned and best practices in other countries or programmes to identify the range of communication options (privileged communication channels, VHF radio, SMS) for effective transmission of early warnings to different users.

2.4.2 Field visits and stakeholder consultations undertaken to understand how users of early warning advisories and warnings use the information for managing climate and weather related risks and how their decision frameworks affect the interpretation of advisories and warnings

2.4.3 Operationalization of the most adequate technology and innovative approaches to communicate early warning messages to the communities.

- Formal collaboration between NMA, DRMFS and Ethiotel to test an SMS system for early warnings for flash floods is set up.
- Traditional (TV, radio, website, fax, email, phone) and innovative (SMS, satellite phones, VHF radio) communication channels enabled. Meteorology journalists trained.
- Linking of early warnings to woreda.net.

2.4.4 Testing and up scaling of most effective and targeted communication technology for issuing early warning to the population and various users

Output 2.5 Plan for sustainable financing for the operation and maintenance of the installed EWS developed and implemented, including public and private financing options

147. **Output 2.5** will aim to put in place financial arrangements and public private partnerships between NMA and clients like the Ethiopian Airlines, the Oromia insurance to raise funds to improve the financial sustainability of the NMA. A comprehensive needs assessment for climate services will be carried out (how needs are currently met, opportunities for private partnerships and gaps in the current services), as well as the willingness and ability to pay for such services across a range of stakeholders, both private and public. Where suitable legal arrangements exist and where the government is willing, private companies will be approached to test their willingness to engage in a public-private partnership with the NMA or associated entity. Similar activities within the country or region will be approached to learn from their experiences (e.g. the CABI initiative in Kenya and Ghana). No baseline projects were identified with this output at this stage. Indicative activities include:

2.5.1 NMA is equipped to ensure accurate accounting and detailed budget analysis and forecasting of the EWS financial requirements for its sustainable operation and maintenance is enabled.

2.5.2 Based on the improved accounting and budgeting abilities, details of a financing plan is developed and implemented.

2.5.3 Private (insurance companies, tourism industry) and public stakeholders (Ethiopian Airlines, Hydro power sector)are engaged to assess their willingness to pay for tailored weather products and services.

2.5.4 Public Private Partnerships are formalized (via Contracts and MoUs) with identified partners to improve the financial sustainability of NMA for the operation and maintenance of the infrastructure.

2.5 Key indicators, risks and assumptions

2.5.1 Project Indicators

148. Performance indicators are crucial to measure the impact of the project at the outcome level and to track change during the project implementation period. The outcome indicators (Table 6) are designed to measure changes in the coverage, impact, and sustainability of the project outcomes. Indicators have been developed to be Specific, Measurable, Achievable, Realistic and Time bound ('SMART') and are indicated in the Project Results Framework

Table 6: Project outcome indicators

Indicator	*Time scale and Measurement*
Project level indicators	Time Frame: By end of Project (annual progress reviews to be conducted)
Indicator 1 .Capacity as per capacity assessment scorecard (baseline: 83; target: 139)	Measured by: Running the capacity scorecard again
Indicator 2 2. Domestic finance committed to the relevant institutions to monitor extreme weather and climate change.	Time Frame: By end of Project (annual progress reviews to be conducted) Measured by: Financial records and reports from National Meteorological Agency
Outcome 1	
Indicator 1 Percentage of national coverage of climate monitoring network.	Time Frame: By end of Project (annual progress reviews to be conducted) Measured by: Procurement records and reports from National Meteorological Agency.
Indicator 2 Frequency of data transmission (baseline: x; target: y)	Time Frame: By end of project Measured by: Internal National Meteorological Agency data receivers and loggers and reports
Outcome 2	
Indicator 1 Percentage of population with access to improved climate information and flood and drought warnings (disaggregated by gender).	Time Frame: By end of Project (annual progress reviews to be conducted) Measured by: Gender disaggregated beneficiary survey including vulnerability reduction assessment relative to baseline
Indicator 2 Development frameworks (e.g. PRSPs) that integrate climate information in the formulation of the Growth and Transformation Plan at national level (baseline: x; target y).	Time Frame: By end of project (annual progress reviews to be conducted) Measured by: Number of climate resilient plans and investment strategies based on integrated climate resilient development plans in place and agreements for financing implementation
Indicator 3 Sector-specific strategies and plans that integrate climate change risks (specify sector, like agriculture, civil aviation, insurance and hydro-power)).	Time Frame: By end of project (annual progress reviews to be conducted) Measured by: Focussed discussions with the leaders and stakeholders of the sectors

2.5.2 Project Risks

149. Key risks and assumptions are indicated in the Risk Log in Annex 1. Risks and recommended countermeasures were identified during bilateral consultations during the project preparation phase. Key risks and associated mitigation measures underlying project development include the following:

Risks	Risk Mitigation Measures
Problems related to involvement and co-operation of stakeholders to work cross-sectorally	Clear commitment of the Ministries and Bureaus to sharing of data and joint programming. Area-based planning approach that promotes cross-sectoral data sharing.
Unavailability of requisite human resources and data	Mitigated by recruitment of international consultants, where necessary, who will work closely with in-country counterparts and by targeted capacity building activities. Training activities of local personnel will be part of all aspects of the work and the relevant institutions will be encouraged to expand the staff base if it is weak in particular areas.
Insufficient institutional support and political commitments	The proposed project is strongly supported by Governments and other key stakeholders and development partners. The project, in conjunction with UNDP, will therefore take advantage of this opportunity to seek substantial support from the Governments and forge strong partnership with other development partners. Direct linkages to existing and planned baseline development activities implemented by government, securing of the necessary co-financing, as well as local buy-in will also minimize this risk. It will also be important to establish buy in from all government departments early as the project will utilize data and information from a wide range of departments.
Poor co-ordination among implementing and executing agency.	Clear Project Management arrangements (see Section 4).
Local IT and telecommunications infrastructure weak e.g. international bandwidth and local mobile telecommunications networks	Cost-effective solutions for each particular situation will be used e.g. satellite and/or radio communications. Where feasible automatic weather and hydrological stations reporting over the mobile telecoms network will be preferred.
Limited capacity within relevant ministries/ insufficient qualified human capacity.	A major part of the project is to strengthen institutional and technical capacity for planning, designing and implementing local level adaptation actions. Technical and capacity building expertise will be contracted, to work with and train local technical staff. A dedicated Project Manager will be supported with short term national and international specialist support to ensure smooth and timely delivery of project outputs.
Work progresses in a compartmentalized fashion and there is little integration e.g. government departments refuse to share data and information	This risk is always present in a project such as this. By ensuring that capacity is built across a range of departments and implementing 'quick win' measures early (developing products based on internationally available data), these issues can be mitigated.
Non-compliance by primary proponents for the successful implementation of this project	Ensuring that the project is designed and implemented in a participatory and inclusive manner, following established UNDP procedures, will mitigate the risk. Since the activities correspond to the urgent needs as expressed by the primary proponents the risk of non-compliance should be reduced
Climate shock occurring during the design and implementation phase of the project	Engage with disaster response and recovery as part of adaptation planning process and incorporation of climate hazard information into planning. There may be some delays as more urgent priorities may need to be addressed by some of the stakeholders (e.g. NHMS or disaster management) but it is unlikely that this will derail the project.

2.5.3 Assumptions

Key assumptions underlying the project design include:

- The Ethiopian Government remains committed to implementing the baseline activities and taking forward their strategy for a climate resilient green economy.
- There is sufficient political support and capacity within the EWS agencies for successful execution and implementation of the project
- The NMA and participating sector Ministries/Bureaus remain committed to the realisation of cross-sectoral collaboration in EWS and climate change planning and implementation of adaptation measures.
- That the target equipment and infrastructure are best adapted to contribute to improved capacity of the NMA and MoWE to observe and forecast severe weather eventsi.e. they are compatible with existing equipment and both have the capabilities to maintain and operate the equipment;
- NHMS will acquire enough capacity to tailor climate products by the end of the project.
- The available climate modelling practitioners and researchers remain available during the project duration for supporting training and capacity building for government staff
- Data sharing protocols can be agreed upon between NMA and the DRMFS and data can be presented in a sufficiently utilitarian way for local application. Data sharing will not be hindered by lack of coordination between agencies or by technical constraints such as bandwidth issues or local mobile telecommunication networks
- The policy priority currently afforded to climate change is not overshadowed by other emergency matters such as humanitarian disasters

2.6 Cost-effectiveness

150. The preparatory and design phase focused on project implementation principles and technology that will meet the objectives of the project in the most cost-effective way. The project will implement 2 of the NAPA (2007) top 12 priority actions.

151. The project will be implemented through government agencies responsible for EWS, climate change adaptation, disaster risk management and multi-sectoral task teams drawing expertise from the departments responsible for planning and implementing climate resilience enhancing practices was considered the most cost effective approach.

152. One alternative way of implementing this project was to expand the hydrological monitoring network based on a cross-border watershed approach; however, this requires cross-border data sharing and more financial resources. This project lays a foundation for future initiatives to model hydrology in river basins by establishing good monitoring networks to build off of. For the meteorology aspect another was to only use manual stations and incorporate SMS communication services; NMA however needs more automatic stations. Some automatic stations are necessary for rapid data gathering to generate timely alerts. In order to gradually build their capacity with automatic stations, equipment procurement will be staggered and existing manual stations will be rehabilitated and continued to be used. Manual data readers are already trained on the existing equipment that is in need of repair or spare parts.

153. The project will also focus on rehabilitating existing weather observational infrastructure rather than allocating a substantial part of the budget to procuring new weather and hydrological stations. This will enhance the cost effectiveness of the project because more observational infrastructure will be

operational for every dollar spent. This will mean an increased availability and quality of weather data compared with the alternative approach of concentrating on procurement of only new equipment. An additional benefit is that the repairing and rehabilitation will be done by the NMA staff and will provide a learning by doing attitude that will strengthen the capacity of the staff to later maintain the infrastructure.

154. The Preparatory phase also analyzed the training and capacity building options and only those within the scope and cost effectiveness of this project were identified. For example the options of sending NMA and HWQD engineers abroad to reputed universities for forecasting and modelling training is more expensive than getting the training done in the country. Most of the training will be done in country either with international experts for short periods, or using national expertise from the University of Addis Ababa and other research institutions with meteorological and climate change expertise. This will create a pool of knowledge and trainers who will in turn be able to transfer the knowledge to other national or regional staff thereby extending the outreach and impact of the project for. The alternative of outsourcing the training to universities and research institution abroad (mostly in the US and Europe) was deemed cost ineffective.

155. This initiative could have alternatively used stations with cheaper sensors to decrease the cost of spare parts; however if sensors do not adhere to WMO standards, WMO will not consider the station data in regional and global models. As a result, the country's data would not be assimilated to improve the regional and international forecasting models the country will exploit and downscale. Another alternative would have been to acquire more equipment to improve national coverage; this option was considered as per the feasibility studies and development plans which demanded more monitoring equipment. However, this project is focusing on capacity development for service delivery (which is lacking in Ethiopia) rather than excessive procurement. Good and targeted service delivery of EWS/CI is more likely if funds are focused on building capacity within NMA, HWQD and DRMFS(Output 2.2). This will ensure the sustainability of continued monitoring and the use of tailored EWS/CI into long-term development plans.

156. The option of installing a system based on lightning detection could have been followed. However these technologies do not provide sufficient warning lead-times for resource mobilization in Ethiopia. They also do not contribute directly to seasonal forecasts, which are essential for Ethiopia and its economic dependence on agriculture, they are dependent on observations from AWS etc for calibration and are so far untested in Africa.

157. All operation and maintenance could have been outsourced to a private company through a PPP (public private partnership) to enable the company time to train information production personnel over a longer period of time. However, NMA and the HWQD already have experience with learning-by-doing and have received training for many of the specific monitoring instruments they have requested to be acquired/rehabilitated.

158. NMA and HWQD could rely solely on regional and international centers for training but this is not cost-effective because the option does not take advantage of internal forecasting expertise within the institutions. Another alternative to building in house forecasting and modelling capacity would have been to use outside forecasting products for free: this option will be considered, such as NOAA's CFS and other forecasting tools which are readily available and free. However, these products must be downscaled and calibrated with in situ data. Therefore, regional and international databases will be exploited to the extent possible to support Ethiopia to develop national forecasting by translating open-source climate monitoring and forecasts into flooding and drought/food security information.

159. This LDCF project is not a standalone project; it is part of a wider multi-country programme that will implement similar initiatives on climate information and Early Warning Systems in at least 10 countries in Africa (including Benin, Burkina Faso, Ethiopia, Liberia, Malawi, Sierra Leone, São Tomé &

Príncipe, Tanzania, Uganda and Zambia). Synergies between these projects will be used to enhance the cost-effective hiring of specialized technical staff, coordination of data and information (including inter-country sharing where feasible), training (operations & maintenance of equipment; forecasting techniques; tailored advisories and warnings), and effective use of communications and standard operating procedures.

160. Surveying the technical support needs for each country a set of common specialized technical staff were identified, each with particular skills related to the development of hydroclimatic observing systems, the effective design and implementation of standard operating procedures and tailored warnings/advisories, as well as the communication of advisories/warnings. Hiring 3-4 full-time technical staff, which can provide the needed support for all countries, will be more cost effective than hiring the same staff as consultants for each country. Further benefits include time saved on HR procurement procedures (e.g. for hiring, advertising etc.) and the ability to compare and standardize support across countries where possible. UNDP will directly undertake the recruitment for all project staff who will support all countries in this multi-country programme.

161. Training and capacity building for operations and maintenance of the hydromet infrastructure and for modeling and forecasting (Outputs 1.5, 2.1 and 2.2) can also be done at a regional level, bringing together participants from all countries to encourage knowledge sharing and the development of collective skills. This has several advantages, namely: i) promoting the sharing of information and learning between countries; ii) encouraging discussions of best practices i.e. what works, reasons for failure etc; and iii) increasing the effective pool of skilled resources which each country can draw upon (increasing the potential for future trainings to be conducted by experts within the region). Such activities will be closely coordinated with other regional and international partners/centres e.g. WMO/GFCS, ICPAC etc.

162. Regional support will also be used to help strengthen the development of standard operating procedures (both the procedures themselves and their legal basis), for the issuing and communication of warnings/advisories, where possible incorporating warnings issued by neighbouring countries e.g. in the case of shared watersheds (Output 2.4). Where private sector engagement (Output 2.4 and 2.5) includes multi-national corporations, regional support will assist engaging head offices in multiple countries, increasing the total effective services being offered and hence bargaining position of each government. In the case of mobile (cellular) communications (which may be used for both disseminating alerts and the collection of data used to generate alerts), the regional support programme will leverage collective negotiations for data services, as well as engaging with corporate social responsibility programmes to enhance services where possible..

2.7 Sustainability

163. The project outcomes are closely aligned and coordinated with efforts already underway within Ethiopia to promote development and MDG targets which is resilient to climate change at the national and local levels. The project is focused on strengthening the capacity of national and sub-national entities to monitor climate change, generate reliable hydro-meteorological information (including forecasts) and to be able to combine this information with other environmental and socio-economic data to improve evidence-based decision-making for early warning and adaptation responses as well as planning.

164. By involving all stakeholders at the planning and design stages and in preparing the infrastructure (outcome 1) and capacity development strategy (outcome 2), the prospects for stakeholders to implement the plans and adopt interventions beyond the duration of the project will be maximised. However, this

will still need the long-term political and financial commitment of policy-makers to provide the enabling investment environments for maintaining and operating a robust EWS and long term planning capacity for climate change adaptation. In addition, adequate technical and institutional capacity and expertise will be transferred to enhance sustainability. The following actions will be applied to address factors that will influence sustainability of the project's outcomes:

Improved hydro-met information

165. The rehabilitation of existing weather observational equipment and the procurement of new AWS and hydro gauging stations (which has a life span of over 15 years) will allow for weather information to be gathered beyond the duration of the project and feed into the enhanced analysis and modelling capacity set up by the project. Through the involvement of the Steering Committee, more effective institutional coordination between relevant government ministries will be sought. The project will feed its implementation experience, good practices and lessons learned back into the developing national and sub-national climate planning processes, and add to the experiences of other on-going projects.

Improved data analysis and modelling capacity

166. Through its capacity building strategy (output 1.6, 2.1 and 2.3) the project will generate a cadre of trained officials with the experience of working in cross-sectoral planning teams. These official govt staff will have accumulated knowledge on weather forecasting and analysis, which will stay beyond the project duration and will be transferred to other regional officers. Furthermore the additional capacity built on operations and maintenance of existing and newly procured hydro-net infrastructure will remain a strong sustainability point well after the project is completed as the project would have created a skilled manpower for NMA to maintain its equipment. Assuming these officials stay in the public service, this experience will be incorporated into the sub-national planning environments and applied to all equipment and infrastructure beyond the duration of the LDCF project.

167. The project has a built in mechanism for addressing issues of long term financial sustainability. Apart from the leveraging of national budget funds that are recurrently allocated for the operation and maintenance of the hydro-met equipment and infrastructure, the project aims through output 2.5 to approach the private sector to increase existing fee structures with existing customers and make additional funds available from insurance companies who expressed readiness to pay (in the national consultation) for weather forecasting services and products. These sectors are, among others, the civil aviation, the hydro power and tourism industry, and farmers associations which are dependent on weather for their smooth operations, and there is evidence from other countries that "pay for weather services" systems can be put in place. As this is built in as a project output, it will be pursued during the entire implementation period of the project and, given initial indications, has a good chance of succeeding.

168. This project is sustainable and will have strong and durable impacts beyond the project implementation phase as it aims at transferring and rehabilitating hydro-met equipment, building capacities of government staff and leveraging private sector financial support through payment for weather services. This project is not a standalone project; it is part of the existing government infrastructure and processes, and will continue to receive financial support from the government of Ethiopia beyond the project duration in the form of annual recurrent government budget allocations.

2.8 Replicability

169. Replication is a central objective of this project as it is building capacity at the national level for improved climate observation and forecasting to enhance the EWS for climate change adaptation. The needs for improved capacity (both human and infrastructure) for EWS for climate change adaptation are too large for this project to cover entirely and therefore it will act as a demonstration for other projects.

This project will provide impact experience and evidence on successful and effective climate monitoring improvements. Detailed lessons learned, good practices, opportunities and challenges will be shared during and after the project implementation. Learning and sharing the lessons will be a cross cutting issue addressed at both outcome levels and within every output.

170. There are several levels of knowledge transfer in this project spanning from training workshops to international information exchange forums and web dissemination. The first approach is the training of trainers (output 1.6) which will build a pool of experts capable of transferring the expertise and knowledge to other colleagues at the national and regional level. This will ensure that knowledge is transferred locally and in a cost effective manner. The second level is the east African regional approach of this project that will provide a platform for sharing between different countries and experiences. This approach has significant value and potential as a method of potential replication and innovation.

171. The strengthening of partnerships between Ethiopian institutions and international institutions working on climate and environmental observation for climate change adaptation will also contribute to sharing of lessons learned and good practices at a larger global level. The Adaptation Learning Mechanism (ALM) is an important dissemination and sharing tool that is accessible by all and constantly updated will the most recent information from the project. The project will contribute on a regular basis with case studies, successes and challenges faced by the implementation team and learning from the experiences.

2.9 Stakeholder involvement plan

172. Stakeholder consultation has been a key feature in the design of this LDCF Proposal, and stakeholders have been involved in identifying and prioritizing the proposed intervention activities. The stakeholder consultation during project implementation will be expected to support all outcomes. Overall, the objective of the consultation plan is to provide a framework to guide and promote two way engagements between the key implementing partners (Federal NMA, regional offices of NMA, DRMFSS and MoWE-Hydrology Directorate) and the key stakeholders with whom the project will engage and directly impact upon.

173. Details of the stakeholder engagement during the preparatory phase were provided in Section 2.1.3 above. A Stakeholder Consultation Plan has been developed (Annex V) that outlines some of the key consultation principles and processes at a strategic level that will need to be translated into practical action during the project implementation. It provides guidance based on the initial stakeholder analysis, conducted as part of the project preparation process, and the consultations so far. This can be used to define exact activities in consultation with the Project Board and Project Manager during the inception period of implementation.

3 PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:
Outcome 1: Strengthened capacities of government and producer institutions to design, develop and deliver key services (Hydro-met services)
Outcome 2: Mainstreaming & operationalization of DRRM policy.
Outcome 4: LCCR & MEA compliance, access to climate finance and technology.

Country Programme Outcome Indicators:
Woredas with early warning system (EWS) and contingency plans
Gender responsive policies, sector strategies, investments increasingly LCCR and MEA compliant;

Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 3. Promote climate change adaptation

Applicable SOF (e.g. GEF) Strategic Objective and Program:
Objective 2: Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level

Applicable SOF (e.g. GEF) Expected Outcomes:
Outcome 2.1: Increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas
Outcome 2.2: Strengthened adaptive capacity to reduce risks to climate-induced economic losses

Applicable SOF (e.g. GEF) Outcome Indicators:

- Relevant risk information disseminated to stakeholders
- Type and no. monitoring systems in place
- % of population covered by climate change risk measures

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Project Objective[5] To strengthen the climate monitoring capabilities, early warning systems and available information for responding to climate shocks and planning adaptation to climate change in Ethiopia.	1.Capacity as per capacity assessment scorecard (baseline: 83; target: 139) 2. Domestic finance committed to the relevant institutions to	1.Limited capacity to generate EWS and CI on a national scale for extreme hydro-meteorological phenomena No Standard Operating Procedure (SOP) for alert communication by NMA to DRMFSS Current score: 83 2. Existing budget plans do not have sufficient funds to	1. Capacity assessment scorecard score of 139 2. Domestic target financing is 100M Birr per year	Capacity Scorecard results Focus group interviews with planning and subject matter specialists Hydro-met institutions plans and related budgets Field Surveys and climate vulnerability analyses	

[5] *Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR*

	monitor extreme weather and climate change.	maintain and operate environmental monitoring infrastructure Current budget: low			
Outcome 1 Enhanced capacity of NMA and HWQD to monitor extreme weather and climate change.	1. Percentage of national coverage of weather/climate and hydrological monitoring infrastructure. 2. Frequency and timeliness of climate-related data availability(baseline: Monthly)	1. Percentage of national coverage of weather/climate and hydrological monitoring network at the beginning of the project Meteorological stations: 1000 manual, 70 automatic Hydrological stations: 489 manual, 4 with telemetry 2. Frequency of data transmission and collection: baseline monthly	1. Increase in 24% national coverage to take steps in achieving NMAs optimal monitoring arrangements as defined in feasibility studies Meteorological stations: 1240 manual stations, 110 automatic Hydrological stations: 439 manual, 64 with telemetry 2. Frequency of data transmission and collection: Daily	Work logs of NMA and HWQD to assess the rehabilitation and repair work done Procurement records of NMA and HWQD for procuring new equipment Training programs feedback forms and internal assessments	Political commitment to enhance the capacity of the hydro-met institutions remains Unavailability of requisite human resources and data Poor co-ordination among implementing and executing agency Local IT and telecommunications infrastructure weak e.g. international bandwidth and local mobile telecommunications networks Limited capacity within relevant ministries/ insufficient qualified
Outcome 2 Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans.	1. Percentage of population with access to improved climate information and flood and drought warnings (disaggregated by gender). 2.Development frameworks (e.g. GTP) that integrate climate information in the formulation 3.Sector-specific EW products and strategies that	1. Use of hydro-meteorological and environmental information for making early warnings currently low for both women and men. Women: 6 million Men: 8 million 2. Currently no development frameworks incorporate climate change information	1. Percentage increase in population who have access to improved EWS/CI (50% increase for women, and 50% increase for men) Women: 9 million Men: 12 million 2. At least 2 of the PRSP policy briefs incorporate analyses of risk maps and/or climate change projections influencing long-term planning proposals 3. Development of at least one	Training programmes feedback forms and internal assessments Meteorology department internal planning and related budgeting National plan and development strategies Institutions cross communications logs and internal assessments Meteorology	Problems related to involvement and co-operation of stakeholders to work cross-sectorally Work progresses in a compartmentalized fashion and there is little integration e.g. government departments refuse to share data and information Non-compliance by primary proponents for the successful implementation of this project Insufficient institutional support and political commitments

	integrate climate risks	3. Limited number of tailor made and sector specific meteorological products. Limited public private partnerships and pay for services contracts.	tailored climate product and presentation of market research plan on how to implement mobile phone based agricultural advisories, both supporting targeted weather/climate service delivery	department contracts with private sector companies	

4 TOTAL BUDGET AND WORKPLAN

Award ID:	00073414	Project ID(s):	00086227
Award Title:	Country Name Project Title Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Ethiopia		
Business Unit:	ETH10		
Project Title:	Country Name Project Title: Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Ethiopia		
PIMS no.:	5095		
Implementing Partner (Executing Agency)	National Meteorological Agency		

Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See Budget Note:
OUTCOME 1: Enhanced capacity of the National Meteorology Agency and the Hydrology and Water Quality Directorate to monitor extreme weather and climate change	**National Meteorological Agency**	**62160**	**LDCF**	71200	International Consultants	38000	40000	12000	20000	110000	1
				71300	Local Consultants	37500	40000	30000	25000	132500	2
				72100	Contractual Services - Companies	420000	1052000	917000	257600	2646600	4, 5
				71600	Travel	22000	18000	15000	21000	76000	6
				74200	Audio Visual and Print Prod Costs	26500	26500	26500	26500	106000	7
				71200	International Consultants	10000	20000	0	25000	55000	15
				75700	Training, Workshop and Conferences	5000	0	5000	0	10000	17
					sub-total GEF	**559000**	**1196500**	**1005500**	**375100**	**3136100**	
					Total Outcome 1	**559000**	**1196500**	**1005500**	**375100**	**3136100**	
OUTCOME 2: Efficient and effective use of	**National Meteorological Agency**	**62160**	**LDCF**	71200	International Consultants	47000	50000	35000	20000	152000	8
				71300	Local Consultants	65000	70000	45000	30000	210000	9
				72100	Contractual	91000	230500	153500	54900	529900	11,12

hydro-meteorological and environmental information for early warnings and long-term development plans					Services - Companies						
				71600	Travel	18000	21000	21000	22000	82000	13
				74200	Audio Visual and Print Prod Costs	22000	26000	23000	25000	96000	14
				71300	Local Consultants	0	12500	0	12500	25000	16
				71600	Travel	3000	12000	5000	12000	32000	18
				72500	Office supplies	3000	3000	3000	3000	12000	19
					sub-total GEF	**249000**	**425000**	**285500**	**179400**	**1138900**	
					Total Outcome 2	**249000**	**425000**	**285500**	**179400**	**1138900**	
PROJECT MANAGEMENT UNIT	**National Meteorological Agency**	**62160**	**LDCF**	71300	Local Consultants	19000	24000	24000	24000	91000	20
				72500	Office Supplies	25500	11000	15000	24500	76000	21
				71600	Travel	9000	12000	12000	15000	48000	22
				74500	Miscellaneous	2500	2500	2500	2500	10000	23
					sub-total	**53500**	**47000**	**51000**	**63500**	**225000**	
					Total Management	**53500**	**47000**	**51000**	**63500**	**225000**	
PROJECT TOTAL						**861500**	**1668500**	**1342000**	**618000**	**4500000**	

Summary of Funds:[6]

	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total
Africa Climate Policy Center	302,000	300,000	300,000	300,000	1,202,000
World Food Program	33,000	30,000	30,000	30,000	123,000
USAID	4,800,000	4,000,000	4,000,000	4,000,000	16,800,000
UNDP	4,000,000	3,000,000	3,000,000	3,000,000	13,000,000

[6]*Summary table should include all financing of all kinds: GEF financing, cofinancing, cash, in-kind, etc...*

FAO	411,410	400,000	400,000	400,000	1,611,410
IN KIND Government staff time and local running costs	150,000	150,000	150,000	150,000	600,000
GEF	**871500**	**1668500**	**1342000**	**618000**	**4500000**
TOTAL	10,567,910	9,548,500	9,222,000	8,498,000	37,836,410

Budget Note	Description of cost item
1	International expertise for hydro-met equipment and infrastructure for procurement, installation, calibration and operation and maintenance. The first two years are planned to have more days for the international consultant as this is when the infrastructure is mostly going to be procured and installed. This includes a total 140 days over four years @ 600 USD per day, + 185 DSA + flight and visas.
2	National experts for training and capacity development in new equipment installation, operations and maintenance and training on the new satellite receiving equipment and software. This includes a total approximately 500 days (125 days per year) over four years @ 250 USD per day plus incidentals.
4	Cost of meteorological (40 AWS@25,000 USD and 200 weather stations rehabilitated) and hydrological (10 automated gauging stations procured and 50 rehabilitated)infrastructure and equipment including rehabilitation of existing equipment and procurement of automated weather stations and gauging stations, calibration units and IT
5	Training and capacity building input costs for hydrology and meteorology engineers at national, regional and woreda level for calibration, operations and maintenance of the newly procure and rehabilitated infrastructure and equipment.
6	Travel to project sites, equipment evaluations and checks, and workshops for NMA staff, observers and consultants
7	Costs of awareness and sensitisation output, covering information briefs on climate change, lessons learned and good practices and dissemination costs
8	International expertise for hydro-met capacity building and training for weather forecasters and climate modellers. Training of trainers for tailoring and packaging hydro-met data. Hydrology engineers for modelling and river basin mapping and soil moisture and flood early warning. This includes a total 117 days over four years @ 600 USD per day, + 185 DSA + flight and visas.
9	National expertise for hydro-met capacity building and training of trainers for weather forecasters and climate modellers. Hydrology engineers for modelling and river basin mapping and soil moisture and flood early warning. This includes a total approximately 700 days (around 155 days per year) over four years @ 250 USD per day plus incidentals.
11	Cost of services for training and capacity building on climate modelling, forecasting and dissemination.
12	Training and capacity building input costs for hydrology and meteorology forecasters, modellers and engineers at national, regional and woreda level. Training programs will use national and international expertise to transfer important analytical skill in forecasting and modelling climate and hydrology information including tailoring meteorology products for specific sectors of the economy, such as agro-met advisories, flood warnings, private sector requirements (insurance, civil aviation) and long term policy briefs.
13	Consultant travel, travel to project sites and workshops
14	Costs of awareness and sensitisation output, covering information briefs on climate change, lessons learned and good practices and dissemination costs
15	International Monitoring and Evaluation Consultant
16	National Monitoring and Evaluation Consultant
17	Costs of stakeholder meetings as part of monitoring and evaluation processes
18	Travel to project sites and stakeholder consultations for consultants and project staff to conduct M&E.

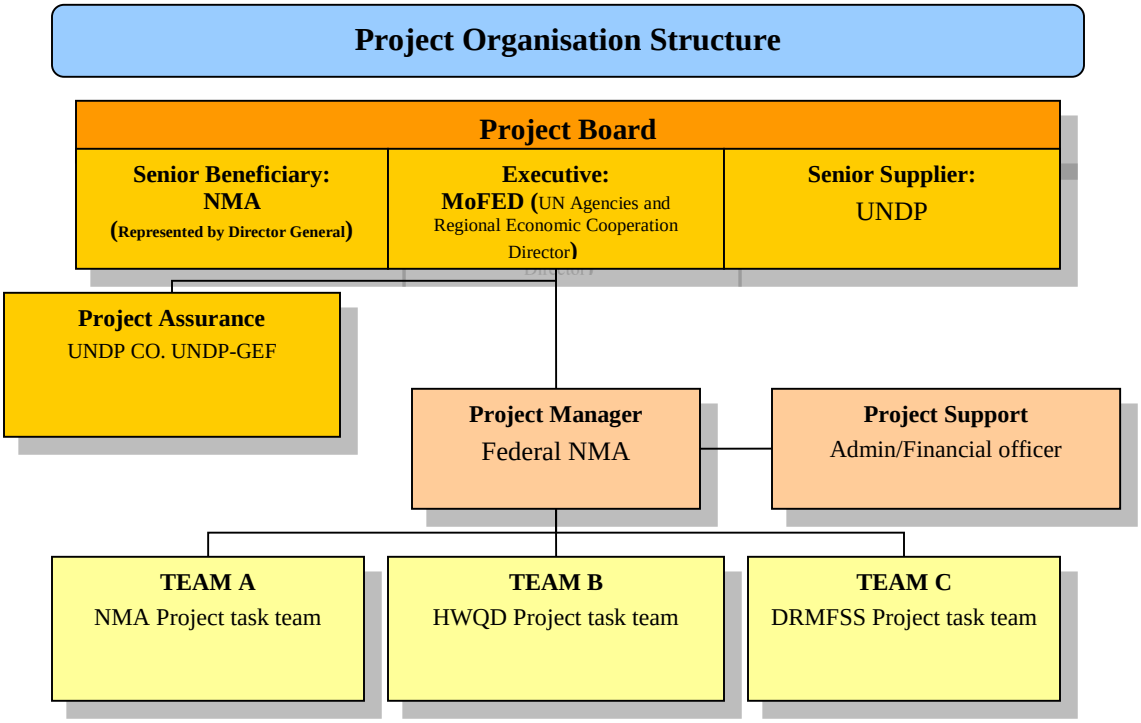
19	Office supplies for the PMU in NMA and other sundry items for the project
20	Project Manager costs for 4 years (national hire)
21	Project support unit office supplies such as stationeries, running costs of electricity, telephones, communication equipment
22	Travel to project sites, equipment evaluations and checks, and workshops for NMA staff, observers/evaluators and consultants
23	Miscellaneous like Insurance, bank charges and other sundries for project coordinating unit

5 MANAGEMENT ARRANGEMENTS

(SEE UNDP POPP FOR FURTHER DETAILS)

174. UNDP's National Implementation Modality (NIM) will be applied for this LDCF Project. The Federal NMA will be the Implementing Partner and will appoint a Project Manager (PM) (paid for by LDCF resources) to coordinate operations and manage the project. A project office shall be set up in NMA. The Responsible Parties will be the Hydrology and Water Quality Directorate (HWQD), the Disaster Risk Management and Food Security Sector (DRMFSS) and their regional offices in the 11 regions of Ethiopia. Implementation oversight at the country level will be by UNDP Ethiopia Climate Change and Vulnerabilities team, supported at the regional and global level by UNDP-GEF. Prior to implementation, a review of the capacity assessment will be made and measures put in place to ensure the project is implemented in full alignment with UNDP policies and procedures.

Figure 2: Proposed Project Operational Structure



175. A project steering committee (PSC) will be established to provide direction to the IP comprising of national and sub-national representatives. The PSC will be chaired by the MoFED more precisely the UN Agencies and Regional Economic Cooperation Directorate Director. The PSC will convene annually to discuss project progress and approve annual work plans. The PSC will comprise MoFED, EPA, NMA, Ministry of Agriculture, Ministry of Water and Energy, UNDP, Regional representatives of NMA and HWQD, Addis Ababa University. Other representatives from relevant Ministries may be represented on the project steering committee: this will be determined at the inaugural meeting of the PSC during the project inception period. It is proposed that UNDP and NMA co-chair the PSC. The Project Manager will be an ex officio member of PSC responsible for taking minutes. Potential members of the project steering committeeare reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the project steering committee as appropriate. Figure 2 proposes a

project operational and reporting structure and the proposed roles of the project structure are outlined below:

176. Project steering committeeis responsible for making management decisions for a project in particular when guidance is required by the Project Manager. The project steering committeeplays a critical role in project monitoring and evaluations by quality assuring these processes and products, and using evaluations for performance improvement, accountability and learning. It ensures that required resources are committed and arbitrates on any conflicts within the project or negotiates a solution to any problems with external bodies. In addition, it approves the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Work Plan, the project steering committeecan also consider and approve the quarterly plans (if applicable) and also approve any essential deviations from the original plans.

177. In order to ensure UNDP's ultimate accountability for the project results, project steering committeedecisions will be made in accordance to standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case consensus cannot be reached within the project steering committee, the final decision shall rest with the UNDP Project Manager.

Potential members of the project steering committeeare reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the project steering committee as appropriate. The project steering committee contains three distinct roles, including:

1) **An Executive**: individual representing the project ownership to chair the group. This will be done by the Ministry of Finance and Economic Development, Ethiopia, Director UNDP Projects as the representative of the Government Cooperating Agency
2) **Senior Supplier**: individual or group representing the interests of the parties concerned which provide funding for specific cost sharing projects and/or technical expertise to the project. The Senior Supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project. This will be done by a representative of UNDP, in this case the Head of the Climate Change Resilience, Green Growth Unit, in the UNDP CO.
3) **Senior Beneficiary**: individual or group of individuals representing the interests of those who will ultimately benefit from the project. The Senior Beneficiary's primary function within the Board is to ensure the realization of project results from the perspective of project beneficiaries. This will be done by a representative of the National Meteorological Agency, in this case the Director General
4) The **Project Assurance** role supports the Project Board Executive by carrying out objective and independent project oversight and monitoring functions. The Project Manager and Project Assurance roles should never be held by the same individual for the same project. This will be done by the Head of the Climate Change Resilience, Green Growth Unit, in the UNDP CO, and UNDP-GEF Regional Technical Advisor

178. **Project Manager**: The Project Manager has the authority to run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost.

179. **Project Support**: The Project Support role provides project administration, management and technical support to the Project Manager as required by the needs of the individual project or Project Manager.

180. As per discussions with the GEF Secretariat, this initiative is part of a multi-country set of NIM projects supported by UNDP-GEF. In response to LDCF/SCCF Council requirement that a regional component would be included to enhance coordination, increase cost effectiveness and, most importantly, benefit from a regional network of technologies, a cohort of technical advisors and a project manager will be recruited to support each of the national level project teams. In particular they will support countries to develop robust adaptation plans and provide technical advice, training and support for accessing, processing and disseminating data for early warning and national/sectoral planning related purposes on a systematic basis. The cost of these project staff has been prorated across all country project budgets and recruitment of these posts will be undertaken by UNDP-GEF (HQ) in coordination with all UNDP Country Offices.

6 MONITORING FRAMEWORK AND EVALUATION

181. **The** project will be monitored through the following M& E activities. The M&E budget is provided in the table below. The M&E framework set out in the Project Results Framework in Part III of this project document is aligned with the AMAT and UNDP M&E frameworks.

Project start

182. A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and program advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

183. The Inception Workshop should address a number of key issues including:

- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- Based on the project results framework and the LDCF related AMAT set out in the Project Results Framework in Section III of this project document, and finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- Plan and schedule PB meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first PB meeting should be held within the first 12 months following the inception workshop.

184. An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.
Quarterly:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP/GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes,

or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).

- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs will be used to monitor issues, lessons learned. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

185. Annually: Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.
The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR

186. Periodic Monitoring through site visits: UNDP CO and the UNDP-GEF region-based staff will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:

187. The project will undergo an independent Mid-Term Review at the mid-point of project implementation. The Mid-Term Review will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term review will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term review will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The LDFC/SCCF AMAT as set out in the Project Results Framework in Section III of this project document) will also be completed during the mid-term evaluation cycle.

End of Project

188. An independent Terminal Evaluation will take place three months prior to the final PB meeting and will be undertaken in accordance with UNDP-GEF guidance. The terminal evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term review, if any such correction took place). The terminal evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The LDFC/SCCF AMAT as set out in the Project Results Framework in Section III of this project document) will also be completed during the terminal evaluation cycle. The Terminal Evaluation should also provide recommendations for follow-up

activities and requires a management response, which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

Learning and knowledge sharing:

189. Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

190. The project will identify and participate, as relevant and appropriate, in scientific, policy based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

191. There will be a two-way flow of information between this project and other projects of a similar focus. At the validation workshop a participant representing USAID mentioned the importance of focusing on monitoring and on food insecure areas. This will be done and is included in the monitoring plan.

192. Audit: Project will be audited in accordance with UNDP Financial Regulations and Rules and applicable audit policies.

Type of M&E activity	**Responsible Parties**	**Budget US$** *Excluding project team staff time*	**Time frame**
Inception Workshop and Report	Project Manager (MEE) PIU UNDP CO, UNDP GEF	Indicative cost: 10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	UNDP GEF RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members. PIU, esp. M&E expert	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	Oversight by Project Manager (MEE) PIU, esp. M&E expert Implementation teams	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	Project manager (MEE) PIU UNDP CO UNDP RTA UNDP EEG	None	Annually
Periodic status/ progress reports	Project manager and team	None	Quarterly
Mid-term Review	Project manager (MEE) PIU UNDP CO UNDP RCU External Consultants (i.e. evaluation team)	Indicative cost: 30,000	At the mid-point of project implementation.
Terminal Evaluation	Project manager (MEE) PIU UNDP CO	Indicative cost : 45,000	At least three months before the end of project

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
	UNDP RCU External Consultants (i.e. evaluation team)		implementation
Audit	UNDP CO Project manager (MEE) PIU	Indicative cost per year: 3,000 (12,000 total)	Yearly
Visits to field sites	UNDP CO UNDP RCU (as appropriate) Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly for UNDP CO, as required by UNDP RCU
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		US$ 97,000 (+/- 5% of total GEF budget)	

7 LEGAL CONTEXT

193. This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA and all CPAP provisions apply to this document.

194. Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

195. The implementing partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;

b) Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

196. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

197. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

8 ANNEXES

8.1 Annex I. Risk Analysis

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
1	Problems related to involvement and co-operation of stakeholders to work cross-sectorally	Incomplete data collection Threat to completion of integrated climate resilient plans	Clear commitment of the Ministries and Bureaus to sharing of data and joint programming. Area-based planning approach that promotes cross-sectoral data sharing.	Political and organizational	P=3 I=5	UNDP CO	UNDP CO	30/04/2013	
2	Unavailability of requisite human resources and data	Implementation is limited and delayed Threat to successful project implementation	The issue of the unavailability of requisite human resources will be mitigated by recruitment of international consultants who will work closely with in-country counterparts and by targeted capacity building activities. Training activities of local personnel will also be part of all aspects of the work and the relevant institutions	Political and organizational	P=3 I=4				

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
			will be encouraged to expand the staff base if it is weak in particular areas.						
3	Insufficient institutional support and political commitments	Endangered project sustainability	The proposed project is strongly supported by Governments and other key stakeholders and development partners. The project, in conjunction with UNDP, will therefore take advantage of this opportunity to seek substantial support from the Governments and forge strong partnership with other development partners. Direct linkages to existing and planned baseline development activities implemented by government, securing of the necessary co-financing, as well as	Political and strategic	P=2 I=4				

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
			local buy-in will also minimize this risk. It will also be important to establish buy in from all government departments early as the project will utilize data and information from a wide range of departments.						
4	Poor co-ordination among implementing and executing agency.	Leading to delays in deliverables	Clear Project Management arrangements (see Section 4).	Political	P=3 I=3				
5	Local IT and telecommunications infrastructure weak e.g. international bandwidth and local mobile telecommunications networks	Threat to successful implementation and project deliverables	Cost-effective solutions for each particular situation will be used e.g. satellite and/or radio communications. Where feasible automatic weather and hydrological stations reporting over the mobile telecoms network will be preferred.	Organizational and financial	P=3 I=3				
6	Limited capacity within relevant ministries/insufficient qualified human	May limit/delay project implementation/completion.	A major part of the project is to strengthen institutional and	Political, strategic	P=3 I=2				

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
	capacity.		technical capacity for planning, designing and implementing local level adaptation actions. Technical and capacity building expertise will be contracted in, to work with and train local technical staff. A dedicated Project Manager will be supported with short term national and international specialist support to ensure smooth and timely delivery of project outputs.						
7	Work progresses in a compartmentalized fashion and there is little integration e.g. government departments refuse to share data and information	Limits the successful implementation of the project and its outcomes	This risk is always present in a project such as this. By ensuring that capacity is built across a range of departments and implementing 'quick win' measures early (developing products based on internationally available data),	Strategic	P=2 I=4				

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
			these issues can be mitigated.						
8	Non-compliance by primary proponents for the successful implementation of this project	Threat to implementation and success of project activities.	Ensuring that the project is designed and implemented in a participatory and inclusive manner, following established UNDP procedures, will mitigate the risk. Since the activities correspond to the urgent needs as expressed by the primary proponents the risk of non-compliance should be reduced	Strategic	P=2 I=4				
9	Climate shock occurring during the design and implementation phase of the project	Threat to implementation and success of project activities.	Engage with disaster response and recovery as part of adaptation planning process and incorporation of climate hazard information into planning. There may be some delays as more urgent priorities may need to be addressed by some of the stakeholders (e.g. NHMS or	Environmental	P = 2 I = 2				

#	Description of the risk	Potential consequence	Countermeasures / Mngt response	Type (Risk category)	Probability & Impact (1-5)	Owner	Submitted, updated by	Last Update	Status
			disaster management) but it is unlikely that this will derail the project.						

8.2 Annex II. References

Conway, D. &Schipper, E. L. F. (2010). Adaptation to climate change in Africa: Challenges and opportunities identified from Ethiopia. *Global Environmental Change*.In press.

FDRE (2006) Plan for Accelerated and Sustained Development to End Poverty 2006-2010

FDRE (2007) Ethiopia Building on Progress: A Plan for Accelerated and Sustained Development to End Poverty (PASDEP) Annual Progress Report 2006/07. Ministry of Finance and Economic Development (MoFED)

FDRE (2007) Ethiopia: National Adaptation programme of action (NAPA) 2007

FDRE (2010) Growth and Transformation Plan 2010 - 2015

IPCC (2007) Fourth Assessment Report

Jing-Yun You, G. &Ringler, C. (2010).Hydro-Economic Modelling of Climate Change Impacts in Ethiopia. *IFPRI Discussion Paper* **00960**. April 2010.

Mideksa, T. (2010). Economic and distributional impacts of climate change: The case of Ethiopia. *Global Environmental Change* **20**:278-286

UNDP (20011) United Nations Development Assistance Framework in Ethiopia 20011-2015

UNDP (2009) Human Development Report Ethiopia 2009

UNDP (2011) Country Programme Action Plan 20011-2015 between the Government of the Federal Democratic Republic of Ethiopia and United Nations Development Programme

Word Bank (2008) Ethiopia At A Glance

8.3 Annex III. Key assessment reports

Written by Benjamin Larroquette, Technical Specialist, and Gebru Endalew, National Consultant)

1. INTRODUCTION

This key assessment report presents the findings of two missions to Ethiopia, desk reviews of policy documents and the work of the National Consultant in order to support the UNDP Country Office engage with Government and other key stakeholders in the design of a project on EWS and climate information systems, to be financed by the Least Developed Country Fund (LDCF), through the Global Environment Facility (GEF). The focus was on hydro-met infrastructure and training requirements as well as institutional relationships and communication channels.

Ethiopia is looking to strengthen its weather information gathering capacity to be able to disseminate more accurate weather forecast and early warnings through existing early warning communication channels.

- Ethiopia has 489 operational hydrological gauging stations measuring water levels, flows and water quality; however there is a need for improving and rehabilitating the system – activity in line with output 1.1 of the project results framework in the PIF.
- Ethiopia has a large network of weather stations (approx. 1200) but not all are functional and there is a need for rehabilitation and procurement of new automated weather stations – activity in line with the output 1.2 of the project results framework in the PIF.
- Ethiopia is interested in improving its capacity to receive and analysesatellite data by receiving training and modern equipment and software - in line with the output 1.5 of the project results framework in the PIF.
- Ethiopia is also interested in enhancing its upper air monitoring stations by procuring new and rehabilitating existing equipment - activity in line with the output 1.4 of the project results framework in the PIF. This activity is only useful for EWS and long term planning if there is strong evidence that it will improve forecasting.
- It seems that Ethiopia is not interested in the procurement of new radar due to the high costs involved, but would like to look into the possibility of rehabilitating existing radar that is currently not operational.
- Training and capacity-building of personnel involved in weather information gathering and analysis from the meteorological stations and the hydrological stations is needed in order to be able to enhance the countries' capacity for "efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans." (Outcome 2).
- During the inception and national workshops as well as the bilateral discussions it was emphasized that during the project a plan for sustainable financing of the O&M of the rehabilitated and installed infrastructure needs to be developed, including exploring private public partnerships – in line with output 2.5 of the project results framework in the PIF.

Currently the NMA is the institution in charge of gathering and analyzing weather data, which is then passed on to the DRM/FSS for action if necessary. The same is done by the Directorate for Hydrology and Water Quality (DHWQ).

From the discussion and presentations it was apparent that Ethiopia was suffering primarily from droughts and flooding. See maps below:

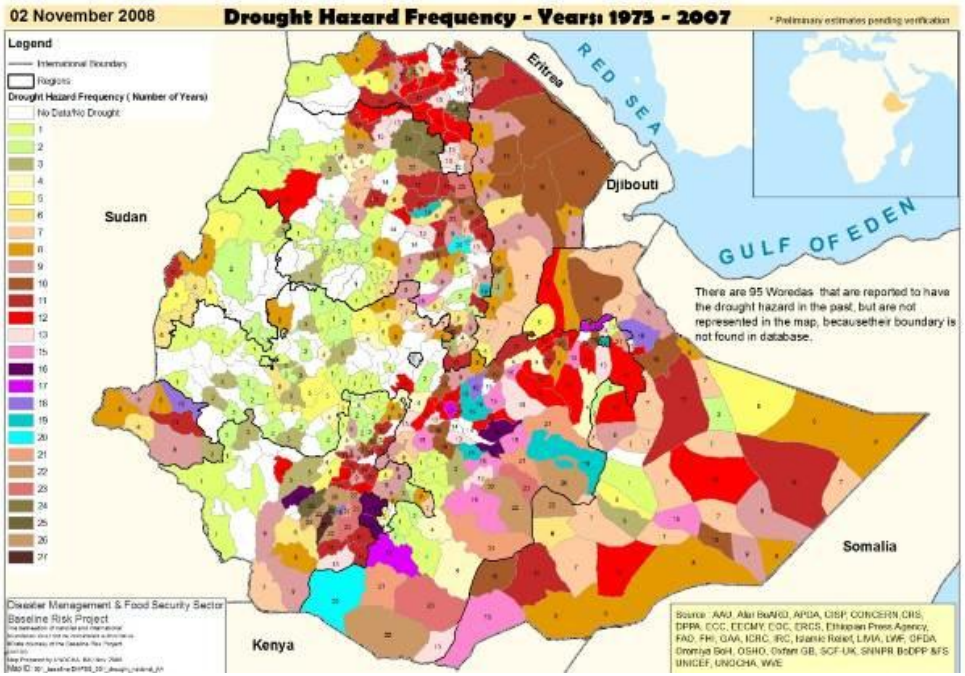


Figure 1: Drought distribution and frequency

This map has been produced by the Ministry of Agriculture and the DRM/FSS. It presents data from various sources and shows the drought frequency between 1975 and 2007. This map could be overlaid with the hydro-met infrastructure to identify where current infrastructure is inadequate and where it needs to be improved.

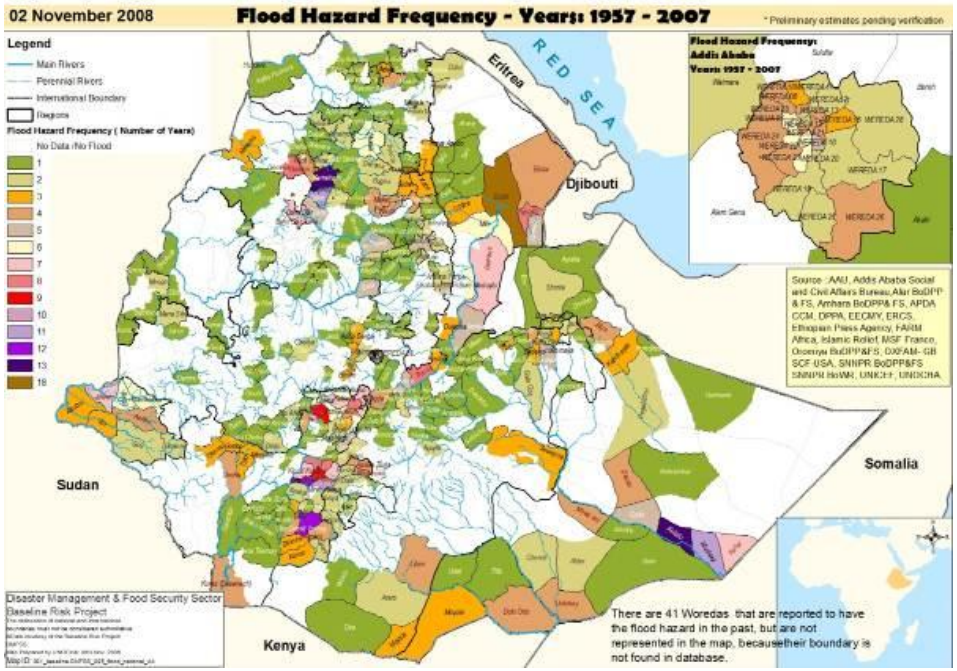
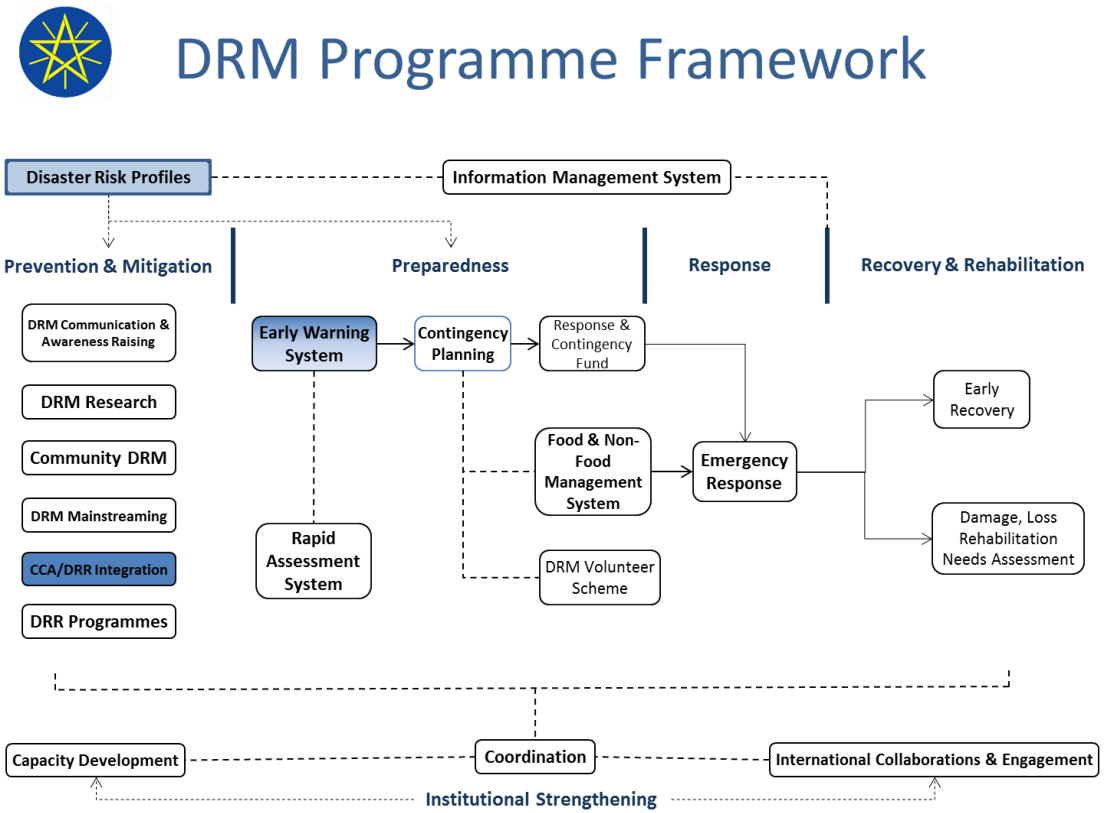


Figure 2: Flood distribution and frequency

The Ethiopian DRM is fairly robust; this is partly due to a history of very serious droughts and floods, leading to the development of a strong DRM system. Below is a diagram describing the DRM framework, showing the centrality of the NMA as an issuer of early warnings for severe weather events such as floods and droughts.



Climate Change Adaptation is clearly identified as a factor for prevention and mitigation. Droughts and floods (climate related events as opposed to earthquakes and tsunamis for example) have been confirmed by the Director of DRM/FSS and the Director of Hydrology and Water Quality as being the main natural disasters faced by Ethiopia. This highlights the importance of a robust weather information gathering system that can analyse the data and issue early warnings when necessary. An enhanced Meteorological department with the ability to collect more observational data and assimilate useful forecast information will be able to feed more useful information into this existing early warning and disaster risk management framework for dissemination to the local populations and long term planning.

This report provides a situation analysis of the early warning system in Ethiopia, including a focus on the current status and gaps in rehabilitation, procurement and capacity building for NMA, DRMFSS and MoWE-DHWQ in sections 2 and 3, respectively. The total budget of the project for maintenance, rehabilitation and capacity building is estimated to be **$ 6,925,456**. This is above the approved budget, but this project may be used as an opportunity to leverage more funds.

2. OUTCOME 1: Enhanced capacity of national hydro-meteorological (NHMS) and Environmental institutions to monitor extreme weather and climate change

2.0 Infrastructure needs

In order to enhance the capacity of the national hydro-meteorological and environmental institutions, the primary activity to be accomplished is strengthening the monitoring, forecasting and dissemination capacity of the main stakeholders through complementary infrastructure needs. In this regard, the current status of the EWS, successful interventions, gaps and the contribution of this project towards complementing the government intervention has been analyzed for NMA, DHWQ and DRMFSS. The total cost for rehabilitation, maintenance and procurement is **$5,579,956**. Below is a detailed analysis of NMA, DHWQ and DRMFSS, respectively.

2.1 NMA Infrastructure needs

The NMA has evolved from a departmental agency to an autonomous national agency. The development and expansion of the NMA is an indication of the need for EW systems from stakeholders as extreme events like drought and flood become more frequent. A nationwide drought in 1984 occurred when no EWS was in place, highlighting the need for suitable meteorological monitoring and forecasting. Following this event and after studying experiences of other countries, preparation of seasonal forecasts began in 1987.

The main stakeholders and collaborators of the NMA include: DRM/FSS, including Regional offices; Ministry of Water and Energy (MOWE)-hydrology department including Regional offices, USAID PRIME, FAO, WFP, the Prime Minister's office; Ministry of Health (MoH); National Defense (to intervene during hazards); Transport (Aviation, Road Authority, Shipping lines (dry and Sea port)); Insurance companies; construction companies; Federal and Regional EPA; Municipalities.

Current state of the EWS: The NMAs' current weather observational infrastructure is presented below, including the current forecasting capacity:

- 1200 weather stations, mostly conventional (manual)
- 37 automated weather stations
- Surface stations

- Sparsely and unevenly distributed (see map, figure 3)
- Concentrated along the main roads and in urban regions
- Equipped with outdated instruments
- Few meteorological elements are observed
- Maintenance and routine station inspection is not accomplished as per WMO's recommendation
- There are question of landownership for establishing stations
- Some stations are below the standard of the World Meteorological Organization's station distribution requirements.

In terms of the current status of the **equipment**, the list of stations, their locations, and which elements have been missing because of insufficient maintenance and rehabilitation has been identified (Annex A). The percentages of elements missing in the 200 principal and synoptic stations vary from element to element with a range of 10-47% (Annex B). The implementation of this project will replace most of the missing instruments and increase representation of elements under observation to at least 90%.

The NMA's **communication facilities** include: 150 SSB radio for near real-time data collection from conventional manned stations for first-class and synoptic stations; 35 AWS using GPRS network to send data every 15 minutes on six meteorological parameters(Temperature, Rainfall, Wind speed &Dir, RH, Solar radiation) for agriculture (food security) & EW purposes.

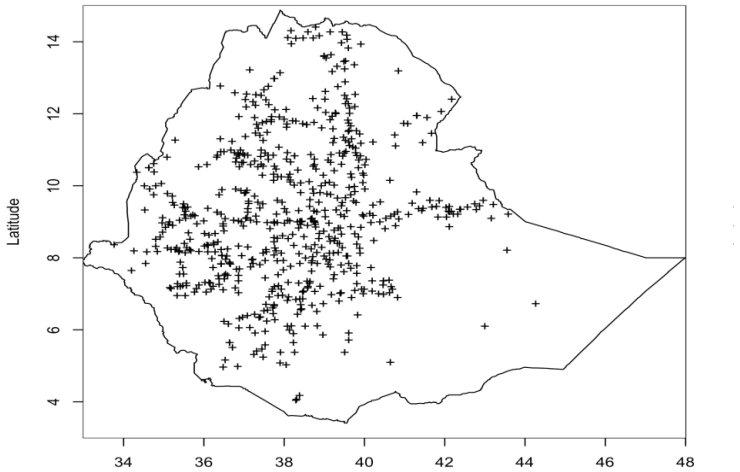


Figure 3: Distribution of Met stations as of 2008 (not all are functioning)

The **database currently used by** the institution was compiled with the support of the Finish government and via the WMO climdata database system, which is backed up at the HQ.

The NMA currently prepares a seasonal forecast one season in advance at a national level, whereas the global standard is up to two years. **Monitoring** is done using remote sensing via Eumetsat; site visits; and feedback from collaborators (WFP, RPIME, Regional governments, DRM/FSS, MoWE). The advisory service is free of charge and accessible online. **Communication of EWS messages** is done via media & internet immediately prior to an event. EWS messages are prepared for the public and policy makers and are briefed by the focal person via the task force & also directly e.g.MoA&MoWE. EW messages are sent directly to the media from NMA as a precautionary measure e.g. warnings of unseasonal rain during harvesting season; warnings of the possibility of dry spells during the rainy season in order to use water economically; or warnings of the possibility of flash floods as a result of heavy rainfall. Ministries such as MoWE, MoA (DRMFSS), MoH receive regular specialised EW messages in order to guide their interventions.

Successful interventions by NMA include:

- The 1988 flood, early 1990's drought (Green Drought), 1996/97 and 1998 floods, 2002 drought, 2006 flood, 2009 & 2011 droughts. These events were successfully forecasted and early warnings were provided to stakeholders at least at the level of policymakers. However, no feedback from the end-users (the community) on the successful and effectiveness of the EW was received.

- In addition to the federal level EW service, there is now representation on regional level. The dissemination mechanism uses all available media (TV, radio, internet and print media) and is translated into four languages (Amharic, English, Oromifa, Tigrigna). As a result, business processes have been re-engineered and new strategies have been developed (LDCF_CC_EWS_ NMA's Strategic issues in its 2004-07 SP; LDCF_CC_EWS_NMA 5 year Strategic plan). The strategy was developed in consultation with selected localities in the country in order to assess the successes and drawbacks of the EWS (LDCF_CC_EWS_ Public Opinion survey on MeteoHailu and Diriba, 2003; LDCF_CC_EWS_ Survey of Meteorological Products Applications in Ethiopia's Tourism Industry, HailuWudinehneh, 2005). A summary of the findings is in Box 1 below:

BOX 1: OPINION OF EWS END-USERS

Efficient and reliable Meteorological information, in particular early warning service, is vital for various social and economical activities of a country. In view of this, GOV and NGO agencies as well as the public utilizes the meteorological information in their short and long term interventions and plans.

NMA delivers meteorological services for diversified sectors. The services it disseminates to the users are many but limited to short, medium and long-range weather and climate forecasts, aeronautical forecasts, agrometeorological and hydrometeorological forecast and impacts as well as climatological services. There are a wide variety of end-users of the services. These include individual members of the general public, DRMFSS, farmers and pastoralists, insurance companies, water managers, policy makers and investors.

The Agency provides information to the users in the form of electronic, printed material and audiovisual media. The most common and widely reached medium seems to be via radio and TV. Various printed documents/bulletins are also regularly sent to the government and NGO officials. To ensure that user requirements are being met, it is necessary to assess end-user opinion about the service. The preliminary field visit on selected end-users on different occasions and from different case studies indicates that:

- There is poor understanding of weather information amongst various members of the public which resulted in mistrust of the early warning products
- There is insufficient communication channels such as radio, TV and other media which prevents farmers from accessing and utilising the weather forecast and early warnings.
- Most of the public barely understand technical terms frequently used by the agency.
- There are not enough representative stations in their localities especially in the pastoralist areas and areas which are far from the main road infrastructure.
- Poor presentation, particularly in ETV and limited awareness also play a major role in the use of climate information.
- The information generated is very general and difficult to act on.
- Dissemination of meteorological information including short and long range forecasts and early warnings sometimes only arrive after the event
- Previously, little was known about the importance of climate information, but the increasing use by farmers of new agricultural technologies has increased reliance on favourable weather conditions

Sources:

- Survey of Meteorological Products Applications in Ethiopia's Tourism Industry, HailuWudinehneh, 2005
- Public Opinion survey on MeteoHailu and Diriba, 2003
- NMA's Strategic issues in its 2004-07 SP

There is a master plan of stations for improving the aerial coverage as well as quality and accessibility of data of stations (LDCF_CC_EWS_ Proposed AWS for the 2004; LDCF_CC_EWS_ Station Instrument_need_2005).

A number of stakeholders and collaborators are supporting EWS by installing AWS and building capacity including:

- 37 AWSs working without interruption for more than a year, supported by WFP and installed by NMA technicians who were assisted with factory and onsite training by the manufacturer. WFP is planning to support a further ten AWS.
- COMESA supported 6 AWS for early warning and monitoring support; UNISDR 4 AWS support; CHIESA-3 AWS for PhD student research on climate change in Jimma/koffele forest transaction area;
- NMA supported 10 AWS in the 2004/2011 budget year & 20 AWS in the 2005/2012 budget year to be installed this year;
- ACPC supported 20 AWS; 1 upper air station; 10 synoptic stations (5 synoptic stations rehabilitate & upgrade; 5 1st class purchase barometer); 1 air quality station, database support, master plan update and capacity development is planned with a proposed budget of $695,000.

Limitations on the current EW interventions include:

Currently, information gaps are a major limitation to an effective and efficient EWS. The information generated is too general and is in frequently in a format which the general public cannot understand. There is a temporal and spatial lack of accuracy in weather data. In general there is a shortage of skills in use of global hydrometeorological products. There are limitations in down-scaling climate information to suit the needs of communities and seasonal forecasts are limited to one season ahead and lack spatial refinement to the level of climatological zone.

The other outstanding issue is the gap in capacity. There is limited knowledge in the use of EW products &interpretation and limited knowledge of the use of existing information/resources. There is a high rate of staff turnover which results in limited knowledge to use existing information/resources. The data sharing mechanism between partners such as research centres, universities and others is weak. There is no two-way data-sharing mechanisms between regions & HQ which limits the effectiveness of the EW process.

With the limited capacity and information currently available at the NMA, the end-users are not able to use the EW product properly. This usage gap is as a result of limited meteorological literacy as well as a loss of trust in order to make decisions based on early warnings. Furthermore the EW message generated has a dissemination gap as a result of limited infrastructure development. Hence, the most vulnerable groups, such as small-scale farmers and pastoralists, are not able to access the information. In Box 2 below is a summary of the status of the use of mobile phone for the EWS and its potential in improving the dissemination mechanism of the EWS in the near future.

BOX 2: The use of Mobile Phone Technology for improving the dissemination of the EWS

The Early warning service provided by NMA, DRMFSS and MoWE-hydrology directorate to the users is disseminated in the form of electronics, printed materials and audiovisuals. The most common and wide-reaching dissemination mechanism seems to be via radio and TV. Various printed documents/bulletins are also regularly sent to the government and NGO officials. According to the opinions collected from end-users, the dissemination mechanism, irrespective of other constraints, is very slow with some notification arriving after the impact has occurred. A lack of communication channels like radio, TV and other media hinders farmers from accessing and utilizing the weather forecasts and early warnings.

A new technology which is now practised in other countries is the use of SMS for early warning purposes. The MoWE hydrology directorate currently uses SMS warnings in selected flood-prone areas. There is a frequent occurrence of flash floods which requires immediate warning. However, the current communication system is inadequate as the event is very short and it is not possible to give warning to downstream communities using radio communication and other means of communication to alert them. In addition areas at risk of flooding are usually highly localised and small. Therefore the Hydrology and Water Quality Directorate with the cooperation of WFP identified flood affected areas and promoted awareness amongst the communities about the risk of flooding and possible solutions through active stakeholder interaction. The first possible solution of the Hydrology and Water Quality Directorate is collecting information from hydrological stations through various media and disseminating the information to local area administration offices; the local administration also gives information to local communities whilst the local communities give information about the impacts of the flood as well as communities intervention through mobile SMS. This interaction was very successful and benefited the communities.

The government of Ethiopia, Ministry of Communication and Information Technology (MCIT), e-Government Directorate is preparing to use SMS technologies including the push and pull service, IVR and NMS for early warning purposes through a national data centre. It was learnt that:

- Identification of key government information sources has been completed;
- The technology will allow them to send the EW message in a group for selected areas;
- The service will be free at this stage and even the main sources of the information like NMA personnel are to be trained on how to improve the service
- MCIT to pay to telecommunication company but will consider in the future how to sustain the initiative through cost recovery/sharing mechanism

Sources:

Ms.BetelhemBedlu, e-Government Directorate, MCIT,

Mr.BirukKebede, Senior hydrologist, MoWE-hydrology Directorate

In general there are gaps in terms of:

- Time: expand to two seasons and further for Climate Change projection
- Space: Fine resolution (to the extent of 10x10km)
- Dissemination: to the grassroots level (farmers, pastoralists) using more technology (such as SMS, community radio)
- Kind of EW: multiple socio-economic sectors

In order to address the above-mentioned needs by the different stakeholders, there are a number of constraints including:

- Staff capacity (there are challenges in retaining staff and having skilled expertise at various levels)
- Limited spatial and temporal availability of meteorological information
- Insufficient computational facilities
- Societal acceptance (resistance from society)
- Weak collaboration between various stakeholders
- Gaps in reporting of disasters to relevant institutions (e.g. from remote areas).

In order to address the aforementioned needs, this project will emphasise maintenance and rehabilitation of existing stations; procurement of 40 AWS; enhanced capacity building and other issues. The detailed needs for equipment and capacity has been analyzed below in sections 2.1.1 and 2.1.2 as well as in section 3.1.This project will address gaps in EWS through implementation of these activities. Below is a summary of budget required by NMA (Table 1).

Table 1: Summary of budget needed by the NMA

Activity	**Financial Requirement in US$ 2014-2016**
Rehabilitation and maintenance	300,000
Procurement	3,842,256
National and International training	680,000

Total sum	**4,822,256**

2.1.1 Rehabilitation

Even if the master plan is to have 3-5 thousand stations throughout the country, it was agreed to prioritise improvements in quality and accessibility of existing stations (nearly 1200) first there currently gaps in accessing quality information. In order to address the aforementioned needs, this project will emphasise the maintenance and rehabilitation of existing stations in order to address gaps in EW.

Out of the 1200 stations in the country, the third-class stations record a limited range of elements, which are mainly rainfall and temperature. For this purpose emphasis is given to principal and synoptic stations which records different elements for diversified stakeholders. The elements missing in the 200 principal and synoptic stations vary from station to station with a range of 10-47% (Annex B). The implementation of this project will replace most of the missing instruments and will be able to achieve a completeness of more than 90%.

Estimations of the project's financial contribution for improving the EWS, thereby reducing the impact of extreme events, is done in a cost-effective and systematic manner, including information on the type of instrument to be rehabilitated and maintained. The detailed instrument needs and costs per region and station have been analyzed and are attached in Annex A. The total cost required to maintain the stations is $300,000.

2.1.2 Procurement of new EWS

The EW is highly dependent on in-situ near-realtime weather data, which are collected from conventional manned stations and a few AWS. These data are largely of poor quality. This is mainly because of gaps and errors in data. Wrong or incomplete data gives incomplete or wrong input to the EW. Missed data fed into an early warning model, for example hydrology/flood model, may result in giving a false warning. The same is true for the drought warning. For example, the LEAP software is missing instrument data for evapo-transpiration computation, which in turn is used for yield forecasting or crop monitoring. Malaria outbreak early warning models also need complete data of rain, temperature and airmoisture. Therefore, filling the instrument gap as well as the instrument calibration and maintenance capacity improves a lot in filling both spatial and temporal data quality, which in turn directly improve the quality and accuracy of EW.

Increasing the number of AWS results in a significant improvement for the EW. This is because observation from the conventional manned stations are taken only during day time and data is transmitted by radio which are prone to frequent malfunction. Observation frequency is approximately every three hours or less. Human error could be introduced during observation, data transmission and data entry. Thus, this system is highly vulnerable to human error and is prone to be incomplete and untimely. In contrast, AWS observations are made continuously At 15-minutes intervals and are not susceptible to human error. Data is transmitted automatically in near-realtime and is easily compatible with available modeling systems for EW. The potential locations for installing new AWS are shown in Figure 4 below. So far the practice of installation of AWS is in different 1st Class stations sites.

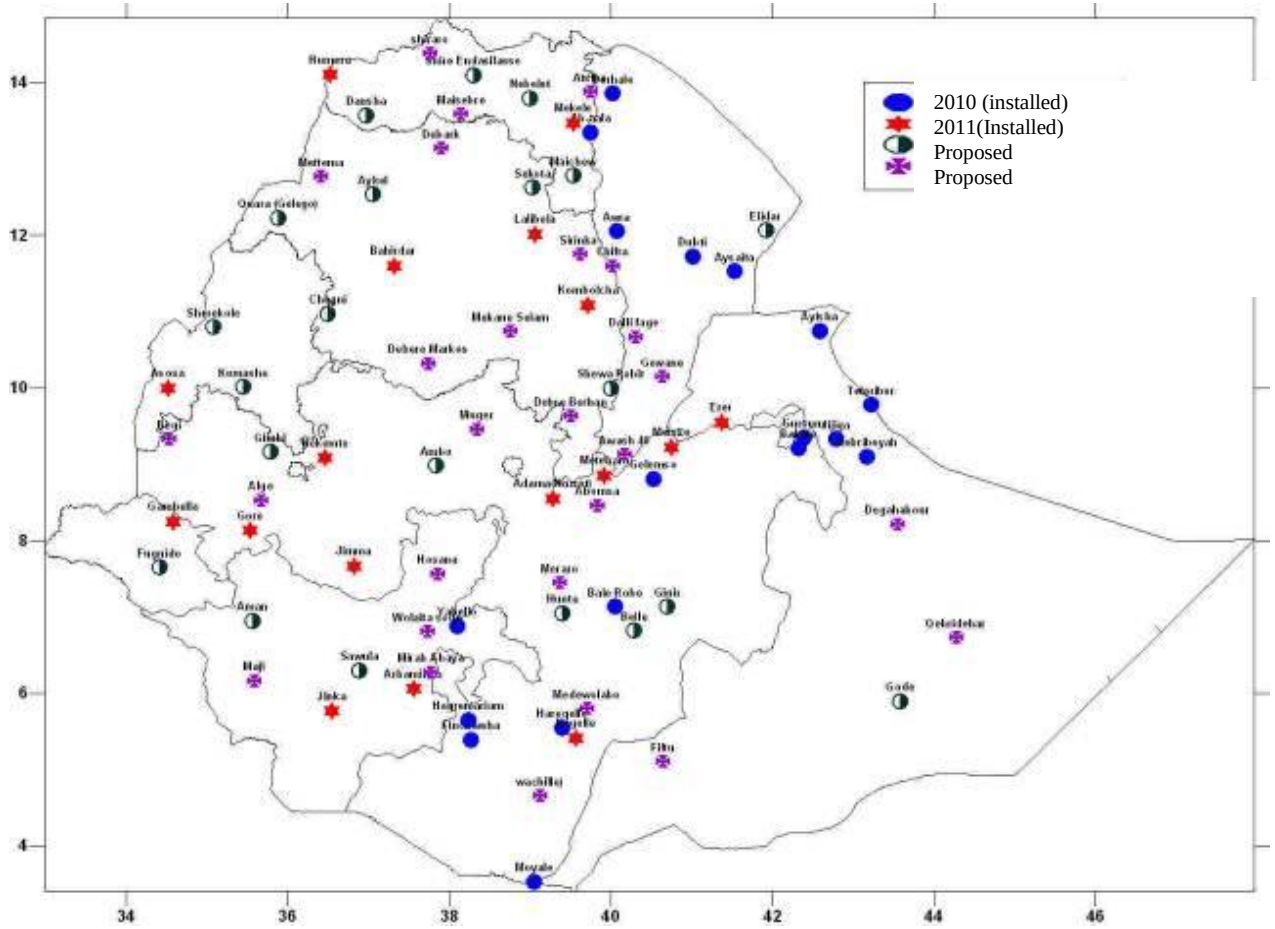


Figure 4: Map of location for proposed new AWS

One of the main causes for deteriorating data quality is instrument failure and limited calibration. WMO manuals set a time limit for newly produced and purchased meteorological equipment for calibration frequencies ranging from six months to 2 years. Table 2 below shows the standard for calibration and monitoring of meteorological instruments. However, mainly due to limited mobile calibration and monitoring facilities as well as trained personnel in instrument maintenance and calibration, these routines have not been consistently adhered to. The 24 hour EW

service is declining because of multiple constraints, including the mobile monitoring facilities. There is no training institution in Ethiopia which gives training for meteorological instrument maintenance and calibration. Hence there is a need to strengthen the existing NMA calibration and maintenance laboratory in terms of calibration equipment, staff training and maintenance toolkits as well as setting up a calibration kit with a set of basic meteorological quantities (temperature, relative humidity, air pressure). On-site testing/calibration of field measuring instruments is an immediate need for the fulfillment of the ISO/IEC 17025:2005 standard for calibration of all major meteorological qualities. This project is expected to contribute to the fulfillment of the calibration and monitoring needs of the country which in turn will have a direct impact in data quality and thus the EW.

.

Table 2: Calibration standard for different meteorological instruments

No.	Instrument Name	Frequency	Reference
1	Anemometer	½ year	WMO No.622(1986)page 339
2	Mercury barometers: Working Standard against Primary Standard	½ year	WMO No.622(1986)page 313 WMO No.8(2006) 3.10.3.1
	Mercury barometers: Reference Standard against National working Standard	½ year	WMO No.622(1986)page 313 WMO No.8(2006) 3.10.3.1
	Mercury barometers: Station Barometer with Reference Standard	1/1 year	WMO No.622(1986)page 313 WMO No.8(2006) 3.10.3.1
3	Thermometers-Glass Thermometers-metal resistance thermistor Humidity Hygrometer	1/5 year 1/1 year 1/6 year 1/1 year	WMO No. 622(1986) page325 WMO No.8 (2006)2.2.5.2
4	Thermo-hygrograph	1/1 year	WMO No. 622(1986) page336
5	Psychrometers	½ year	WMO No. 622(1986) page337
6	Precipitation recorder	½ year	WMO No. 622(1986) page252
7	Evaporation pan	½ year	WMO No. 622(1986) page252
8	Sunshine recorder	1/1year	WMO No. 622(1986) page252
9	Actinograph	½ year	WMO No. 622(1986) page347

Weather radar are well-known to obtain quality data in terms of spatial coverage and details of storms which have immense value especially for flash flood and river flood forecast and early warning of these events. Radar also helps to improve the current climate monitoring system which uses the blending of satellite and station data by filling the gaps from both the satellite and the gauge. Therefore there is a need to assess the functionality and maintenance needs of the first radar in the country on EntotoMountain.

The climate systems in the upper air, especially TEJ and LLJ, are key indicators of short range forecasts in the main rainy season of Ethiopia. Thus, monitoring of this and other upper air system would improve the quality of our short term weather monitoring and prediction and support the development of improved EW, especially for un-timely rain and flood. Besides, it will contribute to the global data set of upper air data which is missing in most parts of the tropical regions, especially in Africa.

Cost estimations for the project's contributions to improving the EWS and reducing the impact of extreme events is done in a cost-effective and systematic manner. This includes an assessment of the types and number of instruments to be procured; condition of existing instruments; appropriate installation sites; and suitable procurement plans.

Consideration must also be given to ease of accessibility of stations for the sake of, maintenance, calibration and monitoring, and the feasibility of ensuring continuous availability of skilled staff in order to monitor and disseminate alerts relating to extreme climate events. These challenges can partly be managed through the procurement of mobile calibration and monitoring facilities both at the HQ and regional level. The total cost for procurement is estimated to be $3,842,256which is attached in Annex C.

2.2 MoWE-DHWQ Infrastructure needs

The Hydrology and Water Quality Directorate is responsible for monitoring national water resources through 489 Hydrological stations and nine regional offices. Ethiopian water resources are classified into 12 river basins. All of Ethiopia's major rivers flow into neighbouring countries through shared river basins (8), lake basins (1) and dry basins (3). The river basins are: Abbay(upper Blue Nile), Tekeze, Awash, Omo-Gibe, Baro-Akobo, Wabi-shebele, Genale-Dawa. The lake basin is Rift Valley Lakes basin, and the dry basins are Aysha, Ogaden and Danakil. Abbay(upper Blue Nile), Tekeze, Omo-Gibe, Baro-Akobo, Wabi-shebele, Genale-Dawa and RiftValleyLakes are all transboundary basins. The basins are shown in figure 5.

Most of the basins are exposed to flash and river bank flooding and as a result of this many communities are frequently displaced. In addition, the big reservoir used for hydropower and irrigation needs special attention in terms of flood control and managements.

The main stakeholders and collaborators include: Ministry of Agriculture (MoA), NMA, Regional DRM/FSS, Regional water offices, Community, EPCO, government enterprises related to water: irrigation, farms.

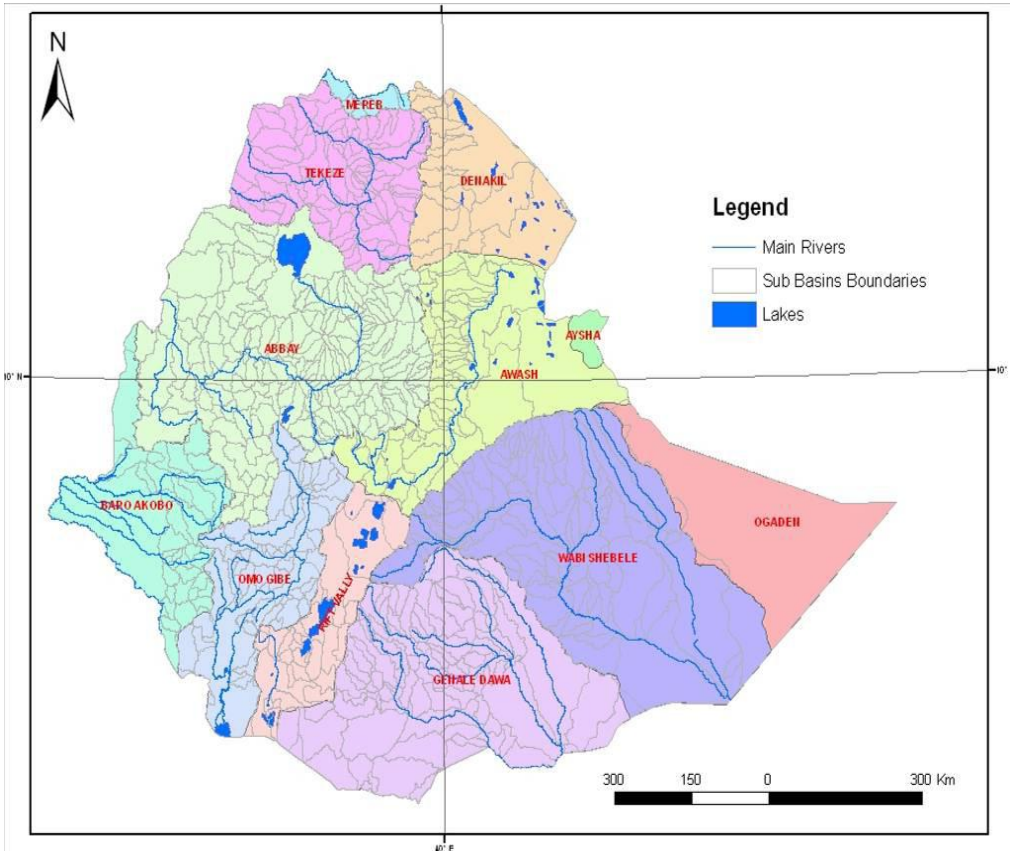


Figure 5:Ethiopian River basins

The development plan in the five year Growth and Transformation Plan (GTP) and overall development plan of Ethiopia focuses on areas of irrigation, hydropower, water supply and disaster management. Effective execution of the GTP requires high-quality spatial and temporal data. Thus, there is a need to develop and improve the surface and ground-water monitoring station network.

Current state of the EWS, including: In the 12 river basins there were around 560 gauging stations, from which a number of stations were abandoned; many were damaged or became inaccessible. At present 489 gauging stations are functional (see Figure 6). Almost all of these are "water-level recording stations" and observations are carried out manually twice a day at most. Continuous measurement (using automatic

recorders) is being introduced in some stations with an Automatic Water Level Recorder using a chart recorder, and 25 stations are equipped with data loggers.

Below is a summary of the state, distribution and condition of the hydrology network:

Abbay Basin: -

- The network has an insufficient number and distribution of stations to fully sample the basin
- The stations in the highlands are located near the sources whereas there are no downstream monitoring stations exist due to inaccessibilityand poor road infrastructure

Awash Basin:-

- The distribution of the station network needs much attention
- This basin is exposed to severe flash floods and river flooding and requires special attention for monitoring through telemetry system

Rift Valley:-

- Chains of lakes are found in this basin and requires additional stations

Wabi_Shebelle: -

- The Hydrological Stations are located in the highlands and do not represent the basin resources adequately
- The basin is affected by flooding and requires improved monitoring through telemetry system

GenaleDawa: -

- The station network is limited in number and distribution, especially downstream.

TekezeBasin:-

- The Hydrological stations are located along the road or whereever there is access
- The stations network is limited and needs reallocation as well as additional stations

Omo_Ghibe Basin: -

- The stations network is limited and needs reallocation as well as additional stations.

In terms of the current status of the **equipment**, the major facilities include: 489 hydrological stations all equipped with manual staff gauge, measuring device; nearly 30-40 record continues measurements automatically; up to 10 stations take data logger measurements at 15 minute interval and 4 stations have telemetry.

The **communication facilities** they have include: Mobile and land telephone, SMS, Internet, five high frequency radio (5) & radio receiving facility at the HQ.

The **database** the MoWE currently uses is the Hydata which is 10-12 yrs old and is access-based with limitations in size & required to use different database in the future.

The **forecast** that MoWE gives includes discharge from upstream and flood early warning. **Monitoring** is done at the end of each rainy season. The **advisory** is given directly to higher government officials and to other stakeholders via internet and radio.

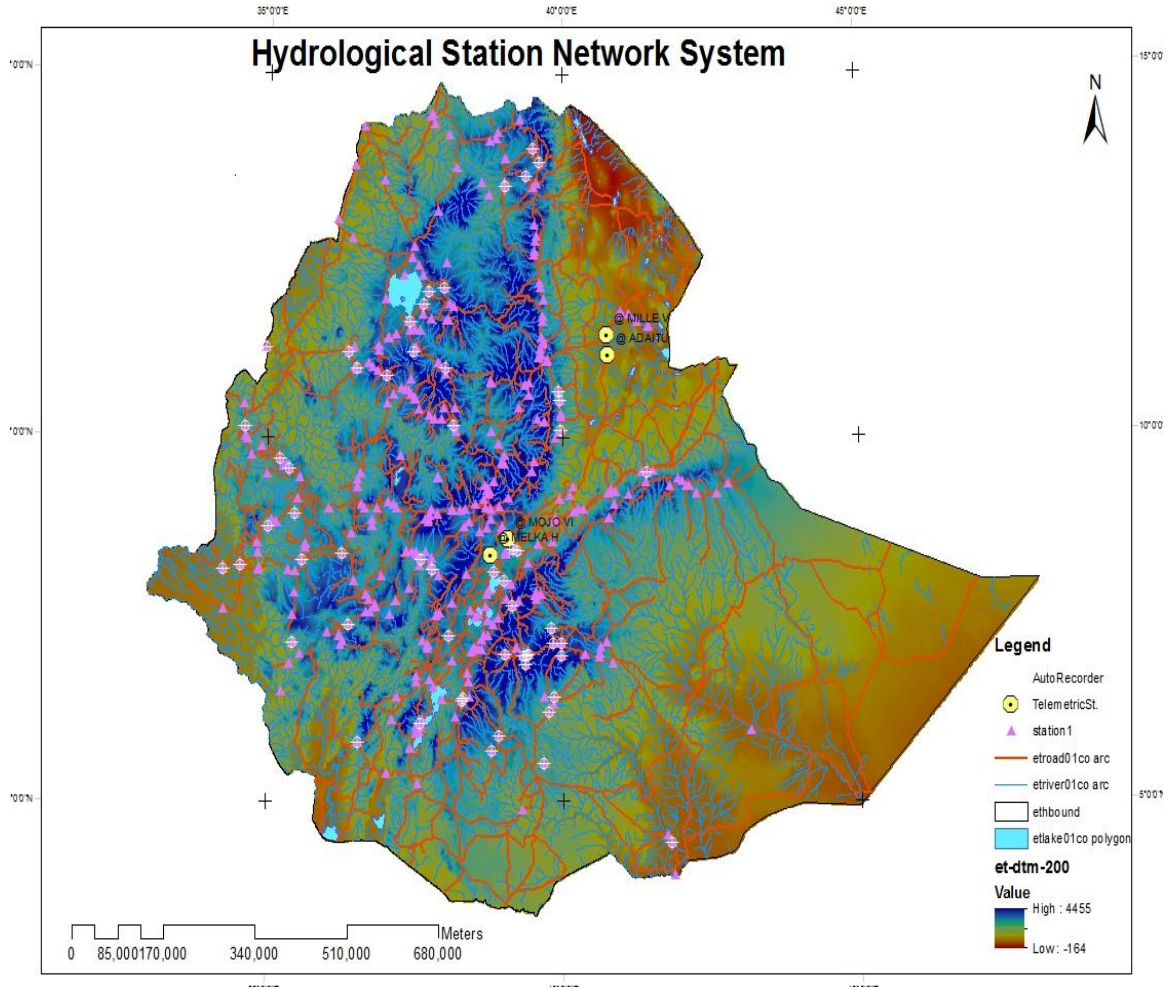


Figure6.Operational hydrological Stations in Ethiopia

Water-level data monitoring is done by collecting the observer's booklets every 4 months and for discharge measurements only 3 times per year. This is insufficiently frequent for adequate monitoring and useful forecasting. The transmission of these data is done manually and should be upgraded to a telemetry system. These factors, coupled with a persistent shortage of transport, equipment and funds, endanger the data collection and transmission works. Data processing also requires capacity building. Furthermore, the collected and processed hydrological data quality needs intensive checking and improvement.

Successful Interventions by MoWE include:

A number of projects have been implemented by the MOWE including: Tana project at national and regional level, supported by ENTRO, and now continued at national level with government budget; the Awash flood area Early Warning project with WFP; and a watershed and flood study by the government.

In 1996, a flood was caused by the release of water from the near-full-capacity Awash Dam (owned by EPCO) without consideration of its impact, as there was no follow-up. EPCO released up to 600 m^3/s of water which flooded farmlands and affected the livelihoods of downstream communities. Following this event, an ad-hoc group of concerned bodies was formed and agreed to monitor the upstream inflow to advise dam management & operational plan. This department became responsible to lead this ad-hoc working group which comprises EPCO, NMA, and MoWE(hydrology department). Then it becomes the duty of MoWE to:

1. Install high-frequency radio to transfer near-real data from manned stations
2. Collect, analyze and deliver the info to concerned bodies via instructing warning and giving information
3. Install stations as per the WMO standard with government budget

Currently the department is doing the routine work and is limited to Awash and Abay basin and also updates and rehabilitates stations with its limited capacity. The assessment made at the end of each rainy season indicates that in the basins where the service is given, the information provided to different stakeholders helps them to manage the dams as well as their irrigation activities.

Limitations on the current EW interventions include:

The major limitations of the current intervention in the EWS includes the insufficient spatial distribution of monitoring; flash floods occur beyond the monitoring network and are difficult to manage (only the communities can exchange information amongst themselves to prepare for flash floods); there is a limited capacity to cover all flood-prone areas; the manually-operated technology is outdated; there is a long lag-time between data delivery and response; and there is a limited ability to rehabilitate and maintain the existing stations in order to improve the flood EWS. This project is expected to contribute towards narrowing the gaps through maintenance and rehabilitation of stations, building the capacity of the department and procurement of additional hydrological stations as per the master plan.

In the future the department plans to: utilise new technology to improve its service; improve technical capacity (both human and instrumental); and expand spatial and temporal monitoring capacity across all of the remaining 10 river basins within the next five years. This project will contribute to the improvement of the service.

These new hydrological monitoring stations would strengthen the network and improve monitoring capacity, especially in flood-prone areas. Telemetry stations transmit real time data through telecommunication systems and also send SMS messages to responsible persons in case of danger. This system is utilized in many countries affected by flooding. Hence, having this modern technology will improve flood warning system and water resources management which in turn will significantly reduce the damage produced by improper management of the dams and floods as result of heavy rainfall in the different basins.

As shown in figure 7below, most of the basins are exposed to flash floods and riverbank flooding. As a result, many communities are frequently displaced. In addition the big reservoir especially used for hydropower and irrigation requires special attention in terms of flood control and managements. Hydrological data collected from the regional offices is not processed and interpreted due to a shortage of skilled personnel. Water users in some basins have expressed dissatisfaction due to water shortages, which highlights the need in some basins to improve water storage management and modeling. The trans-boundary nature of Ethiopia's river basins requires improved capacity for negotiation and consideration of commitments to bordering countries in future developments. All the aforementioned challenges can be addressed through building capacity and improving technology.

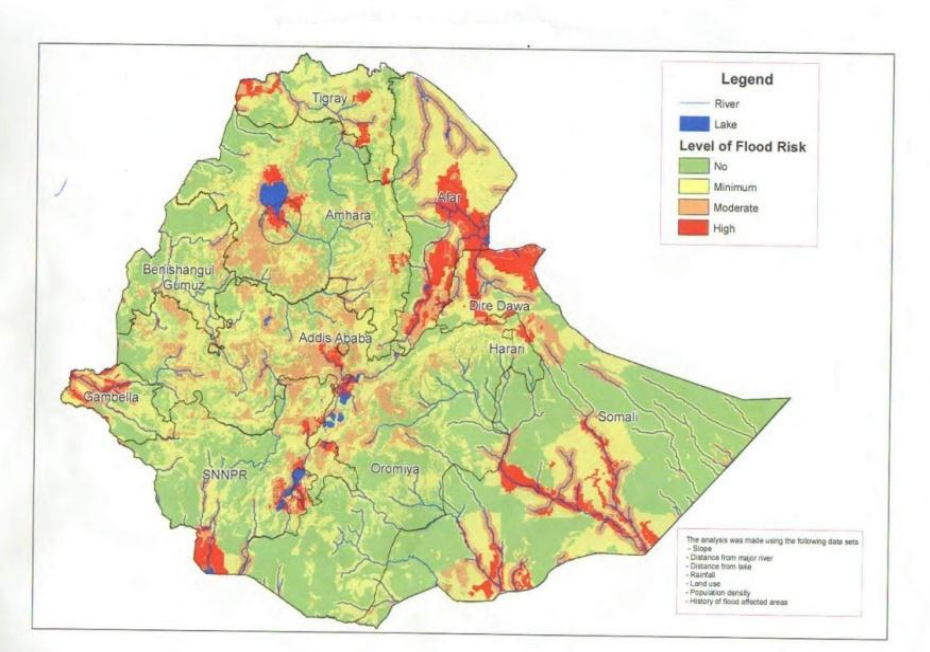


Figure 7: Flood prone area of Ethiopia

As a result of budget constraints, the fieldwork undertaken by the regional hydrology branch offices (HBOs) has been reduced considerably over time. Previously, all stations were checked and the observers' booklets collected by all branch offices every 6 weeks. However, this activity is now done only once every 4 months. The observers' booklets, together with the current metering sheets are sent to the Hydrology and Water Quality Directorate of the MoWE every 4 months.

Budget constraints also limited the inspection and monitoring by the hydrometric team, resulting in less control on observers in the field, and limited action in response to reported problems. Observers have become demotivated as a result which is compounded by inconsistent payment of wages.

Senior hydrologists from the Head office, combined with regional hydrologists at all regional branch office stations, should undertake unannounced visits to check the performance of the observers and to investigate whether maintenance or repair is needed. The observers should be aware that their work is important and that their recordings are being regularly checked. Arrangements have to be made that at all times the observer's booklets are available for checking which will help to improve knowledge of the operational condition of observation stations.

In order to improve the quality of hydrological data, transmitting real time data through a Telemetry system will assist in generating adequate forecasting and warning. Inspection of the hydrological stations and seasonal maintenance is crucial to sustain monitoring. Hence DHWQ is requesting financial and technical assistance in order to accomplish these activities and believe that the proposed project will improve the Hydrological data monitoring system and increase capacity in terms of Hydrological instruments and skilled manpower. The main contributions of this project will include:

- Installing new Hydrological stations with telemetry systems
- Capacity-building in areas of field hydrological stations maintenance and monitoring
- Capacity-building in areas of data analysis and processing
- Providing training to local data observers in the field
- Checking and improving data quality
- Organizing Stakeholder consultation workshops

In order to address the aforementioned needs, this project will emphasise the maintenance and rehabilitation of existing stations; procurement of new hydrological stations; capacity building and other issues. The total budget for EWS requested from the Hydrology Directorate is $1,626,900.00, as detailed in table 3 below.

Table 3: Summary of budget needed by the DHWQ

Activity	**Financial Requirement in US**
	2014-2016
National and International Training	520,000
Telemetry system	100,000
Rehabilitation	50,000
Maintenance	10,000
Hydrological Instrument	729,500
Office Equipment	69,500
Total	**1,479,000**
10 % contingency	**147,900**
Total sum	**1,626,900**

The detailed needs for instruments and capacity has been analyzed below in sections 2.2.1 and 2.2.2 as well as section 3.2.This project will have an impact on addressing the EW gaps through the implementation of these activities.

2.2.1 Rehabilitation and Maintenance

Below is the detailed budget breakdown per activity for rehabilitation and maintenance of hydrological stations and the list of stations to be maintained and rehabilitated in tables4 and table 5a and b, respectively.

Table 4: Cost of equipment for MoWE

No.	Type of activity	Item	Quantity	Unit Price(US$)	Total (US$)
1	Rehabilitation	Data logger for Rehabilitated Stations including installation and accessories	50	1000	50,000
2	Maintenance	Stations to be maintained including field work and per diem	50	200	10,000
	TOTAL COST				**60,000**

Table 5a: List of Hydrological Stations to be maintained

No	Basin	Station Name	Cost - USD
1	Awash	AkakiatAkaki	200.00
2		MelkaKuntire	200.00
3		Hombolle	200.00
4		Mille	200.00
5		Aditu	200.00
6		Logia	200.00
7		Awash 7 Kilometer	200.00

No	Basin	Station Name	Cost - USD
8		Melkawerer	200.00
9		Beseka	200.00
10		Wonji	200.00
11	Abbay	Abbayat Sudan Border	1000.00
12		Didessa Nr Dembi	200.00
13		DondorMetekel	100.00
14		DabusAssossa	100.00
15		Chemoga	100.00
16		Birr Jiga	100.00
17		Amen Dangila	100.00
18		RobaChancho	100.00
19		AzuariMota	100.00
20		Chacha	100.00
21	BaroAkobo	Sore Metu	200.00
22		BirbirYubdo	200.00
23		GebaSupi	200.00
24		BaroBonga	200.00
25		KetoChanka	200.00
26		UKA	200.00
27		U. Akobo	200.00
28		Gilo	200.00
29		BaroItang	200.00
30		Bitinwuha	200.00
31	GhibeOmo	AwaituBabu	200.00
32		Sokie	200.00
33		AjanchoAreka	200.00
34		Great Ghibe	200.00
35		Rebuwolkite	200.00
36		MegechGubre	200.00
37		GilgelGhibe	200.00

No	Basin	Station Name	Cost - USD
38		Mazie	200.00
39		Awaitu Jima	200.00
40		Bulbel	200.00
41	Rift Valley	Bilatetena	200.00
42		L.Awassa	200.00
43		Wolkessa	200.00
44		Dedeba	200.00
45		Meki	200.00
46		Katar	200.00
47		LakeAbbaya	200.00
48		Timala	200.00
49		Gidabo	200.00
50		Chiufa	200.00

Table 5b:List of Hydrological Stations to be rehabilitated

No	Rehabilitation Basin	Station Name	Cost USD
1	Teeze	Embamadri	1000.00
2		Humera	1000.00
3		Zarema	1000.00
4		Atsela	1000.00
5		Maimidmar	1000.00
6		Suluha	1000.00
7		Gheba	1000.00
8		Worie	1000.00
9		Ayehida	1000.00
10		Angereb	1000.00
11	Wabi-Shebelle	Maribo	1000.00
12		Ukuma	1000.00
13		Wabi	1000.00
14		Assassa	1000.00
15		Maribo	1000.00
16		Hamaressa	1000.00
17		Dawe	1000.00
18		Kollu	1000.00
19		Jawes	1000.00
20		Hirna	1000.00
21	GenaleDawa	Melkaguba	1000.00
22		Siftu	1000.00
23		Awata	1000.00
24		Mormora	1000.00
25		GenaleHalewey	1000.00
26		Mana	1000.00

No	Rehabilitation	Station Name	Cost
27		Shawe	1000.00
28		Yadot	1000.00
29		Halgol	1000.00
30		Dimtu	1000.00
31	Danakil and Mereb	Lake Ashe	1000.00
32		AllaWoha	1000.00
33		Golina	1000.00
34		Babur	1000.00
35		Meswait	1000.00
36		Gando	1000.00
37		Hormat	1000.00
38		Kettan	1000.00
39		Indassa	1000.00
40		Durumrumo	1000.00
41	Abbay	Amen Dangila	1000.00
42		Suha	1000.00
43		RobiJida	1000.00
44		Indris	1000.00
45		Neshi	1000.00
46		Jemma	1000.00
47		Temsa	1000.00
48		Haffa	1000.00
49		Beressa	1000.00
50		GambellaAssossa	1000.00

Remark: Hydrological stations lack data loggers. These data loggers help to record water level data from the river or lake continuously. Data can be inaccurate. The stations which are equipped with data logger instruments have great benefits for analysis, especially in determining momentary peaks in flood-prone areas. The cost allocated, 1000.00, is for data logger and an estimated expense for installation

2.1.2 Procurement of new EWS

The estimated cost for the hydrological observing network including purchase of new hydrological stations and potential location is given below in Table 6a-c and 7, respectively.

Table 6a: Estimated cost for procurement of new hydrological stations

No.	Type of activity	Item	Quantity	Unit Price(US$)	Total(US$)
1	New hydrological stations	Telemetry including accessories and installation at field	10	10,000.00	100,000.00
	TOTAL COST				**100,000.00**

Table 6b: Estimated cost for Hydrological Instruments

No.	Items	Quantity	Unit Price(US)	Total(US)
1	Current Meter	20	800.00	16000.00
2	Leveling Instruments	10	2000.00	20000.00
3	Wedding Boot(Chest boot)	20	600.00	12000.00
4	Aluminium Boat with accessories	2	50000.00	100000.00
5	GPS	6	500.00	3000.00
6	E-reel	10	20,000.00	200000.00
7	pH meter	5	1100.00	5500.00
8	Ec meter	5	1100.00	5500.00
9	Turbidity	5	1100.00	5500.00
10	Hand-held water-proof Multi parameter instrument including all accessories	2	1000.00	2000.00
11	4WD Vehicle	4	90,000.00	360000.00
	TOTAL COST			**729,500.00**

Table 6c: Estimated cost for Office Equipment

No.	Items	Quantity	Unit Price (US)	Total (US)
1	Desktop Computer	5	1000.00	5000.00
2	Notebook computer	12	1000.00	12000.00
3	Printer	5	1000.00	5000.00
4	Shelf	5	8000.00	40000.00
5	Table	10	500.00	5000.00
6	Chair	10	250.00	2500.00
	TOTAL COST			**69500.00**

Table7: Potential locations for new telemetric hydrological stations

No.	Station Name	Sta. No	Co-ordinates		Remark
1	GuangRiver nearMetema		12°47'N	36°24'E	
2	TekezeRiver near Sheraro		14° 08'N	37° 31'E	
3	Bar River nearGambela		08°14'N	37°35'E	
4	GhibeRiver nearAbelti		08°14'N	37°35'E	
5	Omo river atOmorate		04°48'N	36° 02'E	
6	WabishebelleRiver nearGode		05°55'N	43°33'E	
7	Awash River nearNurahera		08°32'N	39°35'E	
8	AwataRiver nearShakeso		05°35'N	38°56'E	
9	WabiRiver nearAssassa		07° 02'N	39°9'E	
10	GenaleRiver nearChenemansa		05°42'N	39°32'E	

2.3 DRMFSS

The Disaster Risk Management and Food Security Sector (DRMFSS) was established in 2009. The DRMFSS, which consists of the Early Warning and Response Directorate (EWRD) and the Food Security Programme Directorate, is in charge of the overall organization and guidance towards the functioning of the Disaster Risk Management (DRM) approach taken on by the Government of the Federal Democratic Republic of Ethiopia in collaboration with its humanitarian partners. The new multi-sectoral and multi-hazard DRM approaches disaster management based on vulnerability profiles, thus enabling it to target potential and impeding disasters through an all-inclusive response. Its aim is to explain the underlying and associated causes and implications of disaster vulnerability in an attempt to help policy makers, planners, practitioners, and communities to design appropriate, targeted risk reduction and awareness, disaster management, and development of programs.

The general management and overall coordination of the early warning disaster risk monitoring and response to disasters at national level is in the hands of the Early Warning and Response Directorate. The Directorate is organized as one arm of the Disaster Risk Management and Food Security Sector (DRMFSS) of the Ministry of Agriculture, with three case teams and two case workers. These are:

- Disaster Risk /Hazard Monitoring, Early Warning, and Response Coordination Case Team
- Emergency Logistics Coordination Case Team
- Emergency Finance and Procurement Case Team
- Aid Agencies' affairs Coordination Case worker
- Early Warning and Response Information Management Case worker

The regional, zonal and woreda level offices are organized under Bureaus of Agriculture at regional levels with similar set ups at zonal and woreda levels. The Directorate works in collaboration and provides support and guidance to these line offices in the areas of Disaster Risk Management (DRM).

The main Stakeholders and collaborators of the DRMFSS include: Regional DRM/FSS, UN agencies, NGOs, CBOs. The EW activities were mainly based on disaster management: seasonal assessment, verification, and appeal followed by action. This approach is focused only on saving lives and may take 6-8 months.

Current state of the EWS: The **communication facilities of the** DRMFSS include Geonet cast infrastructure. The **forecast** prepared by the NMA is used as an input for issuing the early warning. Possible impact assessments are made based on past assessments and the forecast and **advisories** are distributed through a website and email (there are 280 customers receiving the EW info); communications are disseminated to decision makers every week. **Communication of EWS messages** is done using Information from woreda EW offices every week through telephone; SMS as well as Internet

Successful Interventions by DRMFSS include:

Previously farmers were taking unnecessary coping mechanisms and the intervention was only for emergency purposes. Not able to reach in time and those affected were selling their assets during the disaster management (emergency services); donor dependency; subjectivity as a result of wrong input as a result of not having strong info exchange system.

After BPR, the hyogoframe five principles based disaster risk management is in place which: improves strength of EW system through contingency plan which is pro-active; awareness creation; early response. Besides, there is strategic program and investment framework which has 20 components. And now risk financing a head of the time is implemented which saves lives and livelihoods,

Limitations on the current EW interventions include: There is a shortage of skilled personnel; high staff turnover, including experts at the woreda level after receiving training. In terms of **coordination** and having better exchange of information for efficient early warning and highlighted that:

- Data exchange is necessary but is done based on the goodwill of the people; there is a resource conflict
- needs (gap) analysis in terms of the information and access; prioritize activities to be handled among stakeholders
- create a dialogue forum to discuss and reach consensus on outstanding issues
- have MoU between major stakeholders like NMA, DRMFSS and DHWQ ;
- nationalized central system and assign focal person

The detailed analysis on area of intervention; level of requirement; importance of the requested human and institutional capacity building as well as the estimated cost for each activity has been done. The total cost is $ 382,800. Below is the detailed budget breakdown in Table8.

Table 8: Detailed budget breakdown for DRMFS

No	Capacity Building	Area of interest	Level of requirement	Importance of the requested capacity for EWS	Estimated cost in USD
1	Items for communication system	Generator for IT section	100 KVA electric power generator	To solve the problem of power interruption in the server room.	60, 000.00
		10 CDMA/EVDO	High quality with cost of communication for one year	For urgent communication during the field assessment	3,000.00
2	Items for office use	2 Colour printer	Heavy duty 4 in 1, colour		60,000.00
		Toner colour cartilage and other accessories			10,000.00
		5 Laptop computers	High capacity	For field trip and training activities	6,000.00
3	Development of Woreda Disaster Risk Profile	20 specific woredas will be selected and addressed.		As the profile is crucial for establishment of specific hazard early warning system in the woredas	200,000.00
		2 photo copy machine			3,000.00
		1 Fax machine			2,000.00
		2 Scanner s			4,000.00
Sub-total					348,000
Contingency budget (10%)					34,800
Total cost					**382,800**

3. OUTCOME 2: Efficient and effective use of hydro-meteorological and environmental information for Early Warnings and long-term development plans.

3.0 Training and capacity needs

In order to enhance capacity of national hydro-meteorological and environmental institutions, the other primary activity to be accomplished is strengthening the monitoring, forecasting and dissemination capacity of the main stakeholders through building the capacity of the institutions. In this regard, the current status of the EWS, successful interventions, gaps and the contribution of this project towards complementing the government intervention has been analyzed for NMA, DHWQ and DRMFSS. The total cost for both national and international training is **$1,345,500.** Below is a detailed analysis for NMA, DHWQ and DRMFSS, respectively.

3.1 Training and capacity needs for NMA

Current state of the human resource capacity: The current state of human resources is below standard and there is limited experienced and self-contained experts with various specialties (Forecast, Applied Meteorology, Remote sensing). There are a number of young graduates from AMU but very few senior and specialized experts. The training needs are in the area of NWP, Instrument calibration and maintenance, database management, GIS and specialization in different applied meteorology fields.

Limitations on the current EW interventions include: Currently, the major gaps which are holding back an effective and efficient EWS are mainly concerned with capacity. There is a limited knowledge in the use of EW products & Interpretation and limited knowledge of using existing information/resources. This is exacerbated by a high rate of staff turnover. This again affects the EW process.

With the limited capacity and information currently available at the NMA, the end-users are not able to use the EW product properly. This usage gap is as a result of meteorological literacy as well as loss of trust in order to make decisions based on the given early warning.

Whilst improving the quality and accessibility of data through increased coverage, frequency of measurements, increasing the number of parameters measured, and rehabilitating and maintaining existing stations, there is also a need to improve the utilization capacity of the data through short and medium-term training both locally and abroad for the meteorologists, hydrologists, agro-meteorologists and forecasters working in the EWS. This will contribute towards improving the quality of early warning and forecasting capacity and as a result will create confidence among the communities who use the product which in turn will contribute towards reducing the impact of extreme events. It needs to be stressed that different stakeholders and collaborators, decision-makers as well as the end-users (especially women, farmers and pastoralists) need to be capacitated to use the EW products.

The estimated cost for training of NMA staff and major stakeholders is $680,000 and the detailed breakdown is given below in table9.

Table 9: Training need from NMA for the EWS improvement

	Type of training	Type of trainee	Where	No. o f trains	Period	Unit cost	Total cost	Remark
1	Remote sensing	Training of trainers	EUMETSAT	2	1 Month	7,000	14,000	Travel:$1000/person & DSA 200/day
		Miscellaneous					1000	$1000 extra expenses
	Rainfall Estimation	Training of trainers	UK	2	1 Month	7,000	14,000	Travel:$1000/person & DSA 200/day
		Miscellaneous					1000	$1000 extra expenses
2		Trains on RFE and RS (11 from regions,	A.A	50	1 week	400	20,000	$50/day for 7daysand $50 for travel/participant
		20 from stakeholders & 10 from HQ)						
		Miscellaneous					1,000	
3	Geneticist	Trains (11 regions and 2 per region)	A.A	22	1 week	400	8,800	$50/day for 7daysand $50 for travel/participant
		Miscellaneous					1,000	
	Modeling-short	Training of trainers	ECMWF	2	2 months	13,000	26,000	Travel:$1000/person & DSA 200/day
		Training	A.A	50	1 week	400	20,000	$50/day for 7daysand $50 for travel/participant
4		Miscellaneous					4,000	
	Modeling –Long	Train of trains	Hadley Center	2	2 months	13,000	26,000	Travel:$1000/person & DSA 200/day
		Training	A.A	50	1 week	400	20,000	$50/day for 7daysand $50 for travel/participant
		Miscellaneous					4,000	
	Applied Meteorology							
5	Agro meteorology	Training of trainers	India	1	1 Month	7,000	7,000	Travel:$1000/person & DSA 200/day
	Hydrometeorology	Training of trainers on:	TBD	2	1 Month	7,000	14,000	Travel:$1000/person & DSA 200/day
	Health	Training of trainers	TBD	1	1 Month	7,000	7,000	Travel:$1000/person & DSA 200/day
	Disaster Prevention	Training of trainers	Asia Disaster	2	1 Month	7,000	14,000	Travel:$1000/person & DSA

			Prev. Centre					200/day
		Trainers (11 from regions,	A.A	50	5 days	400	20,000	$50/day for 7daysand $50 for travel/participant
		Miscellaneous					2,000	
6	Calibration & Maintenance	Training of trainers on:						
		1. Meteorological conventional station	India	2	3 months	19,000	38,000	Travel:$1000/person & DSA 200/day
		2. Meteorological Automatic stations	Europe	2	3 months	19,000	38,000	Travel:$1000/person & DSA 200/day
		Training	A.A	24	2 weeks	750	18,000	$50/day for 7daysand $50 for travel/participant
		Miscellaneous					4,000	
7	GIS	Training	A.A	5	one month	600	3000	
8	Time series Analysis	Training	A.A	3	two weeks	400	1200	
9	Networking	Training	A.A	5	one month	600	3000	
10	Media		In Ethiopia				20,000	
11	Policy Makers		In Ethiopia		2 days		50,000	Both Regional & Federal
12	Business organizations		In Ethiopia		3 days		50,000	Import, export, investors, consultants, contractors
13	Users regional training		At regional capitals	11 training	2 days	10000	110,000	In 9 regions & 2 towns; community representatives,
								farmers, pastoralists, town administrators
14	Academic Institutions		A.A		2 days		50,000	32-Universities, 20-research centers…
15	UN agencies & …		A.A		2 days		50,000	Local & Int. NGOs, Civic societies, religious leaders
16	Gender & EW		A.A		2 Days		20,000	Gender mainstreaming mainly women
						TOTAL	**680,000**	

Remark: Cost for training centers is not included with the assumption that free training will be available

3.2 Training and capacity needs for DHWQ

Hydrological data collected from the regional offices is not processed and changed to information due to a shortage of skilled personnel. Water users in some basins have expressed dissatisfaction due to water shortages, which highlights the need in some basins to improve water storage management and modeling. The trans-boundary nature of Ethiopia's river basins requires improved capacity for negotiation and consideration of commitments to bordering countries in future developments. All the aforementioned challenges can be addressed through building capacity and improving technology.

In addition to this, currently the activity in water level data monitoring is done by collecting the observer's booklets only once every 4 months and for discharge measurements only 3 times per year which is by far insufficient. The transmission of these data is currently manual and should be upgraded to a telemetric system. These factors coupled with a persistent shortage of transport, equipment and funds limit the collection and transmission of data. In terms of the data processing, there is a need to build capacity. Furthermore, the collected and processed hydrological data quality needs intensive checking and improvement.

Below is the training needs with the detailed budget for the national and international trainings in table 10a and 10b, respectively. The total budget for capacity building of DHWQ is $520,000.

Table 10a: National training needed

No.	Item	Quantity	Unit Price ($)	Total($)
1	**Hydrological Data Monitoring** For 20 hydrology Technician 30 days training (lump sum) by hiring consultant	20		170,000.00
2	**Data Processing** For 10 Junior hydrologist 7 days Training in any University(Arbaminch)	10		30,000.00
3	**Data Analysis** Senior Hydrologist will participate in 20 days of training at a national University	14		80,000.00
4	**Water Quality** Four Senior Water Quality Experts will participate in the training	4		15,000.00
5	**Workshop Technician** Two workshop technician will attend the training	2		5,000.00
6	**Observer/Awareness** Hydrological station - awareness training in all 479 stations, including workshops at regional as well as community level (these workshop will be held in 10 regional offices)	lump sum		100,000.00
Total				**400,000.00**

Table 10b:International training needed

	Item	Quantity	Unit Price($)	Total($)
1	**Data Analysis** Training provided to six Senior Hydrologists who will attend 10-15 days in a foreign country's University/Institute	6		60,000.00
2	**Water Quality** four Senior water quality experts will attend training in a related country's University/Institute	4		40,000.00
3	**Ground Water** Two senior Hydrogeologist will attend training at a foreign country's Institute/University	2		20,000.00
	Total			**120,000.00**

3.3 Training and capacity needs for DRMFSS

Below is the training needs with the detailed budget for the DRMFSS in table 11 which is a total of $93,500.

Table 11: Training need with budget breakdown

No	Capacity Building	Area of interest	Level of requirement	Importance of the requested capacity for EWS	Estimated cost in USD
1	Train ten staff at international and 15 staff at local level	use and interpretation of meteorological information for Disaster Risk Manage(DRM)	International level of training for 15 days (Kenya or other relevant country which can accommodate the indicated subject of training)	In order to use and interpret the information appropriately to the required mission	55,000.00
		GIS	ArcGIS for 10 days	To analyze spatial data, hazard mapping etc.	10,000.00
		Study Tour for 10 days.	To learn best practices in areas of disseminating early warning information to vulnerable communities by using SMS or any other system.	to further strengthen the existing early warning system of Ethiopia.	20,000.00
Total					85,000
Contingency budget (10%)					8,500
Total cost					93,500

Annex A: Rehabilitation of Missing/not functioning Instruments need collected from Branch Directorate

No.	Branch Directorate	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	Picheevaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermo.	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph	Measuring cylinder 20cm	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	**Total no. of Instruments need**
1	Kombolcha																										10	10				2	2	24
2	Adama	20	20	6	4	3	2	11	5	5	7	5	5	3	4	4	3	6	3	14	5	15	9	15	4	5	6	4	6	13		4	2	218
3	Bahir Dar	20	20			4		11	1	1	4	4	10		2	2	1				8			4	4		5	15	5	15		5	2	143
4	Mekele	20	20																					10					10	10		3	1	74
5	Jimma				1					6	12	7	8	8												13			6	13		4	2	80
6	Awasa	3	1			8		4													10	6	11				20					3	2	68
7	Jijiga	7	7		5	1		5				4	4	2									1	5			3	2			4	2	1	53
8	Gambela	10	10					5						5								10	3				4	15				2	1	65
9	Asosa																							11			2	2				2	1	18
10	Semera	6	8			5	1	3	5	6	3	5	7	4								2	3				2	2				2	2	66
11	Bale robe								4	4	4	4	4														3					2	2	27
	Total	**86**	**86**	**6**	**10**	**21**	**3**	**39**	**15**	**22**	**30**	**29**	**38**	**22**	**6**	**6**	**4**	**6**	**3**	**14**	**23**	**33**	**27**	**45**	**8**	**18**	**55**	**36**	**27**	**51**	**18**	**33**	**17**	**837**
	U. P	**2,348**	**2,348**	**802**	**863**	**42,560**	**28,797**		**1,399**	**1,407**	**1,400**	**4,687**	**5,610**	**20,097**	***19,094***	**18,746**	**9,297**	**16,249**	**37,564**	**35,065**	**6,668**	**1,000**	**18,891**	**2,244**	**296**	**279**	**3,596**	**2,129**	**1,421**	**1,213**	**493**	**25,000**	**15,000**	**326,564**
	Total Price (Birr)	**201,901**	**201,901**	**4,814**	**8,631**	**893,766**	**86,391**	**150000***	**20,981**	**30,961**	**41,986**	**135,909**	**213,188**	**442,145**	**114,564**	**112,474**	**37,188**	**97,493**	**112,693**	**490,908**	**153,354**	**33,005**	**510,070**	**100,991**	**2,367**	**5,027**	**197,772**	**76,648**	**38,355**	**61,888**	**8,879**	**825,000**	**255,000**	**5,516,250**

Remark:* The price for Soil thermograph is not known and to be inserted later and a total of 150,000 Birr has been allocated

Missing Instruments and their cost for Kombolcha Branch office

Kombolcha Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm diameter	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total cost per station (Birr)
	Missing																										10	10						
1	Amba Mariam																										3596							3596
2	Bati																										3596							3596
3	Cheffa																										3596							3596
4	DebreBerhan																										3596							3596
5	Enewari																										3596							3596
6	Lalibela																										3596							3596
7	Majete																										3596							3596
8	MehalMeda																										3596							3596
9	Mekane Selam																										3596							3596
10	Shola Gebeya																										3596							3596
11	AbayAter																											2129						2129
12	Artuma																											2129						2129
13	Ataye(Effeson)																											2129						2129
14	Awra (Deryitu)																											2129						2129
15	Aynabugna																											2129						2129
16	Bora																											2129						2129
17	Chilla																											2129						2129
18	CheffaRobit																											2129						2129
19	Donessa																											2129						2129
20	Debele																											2129						2129
Total Cost per Instrument																											35959	21291						57250

Missing Instruments and their cost for Adama Branch office

Adama Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane Cup Counter Anemometer	Floating-min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph	Measuring cylinder 20cm	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	No. missing and unit price in birr	20(2348 birr)	20(2348)	6 (802)	4 (863 | 42500 birr)	2 (28797)	11	5	5 (1407)	7(1400)	5(4687)	5(5610)	3(20098)	4(19094)	4(18746)	3(9297)	6 (16249)	3(37564)	14	5(6668)	15 (1000)	9(18891)	15(2244)	4(296)	5(279)	6(3596)	4(2129)	6(1421)	13(1213)	4(25000)	2( )	
	Metehara			x							x	x																				6888
2	Adele	x		x				x		x	x	x	x	x			x	x					x		x							81084
3	Weliso		x			x	x	x		x			x	x	x		x		X		x		x	x			x		x		x	214595
4	Adama							x			x		x	x																		27107
5	Seru	x		x	x			x			x		x			x		x					x		x		x		x		x	95221
6	Arsi robe		x								x	x		x		x						x	x		x							67465
7	Gelemso.				x		x	x		x	x		x					x			x		x		x						x		105181
8	Ijaji			x		x		x			x	x		x	x	x			X		x	x	x				x		x				176526
9	Ambo	x			x			x		x												x	x									x	39510
10	Kachise		x					x		x			x	x				x	X		x		x				x		x				113851
11	Nuraera			x				x					x		x			x			x						x		x				53439
12	Gololcha	x			x			x					x	x	x						x												54680
13	Shambo		x			x		x						x			x						x								x		118194
14	Mieso		x					x				x																			x		32035
15	Abomsa			x												x		x								x		x					40813
16	ArbGebeya	x																			x		x		x								5871
17	Asebeteferi	x	x																				x		x								7219
18	Asgori	x	x																		x		x		x		x		x				11562
19	Assela	x	x																		x		x		x								8219
20	Ayer Tena	x	x																		x		x		x		x		x				11562
21	Bako	x	x																				x		x								7219
22	Chefedonsa	x																			x		x										5592
23	Darba	x																			x		x										5592
24	Dawero		x																		x						x		x				6690
25	Defo		x																		x		x										5592

26	Derba		x																			x		x								5592
27	Dilela	x	x																			x		x						x		9153
28	Huruta	x	x																											x		5909
29	Intoto	x																				x										3348
30	Jeldo	x	x																			x		x								7940
31	Jeldu	x	x																					x				x		x		10282
32	Mojo	x	x																					x								6940
33	Nashe	x	x																					x								6940
34	Ogelcho		x																													2348
Total Cost per Instrument		44,606.11	46,953.80	4,011.25	3,452.00	127,680.90	57,594.30	-	-	7,036.50	8,397.65	18,747.50	44,881.60	160,780.00	76,376.16	74,982.92	27,890.94	97,492.80	112,692.93	-	40,005.48	15,002.10	170,023.23	35,908.04	1,183.53	1,675.55	21,575.17	8,516.48	8,523.35	7,280.92	100,000.00	30,000.00	1,353,271

Missing Instruments and their cost for Bahir Dar Branch office

Adama Branch Bahir Dar Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	Piche Evaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm diameter	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen
	Missing	20	20			4		11	1	1	4	4	10		2	2	1	8	4	4		5	15	5	15	5	2	
1	Adet		2348								1400		5610															9357
2	Ayehu	2348						x				4687		20098						296						25000		52428
3	Aykel		2348			42560	28797	x					5610	20098	19094		9297	6668	2244			3596		1420		25000	15000	181732
4	B.D main							x			1400		5610	20098														27107
5	Bullen	2348						x					5610			18746		6668		296		3596		1420		25000		63684
6	Chagni		2348									4687		20098				6668										33800
7	Dangila						28797	x	X		1400		5610													25000		60807
8	Debark					42560		x			1400	4687		20098	19094	18746		6668				3596		1420				118268
9	Debere Work	2348						x																		25000	15000	42348
10	DebereTabor		2348					x		1407			5610	20098				6668				3596		1420				41147
11	Mankush							x										6668										6668
12	Mettema	2348						x				4687						6668		296								13998
13	Motta	2348	2348																	296								4991
14	NefasMewich	2348																6668										9015
15	Pawi	2348																				3596						5944
16	Quara		2348																									2348
17	Simada		2348																									2348
18	Yetinora		2348																									2348
19	D.M		2348																									2348
20	Asteriyo		2348																				2129	1214				5690
21	AbayShelekо	2348	2348																									4695
22	Addis Alem	2348	2348																				2129	1214				8038
23	Addis kidam	2348																					2129	1214				5690

Adama Branch Bahir Dar Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	Piche Evaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm diameter	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen
24	AddisZemen																		2244				2129	1214				5587
25	AgereGenet	2348																	2244				2129	1214				7935
26	Amanuel		2348																				2129	1214				5690
27	AmbaGiorgis		2348																				2129	1214				5690
28	AmedBer																						2129	1214				3343
29	Anbessamie	2348	2348																				2129	1214				8038
30	Arbaya	2348	2348																2244				2129	1214				10282
36	AribGebia		2348																				2129	1214				5690
37	Asherie	2348																	2244				2129	1214				7935
38	Bichena	2348	2348																									4695
39	Burie	2348																					2129	1214				5690
40	Chandiba		2348																				2129	1214				5690
41	Chenchok	2348																					2129	1214				5690
Total Cost per Instrument		39911	44606			85121	57594			1407	5599	18748	33661	120585	38188	37491	9297	53341	11221	1184		17979	31937	23885		125000	30000	786754

Missing Instruments and their cost for Mekele Branch office

Mekele Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total cost per station (Birr)
	Missing	20	20																					10			10	10				3	1	
1	Adwa																										3596							3596
2	Chercher	2348																									3596							5944
3	Humera/old	2348																									3596							5944
4	Maichew		2348																								3596							5944
5	Maisebre		2348																								3596							5944
6	Nebelet																										3596							3596
7	Senkata		2348																								3596							5944
8	Sheket		2348																															2348
9	Shiraro																										3596							3596
10	Shire Endasilasse																										3596							3596
11	Tekeze Hydro po		2348																								3596							5944
12	AdiMehemeday		2348																															2348
13	ARAGURE		2348																															2348
14	Axum																							2244				2129						4373
15	BANAT																											2129						2129
16	Berhale																							2244				2129						4373
17	Chelena(Bora)	2348	2348																					2244				2129						9069
18	Dewehan	2348	2348																					2244				2129						9069
19	Dera																							2244										2244
20	Dima		2348																					2244				2129						6721
21	Edegarebu		2348																															2348
22	Edagahibret		2348																									2129						4477
23	Erebti																											2129						2129
24	Feresmai		2348																					2244										4592
25	Finarwa		2348																															2348

Mekele Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total cost per station (Birr)
26	Gijjet																							2244										2244
27	HALELLO																							2244										2244
28	HagereSelam		2348																					2244				2129						6721
29	Hawzen																											2129						2129
30	Hiwane		2348																					2244										4592
31	Ketemaneguse		2348																															2348
32	Merhsenay		2348																															2348
33	Mehonni		2348																															2348
34	Maykadera		2348																															2348
Total Cost per Inst.		9391	46954																					24687			35959	21291						**138281**

9 Missing Instruments and their cost for Jimma Branch office

Jimma Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total cost per station (Birr)
	Missing				1					6	12	7	8	8												13			6	13		4	2	80
1	Bedele										1400																						1400
2	Chira									1407	1400	4687	5610	20098															1421					34622
3	Gatira										1400	4687	5610	20098															1421			25000		58214
4	Gore									1407	1400	4687	5610	20098																			15000	48201
5	Jimma										1400	4687	5610																					11696
6	Jaba													20098																				20098
7	Limugenet									1407	1400		5610																1421			25000		34838
8	Maji										1400			20098																				21497
9	Sekoru									1407	1400																					25000		27807
10	Aman									1407	1400	4687	5610	20098															1421					34622
11	Tepi									1407	1400	4687	5610																					13104
12	Masha				863						1400	4687	5610	20098															1421			25000	15000	74077
13	Chewaka										1400			20098															1421					22918
14	Agaro																									279				1214				1493
15	Asendabo																									279				1214				1493
16	Fugoleka																									279				1214				1493
17	Keresi																									279				1214				1493
18	Shebe																									279				1214				1493
19	Tinishumeti																									279				1214				1493
20	Dima																									279				1214				1493
21	Dedo																									279				1214				1493
22	Yebu																									279				1214				1493
23	Gojeb																									279				1214				1493
24	Chora																									279				1214				1493
25	Girigoma																									279				1214				1493
26	Dembi																									279				1214				1493

Total Cost per Instrument				863				8444	16794	32806	44882	160780										3631			8523	15776		100000	30000	422498

Missing Instruments and their cost for Awasa Branch office

Awasa Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total cost per station (Birr)
	Missing	3	1			8		4													10	6	11				20					3	2	
1	Billate																										3596						15000	18596
2	Bore							x													6668	1000	18891											26559
3	BUI	2348				42560		x													6668	1000	18891				3596					25000		100063
4	Burji																				6668	1000	18891				3596							30155
5	DANA1																				6668	1000	18891				3596							30155
6	Dilla					42560		x													6668	1000	18891				3596							72715
7	Hagere Mariam							x													6668	1000	18891				3596							30155
8	Hosana					42560															6668		18891				3596					25000		96715
9	EMDIBER	2348				42560															6668		18891				3596							74063
10	Jinka																				6668		18891				3596							29155
11	Konso																				6668		18891				3596							29155
12	Mega		2348			42560																	18891				3596					25000		92395
13	Mirab Abaya																										3596							3596
14	Moyale					42560																					3596							46156
15	Sawula					42560																					3596							46156
16	Tercha	2348																									3596							5944
17	Werabe																										3596							3596
18	Wolaitasodo																										3596							3596
19	Yabelo																										3596							3596
20	Ziway					42560																											15000	57560
Total Cost per Instrument		7043	2348			340482															66676	6001	207806				64726					75000	30000	**800081**

Missing Instruments and their cost for Jigjiga Branch office

Jijiga Branch Directorete	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary tThermometer	Picheeviporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter Class	Actinograph (Japan)	Ordinary Raingauge	Big Screen	Small screen	Pan Site	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	Missing	7	7		5	1		5				4	4	2	1	5	3	2	4	2	1	
1	Aysha				863							4687	5610									11160
2	Degahabour							x											493			493
3	Dire Dawa					42560		x												25000		67560
4	ERRER				863			x						20097	18891						15000	54852
5	FADIS(BOKE)				863			x				4686					3596					9145
6	GODE (478)											4686	5610							25000		35297
7	GODE ORGINAL				863								5610	20097								26571
8	Harar				863			x					5610				3596		493			10562
9	Jijiga	2347																				2348
10	KEBRIDEHAR											4687										4687
11	Harshin		2347																			2348
12	Hirna																3596					3596
13	Hdigala																		493			493
14	Huse		2347																			2348
15	Jaje		2347													2244						4592
16	Korfachelle	2347														2244						4592
17	Kocher	2347	2347																			4695
18	Kulubi	2347																				2348
19	Langhie	2347																				2348
20	MeserakeGashamo															2244		2129				4373
21	Mekela	2347																				2348
22	Soke		2347													2244						4592
23	Shinille		2347													2244		2129				6721
Total Cost per Instrument		14086	14086		4315	42560						18746	22440	40195	18891	11221	10787	4258	147 9	50000	15000	**268068**

Missing Instruments and their cost for Gambela Branch office

Gambella Branch Directorete	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary thermometer	Pitcheeviporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	Floating-min./max thermometer	still well	Measuring cylinder 20cm dia	Actinograph (Japan)	Big Screen	Small screen	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	Missing	10	10					5			5					10	3	4	15	2	1	
1	Abobo	2347						x														2348
2	Alge							x										35956				3596
3	Bure										20098					1000				25000	1500	47598
4	Dembidolo							X			20098						18891					38989
5	Gambella	2347									20098							35956				26041
6	Lare	2347						x			20098							35956		25000		51041
7	SHEBEL	2347																				2348
8	pwignido	2347	2347					x			20098					1000	18891	35956				48280
9	Jor																		2129			2129
10	Mechara		2347													1000	18891					22239
11	Abol																		2129			2129
12	Aliyadora	2347														1000			2129			5477
13	Ashe		2347																2129			4477
14	BaroBonga																		2129			2129
15	Gnignang		2347													1000			2129			5477
16	Gog															1000			2129			3129
17	Itang															1000			2129			3129
18	OBA WAGGARA																		2129			2129
19	KIDAME GEBEYA															1000			2129			3129
20	Lalo (Lalokele)	2347	2347																2129			6824
21	Methar		2347																2129			4477
22	Muge	2347	2347																2129			6824
23	NIBNIB		2347													1000			2129			5477
24	Nopa															1000			2129			3129
25	PUKIDI	2347																				2348
26	PUCHALA	2347	2347																			4695

27	Pakawo		2347																											2348
Total Cost per Instrument		23476	23476								100487					10001	56674	14383	31936	50000	1500	**311937**								

Missing Instruments and their cost for Asosa Branch office

Asosa Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	Picheeviporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	Missing																							11			2	2				2	2	
1	Asossa																															25000		25000
2	Dedessa																							2244									15000	17244
3	Gida-ayana																																15000	15000
4	Kemashe																															25000		25000
5	Kurmuk																							2244										2244
6	Femetsere																							2244										2244
7	Getema																							2244										2244
8	Haroalelet u																							2244										2244
9	KELLM																							2244										2244
10	Kiramu																							2244										2244
11	Menge																							2244										2244

12	MegabeAbrhabo																						2244									2244
13	Mukelemi																						2244									2244
Total Cost per Instrument																							22442								50000	30000	**102443**

Missing Instruments and their cost for Semera Branch office

Semera Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer type	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Pan Site	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	Missing	6	8	5	1	3	5	6	3	5	7	4								2	3				2	2		2	2	
1	Semera			42560			1398	1407		4686	5610										18891									74554
2	Dalifage			42560		x	1398														18891									62850
3	Elidar			42560	28797	x	1398	1407	1399		5610	20097																		101270
4	Asaita			42560			1398	1407	1399	4686	5610	20097																		77160
5	Dubti			42560		x	1398	1407	1399																					46765
6	Awash Arba							1407		4686	5610																			11704
7	Chifra							1407			5610																			7017
8	Mile									4686	5610	20097																		30394
9	Andido	2347	2347																											4695
10	Gewane									4686	5610	20097																		30394
11	Sabure	2347																												2347
12	Dewe		2347																											2347
13	Ewa		2347																											2347
14	Weama	2347	2347																											4695
15	Detbahiri	2347	2347																											4695
16	Tangayekuma	2347	2347																											4695
17	Eliwuha		2347																											2347
18	Gerjile	2347	2347																											4695
Total Cost per Instrument		14086	18781	212801	28797		6993	8443	4198	23432	39271	80390									37782									474979

Missing Instruments and their cost for Bale Robe Branch office

Bale Robe Branch Directorate	Stations	Maximum Thermometer	Minimum Thermometer	Ordinary thermometer	Pitcheeviporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 05m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Tvne Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Tot cost per station (Birr)
	Missing								4	4	4	4	4														3						2	2	
1	Delo Mena									1407	1400	4687	5610	20098																					33201
2	Dolooddo								1399			4687																							6085
3	Eddo-Dodola											4687																							4687
4	Elkerre								1399			4687		20098																					26183
5	Filtu									1407				20098																					21505
6	Ginir									1407	1400			20098																					22904
7	Gololcha									1407	1400		5610	20098																					28515
8	Harghelle								1399		1400		5610																						8408
9	Hunte												5610																						5610
10	wachille)								1399																										1399
Total Cost per Instrument									5595	5629	5598	18746	22441	100488																					**158497**

Annex B: Total number of instruments missing in the principal and synoptic stations

Region	Maximum Thermometer	Minimum Thermometer	Ordinary Thermometer	PicheEvaporimeter	Rain Recorder	Sunshine Recorder	Soil thermograph	Soil thermometer 0.5m	Soil thermometer 10m	Soil thermometer 20m	Soil thermometer 50m	Soil thermometer 100m	Pan Evaporimeter	Wild Type Wind Vane	Cup Counter Anemometer	floating min./max thermometer	still well	Hg Station Barometer	Digital Barometer	Thermo hygrograph (Japan)	Measuring cylinder 20cm dia	Actinograph (Japan)	Ordinary Raingauge	Psychrometer Stand	Max.& Min. Stand	Big Screen	Small screen	Big Screen Stand	Small Screen Stand	Pan Site	Fence 100m X 100m	Fence 15*15m	Total
Kombolcha																										10	10				2	2	24
Adama	20	20	6	4	3	2	11	5	5	7	5	5	3	4	4	3	6	3	14	5	15	9	15	4	5	6	4	6	13		4	2	218
Bahir Dar	20	20			4		11	1	1	4	4	10		2	2	1				8			4	4		5	15	5	15		5	2	143
Mekele	20	20																					10					10	10		3	1	74
Jimma				1					6	12	7	8	8												13			6	13		4	2	80
Awasa	3	1			8		4													10	6	11				20					3	2	68
Jijiga	7	7		5	1		5				4	4	2									1	5			3	2			4	2	1	53
Gambela	10	10					5						5								10	3				4	15				2	1	65
Asosa																							11			2	2				2	1	18
Semera	6	8			5	1	3	5	6	3	5	7	4								2	3				2	2				2	2	66
Bale robe								4	4	4	4	4														3					2	2	27
Total lose in the principal & synoptic stations	**86**	**86**	**6**	**10**	**21**	**3**	**39**	**15**	**22**	**30**	**29**	**38**	**22**	**6**	**6**	**4**	**6**	**3**	**#**	**23**	**33**	**27**	**45**	**8**	**18**	**55**	**36**	**27**	**51**	**18**	**33**	**17**	**837**
percentage of loss within the 200 **Principal & synoptic stations**	43%	43%	3%	5%	11%	2 %	20%	8%	11%	15%	15%	19%	11%	3%	3%	2%	3%	1.5%	7%	12%	17%	14%	23%	4%	9%	28%	18%	14%	26%	9%	17%	9%	
Completeness after implementation of this Project	**>90%**																															

Annex C: Cost of procurement of equipment for NMA

	Type	Current Situation	No. of appliances	Unit Cost(US$)	Total Cost (US$)	Installation	Supplier	Master Plan
1	Surface:							
	* AWS	37 functioning; 33 soon; 40 on process	40	14000	560,000	As per the MP of NMA	Vaisala/ Adcon	WMO recommends having 3000-5000 stations. The strategic approach of NMA is to handle the existing 1200 basic climatology stations fully operational & delivery of good quality data
2	Upper Air Station	1-A.A functioning 1-Negelle not fully functioning	1	300,000	300,000	Mekelle/B.D		From 3-5 as the running cost is more than 2million birr per station per annum
3	Radar	No but 1- AA not functioning and1- Bahirdar under procurement	1(maintenance)	20,000 for assessment. 80,000 for maintenance based on assessment	100,000			Minimum 6
4	Satellite	At the HQ:- ➢ 1 Geonetcast low-cost receiving station ➢ 1 SADIS for air navigation support ➢ 1 Puma -operation AMESD Satellite receiving station at Awassa, Adama and Bahir Dar:- ➢ Geonetcast low cost station installation in process The remaining 8 regional offices will soon have from government budget	RF estimationprocessing software	100,000	100,000	HQ		
5	Automatic wr.obs system (AWOS)	4 operational at Gonder, B.D, D.D, Meke, 1-A.A failed	1	650,000	650,000	TBC		5 more
6	Agrometeorologicalstns/equipments							
	Lysimeters		3	10000	30000	Selected regions +HQ		
	Soil moisture measuring sensor (leaf wetness and Hydra Probe II SDI-12+8m cable Soil moisture/temp/salinity sensors)			468				
	Adcon telemetry		110	936	102960			

7	Mobile calibration and monitoring equipment		17	61765	1,050,000	At the HQ and branch offices		
8	Strengthening the 24 hour functioning of the EWS	Weak and limited to the HQ	4	100,000	400,000	At the HQ and selected offices		
9	HPC(high performance computer) or cluster pc	1 workstation; 8 GB RAM,500 GB HD	1	200,000	200,000	A.A	Any supplier	
	`Sub-total				3,492,960			
	Contingency(10%)				349,296			
	TOTAL				**3,842,256**			

9.1 Annex IV. Stakeholder involvement plan

Background

Stakeholder consultation has been a key feature in the design of this LDCF Proposal, and stakeholders have been involved in identifying and prioritizing the proposed intervention activities. Details of the stakeholder engagement during the Preparatory phase were provided in Section 2.1.3 above. Ongoing public consultation is critical for successful implementation. This section outlines some of the key consultation principles and processes at a strategic level that will need to be translated into practical action during the project implementation. It provides guidance based on the initial stakeholder analysis, conducted as part of the project preparation process, and the consultations so far. This can be used to define exact activities that will form part of a communications and consultation strategy developed during the inception period of implementation.

Objectives

The stakeholder consultation during project implementation will be expected to support all outcomes. Overall, the objective of the consultation plan is to provide a framework to guide and promote two way engagements between the key implementing partners **(Federal NMA, regional offices of NMA, DRMFSS and MoWE-Hydrology Directorate)** and the key stakeholders with whom the project will engage and directly impact upon.

It is proposed that several more specific objectives for consultation are adopted:

1. To ensure a general vision and understanding of the project and it's expected outcomes by all concerned stakeholders.
2. To engage key stakeholders in planning, implementing and monitoring of specific interventions.
3. To ensure consistent, supportive and effective communication (information, documentation, sharing, learning and feedback) processes with key implementing partners as well as the wider public including farmers and pastoralists.
4. To influence and ensure strategic level support for project implementation from state and non-state organizations and international agencies through engagement in effective community, private sector and donor forums or platforms.

In delivering these objectives, there are a number of simple qualitative considerations that need to be taken into account when planning engagement processes and what they should be seeking to achieve:

- Identify constraints and solutions: As a two way engagement, the consultation process should be used as an opportunity to identify with stakeholders possible constraints to or with the project's implementation and to work with the stakeholders in finding sustainable solutions.
- Managing expectations: The LDCF investment is relatively minor, compared to the adaptation demands facing the country. It will be important that consultations take due consideration to manage expectations of stakeholders and stakeholder groups.
- Partnerships for co-financing: The LDCF seek to add value to their investments by building on existing and parallel projects that represent co-financing and consultations should consider opportunities for partnerships that will leverage co-financing into innovative approaches or technologies that may improve efficiencies and enhance impact.

Stakeholders

Stakeholders include a range of types of groups, all with their own interests and concerns. They have different roles to play in the project and the Table below indicates key stakeholders and their possible roles.

Activities planned during implementation and evaluation

During implementation, the communication and consultation process should be divided into three main phases, being:

Phase 1 – this is the **mobilization** phase in the first year of the project. The fine details of the activities and implementation structures will be designed, partnerships for action will be forged and stakeholder engagement will focus around these design processes.

Phase 2 – represents the main **implementation** phase where investments will be made on the ground in the target areas and stakeholder consultation about engagement will focus on output oriented action.

Phase 3 – represents the **completion** of the project and the plans for scale-up and long-term sustainability of the LDCF investments. Consultation will focus on learning, bringing experience together and looking at processes for continued post-project impact.

Phase I – Developing a strategy and action plan

At mobilization, a simple communications strategy should be developed. Key principles to be considered in the development of the strategy include:

Who? Implementers need to understand the stakeholders well – their needs, the impacts of interventions on each stakeholder group, the opportunities for contribution/engagement, and their power/influence. Whilst, as part of the project preparation, a stakeholder analysis was carried out, during this phase this should be reviewed as stakeholders should be seen as dynamic. The stakeholders that may be involved in or affected by the project are multiple, diverse; so an effective stakeholder identification process will be an important contributor to identifying key factors for success and risks to mitigate.

Gender: In engagement with the project implementation, it will be important to consider the different ways that the early warning products are easily accessed, understood and used by both women and men. The project implementer will need to consider how these two groups access information and interpret it and get feedback through consultation process in selected areas of implementation.

Table 1: Matrix of stakeholders and activities planned during implementation and evaluation

		Outcome 1 **Capacity of national hydro-meteorological (NHMS) and environmental institutions to monitor extreme weather and climate change enhanced**					Outcome 2 **Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans improved**							
Stakeholder	Project Board	Procurement and installation of AWS, upper air, satellite	Procurement and installation ion of hydrological stations	Rehabilitation and maintenance of NHMS monitoring facilities	Procurement of facilities for strengthening the EWS	Training of officers for maintenance and installation	Training	National capacity for Assimilating forecasts and monitoring into development planning, PRSPs and DRMS is built	Coordination among the major actors and initiatives strengthened	Communication channels and procedures enabled	Sustainable financing developed and implemented	Evaluation	Awareness	Strategic Lessons
NMA:														
• Meteorological Instruments and ICT Directorate	PB	✓		✓	✓	✓	✓		✓			✓		
• Meteorological Forecast and Early warning Directorate,	PB	✓		✓	✓	✓	✓	✓	✓	✓		✓		
• Public Relation and Comm. Affairs Directorate,		✓		✓	✓	✓	✓			✓	✓			
• Meteorological Research and Studies Directorate		✓		✓	✓	✓	✓							
• Meteorological Data and	PB	✓		✓	✓	✓	✓			✓				

		Outcome 1 **Capacity of national hydro-meteorological (NHMS) and environmental institutions to monitor extreme weather and climate change enhanced**					Outcome 2 **Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans improved**							
Stakeholder	Project Board	Procurement and installation of AWS, upper air, satellite	Procurement and installation ion of hydrological stations	Rehabilitation and maintenance of NHMS monitoring facilities	Procurement of facilities for strengthening the EWS	Training of officers for maintenance and installation	Training	National capacity for Assimilating forecasts and monitoring into development planning, PRSPs and DRMS is built	Coordination among the major actors and initiatives strengthened	Communication channels and procedures enabled	Sustainable financing developed and implemented	Evaluation	Awareness	Strategic Lessons
Climatology Directorate														
• Aviation Meteorology Service Directorate		✓		✓	✓	✓	✓				✓			
• Developmental Meteorology Service Directorate		✓		✓	✓	✓	✓	✓	✓					
• Regional Meteorological Branch offices		✓		✓	✓	✓	✓	✓	✓	✓				
• Director General & PR of Ethiopia with WMO	PB	✓		✓	✓	✓		✓	✓			✓		
• Deputy Director General	PB	✓		✓	✓	✓		✓	✓			✓		

		Outcome 1 **Capacity of national hydro-meteorological (NHMS) and environmental institutions to monitor extreme weather and climate change enhanced**					Outcome 2 **Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans improved**							
Stakeholder	Project Board	Procurement and installation of AWS, upper air, satellite	Procurement and installation ion of hydrological stations	Rehabilitation and maintenance of NHMS monitoring facilities	Procurement of facilities for strengthening the EWS	Training of officers for maintenance and installation	Training	National capacity for Assimilating forecasts and monitoring into development planning, PRSPs and DRMS is built	Coordination among the major actors and initiatives strengthened	Communication channels and procedures enabled	Sustainable financing developed and implemented	Evaluation	Awareness	Strategic Lessons
MoWE														
Hydrology & water quality Directorate, Director	PB		✓	✓	✓	✓	✓	✓	✓	✓		✓		
MoARD														
DRM/FSS	PB	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
EIAR								✓		✓				
EPA								✓						
MoFED											✓			
ECAO											✓			
Donor Partners											✓			
DFID,PRIME, WB								✓	✓		✓			
NGO's													✓	
CCF-E								✓						

		Outcome 1 **Capacity of national hydro-meteorological (NHMS) and environmental institutions to monitor extreme weather and climate change enhanced**					Outcome 2 **Efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term development plans improved**							
Stakeholder	Project Board	Procurement and installation of AWS, upper air, satellite	Procurement and installation ion of hydrological stations	Rehabilitation and maintenance of NHMS monitoring facilities	Procurement of facilities for strengthening the EWS	Training of officers for maintenance and installation	Training	National capacity for Assimilating forecasts and monitoring into development planning, PRSPs and DRMS is built	Coordination among the major actors and initiatives strengthened	Communication channels and procedures enabled	Sustainable financing developed and implemented	Evaluation	Awareness	Strategic Lessons
OA								✓	✓					
UN agencies											✓			
UNDP	PB							✓	✓			✓		
WFP								✓	✓					
ACPC								✓	✓					
Research Institution											✓		✓	
EIAR								✓	✓					
AAU								✓	✓					
End users								✓			✓		✓	

Why? Implementers need be clear about the purpose of the consultation process as so that the right stakeholders make the right inputs to the planned activities. During Phase I, NMA will seek to have secured the support and commitment of key stakeholders required for project implementation.

Implementers should make key stakeholders aware of the plan and its intended activities and outcomes and make clear their role and scope for contributing to project decisions and activities.

What? In planning stakeholder involvement, the strategy should make as much use of existing mechanisms (institutions and process) as possible, avoiding establishing project oriented structures.

Types of consultation mechanism:

- An overarching multi-stakeholder group, such as a steering committee will form a governance role, but also be a forum for stakeholder engagement.
- Specific focus groups on technical interventions,
- Information briefings for government and co-financing institutions.

Phase II - Consultation through implementation

Once implementation begins, public consultations should become more of an ongoing exchange of information, and there are two main purposes for the various mechanisms outlined under Phase I:

- to gather information from beneficiaries and stakeholders about the impact and effectiveness of the planned adaptation packages(efficient and reliable EWS) to support adaptive management; and
- To provide interested government and donor stakeholders and the general public with information about the progress and impact of the project as it is implemented.

The first purpose relates to engagement for effective implementation and monitoring, whilst the latter is more concerned with information dissemination, 'public relations' and expectation management. Good public relations will also help encourage collaboration with respect to the objective of the LDCF project.

Phase III - Project completion and scale up promotion

This will be a process of ensuring completion, hand-over and long-term sustainability of the LDCF investment. Consultation will focus on bringing experience together, sharing key lessons learnt (through the UNDP ALM, Woreda.net and other forums) and looking at processes for promoting scale up of this project in order to have efficient and reliable EWS in the country.

Social issues and impacts

Different assessments indicate that women and children; elderly people, small scale farmers and pastoralists are among the most affected groups in the society by climate change.

The implementation of this project will improve the EWS of the country and hence the impact of extreme events like flood and drought will be well monitored and the impact will significantly reduced.

Hence, the project will benefit all the communities equally but the most affected group like women will have a comparative advantage as most of burden is on them.

In line with improving the quality and accessibility of the data, EW information, communication channels, training of selected groups especially women on how to use the product is to be done.

9.2 Annex V: Terms of Reference

A. *Project Board*

The Project Board is responsible for making management decisions for a project in particular when guidance is required by the Project Manager. The Project Board plays a critical role in project monitoring and evaluations by quality assuring these processes and products, and using evaluations for performance improvement, accountability and learning. It ensures that required resources are committed and arbitrates on any conflicts within the project or negotiates a solution to any problems with external bodies. In addition, it approves the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Work Plan, the Project Board can also consider and approve the quarterly plans (if applicable) and also approve any essential deviations from the original plans.

The Project Board (PB) shall comprise national and sub-national representatives to guide and oversee the project. The PB will be housed within MOWE and chaired by the MOWE Director of Multilateral Projects. The PB will convene annually to discuss project progress and approve annual work plans. The PB will comprise MOWE Director of Multilateral Projects, NMA Director General, UNDP Team Leader: Climate Change and Vulnerabilities Team, UNDP Climate Change Specialist, UNDP Ethiopia, Regional Manager for NMA from regional offices, Director of NGO Forum for Environment & Director NGO National Climate Change Forum. It is proposed that UNDP co-chair the PB. The National Project Coordinator (NPC) Officer will be an ex officio member of PB responsible for taking minutes. Potential members of the Project Board are reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the Board as appropriate

The responsibilities of the PB will be to:

- Supervise and approve the annual work plans and short term expert requirements
- Supervise project activities through monitoring progress and approving annual reports
- Review and approve work plans, financial plans and reports
- Provide strategic advice to the implementing institutions to ensure the integration of project activities with national and sub-national sustainable development and climate resilience objectives.
- Ensure inter agency coordination and cross-sectoral dissemination of strategic findings
- Ensure full participation of stakeholders in project activities
- Assist with organization of project reviews and contracting consultancies under technical assistance
- Provide guidance to the Project Manager.

B. *Project Manager*

The Project Manager will report to the PB and will lead the project team through the planning and delivery of the Project. The PM will be Federal NMA and they have the authority to run the project on a day-to-day basis on behalf of the Implementing Partners, within the constraints laid down by the Board. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost. The PM will be responsible for financial management and disbursements, with accountability to the government and UNDP. The PM will work closely with MoWE staff from MoARD, MoFED, MoH and the Regional Bureaus.

Responsibilities

- Ensuring effective partnership working between the sub-national implementing Bureaus and the participating national agencies.
- Managing human and financial resources in consultation with the NPC to achieve results in line with the outputs and activities outlined in the project document.
- Leading the preparation and implementation of annual results-based work plans and logical frameworks as endorsed by the management.
- Liaison with related and parallel activities both within EPA and with cooperating implementing Ministries and Bureaus.
- Monitoring project activities, including financial matters, and preparing monthly and quarterly progress reports, and organising monthly and quarterly progress reviews.
- Supporting the NPC to organise task team meetings and annual lesson learning conferences
- Coordinating the distribution of responsibilities amongst team members and organising the monitoring and tracking systems.
- Reporting and providing feedback on project strategies, activities, progress, and barriers to PB.

C. *National Project Coordinator*

The Project Manager will appoint a National Project Coordinator who will be responsible for the overall administration who will be responsible, on behalf of the NMA, for the project. The NPC reports to the DG of NMA and maintains liaison with UNDP. The NPC will be located within the NMA and will be responsible for

- Day-to-day oversight and coordination of implementation of project activities
- Recruitment and supervision of technical and training expertise as required for implementation of the project.
- Developing and maintaining close linkages with relevant sectoral government agencies, UNDP, NGOs, civil society, international organisations and implementing partners of the project.
- Coordinating the project team in carrying out their duties at an optimum level through ensuring efficient and effective resource utilization.
- Coordinating inputs into annual results-based work plans and logical frameworks as endorsed by the management.
- Preparing detailed annual breakdowns of the work plan for all project objectives. And preparation of quarterly work plans.
- Coordinating inputs into all project reports as required (including Annual Project Reports, Inception Report, Quarterly Reports and the Terminal Report).
- Preparing quarterly status and financial reports for comments and approval by the PM
- Coordinate the establishment of sub-national project Task Teams.
- Organise annual task team meetings for experience sharing and lesson learning/

D. *Administrative and Financial Assistant*

One administrative and financial assistant will report to NPC and will contracted by the NMA. Their responsibilities will be to:

- Set up and maintain project files and accounting systems whilst ensuring compatibility with FDRE and UNDP financial accounting procedures.

- Prepare budget revisions of the project budgets and assist in the preparation of the annual work plans.
- Process payments requests for settlement purposes including quarterly advances to the implementing partners upon joint review.
- Update financial plans, prepare status reports, progress reports and other financial reports.
- Undertake project financial closure formalities including submission of terminal reports, transfer and disposal of equipment, processing of semi-final revisions, and support professional staff in preparing the terminal assessment reports.
- Assist in the timely issuance of contracts and assurance of other eligible entitlements of the project personnel, experts, and consultants by preparing annual recruitment plans.
- Collect and maintain project related information data and establish document control procedures
- Administer Project Board meetings
- Administer project revision control
- Compile, copy and distribute all project reports
- Provide support in the use of Atlas for monitoring and reporting

E. *Climate Planning and Risk Management expert (International Short Term)*

The climate planning and risk management expert will report to the NPC and support the NPC and Project task teams with aspects of climate risk analyses, capacity building and integrated climate planning.

Responsibilities

- Contribute to the technical specification for the training for the NMA, HWQD and DRMFSS staff with respect to approaches and requirements for the preparation of climate data analysis and forecasting, climate risk analyses, vulnerability analyses and the preparation of sector specific tailored meteorological products based on the outcome of the risk analysis.
- Outline data requirements and analytical frameworks for climate and environmental data analysis, forecasting training and dissemination of end user friendly products.
- Assist in the preparation of future climate scenarios and their evaluation for planning purposes, including the climate impact assessment and the trade off analysis.
- Participate in and present materials where appropriate at stakeholder workshops and project board meetings
- Assist with training and capacity development activities as necessary
- Assist in the identification of policy and scale up recommendations

G. *Monitoring and evaluation expert*

The M&E expert will report to the NPC and will support the NPC, PM and the project task teams to prepare the relevant M&E systems required to monitor and assess quality of progress, to identify, collect, analyze, document and disseminate lessons learned through an annual project meeting, and support the preparation of project evidence for sharing through the Woreda.net and the UNDP ALM. The M&E expert will liaise with the Planning and Risk management expert to prepare the data collection protocols to enable the task teams to consistently collect data on project progress from project sites and its processing by the NPC for national reporting purposes.

Responsibilities

- Establish the overall results-based M&E strategy in accordance with M&E plans outlined in the project document.
- Together with the climate planning expert, design a system for collecting information on project lessons to be used in annual progress meetings.
- Develop data collection instruments, cognisant of the spatial data requirements advised by the climate specialist.
- Guide and coordinate the review of the project Strategic Results Framework, including:
    a. Provide technical advice for the revision of performance indicators.
    b. Identify sources of data, collection methods, who collects data, how often, cost of collection and who analyses the data.
    c. Facilitate annual review of risks by PM.
- Prepare reporting formats and support NPC to prepare the required reports. Guide project task teams in preparing their progress reports in accordance with the approved reporting formats. This includes quarterly progress reports, annual project reports, inception reports, and ad-hoc technical reports.
- Foster participatory planning and monitoring by advising the training institutions on content for participatory monitoring and evaluation of activities.
- Assist the NPC to collate technical reports and other documents from the project and contribute to the ALM.

H. *Climate data analyst and forecasting specialist (International UNDP Short Term)*

The specialist will support the project by providing expert analysis, data processing capacity and training for NMA, HWQD, and DRMFSS staff and staff in the regional centers. The specialist will train the relevant officials in the use and manipulation of climate data, forecasting and establish specifications for other climate related attribute data that may be used to model climate aspects of climate risk and vulnerability. They will help train the various staffs in the interpretation of the scenarios for evaluating planning impacts and sensitivity analyses.

Responsibilities

- Prepare climate data specifications and data collection protocol.
- Review quality and utility of existing data and advise on additional data collection requirements and data rescue
- Provide training specifications and protocol for climate data analysis and forecasting.
- Prepare various training and capacity building protocols, test and validate for large implementation
- Study the area's climatic trends and prepare climate projections overlays to the maps and model potential future impacts for assessing climate sensitivity and vulnerability analyses in the context EWS for population and economic growth trends
- Support the Project teams identify policy options and practical implementation options according to their mitigation potential, cost-effectiveness, co- benefits, political feasibility and public acceptance;
- Assists the Project teams to draft climate resilient plans based on options analysis, and lessons from pilot implementation.

I. *Capacity Building and Technical Experts (National/Regional Short Term)*

A series of training and research expertise will be required to support the delivery of vocational and practical training of and demonstration in the latest practices and techniques in climate data analysis and forecasting.

- Climate modelling and climate data analysis
- Satellite data and imagery analysis and dissemination
- Training in identified sector specific and tailor made products based on end user needs
- Training on calibration of observational equipment and infrastructure and EWS
- Training in Hydrology modelling and environmental observation and analysis

In addition, national research expertise will be contracted from Ethiopia institutions (e.g. Addis Ababa University, EIAR) to advise on and demonstrate the latest research developments on land based adaptation being developed in Ethiopia so that this can be incorporated into the local level capacity building programme. It is likely that national training and research institutions will be contracted to provide these expertise so that a series of vocational (learning-by-doing) capacity programmes can be set up and run over a period of 3 years.

9.3 Annex VI: Special Clauses

In case of government cost-sharing through the project which is not within the CPAP, the following 10 clauses should be included:

1. The schedule of payments and UNDP bank account details.
2. The value of the payment, if made in a currency other than United States dollars, shall be determined by applying the United Nations operational rate of exchange in effect on the date of payment. Should there be a change in the United Nations operational rate of exchange prior to the full utilization by the UNDP of the payment, the value of the balance of funds still held at that time will be adjusted accordingly. If, in such a case, a loss in the value of the balance of funds is recorded, UNDP shall inform the Government with a view to determining whether any further financing could be provided by the Government. Should such further financing not be available, the assistance to be provided to the project may be reduced, suspended or terminated by UNDP.
3. The above schedule of payments takes into account the requirement that the payments shall be made in advance of the implementation of planned activities. It may be amended to be consistent with the progress of project delivery.
4. UNDP shall receive and administer the payment in accordance with the regulations, rules and directives of UNDP.
5. All financial accounts and statements shall be expressed in United States dollars.
6. If unforeseen increases in expenditures or commitments are expected or realized (whether owing to inflationary factors, fluctuation in exchange rates or unforeseen contingencies), UNDP shall submit to the government on a timely basis a supplementary estimate showing the further financing that will be necessary. The Government shall use its best endeavours to obtain the additional funds required.
7. If the payments referred above are not received in accordance with the payment schedule, or if the additional financing required in accordance with paragraph ( ) above is not forthcoming from the Government or other sources, the assistance to be provided to the project under this Agreement may be reduced, suspended or terminated by UNDP.
8. Any interest income attributable to the contribution shall be credited to UNDP Account and shall be utilized in accordance with established UNDP procedures.

In accordance with the decisions and directives of UNDP's Executive Board:

The contribution shall be charged:

(a) […%]cost recovery for the provision of general management support (GMS) by UNDP headquarters and country offices

(b) Direct cost for implementation support services (ISS) provided by UNDP and/or an executing entity/implementing partner.

9. Ownership of equipment, supplies and other properties financed from the contribution shall vest in UNDP. Matters relating to the transfer of ownership by UNDP shall be determined in accordance with the relevant policies and procedures of UNDP.
10. The contribution shall be subject exclusively to the internal and external auditing procedures provided for in the financial regulations, rules and directives of UNDP.

9.4 Annex VII: Stakeholder Baseline Analysis

Stakeholder	Involvement in Baseline	Identification of	Intervention Risk	Policy/ Strategic alignment	Co-financing Identificati	Capacity Assessment	Implementation planning	National Inception &	Document Endorsement
NMA:									
• Meteorological Instruments and ICT Directorate	✓	✓	✓			✓	✓	✓	
• Meteorological Forecast and Early warning Directorate,	✓	✓	✓	✓		✓	✓	✓	PSC
• Public Relation and Communication Affairs Directorate,	✓	✓				✓	✓	✓	
• Meteorological Research and Studies Directorate	✓	✓				✓	✓	✓	
• Meteorological Data and Climatology Directorate	✓	✓	✓			✓	✓	✓	
• Aviation Meteorology Service Directorate	✓	✓	✓			✓	✓	✓	
• Developmental Meteorology Service Directorate	✓	✓				✓	✓	✓	
• Meteorological Research and Studies Directorate	✓	✓				✓	✓	✓	
• Regional Meteorological Branch offices	✓	✓	✓			✓	✓		
• Director General & PR of Ethiopia with WMO	✓	✓	✓	✓		✓	✓	✓	PSC

• Deputy Director General	✓	✓	✓	✓		✓	✓	✓	PSC
MoWE		✓							
Hydrology & water quality Directorate, Director	✓	✓	✓	✓		✓	✓	✓	PSC
MoARD									
DRM/FSS	✓	✓	✓	✓		✓	✓	✓	PSC
EIAR	✓	✓							
EPA	✓	✓	✓						
Donor Partners				✓	✓				
DFID,PRIME, WB	✓	✓		✓	✓				
NGO's									
CCF-E	✓	✓							
OA	✓	✓							
UN agencies									
UNDP			✓	✓	✓			✓	✓
WFP	✓	✓							
ACPC	✓	✓							
Stakeholder	Involvement in Baseline	Identification of	Intervention Risk	Policy/ Strategic alignment	Co-financing Identificati	Capacity Assessment	Implementation planning	National Inception &	Document Endorsement
NMA:									
• Meteorological Instruments and ICT Directorate	✓	✓	✓			✓	✓	✓	
• Meteorological Forecast and Early warning Directorate,	✓	✓	✓	✓		✓	✓	✓	PSC
• Public Relation and Communication Affairs Directorate,	✓	✓				✓	✓	✓	
• Meteorological Research and Studies	✓	✓				✓	✓	✓	

Directorate									
• Meteorological Data and Climatology Directorate	✓	✓	✓			✓	✓	✓	
• Aviation Meteorology Service Directorate	✓	✓	✓			✓	✓	✓	
• Developmental Meteorology Service Directorate	✓	✓				✓	✓	✓	
• Meteorological Research and Studies Directorate	✓	✓				✓	✓	✓	
• Regional Meteorological Branch offices	✓	✓	✓			✓	✓		
• Director General & PR of Ethiopia with WMO	✓	✓	✓	✓		✓	✓	✓	PSC
• Deputy Director General	✓	✓	✓	✓		✓	✓	✓	PSC
MoWE		✓							
Hydrology & water quality Directorate, Director	✓	✓	✓	✓		✓	✓	✓	PSC
MoARD									
DRM/FSS	✓	✓	✓	✓		✓	✓	✓	PSC
EIAR	✓	✓							
EPA	✓	✓	✓						
Donor Partners				✓	✓				
DFID,PRIME, WB	✓	✓		✓	✓				
NGO's									
CCF-E	✓	✓							
OA	✓	✓							
UN agencies									

UNDP			✓	✓	✓			✓	✓
WFP	✓	✓							
ACPC	✓	✓							