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United Nations Development Programme

Country: CAMBODIA
PROJECT DOCUMENT¹

Project Title:

Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change

UNDAF Outcome(s):

Economic Growth and Sustainable Development

Outcome 1.1 Sustainably developed agriculture sector promoting equitable physical and economic access to an increased number of safe and nutritious food and agriculture products

Outcome 1.2 National and local authorities and private sector institutions are better able to ensure sustainable use of natural resources (fisheries, forestry, mangrove, land, and protected areas), cleaner technologies and responsiveness to climate change

Expected CPAP Output(s)

Outcome 2: By 2015, national and local authorities, communities and private sector are better able to sustainably manage ecosystems good and services and respond to climate change

Implementing Partner: Ministry of Water Resources and Meteorology (MOWRAM)

Responsible Parties: UNDP, Department of Meteorology (DOM), Department of Hydrology and River Works (DHRW), National Committee for Disaster Management (NCDM), Ministry for Agriculture, Forestry and Fisheries (MAFF), Provincial Departments of Water Resources and Meteorology (PDOWRAMs)

Brief Description

The project supports the Royal Government of Cambodia (RGC) in establishing an effective early warning system (EWS) for the timely preparation for extreme events, as well as climate resilient development planning. The project takes a policy approach - defining coordination frameworks for the effective dissemination of climate and weather data, and strengthening national institutions to ensure the development and retention of critical forecasting and modeling capacity. To address the data gaps faced by the RGC, the project also provides for risk mapping and observation equipment - enabling the collection of environmental, climate and weather data, and the generation of tailored climate/weather products, which take into account local conditions, risks and vulnerabilities.

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¹ For UNDP supported GEF/LDCF funded projects as this includes LDCF-specific requirements

Agreed by (Implementing Partner):

BUN-HEAN

Name



Signature

28/Nov/2014

Date/Month/Year

Agreed by (UNDP):

Setso Yanazati

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S. Yanazati

Signature

28/11/14

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28

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List of Acronyms

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
AFD	Agence Française de Développement
AMDAR	Aircraft Meteorological Data Relay
AR5	Fifth Assessment Report
ASEAN	Association of Southeast Asian Nations
AWS	Automatic Weather Station
CamDi	Cambodia Disaster Loss Database
CCCA	Cambodia Climate Change Alliance
CCCSP	Cambodia Climate Change Strategic Plan
CCDM	Commune Committee for Disaster Management
CCSP	Climate Change Strategic Plan for Water Resources and Meteorology
CIDA	Canadian International Development Agency
COSS	Country Office Support Services
CRC	Cambodian Red Cross
DCA/CA	DanChurchAid/Christian Aid
DCDM	District Committee for Disaster Management
DHRW	Department of Hydrology and River Works
DOM	Department of Meteorology
EEPSEA	Economy and Environment Program for Southeast Asia
ECCA	Capacity Building Programme on the Economics of Climate Change Adaptation
ENSO	El Niño – Southern Oscillation
EU	European Union
EWS	Early Warning System
FAO	Food & Agriculture Organization
FRC	French Red Cross
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information Systems
HDI	Human Development Index
HFA	Hyogo Framework for Action
HYCOS	Hydrological Cycle Observation System
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
IRI	International Research Institute for Climate and Society
ITC	Institute of Technology of Cambodia
IWRM	Integrated Water Resources Management
JICA	Japanese International Cooperation Agency
KHR	Khmer Riel
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LPAC	Local Project Appraisal Committee
MAFF	Ministry of Agriculture, Forestry and Fisheries
MDG	Millennium Development Goal
MEF	Ministry of Economy and Finance
M-IWRM 3	Mekong Integrated Water Resources Management Programme Phase III
MOE	Ministry of Environment
MOI	Ministry of Interior
MOP	Ministry of Planning

MoU	Memorandum of Understanding
MOPTC	Ministry of Posts and Telecommunications
MOWA	Ministry of Women's Affairs
MOWRAM	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
MRD	Ministry of Rural Development
NAPA	National Adaptation Programme of Action
NCCC	National Climate Change Committee
NCDM	National Committee for Disaster Management
NIM	National Implementation Modality
NGO	Non-governmental Organization
NHMS	National Hydrological and Meteorological Services
NSDP	National Strategic Development Plan
O&M	Operations and Maintenance
PCDM	Provincial Committee for Disaster Management
PDOWRAM	Provincial Department of Water Resources and Meteorology
PIF	Project Identification Form
PPG	Project Preparation Grant
RCT	Randomized Control Trial
RFMMC	Regional Flood Management and Mitigation Centre
RGC	Royal Government of Cambodia
RIMES	Regional Integrated Multi-Hazard Early Warning System
SBAA	Standard Basic Assistance Agreement
SIDA	Swedish International Development Cooperation Agency
SOPs	Standard Operating Procedures
TSC	Technical Service Center for Irrigation and Meteorology
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
VTDM	Village Team for Disaster Management
WB	World Bank
WMO	World Meteorological Organization
WRF	Weather Research and Forecasting

Executive Summary

Cambodia is facing mounting development challenges due to climate change. Damage related to the October 2013 flooding alone, caused by heavy rain and the seasonal swell of the Mekong River, is estimated at \$356 million, having affected 20 out of 24 provinces² and 1.7 million people; 297,600 hectares of rice paddies were inundated and more than 28,100 hectares of rice were immediately destroyed³. Climate change is resulting in longer dry seasons and shorter, more intense rainy seasons. This impacts both the frequency and severity of natural hazards such as floods and droughts, as well as agricultural production which is dependent on seasonal rainfall. Recovery from such events puts strain on the least developed country's (LDC's) limited resources and forces shifts in development priorities - hindering Cambodia's ability to progress and to achieve its development goals.

The Royal Government of Cambodia's (RGC) preferred situation is to implement an effective early warning system (EWS). The purpose of an EWS is to monitor climate and environmental data on a real-time basis, detect adverse trends and make reliable predictions of possible impacts in the form of early warning information. An early warning therefore refers not only to advisories in emergency situations, but also to information related to the changing climatic trends revealed after tracking and analyzing climate and weather data over time. An effective EWS would thus enable timely response to natural hazards and extreme weather events, as well as informed planning in light of changing climate trends.

The RGC faces several challenges in realizing its preferred situation. With few working climate and weather observation stations, there is insufficient data to refine predictions and forecasts based on sector, geographic areas, or vulnerability. Further, limited human resources and high staff turnover make it difficult for institutions such as the Ministry of Water Resources and Meteorology (MOWRAM) to develop capacity and maintain qualified forecasters and modelers.

Appropriate dissemination of information is also a challenge. MOWRAM is responsible for providing climate and weather information to the planning/line ministries to inform climate resilient planning, and for the communication of natural hazards and extreme weather events for disaster risk reduction. However, the information is often not presented in manner that can be easily understood or applied and standard operating procedures (SOPs) defining roles, responsibilities, and accountability are lacking. The National Committee for Disaster Management (NCDM) is responsible for disaster risk management and communicating related information, but has faced difficulties related to capacity in effectively fulfilling its mandate.

In line with the RGC's goals, the objective of the project is to **strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change**. The project seeks to address the current barriers through three complementary outcomes:

1. Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information
2. Climate and weather information available and utilized for national, sectoral and sub-national planning as well as for transboundary communication in the region
3. Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change

² As of 31 December 2013, the total number of provinces in Cambodia changed from 24 to 25.

³ http://www.undp.org/content/cambodia/en/home/presscenter/articles/2013/10/18/cambodia_s-first-disaster-database-system-unveiled/

1 Situation Analysis

1.1 Climate Change-Induced Problem

Climate change has had a significant impact on Southeast Asia, including higher temperatures and variability in precipitation, as well as greater frequency and intensity of floods, droughts and extreme weather events. The fifth assessment report (AR5) from the Intergovernmental Panel on Climate Change (IPCC) indicates that temperature in the sub-region has been increasing at a rate of 0.14°C to 0.20°C per decade since the 1960s, and predicts increases from 0.8°C to 3.2°C by the end of this century. The report further highlights the positive trend in the occurrence of heavy (top 10% by rain amount) and light (bottom 5%) rain events, and the influence of climate change on several large-scale phenomena affecting the region⁴.

Table 1: Summary of the Relevance of Projected Changes in Major Phenomena⁵

Summary of the Relevance of Projected Changes in Major Phenomena			
Phenomena region	Monsoon Systems	El Niño – Southern Oscillation (ENSO)	Tropical Cyclones
Southeast Asia	LP/MI Decrease in precipitation over Maritime continent.	LP/Hi Reduction in mean precipitation and enhanced warming if El Niño events become more frequent and/or intense.	MP/Hi Projected increase in extreme precipitation near the centres of tropical cyclones making landfall along coasts of South China Sea, Gulf of Thailand, and Andaman Sea.

Note: Confidence that there will be a change in the phenomena is indicated by 'HP' for high, 'MP' for medium, 'LP' for low, and confidence in the impact of the phenomena is indicated by 'Hi' for high, 'MI' for medium, 'LI' for low.⁶

These changes will add to the climate vulnerability felt by communities that reside near rivers and/or rely on seasonal rain — raising the risk level associated with climate hazards such as droughts, storms, floods, inundation, landslides, debris flow, and soil erosion.

In Cambodia, climate change-induced events have caused infrastructure damage, direct and indirect economic losses, risks to health and loss of life. Damage caused by Typhoon Ketsana in 2009 resulted in a loss of \$130 million. Flooding in 2011 affected 683,498 hectares of agricultural land, causing an estimated \$451 million in damages and \$174 million in losses across various sectors of the economy. Damage related to the October 2013 flooding, caused by heavy rain and the seasonal swell of the Mekong River, is estimated at \$356 million⁷, having affected 20 out of 24 provinces⁸ and 1.7 million people; 297,600 hectares of rice paddies were inundated and more than 28,100 hectares of rice were immediately destroyed⁹.

⁴ Climate Change 2013: The Physical Science Basis, IPCC, 2013

⁵ Adapted from Table 14.3 of Climate Change 2013: The Physical Science Basis, IPCC, 2013 (pg 1288)

⁶ Climate Change 2013: The Physical Science Basis, IPCC, 2013

⁷ Cambodia Post-Floods Early Recovery Needs Assessment Report (RGC, NCDM, ADB, March 2014)

⁸ As of 31 December 2013, the total number of provinces in Cambodia increased from 24 to 25.

⁹ http://www.undp.org/content/cambodia/en/home/presscenter/articles/2013/10/18/cambodia_s-first-disaster-database-system-unveiled/

The impacts of climate change could be better mitigated through timely disaster preparedness measures and climate resilient planning. Inadequate climate and weather information, forecasts and analyses, however, create limitations for informed and climate-responsive decision-making.

1.1.1. *Impact on Effective Preparation and Response to Climate Change-Induced Natural Hazards and Extreme Weather Events*

Cambodia has been severely affected by natural disasters. From 1990 to 2009, the impact of climate-induced natural hazards and extreme weather events included:

Table 2: Summary of Climate Impacts in Cambodia 1990 - 2009¹⁰

Type	No. of events	Lives Lost	Individuals Injured	Homeless	Population Affected	Damages in US\$
Flood	14	1,155	54	275,805	9,514,614	467,100,000
Drought	5	0	0	0	6,550,000	138,000,000

As indicated in the previous section, damages from climate-induced natural hazards and extreme weather events are resulting in progressively greater damages and losses, with an estimated \$356 million related to the October 2013 flooding alone. AR5 predictions indicate a further rise in the severity and frequency of events¹¹. Without improved preparedness, Cambodia's capacity to manage these events will continue to be overwhelmed, with increasingly devastating impacts on lives and livelihoods.

1.1.2. *Impact on Climate Resilient Planning and Sustainable Development*

The Royal Government of Cambodia (RGC) seeks to continue to benefit from the "gainful returns from peace"¹² — the economic growth and poverty reduction which has taken place during the past decade, contributing to greater regional and global economic integration. The goal of graduating Cambodia from its current Least Developed Country (LDC) status was highlighted as a guiding principle in the development of the National Strategic Development Plan (NSDP) 2014-2018¹³, as was successful economic integration into the Association of Southeast Asian Nations (ASEAN)¹⁴. This is supported by the Rectangular Strategy Phase III, which includes as one of its four objectives: to ensure an average annual economic growth of 7% and to ensure that this growth is sustainable, inclusive, equitable and resilient to shocks¹⁵.

Climate change-induced natural hazards and extreme weather events, however, are putting strain on the nation's limited resources, forcing shifts in development priorities and hindering its ability to progress and to achieve its goals. For example, before the October flooding event, an economic growth rate of 7.6% was predicted for 2013 (surpassing RGC's target of 7%). Final 2013 numbers, however, may instead show a lower growth rate than previous years¹⁶.

¹⁰ Country Assessment Report for Cambodia, "Strengthening of Hydro-meteorological Services in Southeast Asia" (UNISDR, WB, WMO, RGC, GFDRR)

¹¹ Climate Change 2013: The Physical Science Basis, IPCC, 2013

¹² National Strategic Development Plan (NSDP) Update 2009-2013 (RGC, 2010)

¹³ Guidelines for formulating National Strategic Development Plan (NSDP) 2014-2018 (RGC, MOP, April 2013)

¹⁴ Expected in 2015

¹⁵ Rectangular Strategy Phase III (RGC, 2013)

¹⁶ Cambodia Post-Floods Early Recovery Needs Assessment Report (RGC, ADB, NCDM, March 2014)

Consistent with the AR5, modeling work done as part of Cambodia's First and Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) indicated that the country's mean surface temperature has increased by 0.8°C since 1960. The mean temperature is predicted to continually increase at a rate of 0.013°C to 0.036°C per year, depending on location, until 2099. Climate change is expected to bring about shorter, more intense rainy seasons, and longer dry seasons¹⁷, which can result in inundation during the rainy season and water scarcity in the dry season.

As approximately 80% of Cambodia's agricultural output is based on rain-fed irrigation, climate change has had, and will continue to have the greatest impact on agriculture households. Agriculture households rely on agriculture, fisheries and/or forestry activities for their livelihoods. These households represent 85% of all households in Cambodia and generate 34% of the gross domestic product (GDP)¹⁸.

Food security and climate change-induced natural hazards, such as droughts and floods, were cited as the main risks faced by farmers, behind illness¹⁹. The changes in the length of the wet and dry seasons will require adjustments by farmers to their crop calendars, to better schedule sowing and harvesting in a way that maximizes crop yield and reduces crop loss. In 2010, delayed rains demonstrated the extreme dependence of farmers' livelihoods on the regularity of seasons. The late onset of the rainy season resulted in record-low water levels in the Tonle Sap and Mekong rivers, at a time when many farmers were still recovering from the loss of their crops to Typhoon Ketsana in 2009²⁰.

Similarly, changing seasonal patterns will impact fisheries and forests, which account for over 25% of the agriculture sector's output. The longer dry periods will create shifts in regular fish migratory patterns, and the higher temperatures can destroy current habitats for feeding and spawning. Such changes will challenge the survival of fish species, reducing overall catch and putting pressure on food security, as fish make up 3/4 of animal protein in rural diets²¹. Rising temperatures can also lead to a loss of biodiversity and forest productivity, which translates to a loss of income and livelihood options for forest-dependent communities.

Higher temperatures and humidity will create conditions for increased incidences of malaria and dengue fever²². While this is an obvious and serious health concern, it also has impacts on the productivity of the agriculture sector and thus on development. The ill in agricultural households would simply be unable to work and/or must be cared for by other family members, affecting the household food supply and income generation.

At the national level, a concerning impact of these climate risks is the disruption to agricultural production and the potential reduction in the nationally-produced food supply, upon which Cambodia is dependent. At the individual level, as the majority of the agriculture sector are subsistence farmers, such disruptions in productivity add to the difficulties of breaking out of the cycle of subsistence production.

Planning, informed by climate and weather information, can help mitigate the risks of climate change.

¹⁷ National Human Development Report, Building Resilience: The Future for Rural Livelihoods in the Face of Climate Change (Cambodia, 2011)

¹⁸ Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023 (National Climate Change Committee (NCCC), 2013)

¹⁹ Microinsurance Study: The Understanding and Needs of Low-Income Population Regarding Microinsurance (UNDP, 2013)

²⁰ National Human Development Report, Building Resilience: The Future for Rural Livelihoods in the Face of Climate Change (Cambodia, 2011)

²¹ Cambodia Human Development Report (MoE, UNDP, 2011)

²² Climate Change Strategic Plan for Water Resources and Meteorology, 2013-2017 (MOWRAM, 2012)

1.2 Long Term Solution

The RGC's preferred situation is to implement an effective early warning system (EWS). This approach is consistent with the Hyogo Framework for Action (HFA) (2005-2015) which prioritizes the enhancement of EWS, noting that such investments are far more cost-effective than post-disaster response and recovery.

The purpose of an EWS is to monitor climate and environmental data on a real-time basis, detect adverse trends and make reliable predictions of possible impacts in the form of early warning information. An EWS would also introduce climate considerations into planning processes and early warning infrastructure in order to better respond to climate change conditions. Therefore an early warning refers not only to advisories in emergency situations, but also to information related to the changing climatic trends revealed after tracking and analyzing climate and weather data over time. An effective EWS would therefore enable timely response to natural hazards and extreme weather events, as well as informed planning in light of changing climate trends.

The national progress report on the implementation of the Hyogo Framework for Action (HFA) for Cambodia indicates that early warning systems need to be improved along with appropriate national capacities to make them efficient. Although there has been progress in Cambodia, some of the achievements are not comprehensive or substantial enough due to a lack of systematic policy and/or institutional commitment. Further, human resources, mechanisms and systems to regularly collect, maintain, as well as utilize data and information on hazards, exposure and vulnerabilities are limited.

An effective EWS in Cambodia can therefore be achieved through (a) strengthened institutions and coordination frameworks and (b) strengthened capacity at the national, sub-national, and community level to apply climate information to inform climate resilient planning and emergency response.

1.2.1 *Strengthened Institutions and Coordination Frameworks for an Effective Early Warning System (EWS)*

As the ministry mandated with the collection and analysis of climate and weather information, the Ministry of Water Resources and Meteorology (MOWRAM) plays a vital role in an effective EWS. MOWRAM must have the capacity and tools necessary to confidently fulfil its mandate. These include the software and skills to generate forecasts and models, as well as the management of meteorological and hydrological monitoring stations infrastructure to collect and archive the data necessary to enhance their work with greater accuracy.

As climate change and related impacts are transboundary, improving efforts to exchange data with neighboring countries would further strengthen the EWS. Importantly, those communication lines would also allow Cambodia to benefit from the best practices and lessons learned of neighboring countries. Viet Nam, for instance, is more susceptible to cyclones, but having effectively moderated its vulnerability, Viet Nam has greater adaptive capacity than Cambodia²³.

Given the cross-sectoral nature of climate change, use of a coordination mechanism such as the National Climate Change Committee (NCCC), would help to ensure that the climate and weather information needs of the country are being met, by facilitating dialogue between the ministries and highlighting national priorities. This can further inform the type of tailored information needed by the country. Climate information would be communicated by MOWRAM to ministries, for their further interpretation and application towards climate resilient planning. In addition, advisories related to potential natural hazards and extreme weather events would be communicated through National Committee for Disaster

²³ Climate Change Vulnerability Mapping for Southeast Asia, Economy and Environment Program for Southeast Asia (EEPSEA) 2009

Management (NCDM) channels, as per its mandate, for timely preparation and response at the national, provincial, district, commune and village levels.

Standard Operating Procedures (SOPs) would capture and detail the above roles and responsibilities and others, clarifying the lines of communication, and establishing accountability. Therefore, it is important to define a framework for the effective generation and dissemination of climate information and early warning messages, which does not exist at the moment.

1.2.2 Strengthened Capacity at the National, Sub-national, and Community level to Apply Climate Information to Inform Climate Resilient Planning and Emergency Response

With the provision of climate and weather information, capacity would be strengthened at the national, sub-national and community levels to apply that information towards more climate resilient planning and better preparedness for climate change-induced natural hazards and extreme weather events.

Better planning and preparedness would translate into long term reductions in adverse financial and humanitarian impacts related to climate change, climate change-induced natural hazards and extreme weather events. These savings would allow for greater investment in development efforts, including national priority projects such as irrigation to lessen agriculture's reliance/dependence on seasonal rain, and canals to divert excess water flows in flood prone areas. Climate information could also serve as a foundation upon which to structure financial relief programmes, coping mechanisms, and credit systems for better planning and preparedness.

There are however significant barriers preventing the desired solution from taking effect.

1.3 Barriers to Achieving the Long Term Solution

There are several causes which underpin Cambodia's difficulties in applying climate and weather information for useful and timely early warnings: (1) capacity to analyze and tailor climate and weather data, (2) availability of climate and weather data due to insufficient number and low reliability of current meteorological and hydrological monitoring stations, (3) capacity to effectively communicate climate information and early warning messages and (4) adaptive capacity to apply climate information in planning and responding to early warning messages.

1.3.1 Capacity to Analyze Climate and Weather Data

Through its departments, MOWRAM has the important role of analyzing and tailoring climate and weather data for use by various sectors and target groups. The Department of Meteorology (DOM) and the Department of Hydrology and River Works (DHRW) however have an insufficient number of trained personnel and limited capacity to analyze climate and weather data, especially given the increasing demand for such information.

There is a need to increase the number of staff with skills in producing quality analyses, such as forecasts and models. A challenge for MOWRAM in building and maintaining the necessary capacity has been high staff turnover. With relatively low government salaries and limited incentives, it is difficult for MOWRAM to retain trained staff²⁴. Often, staff acquire skills, become more marketable, and leave for

²⁴ Climate Change Strategic Plan for Water Resources and Meteorology, 2013-2017 (MOWRAM, 2012)

higher-paying opportunities outside the Ministry or abroad. Training efforts thus far have been either short term in nature or have not adequately considered the issue of high staff turnover.

1.3.2 Availability of Climate and Weather Data

Available regional forecasts can provide reliable information, however it is important to integrate local conditions to the analyses for greater accuracy and applicability. Currently, local data is not being adequately collected and archived.

Cambodia has 24 meteorological stations and 114²⁵ hydrological stations. An assessment of existing stations was undertaken in October 2013, as part of the project preparation activities (Annex C). The results indicate that none of the meteorological stations and only 12 of the hydrological stations were fully operational or considered to be in good working condition. The condition of the remaining stations ranged from 'partially operational' to 'abandoned'. These assessment results, unfortunately, are not uncommon for LDCs, which face the common challenges of limited capacity and financing to sustain the network of observational equipment.

The poor condition of the stations is due in large part to a lack of trained technicians, especially at the provincial level, to maintain the equipment and the insufficient resources allocated for operations and maintenance (O&M). MOWRAM is responsible, through its departments, for the collection of data as well as the O&M of the stations. The annual budget allocation from MOWRAM is estimated \$25,000 for O&M of the country's meteorological stations and \$12,500 for the hydrological stations. A more appropriate level would be approximately \$2,500/per meteorological station/per year and \$2,000 per hydrological station/per year or \$60,000 for meteorological stations and \$228,000 for hydrological stations. While MOWRAM acknowledges that the current budget is insufficient, it has faced difficulty in securing the necessary budgetary approvals for the required amount.

Previous efforts have been made by development partners to support the hydro-meteorological data collection needs of Cambodia, but a project-based approach has resulted in (a) a lack of equipment standardization, (b) difficulties related to operations and maintenance of different equipment at different sites, and (c) burdens in centrally synchronizing and analyzing data from different observational platforms. All of which overly complicate the process of climate and weather data collection, and challenge limited capacity and resources.

These challenges, along with the lack of necessary risk mapping and vulnerability assessments, and the related capacity to integrate this information into forecasts and models, further prevent the generation of early warning messages tailored to meet urgent or specific needs.

Information sharing with neighboring countries also needs to be enhanced and systematized. The transboundary nature of climate and weather requires close collaboration with the National Hydrological and Meteorological Services (NHMS) in the region, especially with those countries sharing watersheds and with border areas at higher altitudes with potential risk for flash floods. This refers not only to the regular collection of climate and weather data for analysis purposes, but also emergency information related to natural hazards and extreme weather events, which would allow valuable time for preparation and response in border areas.

²⁵ Based on number of stations visited during working condition assessment in October 2013 (PPG activity)

1.3.3 Capacity to Effectively Communicate Climate Information and Early Warning Messages

MOWRAM is responsible for providing climate and weather information to planning and line ministries to inform climate resilient planning and disaster risk reduction. However, the information is often not presented in a manner that can be easily understood or applied and SOPs defining roles, responsibilities, and accountability are lacking.

Similarly, SOPs are lacking for the communication of advisories related to potential natural hazards and extreme weather events. NCDM is responsible for disaster risk management and communicating related information. NCDM was established by a sub-decree in 1995, for the purpose of leading the management of disasters in Cambodia and developing disaster management capacity at all levels. It is also the responsibility of NCDM to communicate early warning messages to the Provincial Committees for Disaster Management (PCDMs), the District Committees for Disaster Management (DCDMs), the Community Committees for Disaster Management (CCDMs), and the Village Teams for Disaster Management (VTDMs), as appropriate for action and response.

While NCDM has a clear mandate, the exact legal authority of NCDM to exercise its mandate and responsibilities has yet to be clarified, due in part to its status as a committee. This has resulted in its mandated activities being at times undertaken by member ministries, sub-national disaster management committees and non-governmental organizations (NGOs) — blurring the lines of accountability and weakening NCDM's leadership role.

An institutional review and capacity assessment of NCDM was conducted in 2013, with support from the Asian Development Bank (ADB). Concerns and needs expressed during the related stakeholder consultations best illustrate this lack of clarity and responsibility related to disaster management in Cambodia and the role of NCDM²⁶:

- No clarity on NCDM's role and legal authority to implement disaster risk reduction and management activities and its accountability at the provincial and district levels
- No clear definition of the roles and responsibilities of sub-national disaster management committees
- No clear and specific definition for emergencies and disasters, including different types of disasters and specific measures for each
- No defined conditions or criteria for a 'state of emergency' or calamity and who is authorized to make the declaration, at both national and sub-national levels
- No defined rules and guidelines governing the roles of international organizations in Disaster Management including the entry of humanitarian relief and supplies (e.g. customs clearance, taxation, shipping, and other related logistical concerns) and entry and exit of international humanitarian aid workers
- No description of the rights and entitlements of disaster victims and survivors particularly in cases of evacuations and dislocation of people
- Disaster risk reduction strategies are not mainstreamed into national and sectoral plans and programmes
- No policies and guidelines on the involvement of local civil society and the private sector in disaster management
- No system in place to expedite delegation of authority during disasters and to approve contingency funding for provinces to support disaster response

²⁶ Institutional Review and Capacity Assessment of the National Committee for Disaster Management (ADB, 2013)

The absence of legal authority for NCDM has also affected its ability to access a regular budget, limiting its ability to perform its functions, and to build or maintain its capacity.

1.3.4. Adaptive Capacity to Apply Climate Information in Planning and Responding to Early Warning Messages

Adaptive capacity is perhaps the biggest challenge Cambodia facing. Adaptive capacity plays an important role in changing the spatial pattern of vulnerability. Low adaptive capacity has made Cambodia among the most vulnerable areas of Southeast Asia despite its relatively low exposure to climate hazards²⁷. Those most affected by climate change are often those with the fewest options, and thus the least capacity to adapt or to respond to climate information and early warning messages. Poverty levels and literacy rates are both important factors when considering adaptive capacity, and both are development challenges in Cambodia.

Cambodia is ranked 138 on the UNDP Human Development Index (HDI). Of the overall Cambodian population of approximately 14 million, the total number of people below the food poverty line²⁸ is 2.6 million and the number below the (total) poverty line²⁹ is 4.7 million³⁰. Of those categorized as poor, 51% are engaged in agriculture sector, and 91% live in rural areas in general³¹. The poor have very limited flexibility in decision-making and thus weak adaptive capacity to respond to climate change. These difficulties are compounded by the lack of credit systems and insurance³², which would allow for more effective planning and could serve as reliable coping mechanisms.

Poverty rates are particularly high among those with little or no education³³, and literacy rates among women are generally lower than men in Cambodia. Less than half of female household heads in the agriculture sector are able to read or write a simple message compared to 80% for male household heads³⁴. Women, therefore, have especially weak adaptive capacity, given challenges in understanding and responding to early warning messages, and in applying climate information to better inform their agricultural planning. Lower literacy puts those already vulnerable at greater risk, by excluded them from valuable information which would inform preparedness and climate resilient planning. Climate information is needed, which is packaged in a manner that can be understood and applied considering the varying levels of literacy, as well as limited related knowledge about climate change and climate change adaptation options.

Women are significant, and particularly vulnerable, contributors to the agriculture sector in Cambodia. Women make up the majority of the active agriculture population with 53%, compared to men with 47%. 20% of agriculture households are headed by women, and nine out of 10 female agriculture household heads are "de facto" or actual household heads in the permanent absence of their spouses/husbands or adult male members. The remaining 11% are the "de jure" household heads who have assumed the responsibilities in the temporary absence of their spouses, who are either working in other areas of the

²⁷ Climate Change Vulnerability Mapping for Southeast Asia, Economy and Environment Program for Southeast Asia (EEPSEA) 2009

²⁸ The food poverty line is defined as the cost of a food basket just sufficient to meet a minimum food requirement of 2,100 calories/person/day. In the case of Cambodia, this was set at 1,684KHR/person/day or US\$0.42/person/day.

²⁹ The poverty line refers to the food poverty line of 1,684KHR/person/day, plus non-food related items, or 440KHR/person/day, for a total of 2,124KHR/person/day or \$0.531/person/day.

³⁰ In April 2013, the poverty line in Cambodia was redefined, increasing the caloric requirement to 2,200 (per person, per day), making further distinctions between urban and rural consumption, and including the cost of clean water. The results are higher per person per day monetary requirements for sustenance. Analysis of newly collected data, disaggregated by gender and applying the redefined rates, is not yet available.

³¹ A Poverty Profile of Cambodia (RGC, MOP, 2006)

³² Microinsurance Study: The Understanding and Needs of Low-Income Population regarding Microinsurance (UNDP, 2013)

³³ A Poverty Profile of Cambodia (RGC, MOP, 2006)

³⁴ National Gender Profile of Agriculture Households (FAO, National Institute of Statistics, MOP, 2010)

country or abroad. The proportion of male members contributing to the agricultural labor force in female headed agriculture households is less than that of female members by 59 percentage points³⁵. When one considers the role of women as caregivers as well, and the fewer number of men to support in the agriculture work, one can see how adaptive capacity in female headed households is especially limited.

Effective efforts to improve early warning systems in Cambodia must address all of the above barriers, while taking in account the adaptive capacity of the country's most vulnerable.

2. Strategy

The objective of the project is **to strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change.**

Ultimately, the project will contribute to building Cambodia's resilience to climate change by strengthening institutions and coordination frameworks for an effective EWS. This includes increasing institutional capacity to monitor, analyze, disseminate, and apply climate and weather climate information and early warnings, into development planning and disaster preparedness and at the national and sub-national levels.

2.1 Project Rationale and Policy Conformity

The project supports national development priorities; its design is therefore aligned with national policies, strategies and planning documents. Further, the project is eligible for LDCF funding as it responds to the priorities highlighted in Cambodia's National Adaptation Programme of Action (NAPA).

2.1.1 National Adaptation Programme of Action (NAPA)

The RGC has ratified the United Nations Framework Convention on Climate Change (UNFCCC) and is classified among the non-Annex 1 parties to the convention. Cambodia has developed and submitted its National Adaptation Programme of Action (NAPA) and is eligible to benefit from the Least Developed Countries Fund (LDCF) for the implementation of priority projects/measures identified in its NAPA. In implementing priority interventions identified in the NAPA, the project is consistent with the criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18.

The project focus is aligned with the scope of expected interventions as outlined in the LDCF programming paper and decision 5/CP.9. It is also in line with the decision 11/CP.17, where COP 17 requested the GEF to continue to provide financial resources to developing countries for strengthening existing and, where needed, establishing national and regional systematic observation and monitoring networks.

The necessity for an EWS is embedded in the priority activities under NAPA projects on agriculture/food security, health, disaster preparedness and response capacity and water resources. EWSs are often not associated with any one particular sector and are expected to be relevant to multiple sectors, including the food/agriculture, water management, coastal management, health and energy sectors. Cambodia's NAPA recognizes the extreme vulnerability of rural livelihoods to adverse climate events (particularly flood and drought), and expresses the RGC's intention to further develop emergency services, hydro-

³⁵ National Gender Profile of Agriculture Households (FAO, National Institute of Statistics, MOP, 2010)

meteorological networks, and natural disaster prevention and preparedness³⁶. The NAPA further recognizes the crucial role that accurate information on natural disasters and regular weather forecasts play in disaster preparedness as well as agricultural production. It highlights that national agencies, local authorities, and communities would benefit from weather forecasts - especially under climate change³⁷.

Table 3: NAPA-Identified Priority Sectors

#	Priority Areas Mentioned in NAPA	Cambodia
1	Coastal zone management	Yes
2	Cross-sectoral	No
3	Disaster preparedness and response capacity	Yes
4	Education/ capacity building	No
5	Energy	No
6	Food security/agriculture	No
7	Forestry	Yes
8	Health	Yes
9	Infrastructure	Yes
10	Insurance	No
11	Terrestrial Ecosystems	Yes
12	Water resources	Yes

The project is aligned with several other NAPA priorities, specifically the second medium priority project and the third high priority project:

- The second medium NAPA priority project, "Enhancement of the National Weather Forecast Centre", seeks to build capacity of DOM to provide weather forecasts and natural disaster warnings to ensure better preparedness and management. The project will produce regular and timely forecasts, as well as disseminate those to relevant stakeholders. To accomplish this, the NAPA project will upgrade existing hydro- and meteorological stations, as well as procure/install necessary equipment (including rainfall stations) and provide technical training to staff. The estimated budget for the proposed project in the NAPA is \$30 million.
- The third high NAPA priority project, "Disaster Preparedness and Response Capacity" seeks to equip communities with the knowledge and tools needed to prepare for and cope with climate hazards. This includes the development of hazard and response maps for floods and storms, and the provision of communications equipment. The estimated budget for the proposed project in the NAPA is \$5 million.

This LDCF project will contribute partly to the goals of both the above projects by improving the hardware and software necessary to monitor extreme weather and climate, as well as forecast and customize the information as needed for national planning processes. The project will also establish SOPs to disseminate information related to changing climate trends, natural hazards and extreme weather events. The project addresses those NAPA priorities and actions identified which refer to the need for securing, transferring and installing critical technologies, as well as developing the necessary systems for climate change-related information which could then be integrated into decision-making processes. The project is

³⁶ NAPA (MoE, 2006)

³⁷ NAPA (MoE, 2006)

designed to accommodate the additional adaptation costs of priority actions identified in the NAPA and build on several other baseline projects and programmes. The technologies required to achieve these aims will increase the capacity of the national early warning network to forewarn and rapidly respond to extreme climate events. The project will also contribute towards planning and management of climate change risks across several sectors.

2.1.2 Least Developed Countries Fund (LDCF) Objectives

The project is consistent with LDCF objectives, specifically:

- CCA-1: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level
Outcome 1.1: Mainstreamed adaptation in broader development frameworks at country level and in targeted vulnerable areas
- CCA-2: Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level
Outcome 2.2 - Strengthened adaptive capacity to reduce risks to climate-induced economic losses
- CCA-3: Promote transfer and adoption of adaptation technology
Outcome 3.2 - Enhanced enabling environment to support adaptation-related technology transfer

2.2 Country Ownership - Country Eligibility and Country Drivenness

This project was designed in consultation with various national stakeholders and is consistent with national strategy and policy documents.

Approved at the 3rd National Forum on Climate Change in November 2013, the **Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023**³⁸ was a guiding document in the design of the project. The CCCSP seeks to achieve its vision to "develop towards a greener, low-carbon, climate-resilient, equitable, sustainable and knowledge-based society" by way of the following strategic objectives:

- Promote climate resilience through improving food, water and energy security
- Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts
- Ensure climate resilience of critical ecosystems (Tonle Sap, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites
- Promote low-carbon planning and technologies to support sustainable development
- Improve capacities, knowledge and awareness for climate change response
- Promote adaptive social protection and participatory approaches in reducing loss and damage
- Strengthen institutions and coordination frameworks for national climate change responses
- Strengthen collaboration and active participation in regional and global climate change processes

³⁸ Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023 available at <http://camclimate.org.kh/index.php/com-phocagallery/documents-and-media/library/category/12-national-policies.html?download=474:cambodia-climate-change-strategic-plan-2014-2023-en-final> (accessed in April 2014)

The **Climate Change Strategic Plan (CCSP) for Water Resources and Meteorology 2013-2017**³⁹ states as its vision, the sustainable use of water resources in adapting climate change, as well as timely, trusted weather and climatic information. It further emphasizes the need to improve the national weather monitoring and forecasting systems and to develop partnerships for creating downscaled models of future climate. Its adaptive strategies are to strengthen and extend the hydrological and meteorological systems, including data dissemination, and providing short-, medium- and long-term forecasts and warnings for droughts, floods and storms to the public and related institutions.

The further strengthening and extension of the monitoring, forecasting and institutional mechanism for dissemination of timely and accurate hydrological and meteorological information, was also detailed as a priority in the **Rectangular Strategy, Phase III (2013)** - Cambodia's Socio-economic Policy Agenda of the Political Platform of the RGC of the Fifth Legislature of the National Assembly⁴⁰.

The **National Policy and Strategic Development Plan on Green Development 2013-2030**, coordinated by the Ministry of Environment (MOE), aims to find a balance between economic development and environment, society, culture and sustainable consumption of natural resources in order to enhance people's well-being and living conditions⁴¹. The related Cambodia National Green Growth Roadmap lists 7 key priorities: access to water resources management and sanitation, access to food security (agriculture) and non-chemical products, access to sustainable land-use, access to renewable energy and energy efficiency, access to information and knowledge, access to means for better mobility and access to finance and investments⁴².

Following the Rectangular Strategy, Phase III and the launch of the National Policy and Strategic Development Plan on Green Development 2013-2030, ministries have to been asked to (1) identify climate change risks surrounding their sectoral activities, (2) develop measures to address climate change impacts and (3) capitalize on the emerging opportunities in their respective sectors. The **National Strategic Development Plan (NSDP) 2014-2018**, approved in July 2014, will integrate these efforts into a cohesive national plan. Led by the Ministry of Planning (MOP), the NSDP's guiding principles include, pulling the country out of its LDC status, ASEAN economic integration, achieving and surpassing the country's MDGs, and putting the country on a path to attain sustainable and inclusive development. The project is fully aligned with these principles and will further support climate resilient planning through the provision of climate information and related training, particularly in the agriculture sector.

Further, the **Strategic National Action Plan for Disaster Risk Reduction (SNAP) 2008-2013** detailed the need to improve flood forecasting and early warning capabilities, as well as to integrate disaster risk reduction (DRR) into national development plans and mainstream DRR into policies and programmes of relevant government ministries.

This project is in line with the **United Nations Development Assistance Framework (UNDAF) for Cambodia (2011-2015)**. The customized weather and climate information products generated as part of this project will be tailored to the needs of the country's most vulnerable sector (agriculture), for adaptive planning and disaster preparedness in light of climate change. Results achieved through this project will support progress towards Outcome 1 - Economic Growth and Sustainable Development:

Outcome 1.1 Sustainably developed agriculture sector promoting equitable physical and economic access to an increased number of safe and nutritious food and agriculture products

³⁹ Sectoral CCSP Ministry of Water Resources and Meteorology. Eng

⁴⁰ Rectangular Strategy Phase III (RGC, 2013)

⁴¹ http://news.xinhuanet.com/english/world/2013-03/01/c_132201617.htm

⁴² <http://www.slideshare.net/greeninclusivegrowth/green-growth-national-strategy-plan-ngo-forum-conference>

Output 1.1.4 Enhanced national information system on food security, agriculture, and nutrition to provide high quality evidence for program and policy decisions

Outcome 1.2 National and local authorities and private sector institutions are better able to ensure sustainable use of natural resources (fisheries, forestry, mangrove, land, and protected areas), cleaner technologies and responsiveness to climate change

Output 1.2.2 National and local capacities strengthened to plan and implement climate change adaptation measures to reduce vulnerability in agriculture, forestry, fisheries, water resources, coastal zone and health sectors

The project is also aligned with the **Country Programme Action Plan (2011 – 2015)**:

Outcome 2: By 2015, national and local authorities, communities and private sector are better able to sustainably manage ecosystems good and services and respond to climate change

Output 2.3: A national strategy, programme, and financing mechanism established for cohesive climate change response at national, sub-national, and community levels

2.2.1 Stakeholder Baseline Analysis

Input was sought from stakeholders during the project preparation phase, both at the Inception Workshop held on 13 August 2013 and through individual meetings in the months that followed. There were several key messages which were consistent:

- the project must plan for a long term capacity building programme for weather forecasting and climate modeling
- the project must keep the country's most vulnerable a priority – ultimately, the project must contribute to building their resilience to climate change
- the project must include a sustainable O&M plan to ensure functionality of the stations after the project

Changes from the original Project Identification Form (PIF) are the result of integrating this feedback into the ultimate design of the project. Stakeholders consulted in this process include:

Table 4: Stakeholder Consultations

Stakeholder	Role ⁴³
Ministry of Water Resources and Meteorology (MOWRAM)	MOWRAM serves as the Implementing Partner/Executing Partner in this project. It will also provide strategic steering for the project, oversee the accomplishment of project objectives and tasks, lead co-funding requirements, facilitate the process of bringing other stakeholders on board, and will be responsible for the timely and accurate provision of hydro-meteorological information generated by its departments (Outcome 2).
Department of Meteorology (DOM) Department of Hydrology and River Works (DHRW)	DOM and DHRW are the departments under MOWRAM responsible for the collection of hydrological and meteorological data (respectively), as well as O&M of the stations. Given their responsibilities under MOWRAM, DOM and DHRW will play a critical role in the procurement and O&M training outcome of the project, to ensure long term functionality of the monitoring stations (Outcome 3). The departments are also responsible for data analysis and generating forecasts and models, and will be recipients of the

⁴³ This column describes the role of the stakeholder in the design of the EWS project, or the role of the stakeholder in the implementation of the proposed project

Stakeholder	Role ⁴³
	related training under Outcome 1. They will contribute to designing the training programme to ensure the long term retention of skills. Under the direction of MOWRAM, the departments may also be indirectly engaged in Outcome 2 regarding dissemination.
National Committee for Disaster Management (NCDM)	NCDM is responsible for disaster preparedness and response interventions, as well as effectiveness and efficiency of early warning message dissemination. Given its expertise, NCDM will be engaged during the design of tailored weather and climate products especially for flood-prone areas (Outcome 1), as well as during the definition and implementation of SOPs for the dissemination of early warning messages (Outcome 2).
Ministry of Planning (MOP)	The early warning related information communicated from MOWRAM will be informed to MOP, according the SOP to be defined by this project. This will help the MOP to strengthen informed decision and policy making process by communicating relevant information with respective ministries. This will benefit national institutions in strengthening their capacities to better gear to face natural disasters and hazards through reducing the exposure, increasing resilience (through better planning) and reducing vulnerability.
Ministry of Interior (MOI)	Ministry of Interior is the line ministry through which MOWRAM will coordinate while disseminating early warning related information, and as such will be engaged during the definition of SOPs for the dissemination of early warning messages (Outcome 2). MOI is the chair of the NCDD ⁴⁴ .
National Committee for Sub-National Democratic Development (NCDD)	The National Committee for Sub-national Democratic Development (NCDD) is the inter-ministerial mechanism for promoting democratic development through decentralization and de-concentration reforms throughout Cambodia. The strategic framework document outlines: (a) the objectives and priorities of the decentralization and de-concentration (D&D) strategy; (b) the scope of needed reforms to achieve the D&D objectives and priorities; and (c) the structural changes in the existing governance system required to achieve the D&D objectives and priorities. At every level there exists a committee (Provincial Committee for Disaster Management, District Committee for Disaster Management, Commune Committee for Disaster Management), to take appropriate action and disaster risk management. Under the SOPs developed under this project, guided by the Law on Disaster Management (currently in draft form), the role and responsibilities of national institutions will be further defined in the dissemination of early warning information.
Ministry of Environment (MOE)	MOE maintains the role of GEF operational focal point for LDCF projects in Cambodia. MOE is a main stakeholder of the LDCF project, and is one of the representatives for the beneficiaries on the Project Board. MOE is also the chair of the NCCC whose mandate is to oversee and coordinate all climate change related activities in Cambodia. Thus, the role of MOE at the project board level is key to ensuring that progress of the project is being reported and updated to the NCCC. MOE, in particular the Climate Change Department, will also provide advisory services during project implementation, and will be engaged in the design of tailored weather products (Outcome 1).

⁴⁴ <http://www.ncdd.gov.kh/en/about-ncdd/membership>

Handwritten signature/initials in blue ink.

Stakeholder	Role ⁴³
Ministry of Agriculture, Forestry and Fisheries (MAFF)	<p>MAFF is a key stakeholder in the LDCF project and a primary beneficiary, as agriculture is the targeted sector for tailored climate information and for strengthening ministerial capacities to integrate climate information into planning. MAFF is a Responsible Party under Outcomes 1 and 2.</p> <p>MAFF is also the lead implementing agency for complementary projects, such as IFAD's Agriculture Services Programme for Innovation, Resilience and Extension (ASPIRE).</p>
Ministry of Women's Affairs (MOWA)	MOWA is a stakeholder in the LDCF project and a representative for the beneficiaries on the Project Board. MOWA's input will be critical given the role and special needs of women in the agriculture sector.
Asian Development Bank (ADB)	ADB is a key development partner providing critical capacity support to NCDM. ADB is also providing institutional support to MOWRAM the Implementing Partner of the project. This project will be implemented in close collaboration with ADB to ensure an overall to ensure complementarity and synergy in related work.
International Fund for Agricultural Development (IFAD)	Project implementation will ensure collaboration with IFAD on complementary projects, especially ASPIRE which is focused on reducing vulnerability of farmers.
Japanese International Cooperation Agency (JICA)	JICA is engaged in water management projects in Cambodia which include the procurement of monitoring stations and related O&M. Implementation of this project will ensure no overlap in selection station location.
Mekong River Commission (MRC)	MRC, as part of its three key strategies, a) Mekong HYCOS b) the Integrated Water and Related Resources Management (IWRM)-based Basin Development Strategy, and c) the 2011-2015 Strategic Plan, provides regional and transboundary perspectives for basin development planning, opportunities and risks associated with its development. MRC will play a key role to cater common countries' needs and increased communication between countries in the context of transboundary issues. Project implementation will be done in close collaboration with MRC to ensure complementarity and synergy in related work.
Cambodian Red Cross (CRC) French Red Cross (FRC)	The CRC's and FRC's mandate is to disseminate information (only to their constituencies unless it is critical) and to take appropriate response measures. Currently, the funds are being used for disaster relief operations but not for preparedness. The CRC's Community Based Disaster Risk Management (CBDRM) project has the widest coverage in the country, spanning 9 provinces, 23 districts, 94 communes and 317 villages. As part of IFRC's global agenda, the CRC finalized its Community Based Disaster Risk Reduction (CBDRR) strategy. CRC's and FRC's experience with disaster relief in Cambodia will help inform both Outcomes 1 and 2.
Caritas Cambodia	Provides relief, including food and other necessities, to affected communities after natural hazards or extreme weather events. Activities also include ToT training on disaster risk reduction and climate change. Caritas's experience with disaster relief in Cambodia will help inform both Outcomes 1 and 2.
DanChurchAid/Christian	DCA/CA is implementing a small scale climate information project in the

Stakeholder	Role ⁴³
Aid (DCA/CA)	Samaky Meanchey district, Kampong Chhnang province and the Lumphat district, Ratanakiri province, including hardware procurement and training. Implementation of this project will ensure coordination with ongoing and planned hardware efforts, so that there is no overlap in the selection of station location.
Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)	Provides forecast training to member state institutions, including Cambodia to strengthen national institutional capacity to monitor and forecast climate and environmental information. RIMES will be consulted during the design of the training programme for forecasters (Outcome 1) and per its mandate will provide related/continued training during and beyond the project cycle. In the proposed EWS LDCF project, some of the training programs (focusing of topics such as data analysis, forecasting tools, data communication and dissemination of warnings) will be jointly organized. Further, the scope of established SOP will be expanded to cover other climate hazards and finalize an approach to inform national planning processes in coordination with MOI.

Interviews were also conducted with farmers, mostly female, in the Preah Vihear province to gauge the reliability and applicability of currently disseminated climate/weather information and early warning messages, as well as with station monitors during the working condition assessment of stations to identify gaps and challenges related to the collection and transmission of data. Their feedback (i.e. applicability of recent early warning messages) and concerns (i.e. safety related to monitoring of neglected stations) were factored into the design of the project.

2.3 Design Principles and Strategic Considerations

The project was designed in line with UNDP's established programme of work on strengthening climate information and early warning systems for climate resilient development. Initiatives under this programme aim to generate effective EWS by integrating four major elements (to which the project framework is linked):

- **Risk knowledge:** Systematically collecting data and undertaking risk assessments (Outcomes 1 and 3)
- **Monitoring and predicting:** Developing hazard monitoring and early warning services, including weather and hydrological monitoring equipment, improving forecast capabilities and the use of these technologies within agricultural advisories, flood risk monitoring and supply chain management (Outcomes 1 and 3)
- **Disseminating information:** Communicating risk information and reliable climate hazard warnings to potentially affected locations through traditional and new media (Outcome 2)
- **Responding to warnings:** Building national and community response capabilities to act effectively when warnings are received (baseline initiatives and co-financing)

2.3.1 National and Local Benefits

The proposed LDCF project is expected to deliver both national and local benefits. It is generally agreed that investments in disaster risk reduction are more cost-effective than investments in disaster response and recovery. Studies conducted by the World Bank (WB) and International Federation of Red Cross and Red Crescent Societies (IFRC) estimate that for every dollar invested in disaster risk reduction, two to ten dollars are avoided or reduced in disaster response and recovery costs.

Providing ample early warning to extreme weather events would enable households to take the necessary precautions to minimize the impact on crops, livestock and private assets. Further, information about changing weather patterns can help inform crop calendars — improving crop yields and ultimately contributing to improved food security in Cambodia.

The project complies with the NAPA-identified urgent needs, all of which are relevant for supporting national development priorities and for achieving the Millennium Development Goals (MDGs) specifically 1, 3, and 7. The project will contribute to:

- MDG 1 of eradicating extreme poverty and hunger, by providing seasonal forecasts which would allow for climate resilient planning to improve crop yield and reduce crop loss, and by facilitating early warning messages to minimize impacts of natural hazards and extreme weather events on human life, livestock and crops
- MDG 3 of promoting gender equality and empowering women, by ensuring that needs pertaining to women in terms of adaptive capacity are addressed, eliminating gender disparity in the measures towards preparedness and response to climate change
- and MDG 7 of ensuring environmental sustainability by integrating the principles of disaster risk reduction and sustainable development into country policies and programs, and reversing the loss of environmental resources through improved evidence-based decision-making for early warning and national planning processes.

In addition, this project will benefit national institutions in strengthening their capacities to better respond to climate change by increasing resilience and reducing vulnerability, through better planning and disaster preparedness. Since this LDCF project will help to strengthen and inform decisions and policy making, respective departments and ministries may deliver improved products and services to the populations they serve.

If more reliable information is backed by the responsive policies, it will contribute to the economic growth of the country. In the agriculture sector; this can be quantified through increased crop yields and reduced damages and losses after a disaster.

Effective climate change resilience must integrate a gender perspective through the collection of gender-disaggregated data, along with noting specific concerns pertaining to women in terms of preparedness and adaptation requirements, in order to appropriately reduce exposure to hazards. The monitoring and evaluation (M&E) framework will require related data reporting and include vulnerable group-sensitive benchmarks and targets.

2.3.2 *Links to Baseline Initiatives*

The project builds on a range of on-going baseline initiatives and leverages almost 4.5 times the grant contribution of \$4,910,285 in the form of co-financing (\$ 21,884,540).

MOWRAM has committed \$150,000/year going forward for the O&M of its observational network, a total of \$600,000 for the duration of the project. LDCF funds will support the government in supplementing its allocation by developing a financing plan for the long term O&M of the observational network, including engagement of the private sector.

The Cambodia Climate Change Alliance (CCCA) Phase 2 seeks to "Strengthen national systems and capacities to support the implementation and coordination of Cambodia's climate change response, contributing to a greener, low carbon, climate-resilient, equitable, sustainable and knowledge-based

society". The CCCA Phase 2 supports the RGC in establishing legal and monitoring & evaluation (M&E) frameworks, coordination and finance mechanisms for domestic and external finance, and protocols for management of data. LDCF funds will build on this critical foundation by providing climate and weather data, training to analyze that data, and build sectoral ministerial capacity in applying the analyses towards climate resilient planning in Cambodia. The CCCA Phase 2, to be implemented by MOE, is funded by UNDP (\$750,000), the European Union (EU) (approximately \$8,255,900) and the Swedish International Development Cooperation Agency (SIDA) (approximately \$3,851,386), and will commence in 2014. The expected duration of the project is until 2019, therefore \$9,785,090 is budgeted for the period 2014-2018, as it is overlapping with the duration of the LDCF project.

Cambodia's disaster risk management institutions are receiving support at the national, provincial, district and commune levels through two ADB-funded projects. The first is the Strengthening Coordination for the Management of Disasters (SCMD) project with a budget of \$2,000,000, which focuses on establishing a policy that will enable the disaster management system to function effectively and building capacity at the national (NCDM) and provincial (PCDM) levels. This project will also address a critical gap by supporting the RGC in preparing SOPs for disaster management and national guidelines for integrating disaster risk reduction into the subnational planning process. The second project, expected to start in 2014, is the Community-Based Disaster Risk Reduction project. This project, with a budget of \$2,500,000, is aimed at strengthening disaster response capacity at the district (DCDM) and commune (CDCM) levels. Together these projects will provide the necessary support to NCDM at various levels, strengthening its capacity to fulfil its mandate, and to ultimately execute the SOPs of early warning message dissemination to be further defined with support of this LDCF project (Outcome 2).

Collection and application of hydrological transboundary data is being supported by the Mekong Integrated Water Resources Management Project (M-IWRMP) under the:

- Transboundary Cooperation between Cambodia and Viet Nam: Integrated Water Resources Management in the Sesan and Srepok Sub-Basins (\$354,000)
- and the Transboundary Cooperation Between Cambodia and Viet Nam: Integrated Water Resources Management in the Mekong Delta (\$353,450).

These projects will support dialogue, as well as data collection and sharing between Cambodia and Viet Nam, focusing on the provincial and basin levels. The LDCF project will support MOWRAM in ensuring that these data and sharing mechanisms are integrated centrally and are made part of the overall EWS in Cambodia.

Support for O&M related to the 12 hydrological stations installed by the Mekong River Commission Hydrological Cycle Observation System (Mekong HYCOS) project is expected to continue for the duration of the project. Extension of Mekong HYCOS is currently under discussion, with funding from Agence Française de Développement (AFD) estimated at \$300,000. Currently, there are also two Memoranda of Understanding signed between MRC and DOM and DHRW for support to the departments to ensure proper operation of the stations and timely data transfer. The total amount for the period 2013-2016 is approximately \$90,000.

Additional investments in the hydrological observation network include The Mekong Integrated Water Resources Management Programme Phase III (M-IWRM 3), with a planned start date in 2014. Component 2 of the M-IWRM 3 project focuses on river basin management in northern Cambodia and includes budget allocations for hydrological monitoring stations, as well as hydrological equipment, software and related training. Overall, the \$4,620,000 project will generate important transboundary data necessary for effective hydrological monitoring. LDCF project will support MOWRAM and NCDM in ensuring data is centrally archived, analyzed and disseminated.

The Project for River Basin Water Utilization, funded by the Japanese International Cooperation Agency (JICA) includes as its objectives: to manage the water balance in the river basin; to regularly assess the

quantity of water in the river basin and allocate this water for sustainable and equitable exploitation; to maintain minimum flow regimes in rivers; to ensure efficient water supply and use; and where required propose water works to overcome a supply imbalance. The proposal allocates \$682,000 for the installation of hydrological and meteorological stations and the procurement of vehicles for related O&M. This is in line with Outcome 3 of the LDCF project, where it aims to upgrade hydrological and meteorological stations as well as establishment of a financing mechanism for long term operation and maintenance of monitoring stations infrastructure.

Procurement of meteorological and hydrological equipment and site selection under this LDCF project will consider ongoing (and planned) efforts, such as those by JICA, MRC and M-IWRM 3 detailed above. Ultimately the project seeks to ensure a maximum coverage of stations, given the combined resources of ongoing/planned efforts and national priority areas. Close collaboration will ensure a complementary and synergistic approach towards shared objectives.

Table 5: Summary of Co-financing

Sources of Co-financing	Name of Co-financier (source)	Type of Co-financing	Co-financing Amount (\$)
National Government	Ministry of Water Resources & Meteorology (MOWRAM)	Cash	5,927,450
National Government	MOWRAM	In-kind	600,000
National Government	Ministry of Environment (MOE)	Cash	9,785,090
National Government	National Committee for Disaster Management (NCDM)	Cash	4,500,000
Other Multilateral Agency	Mekong River Commission (MRC)	Cash	390,000
Bilateral Aid Agency	Japanese International Cooperation Agency (JICA)	Cash	682,000
Total Co-financing			21,884,540

Hydro-meteorological infrastructure and training activities of the LDCF project will also include close collaboration with ADB. ADB is providing support to MOWRAM on a post-2013 Flood Damage Emergency Reconstruction Project, \$63.08 million. The project includes the installation of hydro-meteorological stations along 3 rivers in the Banteay Meachey province.

Additionally, this LDCF project will be complemented by the efforts of several other UNDP and LDCF projects.

Project implementation will be closely coordinated with the "Strengthening the resilience of Cambodian rural livelihoods and sub-national government system to climate risks and variability" project. The project, with an indicative budget of \$4.6 million, is currently in the design phase. The objective, as detailed in the LDCF PIF, is to improve sub-national administration systems affecting investments in rural livelihoods through climate sensitive planning, budgeting and execution. The climate information generated through this EWS LDCF can inform the sub-national planning supported in the above-named project.

The Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia project (\$2,404,942) funded by the Canadian International Development Agency (CIDA), seeks to strengthen community-based climate information systems to facilitate resilient agriculture choices and practices informed by climate information. The goal of IFAD's \$52 million Agriculture Services Programme for Innovation, Resilience and Extension (ASPIRE), is to reduce poverty and increase resilience of poor and vulnerable smallholder farmers in Cambodia. Together these two projects provide the necessary

capacity support to communities, which can ultimately help them to apply the tailored climate information generated by the LDCF project to their agriculture planning.

UNDP's Strengthening Early Warning Systems for Extreme Weather Events to Advance Climate Risk Management in the South East Asian Region project (\$426,066) has compiled damage and loss related data, and created a centralized disaster management information system i.e. the Cambodia Disaster Loss Database (CamDi). CamDi is designed to be a long-term strategic planning tool. In it, data on various disaster events is stored and analyzed to assist in recovery and reconstruction efforts after natural hazards or extreme weather events. This information is incredibly valuable while conducting risk mapping and vulnerability assessments under this project.

MOE and MAFF are receiving training on economic analysis under the UNDP/USAID-Adapt Capacity Building Programme on the Economics of Climate Change Adaptation (ECCA). ECCA seeks to strengthen institutional capacity to apply economic principles and techniques to inform cost-efficient and sustainable adaptation planning. As part of the programme, a survey was conducted of 300 households to gauge the impact of climate change on economic activity.

Funding has been provided by UNDP to combine these efforts of these two programmes - integrating the data/results generated from CamDi and the ECCA programme into evidence-based loss and damage estimates and climate risk assessments. The climate and weather data generated through the LDCF project could further inform this work and be used to inform climate resilient planning.

The results of the ECCA survey can also be used as a baseline to later assess the results and impact of the LDCF project, using randomized control trials (RCTs). RCTs are used to evaluate the causal effects of specific interventions, such as investment in EWS, and highlight gaps which require further support (e.g. early warning messages need to be more customized, more training is needed for farmers to better apply the information). Please see Annex F for more details.

2.3.3 UNDP Comparative Advantage

The project is supported by UNDP's policy framework, as well as technical expertise, at three levels: global, regional and national.

Global

Given the project's focus on climate resilient planning, the project falls under Outcome 1 of the **UNDP Strategic Plan 2014-2017**:

Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded

- *Output 1.4. Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented*

The project is part of UNDP's well-established programme of work on strengthening climate information and early warning systems for climate resilient development, through projects funded by LDCF, SCCF, the Adaptation Fund as well as bilateral donors. It will therefore benefit from UNDP's extensive experience, as well as the best practices and lessons learned from similar efforts in other countries, especially LDCs.

Regional

The **Regional Programme Document for Asia and the Pacific 2014-2017**, the project would fall under Outcome 3:

- Countries are able to reduce the likelihood of conflict, and lower the risks of natural disasters, including from climate change.

UNDP's regional policy focuses on disaster preparedness within the broader disaster risk management framework, which is central to building greater resilience to climate change and natural hazards. The following are key areas for intervention: effective early warning systems utilizing climate risk information to reduce disaster risks; established capacities in systematic, credible recording of disaster loss and damages that support evidence-based disaster risk reduction planning; and increased participation of women in climate change adaptation and disaster risk reduction plans. UNDP also facilitates development of appropriate methods to transfer knowledge and skills to countries using a practitioners and South-South cooperation approach.

Technical backstopping is provided to the project by the Regional Technical Adviser at the UNDP Asia-Pacific Regional Centre (APRC) in Bangkok and UNDP's network of global Senior and Principal Technical Advisors as necessary.

National

This project is supported by the **UNDP Country Programme Document (CPD)** as well as its energy and environment programme strategy which aims to mainstream environment and disaster prevention measures into national and local development policies, strategies and plans and our overarching role of capacity development. The current cycle of CPD for Cambodia is from 2011 to 2015, which responds to national priorities of the RGC as detailed in the NSDP 2014-2018. Key result area 4.3 "Promoting climate change adaptation" and the related Outcome of "National and local authorities, communities and private sector are better able to sustainably manage ecosystems goods and services and respond to climate change" emphasizes that NCCC, key line ministries and subnational authorities are enabled to integrate adaptation into development.

UNDP will continue to develop national and local capacities to plan, integrate, coordinate and implement policies and plans with climate change adaptation strategies through leading the implementation of a programme-based approach. In addition, UNDP will support public-private sector partnerships that promote low-carbon and climate-resilient development. UNDP also has a demonstrated track record in assisting ministries, national agencies, and related departments. UNDP already works closely with NCDM and relevant ministries in Cambodia to build their capacities in the disaster risk reduction (DRR), in particular with supporting the establishment of CamDi, through its regional project on strengthening early warning systems.

The UNDP Country Office in Cambodia is resourced to provide the necessary oversight to support the Implementing Partner in overseeing this LDCF project. A professional staff from the country office will be responsible for oversight, project assurance and will represent UNDP in the project board meetings. Programme Officers from different practice areas have been engaged during the design of the project and will continue to be consulted during implementation to ensure the highest level of cross-practice collaboration.

Overall, there is substantial in-house technical expertise within UNDP to support the Implementing Partner.

2.4 Project Objective, Outcomes and Outputs/Activities

The objective of the project is to **strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change**. The project aims to build the capacity for analysis, modeling and communication of climate trend information and weather event advisories, as well as transferring weather and environmental observational technology. The project objective is achieved through three complementary outcomes.

Figure 1: Complementary Outcomes and Outputs

LDCF Project Objective To strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change		
Outcome 1: Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information	Outcome 2: Climate and weather information available and utilized for national, sectoral and sub-national planning as well as for transboundary communication in the region	Outcome 3: Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change
Outputs 1.1 Training-of-trainers programmes for DOM and DHRW forecasters to combine regional/global information and data from monitoring stations in data quality control, archiving and modeling/forecasting climate, flood and water resource information (on daily to seasonal, as well as medium to long term timescales) 1.2 Customized weather and climate information for targeted stakeholders to meet the short-term and long-term planning needs 1.3 Training materials and courses available in local university for continued learning 1.4 Central repository for weather, climate and environmental data to enhance historical records of climate and weather trends and related impacts	Outputs 2.1 Standard Operating Procedures (SOP) for effective and timely EWS and climate information dissemination 2.2 Training programmes for planning/line ministry staff at the national and sub-national levels to apply climate information to inform climate resilient planning 2.3 Regular exchange of climate and weather information with border countries on transboundary issues, as well as best practices and lessons learned related to building climate change resilience and adaptive capacity	Outputs 3.1 Upgrade of up to 25 sites with automatic meteorological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies 3.2 Upgrade of 55 sites with automatic hydrological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies 3.3 Training-of-trainers programmes for DOM and DHRW staff to build capacity in the selection (i.e. identifying cost effective technologies), installation, operations and maintenance of equipment to established standards and services 3.4 Sustainable financing plan for the long term O&M of the equipment, including private and public financing arrangements

Outcome 1 *Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information*

Co-financing amounts for Outcome 1: \$5,228,575

LDCF project grant requested: \$912,962

Without LDCF Intervention (baseline)

DHRW currently provides daily weather forecasts during the wet season and weekly outlooks during the dry season, but would benefit from increased access to weather forecasts. The department has delineated catchments, which are prone to flooding due to heavy rains. Cambodia also gets flooded due to upstream rains and flooding along the Mekong River. The weather forecasts could be utilized to forecast flash floods in these catchments and along the river and its tributaries⁴⁵.

As a World Meteorological Organization (WMO) member, DOM currently accesses meteorological data and information (i.e. satellite data, storm information, ground and atmospheric meteorological parameters) from various meteorological agencies in the region and globally, namely Japan, China, Korea, Thailand, France, and the United States. DOM uses SYNERGIE software to generate forecasts and models, and has access to run weather research and forecasting (WRF) models online via the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES). DOM provides daily, three-day, and seasonal forecast as well as warning announcements for extreme events.

In 2012, MOWRAM installed and put into operation, a Doppler Rainfall radar (C band) with a range of 480km, which was expected to improve weather and rainfall forecasting. However, it is still faced with many difficulties, mainly the lack of experienced and dedicated meteorologists to operate the system, including conversion software⁴⁶.

The Country Assessment Report for Cambodia, Strengthening of Hydro-meteorological Services in Southeast Asia (Annex D), indicated that DOM is behind in terms of equipment and forecasting technologies, such as numerical weather and climate modelling, as well as human resources and institutional capacity. And while DOM has a research and development unit, it does not work on the advancement of their services. The assessment further indicates that with its current state of physical and human resources, DOM cannot cope with the increasing demand from different socio-economic sectors⁴⁷.

While training has been made available, capacity is still a challenge for MOWRAM affecting both DOM and DHRW.

Ongoing forecasting training is available from RIMES, to which Cambodia is a member state⁴⁸. RIMES evolved from the efforts of countries in Africa and Asia, in the aftermath of the 2004 Indian Ocean tsunami, to establish a regional early warning system within a multi-hazard framework for the generation and communication of early warning information, and capacity building for preparedness and response to

⁴⁵ Mission report (3-6 March 2013), Strengthening Early Warning Systems for Extreme Weather Events to Advance Climate Risk Management in the South East Asian Region, Members: Rajesh Sharma, Regional Programme Specialist, UNDP APRC Bangkok; Jayaraman Potty, Chief Scientist, RIMES, Pathumthani, Thailand; Ramraj Narasimhan, Disaster Management Specialist, RIMES, Pathumthani, Thailand

⁴⁶ Country Assessment Report for Cambodia, "Strengthening of Hydro-meteorological Services in Southeast Asia" (UNISDR, WB, WMO, RGC, GFDRR)

⁴⁷ Country Assessment Report for Cambodia, "Strengthening of Hydro-meteorological Services in Southeast Asia" (UNISDR, WB, WMO, RGC, GFDRR)

⁴⁸ Bangladesh, Cambodia, Comoros, India, Lao PDR, Maldives, Mongolia, Mozambique, Papua New Guinea, Philippines, Seychelles, and Timor-Leste, and Uzbekistan have signed the RIMES cooperation agreement; 16 additional countries are in various stages of agreement consideration and approval

transboundary hazards⁴⁹. Member States contribute 1% of the gross national budget of the country's national scientific and technical agency mandated to generate early warning information for natural hazards (i.e. MOWRAM), averaged over the previous 3 years. In return, RIMES provides a sustained institutions-based approach to capacity building in the end-to-end early warning chain, from hazard observation and monitoring, data processing and analysis, and prediction and forecasting, to potential impact assessment, warning formulation and dissemination, preparation and communication of response options, community response, and user feedback.

In 2013, two DOM staff received WRF model training from RIMES. Based on discussions with the DOM trainees, however, it does not appear that knowledge was then transferred to a larger group upon completion of the training. This training modality alone therefore will not be sufficient to build institutional forecasting capacity.

There are several projects with training components focused largely on water management. MRC's Information and Knowledge Management Programme is providing capacity building and training on the Decision Support Framework and the MRC Toolbox models to MOWRAM (\$90,000/year over the next 3 years). Discussions are ongoing within ADB to also provide capacity development technical assistance through the Supporting Policy and Institutional Reforms and Capacity Development in the Water Sector programme (\$11.16 million). The program is envisioned to provide support to MOWRAM by (a) strengthening the strategy, policy and legal framework for integrated water resources management (IWRM), (b) improving coordination and cooperation with other ministries and agencies, and at the river basin level and (c) strengthening MOWRAM's technical and human capacity to promote IWRM and climate change adaptation. The programme is expected to provide direct assistance to the Institute of Technology of Cambodia (ITC) to support undergraduate and post-graduate degrees in water resources and irrigation management and technical assistance to MOWRAM to support the expansion of vocational and on-the-job training for staff and farmers through its technical services center.

With the support of the UNDP's Strengthening Early Warning Systems for Extreme Weather Events to Advance Climate Risk Management in the South East Asian Region project (\$426,066), data related to damage and loss has been compiled to create a centralized disaster management information system i.e. CamDi. CamDi is designed to be a long-term strategic planning tool. In it, data on various disaster events is stored and analyzed to assist in recovery and reconstruction efforts after natural hazards or extreme weather events.

Such information, combined with tailored climate and weather forecast and model products, would prove invaluable for planners, when assessing the real costs of investments or plans which have not adequately considered climate change. A long term capacity building programme is needed to strengthen links to existing data sources, collect and apply local data to improve accuracy, and tailor information to meet the climate and weather information needs of different users.

MOWRAM is responsible for disseminating climate, hydrological analyses and forecast information to line ministries for planning purposes. However, this is not happening regularly or in an effective way, as (1) accurate forecasting which combines meteorological and hydrological observations is not available and (2) the information that is provided is not tailored to the needs of the recipient, making the information difficult to interpret and apply.

The objective of the CCCA Phase 2 is to strengthen national systems and capacities to support the implementation and coordination of Cambodia's climate change response. This includes strengthening the national legal and M&E framework for climate resilient planning and action, and the building capacity of line ministries to integrate climate change into planning. Needed is the means and structure to better

⁴⁹ <http://www.rimes.int/>

link the distinct roles of, and data collected by, DOM and DHRW — to provide accurate projections and related impacts to ministries and climate response bodies. Importantly, the programme must also take into challenges, such as staff retention, which keep MOWRAM from building and maintaining capacity.

With LDCF Intervention (adaptation alternative)

In close consultation with RIMES and MRC, a capacity building programme on data analysis and forecasting will be developed and implemented. JICA and ADB will also be consulted given past and planned training-related projects.

Training will include accounting for risks, based on existing vulnerability maps, as well as combining nationally-collected data with other available sources for improved accuracy (e.g. combining weather station data with satellite derived estimates of rainfall). Outcome 1 will be implemented in phases across the duration of the project. This will allow for added levels of detail and complexity with each training, as the data from the stations (Outcome 3⁵⁰) begins to come in and additional risk maps become available during project implementation. These multiple trainings will also serve to build confidence of the trainees and to allow time to establish the credibility of DOM and DHRW forecasting capabilities.

The utility of an early warning can be measured by the recipients' ability to understand and apply that information, to better prepare for extreme weather events and changing weather patterns. To do this, climate and weather products will be further tailored to specific needs. Efforts will begin with developing products for flood/drought prone areas using CamDi and other databases, especially as they relate to the country's most vulnerable – agriculture-based households.

It was clear from the Inception Workshop and subsequent stakeholder consultations that the project should be steered towards ultimately improving the resilience of farmers to the impacts of climate change. Given the particular challenges of adaptive capacity of women in the agriculture sector, tailored products will therefore ensure that the role and vulnerability of women especially is captured.

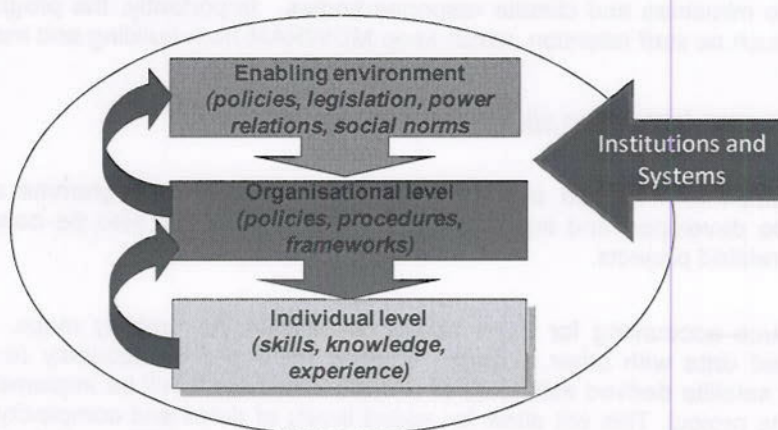
The development of climate and weather forecast products will be done in phases. This will allow initial products to be thoroughly tested, and build the skills and confidence of DOM and DHRW to continue to produce quality products.

Importantly, this will also allow the time necessary to establish DOM's and DHRW's credibility in producing quality forecast and early warning products. For instance, the current system communicates disaster-related early warning messages via mobile phone. Discussions with community members however did not indicate a level of confidence in the received early warning messages due to a lack of reliability (i.e. timeliness), inaccuracies of past messages, and a lack of clarity or guidance on how to interpret and respond to warnings. Time and a proven track record are therefore necessary before any significant impact can be measured for this Outcome.

Employing UNDP's Systems Approach to Capacity Development will ensure that the overall training programme is embedded within the broader institutional system, into existing decision making processes, and into existing national systems (including for planning, budgeting, coordination, consultation, information sharing, M&E), while also identifying gaps in systems. This ensures that the value of the products generated by the forecast teams, including the tailored products are understood within and across planning and line ministries.

⁵⁰ Improved hardware and software capacity to monitor extreme weather, climate change and forecast capacity

Figure 2: UNDP's Systems Approach to Capacity Development



The selection of trainees for the training programme must consider a number of factors including solid background knowledge of the topic, which would enable them to pass on their knowledge through regular in-house trainings and training-of-trainers programmes to colleagues and to new staff. The project will also support MOWRAM in generating training materials and courses offered at a local university for establishing a cadre of qualified manpower and continued learning. This will ensure that capacity building efforts ultimately establish a cadre of qualified staff within DOM and DHRW.

Ultimately, LDCF funds will be used to strengthen capacity and ensure that the institutional system in place within MOWRAM which can cope with the difficulties of staff retention. This will also enable the continued support by partners, in particular by RIMES, which provides perpetual support under its mandate, to advance towards more complex and robust forecasting and modeling training beyond the duration of the project.

To ensure the sustainability of this outcome, the training will be developed into a course to be housed in local universities or institutions, such as the Technical Service Center for Irrigation and Meteorology (TSC) and the Institute of Technology of Cambodia (ITC), for continued learning of staff as well as new students.

Outputs and Indicative Activities

Output 1.1 strengthens links to available sources of information and related forecast capacity. 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 that have no meteorological stations. Using these data, the water balance of crops can be estimated 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. 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).

Output 1.1 *Training-of-trainers programmes for DOM and DHRW forecasters to combine regional/global information and data from monitoring stations in data quality control, archiving and modeling/forecasting climate flood and water resource information (on daily to seasonal, as well as medium to long term timescales)*

An assessment, conducted under the ADB's Supporting Policy and Institutional Reforms and Capacity Development in the Water Sector project, recommended that DHRW and DOM be restructured in a way that they gradually become the NHMS. In support of this recommendation, and anticipating MOWRAM restructuring efforts, Output 1.1 looks collectively at training needs of DOM and DHRW,

Output 1.1 will focus on developing the capacity to generate daily and seasonal climate, flood and water resource forecasts. This will link to ongoing activities and will ensure the capacity to run numerical weather prediction models, and generate rainfall and flood prediction models, or be able to usefully generate and use data from these models run elsewhere in the region or at international centers. Additionally, synthesized products using combined satellite and surface observations will be used to extend the existing monitoring capabilities. Indicative activities include:

- 1.1.1 Identify available sources of data and establish linkages (e.g. CamDi, available satellite information, data from neighboring counties, regional data, upper air data)
- 1.1.2 Develop training material with support from regional, and international research institutions
- 1.1.3 Deliver training with support from regional or international research centers (e.g. National Center for Atmospheric Research (NCAR), International Research Institute for Climate and Society (IRI), RIMES) to provide training and build daily and seasonal weather forecasting expertise in Cambodia
- 1.1.4 Deliver training with support from regional and international research centers to build daily and seasonal flood and water resource forecasting expertise in Cambodia
- 1.1.5 Develop synthesized climate data products with support from a regional or international research institution by combining satellite, monitoring station and other data.
- 1.1.6 Deliver training on geographic information systems (GIS) to DOM to map meteorological risks and integrate into forecasts.
- 1.1.7 Deliver training on GIS to DHRW to map hydrological risks.
- 1.1.8 Produce maps of rainfall, temperature, soil moisture, vegetation, historical floods and other hazards using climate data products

Output 1.2 *Customized weather and climate information to targeted stakeholders to meet the short-term and long-term planning needs*

Through **Output 1.2** LDCF funds will be used to develop new tailored products, which will serve the information requirements of vulnerable target groups, specifically those in areas prone to floods or droughts, and vulnerable groups in the agriculture sector (at the national and sub-national level, as well as the community level). Products will be developed through consultations with the intended users of the information, existing databases (e.g. CamDi), and with the guidance of appropriate research institutions. These initial products will provide projections related to risk of flooding/drought, and can be used to inform crop calendars and other farm management decisions. Indicative activities include:

- 1.2.1 Conduct a study using participatory consultations with sector specific users such as ministries, civil society organizations, farmers' associations, women's groups and other groups to identify user needs and limitations (e.g. literacy, adaptive capacity) and identify potential tailored and sector specific early warning/planning products.

- 1.2.2 Identify additional data needs, and conduct risk mapping as appropriate. Build upon existing maps to improve information to vulnerable populations underserved by observations and warnings.
- 1.2.3 With support of a research institution (e.g. National Center for Atmospheric Research (NCAR), International Research Institute for Climate and Society (IRI), RIMES), design climate and weather information products
- 1.2.4 Deliver training programmes for DOM and DHRW personnel to regularly quality check and update these products. Training programme will include continued engagement with the training (or other relevant) institution to regularly review/vet products before dissemination.
- 1.2.5 Generate tailored and sector specific early warning products, advisories for the agriculture sector, flood/drought early warning, and model-based rainfall predictions and monitoring.

Output 1.3 Training materials and courses offered in local university or institution for continued learning

Output 1.3 ensures the retention of knowledge within the ministry by providing continued access to training, but can also exposes those outside the ministry, or a new generation, to the field of forecasting. Indicative activities include:

- 1.3.1 Develop and formalize a plan for continued support from RIMES and other relevant agencies, which promotes increasingly quality and robust analysis
- 1.3.2 Based on Output 1.1 trainings, develop toolkit which can be used as a reference material or as introductory training for new staff
- 1.3.3 Establish training courses on forecasting and modeling in university or institution for continued learning, as well as an introductory course to stimulate and nurture interest in a new generation of students, and encouraging the enrollment of women

Output 1.4 Central repository for weather, climate and environmental data to enhance historical records of climate and weather trends and related impacts

Output 1.4 will develop a central archive facility that brings together the climate, hydrological and agricultural impact data with information such as land use maps, population information, roads, infrastructure, etc., as a basis for undertaking the risk and vulnerability mapping. This could be used to support the work of planning/line ministries and NCDM, as well as the development of new and tailored products.

- 1.4.1 Identify database needs and links to existing information sources (e.g. CamDi)
- 1.4.2 Evaluate existing database hardware infrastructure and assess needs for a functioning central repository
- 1.4.3 Secure appropriate hardware/software means of storing data given data size and information needs
- 1.4.4 Construct the database with historical data records of climate and weather information, disaggregated by gender where possible
- 1.4.5 Establish protocol for making data available to planning/line ministries, NCDM and other stakeholders as appropriate

Outcome 2 *Climate and weather information available and utilized for national, sectoral and sub-national planning, as well as for transboundary communication in the region*

Co-financing amounts for Outcome 2: \$7,026,760

LDCF project grant requested: \$779,000

Without LDCF Intervention (baseline)

In this section, early warning messages will be separated into two types: messages for the purpose of response action (e.g. related to natural hazards or extreme weather events), and messages for the purpose of climate resilient planning.

Early Warning Messages for the Purpose of Response to Natural Hazards and Extreme Weather Events

MOWRAM is responsible for providing early warning messages to relevant stakeholders, for the purposes of disaster management and response.

The Regional Flood Management and Mitigation Centre (RFMMC), based in Phnom Penh, supports Cambodia, Lao PDR, Thailand and Viet Nam in managing floods by providing timely flood-forecasting and issuing warnings as demanded. The data is sourced from hydro-meteorological stations and forecasts water levels at 23 points on the Mekong River mainstream. RFMMC also forecasts expected water levels, which are communicated through various channels (fax, e-mail, website), to national focal points in each country, NGOs, the media, and the public.

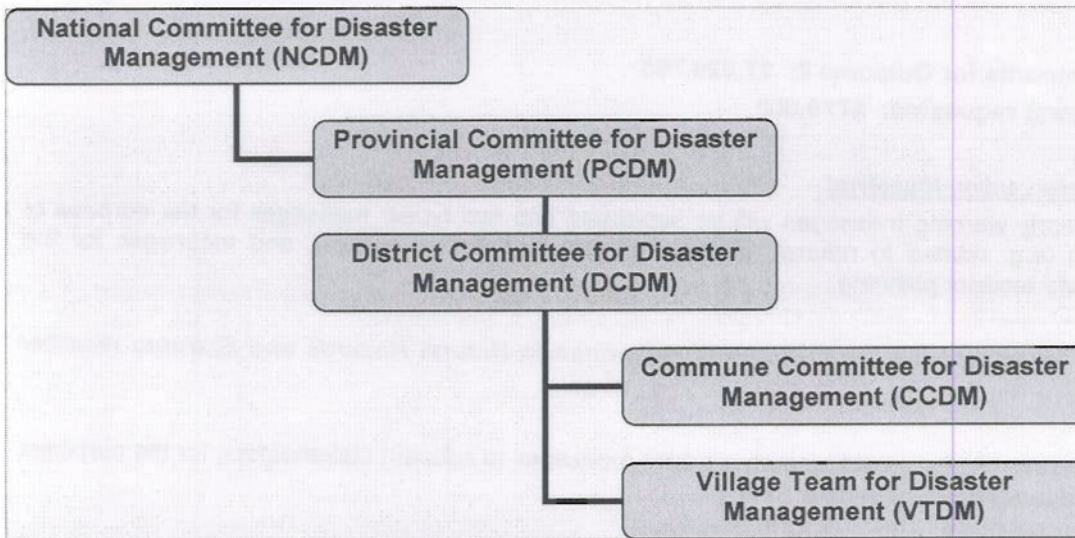
MOWRAM is responsible for compiling information from DOM and DHRW and providing relevant early warning information to national and sub-national government agencies, the Ministry of Planning (MOP), local authorities, and the public through television, national radio, and local newspapers. When it comes to information dissemination, forecast information from MOWRAM will be passed on to NCDM and other stakeholders such as the NCDD, MAFF, and CRC. Each of these institutions will alert their respective constituencies and further communicate the early warning messages.

The NCDM's role at the national level plays an important role in monitoring and developing the content of messages related to early warnings, and they provide instruction to the Provincial Committees for Disaster Management (PCDMs) and District Committees for Disaster Management (DCDMs). NCDM works closely with the Ministry of Posts and Telecommunications (MOPTC) to send messages quickly, and intends to engage the Village Teams for Disaster Management (VTDM)⁵¹, particularly the village chief to disseminate the early warning information.

The targeted transfer of early warning messages down to the community level would follow the institutional structure established for national disaster management:

⁵¹ NCDM has a structure issued by sub-decree at the national, provincial, district and commune levels. The Village Team for Disaster Management has been proposed, but not yet approved.

Figure 3: NCDM Communication Chain for Early Warning Messages



As detailed in section 1.3 above, the Barriers to Achieving the Long Term Solution, effective dissemination of information and disaster response is challenged due to the lack of SOPs to clarify related roles and responsibilities, and the capacity of NCDM to fulfil its mandate. When natural hazards or extreme weather events overwhelm national disaster management capacity, the CRC, FRC, and Caritas, provide necessary support for disaster response.

Efforts, however, are underway to strengthen NCDM's response capacity. ADB has funded two projects targeting different levels of Cambodia's disaster management institutional structure. The first is the Strengthening Coordination for the Management of Disasters (SCMD) project which focuses on establishing a policy environment that will enable the disaster management system to function effectively and building capacity at the national (NCDM) and provincial (PCDM) levels. This project will also address a critical gap by supporting the RGC in preparing SOPs for disaster management and national guidelines for integrating disaster risk reduction into the subnational planning process. This is a 3-year project, expected to start in 2014, with a budget of \$2 million. The second is the Community-Based Disaster Risk Reduction project. This is a 3-year project with a budget of \$2.5 million, aimed at strengthening disaster response capacity at the district (DCDM), commune (CCDM).

Further, a disaster management law for Cambodia has been drafted (not yet been put into operation). This law partly addresses mechanisms for national and local authorities, division of responsibilities, and the role of private companies and international organizations while responding to disaster risk reduction and recovery.

Together these projects, and the disaster management law, will strengthen capacity to disseminate early warning messages and response to disasters — addressing the barrier of capacity to effectively communicate climate information and early warning messages, which is not fully captured in the scope of this LDCF project.

Early Warning Messages for the Purpose of Climate Resilient Planning

The Strategic National Action Plan (SNAP) for Disaster Risk Reduction (DRR) seeks to integrate DRR into national development plans and mainstream it into policies and programmes of relevant government ministries.

While ADB's support addresses the disaster risk reduction capacity and SNAP identifies the need for DRR mainstreaming guidance, the lack of climate and weather information tailored to the needs of line ministries and target groups will continue to be a challenge for climate-resilient planning. Further, SOPs for the effective communication of this information is not yet developed.

There are, however, projects focused on building climate resilience at the subnational and community levels. The Enhancement of Flood and Drought Management and Mitigation in Pursat and Kratie Provinces (\$5.8 million ADB grant) seeks to provide technical assistance to build community capacity to better manage and mitigate risks associated with increasing climate extremes, including the use of early warning systems.

There is a need to strengthen the capacity of national/central institutions to support this important work going forward, and to broaden the scope of intervention to cover the entire country, especially the country's most vulnerable. This includes improving communication with bordering countries. Cambodia shares borders with Thailand, Lao PDR and Viet Nam. Hydro-meteorological information from neighboring countries, such as cyclone trajectory or observed river water levels, could inform both disaster preparedness and climate resilient planning. The Mekong Integrated Water Resources Management Programme Phase III (M-IWRM 3)⁵² for instance will generate important data related to transboundary issues (\$3.1 million excluding investment in observation hardware, equipment and training). And collection and application of transboundary data is being supported by the Mekong Integrated Water Resources Management Project (M-IWRMP) under the Transboundary Cooperation between Cambodia and Viet Nam: Integrated Water Resources Management in the Sesan and Srepok Sub-Basins (\$354,000) and the Transboundary Cooperation Between Cambodia and Viet Nam: Integrated Water Resources Management in the Mekong Delta (\$353,450).

With LDCF Intervention (adaptation alternative)

LDCF funds will be used to improve the dissemination and timeliness of communication related to climate information, forecasts and models to enable more climate-resilient planning as well as preparation and response to natural hazards and extreme weather events.

Outputs and Indicative Activities

Output 2.1 Standard Operating Procedures (SOPs) for effective and timely EWS and climate information dissemination

- 2.1.1 Draft SOP in consultation with MOWRAM, NCDM, MAFF, other ministries as appropriate, ADB, other relevant UN agencies, and humanitarian response institutions working in Cambodia
- 2.1.2 Formalize SOP for communicating forecast bulletins, timely alert information etc. with clear and quantitative units (e.g., crop yield, area of flood plain, wind velocity) for the agriculture sector and flood prone areas

⁵² The proposal is currently under review, with a planned start date in Q3 2014.

- 2.1.3 Test the SOP in selected provinces in collaboration with the local authorities including the PCDM, DCDM and CCDM
- 2.1.4 Monitor and evaluate the SOP mechanism, and improve the mechanism based on lessons learned

Output 2.2 Training programmes for planning/line ministry staff at the national and sub-national levels to apply climate information to inform climate resilient planning

While the training of Outcome 1⁵³ is focused on the technical skills of using climate and weather data to produce forecasts and models, the training of Outcome 2 focuses on applying that analysis into planning. These training programmes are closely linked towards building the overall institutional capacity and coordination framework of the EWS in Cambodia. The training programmes are therefore designed to be complementary.

- 2.2.1 Develop training material on resilient planning integrating climate information and cost-benefit analysis
- 2.2.2 Policy briefs detailing the economic costs/benefits of sectoral impacts using climate and weather data on the medium and long term for Cambodia, disaggregated by gender where possible, and shared with finance and planning ministries
- 2.2.3 Develop climate resilient planning toolkit as a reference material for staff
- 2.2.4 Training provided to planning/line ministry staff at the national and sub-national levels to integrate climate information and inform climate resilient planning
- 2.2.5 Facilitate inter-ministerial dialogue (workshop) on experiences, lessons learned and impacts of integrating climate information into planning
- 2.2.6 Design and establish course in local university or institution for continued learning

Note: The project begins by focusing on flood/drought products for the agriculture sector. Output 3.4 below, however, will focus on gauging the interest and willingness to pay of other interests. These include: banking/lending institutions, insurance providers, telecommunication service providers, construction/infrastructure, tourism operators and large agricultural companies (i.e. producing products for export such as sugar cane, Kampot pepper, and rice). The scope of the project should therefore expand to reflect additional financing, with consideration to the capacity of DOM and DHRW at the time.

Output 2.3 Regular exchange of climate and weather information regularly with border countries on transboundary issues as well as best practices and lessons learned related to building climate change resilience and adaptive capacity

Information sharing with neighboring countries needs to be enhanced and systematized within relevant national institutions. The transboundary nature of climate and weather requires close collaboration with the NHMSs in the region, especially with those countries sharing watersheds and with border areas at higher altitudes with potential risk for flash floods. This refers not only to the regular collection of climate and weather data for analysis purposes, but also emergency information related to natural hazards and extreme weather events, which would allow valuable time for preparation and response in border areas.

⁵³ Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information

Output 2.3 seeks to strengthen communication with neighboring countries to benefit from best practices and lessons learned, as well as enhance its data collection related to transboundary issues (e.g. ground and upper air meteorological data, satellite data, tropical cyclone trajectory). Indicative activities include:

- 2.3.1 Develop communications plan (combined, if possible, with above SOPs) to provide regular and timely climate and weather information which can aid planning and response with neighboring countries
- 2.3.2 Implement the developed communication plan in collaboration with lead ministry
- 2.3.3 Exchange best practices and lessons learned related to climate change resilience in planning and responsive action

Outcome 3 *Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change*

Co-financing amounts for Outcome 3: \$6,340,063

LDCF project grant requested: \$2,984,500

Without LDCF Intervention (baseline):

Local climate and weather observations are important to ensure accuracy of forecasts and models. Limitations of the national network however, leave Cambodia dependent on regional information which does not take adequately take into account local conditions and trends.

The meteorological observation network consists of 24 stations, 1 in each of the 24 provinces⁵⁴ in Cambodia. Of these stations, 5 are in remote areas with only a rain gauge. An assessment conducted as part of the PPG activities (Annex C) indicated that most stations are not fully functional and require repair, upgrade or replacement. With different brands and models at different sites, the assessment further revealed that there did not appear to be a standardized approach to procurement of equipment in the past.

There are currently some ongoing small scale investments in monitoring stations such as the installation of two Automatic Weather Station (AWS) by DanChurchAid/Christian Aid (DCA/CA) in the Samaky Meanchey district of Kampong Chhnang province and another in the Lumphat district of Ratanakiri province. The project is community-focused and the data collected from the stations does not yet get fed back to DOM for national use and analysis. The procurement of these stations has not considered the standardization needs of the national network as the selected brand is not currently used in the country.

Cambodia's hydrological observation network consists of 114⁵⁵ stations; the assessment (Annex C) indicated that only 12 hydrological stations are fully functional. The 12 fully functional stations are distinguished from the other stations in the country, in that they are part of the World Meteorological Organization (WMO) and MRC Mekong HYCOS project, and therefore benefit from MRC support for O&M. The next phase of Mekong HYCOS is currently under discussion, with additional funding \$300,000 from AFD.

Planned support of the hydrological observation network includes over \$600,000 under The Mekong Integrated Water Resources Management Programme Phase III (M-IWRM 3)⁵⁶. Component 2 of the M-IWRM 3 project focuses on river basin management in northern Cambodia and includes budget allocations for hydrological monitoring stations, as well as hydrological equipment, software and related

⁵⁴ As of 31 December 2013, the total number of provinces in Cambodia changed from 24 to 25.

⁵⁵ Based on number of stations visited during working condition assessment in October 2013 (PPG activity)

⁵⁶ The proposal is currently under review, with a planned start date in Q3 2014.

training. Under JICA's Project for River Basin Water Utilization, \$682,000 has been allocated for equipment and related O&M and training.

MOWRAM's budget has been focused primarily on irrigation projects to address Cambodia's dependence on rain-fed agriculture, as well as construction of its provincial offices to facilitate national availability of its services:

Table 6: MOWRAM Annual Investment Cost⁵⁷

Project Description	Source of Funds	Project Duration	Project Total (US\$ 000)	Annual Investment Cost (US\$ 000)				
				2009	2010	2011	2012	2013
Government Budget Project								
On-going Projects								
Building Construction of Department of Water Resources Management and Meteorology in provinces	Government	2002-2013	2,093	100	250	250	300	342
Strengthening FWUC in 25 sites	Government	2002-2012	348	30	80	80	100	
Multiple development project in the areas of western Phnom Penh	Government	2004-2010	12,378	4,869	1,621			
Rehabilitation of 29 irrigation sites	Government	2007-2011	21,850	1,714	1,611	1,720		
Rehabilitation of 19 irrigation sites	Government	2008-2011	12,400	1,465	1,500	1,385		
Maintenance of irrigation sites	Government	2009-2011	8,000	2,000	3,000	3,000		
Irrigation data collection and data entering	Government	2009-2013	80		20	20	20	20
Rehabilitation and establishment of 26 irrigation sites	Government	2009-2013	24,863	3,724	5,000	5,000	5,000	6,139
Total			82,012	13,902	13,082	11,455	5,420	6,501

Budget allocations for hydro-meteorological equipment and related O&M have been little, relative to the needs of the national observation network. Going forward, however, MOWRAM is committed to budget \$150,000 annually to O&M, a total of \$600,000 during the project duration.

The Climate Change Financing Framework developed under the first phase of CCCA provides a roadmap for orienting external and domestic finance, public and private, in support of CCCSP priorities. Phase 2 of the CCCA advances this work by facilitating public-private dialogue on climate change investments and establishing a coordination mechanism for domestic and external climate change finance and investments. Links are needed however to ensure that financing is earmarked for O&M of the national observation network.

⁵⁷ Source: Climate Change Strategic Plan for Water Resources and Meteorology, 2013-2017

In addition to the inadequate budget, capacity to conduct O&M is also limited, particularly at the provincial offices, the Provincial Departments of Water Resources and Meteorology (PDOWRAMs). Trained staff based centrally in Phnom Penh, are therefore required to visit the various sites. MOWRAM however lacks vehicles, making this approach difficult to implement. Observations for the assessment report highlight this difficulty, stating that non-functioning stations were obsolete and ceased functioning after 1 to 2 years of operation due to the lack of maintenance and insufficient training, as well as the lack of O&M funds⁵⁸.

In addition to an improved network of observational equipment, a long term plan is needed for training and financing related to O&M, to ensure its sustainability.

With LDCF Intervention (adaptation alternative)

LDCF funds will be used to strengthen Cambodia's observational network, to enable the collection of local data for analysis, and ultimately to inform planning in response to climate change at the national, sub-national and community levels.

For the collection of meteorology data, this will include for up to 25 sites (1 per province), the procurement of new stations where necessary, the repair or upgrade of stations which can be rehabilitated, as well as O&M-related training to ensure the long term sustainability of the network. This will provide nation-wide coverage for the collection of meteorological data in Cambodia.

For the collection of hydrological data, LDCF funds will be used to procure new, rehabilitate or upgrade 55 hydrological stations. There are currently 114 hydrological stations in Cambodia, but only 12 are fully functional. As the project provides support for 55 hydrological stations, it is not meant to provide national coverage for the collection of hydrological data - but rather targeted support to vulnerable areas. Selection of the sites will be based on priority and vulnerability, with particular focus on upstream/downstream relationships, given the measurable increase in the number of unexpected floods along the Mekong River and its tributaries.

Together, these enhancements will enable improved climate and weather data collection in Cambodia, facilitating forecasting and modeling, supporting sustainable planning, and enabling greater preparation for climate-induced natural hazards and extreme weather events.

Institutional capacity to maintain and routinely calibrate EWS related infrastructure will be increased through training, ensuring the long term functionality of the stations, and the accuracy of the data collected.

Similar to the other outcomes, the project will employ a phased approach to the repair, replacement or upgrade of stations.

To ensure that the best practices are identified and honed early in the project, the project will focus first on just a few sites, then expand slowly to other provinces based on evaluation of training efforts and the verification of data transmission and functionality of the stations. By using this prototype approach, the project mitigates the risk of stations falling into disrepair due to lack of O&M, and allows time to adjust project activities to address related challenges.

⁵⁸ Assessment of Existing Weather and Hydrological Stations and Their Working Condition Across Cambodia (UNDP, 2013)

Consideration for the initial sites of the outcome will be based on the provinces indicated by MOWRAM (e.g. the Banteay Meanchey, Oddar Meanchey, Siem Reap, Preah Vihear and Kompong Thom provinces), and other provinces especially affected by the October 2013 flooding (e.g. Battambang⁵⁹ and Kampong Cham). The project will then expand to the other provinces or priority areas in the country.

Training on O&M will need to be included during station repair/installation by companies providing the equipment. The phased approach to repair and upgrade of stations will therefore create multiple training opportunities spaced across the 4 years of the project, which can serve as refresher courses for existing staff and local trainers, as well as initial trainings for new staff. Additionally training-of-trainers workshops will be undertaken, to provide refresher training and upgrade the knowledge of trainers with advancements in the field of expertise. In addition, initially trained staff will be expected to tutor at least one junior technician after receiving training. Further training and capacity development activities will be undertaken if and when there is a recognized need.

This phased approach will also allow the LDCF project to adjust its budget and approach as other projects, currently in development, take shape and secure approvals for investments in similar equipment and infrastructure. For instance, in addition to the project mentioned above, the Japanese International Cooperation Agency (JICA) has two projects in development with objectives related to this LDCF project; the Master Plan Study on Flood Risk Management in Cambodia (\$1,000,000) and The Project for Meteorology and Hydrology System Improvement (\$8 million). The first project seeks to formulate a flood risk mitigation plan for the river basins covering the mainstream of the Mekong River, the Tonle Sap River and the surrounding floodplain areas. The proposal includes the installation of hydrological stations, vulnerability studies and a mitigation plan for the selected regions, and related knowledge transfer activities to MOWRAM⁶⁰. Establishing monitoring stations in these vulnerable floodplain areas is of critical importance to an effective EWS in Cambodia. Therefore the outcome of the approval process of the JICA proposal will inform planning for this LDCF-funded project in the subsequent phases of Outcome 3. The second JICA project seeks to improve weather observations and real time data collection, disseminate data and information for early warnings, and improve water resources management. This proposal is nation-wide in scope and includes a large component on procurement of monitoring stations, for both meteorology and hydrology⁶¹. This proposal failed to be approved during its first submission; a redesign and resubmission is planned by JICA.

It will be important throughout implementation to communicate the latest plans and progress of the LDCF project with development partners, to ensure that the projects complement each other, avoiding duplication of effort and maximizing impact of these combined resources, while also ensuring compatibility of equipment and communication systems.

To ensure the sustainability of the strengthened monitoring network beyond the life of the project, the project will develop the best practices and lessons learned from previous efforts both in Cambodia and in other countries. The project will also seek innovative approaches and a financing plan for the long term O&M of the stations. O&M is budgeted for the duration of the project plus 5 years, to allow time for the financing plan to generate sufficient resources.

With the monitoring stations in place, Cambodia will be able to collect the accurate and timely data necessary for forecasting and modeling specific to local trends and conditions, which can be then be analyzed, interpreted and tailored to inform planning and preparedness at the national, sub-national, and local levels.

⁵⁹ Coordination needed with the Mekong Integrated Water Resources Management Programme Phase III (M-IWRM 3) once approved. M-IWRM 3 will likely cover Battambang province.

⁶⁰ Application form for Japan's Technical Cooperation (Technical Cooperation Project/Technical Cooperation for Development Planning), "Master Plan Study on Flood Risk Management in Cambodia" (July 2013)

⁶¹ Application form for Grant Aid from Japan, "The Project for Meteorology and Hydrology System Improvement" (August 2012)

Outputs and Indicative Activities

Outcome 3 will support MOWRAM to improve the national coverage of weather and environmental observational capacity in terms of infrastructure, by procuring new or rehabilitating existing hydro-meteorological equipment, rescuing as much data as possible and training staff in O&M of the apparatus. The improved data and information will then feed into cross-sectoral and integrated planning processes for disaster risk management and climate change adaptation, and will thus support Outcomes 1 and 2 of the project.

In all equipment purchases, an assessment of existing equipment will be made, noting the manufacturer, whether it is still working and whether MOWRAM has an interest in continuing with particular makes/models, given the experience and cost of operating and maintaining the equipment. This will need to be weighed against potentially less costly solutions and the added costs of training personnel to service different products.

The poor current state of the existing stations, and the national scope of this project, presents an opportunity for Cambodia to establish a clear set of equipment criteria and standards for its observational network going forward. Standardization will therefore be an important consideration during the procurement process.

Output 3.1 Upgrade of up to 25 sites with automatic meteorological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies

Under Output 3.1, LDCF resources will be used for the procurement and installation, or rehabilitation, of up to 25 automatic meteorological monitoring stations (1 in each province⁶²), with telemetry, archiving and data processing facilities. Procurement will be approached with an institutional capacity strengthening view towards equipment standardization, to reduce overall O&M cost, to ensure compatibility with existing data processing software.

A rapid assessment of the working condition of the existing stations was conducted during the project preparation phase (Annex C). While the findings helped to identify critical gaps and inform budget requirements, further study is needed to select the optimal distribution and placement of the stations and to ensure cost-effectiveness and sustainability. This will include a review of best practices and lessons learned from previous efforts. Important consideration must be given to the ownership concerns behind the current status of the network and the stations provided through international support, as well as the investments which were never fully implemented.

The project will also seek innovative approaches, such as the use of cell phone towers as sites for weather observation stations, establishing partnerships with the telecommunications companies to utilize company staff to maintain equipment⁶³, as well as alternatives to in-situ stations (e.g. radar alternatives such as lightning detection and rain fade) in the context of country ownership, feasibility and long term sustainability.

Indicative activities include:

⁶² As of 31 December 2013, the total number of provinces in Cambodia increased from 24 to 25.

⁶³ Non-traditional Approaches to Weather Observations in Developing Countries: A Study for the World Bank (J. Snow, 2013)

- 3.1.1 A review of best practices and lessons learned from experience related to meteorological equipment in Cambodia, as well as similar efforts in other countries and regions, to inform cost effectiveness, sustainability and standardization of the monitoring stations
- 3.1.2 Informed by 3.1.1, define criteria for the procurement of station equipment under this project, as well as future investments in the national meteorological monitoring network
- 3.1.3 Analyses to optimize the locations of weather stations through micro assessments, based on their use when blended with modelled and remotely sensed data, in order to reduce the costs of infrastructure and system maintenance where possible
- 3.1.4 Participatory consultations with local representatives, at weather station sites before installation, to ensure local ownership and accountability
- 3.1.5 Ensure staff is available at PDOWRAMs to receive training, and to operate and maintain the equipment. This should include a review of working principles, standards and procedures, that describe and indicate the various MOWRAM, DOM and PDOWRAM staff and their responsibilities and role/involvement in the process of O&M
- 3.1.6 Develop Memoranda of Understanding (MoUs) or agreements with partners (e.g. telecommunications companies) for the cooperative O&M of monitoring stations. Engage partners in combined O&M planning and activities
- 3.1.7 Plan for, and rehabilitate or procure and install, meteorological monitoring equipment at 2-3 selected sites (initially) to test the installation approach of the project
- 3.1.8 Install required telemetry equipment, ensuring that data is collected and quality controlled in a centralized database
- 3.1.9 Conduct O&M training to provincial staff in operating and maintaining the equipment
- 3.1.10 Establish criteria and evaluate the success of the installation and training, generate lessons for improvements to be applied
- 3.1.11 Based on the lessons generated in 3.1.9, installation of equipment and related training can be expanded to other sites
- 3.1.12 Develop and implement a plan for sustained operation and maintenance of the monitoring stations

Output 3.2 Upgrade of 55 sites with automatic hydrological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies

LDCF resources will be used to rehabilitate or procure new equipment for 55 sites. Again, a rapid assessment of the working condition or functionality of the existing stations was conducted during the project preparation phase (Annex C). The assessment indicated 55 priority stations needing new equipment or rehabilitation. While the findings helped to identify critical gaps and inform budget requirements, further analysis will be conducted for optimal distribution and placement (with particular attention to upstream/downstream relationships needed to accurately model and understand flow regimes), while prioritizing the country's most vulnerable areas.

Work on this output will begin in the priority provinces indicated by MOWRAM such as Banteay Meanchey, Oddar Meanchey, Siem Reap, Preah Vihear and Kompong Thom, as well as other provinces especially affected by the October 2013 flooding (Battambang and Kampong Cham). The project will then expand to the other provinces in the country, ultimately to 55 sites.

This output was budgeted based on experience with similar projects in other countries, and estimates reflecting the context in Cambodia. Costs of equipment however vary greatly, depending on the level of sophistication of the selected equipment and other factors. Based on a cost assessment, and factoring in the costs of O&M, the project could expand the scope beyond 55 sites within the budgetary constraints. Indicative activities include:

- 3.2.1 A detailed analysis of the needs assessment for the rehabilitation or procurement of hydrological monitoring equipment with telemetry for prioritized 55 sites
- 3.2.2 Detailed cost assessment for rehabilitating and/or upgrading with telemetry for the remaining 59 sites
- 3.2.3 Participatory consultations with local representatives before installation to ensure local ownership and accountability
- 3.2.4 Ensure staff is available at PDOWRAMs (or district level as appropriate) to receive training, and to operate and maintain the equipment. This should include a review of working principles, standards and procedures that describe and indicate the various MOWRAM, DHRW and PDOWRAM staff, their responsibilities and role/involvement in the process of O&M.
- 3.2.5 Plan for, and rehabilitate, or procure and install hydrological monitoring equipment at 5-6 sites as a testing system
- 3.2.6 Install required telemetry equipment, ensuring that data is collected and quality controlled in a centralized database
- 3.2.7 Establish criteria and evaluate the success of the installation and training, generate lessons for improvements to be applied
- 3.2.8 Based on the lessons generated in 3.2.7, improved functional monitoring stations expanded to other sites
- 3.2.9 Once the system has been fully tested and functioned, expand the system to other sites
- 3.2.10 Develop and implement a plan for sustained operation and maintenance of the monitoring stations
- 3.2.11 Conduct O&M training to provincial staff in maintaining the monitoring equipment fully functional

Output 3.3 Conducted training-of-trainers programme for DOM and DHRW staff to build capacity in the selection (i.e. identifying cost effective technologies), installation, operations and maintenance of equipment to established standards and services

LDCF funds will be used to develop the human technical capacity required to operate and maintain the equipment made available through Outcome 3.1 and 3.2. Personnel responsible for the running of the equipment and receiving/archiving the data that it produces particularly at the provincial level will be trained, along with back up personnel. Five staff from DOM and five staff from DHRW will be core members of the training programme. Those trained will be responsible for training others and in this way build a cadre of skilled technicians. Additionally, a vocational school will be engaged to house the training programme for continued learning as well as for new students interested in pursuing this line of work. Indicative activities include:

- 3.3.1 Deliver cost-effective, learning-by-doing training programme, by coupling training with the phased installation of the stations
- 3.3.2 Develop a simplified O&M handbook
- 3.3.3 Procurement of calibration equipment and deliver related training for consistency and accuracy of readings
- 3.3.4 Support (i.e. retraining, mentoring support to trained staff) provided to ensure the capacity of staff to maintain and repair the existing and newly procured equipment
- 3.3.5 Establish O&M training course at a vocational school for continued learning as well as for new students

Output 3.4 Establish sustainable financing for the long term O&M of the equipment, including private and public financing arrangements

Output 3.4 will aim to put in place financial arrangements and partnerships between MOWRAM and clients to generate resources to be used towards the financial sustainability of the climate and weather data collection network. Where suitable legal arrangements exist and where the government is willing, private companies will be approached to test their willingness to engage in public-private partnerships with MOWRAM or an associated entity. CCCA Phase 2 activities may serve as a platform for this dialogue. Similar activities within the country, in the region and in other regions will be sought to learn from their experiences. Indicative activities include:

- 3.4.1 Identify budgetary needs for O&M of the EWS infrastructure, including operations, regular maintenance, replacement of sensors (and calibration) every 3-4 years, possible replacement of equipment at vulnerable sites susceptible to damage from natural events, as well as costs of collecting data generated by other sources (e.g. satellite information, AMDAR)
- 3.4.2 Conduct market research to gauge willingness-to-pay for the tailored weather products produced under Outcome 1, capturing interests such as banking/lending institutions, insurance providers, telecommunication service providers, tourism operators and large agricultural companies (i.e. producing products for export such as sugar cane, Kampot pepper, and rice)
- 3.4.3 Develop a financing plan, based on budgetary needs, results of the above market research and a review of best practices and lessons learned from similar efforts in other countries and regions
- 3.4.4 Formalize public-private partnerships with identified partners to improve the financial sustainability of MOWRAM for the operation and maintenance of the infrastructure
- 3.4.5 Ensure financial mechanism is in place in MOWRAM for the effective implementation and monitoring of the financing plan, including the budget allocation for O&M currently budgeted under the LDCF project

2.5 Key Indicators, Risks and Assumptions

2.5.1 Key Indicators

The outcome indicators (Table 7) are designed to measure changes in the coverage, impact, sustainability and replicability of the project outcomes.

Table 7: Objective and Outcome Indicators, Time Scale and Measurement

Key Indicators	End of Project Targets
Project Objective To strengthen climate observing infrastructure and increase national capacity to utilize climate and environmental information to respond to climate hazards and to support climate resilient development planning planning adaptation to climate change.	
Indicator 1 Number of national, sectoral and sub-national plans informed by accurate and up-to-date climate information (AMAT 1.1.1.3)	2 (MOWRAM and MAFF)
Indicator 2 Effective and timely EW/climate information dissemination mechanism established and functioning (AMAT 2.1.2.1)	SOP for the dissemination of early warnings designed and successfully tested
Outcome 1	

Key Indicators	End of Project Targets
Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information	
Indicator 1 Number and type of targeted institutions/individuals with increased capacity to assimilate and forecast climate and environmental information	6 forecasters from DOM (3) and DHRW (3) trained, which can also serve as trainers, to use information from monitoring stations in modeling, data quality control and forecasting climate information (on daily to seasonal, as well as medium to long term timescales)
Indicator 2 Number and type of training/learning tools on forecasting/modeling available for new hires or for continued learning of staff	3 courses (1 hydrology, 1 meteorology, 1 applying risk maps and GIS data) developed and available to staff (i.e. online, at local learning institution and training programme within MOWRAM) – course content and level should depend on MOWRAM staff needs
Indicator 3 Number and type of targeted institutions with increased capacity to reduce risks of and response to climate variability (AMAT 2.2.1)	Products developed for various agro-ecological zones of the 7 priority provinces and provided to MAFF
Outcome 2 Climate and weather information available for national, sectoral and sub-national planning as well as for transboundary communication in the region	
Indicator 1 Receipt of transboundary climate and weather related data	Communications plan to regularly share transboundary information (combined with ADB-supported SOP, or separate)
Indicator 2 % change in agriculture productivity in select communities	Positive change in agriculture productivity resulting from behavior changes informed by climate information (see Annex F)
Outcome 3 Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change	
Indicator 1 Number (national coverage) of automatic weather and climate monitoring network in Cambodia	67 functional hydrological stations (the 12 currently functional, plus the 55 as part of this project) and up to 25 functional meteorological stations
Indicator 2 Number and type of targeted individuals with increased capacity to maintain EWS related infrastructure	10 key staff from DOM (5) and DHRW (5) trained, and can serve as trainers, in the operations and maintenance of equipment
Indicator 3 % of financing plan funded for hardware and software operations and maintenance	Financing plan with committed resources sufficient to operate and maintain equipment for at least 5 years after the completion of project

2.5.2 Project Risks

Risks and recommended countermeasures were identified during the inception workshop as well as bilateral consultations during the project development phase. Key risks and planned mitigation measures for project implementation include the following:

Key Risks	Level	Risk Mitigation Measures
Failure of forecasting/modeling training programmes to build institutional knowledge or adequately take into account high staff turnover	M	<p>While staff turnover cannot be addressed as part of this project, the training programmes will be designed in a way that ensures sustainability by:</p> <ul style="list-style-type: none"> designing a curriculum which can be housed in a local university or other institution for future learning developing a train-the-trainers programme that will enable DOM and DHRW to maintain a pool of master trainers as part of their regular learning programmes
Climate products generated/distributed by MOWRAM do not meet the needs of stakeholders	L	<p>Stakeholders are engaged throughout the design and implementation phases of the project, informing the design of the climate products to best suit their needs. Additional training of stakeholders on interpreting these products for planning purposes will also ensure their usefulness. The product design can be revisited as needed to ensure that the relevant data is communicated in a way that can be understood and applied.</p>
Poor coordination between implementing and executing agencies, as well as development partners	M	<p>Consultations were conducted with stakeholders and development partners during the PPG stage of the project, with project management arrangements discussed and agreed which facilitate coordination (detailed in Section 4). Effectiveness of the management arrangements will be verified through the regular project implementation reviews and M&E undertaken following UNDP rules and principles. Adjustments may be made to the management arrangements as/if necessary with the approval of the Project Board.</p>
Lack of effective early warning communication at the commune and village levels	H	<p>NCDM is responsible for disaster preparedness and response interventions in Cambodia. NCDM, however, has limited capacity especially at the commune and village levels to effectively fulfil its mandate. There are ongoing co-financing initiatives which seek to address this.</p> <p>Further, SOPs will be put in place for more effective coordination across various governmental levels and timely distribution of information.</p>
Inadequate maintenance of meteorology, hydrology and hydro-met stations, resulting in hardware falling into disrepair	M	<p>Cost of O&M for the duration of the project have been captured in the project budget.</p> <p>However, ownership of, and therefore accountability for, the stations is with Cambodian government. Reflecting this responsibility, MOWRAM has committed \$150,000/year for ongoing O&M of the observation network. This project will further support longer term O&M of the stations by designing a financing plan, which includes strategies for engagement of the private sector.</p> <p>Training programmes for O&M of the equipment will be designed to be periodic, therefore not only at time of installation. In that</p>

Key Risks	Level	Risk Mitigation Measures
		way, the training programme will also look towards the longer term, by building the skills and confidence of individuals to identify and immediately fix/report any problem at the stations. A train the trainer approach will ensure benefits to a wider set of personnel and ensure that skills are retained within the institution.
New equipment is not compatible or consistent with existing systems, making synthesis and analysis of information/data difficult	L	Standardization has been challenge. The project will therefore prioritize the need for standardization in the purchase of new equipment. One of the initial activities of the project is to review lessons learned and define national criteria for the procurement of observation equipment. As part of the prototype approach, quality of O&M of new equipment will be verified to ensure that data transmission requirements are met and staff are able to maintain stations, before additional stations are procured.

Note: L - Low, M - Medium, H - High

2.5.3. Assumptions

Key assumptions underlying the project design include:

- Government remains committed to implementing the baseline activities and to taking forward their existing climate change plans and strategies.
- There is sufficient political support and capacity within the EWS agencies for successful implementation of the project.
- MOWRAM and participating sector ministries/departments remain committed to the realization of cross-sectoral collaboration in climate change planning and implementation of adaptation measures.
- The target equipment and infrastructure is compatible and standardized with existing hardware and software.
- Existing functioning equipment remains in working condition.
- DHRW and DOM will acquire the necessary capacity to customize weather and climate information and forecast products by the end of the project.
- Data sharing protocols can be agreed between MOWRAM and other ministries, and data can be presented in sufficiently utilitarian way for local application.
- The available climate modeling practitioners and researchers remain available for the project duration, providing input and institutional memory to training and capacity building activities of the project.
- The policy priority currently afforded climate change is not overshadowed other matters.

2.6 Cost-effectiveness

The project falls under UNDP's established programme of work on strengthening climate information and early warning systems for climate resilient development. Initiatives under this programme aim to generate effective EWS by integrating four major elements (a) risk knowledge, (b) monitoring and predicting, (c) disseminating information, and (d) responding to warnings.

This comprehensive approach is in line with the GEF Instrument's principles towards ensuring that funded activities are cost-effective, specifically that "the least-cost sustainable means of meeting many global

environment global environment objectives lie in a combination of investment, technical assistance, and policy action at the national and regional level.⁶⁴

Various combinations and cost scenarios were assessed during the process of designing the project. One alternative for instance would have been a greater focus on hardware, given the results of the station assessment conducted as part of the PPG. However, without the budget allocations for training (Output 3.3) and a financing plan for the long term O&M of the stations (Output 3.4), there would be a risk that the procured stations falling into disrepair and requiring costly replacement within a short number of years.

There has also been an adjustment from the approved Project Identification Form (PIF), which reflects cost-effectiveness in the project's ultimate design. The PIF included an output for the procurement of (2) upper air monitoring equipment. The related cost of procurement and regular operations however is quite high (estimated at \$400,000) and not a cost-efficient option to gather this information. Data collected by upper air monitoring stations, such as air temperature, wind speed and wind direction at higher altitudes, is available from commercial flights at ascending, descending and cruising altitudes via the Aircraft Meteorological Data Relay (AMDAR), a World Meteorological Organization (WMO) initiative. DOM already receives upper air data through AMDAR as well as from neighboring Viet Nam on a daily basis, therefore further investment in the collection of upper air data was not pursued as part of this project.

The principle of cost-effectiveness was also employed through the use of prior reviews and assessments to inform project design. As the reports are thorough and recent, duplication of these important assessments during the PPG phase was not necessary:

- Country Assessment Report for Cambodia: Strengthening of Hydro-meteorological Services in Southeast Asia (UNISDR, WB, WMO, RGC, GFDRR, 2013)
- Institutional Review and Capacity Assessment of the National Committee for Disaster Management, Royal Government of Cambodia (ADB, 2013)
- National Gender Profile of Agriculture Households (FAO, National Institute of Statistics, Ministry of Planning, 2010)

2.7 Sustainability

The project provides for a solid foundation of hardware, software and training upon which the RGC can build. While the project is fully aligned with national policy and development goals, there are risks to its sustainability. These risks were important considerations during the design phase, and steps have been taken towards the financial, institutional and social sustainability of an effective EWS beyond the duration of the project.

Stakeholders were consulted throughout the project design process to ensure that lessons learned and best practices from prior and ongoing efforts were incorporated, as well as innovative approaches used in other countries, especially LDCs. The result is a project with long term sustainability designed into each of the components.

2.7.1 Financial Sustainability

⁶⁴ Principles of Cooperation among the Implementing Agencies, Instrument for the Establishment of the Restructured Global Environment Facility (2004)

A critical risk to this project is the long term O&M of the observational network. To mitigate this risk, a sustainable financing plan (Output 3.4) will be developed and implemented. The plan requires developing the market for tailored weather products (Output 1.2).

Time will be needed to establish a track record of timely and accurate products, and thus the credibility of MOWRAM to produce quality products. In the interim, O&M has been budgeted for the project duration plus 2 years after the completion of project.

It is believed that, with the technical support provided by regional and global research institutions, this will be sufficient time for the financial plan to become operational, generate a steady revenue stream to ensure the long term sustainability of the observational network.

2.7.2 Institutional Sustainability

A concern echoed throughout stakeholder consultations was the short term nature of capacity building efforts in the past. This coupled with high staff turnover have made it difficult for DOM and DHRW to build or maintain capacity.

RIMES provides training to build forecasting capacity of its member states, which include Cambodia. RIMES's approach is institution-based, therefore training time and subject matter is tailored to the needs of the country. Through its mandate, RIMES will provide the continued training required to maintain and update skills to reflect new technology and research, thus ensuring the long term sustainability of support provided by this project.

Further, establishing the forecast/modeling training and the O&M training at local learning institutions (i.e. a university and vocational schools respectively), will ensure that the training provided as part of this project will be available beyond its duration.

2.7.3 Environmental and Social Sustainability

The project seeks to increase Cambodia's resilience to climate change, and therefore promotes environmental and social sustainability. As part of the standard processes however, the project underwent a UNDP Environmental & Social Screening.

While little to no adverse environmental impact is expected as a result of the project, it is possible that the most appropriate or cost-efficient location of a monitoring station is in a legally protected national park. If this is the case, further analysis will be conducted and the necessary action taken to ensure the protection or conservation of biodiversity. The Environmental & Social Screening document is included as an Annex J).

Ultimately, RGC's goal of strengthening its institutions is to build the resilience of farmers to climate change. Climate change has already forced farmers to make adaptation choices. Their decisions however are based on experience and perceived trends. Climate and weather information and seasonal forecasts could bring greater accuracy to their planning – improving their preparedness to extreme weather events, informing their crop calendar to maximize crop yield, and thus supporting overall social sustainability.

Indirectly, this project also supports strategies identified in the CCCSP, specifically promoting micro-financing to improve access to credits for local communities for climate change response and setting up insurance and fiscal incentives for reducing climate-risk burdens on society. By improving the quality of climate data collection and the accuracy weather forecasting and modeling, the project can establish a

solid foundation upon which to base financial programmes, which help communities prepare for and respond to a changing climate.

2.8 Responsiveness to Gender-specific Challenges

Women make up 53% of the active agriculture population, and account for 20% of agriculture heads-of-household. Challenges facing male and female-headed agriculture households vary across Cambodia. Differences can be seen in the literacy rates, the number of household members, the ownership of farm equipment, and access to/reasons for loans⁶⁵. Understanding these differences and how they influence vulnerability is critical to building resilience to climate change.

MOWA will be engaged throughout implementation to ensure that (1) the tailored information generated under Outcome 1 takes into account the type of information needed by women and (2) the information is communicated in a way that it can be understood and applied. Surveys, as part of the RCTs (further described in Annex F), will collect data from agriculture households - to measure behavioral changes resulting from the successful dissemination of tailored weather and climate information. Data will be disaggregated by gender, and will thus be an important tool for identifying any gaps and challenges faced by women, in the receipt, interpretation or application of early warning messages. Such information would lead to the refinement of tailored climate and weather information and/or improvements in the SOP for communicating early warning messages – thus ensuring that women's needs are appropriately captured in Cambodia's EWS, and that the EWS is successful in building the climate resilience of women in the agriculture sector.

2.9 Replicability

Replicability was a key factor in the design of the project. While the limited budget cannot address the immediate climate and weather information needs of all sectors, the data collected through the installation/rehabilitation of monitoring stations (Outcome 3) and the skills acquired through the forecasting and modeling training (Outcome 1), will be further applied to generate tailored climate and weather information products for other sectors.

The tourism sector, for instance, is the 3rd largest sector behind the garment industry and agriculture. It contributes 4.3% to the GDP with an annual growth rate of 20%⁶⁶. Cambodia's 3 million annual visitors⁶⁷ are concentrated around the UNESCO World Heritage sites in the provinces of Siem Reap and Preah Vihear, the coastal province of Sihanoukville and the nation's capital Phnom Penh. Economic losses to the sector resulting from the October 2013 floods were estimated at \$1.7 million⁶⁸. Tailored climate and weather products could inform more climate change resilient planning, building the climate resilience of critical ecosystems (i.e. Tonle Sap, the Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage – consistent with the strategic objectives of the CCCSP 2014 - 2023.

⁶⁵ National Gender Profile of Agriculture Households (FAO, MOP, 2010)

⁶⁶ Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023 (National Climate Change Committee (NCCC), 2013)

⁶⁷ Rectangular Strategy Phase III (RGC, 2013)

⁶⁸ Cambodia Post-Floods Early Recovery Needs Assessment Report (RGC, ADB, NCDM, March 2014)

Similarly, climate and weather products tailored to the needs of the construction sector, the 4th sector of Cambodia's narrow economy, could lead to increased economic efficiency and effective climate proofing, contributing to the long term sustainability of investments and infrastructure projects.

Through the sharing of experiences, the project can also be replicated in other countries and regions, especially LDCs that face similar challenges as Cambodia in establishing and maintaining an effective EWS. Lessons learned and best practices will be periodically documented through the regular monitoring, evaluation and reporting requirements of project implementation (further detailed in the Monitoring Framework and Evaluation section of this document). These will be disseminated according to UNDP policies, including publicly accessible online tools such as the UNDP Evaluation Resource Centre (<http://erc.undp.org>) and the UNDP Office of Audit & Investigation website (<http://www.undp.org/content/undp/en/home/operations/accountability/audit.html>). More frequent updates and communications materials will be shared via UNDP communication channels with national, regional, and global reach; these include UNDP websites, newsletters and press releases, the UNDP Adaptation Learning Mechanism, as well as the blog for UNDP EWS projects in Asia and the Pacific (<http://ews-undp-asia-pacific.blogspot.com/>), which has already been active throughout the project design phase, as well as on UNDP Teamworks – an online network used to store knowledge, experience, and lessons learned, which is accessible to UNDP staff, participating UN entities, and other partners.

2.10 Stakeholder Involvement Plan

Stakeholders' consultations throughout implementation will be important to ensure that best practices and lessons learned are captured in decision-making, and to ensure synergies of similar efforts. A list of key stakeholders consulted during the project design phase is included in the Stakeholder Baseline Analysis section. The list of stakeholders consulted during implementation will be similar, with particular focus on areas of mutual interest in the project.

Given the focus of prior and planned efforts on EWS hardware and software, consultations related to Outcome 3 will include, but not be limited to ADB, DCA/CA, JICA and MRC. Consultations related to the training activities of Outcome 1 will include RIMES, TSC and ITC as well as other learning institutions as appropriate, both national and regional/global, which could provide on-line support to continued learning efforts. The development of tailored products will require extensive consultation across various ministries, including MOE, MOP, MAFF and MOWA. Consultations related to activities of Outcome 2 will include MOI, NCDM, MOPTC, ADB and MRC, as well as Caritas, CRC, and FRC as appropriate. UNEP⁶⁹ and FAO⁷⁰ will also be consulted given related ongoing efforts.

As the project ultimately seeks to build the resilience of the agriculture sector to climate change, MAFF is will be consulted on Outcomes 1 and 2, but also on overall project direction. Given the particular vulnerability of women in agriculture, this will also apply to MOWA. The importance of MAFF and MOWA in providing guidance to the project is further reflected in their roles of Senior Beneficiary on the Project Board.

⁶⁹ Ongoing UNEP-led project in Cambodia, Vulnerability Assessment and Adaptation Programme for Climate Change in the Coastal Zone of Cambodia Considering Livelihood Improvement and Ecosystems, \$1.6 million (LDCF); \$4.2 million (co-financing)

⁷⁰ Ongoing FAO-led project in Cambodia, Strengthening the adaptive capacity and resilience of rural communities using micro-watershed approaches to climate change and variability to attain sustainable food security, \$5 million (LDCF) and \$18.8 million co-financing from Government (\$1 million) and bi- and multi-lateral agencies through the FAO – EU: \$11.1 million; Spain: \$ 3.35 million; Italy: \$462,000, and UN-REDD: \$1.3m, as well as the Agriculture Support Programme for Innovation Resilience and Extension (ASPIRE)

It is of critical importance to receive inputs and feedback from communities. As part of the ECCA programme and the CIDA-funded Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia project, an agriculture/water use survey was conducted of 300 households. This survey will provide baseline information for this project on the perceived changes in climate and current agricultural practices. While this is largely a monitoring tool, the subsequent surveys to be conducted under this LDCF project as part of a randomized control approach (see Annex F), should be seen as also a means of gathering stakeholder feedback from a large number of farmer households.

A more detailed stakeholder plan is provided as an Annex G. This plan will evolve throughout the implementation of the project to include additional stakeholders relevant to project board decisions, developments in national policies and plans, and new interventions and investments supporting climate change resilience in Cambodia.

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3. Project Results Framework

<p>This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:</p> <p>Outcome 2: By 2015, national and local authorities, communities and private sector are better able to sustainably manage ecosystems good and services and respond to climate change</p> <p>-Output 2.3: A national strategy, programme, and financing mechanism established for cohesive climate change response at national, sub-national, and community levels</p>					
<p>Country Programme Outcome Indicators:</p> <p>Outcome 2</p> <p>Indicator: Number of national and sectoral strategies, plans, and programmes integrating climate change</p> <p>Baseline: 4 in 2010</p> <p>Target: 10 by 2015</p>					
<p>Primary applicable Key Environment and Sustainable Development Key Result Area: Promoting climate change adaptation</p>					
<p>Applicable SOF (e.g. GEF) Strategic Objective and Program:</p> <p>CCA-1: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level</p> <p>CCA-2: Increasing Adaptive Capacity: Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level.</p> <p>CCA-3: Adaptation Technology Transfer: Promote transfer and adoption of adaptation technology.</p>					
<p>Applicable SOF (e.g. GEF) Expected Outcomes:</p> <p>Outcome 1.1: Mainstreamed adaptation in broader development frameworks at country level and in targeted vulnerable areas</p> <p>Outcome 2.1: Increased knowledge and understanding of climate variability and change-induced threats at country level and in targeted vulnerable areas</p> <p>Outcome 3.2: Enhanced enabling environment to support adaptation-related technology transfer</p>					
<p>Applicable SOF (e.g. GEF) Outcome Indicators:</p> <p>Indicator 1.1.1.3 Type and No. of regulatory reforms that prevent economic loss from climate change, including variability (Type and No.)</p> <p>Indicator 2.1.2.1 Type and no. of monitoring systems in place (Type and No.)</p> <p>Indicator 3.2.1.1 Number of individuals trained in adaptation related technologies</p>					
	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
<p>Project Objective⁷¹</p> <p>To strengthen climate observing infrastructure and increase national capacity to utilize climate and environmental information to respond to climate hazards and to support climate resilient development planning adaptation to climate change.</p>	<p>Indicator 1</p> <p>Number of national, sectoral and sub-national plans informed by accurate and up-to-date climate information⁷² (AMAT 1.1.1.3)</p>	<p>Climate and weather information currently provided by MOWRAM, but information is not sufficiently tailored to adequately inform planning</p>	<p>2 (MOWRAM and MAFF)</p>	<p>National, sub-national, sectoral planning documents, budgets referencing forecasts and products</p>	<p><u>Risks</u></p> <p>Insufficient institutional support and political commitment</p> <p>Poor coordination between implementing and executing agencies</p>
	<p>Indicator 2</p> <p>Effective and timely EW/climate</p>	<p>Early warning messages are disseminated, but roles, responsibilities and</p>	<p>SOP for the dissemination of early warnings designed and successfully tested</p>	<p>SOP developed and approved</p>	<p><u>Assumptions</u></p> <p>Government remains committed to implementing the baseline activities and to taking forward their existing climate change plans and strategies.</p> <p>There is sufficient political support and</p>

⁷¹ Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR

⁷² Rephrased Indicator 1.1.1.3 Type and No. of regulatory reforms that prevent economic loss from climate change, including variability (Type and No.)

	information dissemination mechanism established and functioning (AMAT 2.1.2.1) ⁷³	accountability not clear. No SOP in place.			capacity within the EWS agencies for successful implementation of the project. The policy priority currently afforded climate change is not overshadowed other matters.
Outcome 1⁷⁴ Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information	Indicator 1 Number and type of targeted institutions/individuals with increased capacity to assimilate and forecast climate and environmental information Indicator 2 Number and type of training/learning tools on forecasting/modeling available for new hires or for continued learning of staff Indicator 3 Number and type of targeted institutions with increased capacity to reduce risks of and response to climate variability (AMAT 2.2.1)	9 forecasters at DOM (Staff do not currently serve as formal trainers, do not provide tailored products) Training is generally provided by outside parties and is short term in nature. Forecast information is currently provided, but not tailored.	6 forecasters [(3 from DOM and 3 from DHRW) trained, which can also serve as trainers, to use information from monitoring stations in modeling, data quality control and forecasting climate information (on daily to seasonal, as well as medium to long term timescales)] 3 courses (1 hydrology, 1 meteorology, 1 applying risk maps and GIS data) developed and available to staff (i.e. online, at local learning institution and training programme within MOWRAM) – course content and level should depend on MOWRAM staff needs Products developed for various agro-ecological zones of the 7 priority provinces and provided to MAFF	Capacity assessment, evidence of training and field demonstration of technology transfers Feedback (questionnaire) from trainees to gauge level of knowledge and confidence to assimilate and forecast climate and environmental information Course material, syllabus Tailored climate and weather products generated by MOWRAM, resulting from accurate collection of data, as well analysis and coordination between DOW and DHRW to meet MAFF (or other stakeholder) needs	Risks Failure of forecasting/modeling training programmes to build institutional knowledge or adequately take into account the high staff turnover Climate products generated/distributed by MOWRAM do not meet the needs of stakeholders Assumptions The available climate modeling practitioners and researchers remain available for the project duration, providing input and institutional memory to training and capacity building activities of the project.
Outcome 2 Climate and weather information available for	Indicator 1 Receipt of	Information sharing not	Communications plan to	Reports, data received	Risks Lack of effective early warning communication at the village level

⁷³ Rephrased AMAT Indicator 2.1.2.1 Type and no. of monitoring systems in place (Type and No.)

⁷⁴ All outcomes monitored annually in the APR/PIR. It is highly recommended not to have more than 4 outcomes.

national, sectoral and sub-national planning as well as for transboundary communication in the region	transboundary climate and weather related data Indicator 2 % change in agriculture productivity in select communities (data disaggregated by gender)	systematized. Early warnings provided are not tailored sufficiently to inform planning at agriculture household level	regularly share transboundary information (combined with ADB-supported SOP, or separate) Positive % change in agriculture, productivity, particularly by female headed households, resulting from behavior changes informed by climate information (see Annex F – Randomized Control Trials)	from neighboring countries	<u>Assumptions</u> MOWRAM and participating sector ministries/departments remain committed to the realization of cross-sectoral collaboration in climate change planning and implementation of adaptation measures. Data sharing protocols can be agreed between MOWRAM and other ministries, and data can be presented in sufficiently utilitarian way for local application. The available climate modeling practitioners and researchers remain available for the project duration, providing input and institutional memory to training and capacity building activities of the project.
Outcome 3 Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change	Indicator 1 Number (national coverage) of automatic weather and climate monitoring network in Cambodia (AMAT 2.1.2.1) Indicator 2 Number and type of targeted individuals with increased capacity to provide O&M training for EWS related infrastructure (AMAT 3.2.1.1 ⁷⁵) Indicator 3 % of financing plan funded for hardware and software operations and	12 fully functional hydrological stations 0 fully functional meteorological stations Unclear as brand of equipment and related supplies that need to be procured Currently O&M is funded by the MOWRAM budget, this is however insufficient. A financing plan is needed for the longer	67 functional hydrological stations (the 12 currently functional, plus the 55 as part of this project) Up to 25 functional meteorological stations 10 key staff from DOM (5) and DHRW (5) trained, and can serve as trainers, in the operations and maintenance of equipment Financing plan with committed resources sufficient to operate and maintain equipment for at least 5 years (including 2 years after the completion of project)	Data records at MOWRAM indicating regularly received data from functioning stations Training records and field demonstration of technology transfers Survey of trainees to gauge level of knowledge and confidence to operate and maintain equipment. Developed sustainable financing plan, increases in MOWRAM budget allocation, and contributions/fees from stakeholders with interest	<u>Risks</u> Inadequate maintenance of meteorology, hydrology and hydro-met stations, resulting in hardware falling into disrepair New equipment is not compatible or consistent with existing systems, making synthesis and analysis of information/data difficult <u>Assumptions</u> The target equipment and infrastructure is compatible and standardized with existing hardware and software. Existing functioning equipment remains in working condition.

⁷⁵ Rephrased AMAT 3.2.1.1 "Number of individuals trained in adaptation related technologies"

	maintenance	term sustainability of the network. This does not currently exist.		to receive customized weather and climate information products	
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4. Total Budget and Workplan

Award ID:	00082718	Project ID(s):	00091519
Award Title:	PIMS 5325 LDCF FSP: Cambodia: Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change		
Business Unit:	KHM10		
Project Title:	Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change		
PIMS no.	5235		
Implementing Partner	Ministry of Water Resources and Meteorology (MOWRAM)		

GEF Outcome / Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Source/ 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)	Budget Note:
OUTCOME 1: Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information	MOWRAM/ DOM, DHRW, NCDM & MAFF	62160	LDCF	72100	Contractual Services - Companies	115,000	115,000	115,000	114,955	459,955	a
				72100	Contractual Services - Companies	35,000	15,000	15,000	15,000	80,000	b
				72100	Contractual Services - Companies	0	200,000	100,000	0	300,000	c
				71300	Local Consultants	12,252	12,252	12,252	12,251	49,007	u
				72500	Office Supplies	6,000	6,000	6,000	6,000	24,000	d
					Sub-total LDCF	168,252	348,252	248,252	148,206	912,962	
					Total Outcome 1	168,252	348,252	248,252	148,206	912,962	
OUTCOME 2: Climate and weather information available for national, sectoral and sub-national planning as well as for transboundary communication in the region	MOWRAM/ NCDM & MAFF	62160	LDCF	71200	International Consultants	50,000	50,000	50,000	50,000	200,000	e
				75700	Workshops	55,000	0	95,000	0	150,000	f, j
				71300	Local Consultants	40,000	10,000	10,000	10,000	70,000	g
				71300	Local Consultants	13,000	15,000	13,000	28,000	69,000	h
				74200	Audio, Visual and Print Prod Costs	0	25,000	75,000	25,000	125,000	i
				71200	International Consultants	0	30,000	0	45,000	75,000	k
				71300	Local Consultants	30,000	20,000	20,000	20,000	90,000	l
					Sub-total LDCF	188,000	150,000	263,000	178,000	779,000	

					Total Outcome 2	188,000	150,000	263,000	178,000	779,000	
OUTCOME 3: Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change	MOWRAM/D OM, DHRM, PDOWRAM & UNDP	62160	LDCF	72100	Contractual Services – Companies	550,500	421,500	441,500	427,500	1,841,000	m
				72100	Contractual Services - Companies	21,750	79,000	122,000	503,750	726,500	n
				71200	International Consultants	24,000	0	0	0	24,000	o
				74200	Audio visual and Print Prod Cost	27,000	25,000	25,000	25,000	102,000	p
				71200	International Consultant			50,000	49,000	99,000	q
				71300	Local Consultants	30,000	30,000	30,000	30,000	120,000	r
				74100	Professional Services	3,000	3,000	3,000	3,000	12,000	s
				73400	Rental & Maintenance of Other Equip	52,500	2,500	2,500	2,500	60,000	t
					Sub-total LDCF	708,750	561,000	674,000	1,040,750	2,984,500	
					Total Outcome 3	708,750	561,000	674,000	1,040,750	2,984,500	
PROJECT MANAGEMENT UNIT	MOWRAM /UNDP	62160	LDCF	71300	Local Consultants	37,748	37,748	37,748	37,749	150,993	u
				74500	UNDP Cost Recovery	20,708	20,708	20,708	20,706	82,830	v
					sub-total LDCF	58,456	58,456	58,456	58,455	233,823	
						Total Project Management	58,456	58,456	58,456	58,455	233,823
PROJECT TOTAL						1,123,458	1,117,708	1,243,708	1,425,411	4,910,285	

Table 8: Summary of Funds (GEF and co-financing)⁷⁶

	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total
GEF	\$1,123,458	\$1,117,708	\$1,243,708	\$1,425,411	\$4,910,285
Others (cash & in-kind)	\$4,430,745	\$7,400,746	\$6,088,656	\$3,964,393	\$21,884,540
TOTAL	\$5,554,203	\$8,518,454	\$7,332,864	\$5,392,304	\$26,794,825

Budget Notes	Description of Cost Items
a	International expertise for hydro-meteorological capacity strengthening and training of trainers for weather forecaster and modelers, and customization of products for sectors. This usually includes training based on a research project in-country. Support should be for the project duration, so that research institution can vet products and advance work as the project continues. Estimated as team of two, one senior \$650/day, 1 junior \$400/day, 400 days across project duration collectively, and travel \$5000/mission, 4 missions
b	GIS licensing estimated @ \$20,000, and related training, \$15,000/year. Free GIS software is available, scoping of available option should be conducted to match to country needs.
c	Teams to conduct multiple risk mapping, includes local travel and DSA, led by local research center, with support from international expertise as necessary.
d	Office supplies and equipment
e	International consultant to conduct training on applying integrating climate information into agriculture planning and preparedness for extreme weather and natural hazards, including on-going mentoring support, estimated @ \$500/day, 90 days/year plus travel
f	Inter-ministerial workshop on experiences, lessons learned and impacts of integrating climate information into planning, to also include best practices from other countries, estimated at \$40,000
g	Local consultant to support the development and testing of the SOP, 180 days @ \$300/day, plus incidentals
h	Randomized control trial-related surveys at the midpoint and end of the project to gauge uptake of climate information at village level, 2 surveys @ \$15,000/survey. Local RCT expert to support initial design and subsequent analysis and interpretation of survey results.
i	Costs of communications materials (e.g. website, videos, information briefs), generation and dissemination of lessons learned, knowledge sharing on transboundary issues
j	Knowledge sharing and partnership building workshops with neighboring countries on transboundary issues, including cross-sectoral representation, 2 workshops @ \$55,000
k	M&E consultant for midterm and final evaluation, per M&E section
l	Inception Report @ \$10,000, and annual measurement of means of verification for project progress on output and implementation, estimated @ \$20,000/year.

⁷⁶ Summary table includes all financing: GEF financing, co-financing, cash, in-kind, etc.

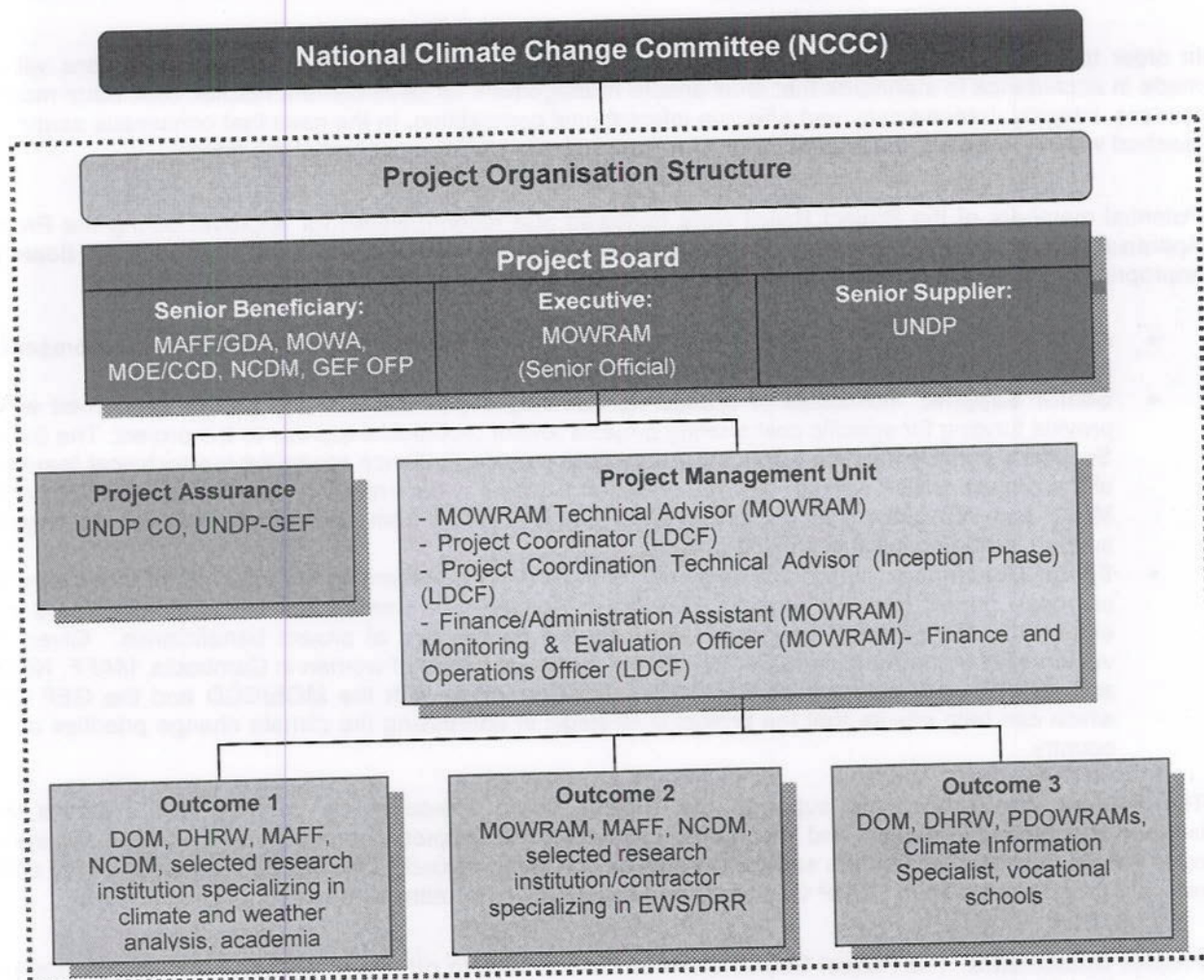
m	Procurement of 25 new meteorological stations (though 7 sites have new equipment not yet operational), \$24,000/each, 55 hydrological stations total estimated at \$15,000/each, and calibration equipment estimated @ \$96,000, related installation and training – 8 trainings at \$40,000/each
n	Local consultants (with support from hydro-met equipment company if appropriate) for operations & maintenance of network, estimated at \$2,500/per met station per year and \$2000/per hydro station per year, plus 2 years (budgeted in final year), in line with phase approach of project.
o	International Consultant to support MOWRAM with initial activities, such as installation prioritization and scheduling, \$400 * 60 days
p	Awareness raising and public-friendly signage at sites, estimated at \$500/sign for 80 signs, plus design costs
q	Innovative Finance Consultant, estimated at 180 @ \$550/day
r	Finance & Operations Officer estimated at \$30,000/year, based UNDP Service Contract Remuneration Scale (April 2014)
s	Annual audit, estimated at \$3,000/year (total \$12,000)
t	Vehicle for O&M, plus maintenance costs
u	Project Coordinator estimated at \$50,000/year, based on UNDP Service Contract Remuneration Scale (April 2014)
v	DPC budget is for recruitment of project staff/consultants, several training activities and procurement of goods and services. Detail of UNDP support services is provided in Annex L

5. Management Arrangements

This project will be implemented following UNDP's National Implementation Modality (NIM).

MOWRAM will be the Implementing Partner for the project and will appoint a MOWRAM Technical Advisor to oversee and provide appropriate guidance to the Project Coordinator. The Project Coordinator, funded by the LDCF project, will be accountable for the day-to-day operations and management of the project. The Project Coordinator will be supported by a Project Finance/Administration Assistant and a Monitoring and Evaluation Officer, to be appointed and funded by MOWRAM. To address gaps identified through the UNDP Micro-Capacity Assessment of the Implementing Partner⁷⁷, the LDCF project will finance additional technical assistance posts to support and build the capacity of MOWRAM, including (1) a short term Project Coordination Technical Advisor (Inception Phase) to facilitate the start-up of the project, and (2) a Finance and Operations Officer to provide day-to-day support on the financial and operational aspects of the project as well as to Terms of Reference for these positions are detailed in the Annex I.

Figure 4: Project Operational Structure



Costs for the Project Coordinator, the Project Coordination Technical Advisor (Inception Phase) and the Finance and Operations Officer will be borne by the LDCF project to fulfil the duties of the project

⁷⁷ A UNDP Micro-Capacity Assessment of the Implementing Partner was conducted during the PPG stage of the project, see Annex G

management unit and will provide mentoring support to the MOWRAM-appointed Monitoring & Evaluation Officer and the Finance and Administration Assistant. At a broader level, to ensure synergies with ongoing efforts in the country as well as consistency with national priorities and strategies, and the project progress will be regularly reported to the National Climate Change Committee through the MOWRAM's Climate Change focal point to the Committee.

The project is governed by a dedicated Project Board comprising of representatives from the Implementing Partner, UNDP and relevant government agencies. The Project Board is responsible for ensuring strategic direction to the project and making management decisions for a project in particular when guidance is required by the Project Coordinator. The Project Board plays a critical role in project monitoring and evaluations by reviewing the quality of project level processes and products, and using evaluations to guide policy decisions aimed at project level 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 Coordinator. 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 prior to clearance by UNDP and GEF (if applicable).

In order to ensure UNDP's ultimate accountability for the project results, Project Board decisions 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 the case that consensus cannot be reached within the Board, the final decision shall rest with the UNDP on behalf of the donor.

Potential members of the Project Board were reviewed and recommended for approval during the Project Appraisal Committee (PAC) meeting. Representatives of other stakeholders can be included in the Board as appropriate. The Board contains three distinct roles, including:

- **An Executive:** individual representing the project ownership to chair the group, will be represented by MOWRAM (Senior Official), who is also appointed as the National Project Director.
- **Senior Supplier:** individuals or groups 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. UNDP will fulfil the role of Senior Supplier, where needed, coordinate with ADB, JICA, MRC, and WB given their expertise and lessons learned from past efforts, as well as ongoing support to related initiatives in the country.
- **Senior Beneficiary:** individuals or groups 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. Given the vulnerability of the Agriculture Sector and the particular needs of women in Cambodia, MAFF, NCDM and MOWA were selected as Senior Beneficiaries, along with the MOE/CCD and the GEF OFP which can help ensure that the project is strategic in addressing the climate change priorities of the country.

The **Project Assurance** role supports the Project Board Executive by carrying out objective and independent project oversight and monitoring functions. The Project Coordinator and Project Assurance roles should never be held by the same individual for the same project. This will be the responsibility of the relevant programme staff of UNDP Cambodia and the UNDP-GEF team at the regional and HQ level.

Project Coordinator: The Project Coordinator 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 Coordinator'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.

Project Support: The Project Support roles, captured under the Project Management Unit, provide project administration, management and technical support to the Project Coordinator as required by the needs of the project.

DOM and DHRW are the primary responsible parties for each of the Outcomes. The Project Coordinator however will also ensure the engagement of various parties during implementation. Under Outcome 1, as activities include the design of tailored products for the agriculture sector, the Project Coordinator will ensure active cooperation by MAFF. And as ADB provides technical training to MOWRAM, cooperation is needed with ADB to ensure a robust and sustainable training programme. Similarly, for Outcome 2 which supports the dissemination of information, active collaboration will be sought with NCDM, which is responsible for communication related to disaster management and response. As Outcome 3 is largely focused on observation hardware/software and related training, active collaboration will be sought with co-finance partners such as JICA, MRC and WB to ensure standardization of equipment as well as a complementary approach to the joint efforts.

Responsible Parties for the project differ by Outcome.

Outcome 1 is focused on the analysis of climate information. Responsible Parties therefore include DOM and DHRW which will receive training and will select modelers, forecasters, meteorologists and hydrologists which will serve as trainers going forward. To ensure sustainability of the training programme, courses will be developed to be housed in a local university. In addition to DOM and DHRW, MAFF, NCDM, and other stakeholders as appropriate (e.g. MOE, MOWA) will be engaged in developing customized climate and weather products with the guidance of a research institution, and are therefore also Responsible Parties under Outcome 1.

Outcome 2 is focused on the dissemination and application of climate information, including transboundary. Responsible Parties include MOWRAM, NCDM, and other parties with roles which will be further defined in the SOP (Output 2.1), such as MOI, MOPTC, and NCDD. Given the special needs of women in agriculture, MOWA will also be engaged to ensure that messages are disseminated in a way that can be understood and applied. Training by a research institution/expert will be provided to MAFF, and other institutions or target groups (e.g. farmer's/women's groups) as appropriate, on the application of the analysis to inform climate resilient planning (Output 2.2), these roles are therefore also captured as Responsible Parties under Outcome 2.

Outcome 3 is focused on hydro-meteorological equipment and related O&M and training. DOM and DHRW, with the support of an EWS expert will define specifications/standards for equipment selection and will establish criteria for the evaluation of pilot initiatives. The evaluation criteria will be used to inform project implementation, specifically the phased installation of stations. DOM and DHRW will also ensure that the O&M training programme for PDOWRAM staff is sustainable by selecting trainees (either from the PDOWRAMs or from within DOM and DHRW) which can serve as trainers going forward, and by supporting the engagement with vocational schools to develop a related curriculum/courses.

Following the results of the UNDP Micro-Capacity Assessment, and with the approval of MOWRAM, UNDP will provide direct support to implementation by supporting human resources, procurement and finance related activities. UNDP is therefore also Responsible Party under the 3 outcomes as well as the project management component.

6. Transfer of Financial Resources

The Implementing Partner is responsible and accountable for managing the project - including the monitoring and evaluation of project interventions - and achieving project outputs, and for the effective use of project

resources. Based on the approved Annual Work Plan, UNDP provides the required financial resources to the Implementing Partner to carry out project activities. The transfer of financial resources is done in accordance with the Harmonized Approach to Cash Transfer (HACT) mechanism, which identifies the following four cash transfer modalities:

1. Direct Cash Transfers to Implementing Partners, for obligations and expenditures to be made by them in support of activities;
2. Direct Payments to vendors and other third parties, for obligations incurred by the Implementing Partners;
3. Reimbursement to Implementing Partners for obligations made and expenditure incurred by them in support of activities;
4. Direct Agency Implementation through which UNDP makes obligations and incurs expenditure in support of activities (Country Office Support Services – COSS).

UNDP has consulted with the Implementing Partner and agreed to adopt the National Implementation Modality (NIM) with Direct Agency Implementation support for the large procurements and hiring of project staff and consultants.

Under the COSS arrangement, UNDP will be responsible for (i) the identification and recruitment of project and programme personnel, (ii) procurement of goods and services, (iii) the administration of donor financial contributions and, (iv) provision of other technical or administrative support required to deliver the outputs. In providing these services, UNDP will apply its rules and regulations. The support services and conditions are described in the Country Office Support Service Agreement in Annex L. Services provided by the UNDP Country Office will be subject to audit by UNDP's external (the United Nations Board of Auditors) and/or internal auditors (UNDP's Office of Audit and Investigation).

Following RGC and UNDP Cambodia procedures, the Implementing Partner will report transferred assets from the project, to the Ministry of Economy and Finance.

Table 9: Estimate of Direct Project Services (DPS)/COSS (US\$)

	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Year 4 (USD)	Total (US\$)
DPS/COSS (support for recruitments, procurement, selection & awarding of sub-contracts, approvals, etc.)	20,708	20,708	20,708	20,706	82,830
Total (US\$)	20,708	20,708	20,708	20,706	82,830

Prior obligations and prerequisites

No prior obligations or prerequisites have been identified.

Agreement on the intellectual property rights and use of logo on the project's deliverables

In order to accord proper acknowledgement to GEF for providing LDCF grant funding, a GEF logo should appear on all relevant GEF-supported project publications, including among others, project hardware, if any, purchased with LDCF funds. Any citation on publications regarding projects supported by GEF using LDCF grants should also accord proper acknowledgement to GEF. Alongside GEF and UNDP logo, MOWRAM logo may also feature as the Implementing Partner of the proposed project.

Communications and visibility requirements:

Full compliance is required with UNDP's Branding Guidelines. These can be accessed at <http://intra.undp.org/coa/branding.shtml>, and specific guidelines on UNDP logo use can be accessed at: <http://intra.undp.org/branding/useOfLogo.html>. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects needs to be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at <http://intra.undp.org/coa/branding.shtml>.

Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf. Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

7. Monitoring Framework and Evaluation

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 Adaptation Monitoring and Assessment Tool (AMAT) and UNDP M&E frameworks.

Project Start

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 programme 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.

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

- Understanding objectives & other outputs and activities.
- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP staff at the country and regional level 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 organization structures should be clarified and meetings planned. The first PB meeting should be held within the first 6 months following the inception workshop.

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 Review

- 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.

Annual Review

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

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

The project will undergo an independent Mid-Term Review at the mid-point of project implementation (expected to be in June 2016). 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 management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The LD/FC/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

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 LD/FC/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).

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and Knowledge Sharing

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

- 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.
- There will be a two-way flow of information between this project and other projects of a similar focus.

Audit

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

Monitoring & Evaluation Activities			
Type of M&E activity	Responsible Parties	Budget US\$ (excluding project team staff time)	Time frame

Monitoring & Evaluation Activities			
Type of M&E activity	Responsible Parties	Budget US\$ (excluding project team staff time)	Time frame
Inception Workshop and Report	<ul style="list-style-type: none"> Project Coordinator (supported by project team) UNDP CO, UNDP GEF 	Indicative cost: \$10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	<ul style="list-style-type: none"> UNDP GEF RTA/Project Coordinator will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members. Project team, 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	<ul style="list-style-type: none"> Oversight by Project Coordinator Project team, esp. M&E expert Implementation teams 	To be determined as part of the Annual Work Plan's preparation. Indicative cost: \$20,000 (total \$80,000)	Annually prior to ARR/PIR and to the definition of annual work plans
Randomized Control Trials ⁷⁸	<ul style="list-style-type: none"> Oversight by Project Coordinator in consultation with MAFF 	To be determined as part of the Annual Work Plan's preparation Indicative cost: \$15,000/survey (total \$30,000)	At midterm and end of project
ARR/PIR	<ul style="list-style-type: none"> Project Coordinator (supported by project team) UNDP CO UNDP/GEF RTA (Bangkok) UNDP Environment & Energy Group (HQ & Bangkok) 	None	Annually
Periodic status/progress reports	<ul style="list-style-type: none"> Project Coordinator (supported by project team) 	None	Quarterly
Mid-term Review	<ul style="list-style-type: none"> Project Coordinator (supported by project team) UNDP CO UNDP/GEF RTA (Bangkok) UNDP Environment & Energy Group (HQ & Bangkok) External Consultants (i.e. evaluation team) 	Indicative cost: \$30,000	At the mid-point of project implementation.
Terminal Evaluation	<ul style="list-style-type: none"> Project Coordinator (supported by project team) UNDP CO 	Indicative cost: \$45,000	At least three months before the end of project

⁷⁸ Please see Annex F for more details

Monitoring & Evaluation Activities			
Type of M&E activity	Responsible Parties	Budget US\$ (excluding project team staff time)	Time frame
	<ul style="list-style-type: none"> UNDP/GEF RTA (Bangkok) UNDP Environment & Energy Group (HQ & Bangkok) External Consultants (i.e. evaluation team) 		implementation
Audit	<ul style="list-style-type: none"> UNDP CO Project Coordinator (supported by project team) 	Indicative cost per year: \$3,000 (\$12,000 total)	Yearly
Visits to field sites	<ul style="list-style-type: none"> UNDP CO UNDP/GEF RTA (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\$ 207,000 (or up to 5% of total GEF/LDCF budget)	

8. Legal Context

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 Standard Basic Assistance Agreement SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

Consistent with the Article III of the SBAA, 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.

The implementing partner shall:

- 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;
- assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

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.

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.

9. References

- Assessment of the Existing Weather and Hydrological Station and their Working Condition Across Cambodia (UNDP, 2013)
- Cambodia Climate Change Strategic Plan (CCCSP) 2014 – 2023 (NCCC, 2013)
- Climate Change Strategic Plan for Water Resources & Meteorology (2013 – 2017), (MOWRAM, 2013)
- Cambodia Climate Public Expenditure and Institutional Review (UNDP, CDDE Facility, ODI, 2012)
- Country Assessment Report for Cambodia – Strengthening of Hydro-meteorological Services in Southeast Asia (UNISDR, WB, NHMS, GFDRR, 2013)
- Institutional Review and Capacity Assessment of the National Committee for Disaster Management (MEF, 2013)
- Microinsurance Study: The Understanding and Needs of Low Income Populations regarding Microinsurance (UNDP, 2013)
- National Adaptation Programme of Action to Climate Change (NAPA), (MOE, 2006)
- National Gender Profile of Agriculture Households, (FAO, MOP, 2010)
- Non-traditional Approaches to Weather Observations in Developing Countries: A Study for the World Bank (J. Snow, 2013)
- Strategic National Action Plan for Disaster Risk Reduction 2008 – 2013 (MOP, 2008)
- Technical Report on Performance of WRF Model Precipitation Forecast Over Cambodia Using Three Horizontal Resolutions and Physical Parameterization Scheme Comparisons (DOM, 2012)
- UNDP Strategic Plan 2014-2017 - Changing with the World (UN, 2013)

10. Annexes

Annex A: Risk Analysis

#	Description	Date Identified	Type ⁷⁹	Impact & Probability ⁸⁰	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
1	Failure of forecasting/modeling training programmes to build institutional knowledge or adequately take into account high staff turnover	PPG	Organizational	P: 3 I: 4	While staff turnover cannot be addressed as part of this project, the training programmes will be designed in a way that ensures sustainability by: <ul style="list-style-type: none"> designing a curriculum which can be housed in a local university or other institution for future learning developing a train-the-trainers programme that will enable DOM and DHRW to maintain a pool of master trainers as part of their regular learning programmes 	MOWRAM	MOWRAM, UNDP CO	July 2014	
2	Climate products generated/distributed by MOWRAM do not meet the needs of stakeholders	PPG	Strategic	P: 2 I: 4	Stakeholders are engaged throughout the design and implementation phases of the project, informing the design of the climate products to best suit their needs. Additional training of stakeholders on interpreting these products for planning purposes will also ensure their usefulness. The product design can be revisited as needed to ensure	MOWRAM	MOWRAM, UNDP CO	July 2014	

⁷⁹ Organizational, Financial, Operational, Environmental, Strategic, Regulatory, Security, Political, Other

⁸⁰ Impact and Probability Scale, 1-5 (from very low to very high)

#	Description	Date Identified	Type ⁷⁹	Impact & Probability ⁸⁰	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
					that the relevant data is communicated in a way that can be understood and applied.				
3	Poor coordination between implementing and executing agencies, as well as development partners	PPG	Organizational	P: 3 I: 4	Consultations were conducted with stakeholders and development partners during the PPG stage of the project, with project management arrangements discussed and agreed which facilitate coordination (detailed in Section 4). Effectiveness of the management arrangements will be verified through the regular project implementation reviews and M&E undertaken following UNDP rules and principles. Adjustments may be made to the management arrangements as/if necessary with the approval of the Project Board.	MOWRAM	MOWRAM, UNDP CO	July 2014	
4	Lack of effective early warning communication at the commune and village levels	PPG	Organizational	P: 4 I: 4	NCDM is responsible for disaster preparedness and response interventions in Cambodia. NCDM, however, has limited capacity especially at the commune and village levels to effectively fulfil its mandate. There are ongoing co-financing initiatives which seek to address this. Further, SOPs will be put in place for more effective coordination across various governmental levels and	MOWRAM	MOWRAM, UNDP CO	July 2014	

#	Description	Date Identified	Type ⁷⁹	Impact & Probability ⁸⁰	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
					timely distribution of information.				
5	Inadequate maintenance of meteorology, hydrology and hydro-met stations, resulting in hardware falling into disrepair	PPG	Operational	P: 3 I: 4	<p>Cost of O&M for the duration of the project have been captured in the project budget.</p> <p>However, ownership of, and therefore accountability for, the stations is with Cambodian government. Reflecting this responsibility, MOWRAM has committed \$150,000/year for ongoing O&M of the observation network. This project will further support longer term O&M of the stations by designing a financing plan, which includes strategies for engagement of the private sector.</p> <p>Training programmes for O&M of the equipment will be designed to be periodic, therefore not only at time of installation. In that way, the training programme will also look towards the longer term, by building the skills and confidence of individuals to identify and immediately fix/report any problem at the stations. A train the trainer approach will ensure benefits to a wider set of personnel and ensure that skills are retained within the institution.</p>	MOWRAM	MOWRAM, UNDP CO	July 2014	

#	Description	Date Identified	Type ⁷⁹	Impact & Probability ⁸⁰	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
6	New equipment is not compatible or consistent with existing systems, making synthesis and analysis of information/data difficult	PPG	Operational	P: 2 I: 3	<p>Standardization has been challenge. The project will therefore prioritize the need for standardization in the purchase of new equipment. One of the initial activities of the project is to review lessons learned and define national criteria for the procurement of observation equipment.</p> <p>As part of the prototype approach, quality of O&M of new equipment will be verified to ensure that data transmission requirements are met and staff are able to maintain stations, before additional stations are procured.</p>	MOWRAM	MOWRAM, UNDP CO	July 2014	

Annex B: Agreements

Any additional agreements, such as cost sharing agreements, project cooperation agreements signed with NGOs⁸¹ (where the NGO is designated as the "executing entity", letters of financial commitments, GEF OFP letter, GEF PIFs and other templates for all project types) should be attached.

All the co-financing letters are attached in a separate file, which is an integral part of this document.

⁸¹ For GEF projects, the agreement with any NGO pre-selected to be the main contractor should include the rationale for having pre-selected that NGO.

Annex C. Assessment of Existing Weather and Hydrological Stations and Their Working Condition Across Cambodia

Prepared for UNDP by Liko Solangkoun

Background: This assessment is the result of a PPG activity to assess the condition of hydro-meteorological stations and to propose achievable solutions, which can be translated into activities under the LDCF project. The assessment consultant was accompanied by representatives from DOM and DHRW, as well as a member of the LDCF project development team. The assessment was conducted between 1-23 October 2013, and included site visits to 24 meteorological stations and 114 hydrological stations.

The below is a summary of findings and conclusions, the complete report is available upon request.

Summary

Status of Meteorological Stations

No.	Province	Visit Date	Priority	Coordinates		Station Type	Current Status		Recommendation/ Action By	Remarks	
				Latitude	Longitude		Civil Work	Instrument			
1	Phnom Penh	3-Oct-2013		2	11.600	104.564	AWS/MN	Minor CW	Campbell	MOWRAM	Needs more parameters
2	Prey Veng	4-Oct-2013		2	11.467	105.150	AWS/MN	Under Rehabilitation	Needs New Instruments	MOWRAM	
3	Svay Rieng	4-Oct-2013	1		11.083	105.783	AWS/MN	Poor Condition	Campbell – too old	EWS project	Upgrade is required
4	Kampot	5-Oct-2013		2	10.617	104.217	AWS/MN	Poor Condition	Campbell – too old	MOWRAM	Needs more parameters
5	Takeo	5-Oct-2013		2	10.983	104.800	AWS/MN	Good Condition	Campbell – new	MOWRAM	Needs more parameters
6	Koh Kong	6-Oct-2013		2	11.633	103.000	AWS/MN	Good Connection	Campbell – new	MOWRAM	Needs more parameters
7	Sihanouk Ville	6-Oct-2013		2	10.633	103.483	AWS/MN	Good Connection	Campbell – new	MOWRAM	CCCA
8	Kompong Speu	7-Oct-2013		2	11.344	104.056	AWS/MN	Good Connection	Campbell – new	MOWRAM	Needs more parameters
9	Kompong Chhang	8-Oct-2013		2	12.241	104.667	MN	Fence	No AWS	MOWRAM	Needs more parameters
10	Pursat	10-Oct-2013		2	12.550	103.900	2 AWS/MN	Good Connection	Sutron, Campbell – new	MOWRAM	Upgrade is not required
11	Banteay Meanchey	11-Oct-2013	1		13.609	102.971	AWS/MN	New Installation	Sutron – new	EWS project	Upgrade is not required
12	Battambang	11-Oct-2013	1		13.100	103.200	AWS/MN	New Installation	Sutron, Campbell – new	MOWRAM	AWS available

13	Pailin	11-Oct-2013	1		12.859	102.618	MN	New CV including fence	No AWS	EWS project	Needs more parameters
14	Oddar Meanchey	12-Oct-2013		2	14.160	103.300	MN	New CV including fence	No AWS	MOWRAM	Needs more parameters
15	Preah Vihear	12-Oct-2013	1		13.780	104.960	MN	New CV including fence	No AWS	EWS project	Upgrade is required
16	Siem Reap	12-Oct-2013	1		13.367	103.850	AWS/MN	Station Platform good	All instruments to be removed, reinstalled	MOWRAM	JICA equipment available
17	Kompong Thom	14-Oct-2013	1		12.686	104.900	AWS/MN	2 Campbell, 1 Australia, 1 JICA	KAWA, Japan, Australia	EWS project	Upgrade is required but needs clarification from DOM
18	Kompong Cham	16-Oct-2013	1		12.000	105.270	MN	2 Tower empty	No AWS	EWS project	Upgrade is required
19	Kratie	17-Oct-2013		2	12.286	106.024	MN	2 Tower empty	No AWS	MOWRAM	Upgrade is not required
20	Stung Treng	18-Oct-2014	1		13.519	105.971	AWS/MN	2 Tower, 2 empty	1 Campbell – old	EWS project	Upgrade is required
21	Ratanakiri	19-Oct-2013		2	13.730	107.000	MN	Fence only	1 manual rain	EWS project	Upgrade is required
22	Mondolkiri	20-Oct-2013	1		12.817	102.617	MN	Fence only	1 manual rain	EWS project	Upgrade is required
23	Kandal	3-Oct-2014		2							
24	Kep			2							

MN – Manual EWS – Early Warning Systems AWS Automatic Weather Station CCCA – Cambodia Climate Change Alliance

Status of Hydrological Stations

No.	ID	Priority	Station	Province	Date Visited	Equipment	Status	Year Installed	A, Shelter, Facilities	Funded by
1	430102	N/A	Seam Pang	Stung Treng	18-Oct-2013	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
2	014501	N/A	Stung Treng	Stung Treng	18-Oct-2013	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
3	020102	N/A	Prek Kdam	Kandal	3-Oct-2013	VSG/OTT SE 200	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
4	610101	N/A	Kg Thom	Kg Thom	14-Oct-2013	VSG/OTT RLS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
5	014901	N/A	Kratie	Kratie	17-Oct-2013	VSG/OTT CBS	A OP	2007	HYCOS repair	MRC-HYCOS
6	033401	N/A	Chat Tomuk	Phnom Penh	3-Oct-2014	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
7	0201066	N/A	Kg Loung	Pursat	8-Oct-2013	VSG/OTT SE 200	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
8	440102	N/A	Veoun Sai	Ratanakiri	19-Oct-2014	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
9	450101	N/A	Lom Phat	Ratanakiri	19-Oct-2014	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
10	550102	N/A	Battambang	Battambang	11-Oct-2013	VSG/OTT RLS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
11	640102	N/A	Thnous Loung	Kg Speu	7-Oct-2013	VSG/OTT RLS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS

No.	ID	Priority	Station	Province	Date Visited	Equipment	Status	Year Installed	A, Shelter, Facilities	Funded by
12	530101	N/A	Spean Santepheap	B Meanchey	11-Oct-2013	VSG/OTT CBS	A OP	2007	SG Gd, Shelter Gd	MRC-HYCOS
13	551101	1	Prek Chik (river)	Battambang	10-Oct-2013	SG/OTT Pheneus Mini	A NOP	2007	SG Gd, Shelter Gd	JICA
14	550104	1	Dong Tong	Battambang	11-Oct-2013	SG/OTT Mini	A NOP	2007	SG Gd, Shelter Gd	JICA
15		1	Prek Ta Taing	Kandal	16-Oct-2013	SG/MRC Housing	A NOP	Old JICA	SG Poor, Shelter Gd	JICA
16	033402	1	Koh Khel	Kandal	4-Oct-2013	SG /Orphimedes	A NOP		SG Poor, Shelter Gd	MRC
17		1	Spean Tros	Kg Cham	16-Oct-2013	SG, SEBA	M NOP		SG Poor, Shelter Gd	MRC
18	590105	1	Ta Kab	Kg Chhang	8-Oct-2013	SG/OTT Thalimedes	A NOP	2007	SG Gd, Shelter Gd	JICA
19	590102	1	Peam	Kg Chhang	7-Oct-2013	SG/OTT Pheneus Mini	A NOP	2007	SG Gd, Shelter Gd	JICA
20	020150	1	Koh Kong	Koh Kong	6-Oct-2013	No SG	M NOP	New bridge	No Shelter, No SG	DHRW
21	020120	1	Sre Ambel	Koh Kong	6-Oct-2013	SG	M NOP	New bridge	No Shelter, No SG	DHRW
22	020140	1	Trapeang ROUNG	Koh Kong	6-Oct-2013	SG	M NOP	New bridge	No Shelter, No SG	DHRW
23	020100	1	Koh Pos	Koh Kong	6-Oct-2013	SG	M NOP	New bridge	No Shelter, No SG	DHRW
24	020110	1	Andaoung Toeuk	Koh Kong	6-Oct-2013	SG	M NOP	New bridge	No Shelter, No SG	DHRW
25		1	Pailin	Pailin	11-Oct-2013		New site proposed		No Shelter, No SG	DHRW
26		1	Boeung Tamak	Phnom Penh	3-Oct-2013	Stilling well	M NOP	JICA	Gd Shelter, No SG	JICA
27	670101	1	Prey Veng	Prey Veng	4-Oct-2013	SG/SEBA	A NOP		Gd Shelter, tower	DHRW
28	200110	1	Kompong Popil	Prey Veng	16-Oct-2013	SG	M OP		No SG, new bridge	DHRW
29	200120	1	Snay Pol	Prey Veng	16-Oct-2013	SG	M OP		No SG, new bridge	DHRW
30	019806	1	Neak Leung	Prey Veng	4-Oct-2013	SG/Nimbus	A NOP		Gd Shelter, Gd SG	MRCS
31	660101	1	Kg Trabek	Prey Veng	4-Oct-2013	SG	M OP		Gd Shelter, Old SG	MRCS
32	580133	1	Bamnak B	Pursat	8-Oct-2013	SG/OTT Thalimedes	A NOP	2007	Gd Shelter, Gd SG	JICA
33	580134	1	Veal Veng	Pursat	9-Oct-2013	SG/OTT Pheneus Mini	A NOP	2008	Gd Shelter, tower	JICA
34		1	Pursat	Pursat	10-Oct-2013	SG	A NOP		Gd Shelter, Gd SG	JICA
35	440103	1	Andaung Meas	Ratanakiri	19-Oct-2013	SG/Nimbus/RG	A NOP	Sok (MRC)	MSG good	3S
36	560102	1	Prasat Keo	Siem Reap	12-Oct-2013	SG	M OP	With propeller	MSG poor	JICA
37	430103	1	Chan Tangoy	Stung Treng	17-Oct-2013	SG/Nimbus	A NOP	JICA	Gd SG, Gd Shelter	MRC-JICA
38	440101	1	Ban Kamphoun	Stung Treng	17-Oct-2013	SG/Nimbus	A NOP	JICA	Gd SG, Gd Shelter	MRC-JICA
39	019802	1	Kg Cham	Kg Cham	16-Oct-2013	SG/Nimbus	A OP	2000	No Shelter, old SG	MRCS
40	650101	2	Svay Rieng	Svay Rieng	4-Oct-2013	SG	M OP		GS SG, Gd Shelter	DHRW
41		2	Prek Koy	Kandal	16-Oct-2013	SG/Thalimedes	M NOP		No shelter, old	MRCS
42	640103	2	Peam Kley	Kg Speu	7-Oct-2013	SG/Thalimedes	A NOP	2007	Gd shelter, poor SG	MRCS
43	100001	2	Prek Toeuk Chhou	Kampot	5-Oct-2013	SG minidata destroyed	A NOP	Recommend to remove	No shelter, no SG	DHRW
44		2	Sambor	Kratie	17-Oct-2013	SG	M NOP		No shelter, poor SG	DHRW
45	610102	2	Kg Putrea	Preah Vihear	13-Oct-2013	SG	M OP	New site proposed	No shelter	DHRW
46	19901	2	Stung Slot	Prey Veng	4-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
47	670110	2	Prey Veng Tower	Prey Veng	4-Oct-2013	SG	M OP		SG Shelter, old SG	DHRW
48		2	Kbal Chhay 1	Sihanoukville	6-Oct-2013	SG	M OP	Kg Som	SG damaged	DHRW
49	580131	2	Koh Chhom	Pursat	10-Oct-2013	SG	M OP	2007	MSG, poor	DHRW

No.	ID	Priority	Station	Province	Date Visited	Equipment	Status	Year Installed	A, Shelter, Facilities	Funded by
50	581102	2	Svay Donkeo	Pursat	10-Oct-2013	SG	M OP		No SG, old bridge	DHRW
51	550105	3	Moung Russey	Battambang	10-Oct-2013	SG	M OP	Installed 2007	No SG	DHRW
52	020103	3	Kg Chhnang	Kg Chhnang	8-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
53	590101	3	Boribo	Kg Chhnang	8-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
54	600101	3	Kg Chen	Kg Thom	13-Oct-2013	SG	A NOP		No shelter, poor SG	DHRW
55	620101	3	Kg Thmar	Kg Thom	14-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
56	640140	3	Sandan	Kh Thom	14-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
57	610103	3	Panhachi	Kg Thom	14-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
58		3	Taing Krasaing	Kg Thom	14-Oct-2013	SG	M OP		No shelter, poor SG	DHRW
59	020130	3	Phum Dong	Koh Kong	6-Oct-2013	SG	M NOP	Housing only	No shelter, poor SG	DHRW
60	019801	3	Chr Changvar	Phnom Penh	11-Oct-2013	SG/Nimbus	A NOP	M only	Good shelter, no SG	MRCS
61	020101	3	P Penh Port	Phnom Penh	11-Oct-2013	SG/Nimbus (Sok)	A OP	Poor condition	Good shelter/G SG	MRCS
62		3	Preah Vihear							
63	580201	3	Peam Hav	Pursat	10-Oct-2013	SG	M OP		No SG, damaged bridge	DHRW
64	580130	3	Bamnak (Up)	Pursat	8-Oct-2013	SG	M OP		MSG/ Poor	DHRW
65	580120	3	Taing Leach	Pursat	21-Oct-2013	SG	M OP		MSG/Poor	DHRW
66		3	Prey Klong (down)	Pursat	9-Oct-2013	SG	M OP		MSG/Poor	DHRW
67	571101	3	Kg Kdei	Siem Reap	13-Oct-2013	SG	M OP		MSG/Poor	DHRW
68	570102	3	Chong Khneas	Siem Reap	12-Oct-2013	SG/Nimbus/Cambe II	A NOP	Hydro/meteo	MSG/poor	MRCS
69	560103	3	Kraing Kroch	Siem Reap	12-Oct-2013	SG	M OP	Old	Old	MRCS
70	680101	DHRW	Kg Ampil	Takeo	5-Oct-2013	SG/SEBA	A NOP	damaged	damaged	DHRW
71	680103	DHRW	Koh Andet	Takeo	5-Oct-2013	No SG		damaged	damaged	DHRW
72		DHRW	Dong Tong	Koh Kong	6-Oct-2013	SG	M NOP			DHRW
73		DHRW	Kbal Chhay 2	Sihanoukville	8-Oct-2013	SG	M OP	KG Som	SG Damaged	DHRW
74	580132	DHRW	Bamnak A	Pursat	9-Oct-2013	SG/OTT Thalimedes	A NOP	2007	No Shelter, G-SG	DHRW
75	580302	DHRW	Prey Klong	Pursat	10-Oct-2013	SG	M OP		MSG/Poor	DHRW
76	580110	DHRW	Kbal Hong (up)	Pursat	10-Oct-2013	SG	M OP			DHRW
77	580120	DHRW	Kbal Hong (up)	Pursat	10-Oct-2013	SG	M OP			DHRW
78	580104	DHRW	Kbal Hong (down)	Pursat	10-Oct-2013	SG	M NOP		MSG/Poor damaged	DHRW
79	540101	DHRW	Kralanh	Siem Reap	12-Oct-2013	SG	M OP		MSG/Poor	DHRW
80		DHRW	Chihe	Kg Cham	16-Oct-2013	SG	M NOP		MSG/Poor	DHRW
81	580103	DHRW	Baktrakoun	Pursat	21-Oct-2013	SG/OTT Orphemedes	A NOP	2004	Abandoned	DHRW
82	580105	DHRW	Lolok Sa	Pursat	21-Oct-2013	SG	M NOP		MSG/Poor	DHRW
83	580310	DHRW	Sanlong (up)	Pursat	21-Oct-2013	SG	M NOP		MSG/Poor	DHRW
84	580320	DHRW	Sanlong (down)	Pursat	21-Oct-2013	SG	M NOP		MSG/Poor	DHRW
85	583010	DHRW	Thlea Maam (1)	Pursat	21-Oct-2013	SG	Abandoned		No SG	DHRW
86	583020	DHRW	Thlea Maam (up)	Pursat	21-Oct-2013	SG	Abandoned		No SG	DHRW
87	580330	DHRW	Svay At	Pursat	22-Oct-2013	SG	M NOP		MSG/Poor	DHRW

No.	ID	Priority	Station	Province	Date Visited	Equipment	Status	Year Installed	A, Shelter, Facilities	Funded by
88	581310	DHRW	Wat Liep (down)	Pursat	22-Oct-2013	SG	Abandoned		No SG, irrigation	DHRW
89	581410	DHRW	Wat Liep (up)	Pursat	22-Oct-2013	SG	Abandoned		No SG, irrigation	damaged
90		DHRW	Stung Kantout	Kandal	Damaged	SG	No Info		damaged	Damaged
91	550101	DHRW	Treng	Battambang	flooded	SG	M NOP		flooded	
92	520101	DHRW	M Borey	B Meanchey	flooded	SG	M OP		flooded	
93		DHRW	Tep Krasar	B Meanchey	flooded	SG	M NOP		flooded	
94		DHRW	Rokakaong	Kg Cham	flooded	SG	M NOP		flooded	
95	020108	DHRW	Chhnok Trou	Kg Chhang	flooded	SG/Thalimedes	A NOP		flooded	
96	590103	DHRW	Svay Chek	Kg Chhang	flooded	SG	M OP		Flooded	DHRW
97	580106	DHRW	Phum Kos	Pursat	flooded	SG	M OP		Flooded	DHRW
98	581101	DHRW	Campang	Pursat	flooded	SG	M NOP		No visit	DHRW
99	581210	DHRW	Kroch seuch (up)	Pursat	flooded	SG	M NOP		No visit	DHRW
100	581220	DHRW	Kroch seuch (down)	Pursat	flooded	SG	M NOP		No visit	DHRW
101	583101	DHRW	Banteay Krang	Pursat	flooded	SG	Abandoned		No visit	DHRW
102	560101	DHRW	Bot Chvear	Siem Reap	flooded	SG	Abandoned		No visit	DHRW
103	650102	DHRW	Kompong Trach	Svay Rieng	flooded		No info		Flooded	DHRW
104	702104	DHRW	O Smach	Svay Rieng	flooded		No info			
105	201107	DHRW	Bakprea	Battambang	flooded	SG	M NOP			
106	551102	DHRW	Toul Tathon	Battambang	flooded	SG	M NOP		No SG	DHRW
107		DHRW	Tasal	Kg Speu	Road blocked		No info		No SG	DHRW
108		DHRW	Kampong Touk	Takeo	Road blocked	SG	M NOP		Road block	DHRW
109		DHRW	Angkor Borey	Takeo	Road blocked	SG	M NOP			
110	900101	DHRW	Chop Pring		Road blocked	No SG	Abandoned			
111		DHRW	Chue Tea Chrom				No info			
112		DHRW	Peam Sdei				No info			
113		DHRW	Chibrorong				No info			
114	660102	DHRW	Prek Tatam	Prey Veng	flooded	SG/Minidata	A NOP		No shelter	DHRW

SG – staff gauge,

Gd – good

M – manual

OP – Operational

NOP – Not operational

Conclusions

The national hydro-meteorological services (NMHS) in Cambodia are currently faced with high demand for timely and quality information, services and products. However, inadequate observational station network due to lack of instruments, shortage of trained personnel, and in some cases problems associated with flood, security, the telecommunications systems, data processing and information dissemination facilities are major drawbacks. The infrastructure and facilities have continued to deteriorate leading to great difficulties in giving hydrology, weather and climate services in the region to meet national and regional needs.

The most important step in integrating the NHMSs of Cambodia is the harmonization of the policies in observing practices, exchange of data and products, capacity building education and training including research and development. In this connection, it is important for the NHMSs to have similar institutional framework and same operating status. There should also be rationalization of common projects in hydro-meteorological services.

Despite the problems faced by the NHMSs in Cambodia, it is recognized that, within the means available, the government has to contribute to the current level of operations. However, there is a need to address the following areas:

- a) Rehabilitation and enhancement of the basic hydro-meteorological services infrastructure to enable the NHMSs to fulfill their national and international obligations;
- b) Replacement and upgrade basic equipment and hydro-meteorological instruments;
- c) Improvement of telecommunications facilities for rapid data exchange;
- d) Enhancement of human resources within the NHMSs through recruitment and training;
- e) Support for research and development, and application of hydro-meteorological services and products.

In order to contribute to the EWS and the Cambodian hydro-meteorological programme, it is necessary to find short term and long-term solutions to the stations which are silent for various reasons, and the gaps in the network.

It is suggested that these should be taken in conjunction with international organizations such as MRC, WMO, UNDP, as well as the Global Facility for Disaster Reduction and Recovery (GFDRR).

Short Term Solutions

- To improve, operate and install automatic weather stations (AWS) at key locations based on the Priority 1 selected,
- To strengthen knowledge of hydrological staff up to the post-graduate level,
- To strengthen the collaboration with all local authorities concerned and international organizations,
- To improve telecommunications, data transmission system (e.g. GPRS, SMS, email, internet, microwave frequencies using Wi-Fi technology, offer good prospects),
- To assist in acquisition of basic hydro-meteorological equipment for key stations to ensure continuity of records.

Medium to Long Term Solutions

- To increase the capability of measuring, transmitting and managing of data in the computer system,
- To provide national capability to produce basic equipment and consumables, (e.g. manual rain bucket, staff gauges, etc.)

- To increasing the capacity of hydrological and meteorological staff through training on information management and analysis,
- To introduce and innovate modern technology for the operation and maintenance of equipment as well as train staff on operation and maintenance of equipment, IT etc.
- To research analyses and create precise hydro-meteorological information in order to better serve the needs of Cambodia.
- To equip the broadcasting emergency help system in all cases of climate change and disaster phenomena.

The development and construction of an Early Warning System is not sufficient to guarantee a good warning. As the result of flooding in Cambodia in September 2013, 17 provinces were affected by floods, there were 134 confirmed deaths, more than 377,000 households were affected and more than 26,000 households were evacuated to safe areas.

The EWS must be transferred to the people at risk through a chain of actions starting with a conversion of the forecast into warning by a decision process involving different stages, and finally, the warning has to be converted into appropriate action by local authorities and the people at risk themselves. The performance of an early warning system must be measured on how effective these actions are:

- A warning that is too late for response is useless.
- The warning must be an integrated part of a complete information system. We have to identify the path of the warning from the forecast to the persons responsible for decision making for disaster, flood protection actions. This is an aspect that has been little covered in the literature, and the experiences of administrators in different parts of the world are called for, and are to be compared with the experience of local administrators.
- The last part is the conversion of warnings into response action on ground from those who obtain the warning. How is the warning used for different purposes, and which methods can be used to help, or to give people the means and the information to help themselves? Social scientists (*Kraas, and Affeltranger, in MRCS*) reviewed local persons and non-governmental organizations with considerable experience and identified weak points in the structure of information transferred to end users:
 - Experiences which cannot be directly translated into engineering solutions, but which are invaluable for local decision making.
 - The major conclusions were based on the task of seeing the early warning as a holistic problem, in which all components of the chain of actions had equal weight
 - The emphasis on forecasting being important, but other more neglected aspects needing more attention in the future.
 - This includes first of all a strengthening of the staff at all levels: to be able to handle early warnings, to build up capacity and experience, and last but not least, to increase the institutional memory. Good weather information, hydro-meteorological information requires good meteorologists, hydrologists who can evaluate the information provided from forecasts of weather, climate and flood by forecasting services such as the DOM, DHWR, the WMO as well as the Typhoon Committee.

Recommendations

Adequacy and Efficiency of the Current Station Network

The current network has gaps in some areas and is silent in others. To address this, the following are recommended:

- AWSs should be installed, especially in vulnerable areas with gaps or sparsely populated, to ensure that data is available for the EWS purpose.
- To ensure continuity key stations with good and long records must be maintained and equipped
- Improve telecommunications taking into account available technology. The example of data transmission technology by MRC-Mekong-HYCOS could be applied.

Capacity of NMHSs to Operate and Maintain Existing Stations

The issue of affordability should be taken into account since Cambodia as some other South East Asian SEA Countries may not be able to sustain the operation of some equipment (e.g. radar, AWS). It is recommended that:

- Telecommunications to key stations should be improved urgently
- Deploy AWSs at key stations
- Training must be given on high priority. In many instances, weather messages are lost due to poor coding (formatting). There is also a need to train technicians and on IT
- The use of Aircraft Meteorological Data Relay (AMDAR) should be enhanced. Data should be made readily available on Global Telecommunication System (GTS)

Causes of Silence of Stations

The main causes of silence of stations in Cambodia are:

- Lack of staff. Cambodia still has insufficient staff to operate stations. This is mainly due to insufficient financial resources and lack of recruitment. Some stations are manned one observer.
- Inadequate telecommunication facilities. Data cannot reach National Mekong Committees (NMCs) as most of the stations are manual and data are not on real time basis.
- Lack of equipment and instruments due to poor financial resources. The national hydrological and meteorological services (NHMSs) cannot afford to buy equipment and instruments. Most of these are not available locally and generally expensive.
- Selection of stations in the basic network, especially flood, irrigation, climate change as well as some for DRR, is not done in consultation with NHMSs. Many good stations have been left while those included are chosen on the basis of location and to some extent length of record.

Human Resources Capacity for Operation and Maintenance of Instruments

- Efforts must be made to assist Cambodia to have capacity to maintain instruments. The need is for provision of calibration equipment and trainings are needed.
- Those that have very limited staff should be assisted to use facilities in neighboring countries or regional centers.

Influence of the Infrastructure

With the current station network roads, power and water are not a major problem in most cases as Cambodia. It is recommended that:

- The station site should have nearby the village to reduce risk of vandalism,
- The station site, especially weather station should be close to existing telephone lines or under telephone network coverage for economical connections. A possibility of direct access to AC power supply, which is more trust-worthy than independent supplies (solar panels etc.), so peripherals consuming a significant amount of power may be supplied in a continuous manner.
- There should be local personnel (private or public) to help maintain the site to meet MOWRAM's requirement,
- Make sure that the weather station is secured to interventions from irrelevant persons or animals.

- Avoid installation of many weather towers, and for same parameter but different brand in the same station platform. One may interfere with the other through reflection of solar radiation, further may influence the rain, temperature, humidity sensors. Therefore, need to follow the prescribed guidance of World Meteorological Organization (WMO).

Operation and Maintenance

The hydro-meteorological stations operated by NHMSs and other agencies that have good records. It was found that there are no proper arrangements for the operation and maintenance of stations, especially after the end of the project. It is therefore recommended that:

- Memoranda of Understanding (MoU) for ownership and operation & maintenance of stations should be signed by the parties concerned: DOM, DHRW and the donor. The general objective of this MoU is to ensure the long-term sustainable management, operation and maintenance of the hydro-meteorological network and to identify the agreed resources and agreed procedures and payment conditions to provide these resources and support systems.
- Frequent contacts be made in order to ensure smooth and sustainable operation of the stations for benefit of the Cambodia as well as WMO community,
- Engagement of DOM and DHRW in the national DRR planning and institutional frameworks and reflection of the roles of NHMSs with partners such as the MRC, JICA, WB, GFDRR, UNISDR.
- Some of the more important routine operation and maintenance chores can and should be performed by local maintenance personnel since they can access the station on a regular basis, while special work should be performed by a trained technician from the Center.

Potential Areas of Collaboration

Areas of collaboration with other agencies include:

- Operation and maintenance of station networks (Ministries of Water Resources and Hydrology, Ministry of Agriculture, research institutions as well as private investors, such as hydropower developers, etc.)
- Early warning system for flood disasters risk reduction, water supply, power generation as well as warning for flood security, should have regular contacts with relevant institutions aimed at improving services to these sectors. EWS require coordination across many levels and agencies reflected in national to local disaster risk reduction plans, legislation and coordination mechanisms.

Selection and Validation of Automatic Instrumentation for EWS

The list of stations to be upgraded with priority ranking and proposal of equipment and communication system should be discussed and validated during consultations with DOM and DHRW. The stations are proposed as Priority 1 should be installed with priority, while the stations are proposed as priority 2 and Priority 3 will be upgraded depending on availability of budget.

It is suggested that the process of choosing equipment is based on the following:

- The project requirement in terms of real time data acquisition and transmission,
- Experience or familiar operation and maintenance of DOM and DHRW to ensure that the most suitable equipment be selected.
- The list of proposed equipment should consist of many suitable types that come from successful projects such as MRC, JICA in other similar river systems projects across the world.
- It is easy to operate and maintain
- The communication between the AWS, Automatic Hydrological Station (AHS) and the collection agency should be: reliable, inexpensive, and in line with standard protocols.

Recommendations on the status of early warning systems

In order to improve on the status of the infrastructure for hydro-meteorological early warning systems, it is recommended that the Government and UNDP should assist NHMSs to:

- Revive or establish more stations to increase the availability of hydrological and climatic data required for monitoring droughts and floods;
- Establish automatic weather stations in data sparse areas including over the Tonle Sap, and along main rivers;
- Improve the network of surface synoptic meteorological stations;
- Acquire and network weather radars for monitoring severe weather events for the safety of air and marine navigation and disaster management;
- Improve telecommunications for rapid and effective data and information exchange;
- Enhance cooperation between the NHMSs, disaster management authorities and the media to ensure timely dissemination of products and information, related to early warning.

Annex D. Country Assessment Report for Cambodia, Strengthening of Hydro-meteorological Services in Southeast Asia (UNISDR, WB, WMO, NHMS, GFDRR)

Executive Summary

The role of hydro-meteorological services

All human activities are linked to weather and climate. As a matter of fact, various economic sectors have started to appreciate the value of weather forecasts due to worsening impacts of hydro-meteorological related hazards as a result of changing weather patterns. The extreme events that were experienced in recent years are precursors of the impacts of a changing climate. With climate change, the impacts will exacerbate and will continuously affect all sectors in unprecedented ways, particularly in many areas where water is a limited resource. On the other hand, tropical cyclones can generate extreme rainfall event resulting to catastrophic flooding. The attendant weather extremes manifested in floods and droughts considerably decrease agricultural productivity and aquaculture. Accelerated sea level rise will expose more people to the risk of coastal flooding while increased exposure to vector-borne infectious diseases and heat stress will threaten human health. Moreover, tourism which is an important source of income would be affected by severe disruption from climate change and sea level rise.

As more weather extremes start to unfold, demand for more accurate, timely and effective weather forecasts and climate prediction at all-time scales and other crucial information will be sought for the human safety and well-being and for planning. Hence, national meteorological and hydrological services (NMHS) will need to expand to meet the emerging needs of the various economic sectors.

To achieve or address such demand, it is urgent to put in place or enhance the very basic requirements for an NMHS to function effectively:

- adequate networks to monitor hydro-meteorological parameters;
- a robust communication system for data transmission, disseminate of forecasts and sharing of information;
- high speed computing system for data assimilation and ensemble forecasting;
- human resource equipped with appropriate trainings; and
- more interaction with users of weather and climate information.

But the transboundary nature of weather-causing phenomena would require collaboration among NMHS in the region; hence there is now an urgent need to enhance regional cooperation and data sharing which is currently being undertaken by the WMO through its WMO Information System (WIS).

Assessment of needs of improved hydro-meteorological services in Cambodia

In its current capacity, the Department of Meteorology (DOM) is mandated to provide the basic services needed for disaster risk reduction in Cambodia. It has recently undergone a major change in leadership. Compared to other countries in the region, DOM is lagging behind in terms of equipment and forecasting technologies such as numerical weather and climate modeling as well as human resources and institutional capacity. It has a research and development unit but it does not work on the advancement of their services. With its current state of physical and human resources, it cannot cope with the increasing demand from different socio-economic sectors. After the Typhoon Ketsana that hit Cambodia in 2009, DOM faces a great challenge to improve on its tropical cyclone forecasting. All sectors of the society were seriously affected by the typhoon, leading to a massive rehabilitation program. Assistance from foreign donors came in. However, the upgrading of DOM's capabilities was not given due consideration in the rehabilitation program. Accurate and advance forecast of the cyclone's track could have saved lives and properties. Advance warning would

enable the people to move to safer grounds and make precautionary measures. There are large spatial, temporal and parameters data gaps for effective integrated water resource development and planning as well. This study hopes to highlight the importance of DOM's services.

There is the lack of knowledge of the available hydro-meteorological services in more economically advanced countries and the possibilities to produce more end-user specific services have not been well recognized by most of the socio-economic sectors in Cambodia. Also the sectors have not yet appreciated the importance of hydro-meteorological services for the improvement of their production and productivity. It seems that DOM is performing its task as a separate entity and not linked with the other sectors. The DOM has no annual budget. It has no program to network or link with the end users and stakeholders of weather services. It does not have a well-defined linkage with many of the potential users of hydro-meteorological services despite the increasing need and potential market for improved meteorological services especially after the passage of Tropical Cyclone Ketsana. There is a need to increase dialogue and partnerships between DOM and the socio-economic sectors. This gap on communication and cooperation with the stakeholders and users of weather and climate information should therefore be reduced if not eliminated. This would yield better services and obviously also promote private sector participation to invest in the establishment or enhancement of meteorological observation network.

National set-up for production of hydro-meteorological services in Cambodia

The DOM is under the MOWRAM which is mandated to provide weather services for Cambodia. It is responsible for the operation and maintenance of all the meteorological observation and measurements, issuance of weather forecasts and severe weather warnings all over the country. It provides weather services to aviation and land transportation, agriculture and other sectors. It plays a vital role in disaster management being a member of the NCDM to assist in decision making for taking prompt actions toward hydro-meteorological induced disasters. It assists the NCCC by providing climatological information particularly for climate change projections.

The local visibility of the DOM to the public and in the science community is poor. MOWRAM and DOM officials should exert efforts to communicate with the media to publicize their services. Currently, DOM has no website to publish its activities and services to the public. DOM's activities are mostly confined to provision of weather forecasts and meteorological data to other sectors and provision of lectures.

Collaborative projects with other government agencies like the MOE, MAFF, etc. should be enhanced. Most importantly, the DOM should work closely with the DHRW, also under MOWRAM to expand flood forecasting currently covers only three days forecast for five stations along the Mekong mainstream to cover vulnerable areas on major tributaries.

The Kingdom of Cambodia, as an agrarian country, is highly vulnerable to the impacts of extreme climate events. It is vulnerable to weather and water related hazards as more than 80 percent of its population is subsistence farmers. Adverse impacts are already being felt and these include increased flood and drought damages, reduction in crop yields, decrease water availability and increase in the number of people exposed to vector and water-borne diseases. Based on data from the past five years, Cambodia's paddy production was destroyed by as much as 70 percent by floods, and 20 percent and 10 percent, respectively by droughts and diseases. The recent strong typhoon Ketsana was a manifestation of a severe weather event that devastated the country. It is therefore important to upgrade the capabilities of the DOM and DHRW to provide quality products and services such as timely and accurate forecasts and warnings.

The DHRW is responsible for hydrological services in Cambodia. It maintains and monitors hydrological stations along the rivers systems of Cambodia particularly the major rivers of Mekong, Bassac and Tonle Sap. It provides three days water level and flood forecasting for seven stations along the Mekong-Tonle Sap-Bassac rivers using simple regression models.

In order to cope up with the growing demand for hydro-meteorological information/services and the fast technological advancement, automation in the DOM is a necessity. It is therefore critical that there is a national vision, development plan and strategy to improve the network of monitoring and production of weather and climate services in order to meet the basic need of environment protection through the provision of accurate weather forecasts.

State of affairs of the DOM

Compared to most of the NMHSs in the Southeast Asian countries, DOM has relatively limited technical, human and financial resources to carry out its mission. Its observation network, production system and its current financial resources are not adequate to ensure the expected quantity and quality of data to meet the rapidly growing needs of global and regional weather forecasting, early warning systems for natural hazards, and of national public and different socio-economic sectors.

The DOM is one of the six technical departments of the MOWRAM, which is mandated to install and manage the weather monitoring network throughout Cambodia; monitor weather condition happening in the region; and issue weather forecast and provide warning on weather condition to relevant ministries and public via media. In dealing with hydro-meteorological hazards, DOM partners with the DHRW, which is responsible for flood forecasting and warning. As regards to its duties and responsibilities, DOM has special relationships and responsibilities with several ministries and state bodies such as MOE, MAFF, NCDM, Ministry of Public Works and Transport (MPWT), Ministry of Labor and Social Welfare (MLSW), Ministry of Industry, Mines and Energy (MIME), and the CRC.

The DOM is headed by a Director who reports directly to the Minister. It is composed of six offices namely: Administrative Office, Observation Office, Equipment Office, Forecasts and Researches Office, and Climate Office and Hydro-meteorological Office.

In each of the 24 provinces and municipalities, the Hydro-meteorological Offices are established under the PDOWRAM. The DOM's headquarters is presently housed at the ground floor of a new 3-story building of MOWRAM located and at the Doppler Radar building at M.V. Preah Monivong, Phnom Penh, Cambodia.

DOM employs a total of 44 staff at the Headquarters in Phnom Penh distributed in 5 offices: Administration = 5, Observation = 10, Research and Forecasting = 9, Climate = 9, and Equipment Management = 9. There are 34 males and 10 females. Five staffs are trained as professional meteorologists (with bachelor or master degree) other three undergraduates were trained in other disciplines, and 35 technicians. All the Master's Degree holders obtained their diploma from Russian universities through scholarship grants and the engineers and Bachelor Degree holders from Belgium, Viet Nam, Russia some twenty years ago and Cambodia (technicians meteorologists CL3). There are only one or two technicians meteorologists or hydrologists in some of the Provincial Hydro-meteorological offices, totaling only 13 staffs, retired staffs are not replaced. DOM has recently recruited five IT staffs to handle the technical requirements of the newly installed Doppler rainfall radar. There is a big gap to fill in terms of the personnel complement of DOM. There is a need to increase the number of staff with higher academic education (MSc and PhD), employ more young technical staff and promote the retention of the newly recruited IT staff.

The DOM's observation network in its current status is not capable of providing high quality information and services to the people. In the assessment made by the Asian Disaster Preparedness Center (ADPC) of the 13 surface meteorological observatories in Cambodia in July 2007, all the observatories are reported to be in primitive stage. Observed data consists mainly of temperature and rainfall. Other instruments i.e. cup anemometers, barographs, are not working. The main constraints in the observation and monitoring network are the lack of automatic meteorological stations (some 10 automatic weather stations installed between 2001 and 2002 are no more operational), no upper-air observing station, the new weather radar could still

not effectively operated and lack fast and modern telecommunication system. Moreover, DOM is not running any NWP models resulting to the low accuracy of the forecasts.

The Government is exerting efforts to upgrade the capability of DOM. The provision of new headquarters office is a proof to this. There have also been some significant changes related to hydro-meteorological network development and management in Cambodia. In terms of meteorological equipment, the Asian Disaster Preparedness Center (ADPC) provided 10 sets of semi-automatic weather stations in 2009. Nevertheless, these stations have not been installed due to lack of funds and expertise.

In 2012, MOWRAM installed and put into operation under the government budget a Doppler Rainfall radar (C band), which is expected to improve weather and rainfall forecasting. However, it is still facing with many difficulties, mainly the lack of experience and dedicated meteorologist to operate the system including conversion software.

The DOM is negotiating for the provision of 24 Automatic Weather Stations (AWS) to be installed at each of the province/municipalities, including training.

For hydrology, the Mekong River Commission Hydrological Cycle Observation System (MRC-HYCOS) is under discussion for its extension. In terms of policy and institutional reform, the ADB in collaboration with a number of donors is financing the capacity technical assistance by providing specialist support to MOWRAM to:

- i. Develop its capacity to manage water resources through strengthening the strategy, policy and legal framework for integrated water resources management (IWRM);
- ii. Improve coordination and cooperation with other ministries and agencies, and at the river basin level; and
- iii. Strengthen MOWRAM's technical capacity to promote IWRM and climate change adaptation; and develop human resources capacity.

Component (ii) will establish the National Inter-ministerial Water Resources Management Committee (NWRMC) and component (iii) intends to support the training of some 300 water resources engineers in collaboration with the Technical Institute of Cambodia (ITC) in the next five years and the strengthening the capacity of MOWRAM in climate change policy and strategy. DOM and DHRW should in the same way try to plan and train their new staffs to enable them to deliver expected services.

The Government cannot fully support all the financial requirements of DOM to produce increased and improved hydro-meteorological services to support economic growth and the safety and wellbeing of the citizens. As a Least Developed Country (LDC), Cambodia has been striving for DOM's enhancement through bilateral cooperation schemes. For instance, the grant assistance from the Government of Japan facilitated the transfer of knowledge and upgraded facilities, resulting in better forecasts. This also included the re-installation of the MTSAT in the new building and retraining of DOM's staff. Regional and international initiatives on disaster risk management are being implemented. Donors include World Bank, AusAID, UNDP, ADPC, among others. International support to DOM and other NMHSs in the South East Asian countries is a must to provide an opportunity to enhance the hydro-meteorological measurements and services in Cambodia and in the region to a level sufficient to meet the national and regional needs for sustainable development of DOM and other NMHSs. However, on the contrary to DHRW, the DOM has never received a project but only some patchy technical assistance on an ad-hoc basis. It does not even have vehicles for field work such as station installation and inspections.

Project proposal to strengthen the DOM

To strengthen DOM and DHRW institutional and human capacity, a medium to long term plan is required to fill in the significant professional generation gaps of some twenty years and shortage of qualified staffs at all level as well as lack of leadership. This might need up to twenty years.

The first five years would be to focus on the restructuration planning of the DOM and DHRW in line with the Policy and Institutional Reform and Capacity Development in Water Sector of the MOWRAM. In this period, to enhance the capability of DOM as a warning institution for hydro-meteorological hazards, it is proposed to upgrade its physical and human resources. It needs to upgrade the 12 synoptic stations and manual or analogue instruments be replaced with automatic observation system. An upper-air observation station, one radar facility and about 3 lightning detectors should also be established for better assessment of the vertical structure of the atmosphere especially during occurrence of tropical cyclones and deep meso-scale convective systems such as thunderstorms and tornadoes. Composite radar images from all radar equipment from the neighboring countries should be utilized through stronger regional cooperation. Advanced telecommunication system is necessary for the transmission of data from field stations and for fast dissemination of forecasts and warnings to the public and other end-users.

A website should also be developed to make the weather forecasts readily available to the public. DOM needs to hone the skills of its human resources through the conduct of specialized and highly technical training courses to keep abreast with the fast pace of technology.

Climate change is another challenge for Cambodia. In addition to the increased reliability and timely weather forecasting and dissemination, information is also required for the grass root level to understand and adapt to the imminent foreseen impacts of climate change. Rainfall data collection is far from being adequate for flood/drought forecasting as well as medium to long term water availability in each of the sub-basin. The DOM and DHRW must review, upgrade and expand the national rainfall network at least to cover half of the 1,620 communes in the country. A total of 800 manual rain gauges are proposed to be installed in 800 communes to be the asset of the communes that can report near real time data for flood/drought forecasting for each of the major sub-basin in the country. This also includes the existing rain gauges that need complete review.

Investment plan

The proposed project is designed to enable the DOM to provide reliable, timely, and accurate forecasts and warnings on weather related hazards for the safety and well-being of the people and to promote the economic growth of Cambodia. This can be achieved through upgrading and modernization of the facilities, capacity building and establishment of a strong research and development arm. This entails a significant investment particularly on the automation of the meteorological observing network including telecommunication facilities and other equipment. Investment will be reduced if cooperation with other Asian countries is strengthened through data sharing and training on compositing of all radar data and images available in the region. Joint projects on climate change and other global issues could also be considered to promote cooperation.

Scholarship grants from international funding institutions can also reduce the required investment. An investment plan is designed which includes funding for operation and maintenance cost during the implementation of the project. Two options for investment are proposed:

- (A) Strengthening of NHMS as "Stand-alone system",
- (B) Planning and implementing the strengthening as part of the cooperative project.

Cambodia	A (USD)	B (USD)
International cooperation of experts	200,000	100,000
Communication systems		
- hardware and software	600,000	600,000
IT Center		
- hardware	150,000	150,000
- consulting	50,000	50,000
Data management		
- hardware and installation	610,000	610,000
- storage 30 TB	125,000	125,000
- consulting and training	100,000	50,000
Meteorological observation network		
- 24 Automatic Weather Stations (AWS) and training	6,309,590	6,309,590
- Installation of manual and rehabilitation of existing rain gauges	400,000	400,000
- Installation of 10 Semi-automatic weather stations	10,220	10,220
Hydrological observation network		
- Automatic hydrological stations	550,000	550,000
- Data communication + maintenance	110,000	110,000
Remote sensing network		
- Upper air observations	445,000	445,000
- Upper air operations and maintenance (5 years)	1,000,000	1,000,000
- New weather radars (including towers)	6,200,000	2,050,000
- Lightning detection	10,500	10,500
- Satellite receiving station	135,000	135,000
- Calibration and maintenance	100,000	75,000
Forecasting and manufacturing tools		
- Visualization system	400,000	400,000
- Training	20,000	10,000
Capacity Building		
- Training of forecasters, technicians and IT staff	100,000	50,000
- Formal training of professional staff	2,500,000	2,500,000
Research and Development		
- Impacts of climate change	100,000	50,000
- Socio economic impacts	100,000	50,000
- National seminar on socio economic benefits	100,000	100,000
- End-user seminar	75,000	20,000
- Website	50,000	30,000
Project management		
- Consultant	200,000	100,000
- Local project coordinator	100,000	100,000
Total	20,740,310	16,080,310

It should be noted that the proposed investment plan has changed from the first draft, proposed by the consultant as the result of a national workshop to review the draft report. The changes include: adding the proposed installation of the 24 AWS by JICA (US\$ 6,309,590)⁸², the cost to install and make operational the

⁸² Project has not been approved and is being revisited by JICA

10 semi-automatic weather stations (US\$ 10,220) and the installation of manual and rehabilitation of existing rain gauges. Specifically, a long-term professional training totaling US\$ 2,500,000 was also added, recognizing the urgent and challenging task to build technical human resources.

Economic value of weather forecasts and hydro-meteorological services in Cambodia

For the stand alone option, the results of the computations show that using a 10 percent reduction in damages as a measure of benefits, the total costs of NMHS improvements are \$20.74 million, discounted total benefits are \$24.98 million, discounted net benefits are \$4.24 million and C/B ratio is 1:1.20. For a regional integration option, the results of the computations show that using a 10 percent reduction in damages as a measure of benefits, the total costs of NMHS improvements are \$16.08 million, discounted total benefits are \$24.98 million, discounted net benefits are \$8.90 million and C/B ratio is 1:1.55.

Table 10: Options, Costs, Discounted Total Benefits, Discounted Net Benefits and Cost-Benefit ratios for improvements in NMHS in Cambodia, 2010-2029

Option	Total Costs (Million US\$)	Discounted Total Benefits (Million US\$)	Discounted Net Benefits (Million US\$)	Cost/Benefit Ratio (C/B)
Stand alone	20.74	24.98	4.24	1:1.20
With regional cooperation	16.08	24.98	8.90	1:1.55

Environmental impacts of enhancement of the observation network

Automation of observation network does not produce harmful effects on the environment. The only activity that relates to this is the operation of upper-air observation and weather radars. The upper-air observation involves tracking of a pilot weather balloon in the atmosphere through an attached transmitter. Weather radars emit radioactive waves which is a threat to public health hence they must be located over remote and high areas.

Financing of the proposed project

Funds for the implementation of the project will be a big burden for DOM hence out sourcing is necessary. Foreign donors such as JICA, KOICA, USAID, AusAID or World Bank could be tapped. Assistance from neighboring countries who will be sharing the data and the products should also be sought.

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Annex E. Institutional Review and Capacity Assessment of the National Committee for Disaster Management (NCDM)

Prepared by:

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Flood Disaster Emergency Reconstruction Project (FDERP)
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Executive Summary

In April 2012, the RGC and the ADB signed a loan agreement for a "Flood Damage Emergency Reconstruction Project" (FDERP) to facilitate the economic and social recovery of six provinces affected by the severe flooding that occurred in late 2011. In line with current ADB disaster and emergency assistance policy promoting the incorporation of risk reduction approaches into the design and implementation of recovery and reconstruction projects, the FDERP included a flood management sub-component as part of the project. The objective of the flood management sub-component is to strengthen the ability of the RGC to prepare for and manage floods and other disasters in the future through the strengthening of government mandated disaster management structures under the umbrella of the NCDM.

Activities under the flood management sub-component of the FDERP can best be understood in the context of a long-term capacity development process for the NCDM that the ADB is considering of supporting. Potential sources of technical and funding support for the proposed long-term institutional strengthening of the NCDM have already been identified and technical assistance provided under the FDERP is expected to lay the foundation for the design and implementation of the proposed long-term intervention. The primary purpose of the external review and assessment is to identify the strengths and weaknesses of the NCDM in relation to its roles and responsibilities. It seeks to provide the ADB and NCDM with sufficient information that will enable them to discuss and determine the feasibility, scope, size and timing of a proposed long-term capacity development intervention.

This review and assessment was conducted by a Disaster Management Institutional Specialist in coordination with the Secretary General of the NCDM as the focal person, and assisted by an NCDM staff. Data and information was gathered using several tools and methodologies including a comprehensive research and review of available disaster-related documents; key informant interviews with selected stakeholders, government officials (i.e., ministry representatives) and NCDM personnel; a self-assessment exercise by NCDM staff; and a quick survey on the status of the Provincial Committee for Disaster Management (PCDM) in four provinces covered by the FDERP. The report also draws on the in-country experience of the disaster management specialist gained in the course of undertaking several previous consultancy missions in the country.

The review starts with a critical examination of existing disaster management policy, legislation and institutional arrangements (i.e., disaster management (DM) structures and coordinating mechanisms) as these provide the foundation for the practice of disaster management in the country and define the parameters that directly affect the NCDM's ability to perform its mandated roles and responsibilities. This is followed by an assessment of existing internal capacities at various levels of the NCDM while the last section provides general recommendations that can form the basis for the next phase of designing a detailed medium to long-term institutional strengthening program.

Policy and Legal Framework

Overall, the review finds that there is no solid foundation for the practice of DRM in the country as key legal and policy instruments (i.e., National Disaster Management Strategy, National Policy for Emergency Management (NPEM) and a proposed Disaster Management law), are still in the process of development and have yet to be adopted and approved. While some general policies do exist, they are primarily designed

and focused on ensuring coordinated disaster relief and response. At the sub-national or provincial level, policy formulation is non-existent as they depend entirely on the national level (i.e., NCDM General Secretariat) for policy initiatives.

There are several policy-related issues and challenges facing the NCDM that have been identified and these include; the lack of adequate fiscal resources; weak capacities to formulate and advocate for relevant legislation, policies and strategies; an immediate need to mainstream DRR into national development plans and into climate change adaptation policy, plans and programs; and the inability of the General Secretariat to translate policies and strategies into operational plans and implement them.

The government has relegated DRM as a residual concern and the NCDM General Secretariat does not appear to have sufficient political clout and abilities in advocating and lobbying for DRM. As a result the NCDM has, for the past several years, been unable to access adequate fiscal support from the national government to effectively perform its mandate. Current efforts are thus focused on the passage of a proposed Disaster Management (DM) law that presumably addresses the two most critical disaster management concerns identified which are to more clearly define the exact legal authority of the NCDM to undertake disaster risk reduction and management activities, and to ensure that DM committees at all levels have access to budget support. It should also be noted that both policy and legislation are essential for creating the enabling environment for the institutionalization of DRM, hence NCDM should continue advocating for approval of both the national policy and the proposed law.

A window of opportunity for integrating DRR into the national development plan presents itself as the MOP is reported to have initiated the planning process for the development of the new five year national development plan, the NSDP 2014-2018. NCDM should already be holding discussions and mobilizing stakeholders and donors in this effort including enlisting the support of the country's main development partners (e.g. WB, ADB, EU, UN Agencies, etc.). Discussions on the concept and rationale for complementation and integration of Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) has been initiated through several dialogues and workshops but interaction between CCA and DRR agencies in the country is still in its early stages. NCDM now needs to take this a step further and establish regular lines of communication and more formal coordination mechanisms. Joint efforts towards mainstreaming into the NSDP should also be seriously considered.

The NCDM has had some success in terms of developing a number of important national strategies and plans but its capacity to translate these into workable annual operational plans and move forward with their implementation is severely lacking. There are, for example, no concrete action plans and very little activities carried out towards the implementation of the "Five Year Institutional Strengthening Program and Two Year Action Plan for the NCDM", the "Strategic National Action Plan (SNAP) for Disaster Risk Reduction (DRR) 2008 -2013", and in the most recent national planning document, the National Contingency Plan (NCP). This also highlights the need for NCDM stakeholders and donors to be more conscious of NCDM's capacity and resource constraints and be more realistic in terms of formulating strategies and plans, and in setting project goals and objectives.

Disaster Management Structures & Coordinating Mechanisms

This review finds that NCDM operations are severely challenged at all levels including the absence of functional DM structures. At the national level, NCDM meetings do not occur regularly as mandated and for the past several years' government ministries and stakeholders have only met as a result of emergencies and disasters. The inter-ministerial DM Working Group which includes representation from the CRC, International federation of the Red Cross and Red Crescent Societies (IFRC) and UN Disaster Management Team (UNDMT), is also not fully functioning. They have not met for the past few years and there are no apparent plans for their activation. Likewise the five (5) sectoral Sub-groups on: Emergency Response; Food Security; Health; Small-scale Infrastructure, Water & Sanitation; and Preparedness & Mitigation, do not seem to have ever been fully activated at all. Nevertheless, information obtained from various ministries reveals that an increasing number of government ministries (e.g. MOH, MOEYS, MAFF and MOWRAM) have started

taking the initiative and are already undertaking their own disaster management and climate change adaptation related activities and projects.

The NCDM's General Secretariat is also not functioning normally. While it is undoubtedly operating as best as it can under the severe financial and human resource constraints it is faced with, almost all of the main tasks are being undertaken at the highest levels of the organization's hierarchy with very little done by its regular departments. Neither the General Secretariat as a whole nor any of its operational departments have developed annual action or operating plans nor have any of them been provided with any annual operating budget. In the absence of regular operating plans it then comes as no surprise that systems and procedures for other regular organizational management functions (i.e., budgeting, human resource management, organizing, leading, and monitoring & controlling) are very weak. There are also a number of other observable deficiencies in the Secretariat's structure including an apparent overlapping of functions between departments and lack of a specific unit responsible for information management although the latter is now being partially addressed by a UNDP initiative on the establishment of a Disaster Management Information System (DMIS).

At the sub-national level, the different DM committees have likewise been given the responsibility to lead disaster management efforts at their respective administrative levels without being provided adequate resources and training. Conditions at sub-national level are actually more challenging considering they are front-line actors that have to address the direct effects and impact of emergencies and disaster events. Their operation is also constrained by the lack of clear cut guidelines and Standard Operating Procedures (SOPs) in relation to the roles and responsibilities among each other (i.e., PCDM-DCDM-CCDM), with the General Secretariat and with the different local and international organizations that respond to emergencies and disasters. Actual capacities differs considerably from one area to another and depends primarily on the presence or absence of external stakeholders especially since the NCDM, in the face of its resource constraints, cannot provide any form of support on its own.

NCDM Organizational Capacities

In general, NCDM staffs feel that they possess sufficient capacities to perform most of their mandated disaster management functions and tasks but are constrained from performing their duties due to the lack of financial and material resources. Both stakeholders and NCDM agree that enhancing capacities for disaster response coordination should be a priority concern for any future capacity development intervention. Staff also feel that NCDM capacities in community-based risk reduction activities have been well developed as a result of long-term support and funding provided by stakeholders implementing Community-Based Disaster Risk Management (CBDRM) programs.

The key issues and challenges on the operations of NCDM are identified as: significant resource constraints; unsustainable project implementation; uncoordinated donor support; lack of human resource development opportunities; and an inadequate information management system.

One of the biggest challenges for NCDM is to overcome the temptation of using current resource constraints, significant as they are, as a convenient reason for not aiming to attain high standards of performance or for not performing its mandated functions and tasks at all. If the required resources are not available to attain organisational objectives, then strategies and action plans for generating increased funding is formulated and organizational work objectives is scaled down to realistic levels. In any case, there should be no reason for the absence of NCDM operational action plans and budgets, including from all its departments.

NCDM has developed good capacities for project implementation as evidenced by its apparently successful experience in the implementation of several donor-funded projects including the "Avian and Human Influenza Control and Preparedness Emergency Project" (AHICPEP or more commonly referred to as the AHI Project) funded by the WB, the "Emergency Food Assistance Project and Strengthening Institutional Capacity for Emergency Response to Food Crisis and Improving Food Security" (EFAP) funded by the ADB, an on-going

capacity building project funded by the UNDP, and the "Ketsana Emergency Rehabilitation Reconstruction Project" (KERRP) also funded by the WB. All of the projects however have been, or are being, implemented using a project-based approach involving the use of *ad hoc* project teams that are provided with direct operational support. While this has led to successful implementation of project activities and attainment of most project objectives, the results are not likely to be sustainable as the project teams are disbanded after donor funding is consumed. Projects are also usually implemented outside, or independent, of NCDM's operational departments hence the duties and responsibilities of the project team members are not assumed and integrated into existing departmental units leaving no one with official responsibilities for follow up action after donor funding is depleted.

The use and dependence on a project-based approach also results in very strong tendencies for the projects and activities of different stakeholders and donors to be implemented independent of each other despite obvious complementarities and opportunities for synergy. Both the AHI and EFAP projects, for example, initiated activities related to the development and installation of a DMIS but there is little trace and evidence of complementation between the two. Furthermore, the UNDP has also recently launched an initiative for the purpose of establishing a DMIS and the WB-funded KERRP scheduled for implementation in the next few months also has a strong DMIS component. It is imperative that NCDM management ensures complementation right at the very inception of potential projects and insist on joint programming or re-programming by donors supporting similar interventions.

Under its mandate, the NCDM is responsible for developing disaster management capacities at all levels. Citing the lack of financial and material resources, the Department of Preparedness & Training has been unable to perform this task. NCDM sponsored capacity building and training for the different ministries is non-existent as it does not have sufficient experience and capacities to provide sector-specific disaster management training to the different ministries. Capacity development of the NCDM for its own staff is limited, sporadic and consists of predominantly one-time short courses. There are significant capacity development initiatives at community or commune levels, mostly from the NGO partners of the Disaster Preparedness Programme of the European Commission Humanitarian Aid and Civil Protection Department (DIPECHO), but NCDM participation remains largely activity-based and they have been reluctant to take the lead. For sub-national DM committees, at provincial and district levels, these CBDRM projects have also provided opportunities for training and capacity building.

Currently the NCDM does not have a fully functioning data gathering and information management system in place. While there is some perceived capacity in data gathering and consolidation, capacities for analysis, database management, reporting and communications is weak. There is consensus among NCDM staff that while they have sufficient capacities to access and analyze disaster-related data of PCDMs, the capacities of sub-national DM committees to undertake accurate assessments is weak and needs to be significantly improved. Knowledge management is almost non-existent which is most unfortunate as significant opportunities for its application especially in the area of CBDRM exists. Given the wealth of experience and knowledge in CBDRM developed in the country, it is important that NCDM capacities for knowledge management in CBDRM are developed as part of any long term institutional strengthening program.

Recommendations

The last section of the report presents the priority areas for investment that can lead to the strengthening of the disaster management system in the country with human resource development forming an integral component of all interventions across all areas and levels. Five key areas of intervention are recommended, as follows: (1) Enhance capacities for policy formulation & development; (2) Activate and develop capacities of dormant DM structures; (3) Develop the General Secretariat's organizational management capacities; (4) Strengthen capacities of sub-national DM committees; and (5) Strengthen organizational capacities for DM Coordination.

- (1) Developing Capacities for Policy Development requires the establishment of a policy and planning unit within the General Secretariat and mobilizing an interim external stakeholder advisory group to assist and

support NCDM policy-making efforts. The immediate agenda would be the passage of the proposed DM Law in compliance with international humanitarian principles, refinement and approval of the draft NPEM, development of a national strategy for disaster management, and advocacy for integrating DRR into the NSDP 2014 -2018.

- (2) Activating and developing capacities of dormant DM structures calls for re-establishing dormant but mandated national and inter-ministerial structures and building NCDM Secretariat's capacities to facilitate its meetings and activities. These involve the conduct of NCDM annual meetings at the national level and re-establishing the DM Working Group of Ministries & Institutions and five (5) sectoral sub-groups at the ministry level.
- (3) Enhancing General Secretariat organizational management capacities basically involves an initial facilitation, and eventual institutionalization, of an internal strategic and operations planning process beginning with revisiting organizational vision, mission and goals; formulation of a long-term organizational plan; re-organization of internal structures and units if necessary; review of staffing requirements and their deployment; formulation of annual organizational and departmental action plans; and the installation of systems and procedures for monitoring, evaluation and reporting organizational performance.
- (4) Strengthening capacities of sub-national DM committees involves the conduct of a national audit of disaster preparedness and response capacities of sub-national DM committees, the setting of performance standards for a well-functioning and effective sub-national DM committee followed by the provision of a "support package" for each level. A separate initiative for the design and implementation of a national CBDRM program with participation and support of stakeholders should be undertaken.
- (5) Strengthening NCDM organizational capacities for DM Coordination involves focusing initial capacity development interventions on enhancing the core NCDM function of coordination, in terms of both preparedness and disaster response. Coordination of DRR will require strengthening of the Department of Preparedness & Training while enhancing disaster response coordination begins with a detailed review and enhancement of the existing national disaster assessment system including the development of standard assessment methodologies and reporting formats. In both cases, establishing a fully functional and fully staffed Disaster Management Information System (DMIS) is required.

In the implementation of the recommendations enumerated above, a number of implementing strategies are recommended and include, among others: setting realistic goals and objectives that consider current human resource and capacity constraints; the use of stakeholders as sources of technical assistance and support rather than external short-term consultants; improved donor coordination through joint programming; identification and use of local service providers; use of coaching and on-the-job training as primary staff capacity building methodology; and the use of the NCP as the entry point for building capacities in organizational management.

In closing, given the significant external and internal constraints of the NCDM coupled with the certainty of the increased occurrence of extreme hydro-meteorological hazards, the disaster management system in the country will undoubtedly face even greater challenges than the already considerable constraints it currently faces. A long-term institutional strengthening program is therefore highly relevant, appropriate and long overdue. Any future capacity development program however requires that NCDM does not merely articulate but, more importantly, concretely demonstrate the commitment and initiative towards changing the status quo. Just as they recognize limited organizational resources and staff capacities, there must likewise be the acceptance and firm resolve to address these. More so, that the NCDM will need to take the leadership role in the proposed program acting on behalf of key member ministries and sub-national DM committees. Without this genuine commitment to action, no amount of external funding, technical assistance or training will result to any significant impact.

Annex F: Randomized Control Trial Methodology of Early Warning Systems for Farmers

This annex outlines the potential and design of a randomized control trial (RCT) to evaluate the causal effects of activities related to the UNDP/LDCF project titled "**Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change**". The intention is to measure the impact of strategic interventions, such as investment in EWS, and highlight gaps which require further support (e.g. early warning messages need to be more customized, more training is needed for farmers to better apply the information).

Randomized Control Trials

A major challenge in evaluating any intervention is establishing its real impact. One approach can be to look at the outcomes of a group before and after an intervention – if the outcomes of interest have changed after the intervention, the intervention may be responsible for the changes. However, looking at the outcomes of only the target group before an intervention, and comparing them with outcomes after the intervention, can yield false results. This is because there could be a natural change over time in the target group that results in changed outcomes i.e. the intervention alone may or may not be responsible for the change in the outcomes and we have no way of knowing. Therefore, it is important to have a group that acts as a control – a control group with which the intervention group can be compared. When we have an outside point of comparison, we can look at the difference between the outcomes of the control and treatment groups attributing the difference to the intervention.

Randomized control trials (RCT) are a rigorous way to test the impact of an intervention of interest. Originally used in medicine to test the impact of medical interventions, this methodology has increasingly been adopted in economic science to test the impact of a policy or social intervention. The basic construct of an RCT is quite straightforward. Two groups of people are randomly selected in a population of interest, where one is designated the control group and the other is designated the treatment group. The policy of interest (e.g. subsidized bed nets for malaria prevention) is implemented on the treatment group and after it has run its course, the difference in outcomes of interest (e.g. malaria incidence) is recorded in both control and treatment groups. This way, the pure effect of the policy is established because of the random nature of control and treatment group selection⁸³.

The two groups, the control and the trial group, should be equivalent. Even if there is a control group (i.e. a group that did not receive the intervention), there is still the issue of selection. There could be something about the two groups that innately results in changed outcomes rather than the intervention. Therefore, it is important to not only have a control group but a randomly chosen target population that receives the intervention and a randomly chosen part of the target population that acts as a control group (i.e. do not receive the intervention).

Early Warning Systems Project: Possible Themes of Interest

The document "**Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change**" provides for a large and integrated set of outcomes to improve climate resilience:

Outcome 1: Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information

⁸³ For more information, visit the Abdul Latif Jameel Poverty Action Lab (J-PAL) website: <http://www.povertyactionlab.org/methodology>

Outcome 2: Climate and weather information available and utilized for national, sectoral and sub-national planning as well as for transboundary communication in the region

Outcome 3: Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change

A priority of the RGC is to reduce vulnerability of farmers. With this in mind, one particular activity type has the potential for an RCT evaluation. Outcome 2 includes SOPs for the effective dissemination of early warnings. By using RCT, an evaluation can be made on the timeliness and usefulness/applicability of early warnings received by farmers, and how those early warnings informed their planning.

The phased approach of the project creates opportunities to select target farmer groups based on those receiving tailored early warnings (planned for the earliest in the project) and those which early warning messages not yet tailored (but planned for in later stages in the project). Potential provinces to select as trial provinces may therefore include the priority provinces indicated by MOWRAM (Banteay Meanchey, Oddar Meanchey, Siem Reap, Preah Vihear and Kompong Thom, as well as other provinces especially affected by the October 2013 flooding (Battambang and Kampong Cham).

Study Design

Intervention: Timely Weather Information

The intervention will be randomly administered weather information dissemination to farmers. This requires that a dissemination mechanism is developed and deployed which could include visits by extension workers, TV and radio spots, mobile text messages and phone calls. Since, cell phone penetration is significant and growing in most developing countries, it offers a good way to disseminate weather information in a timely and efficient manner. Thus, farmers who are selected for the program can choose to receive SMS texts and calls on a regular basis to provide weather information and updates.

Because farmers are being targeted by the intervention, the evaluation will need to capture at least one growing season if not more. At least one annual cycle of growing seasons should be accounted for and ideally more than a year so that dynamic effects can be captured too (farmers may require a season or two of getting accustomed to the intervention before behavioral changes can be measured).

Given the particular vulnerability of women in the agriculture sector, evaluations will ensure that data collected can be disaggregated by gender.

Possible Outcomes of Interest

There are many outcomes of interest that may be impacted by the intervention. Two prominent types of outcomes are:

1. Primary outcomes: Farmer agricultural outcomes with simple information transfers i.e. does weather information change planting dates, net revenues, yields, crop selection, farm type (crops vs. meat and poultry), investments (irrigation systems) etc.
2. Secondary outcomes: Non-agricultural outcomes such as farmer uptake of financial assistance (loans), diversification of income streams, migration of family members, etc.

Information Capture

Finally, the right kind of information must be captured at the right times and from the correct group. The basic survey sequence is:

- Baseline survey to capture basic characteristics before randomly administered weather information dissemination.

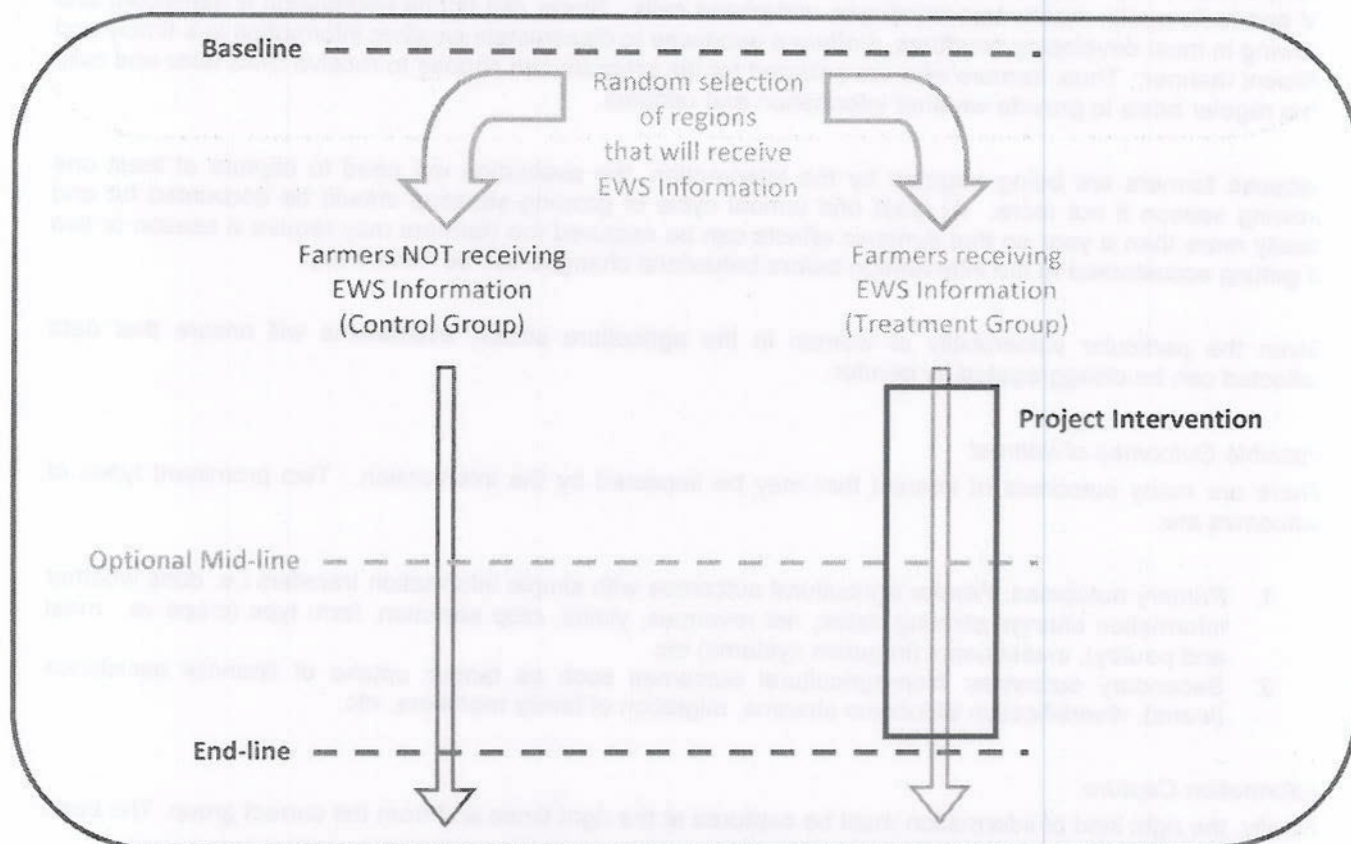
- Mid-line survey (optional) to record characteristics and outcomes of interest – helps to capture dynamics.
- End-line survey to record characteristics and outcomes of interest.

All surveys must be administered to both control and treatment groups simultaneously. The baseline survey should be administered before the EWS program is rolled out for the intervention group. The end-line survey will capture outcome information at the end of an agricultural growing cycle (a season). If the evaluation program intends to work over multiple seasons, then the end-line could be conducted at the end of each growing season that is part of the evaluation program.

Given the LDCF project's focus on building climate resilience of Cambodia's most vulnerable, and the particular needs of women in the agriculture sector, surveys must be gender-disaggregated in order to appropriately measure the project's results against its objective.

Note: As part of the **Capacity Building Programme on the Economics of Climate Change Adaptation (ECCA)**⁸⁴, a gender-disaggregated agriculture/water use survey was conducted of 300 households in at least 3 agro-ecological zones in Cambodia. The survey included questions on perceived climate change, crop yields, crop types, crop calendar, related income, etc. The results of this survey can serve as a baseline for the RCT. Subsequent surveys can include questions related to the receipt and applicability of early warning messages. Based on this, assumptions can be made on the influence of those messages on the changes in the other categories.

Basic Sequence of EWS Program for Farmers RCT Study



⁸⁴ For more information on ECCA, visit: <http://www.undp-alm.org/projects/ecca-asia>

Annex G. Stakeholder Involvement Plan⁸⁵

Project Outcomes and Outputs	Potential Stakeholder Involvement			
	Year 1	Year 2	Year 3	Year 4
Outcome 1: Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information				
Outputs				
1.1 Training-of-trainers programmes for DOM and DHRW forecasters to combine regional/global information and data from monitoring stations in data quality control, archiving and modeling/forecasting climate, flood and water resource information (on daily to seasonal, as well as medium to long term timescales)	DOM, DHRW, MRC, RIMES, ADB	DOM, DHRW, MRC, RIMES, ADB	DOM, DHRW, MRC, RIMES, ADB	DOM, DHRW, MRC, RIMES, ADB
1.2 Customized weather and climate information for targeted stakeholders to meet the short-term and long-term planning needs	DOM, DHRW, MOE, MOP, MAFF, MOWA, NCDM, CRC, FRC, IFRC, Caritas	DOM, DHRW, MOE, MOP, MAFF, MOWA, NCDM, CRC, FRC, IFRC, Caritas	DOM, DHRW, MOE, MOP, MAFF, MOWA, NCDM, CRC, FRC, IFRC, Caritas	DOM, DHRW, MOE, MOP, MAFF, MOWA, NCDM, CRC, FRC, IFRC, Caritas
1.3 Training materials and courses available in local university or institution for continued learning		RIMES, ITC, TSC, JICA, MRC, ADB, Academia	RIMES, ITC, TSC, JICA, MRC, ADB, Academia	RIMES, ITC, TSC, JICA, MRC, ADB, Academia
1.4 Central repository for weather, climate and environmental data to enhance historical records of climate and weather trends and related impacts	MOWRAM, DOM, DHRW, MOE, MOP, MRC, NCDM, RIMES, ADB	MOWRAM, DOM, DHRW, MOE, MOP, MRC, NCDM, RIMES, ADB	MOWRAM, DOM, DHRW, MOE, MOP, MRC, NCDM, RIMES, ADB	MOWRAM, DOM, DHRW, MOE, MOP, MRC, NCDM, RIMES, ADB
Outcome 2: Climate and weather information available and utilized for national, sectoral and sub-national planning as well as for transboundary communication in the region				
Outputs				
2.1 Standard Operating Procedures (SOP) for effective and timely EWS and climate information dissemination	MOWRAM, MAFF, MOE, MOI/NCDD, MOP, NCDM, PCDM, DCDM, CCDM, VTDM, MOPTC, ADB, MRC, CRC, FRC, IRFC, Caritas	MOWRAM, MAFF, MOE, MOI/NCDD, MOP, NCDM, PCDM, DCDM, CCDM, VTDM, MOPTC, ADB, MRC, CRC, FRC, IRFC, Caritas	MOWRAM, MAFF, MOE, MOI/NCDD, MOP, NCDM, PCDM, DCDM, CCDM, VTDM, MOPTC, ADB, MRC, CRC, FRC, IRFC, Caritas	MOWRAM, MAFF, MOE, MOI/NCDD, MOP, NCDM, PCDM, DCDM, CCDM, VTDM, MOPTC, ADB, MRC, CRC, FRC, IRFC, Caritas

⁸⁵ The Stakeholder Involvement Plan is meant to be indicative and should be adjusted during project implementation as necessary.

Project Outcomes and Outputs	Potential Stakeholder Involvement			
	Year 1	Year 2	Year 3	Year 4
	(developing SOP)	(developing SOP)	(testing SOP)	(testing SOP)
2.2 Training programmes for planning/line ministry staff at the national and sub-national levels to apply climate information to inform climate resilient planning	MOWRAM, MOP, MAFF	MOWRAM, MOP, MAFF	MOWRAM, MOP, MAFF	MOWRAM, MOP, MAFF
2.3 Regular exchange of climate and weather information with border countries on transboundary issues, as well as best practices and lessons learned related to building climate change resilience and adaptive capacity	MOWRAM, MOE, NCDM, MOI, NCDD, MOP, MAFF, MRC	MOWRAM, MOE, NCDM, MOI, NCDD, MOP, MAFF, MRC	MOWRAM, MOE, NCDM, MOI, NCDD, MOP, MAFF, MRC	MOWRAM, MOE, NCDM, MOI, NCDD, MOP, MAFF, MRC
Outcome 3: Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change				
3.1 Upgrade of up to 25 sites with automatic meteorological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies	DOM, DHRW, PDOWRAMs, ADB, JICA, DCA/CA	DOM, DHRW, PDOWRAMs, ADB, JICA, DCA/CA	DOM, DHRW, PDOWRAMs, ADB, JICA, DCA/CA	DOM, DHRW, PDOWRAMs, ADB, JICA, DCA/CA
3.2 Upgrade of 55 sites with automatic hydrological stations, establish telemetry and data quality & control systems for centralized access by all CI/EWS agencies	DOM, DHRW, PDOWRAMs, MRC, ADB, JICA	DOM, DHRW, PDOWRAMs, MRC, ADB, JICA	DOM, DHRW, PDOWRAMs, MRC, ADB, JICA	DOM, DHRW, PDOWRAMs, MRC, ADB, JICA
3.3 Training-of-trainers programmes for DOM and DHRW staff to build capacity in the selection (i.e. identifying cost effective technologies), installation, operations and maintenance of equipment to established standards and services	DOM, DHRW, PDOWRAMs, JICA, ITC, vocational schools	DOM, DHRW, PDOWRAMs, JICA, ITC, vocational schools	DOM, DHRW, PDOWRAMs, JICA, ITC, vocational schools	DOM, DHRW, PDOWRAMs, JICA, ITC, vocational schools
3.4 Sustainable financing plan for the long term O&M of the equipment, including private and public financing arrangements		MOWRAM, MOEF, MOE, MOP, MPWT, MIME, telecom companies, private sector	MOWRAM, MOEF, MOE, MOP, MPWT, MIME, telecom companies, private sector	MOWRAM, MOEF, MOE, MOP, MPWT, MIME, telecom companies, private sector

UNDP Micro-Capacity Assessment Checklist

Name of institution: Ministry of Water Resources and Meteorology [Department of Meteorology (DOM) and Department of Hydrology and River Works (DHRW)]

Date of Assessment: April 2014

MOWRAM is the national ministry that manages the largest proportion of the national budget and one of the biggest recipients of grant and loans from multilateral and bilateral donors. Thus, MOWRAM as a whole has extensive experience in managing development projects. However, MOWRAM has not implemented UNDP supported project in the past and thus is not familiar with UNDP implementation policies and procedures. It is observed during the assessment that the two main Departments (DOM and DHRW) which are the main responsible parties to implement the LDCF project activities as per their mandate, have some existing technical capacities throughout various supports from other partners such as MRC, JICA and ADB. However, there is limited experience in managing medium to big size projects compared to other departments, as the previous support by various donors are based on a work package or external consultancy support rather than placing the ownership and management decision with the two Departments. To address the objective of the project to enhance strengthening national capacities and ownership, the UNDP NIM policies and procedures will be applied as part of the implementation arrangement and necessary technical and managerial support to be financed from the project with additional assurance support from the UNDP CO and RTA will be provided throughout the project implementation. In the early stage of the project implementation, significant backup support is needed from UNDP to ensure proper and smooth start-up of the project implementation, thus the majority of the activities will be under the UNDP responsibilities. It is expected that as the project moves to an advance stage of implementation, some roles and responsibilities will be further delegated to MOWRAM as their project management capacity is strengthened through UNDP technical assistance.

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
PART I. Background Information		
1. History	Date of establishment of the organization	The Ministry of Water Resources and Meteorology (MOWRAM) was created in 1999 during the second term of the Royal Government of Cambodia. Website: www.mowram.gov.kh
2. Mandate and constituency	What is the current mandate or purpose of the organization? Who is the organization's primary constituency?	Within a mandate to lead and manage water resources and Meteorology sector of the Royal Government of Cambodia, MOWRAM's duties and responsibilities are: <ul style="list-style-type: none"> • To identify policy and strategy development of water resources, to business development, maintain and preservation according to national and international in accordance with policy context of the Royal Government of Cambodia. • To study and research on potential

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
		<p>water resources include on the ground water, underground water and the weather to confirm technical science based which fit to national framework.</p> <ul style="list-style-type: none"> • To develop short, medium and long term plan for business development and preservation according of water resources and meteorology to serve national economic for alternative livelihood of the urban and rural people. • To manage and control all business making on water resources directly and indirectly, and to minimize the disaster. • To develop regulation, legislation and other documents to ensure the management and monitoring on the implementation of water resources. • To collect and documenting information on meteorology and hydrology, and make use of them to serve national and international related sector for national benefits. • If necessary, provide support and technical advice to stakeholders such as private sector, NGO, community and people to appropriately correct/or better balance on water resources business making. • To widen and introduce more model technology in order to better train and propagate widely. • To participate in executing all works related to Mekong river basin in accordance with duties and responsibilities of MOWRAM. • Strengthen and promote national and international cooperation on water resources and meteorology. • The Ministry of Water Resources and Meteorology is led by Minister HE Lim Kean Hor.
3. Legal status	What is the organization's legal status? Has it met the legal requirements for operation in the programme country?	Ministry of Water Resources and Meteorology (MOWRAM) was established based on proclamation, NS/RKM/0699108, dated on June 23rd, 1999.
4. Funding	What is the organization's main source (s) of funds?	As part of the ministries under the Royal Government of Cambodia, MOWRAM receives yearly funding to support its function from the Royal Government of Cambodia following MOWRAM request in

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
		according to the country financial management law and subject to the approval from the National Assembly.
5. Certification	Is the organization certified in accordance with any international standards or certification procedure?	MOWRAM is not certified in accordance with any international standards or certification procedure.
6. Proscribed organizations	Is the organization listed in any UN reference list of proscribed organizations?	MOWRAM is part of the line ministries established by the Royal Government of Cambodia, hence not found in any UN list of proscribed organizations. http://www.un.org/sc/committees/1267/con solist.shtml
PART II. Project Management Capacity		
2.1 Managerial Capacity		
1. Leadership Commitment	Are leaders of the organization ready and willing to implement the proposed project?	<p>The management of MOWRAM was engaged since the stage of validating the project concept. There is strong support from the Minister of MORAM and he has assigned one focal point and a group of technical team from the two relevant departments (DOM and DHRW) to work with UNDP representatives to further formulate the project in order to achieve its development result.</p> <p>The proposed project is also in line with the priorities identified by MOWRAM as part of the their climate change strategic and action plan recently being developed.</p>
2. Management experience and qualifications	Which managers in the organization would be assigned to work on the proposed project? What are their credentials and experience that relate to the proposed project? Do these managers have experience implementing UNDP or other donor-funded projects?	<p>The project has the objective to support the development of the Early Warning System to support the country development (with the scope to support infrastructure improvement, climate/environmental data gathered, and capacity building for data interpretation and ensure its usage in the relevant sector such as agriculture and planning in overall). MOWRAM has the mandate in this area; hence the ministry was selected as the Implementing Partner of the project. In line with the ministry mandate, its staffs are also equipped with the technical knowledge necessary for the implementation of the project and to further explore the good strategic approach to ensure the implementation of the project which will lead to effective development result/impact.</p>

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
		<p>To implement the project, one senior representative from the National Project Management Committee and a group of representatives at the technical level will be assigned to ensure the proper function of the project.</p> <p>Although UNDP engages with MOWRAM for the first time, the manager has experience dealing with different donor-funded projects and has understanding on the basic requirement on the project management and its dynamic.</p>
3. Planning and budgeting	<p>Does the organization apply a results-based management methodology? Are there measurable outputs or deliverables in the strategies, programmes and work plans? Are budgets commensurate with intended results? How do planners identify and accommodate risks?</p>	<p>Specifically to the two departments that the project will work with, DHRW and DOM, the focal person was involved in different development projects but their nature was short-term (less than one year) and mainly on providing training. In this regards, the nature of the monitoring/management is less complex compared to the scale of the project – Strengthening Climate Information and Early Warning Systems in Cambodia to Support Climate Resilient Development and Adaptation to Climate Change.</p>
4. Supervision, review, and reporting	<p>How do managers supervise the implementation of work plans? How do they measure progress against targets? How does the organization document its performance, e.g., in annual or periodic reports? How are the organization's plans and achievements presented to stakeholders? Does the organization hold regular programme or project review meetings? Are such meetings open to all stakeholders? Are the organization's activities subject to external evaluation? How does the organization learn and adapt from its experience?</p>	<p>Specifically to the two departments that the project will work with, their experience was with the simpler/shorter project. Hence, the measurement of the progress is straight forward by looking at completion of the different milestone. At the ministry level, the assigned project working group will need to regularly report to the National Project Management Committee. The meeting of the NPMC is internal to the ministry.</p>
5. Networking	<p>What other organizations are critical for the successful functioning of this organization? How does the organization conduct relations with these organizations? Is the organization a party to knowledge networks, coordinating bodies, and other fora?</p>	<p>As the line ministries of the Royal Government of Cambodia, to ensure the development of the country, MOWRAM needs to work with other line ministries, development agencies, and other stakeholder.</p>
2.2 Technical Capacity		
1. Technical knowledge and skills	<p>Do the skills and experience of the organization's technical professionals match those required for the project? Would these professionals be available to the project?</p>	<p>As mentioned in the comment to the part 2.1.2 "The project has the objective to support the development of the Early Warning System to support the country</p>

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
	<p>Does the organization have the necessary technical infrastructure (e.g., laboratories, equipment, software, technical data bases, etc.) to support the implementation of the project?</p> <p>How do staff members of the organization keep informed about the latest techniques and trends in their areas of expertise?</p> <p>What external technical contacts and networks does the organization utilize?</p> <p>What professional associations does the organization and/or its professional staff belong to?</p>	<p>development (with the scope to support infrastructure improvement, climate/environmental data gathered, and capacity building for data interpretation and ensure its usage in the relevant sector such as agriculture and planning in overall). MOWRAM has the mandate in this area; hence the ministry was selected as the Implementing Partner of the project. In line with the ministry mandate, its staffs are also equipped with the technical knowledge necessary for the implementation of the project and to further explore the good strategic approach to ensure the implementation of the project which will lead to effective development result/impact."</p> <p>With its mandate, MOWRAM is lead government agency gathering info on weather and climate. Although there is limitation preventing the full function of the technical infrastructure, the infrastructure exist which allows MOWRAM to generate info on weather and climate in Cambodia and they have nation-wide network with the sub-national authority.</p>
PART III. Administrative and Financial Management Capacities		
3.1 Administrative capacity. Note: Answer only questions that are relevant to the proposed project.		
1. Facilities, infrastructure and equipment	<p>Does the organization possess sufficient administrative facilities, infrastructure, equipment and budget to carry out its activities, particularly in relation to the requirements of the project?</p> <p>Can the organization manage and maintain the administrative and technical equipment and infrastructure?</p>	<p>MOWRAM is located in a big compound in the centre of Phnom Penh city. The compound consists of office spaces and facilities to support the functioning of the ministry. It contains of the office spaces for different line departments of the ministry and the working spaces for its different development projects.</p> <p>MOWRAM is one of the ministries established by the Royal Government of Cambodia to support the development effort for the country; the infrastructure to support the function of MOWRAM is going to remain and can be used by the project based on the discussion with the counterpart from MOWRAM to ensure the necessary arrangement.</p>
2. Recruitment and personnel management	<p>Does the organization have the legal authority to enter into employment contracts with individuals?</p> <p>If not, what is the relationship of the</p>	<p>MOWRAM, as a ministry, has legal authority to enter into employments contracts with individual.</p>

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
	<p>organization with third parties in entering into employment contracts with individuals in terms of employee – employer relationship, payment of salaries, administration of entitlements, settlement of disputes and liabilities?</p> <p>Does the organization have dedicated personnel capacity? Do recruitment personnel have skills and experience that are appropriate to the requirements of the project? Does the organization have written recruitment procedures?</p> <p>Is there evidence that the organization conducts recruitment objectively on the basis of competition, fairness, and transparency? Does the organization have a salary scale that would apply to project personnel? Would that scale inhibit the hiring of the best candidates?</p> <p>If the organization has a salary scale, how often is this salary scale revised and what would be the likely impact of these raises to the project costs?</p> <p>Does the organization have established rules to deal with dispute cases effectively? What is the staff well-being policy of the organization, in particular dealing with discrimination, grievances, harassment and abuse cases?</p> <p>In case of dispute cases with its staff working in projects does the organization undertake full responsibility to investigate and settle such cases without infringement to UNDP? Is the leave policy of the organization compatible with UNDP's leave policies and is this policy likely to impede project implementation activities?</p> <p>Does the organization have personnel policies regarding death and disability? Does the organization have personnel policies on health insurance and pension arrangements?</p>	<p>Each year, based on the overall guidance from the Ministry of Public Function – the newly-established ministry and the former State Secretariat of Public Function under the Council of Minister – MORAM identifies its needs for contract staffs or civil servants. Then, its Department of Personnel will produce the request to be approved by MORAM management and by the Ministry of Public Function. The guidance note will be issued to guide the process of recruiting the staffs which is going to be taken by MORAM. The process of recruitment is normally through the advertisement, then the candidates will take the public exam, and the selected names will be identified.</p> <p><i>There is no clear assurance mechanism to ensure the quality of the recruitment and also to ensure the compliance to the international standard of the recruitment. In addition, with the absence of the detail recruitment requirement, to perform the function in accordance to the international standard of recruitment and personnel management, the staffs of the ministry needs capacity building in this area.</i></p> <p>There is salary scale which is not regularly reviewed to ensure the competitiveness of the package payment to the staffs. There is the rule dealing with dispute cases, staff well-being policy, leave policy, personal policy regarding death and disability, and personnel policy on health, but the enforcement, consistency in the implementation, and its impact to staff are still not clear.</p>
3. Procurement and contracting	<p>Does the organization have the legal authority to enter into contracts and agreements with other organizations? Does the organization have access to legal counsel to ensure that contracts are enforceable, meet performance standards, and protect the interests of the organization and UNDP?</p> <p>Does the organization have dedicated procurement capacity? Do procurement personnel have skills and experience that</p>	<p>MORAM has the legal authority to enter into contract and agreement with other organization in its capacity as the line ministry of the Royal Government of Cambodia.</p> <p>There is the process used in the ministry to perform procurement function and contracting, but mostly for relatively small goods and services. <i>There is no clear assurance mechanism to ensure the quality of the procurement and contracting</i></p>

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
	<p>are appropriate to the requirements of the project? Does the organization have written procurement procedures? Number of staff involved in procurement?</p> <p>Is there evidence that the organization conducts procurement on the basis of best value for money, transparency, and effective international competition?</p> <p>Number of procurement actions and their value in the past year?</p> <p>Is there a procurement plan for either the current, or next year?</p>	<p><i>process and also to ensure the compliance to the international standard requirement. In addition, with the absence of the detail procurement and contracting requirement, to perform the function in accordance to the international standard of procurement and contracting, staffs of the ministry still needs capacity building in this area.</i></p>
3.2 Financial Management Capacity		
1. Financial management organization and personnel	<p>Does the organization have written rules and regulations for financial management that are consistent with international standards? Does the organization have a dedicated finance unit?</p> <p>Do finance managers and personnel have skills and experience that are appropriate to the requirements of the project? Is the existing financial management capacity adequate to meets the additional requirements of the project?</p> <p>Do finance personnel have experience managing donor resources?</p>	<p>MOWRAM has dedicated Department of Finance. The department takes care of the financial resources allocated to the ministry by the Royal Government of Cambodia and distributes accordingly to each line department based on the approval from MOWRAM management.</p> <p>The current financial practice/procedure was never been reviewed to ensure/check its consistency with international standard. <i>With the absence of the guidance on the detail requirement in financial management, to perform the function in accordance to the international standard requirement of financial management, staffs of the ministries will need capacity building in this area.</i></p>
2. Financial position	<p>Does the organization have a sustainable financial position?</p> <p>What is the maximum amount of money the organization has ever managed? If the proposed project is implemented by this organization, what percentage of the organization's total funding would the project comprise?</p>	<p>MOWRAM is functioned by the fund allocated every year by the Royal Government of Cambodia.</p> <p>MOWRAM manage every year the budget of around US\$39.50 Million (Source: National Budget Department of MEF). The percentage of the project fund to the total development aid received by MOWRAM is 70-100 Million US\$ per year (grant+loan).</p>
3. Internal control	<p>Does the organization maintain a bank account? Does the organization have written rules and procedures on segregation of duties for receipt, handling and custody of funds? How does the organization ensure physical security of advances, cash and records?</p> <p>Does the organization have clear written procedures and internal controls governing payments? How does the organization</p>	<p>With the absence of the guidance on the detail requirement in financial management, and with the limited experience in managing long-term development projects, specifically to the two departments (DHRW and DoM) involved by the project, the project will need to work closely with the two departments to reach the agreement on the internal control in managing project</p>

Areas for Assessment	Assessment Questions	Reference Documents and Information Sources
	<p>ensure that expenditures conform to their intended uses? Does the organization have a policy requiring two signatures for payments over a defined limit?</p> <p>Is there any evidence of non-compliance with financial rules and procedures?</p>	financial resources.
4. Accounting and financial reporting	<p>Are accounts established and maintained in accordance with national standards or requirements?</p> <p>When and to whom does the organization provide its financial statements?</p> <p>Can the organization track and report separately on the receipt and use of funds from individual donor organizations?</p> <p>Is there any evidence of deficiencies in accounting or financial reporting?</p> <p>Does the organization have a system and procedures for asset management and inventory control?</p>	<p>Based on the current practice, there is not clear guideline on the standard system used for accounting and financial reporting purpose, and asset and inventory control. No clear monitoring mechanism/arrangement to ensure the quality of asset and inventory management and also to ensure the accuracy of accounting and financial reporting.</p> <p>In working with development agencies on the development projects, the requirement of the development agencies are used.</p>
5. Audit	<p>Is the organization subject regularly to external audit? Is audit conducted in accordance with international audit standards? Are audit findings public? If so, have the organization's financial audits produced any significant recommendations for strengthening of financial systems and procedures? Have audits identified instances of non-compliance with rules and procedures or misuse of financial resources? What has been done to carry out audit recommendations?</p>	<p>The organization is subject to internal audit and external audit conducted by the National Audit Authority. There is no claim in regards to the compliance of the current audit to the international standard. The result of the audit was also not public.</p>

Annex I. Terms of Reference

The following are general terms of reference for key functions and positions in the project, which should be further elaborated as necessary.

A. Project Board

The role of Project Board is already described in Section 5. The Project Board shall meet semi-annually, as well as on an ad hoc basis when requested by the Project Coordinator.

The Project Board is the group responsible for making by consensus management decisions for a project when guidance is required by the Project Coordinator, including approval of project plans and revisions. In order to ensure UNDP ultimate accountability, Project Board decisions should be made in accordance to standards⁸⁶ that shall ensure best value to money, fairness, integrity transparency and effective international competition. In case a consensus cannot be reached, final decision shall rest with the UNDP Programme Manager (i.e. the Country Director).

Project reviews by the Project Board are made at designated decision points during the running of a project, or as necessary when raised by the Project Coordinator. The Project Board is consulted by the Project Coordinator for decisions when project tolerances have been exceeded⁸⁷.

Based on the approved annual work plan (AWP), the Project Board may review and approve project quarterly plans when required and authorises any major deviation from these agreed quarterly plans. It is the authority that signs off the completion of each quarterly plan as well as authorises the start of the next quarterly plan. It ensures that required resources are committed and arbitrates on any conflicts within the project or negotiates a solution to any problems between the project and external bodies.

The Project Board has specific responsibilities at different stages of the project. They include:

Defining a project

- Review and approve the Initiation Plan

Initiating a project

- Review the Progress Report for the Initiation Stage

Running a project

- Review and appraise detailed Project Plan and AWP, including Atlas reports covering activity definition, quality criteria, issue log, risk log and the monitoring and communication plan
- Provide overall guidance and direction to the project, ensuring it remains within any specified constraints
- Address project issues as raised by the Project Coordinator

⁸⁶ UNDP Financial Rules and Regulations: Chapter E, Regulation 16.05: a) The administration by executing entities or, under the harmonized operational modalities, implementing partners, of resources obtained from or through UNDP shall be carried out under their respective financial regulations, rules, practices and procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. b) Where the financial governance of an executing entity or, under the harmonized operational modalities, implementing partner, does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition that of UNDP shall apply.

⁸⁷ The Project Board has the responsibility to define for the Project Coordinator the specific project tolerances within which the Project Coordinator can operate without intervention from the Project Board. For example, if the Project Board sets a budget tolerance of 10%, the Project Coordinator can expend up to 10% beyond the approved project budget amount without requiring a revision from the Project Board.

- Provide guidance and agree on possible countermeasures/management actions to address specific risks
- Agree on Project Coordinator's tolerances in the Annual Work Plan and quarterly plans when required
- Conduct regular meetings to review the Project Quarterly Progress Report and provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans
- Review Combined Delivery Reports (CDR) prior to certification by the Implementing Partner
- Review each completed project stage and approve progress to the next
- Appraise the Project Annual Progress Report, make recommendations for the next AWP, and inform the Outcome Board about the results of the review
- Provide ad-hoc direction and advice for exception situations when tolerances are exceeded
- Assess and decide on project changes through revisions

At the end of the project

- Assure that all Project deliverables have been produced satisfactorily
- Review and approve the Final project report, including lessons learnt
- Make recommendations for follow on actions to be submitted to the Outcome Board
- Commission project evaluation
- Notify operational completion of the project to the Outcome Board

B. Project Coordinator

The Project Coordinator will be accountable to both the MOWRAM Senior Official and to UNDP Cambodia for the overall management of the project, including quality, timeliness and effectiveness of the services provided and the activities carried out, as well as for the use of funds. He/she will lead the project team on the technical aspects and strategic direction of the project, with guidance from the MOWRAM Technical Advisor.

The project includes training on forecasting, packaging of climate information, and installation of hydro-meteorological stations. Appropriate sequencing and pacing of activities will therefore be critical to the success of the project. The Project Coordinator will ensure that workplans reflect the strategic direction of the project, while considering appropriate timing and challenges that could delay or disrupt project implementation. Responsibilities include to:

- Ensure effective partnerships, including active engagement of national and provincial hydro-meteorology departments, as well as participation from sectoral and planning ministries
- Manage human and financial resources to achieve results in line with the outputs and activities outlined in the project document
- Lead the preparation and implementation of annual results-based workplans and the logistical framework, ensuring that the project appropriately reflects latest policy developments, as well as collaboration and synergy of efforts with ongoing efforts by government and development partners
- Day-to-day oversight and coordination of implementation of project activities
- Monitor project activities and financial management of the project, ensure the project is on-track and on-budget, ensuring also that monitoring systems are effective
- Report and provide feedback on project strategies, activities, progress and challenges to the Project Board
- Ensure reporting requirements are met in timely manner
- Applying evaluation criteria to past activities and make informed decisions on the way forward on the phased workplanning of the project, including recommendations to the Project Board as necessary
- Establishing and maintaining monitoring and tracking system
- Prepare regular reports on the project status, progress and challenges. Provide regular reports on risks and impacts of risk mitigation measures.

- Coordinate inputs to reports as required (including Annual Progress Reports, Inception Report, Quarterly Report, and the Terminal Report)

C. Project Coordination Technical Advisor (Inception Phase)

The Project Coordination Technical Advisor will technically assist the MOWRAM Technical Advisor and the Project Coordinator during the start-up of the project and focus on building technical capacity for running a project based on Results Management Guideline (RMG) approach. The Project Coordination Technical Advisor will assist the Project Coordinator to develop a project management system including roles and responsibilities, project work plan, reports, preparation for project audits and project evaluation, communication plan and risk management plan. Responsibilities include to:

- Develop a project inception report and set up the project management structure, defining roles and responsibilities of key players in accordance with RMG, which should include but not limit to the following points:
 - Project management structures with clear role and responsibility and reporting lines,
 - Project reporting requirements for UNDP and GEF/LDCF,
 - Finalize TORs for key positions,
 - Technical specification of key project outputs,
 - Review and refine project indicators and baseline information needed,
 - Project risk log/issue log,
 - Project work plan including annual workplan and quarterly workplan,
 - Project procurement plan and recruitment plan
 - Project monitoring and evaluation plan
 - Project lessons learned log
 - Set up and make formalize make-up and ToR of the Project Board,
- Mobilize project team to support project implementation
- Conduct capacity needs assessment and institutional mapping to develop a capacity development plan for project staff and key project stakeholders at both the national and provincial levels
- Develop a strategy to ensure appropriate gender mainstreaming into project implementation
- Coach project management team in start-up process for the project and for raising the profile of the project through launching workshops
- Identify opportunities to promote strong partnerships and synergies with other development partners especially ADB, MRC, JICA and WB.

D. Finance & Operations Officer

The Finance & Operations Officer will ensure timely project delivery, transparent reporting and record keeping, as well as compliance with NIM policies. The Finance & Operations Officer will work closely with the UNDP CO, which will provide direct support to project implementation. Responsibilities include to:

Workplanning & Budgeting

- Research and advise the Project Coordinator on cost/time estimates to support project activities, ensuring efficiency and cost-effectiveness
- Regular review of the overall project balance ensuring that ultimately cumulative expenditure is within the overall project budget
- Prepare of annual budgets to support the planned activities, ensuring that budgeted amounts and expected disbursement schedules are reasonable, and remaining funds are sufficient
- Draft procurement/recruitment plan to support agreed workplan

- Inform Project Coordinator of financial/operational issues affecting project delivery, propose budget revisions/adjustments as necessary

Project Delivery & Reporting

- Execute procurement and recruitment plan, ensuring transparency, cost-effectiveness/efficiency, and compliance with NIM
- Manage payroll and cash reserves of the project
- Prepare quarterly expenditure report, and request cash advance from UNDP (i.e. Fund Authorization and Certificate of Expenditure (FACE))
- Manage financial and administrative aspects of project assets, maintain registers for inventory of non-expendable equipment and ensure that the equipment is safe and in proper working condition, providing regular updates to inform further implementation (e.g. next phase of station installation)
- Prepare financial/operational progress reports for project team, PB, or other meetings
- Identify reporting challenges and make adjustments to internal reporting procedure as necessary to address problems (if any), ensure that the minimum reporting requirements are met
- Ensure documentation and records are up-to-date and complete, meeting audit standards
- Support the regular monitoring, as well as evaluation and audit processes by providing reports, supporting documentation and other information as needed
- Provide information as needed for other purposes or ad hoc requests (e.g. UNDP or donor request, publications, communication materials, etc...)

E. Observational Equipment Specialist (Short term)

As an initial step to Outcome 3, the Specialist will support the Project Coordinator in identifying data needs (parameters) and establishing criteria for the procurement of stations, ensuring standardization in the national observational network. Responsibilities include:

- Establish criteria for the procurement of hydro-meteorological stations (e.g. parameters, brands, etc.)
- Draft budget for the long term O&M of the equipment, including operations, regular maintenance, replacement of sensors (and calibration), possible replacement of equipment at vulnerable sites susceptible to damage from natural events, as well as costs of collecting data generated by other sources
- Research innovation approaches to station placement which can ensure longer term sustainability (e.g. entering into MoU with telecom companies), propose detailed alternatives and related cost implications. With support from Project Coordinator initiate related partnerships.
- Identify criteria for evaluation of working condition and risk levels related to O&M, which will inform the subsequent procurement and installation of additional stations throughout project implementation

F. Knowledge Management and Training Expert (Part time)

The Knowledge Management and Training Expert will be recruited to support the Project Coordinator in ensuring that the training efforts of the project are sustainable.

- Provide guidance on identifying staff to serve as trainers (i.e. Outcome 1, 3)
- Work with the research institutions (Outcomes 1, 2) and companies (Outcome 3) delivering the training, to develop training materials which can be maintained by recipient institutions
- Engage and formalize agreements with local universities and vocational schools to house training programmes

G. Innovative Finance Specialist

The Innovative Finance Specialist will support the Project Coordinator in identifying and securing financing for the long term O&M of the observational equipment, including private and public financing arrangements. Responsibilities include to:

- Draft financing plan indicating O&M costs,
- Conduct market research to gauge willingness-to-pay for the tailored weather products produced under Outcome 1, capturing interests such as banking/lending institutions, insurance providers, telecommunication service providers, tourism operators and large agricultural companies (e.g. producing products related to major exports such as sugar cane, Kampot pepper, and rice)
- Identify partners/contributors and support in formalizing public-private partnerships
- Support MOWRAM in establishing a financial mechanism (or linking to mechanism established under the CCCA) for the effective implementation and monitoring of the O&M financing plan, including the budget allocation for O&M currently budgeted under the LDCF project

H. Capacity Building and Technical Expertise

A series of training and research expertise will be required to support the delivery of vocational and technical training related to the collection, analysis and application of climate information:

- Climate forecast, modeling and analysis
- Satellite data and imagery analysis and dissemination
- Training in hydrology modeling analysis
- Training in identifying and developing sector specific and tailor made products based on user needs
- Training on applying information such as risk maps and environmental information to improve accuracy and timeliness of early warning messages
- Training on applying climate analysis to inform climate resilient planning
- Training in the operations, maintenance and calibration of observational equipment

Annex J.

UNDP Environmental and Social Screening

QUESTION 1:

Has a combined environmental and social assessment/review that covers the proposed project already been completed by implementing partners or donor(s)?

Select answer below and follow instructions:

☒ →NO: Continue to Question 2 (do not fill out Table 1.1)

☐ →YES: No further environmental and social review is required if the existing documentation meets UNDP's quality assurance standards, and environmental and social management recommendations are integrated into the project. Therefore, you should undertake the following steps to complete the screening process:

1. Use Table 1.1 below to assess existing documentation. (It is recommended that this assessment be undertaken jointly by the Project Developer and other relevant Focal Points in the office or Bureau).
2. Ensure that the Project Document incorporates the recommendations made in the implementing partner's environmental and social review.
3. Summarize the relevant information contained in the implementing partner's environmental and social review in Annex A.2 of this Screening Template, selecting Category 1.
4. Submit Annex A to the PAC, along with other relevant documentation.

Note: Further guidance on the use of national systems for environmental and social assessment can be found in the UNDP ESSP Annex B.

TABLE 1.1: CHECKLIST FOR APPRAISING QUALITY ASSURANCE OF EXISTING ENVIRONMENTAL AND SOCIAL ASSESSMENT	Yes/No
1. Does the assessment/review meet its terms of reference, both procedurally and substantively?	
2. Does the assessment/review provide a satisfactory assessment of the proposed project?	
3. Does the assessment/review contain the information required for decision-making?	
4. Does the assessment/review describe specific environmental and social management measures (e.g. mitigation, monitoring, advocacy, and capacity development measures)?	
5. Does the assessment/review identify capacity needs of the institutions responsible for implementing environmental and social management issues?	
6. Was the assessment/review developed through a consultative process with strong stakeholder engagement, including the view of men and women?	
7. Does the assessment/review assess the adequacy of the cost of and financing arrangements for environmental and social management issues?	

Table 1.1 (continued) For any "no" answers, describe below how the issue has been or will be resolved (e.g. amendments made or supplemental review conducted).

QUESTION 2:

Do all outputs and activities described in the Project Document fall within the following categories?

- ☐ Procurement (in which case UNDP's Procurement Ethics and Environmental Procurement Guide need to be complied with)
- ☐ Report preparation
- ☐ Training
- ☐ Event/workshop/meeting/conference (refer to Green Meeting Guide)
- ☐ Communication and dissemination of results

Select answer below and follow instructions:

- ☒ **NO** → Continue to Question 3
- ☐ **YES** → No further environmental and social review required. Complete Annex A.2, selecting Category 1, and submit the completed template (Annex A) to the PAC.

QUESTION 3:

Does the proposed project include activities and outputs that support *upstream* planning processes that potentially pose environmental and social impacts or are vulnerable to environmental and social change (refer to Table 3.1 for examples)? (Note that *upstream* planning processes can occur at global, regional, national, local and sectoral levels)

Select the appropriate answer and follow instructions:

- ☒ **NO** → Continue to Question 4.
- ☐ **YES** → Conduct the following steps to complete the screening process:
 1. Adjust the project design as needed to incorporate UNDP support to the country(ies), to ensure that environmental and social issues are appropriately considered during the upstream planning process. Refer to Section 7 of this Guidance for elaboration of environmental and social mainstreaming services, tools, guidance and approaches that may be used.
 2. Summarize environmental and social mainstreaming support in Annex A.2, Section C of the Screening Template and select "Category 2".
 3. If the proposed project **ONLY** includes upstream planning processes then screening is complete, and you should submit the completed Environmental and Social Screening Template (Annex A) to the PAC. If downstream implementation activities are also included in the project then continue to Question 4.

TABLE 3.1	EXAMPLES OF UPSTREAM PLANNING PROCESSES WITH POTENTIAL DOWNSTREAM ENVIRONMENTAL AND SOCIAL IMPACTS	Check appropriate box(es) below
1.	Support for the elaboration or revision of global-level strategies, policies, plans, and programmes. <i>For example, capacity development and support related to international negotiations and agreements. Other examples might include a global water governance project or a global MDG project.</i>	
2.	Support for the elaboration or revision of regional-level strategies, policies and plans, and programmes. <i>For example, capacity development and support related to transboundary programmes and planning (river basin management, migration, international waters, energy development and access, climate change adaptation etc.).</i>	
3.	Support for the elaboration or revision of national-level strategies, policies, plans and programmes. <i>For example, capacity development and support related to national development policies, plans, strategies and budgets, MDG-based plans and strategies (e.g. PRS/PRSPs, NAMAs), sector plans.</i>	
4.	Support for the elaboration or revision of sub-national/local-level strategies, policies, plans and programmes. <i>For example, capacity development and support for district and local level development plans and regulatory frameworks, urban plans, land use development plans, sector plans, provincial development plans, provision of services, investment funds, technical guidelines and methods, stakeholder engagement.</i>	

QUESTION 4:

Does the proposed project include the implementation of *downstream* activities that potentially pose environmental and social impacts or are vulnerable to environmental and social change?

To answer this question, you should first complete Table 4.1 by selecting appropriate answers. If you answer "No" or "Not Applicable" to all questions in Table 4.1 then the answer to Question 4 is "NO." If you answer "Yes" to any questions in Table 4.1 (even one "Yes" can indicate a significant issue that needs to be addressed through further review and management) then the answer to Question 4 is "YES":

☐ **NO** → No further environmental and social review and management required for downstream activities. Complete Annex A.2 by selecting "Category 1", and submit the Environmental and Social Screening Template to the PAC.

☒ **YES** → Conduct the following steps to complete the screening process:

1. Consult Section 8 of this Guidance, to determine the extent of further environmental and social review and management that might be required for the project.
2. Revise the Project Document to incorporate environmental and social management measures. Where further environmental and social review and management activity cannot be undertaken prior to the PAC, a plan for undertaking such review and management activity within an acceptable period of time, post-PAC approval (e.g. as the first phase of the project) should be outlined in Annex A.2.
3. Select "Category 3" in Annex A.2, and submit the completed Environmental and Social Screening Template (Annex A) and relevant documentation to the PAC.

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT	
1. Biodiversity and <u>Natural</u> Resources	Answer (Yes/No/ Not Applicable)
1.1 Would the proposed project result in the conversion or degradation of <u>modified habitat</u> , <u>natural habitat</u> or <u>critical habitat</u> ?	No
1.2 Are any development activities proposed within a legally protected area (e.g. natural reserve, national park) for the protection or conservation of biodiversity?	Yes
1.3 Would the proposed project pose a risk of introducing invasive alien species?	No
1.4 Does the project involve natural forest harvesting or plantation development without an independent forest certification system for sustainable forest management (e.g. PEFC, the Forest Stewardship Council certification systems, or processes established or accepted by the relevant National Environmental Authority)?	No
1.5 Does the project involve the production and harvesting of fish populations or other aquatic species without an accepted system of independent certification to ensure sustainability (e.g. the Marine Stewardship Council certification system, or certifications, standards, or processes established or accepted by the relevant National Environmental Authority)?	No
1.6 Does the project involve significant extraction, diversion or containment of surface or ground water? <i>For example, construction of dams, reservoirs, river basin developments, groundwater extraction.</i>	No
1.7 Does the project pose a risk of degrading soils?	No
2. Pollution	Answer (Yes/No/ Not Applicable)
2.1 Would the proposed project result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and transboundary impacts?	No
2.2 Would the proposed project result in the generation of waste that cannot be recovered, reused, or disposed of in an environmentally and socially sound manner?	No
2.3 Will the proposed project involve the manufacture, trade, release, and/or use of chemicals and hazardous materials subject to international action bans or phase-outs? <i>For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Convention on Persistent Organic Pollutants, or the Montreal Protocol.</i>	No
2.4 Is there a potential for the release, in the environment, of hazardous materials resulting from their production, transportation, handling, storage and use for project activities?	No
2.5 Will the proposed project involve the application of pesticides that have a known negative effect on the environment or human health?	No
3. Climate Change	

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT		
3.1	Will the proposed project result in significant ⁸⁸ greenhouse gas emissions? <i>Annex E provides additional guidance for answering this question.</i>	No
3.2	Is the proposed project likely to directly or indirectly increase environmental and social vulnerability to climate change now or in the future (also known as maladaptive practices)? You can refer to the additional guidance in Annex C to help you answer this question. <i>For example, a project that would involve indirectly removing mangroves from coastal zones or encouraging land use plans that would suggest building houses on floodplains could increase the surrounding population's vulnerability to climate change, specifically flooding.</i>	No
4.	Social Equity and Equality	Answer (Yes/No/ Not Applicable)
4.1	Would the proposed project have environmental and social impacts that could affect indigenous people or other vulnerable groups?	No
4.2	Is the project likely to significantly impact gender equality and women's empowerment ⁸⁹ ?	Yes
4.3	Is the proposed project likely to directly or indirectly increase social inequalities now or in the future?	No
4.4	Will the proposed project have variable impacts on women and men, different ethnic groups, social classes?	Yes
4.5	Have there been challenges in engaging women and other certain key groups of stakeholders in the project design process?	Yes
4.6	Will the project have specific human rights implications for vulnerable groups?	No
5.	Demographics	
5.1	Is the project likely to result in a substantial influx of people into the affected community(ies)?	No
5.2	Would the proposed project result in substantial voluntary or involuntary resettlement of populations? <i>For example, projects with environmental and social benefits (e.g. protected areas, climate change adaptation) that impact human settlements, and certain disadvantaged groups within these settlements in particular.</i>	Yes
5.3	Would the proposed project lead to significant population density increase which could affect the environmental and social sustainability of the project? <i>For example, a project aiming at financing tourism infrastructure in a specific area (e.g. coastal zone, mountain) could lead to significant population density increase which could have serious environmental and social impacts (e.g. destruction of the area's ecology, noise pollution, waste management problems, greater work burden on women).</i>	No
6.	Culture	
6.1	Is the project likely to significantly affect the cultural traditions of affected communities,	No

⁸⁸ Significant corresponds to CO₂ emissions greater than 100,000 tons per year (from both direct and indirect sources).

⁸⁹ Women are often more vulnerable than men to environmental degradation and resource scarcity. They typically have weaker and insecure rights to the resources they manage (especially land), and spend longer hours on collection of water, firewood, etc. (OECD, 2006). Women are also more often excluded from other social, economic, and political development processes.

Handwritten signatures and initials in blue ink.

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT		
	including gender-based roles?	
6.2	Will the proposed project result in physical interventions (during construction or implementation) that would affect areas that have known physical or cultural significance to indigenous groups and other communities with settled recognized cultural claims?	No
6.3	Would the proposed project produce a physical "splintering" of a community? <i>For example, through the construction of a road, powerline, or dam that divides a community.</i>	No
7. Health and Safety		
7.1	Would the proposed project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions? <i>For example, development projects located within a floodplain or landslide prone area.</i>	No
7.2	Will the project result in increased health risks as a result of a change in living and working conditions? In particular, will it have the potential to lead to an increase in HIV/AIDS infection?	No
7.3	Will the proposed project require additional health services including testing?	No
8. Socio-Economics		
8.1	Is the proposed project likely to have impacts that could affect women's and men's ability to use, develop and protect natural resources and other natural capital assets? <i>For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their development, livelihoods, and well-being?</i>	No
8.2	Is the proposed project likely to significantly affect land tenure arrangements and/or traditional cultural ownership patterns?	No
8.3	Is the proposed project likely to negatively affect the income levels or employment opportunities of vulnerable groups?	No
9. Cumulative and/or Secondary Impacts		Answer (Yes/No/ Not Applicable)
9.1	Is the proposed project location subject to currently approved land use plans (e.g. roads, settlements) which could affect the environmental and social sustainability of the project? <i>For example, future plans for urban growth, industrial development, transportation infrastructure, etc.</i>	No
9.2	Would the proposed project result in secondary or consequential development which could lead to environmental and social effects, or would it have potential to generate cumulative impacts with other known existing or planned activities in the area? <i>For example, a new road through forested land will generate direct environmental and social impacts through the cutting of forest and earthworks associated with construction and potential relocation of inhabitants. These are direct impacts. In addition, however, the new road would likely also bring new commercial and domestic development (houses, shops, businesses). In turn, these will generate indirect impacts. (Sometimes these are termed "secondary" or "consequential" impacts). Or if there are similar developments planned in the same forested area then cumulative impacts need to be considered.</i>	No

ENVIRONMENTAL AND SOCIAL SCREENING SUMMARY ANNEX A.2:
(to be filled in after Annex A.1 has been completed)

Name of Proposed Project: Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change

A. Environmental and Social Screening Outcome

Select from the following:

☐ Category 1. No further action is needed

☐ Category 2. Further review and management is needed. There are possible environmental and social benefits, impacts, and/or risks associated with the project (or specific project component), but these are predominantly indirect or very long-term and so extremely difficult or impossible to directly identify and assess.

☒ Category 3. Further review and management is needed, and it is possible to identify these with a reasonable degree of certainty. If Category 3, select one or more of the following sub-categories:

☒ Category 3a: Impacts and risks are limited in scale and can be identified with a reasonable degree of certainty and can often be handled through application of standard best practice, but require some minimal or targeted further review and assessment to identify and evaluate whether there is a need for a full environmental and social assessment (in which case the project would move to Category 3b).

☐ Category 3b: Impacts and risks may well be significant, and so full environmental and social assessment is required. In these cases, a scoping exercise will need to be conducted to identify the level and approach of assessment that is most appropriate.

B. Environmental and Social Issues (for projects requiring further environmental and social review and management)

In this section, you should list the key potential environmental and social issues raised by this project. This might include both environmental and social opportunities that could be seized on to strengthen the project, as well as risks that need to be managed. You should use the answers you provided in Table 4.1 as the basis for this summary, as well as any further review and management that is conducted.

1.2 Are any development activities proposed within a legally protected area (e.g. natural reserve, national park) for the protection or conservation of biodiversity?

The project includes the installation of up to 24 meteorological stations and 55 hydrological stations. Though not yet certain, it may be possible that some of the selected locations are located in protected areas. Selection of locations will be based on various factors such as need (i.e. to ensure adequate national climate observation coverage), climate vulnerability of the area, and cost. If the proposed locations are situated in legally protected areas, detailed analysis will be conducted and appropriate measures will be taken for the protection or conservation of biodiversity.

3.2 Is the proposed project likely to directly or indirectly increase environmental and social vulnerability to climate change now or in the future (also known as maladaptive practices)? You can refer to the additional guidance in Annex C to help you answer this question.

The project indeed aims to reduce the environmental and social vulnerability of communities through providing early warnings, seasonal and climate forecasts that enable the communities to respond to climate induced risks (based on hazard, exposure and vulnerability).

4.2 Is the project likely to significantly impact gender equality and women's empowerment?

The project seeks to enhance gender equality. The project will ensure that early warning messages take into account the special needs of women (e.g. lower literacy rates in vulnerable communities). By ensuring that messages are communicated in an effective

way, men and women alike will have access to the same climate information and early warning messages. Knowledge which can then be applied in household level agriculture planning and disaster preparedness.

Further, disaster risk reduction needs to integrate gender perspective through the collection of gender specific data along with noting specific concerns pertaining to women in terms of preparedness and adaptation requirements while reducing exposure to hazards. It is also imperative that an enabling environment be created for women to be equal partners in the implementation of climate risk management measures. Likewise while gearing for disaster risk reduction, constraints of marginalized and vulnerable groups (i.e. adaptive capacity) have been factored into project ownership and benefits.

4.4 Will the proposed project have variable impacts on women and men, different ethnic groups, social classes?

The project seeks to provide climate information and early warning messages that can be applied at various levels. Stakeholder consultations stressed the importance of ensuring that the nation's most vulnerable benefit from the project. Towards this goal, the project focuses largely on the agriculture sector, which represents 85% of households and is the sector most vulnerable to climate change.

4.5 Have there been challenges in engaging women and other certain key groups of stakeholders in the project design process?

No. The Ministry of Women's Affairs participated in the Inception Workshop of the design phase, and female farmers were consulted during the design phase of the project. Specifically the women were asked about their experience with receiving early warning messages and how the existing system could be improved. Their comments were integrated into the project document.

5.2 Would the proposed project result in substantial voluntary or involuntary resettlement of populations?

The proposed EWS project will produce tailored climate and weather information service (both short- and long-term) for improved sectoral planning (agriculture, water, finance etc.) and disaster management. The decision making is based on the uncertainties associated with location and past history of extreme weather events experienced. This EWS project will also strengthen the Standard Operating Procedures (SOPs) for issuing and disseminating warnings. It is possible that vulnerable communities located in flood prone areas may opt for voluntary resettlement to safer locations, which is beyond the project scope.

7.1 Would the proposed project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?

As mentioned in 5.2 above, the proposed project reduces the vulnerability of communities to flooding and extreme climatic conditions.

C. Next Steps (for projects requiring further environmental and social review and management):

In this section, you should summarize actions that will be taken to deal with the above-listed issues. If your project has Category 2 or 3 components, then appropriate next steps will likely involve further environmental and social review and management, and the outcomes of this work should also be summarized here. Relevant guidance should be obtained from Section 7 for Category 2, and Section 8 for Category 3.

Environmental Impacts: Overall, the proposed LDCF project focuses on introducing climate considerations in the planning processes and early warning infrastructure to respond to changing climate conditions. This is achieved through improving the hardware and software capacity to monitor extreme weather and climate, forecast and customise the information as needed for national planning processes and alert communities of climate induced risks such as flooding as prioritized by the MOWRAM, the DOM and the Department of Hydrology and River Works (DHRW) in Cambodia. But, as mentioned under 1.2 and 3.2 above, the project indeed aims to reduce the environmental and social vulnerability of communities through providing early warnings, seasonal and climate forecasts that enable the communities to respond to risks. In case if the proposed locations are situated in legally protected areas, appropriate measures will be identified for the protection or conservation of biodiversity.

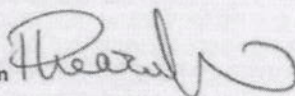
Socio-economic Impacts: During the design and implementation of the project, vulnerable communities and groups, especially women, children, elderly, the disabled, and the socially or economically weaker sections will be sufficiently consulted and facilitate their participation to ensure the inclusiveness of measures being planned and implemented. As it was emphasized in 4.2, 4.4, and 5.2, the project seeks to enhance gender equality by ensuring that messages are disseminated in a manner that reaches the largest number of people. This includes taking into account issues of illiteracy, which affect women disproportionately in Cambodia.

Overall, the project will also reduce the vulnerability of communities to flooding and extreme climatic condition. The project was designed to ensure that the most vulnerable provinces are prioritized in the staged implementation of the project.

D. Sign Off

Project Manager

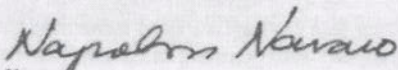
For Sovanny Chhum



Date 06/08/2014

PAC

Napoleon Navaro

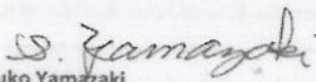


Date

2014.08.6

Programme Manager

Setsuko Yamazaki



Date

6/Aug/2014



Annex K: Local Project Appraisal Committee (LPAC) Minutes

Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change (EWS)
Local Project Appraisal Committee (LPAC) Meeting

25th April 2014, 14:30-17:00
The Imperial Garden Villa & Hotel

Background

About LPAC and processes leading to the LPAC

- The LPAC provides a forum for discussion and review the technical soundness and relevance of a new UNDP project. The recommendation of the LPAC will be submitted to the UNDP senior management for the final endorsement of the project before submitting for approval from the GEF Council. The Committee's main roles and responsibilities are to review the proposed project document and provide comments with specific focus on, but not limited to, the following areas: 1. Relevance to national priorities/policies and community needs; 2. Project Strategy to address underlying problems and promote sustainability; 3. Strategy result framework; 4. Implementation arrangement; and M&E and risk management
- Prior to the LPAC meeting, UNDP conducted a series of consultation meetings with various relevant stakeholders; these includes the Project Inception Workshop on August 13th, 2013 to officially commence the project design process, followed by a number of bilateral meetings with key government counterparts, development partners and civil society organisations, and the finally the stakeholder consultation workshop to validate the early draft of the project document on March 13th, 2014. The comments received from these stakeholder consultations have been incorporated into the draft project document that was sent to the LPAC members prior to the meeting.

About Cambodia and EWS

- Climate change induced events such as floods, cyclones/typhoons and droughts have significantly impacted the Cambodia causing infrastructure damage, direct economic losses, risks to health and even loss of life. The damage that was caused by Typhoon loss of US\$ 130 m. The flood in 2011 affected 683,498 ha of agricultural land, causing estimated US\$ 451 m damage and recently flood year 2013 resulted in loss of US\$ 356 m thus affecting the Cambodian economy more susceptible to floods and drought.
- The Royal Government of Cambodia (RGC) recognized the climate of change need counter measures and cost considerations in long-term planning, and sector decision making processes. The expectation is that if such events are monitored and predicted early, anticipated impacts could be minimized (or opportunities maximised) significantly.
- Thus far, the Cambodia line ministry especially Ministry of Water Resources and Meteorology has been supported by numerous supporting frameworks such as ADB, JICA and MRC.

About GEF and the objective of the EWS project

- The project is a result of the UNDP's assistance to the Royal Government of Cambodia with financial support from the Global Environment Facilities' Least Developed Countries Trust Fund (GEF/LDCF) in addressing the country's climate change adaptation priorities.

- The objective of the project is to strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change. The project aims to build the capacity for analysis, modeling and communication of climate trend information and weather event advisories, as well as transferring weather and environmental observational technology. The project objective is achieved through three complimentary outcomes as follows:

- Outcome 1: Increased institutional capacity to assimilate and forecast weather, hydrological, climate and environmental information
- Outcome 2: Climate and weather information available and utilized for national, sectoral and sub-national planning as well as for transboundary communication in the region
- Outcome 3: Strengthened institutional capacity to operate and maintain EWS and climate information infrastructure, both software and hardware, in order to monitor weather and climate change

Remarks

The meeting was co-chaired by Mr. Napoleon Navarro, UNDP Deputy Country Director, and H.E. Bun Mean, Secretary of State, Ministry of Water Resources and Meteorology.

H.E. Bun Mean thanked UNDP for organizing the meeting and expressed his full support for the EWS project by highlighting that the project will further support the government of Cambodia in strengthening EWS and climate information in response to climate change impacts and natural hazards. He emphasized the government commitment to support the project implementation and beyond by committing the allocation of the national budget to support the operations and maintenance of the climate observing infrastructure which will be supported by the project. He also invited the participants to share their views and comments for the project drawing on the lessons that they have learned from existing experiences.

Mr. Napoleon Navarro greeted and welcomed all the participants and introduced the background and main purposes of EWS and LPAC meeting. He remarked that EWS would make important contribution to existing adaptation framework as part of the country's response to climate change impacts. He emphasized two important aspects that need to be considered in the meeting as follows (i) how to sustain the network and (ii) how to interpret data/information to be useful for end users.

Presentation

Ms. Kalyan Keo, Programme Analyst, UNDP and Mr. Toch Benvongsar, National Project Development Coordinator made a presentation of the draft project document. The presentation covered the following aspects:

- 1) Overview of the project formulation process,
- 2) The project rationale,
- 3) Strategic direction of the project,
- 4) Results framework and budget on the project,
- 5) Project implementation arrangement and monitoring and evaluation, and
- 6) Risk mitigation strategy

Discussion and comments

The presentation was followed by a number of questions/comments raised by participants. Key points are summarized as follows (please refer to the attachment 1 for more detailed comments).

The project overall approach:

- The participants expressed the relevance of the project and its importance for Cambodia and thus stated their positions to support the implementation of the project.

The project strategic direction:

- While it is important to strengthen the climate observing infrastructure to be able to generate more robust, up-to-date and accurate data, it is also crucial to balance the scope of the project with an effective information dissemination that will meet the needs of the end users.
- It is suggested that the rehabilitation and installation of stations should be prioritized around the mainstream and tributaries of the Tonle Sap Lake. The following step will extend to other river basin in Cambodia.
- On the capacity development, the project should focus on building younger generations of hydrologists and meteorologists by working in close collaboration with national academic institutions.
- Women's participation in key project activities in particular capacity building activities is crucial.
- Lessons and experiences from the MRC's HYCOS initiative are valuable to be incorporated into the project design. It is important to ensure budget for operations and maintenance is secured not only during the project implementation but also after the project ends. It is also important to promote standardizations in terms of procedures and models.
- The term "prototype" needs to be clearly defined. It is important to ensure that detail specification/criteria will be developed during the early stage of the project implementation is well developed following all the details comments and lessons learned from other initiatives.

The project implementation arrangement:

- The roles and responsibilities of the Ministry of Environment and the National Committee for Disaster Management needs to be clearly spelled out
- There is a strong benefits of the EWS to the Mekong's Regional Initiative called Climate Change Adaptation Initiative, a 15-year programme implemented by the Mekong River Commission (MRC) which the project needs to explore future on the potential cooperation and synergies during the implementation

The project Result framework and Budget:

- There is a suggestion to reduce the budget for international consultants and to try to encourage the use of more national expertise.

The project Risks:

- According to the risk analysis conducted under the project, all potential risks have been adequately addressed under the project (refer to the Risk table in the project document)

Conclusion

Mr. Napoleon Navarro concluded that the LPAC meeting endorsed the project by noting that no fundamental issues were raised against the project. He further summarized the key comments that were raised during the meeting which covers the following categories: prototyping criteria, equipment specifications and standards, operations and maintenance, capacity building, women's participation, and partnerships with on-going initiatives or partners.

H.E Bun Hean thanked all the participants for taking the time to attend the meeting and contributing to its improvement and confirmed the endorsement of the project to proceed to the next approval step. He also reiterated the commitment of the government to secure the operations and maintenance budget from the national budget to ensure the sustainability of the project supported infrastructure network.

Minutes taker
Ms. Kalyan Keo
Programme Analyst
UNDP Cambodia

Co-chairs of the LPAC meeting

H.E Bun Hean
Secretary of State
Ministry of Water Resources and Meteorology

Mr. Napolen Navarro
Deputy Country Director
UNDP Cambodia

Signature: 

Signature: 

Date: 30. May. 2014

Date: 2014.06.03

Annex 1: Detailed comments made by participants

Mr. Sorn Serey, Deputy Director, Department of irrigation and agriculture, MoWRAM:

- The EWS is the important project for Cambodia farmer but the infrastructures (installation the number of hydro-meteorological stations) to observe weather and climate are also important, without those infrastructures there is no any data/information to be forecasted / warned. How does the project can share/inform to the farmer about the climate is going to be what in the future for their rice cultivation. In the previous experiences MoWRAM had produced the forecasting bulletin distributed to them by mass media such as radio, television, news paper,...etc. It seems that information did not reach them effectively and thus suggest that the project can focus on this issue as part of its intervention.

Dr. Heng Chanthoeun, Deputy Director, Climate Change Department, MoE

- What is the meaning of prototype approach, in which country had been applied this approach?
- How can the project define the priority provinces to install the infrastructure to observe weather and climate, what is the criteria to select priority provinces, normally it should be based on the level of risks that mainly affecting the agriculture productivity especially the southern provinces along the Mekong River.
- There should be a limitation budget expense on the international consultant and encourage the use of national expertise
- In the project implementation arrangement, what is the role/responsibility for Ministry of Environment?

Mr. Chhuy Hykarona, Engineering Department, MoWRAM

- Emphasize the data/information collection, especially hydro-meteorological data. In order to get that information there should be more infrastructures (hydro-meteorological station) built on the mainstream and tributaries around the Great Lake.
- Capacity building should focus both the existing and future staff working at both department's hydrology and meteorology. Capacity building on knowledge of hydrology and meteorology should make alignment with national education at national institution to generate interest younger generation to be interested in this field.

Mr. Soth Kimkolmony, NCDM

- The EWS is the important project to inform the people minimize any damage and loss to their property and livelihoods resulting from natural disasters and climate hazards. One of the key roles as per NCDM's mandate is the effective dissemination of information and disaster preparedness and response, what is the role of NCDM within EWS project during the implementation period.
- Request to review the structure of NCDM with the project document on page 33, change Village Committee to Village Team

Mr. Nicolas Bakker, Chief Technical Advisor, MRC

- The expected CPAP is considered "rather" ambitious, but if that is required for funding, it's understood.
- We strongly support the EWS and linkage to the HYOGO Framework for Action.
- Standard Operations Procedures are crucial for proper implementation of EWS.

- DOM and DHRW in our view should consider established working principles, standards and procedures, that need to describe and indicate the various staffs and their responsibilities and role/involvement in the process.
- We recommend that the project secures on O&M for the longer period (presently 2 years covered only), possibly with a declining rate of support. That helps handing over responsibilities and budgeting.
- The availability of spare parts of the equipment should be in the range of 15-25% and should be included in the tender for equipment.
- There is an estimated cost for O&M of USD 2,500/station suggested, which we recognize. We consider operators extremely important factors in the operations of the stations. The operators should be trained in the local language and the project should have oversight over that training. Capacity building bottom up may be considered. Manuals/handbooks to be provided to operators in the local language.
- How to make sure that capacity building & training is implemented, progress monitored and recorded, to ensure that knowledge and skills are shared and embedded in the departments?
- Page 19: Mekong River Commission: Please write under a) "Mekong HYCOS" only, not phase II. The term which is used in the MRC is "Mekong HYCOS" and no other terminology is used. The entire network has been handed over to the member countries gradually over 2012.
- Page 22: from 2013 to 2015 IKMP makes annual contributions to MCWRAM/DHRW to the total amount of USD 60,000 approximately. AFD is considering additional funding to extend the Mekong HYCOS. The latest estimate discussed between AFD and MRC/IKMP was in the order of USD 300,000.
- Page 22: In table 5 the contribution from MRC/FMMP to DOM and DHRW should also be incorporated. Two Memorandum of Understanding have been signed between MRC and respectively DOM and DHRW for support to the departments to ensure proper operation of the stations and timely data transfer. The total amount for the period 2013-2015 is approximately USD 45,000.
- Page 30, 31: Could the UNDP share the capacity building and training documentation that will be developed by the project? FMMP is providing periodically training to DOM and DHRW on the MRC flood forecasting and flash flood guidance system periodically. IKMP is providing capacity building and training on the Decision Support Framework and the MRC Toolbox models to MCWRAM. As such FMMP and IKMP would be happy to discuss cooperation and contribute to the training and capacity building development. See Outcome 1, outputs 1.1. to 1.5.
- Page 32-35: Regarding the EWS procedures the project may also look into the USAID RANET initiative.
- The transfer of data through the telecommunication systems is troublesome. The telecom-company can change any format or script at any time, requiring updating of individual sim-cards. Therefore it is recommended to have a back-up system, meaning two ways of data transfer.
- The IT-component of a hydromet network is crucial and a dedicated staff is required. The retrieval, storage and dissemination of data in a real-time manner is the core of an EWS. Its operation should be secured 24/7. This also includes the definition of thresholds for warning and lines of communication and related mandates.
- Please keep in mind the application of WMO standards for especially the rainfall and water level stations, including the data format.
- The collected data should be made available to GTS (WMO). GTS data are available at DOM and the MRC's Regional Flood Management and Mitigation Center needs these data daily from DOM.

H.E Sivann Botum, Secretary of State, MoWA

- EWS is an important project, thus the participation from woman is absolutely needed, as women are among the most vulnerable people from natural hazards and weather extreme events. Therefore, it is suggested that any training or information dissemination during the project implementation needs women participation.

H.E Kol Vathana, Deputy Secretary General, CNMC

- The implementation of EWS is very important to support the study on climate change especially the CCAI project. As mention on EWS project document data/information and capacity building on modeling/forecasting are needed to understand natural hazard and weather extreme event. On lesson learnt, the CCAI project had conducted a pilot study in Prey Veng province. He sought for further collaboration during the implementation of the project with the CCAI initiative.

Annex 2: Attendees

No.	Name	Title	Organization
1	H.E Bun Hean	Secretary of State	Ministry of Water Resources and Meteorology (MoWRAM)
2	Mr. Napoleon Navarro	Deputy Country Director	United Nations Development Programme (UNDP)
3	H.E Kol Vathana	Deputy Secretary General	Cambodia National Mekong Committee (CNMC)
4	H.E Sivann Botum	Secretary of State	Ministry of Women's Affairs (MoWA)
5	Ms. Laing Sokim	Vice-Chief Office, Department of Farmer Water Use Community	MoWRAM
6	Mr. Sok Boren	Chief Office, Department of Farmer Water Use Community	MoWRAM
7	Dr. Theng Tara	Deputy Director General of Technical Affairs and Director of Department of Water Management and Conservation	MoWRAM
8	Mr. Meas Savoeun	Vice-Chief, Technical Service Center for Irrigation System and Meteorology (TSC)	MoWRAM
9	Mr. Sorn Serey	Deputy Director, Department of Irrigation and Agriculture	MoWRAM
10	Ms. Chhay Vary	Chief Office, Department of Hydrology and River Works	MoWRAM
11	Mr. Mao Hak	Deputy Director General of Technical Affairs and Director of Department of Hydrology and River works	MoWRAM
12	Mr. Chea Vannak	Chief Office, Department of Administration and Human Resources	MoWRAM
13	Mr. Koeut Puthvarun	Deputy Director of Department of Water Supply and Sanitation	MoWRAM
14	Mr. Chhuy Hy Karona	Engineer of Irrigation, Department of Engineering	MoWRAM
15	Mr. Oum Ryna	Director of Department of Meteorology	MoWRAM
16	Mr. Hiraiwa Masahiko	JICA Advisor for MoWRAM	JICA-MoWRAM
17	Mr. Sorn SunSopheak		National Committee for Sub-national Development Secretariat (NCDDS)
18	Mr. Felix Seebacher	International Adviser on Hydrology for IKMP	Mekong River Commission (MRC)
19	Mr. Nicolaas Bakker	Chief Technical Advisor	MRC
20	Dr. Heng Chanthoeun	Deputy Director, Climate Change Department	Ministry of Environment (MoE)
21	Mr. Soth Kim Kolmony	Director	National Committee for Disaster

			Management (NCDM)
22	Mr. David Boisson	Head of Delegation	French Red Cross (FRC)
23	Mr. Kong Samnang		Cambodia Red Cross (CRC)
24	Mr. Chhum Sovanny	Assistant Country Director and Team Leader a.i., Environment and Energy Unit	UNDP
25	Ms. Theng Sopheak	Programme Associate	UNDP
26	Mr. Hum Sophon	DRR Coordinator, Environment and Energy Unit	UNDP
27	Ms. Kalyan Keo	Programme Analyst, Environment and Energy Unit	UNDP
28	Mr. Toch Bonvongsar	National Development Coordinator	

Annex L. Letter of Agreement on Direct Project Cost

AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

Dear [name of government official],

1. Reference is made to consultations between officials of the Royal Government of Cambodia (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant programme support document or project document, as described below.
2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.
3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the programme/project:
 - (a) Identification and/or recruitment of project and programme personnel;
 - (b) Identification and facilitation of training activities;
 - (c) Procurement of goods and services;
4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex to the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.
5. The relevant provisions of the Agreement between The Government of the Kingdom of Cambodia and the United Nations Development Programme signed on 19 December 1994 (the "SBAA"), including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.
6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.
7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the programme support document or project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

Signed on behalf of UNDP
Ms. Claire Van der Vaeren
UNDP Resident Representative

For the Government

[Name/title]

[Date]

Attachment

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between MOWRAM, the institution designated by the Government of Cambodia and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project "Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change", "the Project".

2. In accordance with the provisions of the letter of agreement signed on _____ and the project document, the UNDP country office shall provide support services for the Project as described below.

3. Description of Support services, functions and responsibilities of the parties involved:

#	Type of Support Service (insert description)	Schedule for the provision of the support services	UNDP Cambodia Implementation Support Service Price List (USD) ⁹⁰	Total Estimate Cost to UNDP of providing support services (where appropriate)	Method of reimbursement to UNDP
1	Recruitment of Project Staff	To be recruited as per AWP	\$1,420/case, including recurring costs after hire (i.e. payments)	Estimate cost: \$5,678	ATLAS billing
2	Recruitment of Consultants (i.e. Climate Experts, GIS Specialist, Innovative Finance Specialist, M&E Activities, etc.)	To be recruited as per AWP	\$1,237/case	Estimate cost: \$19,799	ATLAS billing
3	Contractual service - Companies (i.e. procurement of observation equipment, annual audit)	To be engaged as per AWP	\$1,237/case	Estimate cost: \$25,986	ATLAS billing
	Contractual service – Research Institutions (i.e. training programmes)	To be engaged as per AWP	\$1,237/case	Estimate cost: \$12,370	ATLAS billing
4	Payments	To be arranged as per AWP	\$41/payment	Estimate cost: \$4,873	ATLAS billing
5	Travel	To be arranged as per AWP	\$84/travel	Estimate cost: \$2,523	ATLAS billing
6	Workshops and training events	To be organized as per AWP	\$116/day (for preparation and during workshop)	Estimate cost \$11,600	ATLAS billing

4. Description of functions and responsibilities of the parties involved:

⁹⁰ Complete list available upon request

4.1 Project Implementing Partner is responsible for the development of terms of reference for the recruitment of personnel and for the procurement of services; identification of goods needs for the project.

4.2 UNDP Human Resources Unit is responsible for the process of recruitment of project personnel.

4.3 UNDP Procurement Unit is responsible for identification of suppliers of goods and services. Further, it is responsible for the procurement of goods and recruitment and contracting services both individual and institutions.

