Royal Government of Bhutan
United Nations Development Programme
PROJECT DOCUMENT

Empowered lives.
Resilient nations.

Addressing the Risks of Climate-induced Disasters through Enhanced National and Local Capacity for Effective Actions

UNDAF Outcome(s):
Outcome 1(Sustainable Development): By 2018, sustainable and green economic growth that is equitable, inclusive, climate and disaster resilient and promotes poverty reduction, and employment opportunities particularly for vulnerable groups enhanced.

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: Strengthened capacities of developing countries to mainstream climate change adaptation policies into development plans
UNDP Strategic Plan Secondary Outcome: National, regional and local levels of governance expand their capacities to manage the equitable delivery of public services and support conflict resolution.

Expected CP Outcome(s):
CP Outcome 1.1: Increased capacities for integrated natural resource management, climate change adaptation/mitigation, and poverty-environment nexus developed.
CP Outcome 1.2: National and local institutions and individuals are better prepared and able to respond to and reduce climate change-induced and other disaster risks.

Executing Entity/Implementing Partner: National Environment Commission Secretariat

Implementing Entity/Responsible Partners: Gross National Happiness Commission, Ministry of Economic Affairs, Ministry of Works and Human Settlement, Ministry of Home and Cultural Affairs, Ministry of Agriculture and Forests, Phuentsholing Thromde, Mongar Municipality, Tarayana Foundation

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LDCF (GEF)	**$**	**11,491,200**
Co-financing:		
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GEF agency parallel	$	362,000
CSO (Tarayana) in-kind	$	156,000
CSO (Tarayana) parallel	$	671,000
Total Co-financing	**$**	**54,539,829**

Agreed by (Government):
Mr. Thinley Namgyel, Officiating Secretary, GNH Commission Secretariat — **18 April 2014**

Agreed by Implementing Partner (Government):
Dr. Ugyen Tshewang, Secretary, NEC Secretariat — **18 April 2014**

Agreed by (UNDP):
Ms. Hideko Hadzialic, Resident Representative a.i, UNDP Bhutan — **18 April 2014**

Brief Project Description

Bhutan is among the countries most vulnerable to climate change in the Asia-Pacific region because of its vulnerable mountain terrain and volatile ecosystems. The country is exposed to multiple hazards, in particular glacial lake outburst floods resulting from glacial melting, flash floods, landslides, windstorms, forest fires, localized changes in rainfall patterns and increasing droughts during dry season. Climate change is projected to significantly magnify the intensity and frequency of these hazards, as has already been evidenced by for example the glacial lake outburst flood of Lugge Tsho in 1994 and more recently the high intensity cyclone Aila which caused major damages in Bhutan in 2009. The National Adaptation Programme of Action, Second National Communication and National Human Development Report 2011 give an account of a number of recent, climate-related disaster events that have impacted national and local economies and livelihoods.

This project has been conceived with the objective to enhance national, local and community capacity to prepare for and respond to climate-induced multi-hazards to reduce potential losses of human lives, national economic infrastructure, livelihoods and livelihood assets. The project has been designed to address the immediate and urgent climate change adaptation needs prioritized through the update of the NAPA undertaken in 2011, involving review and updating of the earlier NAPA produced in 2006. It has three broad outcomes.

The first outcome will focus on demonstrating effective practical measures to reduce flood and landslide risks in Phuentsholing and the adjoining industrial estate of Pasakha, which are the economic and industrial hubs of the country as well as among the most critical areas that are recurrently besieged by floods and landslides. This outcome will also be devoted to systematic assessment and mapping of geo-hazard risks in four other critical flood- and landslide-prone areas in the country in order to build the information base for planning flood and landslide risk mitigation in those areas, as well as in other areas that are vulnerable to similar risks.

The second outcome is aimed at enhancing community resilience to climate-induced risks. This will include designing and building or rehabilitating systems for water harvesting, storage and distribution in selected villages and towns which face water scarcity, community-level water resources inventory to create the information base for water resource management, and strengthening disaster management institutions at national and local levels with training and development of community-based disaster management plans.

The third outcome is dedicated to improving the quality, analysis and dissemination of climate information across climate-sensitive development sectors on a timely and reliable basis to aid climate change adaptation planning and to enhance preparedness and response to extreme weather events. This will involve expanding and upgrading the network of meteorological stations for real-time weather observation and forecasting, and strengthening the National Weather and Flood Forecasting and Warning Center with the capacity to analyze, manage and disseminate climate information in a timely manner.

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List of Acronyms and Glossary of Bhutanese Terms

Acronyms

ABI	Association of Bhutanese Industries
AWS	Automated Weather Station
AWLS	Automated Water Level Station
AWP	Annual Work Plan
CC	Climate Change
CD	Capacity Development
CCA	Climate Change Adaptation
CSO	Civil Society Organization
DfID	Government of United Kingdom's Department for International Development
DDM	Department of Disaster Management (MoHCA)
DES	Department of Engineering Services (MoWHS)
DGM	Department of Geology and Mines (MoEA)
DHMS	Department of Hydro-Meteorological Services (MoEA)
DM	Disaster Management
DoFPS	Department of Forests and Park Services (MoAF)
DoR	Department of Roads (MoWHS)
DRR	Disaster Risk Reduction
EFRC	Environment-friendly Road Construction
FEMD	Flood Engineering and Management Division (DES, MoWHS)
FFMP	Forest Fire Management Programme (DoFPS, MoAF)
FYP	Five Year Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas Emission
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GNH	Gross National Happiness
GNHC	Gross National Happiness Commission
GNHCS	Gross National Happiness Commission Secretariat
ICIMOD	International Center for Integrated Mountain Development
IPCC	Inter Governmental Panel on Climate Change
JICA	Japan International Cooperation Agency
JSP	Joint Support Programme on Capacity Development for Mainstreaming Environment, Climate Change and Poverty Concerns
LDCF	Least Developed Countries Fund
M&E	Monitoring and Evaluation
MoAF	Ministry of Agriculture and Forests (RGoB)
MoEA	Ministry of Economic Affairs (RGoB)
MoHCA	Ministry of Home and Cultural Affairs (RGoB)
MoWHS	Ministry of Works and Human Settlement (RGoB)

MSTCCC	Multi-Sectoral Technical Committee on Climate Change
NAPA	National Adaptation Programme of Action for Climate Change, first produced in Bhutan in 2006
NAPA-2	National Adaptation Programme of Action for Climate Change, reviewed and updated in 2012
NEC	National Environment Commission
NECS	National Environment Commission Secretariat
NEX	National Execution
NWFFWC	National Weather and Flood Forecasting and Warning Center (DHMS)
PIA	Pasakha Industrial Area
PMU	Project Management Unit
PTH	Phuentsholing-Thimphu Highway
PPG	Project Preparation Grant
RGoB	Royal Government of Bhutan
PWG	Project Working Group
TAG	Technical Advisory Group
UISD	Urban Infrastructure Services Division (DES, MoWHS)
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-HABITAT	United Nations Human Settlements Programme
VLFFMG	Village Level Forest Fire Management Group
WRCD	Water Resources Coordination Division (NECS)

Glossary of Bhutanese Terms

Chiwog	Village or a group of few hamlets
Dzongkhag	District
Dungkhag	Sub-District
Gewog	A county, the lowest government administrative unit, made up of a group of villages.
Thromde	Municipality

1. Situation Analysis

1.1 National Context and Climate Change

1.1.1 Introduction to the Country

1. The Himalayan Kingdom of Bhutan is a small land-locked country with a population of 733,004 (2013 projected figure[1]) and a geographic area of 38,394 km^2. The country is almost entirely mountainous dissected by an intricate system of several rivers, rivulets, and streams, with nearly 95 percent of the country being above 600 meters altitude[2]. The topography is rugged and steep, with elevation rising from under 200 m to above 7,500 m within a short south-north distance of some 170 kilometers (km). The country can be distinguished into three broad physiographic zones: the southern belt made up of the Himalayan foothills adjacent to a narrow belt of flatland along the Indian border; the inner Himalayas consisting of main river valleys and steep mountains; and the high Himalayas featuring alpine meadows and snow-capped mountains.

2. The geology and topography of Bhutan are shaped by the intense tectonic activity that resulted from the collision of the Indian and Eurasian continental plates, the closure of the intervening Tethys sea, and the uplift of the Himalayas. The mountains are primarily made up of uplifted sedimentary and metamorphic rocks, which are highly fragile and sensitive to erosion due to rainfall. Its fragile geology makes Bhutan also highly vulnerable to earthquakes. Bhutan is therefore one of the most disaster prone countries in the Asia-Pacific region, irrespective of the presence of climate change. In terms of relative exposure to flood risks (as % of population), Bhutan ranks fourth highest in the region at 1.7% of the total population exposed to such risks. Although the direct human risks of landslides, windstorms, and forest fires are not particularly higher compared to other countries, the socioeconomic repercussions from these events are thought to be high due to the baseline poverty prevalence. Climate change is likely to magnify the intensity and frequency of these hazards.

3. The country is endowed with an outstanding natural environment. It is dubbed as the 'crown jewel' of the Eastern Himalayas, a region recognized as a global biodiversity hotspot. Broadly speaking, the natural habitats range from the subtropical broadleaf forests and grasslands through temperate mountain forests to alpine meadows and scree interspersed with marshlands and various water bodies. To maintain the rich natural environment, 42.7 percent of the country has been declared as protected areas, which include five national parks, four wildlife sanctuaries, a strict nature reserve and biological corridors. The biological corridors connect the larger protected areas to ensure contiguousness of the natural habitats and to allow for wildlife movements between the protected habitats.

4. Forests account for more than 70 percent of the country's land cover – one of the highest in the world. The Constitution mandates that at least 60 percent of the country is maintained under forest cover at all times. As a result of vast tracts of forest cover and limited number of polluting industries, Bhutan is

[1] Dzongkhag Population Projections 2006-2015 by the National Statistics Bureau, Royal Government of Bhutan, based on the results of the Population and Housing Census of Bhutan 2005.

[2] Atlas of Bhutan: Land Cover and Area Statistics, 1997, Ministry of Agriculture, Royal Government of Bhutan

among the few countries in the world with net greenhouse gas (GHG) emission in negative. The net GHG emission is estimated to be -4,750.04 Gigagram (Gg) of CO_2 equivalent based on 2000 data[3].

5. Administratively, the country is made up of 20 dzongkhags (districts, see Figure 1). Each Dzongkhag consists of gewogs, which are a block of villages and represent the smallest unit of public administration. There are altogether 205 gewogs across the country. Some of the dzongkhags are broken down into dungkhags (sub-districts) to ease geographical and logistical constraints posed on public administration. Currently, there are 16 dungkhags. Major population centers are in the west and south. The northern region is very sparsely populated. Sixty-nine per cent of the population live in rural areas and predominantly subsist on a farming system, which integrates crop agriculture, livestock rearing and forest resource use.

6. The advent of the Five-Year Plan (FYP) in 1961 marked the beginning of modern development. Since then, FYPs have served as the key strategic instrument for the implementation of national development policies and programmes. The country has completed its 10th FYP and commenced the 11th FYP in July 2013. The home-grown development philosophy of "Gross National Happiness" guides the national development process. This philosophy is underpinned by the four central objectives of equitable socio-economic development, environmental sustainability, promotion and preservation of culture, and good governance.

Figure 1: ***Administrative Map of Bhutan***

7. Bhutan's economy is one of the smallest in the world but one that has seen impressive growth over the years. The country's Gross Domestic Product (GDP) at current prices has grown from Nu. 40,673.52 million (US$ 897.67 million) in 2006 to Nu. 85,580.58 million (US$ 1,584.9 million) in 2011, up by

[3] Second National Communication to the UNFCCC, November 2011.

about 110 percent[4]. The key contributors to the GDP are construction (16.3 percent) followed by renewable natural resources (comprising agriculture, livestock and forestry)(15.7 percent), and electricity and water (13.9 percent)[5]. The overall growth has been primarily stimulated by investments in the hydropower sector. Fueled primarily by hydropower, urban development and road projects, the construction sector has fast developed into a major economic sector. In terms of employment, the renewable natural resources sector remains the most important economic sector although its GDP share has been falling over the years. Tourism is another sector contributing significantly to the country's economy particularly in terms of foreign exchange and creation of jobs.

8. In order to optimize the development and use of infrastructure and services to support industries, the Royal Government of Bhutan (RGoB) has been promoting clustering of industries into industrial hubs. Due to easy access to markets, labor forces and raw materials, these industrial hubs are located in the southern dzongkhags bordering India. In the 10th FYP, development of Pasakha Industrial Area was continued as a spillover from the 9th FYP and development of three new industrial hubs – Dhamdum in Samtse dzongkhag, Motanga in Samdrup Jongkhar dzongkhag and Jigmeling in Sarpang dzongkhag – were initiated[6].

9. Roads in Bhutan form the lifeline of Bhutan's economy. As of June 2011, the country's road network totaled 8,381 km[7]. It includes 2,273 km of national highways, 1,127 km of dzongkhag roads, and 3,290 km of farm roads. At the national level, key among these are the east-west lateral highway connecting the capital city of Thimphu and the eastern most dzongkhag town of Trashigang and the various north-south highways connecting the inner parts of the country to the border towns and commercial hubs of Phuentsholing, Gelephu and Samdrup Jongkhar.

1.1.2 Climate and Climate Change Scenarios

10. The climate varies considerably in Bhutan, due to dramatic changes in topography. The southern foothills typically have subtropical climate with high humidity and heavy rainfall with several locations recording more than 4,000 mm annual rainfall. The temperature in the southern region ranges from 10°C to 25°C in winter and 20°C to 35°C in summer. The central mountains and valleys are characterized by cool winters and warm summers with temperature ranging from -5°C to 15°C in winter and 15°C to 25°C in summer. Rainfall in this region is moderate between 1,000-2,000 mm per year. The high alpine mountains and meadows have cold winters and cool summers with generally low precipitation of less than 500 mm per year primarily in the form of snow. The summer monsoons occur from late June through late September. The moisture-laden clouds that originate in the Bay of Bengal travel north towards the Himalayas. When these clouds are blocked from traveling further by the high Himalayas, they bring heavy rainfall to the region. The monsoons play a critical role in the life of the people of this region. Most of the farmers are totally dependent on the monsoons for irrigation. The late onset of the monsoons can lead to drought in the region while excessive monsoon rains can result in flashflood and landslides.

11. Meteorological records in terms of area and historical coverage are very limited in Bhutan. A limited data set of reliable observed data at dzongkhag level is available since 1994, with a more

[4] National Accounts Report 2012.
[5] The figures are for 2011 as cited in the National Accounts Report 2012.
[6] Tenth Five Year Plan (2008-2013), Vol 2: Programme Profiles.
[7] Road Network Information 2011, Department of Roads.

expanded network from 1996 onwards, from 20 Class A and 61 Class C stations. Class A stations are Agro-meteorological stations recording 8-9 climate parameters while Class C stations are climatological stations recording 3-4 parameters. Most of the stations are located in the southern region and middle latitudes of the country. Snowfall records are non-existent and recording of solar radiation and wind data has started only in the recent 3-4 years at a few stations. Data gaps exist in several cases, including even in the more reliable records. Nevertheless, an analysis of data from a few selected automated meteorological stations representing the four eco-floristic zones of Bhutan from 2000 to 2009 was carried out in the preparation of the National Thematic Paper on Biodiversity for the Climate Summit for a Living Himalaya – Bhutan 2011. This analysis showed a trend of rising mean summer and winter temperature while there was no detectable trend in rainfall. Simulated exercises using ECHAM5 and HadCM3Q0 climate models for projection of long-term climate scenarios, carried out as a part of the Second National Communication, suggest the following (for more details see Annex 1):

- ***Change in temperature***: Mean annual temperature for the 2010-2039 is projected to increase by ~0.8^{o}C (ECHAM5/A1B scenario) to ~1.0^{o}C (HadCM3QO/A1B scenario) compared to the current (1980-2009) climate. There is little or no difference between the annual and seasonal (monsoon and winter) temperature changes according to the ECHAM5/A1B scenario whereas HadCM3QO/A1B scenario projects a slightly higher increase in mean winter seasonal temperature (~1.2^{o}C) and a slightly lower increase in mean monsoon seasonal temperature (~0.8^{o}C). For the 2040-2069 period, mean annual temperature is projected to increase by ~2.0^{o}C (ECHAM5/A1B scenario) to ~2.4^{o}C (HadCM3QO/A1B scenario). Again, there is little or no difference between the annual and seasonal (monsoon and winter) temperature changes according to the ECHAM5/A1B scenario but HadCM3QO/A1B scenario projects a slightly higher increase in mean winter seasonal temperature (~2.8^{o}C) and a slightly lower increase in mean monsoon seasonal temperature (~2.1^{o}C);

- ***Change in precipitation***: ECHAM5/A1B and HadCM3Q0/A1B scenarios project a slight increase of ~6% for the 2010-2039 period. On a seasonal basis, there is a slight decrease in winter precipitation (~2%) and an increase of 4-8% in the monsoon period. For the 2040-2069 period, the ECHAM5/A1B scenario projects an increase of ~25% in the mean total annual precipitation with generally higher increase in the monsoon compared to the winter season. The HadCM3Q0 also projects almost a similar scenario: an increase of ~21% with generally higher increase in the monsoon than in the winter season. The general projection is thus that the mean annual precipitation will see an increase over the next 30 to 60 years but with more intense and concentrated rainfall in the monsoon season and an in general drier winter season;

- ***Change in extreme weather events*****:** Bhutan's geology is highly fragile and sensitive to erosion. Projected increase in frequency and intensity of extreme rainfall events will exacerbate surface runoff and erosion and saturated soils and highly weathered rock will be increasingly prone to climate-induced disasters such as landslides and flash floods. The latter still further aggravated by glacier melting, increasing the risk of glacial lake outburst floods (GLOFs). Prolonged extreme droughts in turn increase the risk of loss of biodiversity and agricultural crops, as well as forest fires.

1.1.3 Climate Change Impacts and Vulnerabilities

Rural livelihoods

12. Sixty-nine per cent of the population live in rural areas and is highly dependent on farming systems which integrate crop agriculture, livestock rearing and forest resource use, any changes in the regional and local climate will have a significant impact on the viability of their livelihoods. An analysis of risks and vulnerabilities in relation to livelihoods was made by the Joint Support Programme[8] in August-September 2011, providing insight on climate change vulnerabilities at the local level. Participatory Rural Appraisal-based assessments of the environmental and climate change impacts on key local livelihoods resources and assets were carried out in some of the poorest gewogs in the country. The assessments revealed that farmlands were the most vulnerable of all local livelihood resources/ assets, followed by water resources and supply systems, and forests (Figure 2). This connotes and confirms considerable climate change risks as the nation's socio-economic wellbeing is hugely dependent on agriculture, water resources and forests.

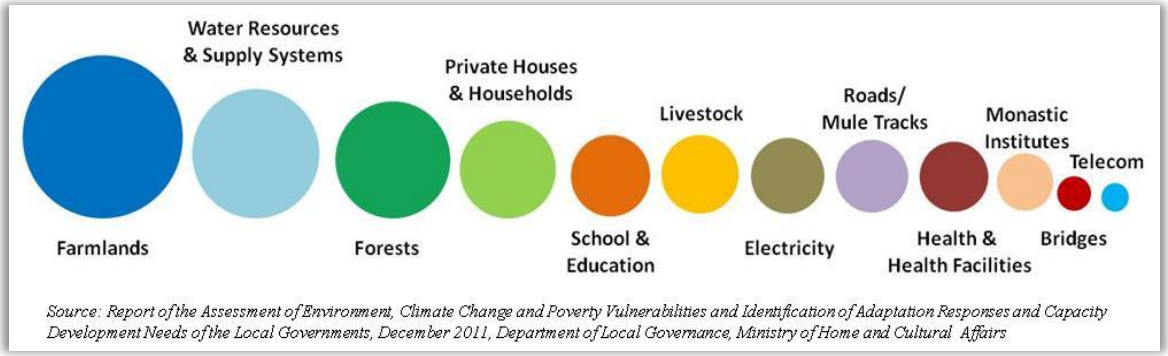

Figure 2, Proportional Scale of Environmental and Climate Change Vulnerabilities to Local Livelihood Resources and Assets

Impacts on Water Availability

13. As presented in the previous section, there is a projected increase in annual average rainfall in Bhutan. The additional rain, however, is projected to mostly fall during the existing wet season of June to August when it is often not required to improve crop yields (though more evenly distributed rainfall within these months would likely reduce the incidences of yield declines due to dry spells during pollination of some crop species). Similarly for aquifer recharge, the higher intensity of rainfall events generally leads to extra surface run-off rather than infiltration once the soil is saturated, limiting the benefits of the extra amount of projected precipitation. It is thus likely that the increases in rainfall projected between June and August by the climate models will only serve to exacerbate problems associated with erosion, landslides and floods.

14. Furthermore, the projected increases in rainfall variability can lead to decreases in precipitation for extended periods, causing water availability and access problems. Water access is further aggravated through accelerated melting of glaciers, which act as a gigantic natural water retention and dispensing

[8] Joint Support Programme, Capacity Development for Mainstreaming Environment, Climate Change and Poverty Concerns in National Policies and Programs. It is managed by the Gross National Happiness Commission Secretariat and funded by the Government of Denmark, UNDP and UNEP.

mechanism to communities downstream, is disrupting the hydrological regime of the perennial river systems in the region. Projected climate change impacts thus undermine current water distribution infrastructure and communities' abilities and rights to access water for household and agricultural requirements. Springs and small streams are the main water sources for the rural part of the country. According to the Annual Health Bulletin 2013 of the Ministry of Health, 90 percent of the households in Bhutan have access to safe drinking water and 95 percent have access to improved sanitation. The source of drinking water is important because potentially fatal diarrheal diseases, such as typhoid, cholera, and dysentery, are common in Bhutan, especially the prevalence of waterborne diseases among young children. Sanitation at schools is still a serious health risk that threatens the development of children. Many schools have toilets, with water for flushing or hand washing but in general hygienic behavior is still poor. Although overall Bhutan is on track to achieve its targets in terms of MDG 7 on coverage of drinking water and sanitation, sustainability and improved hygiene behavior is still a challenge, and it is likely to increase with increased climate variability and climate change.

15. All in all, climate change will increase the uncertainty of water availability throughout the year, and rural farmers are likely to have to better manage high fluctuation of rainfalls – increasing volume of monsoonal rain so that they can sustain longer dry periods. The updated NAPA 2012 also prioritized water resources as a sector most likely to be severely affected by climate change, with far-reaching implications relating to drought, floods, access to water and water quality. The NAPA 2012 therefore includes actions for (g) Rainwater Harvesting and Drought Adaptation.

Impacts on Agriculture

16. Subsistence agriculture activities in Bhutan will be affected by the projected variability in rainfall patterns and intensity. Geological differences have a large influence on whether access to water is guaranteed year round, or whether water sources dry up rapidly or gradually at the onset of the dry-season. From an agricultural perspective elevation, geology and pedology also play a large role in determining whether farmers have a high risk of wet season crop failure and any opportunity of dry season cultivation. The vast majority of agriculture activities is rain-fed subsistence and cash crop production and irrigated rice crops. To sustain agriculture new sources of water must be identified locally, including water harvesting, and innovation required in storing water through the dry season. The feasibility of dams and reservoirs is not yet adequately assessed. However, the geological conditions in Bhutan with permeable unstable soils and rock will make it technically and geologically challenging in most instances.

17. The number of households in Bhutan rearing livestock is relatively low and traditional husbandry is generally of low quality and with little inputs. Animals are generally let loose in the open on communal land and in forests with little food supplementation provided, as there is little cultivation of grass or other fodder. Water and livestock connections are weakly documented, but since most farmers have only a few animals grazing on communal lands this usually makes them mobile enough to travel to various water sources therefore limiting the dependence on any one source. However, drying up of springs in the dry season is anticipated to become a greater problem with climate change.

18. During the PPG stakeholder consultations and field visits (Annex 2) communities also identified rainfall and water availability as the two principal environmental constraints on agricultural production.

Especially in the southern parts of Bhutan, communities face dwindling access to water during the dry season when natural springs that they rely on reduce considerably in flow or cease altogether. There is thus a clear recognition by communities of the importance of reliable water resources and for the potential increased stress that climate change poses for these water sources, and related livelihoods activities. Because of the high spatial variability which exists across the country, vulnerabilities like drought, landslides and erosion vary greatly in the country. Vulnerability of water sources and agriculture to climate change has thus many facets, and the selection of focus districts under the LDCF project captures this diversity in terms of climate change impacts and vulnerabilities.

Impacts on Forestry

19. The country's vast tracts of forests, which make up more than 70 percent of the land cover, have historically provided an important source of food, fuel, fodder, medicine and building materials, especially to the poor. Moreover, they help cushion the impacts of climate change-induced hazards such as landslides and flash floods and thus their importance is expected to increase as the impacts of climate change become more and more visible. However, these forests themselves are increasingly at risk from wild fires as a result of drier conditions and prolonged absence of precipitation during winters. Collation and a preliminary analysis of forest fire data maintained by the Department of Forests and Park Services reveal that wild fires have severely damaged more than 70,700 hectares (ha) of forests, or approximately 1.5% of total landmass, since 2000 at the rate of close to 5,900 ha each year. Considering multiple functions of forests – as a supplier of livelihoods and income substitutes, disaster prevention and risk mitigation, carbon sequestration, and hydrological control in a given water catchment – it is critical that the country's forest resources are protected, especially from the increased risk of forest fire in drier conditions.

Impacts of Extreme Weather Events

20. Past climate change related natural disaster trends show that the country is already experiencing more frequent extreme climatic events over recent years. The glacial lake outburst flood (GLOF) of Lugge Tsho in 1994 brought to the fore the imminent threats of climate change. The winter of 1998/99 was characterized by a prolonged spell of dry (snowless) weather. This exacerbated incidents of forest fires that winter, with forest fires occurring even in places where they were earlier not known. Summers of 2000, 2004, 2009 and 2010 were witness to extreme monsoon rains. The heavy rains triggered an unprecedented number of flash floods and landslides, causing loss of dozens of human lives and livestock, and damage to many farms, homes, development infrastructure and industrial establishments. The 2004 flash floods in the six eastern dzongkhags killed nine people, washed away 29 houses, damaged 107 houses, and destroyed 268 ha of farmlands. In May 2009, Cyclone Aila originating from the Bay of Bengal caused one of the worst climatic disasters, causing 12 deaths, destroying crops on farmlands in many dzongkhags, and damaging roads, bridges, schools, health care facilities, government buildings, hydro-power installations, and other infrastructure. The total economic damage of Cyclone Aila in Bhutan was estimated at around US$ 15 million[9]. In 2010, intense rains triggered landslides and flashfloods and damaged more than 800 ha of farmlands affecting 4,165 households, and several farm roads and irrigation channels affecting 529 households. Wind- and hail-storms have also been growing in severity and frequency in the recent years, causing often severe localized damages to crops and buildings. The Department of Disaster Management's damage assessment report of successive windstorms in the spring

[9] Bhutan Economic Update, World Bank, April 2010.

of 2011 inform that 2,424 rural homes, 81 religious structures, 57 schools, 21 health centers, and 13 other government institutions were damaged across 16 of the country's 20 dzongkhags.

21. For a country with a small economy, population and land area, these impacts pose severe setbacks to development progress and achievements attained over the past several years. Based on the climate change projections the intensity of extreme weather events in Bhutan will further increase, potentially causing more localized landslides and floods, as well as exacerbating the long term effect of erosion. Physical vulnerability varies across Bhutan, mainly due to topographic differences and differences in elevation, but is in all cases considered to be high.

1.2 Root Causes of Climate Change Vulnerabilities

22. The underlying causes of CC vulnerability are multiple and encompass both climate and non-climate related factors. The sources of inherent vulnerabilities of Bhutan to climate change impacts can be found in the combination of the country's geology and topography, existing land use practices, and poverty. The analysis below provides an overview of underlying causes of vulnerability.

Geology and Topography

23. From a geo-tectonic perspective Bhutan has three zones: the Frontal Belt, making up the foothills and parts of the Lesser or Lower Himalaya; the Central Crystalline Belt, occupying portions of the Lesser and Higher Himalaya; and the Tethyan Belt, covering the Higher Himalaya and isolated but large portions of the Lesser Himalaya . The Frontal Belt consists of recent deposits of sand, gravel, and boulders in the foothill terraces. The Siwalik group of rocks consists of sedimentary and meta-sedimentary rocks extending in an east-west direction and dipping north. They are exposed in the south-central part of the country extending from the east of Raidak river (Wang Chhu) to the west of Sarpang town and in the eastern part from the east of Manas river to the eastern boundary with the Indian state of Arunachal Pradesh. The Damuda (Gondwana) and Diuri Formations are exposed in the eastern part of the country. The Damuda rocks of Permian age consist of sandstone, shale, and coal seams; they overlie the Siwalik rocks along the Main Boundary Thrust. The Diuri Formation, at times considered part of the Damuda, comprises grey slate boulders, made up of pebbles of quartzite, phyllite, dolomite, and gneiss in a slaty matrix. The Buxa group of rocks consists of dolomite, variegated phyllite, quartzite, and conglomerate. This group of rocks stretches from the western-most part of the country to the east along the foothills. The Shumar Formation overlies the Buxa group and consists of meta-sedimentary phyllite, quartzite, and thin marble bands.

24. The two main lithological groups of metamorphic thrust sheets of the Central Crystalline Belt are the Thimphu Gneissic Complex and the Paro Formation. The Thimphu Gneissic Complex is characterized by migmatites and biotite-granite-gneisses with thin beds of quartzite, quartz mica schist, calc-silicate, and marble, and is the major rock type covering the country. The Paro Formation is characterized by quartz mica schist, quartzite, calc-silicate, marble, and a thin bed of graphitic schist, and this is exposed in and around Paro. The Central Crystalline Belt is affected by intrusion of tourmaline bearing granites and pegmatites in the form of dykes, sills, laccoliths, and larger intrusions. The larger intrusive bodies are concentrated in the northern ranges.

25. The geology and topography of Bhutan are thus shaped by the intense tectonic activity and made up of uplifted sedimentary and metamorphic rocks, which makes the geology among the most fragile in the Sub-Himalayan range. The geology is also highly sensitive to intense rainfall and surface runoff and erosion rates are high, frequently resulting in substantial landslides[10] and other climate-induced disasters such flash floods.

Poverty

26. Although the poverty rate has been reduced markedly over the years – from 31.7 percent in 2004 to 23.2 percent in 2007 and further down to 12 percent in 2012 – it still remains a key development challenge. According to the Poverty Analysis Report 2012, the poverty rate is higher in rural areas (at 16.7 percent compared to 1.8 percent in urban areas) and more than 90 percent of the country's poor reside in the rural areas. Poverty rates are also highly variable between Dzongkhags, some of the highest being Lhuentse (31.9 percent), Pema Gatshel (26.9 percent), Zhemgang (26.3 percent), Dagana (25.1 percent), Samtse (22.2 percent) and Samdrup Jongkhar (21.0 percent)[11]. These poverty figures reflect that existing patterns of poverty are largely caused by geography and topography, which limit access to markets and public services and increase the cost of (agricultural) inputs. Also water access is difficult with a large part of available water present in rather steep gorges and valleys, often away from settlements. Poorer communities are therefore also the most vulnerable to the problems posed by environmental degradation and climate change, because of the greater reliance of their livelihoods on natural resources. In the event of a natural disaster, the poor are also the most affected due to lack of resources to respond to, and recover from, the disaster. Where environment is well kept, it serves as a critical source of local livelihoods, an asset for poverty alleviation and an effective cushion to the impacts of climate change. Where communities are impoverished or lacking livelihood opportunities, threats to the environment are greater in the form of rampant use of natural resources and other unsustainable practices which in turn exacerbate manifestations of climate change impacts.

Land-use Practices

27. Usable land for humans is limited in the country due to rugged terrain and inhospitable climate in large parts of the country. Most of the arable land is used for subsistence farming and existing farming practices are at present not always sustainable[12] considering the increased risks of erosion and degradation. Furthermore there is an emerging phenomenon with increasing pressure on conversion of natural lands for development of urban areas, industrial estates, and infrastructure. Land capability becomes secondary to market forces in deciding land use. For instance, despite frequent landslides and flashfloods in the southern region, major industrial estates are located there because of the relatively flatter land, access to commodities (mining), proximity to the Indian market and thus easy access to materials and cheap labor. The impacts of climate-induced disasters are exacerbated where there is incompatibility between land capability and land use.

[10] A Provisional Physiographic Zonation of Bhutan by Chencho Norbu et al, National Soil Services Center, Semtokha, and Cranfield University, 2004.

[11] Bhutan Poverty Analysis 2012 by the National Statistics Bureau, Royal Government of Bhutan, and the World Bank.

[12] Sustainable Land Management Project, Bhutan, World Bank.

1.3 Focus District Selection

28. The Phuentsholing Thromde and Pasakha Industrial Area have been selected under Outcome 1 for remedial measures to address the risks posed by landslides and flash floods. The combination of high economic value (Phuentsholing-Thimphu Highway and Pasakha Industrial Area), highly unstable geological conditions and a high vulnerability to projected climate change (especially extreme rainfall events) make these two locations a priority target for the RGoB, as reflected in the updated NAPA document.

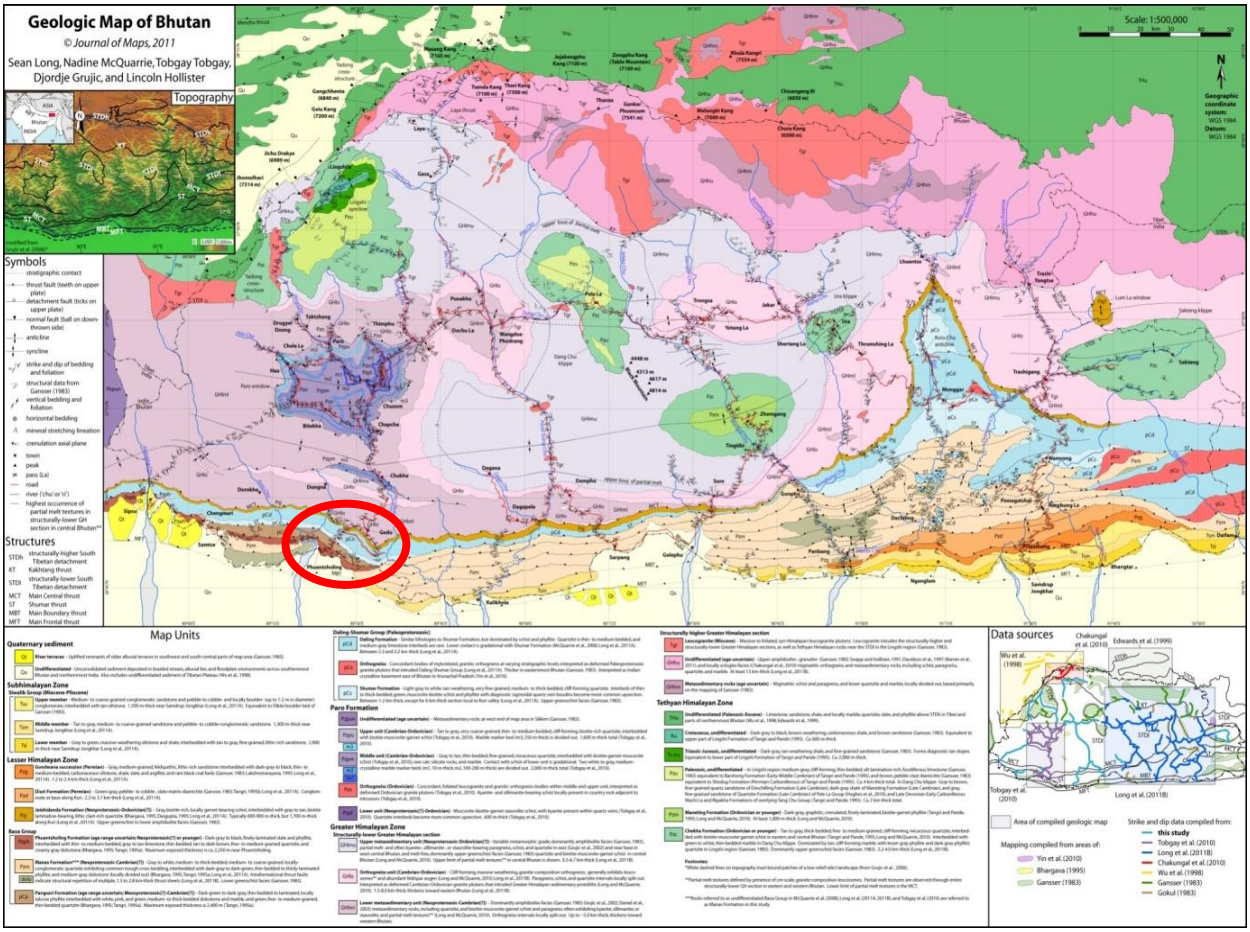

Figure 3, Geological Map of Bhutan

29. The Geological Map of Bhutan[13] is presented in Figure 3. The geology in Phuentsholing area, called the Phuentsholing Formation of Baxa Group of rocks, consists of variegated (purple, grey, pink, carbonaceous) phyllite, talcose phyllite with thin bands of grayish white quartzite, limonitic quartzite, dolomite bands and basic rocks (see for more details the technical report of DGM in Annex 4). The variegated phyllite is highly weathered, fractured and at places decomposed to residual soil. The area is furthermore traversed by major tectonic and neo-tectonic activities resulting in formation of landslides at different structural levels.

30. As presented in Annex 4 the Phuentsholing Thromde and the Department of Geology and Mines (DGM) prioritised four landslides for remedial measures:

[13] Produced after S. Long et al; as a slight modification from the Geological Map produced by the Geological Survey of India, Bhutan Unit.

1. Kharbandi Check Post area; (in combination with)
2. West of the Reldri Higher Secondary School;
3. In between Old Hospital & RBA family colony; and
4. Rinchending Goenpa.

Of the four selected landslides the landslide at Kharbandi Check post and Reldri high school have been accorded the highest priority (see pictures in Figure 4).

a) b) c)

Figure 4, Landslides at Kharbandi check post and Reldri School.
Old road alignment Phuentsholing-Thimphu Highway on the right has been lost to the landslide (Panel a)
View on Kharbandi check post landslide in forefront and Reldri school landslide in upper left corner (Panel b)
View on Kharbandi check post landslide from Reldri school (Panel c).

Outcome 1 of the project will also focus on the protection of the Pasakha Industrial Area (PIA) from flood risks. The PIA is located on the confluence of Barsa and Bhalu Jhora Rivers and increased intensity of extreme rainfall events under a changing climate will increase the erosion within the Barsa river watershed which will subsequently lead to increased sedimentation of the river. In the past sedimentation has caused higher flood levels in Barsa river, resulting in flooding of parts of the PIA and substantial economic damage. Furthermore the important access road to PIA is under threat of river bank erosion due to increased river flow and flood levels. Figure 5 presents a map of Barsa River near the PIA (left), as well as a hydrological model of the Barsa river watershed (right). For more details see the technical report of FEMD in Annex 3.

31. Furthermore, under Output 1.3, four critical areas (from across the country) have been selected by the DGM for the geo-hazard risk assessment and mapping. In order to derive detailed and holistic knowledge of the geo-hazard risks and aid planning of potential mitigation measures at a landscape/watershed level, geo-hazard risk assessment and mapping of Phuentsholing-Barsa watershed (as a whole area, exceeding the municipal boundaries) will be undertaken. Other areas for detailed geo-hazard risk assessment and mapping will be carried out in Wamrong/Moshi area in Trashigang dzongkhag; Lamsorong area on Samdrup Jongkhar-Trashigang highway; and Box-cutting area (between Surrey and Gelephu Tshachu) along Gelephu-Zhemgang highway. As in the case of selection of Phuentsholing and Pasakha, these areas have been selected due to their high economic value (in their respective regions – eastern and central), highly unstable geological conditions and a high vulnerability to extreme rainfall. Moreover, building the national capacity for carrying out geo-hazard risk assessment

with a focus on climate risks as a compounding factor is critically important for guiding the road investments, which is considered a high priority in the RGoB's FYPs.

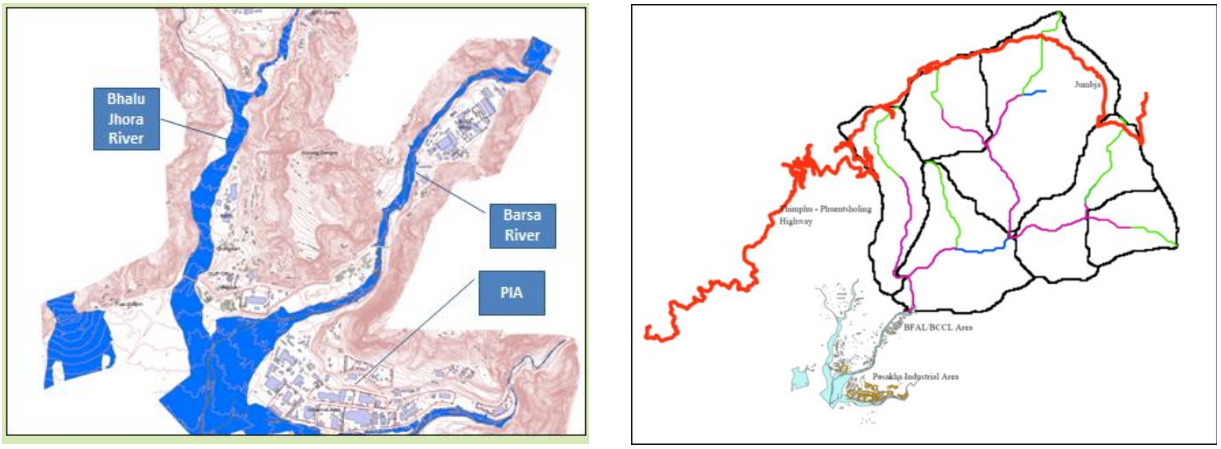

Figure 5, Left: Barsa River and Pasakha Industrial Area, Right: Barsa river watershed as per hydrological model of FEMD (in red the Phuentsholing-Thimphu Highway)

32. Outcome 2 of the project, which aims at building community-based Disaster Risk Management capacity on a wide range of climate-induced natural hazards, will be carried out in dzongkhags that have been selected on the basis of climate variability impacts and vulnerabilities as well as the presence of implementing agencies and possible complementarities and synergies in project implementation. Key in the selection is that especially water related climate impacts anticipated in Bhutan, i.e. water scarcity and prolonged periods of drought, are captured so the LDCF project can research and test innovative water harvesting and water efficient technology, which are a key part of Outcome 2 of the project. Apart from water availability related climate risks, other factors that were considered include:

- Urban water supply development in Mongar Municipality under output 2.1. therewith making Mongar district one of the focus districts;
- Poverty and vulnerability indices;
- Possibility to create complementarity and synergy amongst Implementing Partner and Responsible Parties for project implementation:
  - Tarayana Foundation on community development and water harvesting;
  - NECS on water resource inventory;
  - DDM on capacity development of local institutions for disaster preparedness and response;
  - DoFPS on capacity strengthening for forest fire management.
- Relative accessibility, including clustering of districts, to keep implementation support cost low.

33. Based on these criteria, Table 1 presents the focus dzongkhags which have been selected for the different outputs under Outcome 2.

Outputs	**Selected Areas**	**Criteria**
Output 2.1: Water harvesting, storage and distribution system in four dzongkhags	• Mongar town and Mongar dzongkhag • Tsirang dzongkhag • Pema Gatshel dzongkhag • Samtse dzongkhag	• Persistent water scarcity problem • High level of poverty incidence • Tarayana Foundation's involvement in these dzongkhags for local community

		development and, therefore, opportunities to address water scarcity within the overall context of poverty reduction and sustainable livelihoods at the grassroots level.
Output 2.2: Community-level water resources inventory in four dzongkhags	• Mongar dzongkhag • Tsirang dzongkhag • Pema Gatshel dzongkhag • Samtse dzongkhag	• Linkage with Output 2.1 and opportunities for complementarity and synergy between the two outputs
Output 2.3: Establishment and strengthening of disaster management institutions at various levels in four dzongkhags	For disaster risk management in general: • Chhukha dzongkhag • Pema Gatshel dzongkhag • Samtse dzongkhag • Dagana dzongkhag For forest fire management: • Mongar dzongkhag • Trashigang dzongkhag • Thimphu (and Paro) dzongkhags • Wangduephodrang (and Punakha) dzongkhags	• Vulnerability to climate-induced disasters • High level of poverty incidence • Chhukha dzongkhag has been selected to build linkages and synergy with outputs 1.1 and 1.2, through which flood and landslide risks reduction investments are planned through the project • The dzongkhags targeted for forest fire management are the most forest fire prone dzongkhags in terms of number of forest fire incidents and forest area burnt

Table 1, Selected dzongkhags under project outcome 2

34. Project Outcome 3, the expansion of the hydro-met network and strengthening local and national early warning and climate change adaptation capacity, is nationwide.

1.4 Long term solutions and barriers to achieving the solution

1.4.1 Long term solutions

35. The national conviction to enhance the resilience to natural disasters is manifested strongly in the National Disaster Risk Management Framework (NDRMF) and Disaster Management Act, which are in turn underpinned by the 11th five-year plan and the country's long-term development vision expressed in 'Bhutan 2020'. Such legislative support is one of the critical elements in achieving both short- and long-term resilience. However, legislative support constitutes only a portion of what is needed to build a society that is capable of addressing emerging challenges imposed by climate change. To be fully prepared to localized climate anomalies and resultant hydro-meteorological hazards, first, a national level capacity to capture climate information needs to be developed. In the context of Bhutan, this can only be achieved by establishing a nation-wide network of data infrastructure to accommodate highly variant local climates. The enhanced hydro-met infrastructural capacity needs to be accompanied by sufficient human resource capacity, within the meteorological department and climate-sensitive sectors, to translate climate information into climate hazard information based on underlying baseline risks (such as landslide risk assessments, potential peak discharge information of flood prone rivers). For example, weather-related information captured by the network of real-time Automated Weather Stations would be stored and managed within the Department of Hydro-Meteorological Service (DHMS), which also houses the National Weather Forecasting and Flood Warning Center (NWFFWC). This information needs to be shared across departments/ministries effectively to best utilize the greater infrastructural climate information network for climate resilience and disaster preparedness/response. For example, the Department of Disaster Management requires adequate real time data for the early warning system, and the Department of Geology and Mines, which is mandated to undertake assessment on and monitor

landslide risks, would be able to improve the accuracy of their assessments by integrating climate information, but avenues for information sharing are currently unavailable. Ministry of Agriculture and Forest can also utilize seasonal forecasting on rainfall and humidity to better assist farmers in developing adaptation strategies like coping with late/early arrivals of monsoons and preparing communities for heightened risk of forest fire.

36. At the community level, various volunteer groups such as search and rescue teams, forest volunteers, etc. coordinated by the Dzongkhag Disaster Management Committee (DDMC) or Gewog DMC need to be sufficiently trained to operate within the framework of the Dzongkhag Disaster Management Plan. The concept of disaster risk management at the community level is only gradually taking root through recent donor assistance programmes such as the first LDCF project, reinforced by the trend of decentralization in general and the formulation and endorsement of the Disaster Management Act in particular. Various capacity building initiatives for various aspects of DRM to date, such as trainings on forest fire management or wind resistant masonry, have largely been at the national level, and these new technical know-hows need to be expanded into lower tiers of disaster management institutions and society. Similarly, the concept of Community-Based Disaster Risk Management (CBDRM) that has been successfully piloted in three Dzongkhags through the first LDCF project needs to be continuously expanded to obtain a greater coverage. Strengthened CBDRM capacity includes a robust communication protocol within the community and with the central disaster agency (which in turn relies on the nation-wide climate information network to communicate specific climate risks described above), and clear lines of responsibilities which are continuously tested and validated through periodic trainings and mock drills. What underlies community resilience is awareness about sources of risks and vulnerabilities.

37. Such long-term efforts for strengthening resilience need to be supplemented by a central response to address some of the urgent risks that could potentially undermine the lives and livelihoods of communities. Lowering water levels of some of the critical glacial lake, addressed as part of the first LDCF project, is an example. A few other examples of urgent adaptation actions include the implementation of slope stabilization measures in Phuentsholing and flood protection measures in the Pasakha Industrial Area to mitigate the potential risks of landslides and floods, and adaptive investments that mitigate the future risks of water stress and scarcity in areas where such an issue is already visible. In such areas, communities are well aware of seasonal water scarcity, but the adaptive capacities to respond to the problem and the technical solutions are in many cases unknown or unachievable without external support. Instead of building additional water storage facilities to offset longer or more intense dry periods, communities continue to use surface water from further away streams, which puts a heavy burden on women. This indicates the need for improved dialogue between local governments and climate vulnerable communities, as well as stimulation of innovation to more structurally and creatively addresses water scarcity and climate related risks and disasters. This is not only important for the rural context but also, if not more, for the urban context where increasing numbers of people and assets are concentrated on a small geographical area, without often an adequate understanding on climate risks and hazards.

38. To complement, an understanding of critical ecosystem services and functions in sustaining access to water and in protecting large infrastructure works needs to be integrated into local planning and budgeting. While awareness of the provisioning services of ecosystems exists amongst local stakeholders, these services are not sufficiently valued, particularly as a means of coping with climate change. Forests

and vegetation in upper catchment areas protect populations and economic assets, as well as rural water supply and irrigation schemes, by reducing the risk of failure as a consequence from flash floods and landslides. This contributes towards sustainable service delivery and thus creates more resilient livelihoods and population centers. On a micro-level such stabilizing vegetation or 'bio-engineering', can be a valuable addition to physical structural works; they also require a relatively low investment and are thus cost effective. The complementary nature of ecosystem-based adaptation solutions and physical infrastructure is an essential principle that needs to become a much more common and intuitive element in (local) development and investment planning.

1.4.2 Barriers to Achieving Long term solutions

39. There are a number of individual, informational, financial, regulatory, technological and institutional barriers that prevent the desired situation from emerging.

Basic climate data limitation

40. Effective planning and design of climate change adaptation investments are currently hampered by insufficient hydro-meteorological data collection infrastructure. The existing hydro-met network managed by the Department of Hydro-Meteorological Services (DHMS) is presently only a broad network, mostly developed for hydro-power project assessments and management, and is therefore insufficient to enable DHMS to collect and analyze increasing variability in various climate parameters in specific locality. The existing network consists of 26 river gauge stations, 90 meteorological stations and 15 flood warning stations[14], many of which were established some 20 years ago with limited functionalities. For example, only 10 river gauging stations and 13 meteorological stations are automatic stations. Considering that DHMS believes 205 AWSs are needed in the country for effective assessments of local climate along with a number of other river and snow gauges, the existing infrastructure in the country is grossly insufficient.

41. Lack of basic hydro-met infrastructure is directly attributable to the limited capacity within some key ministries to undertake technical climate risk assessments. For example, while the National Weather and Flood Forecasting and Warning Center (NWFFWC) was established within DHMS to strengthen the capacity of weather forecasting and warning, their current warning is inevitably limited to what the insufficient national hydro-met network can generate, supplemented by additional information on water level information provided by the Central Water Commission, Government of India One of the wider implications of limited hydro-met data availability is the inability for technical ministries/departments such as the Department of Geology and Mines (DGM) and Flood Engineering and Management Division (FEMD) to integrate climate change risks into the technical assessments these agencies carry out. For example, while the DGM has relatively high technical capability in assessing landslide hazard risks, currently they are not able to include future projections of localized rainfall (e.g. frequency, duration, and intensity) in the assessments. This is similar for FEMD's assessments on flood risks and required risk mitigation measures.

42. The barrier related to basic climate data limitation will be addressed primarily through Output 3.1 and 3.2. Under Outputs 3.1 and 3.2, the expansion of the hydro-met network, combined with the capacity

[14] Department of Energy, Ministry of Economic Affairs (2011). Application for Japan's Technical Cooperation. (Unpublished).

enhancement of the National Weather and Flood Forecasting and Warning Center (NWFFWC), will generate a higher density of weather data useful for monitoring climate change, for climate resilient local and urban planning and for improved disaster warning and response capacity at local and national level.

Limited financial resources for climate change and disaster resilience

43. Removing imminent threats that stem from climate risks, especially in Phuentsholing and Pasakha Industrial Area, requires large investments. However, the small economy, limited public funds, and competing needs for other development investments, result instead in a series of small investments that are fragmented and piecemeal in nature. For example, recurrent expenditures to remove the threats of landslides in Phuentsholing include drainage of surface and sub-surface water from failure-prone slopes[15] while the fundamental risks continue to be unaddressed. In PIA, the Association of Bhutan Industries spends nearly $500,000 annually only to remove silt transported from upstream. Although this is a significant amount, it is sufficient only to remove the *annual accumulation* of risks, instead of being able to address the risks of floods with a longer-term timeframe.

44. The barrier of limited financial resources to make large initial investments to remove imminent threats in a holistic manner will be addressed primarily through Output 1.1 and 1.2. LDCF resources will be used to remove risks of landslides and floods in most critical sections of Phuentsholing and PIA, respectively, through a series of engineering solutions.

Limited disaster knowledge and information

45. Limited climate information has a significant bearing on the limited national knowledge on potential sources and locations of natural hazards. As the section on future climate change projections make it clear, climate change is likely to affect local rainfall patterns, duration and intensity, which in turn will change the way communities face slow and sudden onset of disasters. However, exiting knowledge on hazards, such as landslides and floods or drought, is still based on business-as-usual climate scenario. As climate information and the associated capacity to analyze and disseminate it become more widely available (partially through Output 3.1 and 3.2 of this project), knowledge on both sudden and slow onset of disasters – such as a threshold point beyond which a warning is issued – and associated plans need to be updated and upgraded.

46. This barrier will be addressed primarily through Output 1.3 and 2.2. Through the former, critical landslide and flood hazard mapping, with future climate risks integrated, as well as establishment of the technical specifications and methodologies for such geo-hazard risk assessment will be undertaken. The new specifications and methodologies will take into considerations in their designs availability of more localized, real-time climate information (made available through Output 3.1 and 3.2) so that standardized assessments can include variables such as increasing volume and intensity of rainfall and/or prolonged dry spells. The same Output will also generate threshold data for early warning for landslides and flash floods, which are directly linked to the expanded hydro-met network. Through Output 2.2, the knowledge of community level water resource availability and its dynamic interactions with climate variables will be strengthened.

[15] In 2010-2011 in the current five-year cycle, the largest proportion (Nu 20m = US$0.4m) of PCC's budget is spent on landslide mitigation

Institutional capacity for climate and disaster resilient policy development

47. Institutional fragmentation has led to limited collaboration between ministries and for the most part isolated sector policies on climate change within agriculture, forestry, water resources management, and infrastructure development. Climate risk information and possible approaches for climate resilient development need to be integrated into sector policies at the national level, but such data is now often fragmented and more often only available within specific departments and donor projects and not necessarily broadly accessible. Furthermore there is limited sharing of knowledge and experiences amongst government agencies, civil society organizations (CSO) and education/research institutes (e.g. University), which further limits the effective and efficient generation, capture and application of climate change information and knowledge. This very low institutional capacity for 'knowledge management' hampers evidence based policy and strategy development for addressing climate change more structurally in Bhutan.

48. At the national level there is relatively weak sector leadership and inter-sector coordination on climate change and especially localized impacts and vulnerabilities. The National Environment Commission Secretariat (NECS) is mandated by the Government to take the lead role in addressing climate change but has in the past mainly worked on international climate change related agreements and global covenants, next to its role in creating and monitoring environmental safeguards for development. The NECS has now taken upon itself to strengthen its role in coordinated knowledge management and exchange on climate change related issues and has yet to work out a strategy on how to address and mainstream climate change concerns and opportunities into sector ministries and policies.

49. This barrier will be addressed primarily through Output 3.3, although the whole project has a multi-stakeholder design with exchange and coordination mechanisms. The climate risk and resilience knowledge and good practice developed under project outcomes 1 and 2 will be used to build national capacity on climate adaptation and resilience through sharing and exchange of climate knowledge amongst sectors, public-private entities and national-local institutions. The NECS will be strengthened in its national role as the coordinating agency for climate resilient development (and climate change mitigation) and will coordinate and support mainstreaming of climate change in sector policies (policy-influencing). NECS will also establish a national dialogue and information exchange platform to ensure all relevant information and knowledge generated within the country as well as outside is shared. In order for NECS to take up its expanded responsibilities, a capacity development programme will be developed and implemented under Output 3.3.

Capacities in climate resilient local planning for water resource management and natural disasters

50. In Bhutan, local administrations and elected bodies have a reasonable capacity when it comes to local development planning. However, at present there is little awareness and understanding about the possible localized impacts of climate change and variability (and resulting climate induced natural disasters and livelihoods vulnerabilities), although there is general recognition that water resource management for drinking as well as agricultural purposes needs to be improved to ensure the viability and long term sustainability of the investments. The different levels of vulnerability to climate risks from one geographical location to another or from one social group to the next, including the gender dimension, are not yet analyzed, even at a very basic level. Risk information is not systematically collected and fed back into the annual planning process. Existing design standards furthermore do not take into account potential

multiple services that can be provided by a single infrastructure category. For example, integrated thinking on water harvesting and storage, using public buildings or multipurpose water reservoirs for household consumption, sanitation, fish farming and agriculture has not been explored or applied beyond isolated incidences.

51. The recently adopted Disaster Management Act provides a clear institutional framework for national and local disaster preparedness and response. The Department of Disaster Management (DDM) has in the past years conducted awareness and advocacy exercises at the local level on natural disasters, including climate related ones, through e.g. local disaster risk mapping exercises. As the nodal implementing agency of the Disaster Management Act, DDM is presently assessing the requirements to establish a functional institutional framework, which will surely go well beyond awareness, advocacy and risk mapping and will require substantial capacity strengthening of especially local institutions.

52. This barrier will be addressed primarily through Outputs 2.1, 2.2 and 2.3 by: (a) establishing climate-resilient water harvesting, storage and distribution systems using community-based approaches; (b) creating information base and knowledge on local water resources for integrated water resources management planning keeping in mind potential local climate change impacts, and (c) strengthening the capacities of various local institutions for holistic responses to disasters and disaster risks based on the institutional framework and mechanisms stipulated in the Disaster Management Act. The project will also make available climate change knowledge and good practices to local institutions and communities for improved water resource planning and disaster response under output 3.3, as explained before. Under output 2.1 the development of climate-resilient water harvesting, storage and distribution systems through direct community engagement will be promoted. This will not only generate technically innovative solutions, but will also strengthen community resilience through the facilitation of participatory empowerment processes. This is the only output directly implemented by a non-government entity (CSO), the Tarayana Foundation. The role of CSOs in local development in Bhutan is still undervalued and through this output the project also aims to highlight and strengthen the value of partnerships with CSOs for developing climate resilient communities. Furthermore a similar water demand and supply assessment, a technical design for a phase-wise expansion of the water supply system as well as actual investments in improving climate resilience of the water supply system of Mongar Municipality will be taken up with LDCF resources under this Output. Under Output 2.2 a community-level water resource inventory will be conducted in selected districts by NECS, which will generate an overview of existing water sources for local use as well as insight in trends in water availability due to climate change. The inventory will furthermore capture the presently un-used water sources, which could be tapped into in future to increase climate resilience. The water resource inventory and mapping will provide a useful basis for climate modeling of water availability projections and aid water resource planning at the local level and is therefore also an important input to Output 2.1. Output 2.3 concerns capacity development of disaster management institutions at various levels on integrating climate and disaster risk information, including extreme weather events/calamities, into local disaster preparedness and response. The DDM will use LDCF resources to strengthen the capacities of selected local institutions in line with the recently enacted Disaster Management Act and local climate and disaster resilience demand.

Understanding of the benefits for ecosystem based adaptation measures

53. There is still a significant knowledge gap in Bhutan with regards to combined ecosystem-based management and water infrastructure development and maintenance solutions. The Environmental Friendly Road Construction (EFRC) concept applied in the roads sector has generated a lot of experience and good practice, but this has not yet been simplified and localized to small-scale (water) infrastructure works. The way in which ecosystems protect small-scale water infrastructure, as well as reduces the risks of landslide and flash flood, both directly and on a wider landscape scale, remains therefore largely under-valued and as a consequence ecosystem services are not yet adequately factored into local development planning processes. Related to this is a typically low level of awareness among planners and investors of the interdependencies inherent in sound environmental management and adaptation. For example it may make more sense at lower elevations within a given catchment to invest in reinforcing small scale infrastructure with robust, permanent fixtures (in combination with bio-engineering) that are better able to withstand the expected increase in surface run-off, erosion and flash floods. By contrast in the upper elevations of the same catchment, it may make more sense to invest in ecosystem-based adaptation options, consisting of e.g. reforestation and other land use changes, to improve the retention capacity of soils, reduce runoff, and reduce erosion, thereby limiting the occurrence of e.g. landslides and the severity of flash floods downstream. Yet both upstream and downstream levels of adaptation must be implemented together in order to reduce the overall vulnerability of critical infrastructure to acceptable levels.

54. This barrier will be addressed through Outputs 1.1, 1.2, 1.3 and Output 2.1. The landslide and watershed assessments and the design of stabilization and protective measures for Phuentsholing Thromde (Municipality) and Pasakha Industrial Area to be designed and constructed under outputs 1.1 and 1.2 will comprise next to stabilization and protection structures, especially eco-system based interventions as bio-engineering and regeneration of vegetation, as well as wider watershed management measures. As such the value of eco-systems as a critical factor for climate resilience of slopes and watersheds will be emphasized as well as the use of eco-systems for stabilization and protection once harm has been done. This is also applicable to output 1.3, with the risk mapping exercise as well as the landslide monitoring aspects of this outcome. Furthermore the water resource management and development of climate-resilient water harvesting, storage and distribution systems through direct community engagement under output 2.1 will generate a better understanding of ecosystem based impacts of climate change and the role of ecosystems in adaptation at community level especially for water resource management and sustainability of technical solutions.

1.5 Stakeholder Baseline Analysis

55. During the PPG phase extensive stakeholder consultations with national and sub-national government agencies, development partners, CSOs, research bodies as well as representatives of the target groups and local organizations have taken place. The aim was to ensure a maximum fit of the project with government priorities, to capture local views and sometimes differing needs in that regard and to align and harmonize the project with the efforts of all concerned development partners. The stakeholder consultations were conducted through workshops, bilateral working sessions, field trips, one-to-one meetings with key individuals, and focused meetings with individual responsible agencies. The main stakeholder consultation events during the PPG are listed below:

- A national inception workshop of the PPG phase in Thimphu on 22nd August, 2012;

- Field trip to Phuentsholing and Pasakha from 7th to 10th November, 2012, for initial assessment of local institutional context and local stakeholders' perception survey on flood and landslide risks;
- National stakeholders' consultative workshop on 4 and 5 January, 2013, for output 3.1 as a part of DHMS's PPG-Technical Study on strengthening hydro-meteorological services;
- Bilateral consultative working sessions, from 8th to 19th April, 2013, for all project outputs, followed by additional bilateral consultative working sessions with the Department of Disaster Management on 30th April, 2013, and with Tarayana Foundation on 8th May, 2013, to flesh out the key areas of project support, approach and activities for the various outputs/sub-components;
- Intermediate Project Formulation Review Workshop on 10th July, 2013, to elicit feedback on the technical content and indicative activities drafted for the various project outputs;
- Field trip to Phuentsholing and Pasakha and a local stakeholders' workshop, from 16-18 July, 2013, to validate the findings and recommendations of the PPG-technical studies for outputs;
- Final National Consultation Workshop on 23rd September, 2013 to present the final draft of the project document and elicit feedback on it.

56. The series of consultations listed above offered important opportunities to consult, not only a number of government officials who will be involved in the project implementation, but also potential beneficiaries of the project. More specifically, a total of 109 individuals (75 men and 34 women) and 20 industries have been consulted during the preparatory phase.

57. Prior to commencement of stakeholder discussions, a review was undertaken of existing policies, projects and legal frameworks with relevance to the proposed project as outlined in the approved PIF. This involved information gathering on similar CCA initiatives in other countries, as well as baseline data collection on relevant issues of the project (e.g. on climate change, quality of infrastructures and ecosystems, CCA related subjects, participatory planning tools, etc.). The outcome of the review was the identification of important parts of the baseline data needed for project document development, as well as a better idea on how to structure bilateral discussions to fill in remaining information gaps.

58. The NECS, supported by the project formulation team comprised of various government and non-government stakeholders conducted extensive consultations with all relevant project stakeholders, including communities and local authorities, throughout the project preparation phase. The intense one-to-one consultations and bilateral working sessions with implementing parties, combined with regular multi-stakeholder engagement, have ensured a feasible project design as well as ownership for outputs to be achieved. An overview of the key stakeholder agencies and their role in the PPG and during project implementation are outlined in Table 5, section 2.10. The full list of the consultations with key issues and outcomes can be found in Annex 2.

2. Strategy

2.1 Project Rationale and Policy Conformity

59. As a net sequester of greenhouse gas (GHG), Bhutan does not contribute to global warming. This, however, does not exempt the country from the impacts of climate change. In fact, with a predominantly fragile mountainous ecosystem and as a least developed country (LDC), the country is highly vulnerable to climate change and its impacts. Socio-economic development is hugely dependent on climate-sensitive sectors such as agriculture, hydro-power, forestry, and road communication. Furthermore, as a mountainous country with an intricate natural drainage system of several watersheds and water catchments, the country is intrinsically exposed to and impacted by multiple climate change hazards including GLOFs, landslides, flash floods, forest fires, droughts, and windstorms. According to the International Disaster Database, the 10 most significant natural disasters in Bhutan in terms of casualties and number affected between 1900 and 2012 have all occurred in the last twenty years. Climate change is likely to magnify the intensity and frequency of these hazards.

60. The project objective is therefore to: **"enhance national, local and community capacity to prepare for and respond to climate-induced multi-hazards to reduce potential losses of human lives, national economic infrastructure, livelihoods, and livelihood assets"**. Bhutan requires crucial support to counter immediate threats posed by climate change to vital economic infrastructure, as well as to strengthen national capacity for climate change adaptation and developing adaptation alternatives for projected prolonged periods of drought in rural areas and urban centers. The proposed project Outcomes and Outputs individually address specific needs as identified under the NAPA (see below), while together they constitute a comprehensive package which leverages Outcomes and Outputs' complementarity and synergy towards strengthening of overall national and local capacity for disaster and climate change resilience. The project Outcomes address the following key adaptation issues identified by Bhutan:

1. Safeguarding Phuentsholing town and Pasakha Industrial Area from critical landslides and flash floods while systematizing technical and institutional solutions implemented under the outcome for application nationwide;
2. Conducting a water resource inventory and developing adaptation solutions for increased droughts in rural areas as well as Mongar town, introducing innovative technical and development approaches, as well as strengthening local institutions to prepare and respond to climate induced disasters, including forest fires;
3. Climate change data captured, analyzed and disseminated for increased resilience of development activities and response to climate induced disaster, through the strengthening of the national hydro-met network and early warning system. Overall national capacity for climate change resilience reinforced through strengthened institutional leadership and improved knowledge for climate resilient policy development.

The overarching goal of the project is thus to safeguard Bhutan's key economic development infrastructure, to strengthen resilience against climate-induced water scarcity and in general terms to strengthen national and local capacity for natural disaster response and climate resilience. This goal is consistent with and underpinned by, a number of important policies and strategies governing Bhutan's national development and its specific response to climate change.

61. Bhutan has made great progress with strengthening institutional structures to respond to the growing challenges of climate change. At the highest level, the National Environment Commission (NEC), established in 1992 and chaired by the Prime Minister, is designated to lead and coordinate all environment and climate change related strategies and activities in the country. A Multi-sectoral Technical Committee on Climate Change (MSTCCC) was also formed at the national level. In 2009, a Climate Change Unit was created within the NEC Secretariat (NECS) to deal specifically with the increasing climate change challenges and necessary country responses. This Unit was upgraded to the Climate Change Division in 2011. Other key institutional developments include the creation of the Department of Disaster Management under the Ministry of Home and Cultural Affairs and upgrading the Hydro-met Division under the Ministry of Economic Affairs (MoEA) to a full-fledged Department of Hydro-Met Services (DHMS). The DHMS has the national mandate for climate research, hydro-met and CC data collection and dissemination and also serves as the national center for weather monitoring, forecasting and early warning.

62. Bhutan is seriously committed to addressing the challenges of climate change also in its development philosophy, plans and policies. Driven by the country's overarching development vision of Gross National Happiness (GNH) and the commitment to the global agenda of sustainable development, Bhutan's overall national development goals encompass the spirit and purpose of international commitments and focus on poverty reduction, equitable socio-economic development, environmental sustainability, gender equity, good governance, and community participation. The following key documents provide the national policy context for initiating and pursuing climate change adaptation and mitigation programmes and projects:

- **Bhutan 2020**, outlines the country's vision document outlining development goals, objectives and targets with a twenty-year perspective to maximize GNH. As one of the four main GNH objectives[16], it enunciates that development pursuits are to be carried out within the limits of environmental sustainability and without impairing the ecological productivity and natural diversity, thus providing the overarching policy context for sustainable development implicitly encompassing one that is resilient to, and mitigates, climate change;
- **National Forest Policy**, was first formulated in 1974 and subsequently revised in 1979, 1991 and most recently in 2012, and serves as the main guiding policy framework for forest management and nature conservation. The new forest policy of 2012 recognizes the important role of sustainable forest management in CC mitigation and adaptation;
- **National Environment Strategy (NES)**, was first published in 1998, identifies and describes the main avenues and approaches for sustainable development. The strategy is currently under review and in the absence of a separate CC policy, the revised NES will among other things focus on low-carbon and climate resilient development, addressing both climate change mitigation and adaptation aspects, which was not the case in the earlier NES;

[16] The other three are equitable socio-economic development, preservation and promotion of culture, and good governance.

- **Bhutan Water Vision and Policy**, was adopted in April 2003 and establishes Bhutan's water vision and describes the approach and context of water resources management from a broad, multi-sectoral perspective with recognition of the responsibility of the various sectors to play their part in meeting the policy objectives. One of the key elements that the policy advocates is integrated water resources management to address existing and emerging water issues including those emanating from climate change;

- **National Communications to the UNFCC**: The Initial National Communication was produced in 2000 and the Second National Communication in 2011. These National Communications provide inventories of GHG emission and sequestration, describe climate change vulnerabilities, and outline a wide range of adaptation and mitigation options across various climate-sensitive development sectors;

- **National Adaptation Programme of Action for Climate Change (NAPA)**, was produced in 2006 and regarded Glacier Lake Outburst Floods as the highest priority climate hazard. The NAPA was reviewed and updated in 2012 to incorporate new climate hazards such as windstorms and cyclones and also to take stock of the implementation status of the priority projects;

- **National Strategy and Action Plan for Low Carbon Development** (2012). This Strategy has been primarily prepared in support of Bhutan's commitment to remain carbon neutral development at the 15th Conference of Parties of the UNFCCC in Copenhagen in December 2009. It presents a long-term national strategy comprising of various scenarios analyzing development paths from 2005 until 2040. Concomitant to these scenarios, the action plan articulates a number of short and medium-term interventions under various development sectors to achieve sustainable economic growth through green and low-carbon growth;

- **National Disaster Management Act**, which has been developed through a series of stakeholder consultations at central and local levels, was ratified by the Parliament on 27th February 2013. This will significantly strengthen Disaster Risk Reduction (DRR) activities in Bhutan. The Act formalizes the decentralization of disaster management planning and response by the establishment of disaster management committees at the dzongkhag level, with coordination mechanisms at the gewog and community levels with the aim to develop and implement disaster reduction and response strategies more effectively. The implementation of the Act will necessitate a great deal of capacity development for institutions at various levels, especially of local governments, non-state actors and local communities;

- **Eleventh Five Year Plan:** The Eleventh Five-Year Plan document (2013-2017) was recently approved by the new government. The overall goal of 11th FYP is "self-reliance and inclusive green socio-economic development." It seeks to promote carbon-neutral and environmentally sustainable development, and engenders mainstreaming of environment, climate change and disaster risk reduction as cross-cutting issues along with gender and poverty reduction.

2.2 Country Ownership: Country Eligibility and Country Driven-ness

63. The project presents ways in which additional risks imposed by climate change will be addressed, which is consistent with Bhutan's requirements and the objectives of the Least Developed Countries Fund (LDCF). It will finance the additional costs of achieving sustainable development imposed on the GEF-eligible countries by the impacts of climate change. Derived from the NAPA process, the project is fully country-driven, cost-effective and emphasizes the needs of the poorest and most vulnerable including women and farmers relying on water sources for their livelihoods and survival. The project focuses on safeguarding essential economic infrastructure through reduction of flood and landslide risks; water harvesting and drought adaptation; community-based disaster risk management; strengthening of weather forecasting and early warning systems; and improving local awareness and understanding of communities and other key stakeholders about the necessity and benefits of preparedness for climate change risks. The project is thus fully aligned with LDCF/SCCF focal area objective 1 to "reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level" and objective 2 to "increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level." This project also underpins the recognition of the linkage between adaptation and poverty reduction (GEF/C.28/18, 1(b), 29) and is aligned with the scope of expected interventions as articulated in the LDCF programming paper and decision 5/CP.9. The project also supports UNDP's global objective for Thematic Area 4 on Disaster Risk Management within the Monitoring and Evaluation Framework for Adaptation to Climate Change: "Enhanced resilience of settlements, infrastructure, and landscapes to increases in the frequency of climatic extremes, focusing on the reduction of risk associated with increasingly frequent extreme rainfall events and their impacts through planning, land management, and vulnerability reduction."

64. Bhutan has recognized climate change as a serious challenge to sustainable development since the issue first appeared on the international agenda. It supported the United Nations Framework Convention on Climate Change (UNFCCC) as a signatory at the United Nations Conference on Environment and Development at Rio de Janeiro in June 1992 and followed up with its ratification in August 1995. As a Party to the UNFCCC and a country committed to sustainable development, Bhutan completed its Initial National Communication to the UNFCCC in 2000 and the Second National Communication in 2011. The project will use LDCF resources to implement a suite of programmes and activities to address immediate and urgent adaptation needs identified as priority projects in the National Adaptation Programme of Action (NAPA) 2012. In doing so, it satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. Applying a step-by-step approach of screening, selecting and finally ranking using multiple criteria, the updated NAPA came up with the following priority projects: (a) Disaster Risk Reduction and Management – planning disaster management interventions and providing emergency medical services; (b) Landslide Management and Flood Prevention; (c) Application of Environment Friendly Road Construction Nationwide to the National Engineering Institutes; (d) Enhancing National Capacity for Weather and Seasonal Forecasting; (e) Pilot Project for Community based Climate Resilience; (f) Flood Protection of Downstream Industrial Area; and (g) Rainwater Harvesting and Drought Adaptation; (h) Community-based Forest Fire Management and Prevention. The project design has been conceived to

address all of the above-listed NAPA-2 priorities except for (c) Application of Environment Friendly Road Construction Nationwide to the National Engineering Institutes[17].

65. The project, derived from the NAPA update process and further designed through detailed consultations with a wide number of national stakeholders and their partners, has full country ownership and is driven by national circumstances and priorities. This multi-stakeholder process for identifying urgent and immediate adaptation priorities is reflected in the project implementation architecture. More specifically, the programmatic approach of this project was adopted out of the conscious decision of key project partners to ensure institutional sustainability of the project results. The RGoB is fully cognizant that, given the multifaceted climate change impacts that cut across various sectors and ministries as outlined in the updated NAPA 2012, a range of institutions, both government and non-government, need to obtain experience and build capacity in addressing climate change induced risks in the respective sectors, while the overall orchestration and coordination is ensured by NECS.

66. The national ownership is further ensured through the national execution of the project in accordance with the National Implementation Modality (NIM) agreed between RGoB and UNDP. While technical support will be provided through the UNDP Country Office, the project will be driven by the national implementing agencies and project teams led by national officials. At the field level, local government authorities will be fully involved in project implementation.

2.3 Project links to past and on-going initiatives

67. The LDCF project aims at building on experience and good practice from past initiatives and to seek collaboration where possible with ongoing and/or new initiatives for joint learning and development of capacity for effective response to climate-induced disasters and disaster risks at national and local levels. Key initiatives identified are presented in Table 2.

Project Title	**Key Objectives**	**Key Implementing Agency(ies)**	**Relevant Areas**
UNDP/GEF/LDCF Project on Reducing Climate Change Risks and Vulnerabilities from GLOFs (2008-2013)	The goal of the project is to enhance adaptive capacity to prevent climate change-induced GLOF disasters in Bhutan. The objective of the project is to reduce climate change-induced risks of GLOFs in the Punakha-Wangdi and Chamkhar Valleys.	Department of Geology & Mines, Department of Hydro-met Services, and Department of Disaster Management	Community-based disaster risk management, early warning system (Relevant for Outcome 2) It has initiated the CBDRM approach in the country.
Bhutan Recovery and Reconstruction Project (January 2010-December 2011)	Support to affected communities to recover and rehabilitate in the aftermath of major disasters in 2009 particularly the Sept earthquake and Cyclone Aila	Ministry of Home & Cultural Affairs, Ministry of Economic Affairs	Community-based livelihood regeneration, capacity development for disaster response and recovery coordination. While it has contributed to building community DRR capacity, it did not have climate change concerns in the design and has ended. So there is no risk of duplication.
World Bank/GFDRR project on Improving	Improve disaster management capacity in terms of formulation of rules and	Department of Disaster Management Division/	Capacity development for disaster risk management

[17] This priority is being addressed through the UNDP/UNEP/DANIDA Joint Support Programme on Capacity Development for Mainstreaming Environment, Climate Change and Poverty Concerns in National Policies and Plans.

Disaster Management Capacity in the Kingdom of Bhutan (2012-2013)	regulations, by-laws and standard operating procedures; institutional set-up at various levels; and sensitization of institutions and committees to DRM concepts and policies, coinciding with the DM Act.	MoHCA	(Outcome 2: Co-financing source) It is building the baseline capacity of DDM at the national level.
BTF-National Water Resources Inventory Project (2012-2014)	Completion of national water resources inventory to create information for preparation of National Integrated Water Resources Management Plan	Water Resources Coordination Division	The national water resources inventory will provide the basis as it provides the current snapshot of water availability against demand. (Outcome 2: Co-financing source) LDCF will integrate GIS mapping and climate modeling as well as building local-level capacity to repeat the assessment.
Local Governance Sustainable Development Programme (in the pipeline for 2013-2018)	The project objectives are sustainable and equitable socio-economic development, conservation and sustainable management of the environment, and good governance at the local level. It is the amalgamation of JSP and LGSP into the next phase coinciding with the strategic context and period of the Eleventh FYP.	GNHC Secretariat and Department of Local Governance/MoHCA	Capacity development for green inclusive socio-economic development and good governance at the local level. During the inception phase of the project, opportunities for synergies will be explored.
ADB Bhutan Sub-regional Project for Phuentsholing (Regional Transport Development in South Asia) (2015-2017)	Improving transport infrastructure conditions for import/export trade through Phuentsholing, including the Pasakha access road.	Phuentsholing Thromde, MoWHS	Landslide management/ flood risk mitigation along Pasakha access road (Outcome 1: Co-financing source) LDCF investment will contribute to safeguarding the ADB investment
Tarayana's support in poverty reduction through Self-Help Groups – support from Helvetas and ADB	Local Self-Help Groups to organize local communities for carrying out activities towards poverty reduction in in Mongar, Samtse, and Pemagatshel dzongkhags	Tarayana Foundation	This experience will help mobilize local communities into self-help groups for installation, operation and maintenance of rural water harvesting technologies (Outcome 2: Co-financing source) Adaptation actions aiming at reducing vulnerability to water scarcity will be integrated into Tarayana's program
JICA's project for Capacity Development of GLOF and Rainstorm Flood Forecasting and Early Warning in the Kingdom of Bhutan (2013-2015)	Improving the capacity of NWFFWC for GLOF and rainstorm flood risk assessment; developing EWS for GLOF/rainstorm in Mangdechhu and Chamkharchhu river basins; and building emergency response capacity against GLOF/storm flood.	Department of Hydro-Meteorological Services, MoEA	The design standards for the hydro-met infrastructures to be installed.
Joint Support Programme (2008-2013)	Development of capacity for mainstreaming environmental, climate change and poverty concerns at national and local levels. They have also financed CBDRM activities in Sarpang and Tsirang dzongkhags.	GNHC Secretariat, NEC Secretariat, and Department of Local Governance/MoHCA	Capacity development of national and local governments for environment and climate mainstreaming (Outcome 2: Co-financing source) Real-time climate risk information will be integrated into the existing capacity building and contingency plan

Table 2, LDCF project links to past and on-going projects and initiatives

2.4 Gender and vulnerable groups

2.4.1 Gender in Bhutan

68. Bhutan's female population ratio is slightly higher, at 375,471 (51.1 percent) against a male population of 359,379 (48.9 percent). On the gender inequality index, Bhutan was placed at 98 among 146 countries (with data) in 2011. Women in Bhutan, in general, enjoy a favorable socio-cultural environment compared to most countries in the region. Their situation is largely influenced by Buddhist traditions and values, which regard men and women as equals. In many parts of the country, a matriarchal society persists and women generally inherit family properties. Because of the general view of equality, there are very few specific laws against the discrimination of women. The Constitution of Bhutan, in its Article 7, guarantees equality before the law and protection from discrimination on the grounds of gender. Article 9 provides further protection of women's rights by providing that the "State shall endeavor to take appropriate measures to eliminate all forms of discrimination and exploitation against women including trafficking, prostitution, abuse, violence, harassment and intimidation at work in both public and private spheres. Bhutan signed the Convention on Elimination of All Forms of Discrimination Against Women in 1980.

69. Nevertheless, there are a number of gender issues that need to be addressed. Data on the occurrence of domestic violence is still scarce in Bhutan, although there is a general agreement that it is high. Attitudes from both sexes towards domestic violence are, however, clearly identified as a major impediment in reducing domestic violence. According to National Statistics Bureau's Bhutan Multiple survey 2010, about 70 percent of women said that they deserved beating if they neglected their children, argued with their partners, refused sex or spoiled meals. The acceptance of violence was highest in Paro at 90 percent and least in Thimphu at about 50 percent. In July 2013 the Domestic Violence Prevention Bill was adopted, following historic changes to the penal code making domestic violence a punishable public crime. It is hoped that this law will reduce violence and indeed change perceptions on the legitimacy of (domestic) violence. Women's employment in non-agriculture jobs is very low. According to the National Labor Force Survey 2012, women make up only 13.7 percent of employment in non-agriculture jobs whereas men make up 26.4 percent. Unemployment rate is 2.2 percent for women compared to 1.9 percent for men. Illiteracy is also higher among women at 54 percent compared to 44.7 percent among men. Most notably, women representation in politics and governance is dismal. While women made up 50.8 percent of the total eligible voters and generally turn up in higher numbers than men for the elections, elected women local government leaders and functionaries constituted a mere 7.3 percent of the filled posts at the Gewog level and 11.9 percent at the Thromde level as per records maintained by the Department of Local Governance, Ministry of Home and Cultural Affairs. On a more positive note the first women Minister was appointed in 2013. Reasons attributed to this low representation include lack of exposure, low literacy level among rural women, household duties, and low confidence in decision-making and leadership roles of women.

2.4.2 Gender and climate change

70. In general, women in Bhutan (both in rural and urban areas) have social freedom and participation in household decision making. Demographically there are more women (51%) compared to men (49%). Life expectancy is the same for men and women and maternal mortality rate on the decline.

71. Women in general and mountain women in particular face the burden of climate change disproportionately. Women play many roles, as farmers, natural resource managers, caregivers, and household managers and in these roles, mountain women are constantly forced to cope with the heavy burden of household chores combined with farm production and livestock raising. Moreover, the mountain landscape, with its steep and fragile slopes, makes collection and fetching of water, fuel wood, and fodder more arduous and hazardous. This burden takes a toll on the health of mountain women. But because, as women, they are generally less able to voice their needs, they rarely access the technologies and other resources that would reduce their drudgery and build their resilience to environmental changes[18]. In the mountains, remoteness and isolation deprive the population of access to essential information about climate risks. In addition, with the high rate of men migrating for economic reasons, mountain women are often left alone in experiencing the stress of ensuring the safety of household members, coping with the loss of household assets, and dealing with health issues and food insecurity.

72. Climate change is not happening in isolation, but is coinciding with many other trends and stresses on livelihoods. Women are vulnerable not because of natural weakness (i.e. their sex), but rather because of the socially and culturally constructed roles ascribed to them. Climate Change is likely to magnify existing patterns of gender disadvantage. Factors exacerbating this are e.g.:

- Limited access to resources (e.g. natural and financial);
- Dependence on natural resources and gender-based division of labor (e.g. fetching water and fire wood);
- Lack of education and access to information (e.g. lower literacy and formal education rates making employment and participation in politics and governance difficult);
- Limited mobility (e.g. migration may not be an option due to household duties and the role of taking care of ancestral properties);
- Limited roles in decision-making (while often more closely involved in natural resource use and conservation).

73. Past hazards and disasters illuminate how women and men are differently affected by natural disaster and indeed more women in general die than men[19]. This reflects women's social exclusion: they are less able than men to run, often have not learned to swim, are less educated and have behavioral restrictions that limit their mobility in the face of risk. Access to water also has a clear gender dimension as it is often the women in the household who bear responsibility for the health and education of the children and for supplementing household nutrition through kitchen gardening. With climate change the risk of existing water sources drying up increases, which likely will increase the time required for fetching drinking water for households.

74. In addition to gender there are also specific groups in society with higher vulnerabilities to climate change impacts, changes in livelihoods and natural disasters: children, less-abled and elderly. Care needs to be taken that specific needs of these vulnerable groups are addressed as well.

[18] Brigitte Leduc, Kathmandu, 2009. Gender and Climate Change in the Himalayas. Background paper for the e-discussion from 5 to 25 October 2009 on 'Climate Change in the Himalayas: The Gender Perspective' organized by ICIMOD and APMN

[19] Gender, Climate Change and Community-Based Adaptation, A guidebook for designing and implementing gender-sensitive Community-Based Adaptation programmes and projects", UNDP, 2010, New York

2.4.3 Gender strategy of the LDCF project

75. Gender issues, especially the specific access patterns to natural resources like water and ecosystem services, as well as access to disaster preparedness and response mechanisms, are of special importance to the project with regards to inclusiveness and sustainability. Since climate change and climate risks affect communities differently according to their respective vulnerabilities and adaptive capacities, adaptation must be location and context specific. As described above, the project preparation process recognized the special needs of other vulnerable groups such as children, less-abled, elderly, and the poor, in addition to women and the project thus recognizes the need for context-specific adaptation based on local vulnerabilities, drawing on local knowledge and capacities, and involving all stakeholders. The LDCF project will support gender sensitive approaches for example in the following ways:

- **'Mainstreaming gender sensitivity in project approaches'**, in e.g. a) ensuring women and other vulnerable groups participate in a meaningful way in the water resource and climate change impact inventory, b) Tarayana's community development and empowerment approach to identify and support gender equality and gender sensitive development activities that aim to enhance the resilience of communities and ecosystems especially to projected climate change impacts on water sources, c) DDM's capacity development package and local institutional DM design to ensure the most vulnerable groups are equally participating and benefiting from project support, and d) the design of household survey questionnaire for national water resource inventory among other things to derive gender-disaggregated data; and
- **'Directly addressing discrete adaptation needs'**, through e.g. a) implementing specific activities strengthening the resilience of vulnerable groups in communities, identified with support from Tarayana's community development and empowerment approach, and b) specifically targeted capacity development activities for vulnerable groups, addressing their specific needs and role in disaster management.

The water resource inventory, Tarayana's community development and empowerment approach and DDM local capacity strengthening approach will provide gender disaggregated information on participants and where useful also on household assets and other socio-economic conditions. This will allow for analysis of patterns of socially differentiated access to water infrastructure and other livelihood assets as well as to government capacity development services. Textbox 1 provides a checklist which has been and will be providing a guiding framework in the design and implementation of the project. The LDCF project will ensure strengthening and institutionalizing women's participation in local institutions to improve community's and local administrations' resilience to the impact of climate change. Emphasis will be put on different rights, roles and responsibilities of individuals and their contribution to overall community resilience to climate change and natural disasters.

Problem identification, identifying CC causality and gender issues:

- Is relevant gender information, especially socio-economic information, identified and collected so that it can be included in discussions about project formulation?
- Is background data disaggregated by sex? (In many cases, disaggregation by other social identities such as age and ethnic origin is also required, given that communities are rarely homogeneous units.)
- Are gender specialists and representatives of women's organizations within the community been consulted?
- Are both men and women involved in problem identification (even if problem affects one sex more than the other)?

Project formulation, adaptation responses, possible barriers, results:

- What is the current situation of men and women in the sector of your planned intervention?
- Will the proposed project contribute to existing inequalities among men and women?
- Does the proposed project break down or challenge existing inequalities among men and women?
- Will the proposed project change the perceptions or stereotypes about men and women and their roles in any way?
- What options should be considered to strengthen a gender perspective?
- Will the proposed project contribute to women's empowerment? If not, is there place for an allied intervention that will contribute to empowerment, so as not to reinforce the disparity between men and women?

Project appraisal:

- Have gender issues, including gender impact and anticipated outcomes, been systematically identified?
- Have staff members informed themselves substantively of the gender dimensions of adaptation in the appropriate country?
- How far have individuals and women's organizations with knowledge and experience of gender mainstreaming participated in project identification, formulation and appraisal?
- Have female beneficiaries of the project, been consulted equally with men during the formulation process?
- Has all background data been disaggregated by sex?
- Have gender-related links with other projects and programmes been identified and incorporated into documentation?
- Have relevant gender issues been raised at project appraisal meetings, ensuring discussion of the impact of the project on gender equality in the country?

Project Implementation:

- Are CBA project implementation staff/team committed and capacitated to implement the gender-mainstreamed CBA project process and activities?
- Is technical backstopping on CC and gender available?

Project Monitoring:

- Is the monitoring and evaluation methodology of the CBA project tailored to the cultural context? For instance, does the approach invite input and feedback from women and men?
- Are generated data, analysis and reports sex-disaggregated, if possible?
- Are gender-related indicators established in the planning phase effectively used and assessed?
- Does monitoring consider both women's and men's roles (even if those roles are different)?
- Is progress toward any specific objectives related to men or women on track?
- Have any gender issues arisen that were not identified at the CBA project design stage? If so, how can they be addressed?

Project evaluation (and for Impact assessment and lessons learned):

- Did this project bring about adaptation and reduced vulnerability to climate change for men and/or women?
- Did this project address both women's and men's specific needs for adaptation? What mechanisms ensured this?
- Has appreciation of both women's and men's knowledge and expertise improved the results of the CBA project? If so, how?
- Have men's and women's perceptions (norms, stereotypes, values) been altered during the course of the project?
- To what extent have any objectives of promoting gender equality been met?
- Has the project had any unexpected or unintentional gendered effects?
- Which lessons and good practices related to mainstreaming gender in CBA projects can be scaled up and documented?

Textbox 1, Gender and climate change check list for Project Cycle analysis (UNDP)

76. In addition, the UNDP Bhutan Country Office has recently carried out an exercise to mainstream gender concerns and opportunities in selected UNDP managed projects under the Energy, Environment and Disaster Unit, and the proposed LDCF-financed project was also part of this portfolio exercise. The key entry points identified for the project are outlined below.

77. **In the area of capacity development for community-based disaster risk management:** Disaster mitigation work in Bhutan does involve women in local committees, which is appreciable. In addition,

experience in dealing with disaster in other countries in the region suggests the following good practices[20]:

- Target the informal sector: Home based workers and women in livelihood enhancement;
- Target highly vulnerable categories of women –widows, women living below poverty level and unemployed women;
- Ensure that equipment for rescue is in accordance with their physical strength and capability;
- Capitalize on women's local knowledge about vulnerable members of the village, neighborhood, and community and about coping strategies in past disasters;
- Safe shelter and housing: adequate lighting and provisions to protect security and privacy in shelter and housing;
- Restoration of pre-school and child-care centers, schools, and community education programmes targeting women and girls (in the aftermath of a disaster);
- Mobile first-aid and medical services.

78. **In the area of design and establishing water harvesting, storage and distribution systems:** The following intrinsic linkages between gender and water will need to be considered:

- Women are the primary collectors, transporters, users, and managers of domestic water and promoters of home and community-based sanitation activities;
- Securing water for families has a direct bearing on women's health and access to education and employment; fetching water takes time and effort. Time saving has potential on women's livelihoods;
- Women have a deep knowledge on water resource and coping strategies, but generally in many societies women's views are not systematically represented in decision-making bodies;
- Women can be instrumental in realization of potential of health benefits of water supply schemes.

[20] ICIMOD ECHO 2007. Gender matters. Lessons for disaster risk reduction: lessons from South Asia.

2.5 Project Objective, Outcomes, Outputs and Activities

2.5.1. Project Objective

79. The RGoB requests the LDCF to finance the additional costs of enhancing the resilience of economic development, human settlements and rural agricultural development to climate risks and climate induced disasters. The impacts of climate change will affect economic and transport infrastructure as well as human settlements through the increased risks associated with more frequent extreme weather events causing floods and landslides and increased water scarcity caused by more prolonged and severe droughts. In addition to concrete resilience measures in selected locations, LDCF resources will also be used to finance the expansion and strengthening of the national hydro-met network and the national capacity to prepare for and respond to local and national disasters, as well as to provide climate (risk) data for increased climate resilience of vulnerable sectors.

80. The project has been conceived with the objective to **"enhance national, local and community capacity to prepare for and respond to climate-induced multi-hazards to reduce potential losses of human lives, national economic infrastructure, livelihoods, and livelihood assets"**.

2.5.2. Project Outcome 1

Outcome 1: Risks from climate-induced floods and landslides reduced in Bhutan's economic and industrial hub Pasakha Industrial Area.

Co-financing amount for Outcome 1	
Construction of national highways	US$15,829,965
Expansion of Phuentsholing City	US$25,372,864
DGM TA support from Norway	US$4,000,000
Total co-financing	**US$45,202,829**

LDCF grant requested: US$ 4,634,800

Baseline:

81. In pursuit of equitable socio-economic development and balanced rural-urban development, the RGoB is investing in the development of a few industrial areas and major municipalities. The industrial areas are by and large concentrated in the southern belt of the country due to proximity to India and to avoid the rugged mountain terrain in the middle and northern parts of the country. The city of Phuentsholing and the adjacent Pasakha Industrial Area, in particular, are the single most important driving forces for Bhutan's economic development. Phuentsholing's importance is also manifested in the fact that it is one of the four designated "Class A" municipalities in Bhutan (the others being Thimphu, Gelephu and Samdrup Jongkhar) and thus has high autonomy with elected representatives as part of the country's decentralization process (Bhutan Municipal Act 1999). Investments in roads that connect industrial areas and municipalities continue to be one of the highest priority areas in the 11th FYP inherited from the 10th FYP.

82. Phuentsholing city sits on alluvial deposits covered by gravels and sand with large blocks of rocks occurring as terraces. The terrain is inherently fragile due to the relatively young geologic formation, which is characteristic along much of the Himalayan foothills in Bhutan and the northeast region of India. This fragility causes the development of tension cracks on the hill slopes. Rainfall is high, averaging 4,000 mm annually (see Annex 1). Three-fourth of the rainfall occurs in the monsoon, which advances into the country in June and retreats in September. During extreme rainfall events, water percolates into these cracks and causes landslides. Surrounded by rugged hill slopes, thick forests, and several rivers and rivulets, escape routes are limited and this makes the entire city extremely vulnerable in the event of landslides and floods.

83. At the same time, the southern belt of Bhutan and especially Phuentsholing area is the zone where many rivers converge before they drain to the plains of India. This zone contains a number of flood- and landslide-prone areas posing continuous challenges to protecting crucial economic/industrial/commercial infrastructure from the risk of hydro-meteorological hazards. The extended Phuentsholing urban area comprises an area of 19.68 km^2 and in an effort to alleviate the pressure from increasing population, the city is currently planning to expand the city boundary to areas that have higher risks of landslides (see Annex 4). The Phuentsholing Thromde and Department of Roads will, as per the 11^{th} Five Year Plan, invest about US$ 25,372,864 in urban infrastructure for city expansion, including roads and improved drainage. Part of this expenditure also includes budgets for slope stabilization and river protection measures in the larger Phuentsholing area, including the access routes to Pasakha. However, such risk mitigation expenditures are barely enough to remove imminent risk of existing landslides considering the already high-risk geological conditions of the area.

84. In some of the historical landslide-prone zones, more stabilization/protection measures are urgently required but such measures have not been feasible considering the high estimated cost and the technical know-how required. Among these highly unstable landslide and flood prone vulnerable areas in Phuentsholing are:

a. Rinchending area; this area is besieged by recurrent landslides triggered by intense rainfall, particularly when monsoon is at its peak. With each passing monsoon, the landslides are shifting inwards and increasingly threatening public and private properties, and immediate risk mitigation actions are deemed necessary. Key institutions, such as the College of Science and Technology (the country's oldest technical education institute), the Kharbandi Goempa (Buddhist monastery built in 1967) and the Medical Supply Depot, are located in this area. In addition, a private school and a few industrial enterprises have come up in the area in recent years. Most importantly, the take-off stretch of the 170-km Phuentsholing-Thimphu Highway (PTH) runs through this area. The PTH, built in the early 1960s and widened over the past 10 years to become a part of the Asian Highway, is the lifeline of the country's economy. It connects Thimphu and many places in the inner region of the country to India, which is Bhutan's principal trade partner and the only land transit route to other international markets. Furthermore, in the Rinchending area, the PTH is connected to the Pasakha road which provides motorable access to Pasakha Industrial Area, the country's largest industrial estate. The Department of Roads (DoR) in collaboration with Project DANTAK (Indian Government) will contribute over the project period an estimated US$ 9,491,666 for a new by-pass in the Thimphu-Phuentsholing Highway, at Damchu-Chukha, which will further strengthen and

safeguard access from Phuentsholing to Thimphu as well as the PIA through the Phuentsholing-Pasakha road;

Figure 6, Photograph showing the different stages of landslide in the NW of Rinchending Goenpa area over residential areas

b. The Pasakha Industrial Area (PIA); the PIA was hit by two major floods in the last two decades, each time resulting in considerable material damages and losses inflicting economic setbacks for the entire country. The monsoon season water level of Barsa and Singye rivers that flow in the area have been rapidly increasing in recent years. The Association of Bhutanese Industries (and individual enterprises) spends substantial amounts each year to alleviate the potential damages from monsoon floods. However, the ongoing risk mitigation measures are interim and piecemeal in nature. For example, the industries in Pasakha and the local government engage in dredging of river each year to remove silt transported from upstream areas during the monsoon season. The silt raises the riverbed and thus increases the risk of overflow of water during the monsoon. While the annual average amount invested in dredging amounts to nearly $500,000, it is sufficient only to remove the annual accumulation of risks, instead of being able to address the additional risks of floods. Private firms that are situated near the rivers also invest in more direct protection measures such as rock gabions and rudimentary manual systems of siren-based early warning. However, all of these measures do not take into consideration likely increase in peak discharge of monsoon river flows and thus these ongoing investments face a significant risk of failure as the impact of climate change becomes increasingly significant.

85. A risk perception survey administered during the PPG phase highlights a stark difference in the risk perception of Phuentsholing/Pasakha residents about floods and landslides, compared with the national average.

Comparison of National and Pasakha/Phuentsholing Flood Vulnerability/ Risk Perception

Vulnerability/ Risk Perception Level	National % (GNH Survey 2010)	Pasakha & Phuentsholing % (NAPA-II PPG survey)		
		General	On Lives	On Livelihoods
Major Concern	26.0	49.6	54.1	45.0
Some Concern	19.0	33.0	33.0	33.0
Minor Concern	14.0	17.4	12.9	22.0
No Concern	41.0	0.0	0.0	0.0

Comparison of National and Pasakha/Phuentsholing Landslide Vulnerability/ Risk Perception

Vulnerability/ Risk Perception Level	National % (GNH Survey 2010)	Pasakha & Phuentsholing % (NAPA-II PPG survey)		
		General	On Lives	On Livelihoods
Major Concern	29.0	50.9	53.2	48.6
Some Concern	23.0	35.3	34.0	36.7
Minor Concern	16.0	13.3	11.9	14.7
No Concern	32.0	0.5	0.9	0.0

86. In general, hazard assessments inform planners how and where hazard risks can be best avoided when large investments such as city expansion and roads are considered. However, existing hazard assessments, nationally and even within the Phuentsholing area, are limited in number and do not take into considerations additional risks imposed by climate change. At present little is known about the impact of a changing climate, especially rainfall and temperature patterns and events, on the stability of landslides and potentially unstable areas in the different zones in Bhutan. Changing rainfall patterns like prolonged periods of average rainfall and extreme rainfall events will have different impacts on soil humidity, soil saturation conditions and runoff water occurrence and will pose different risks in terms of e.g. erosion and slope failure.

87. The ongoing assistance programme by the Norwegian Agency for Development Cooperation (US$ 4,000,000 over the coming 4 years) and, in the past, technical assistance from the Government of Netherlands have contributed tremendously to strengthening the technical capacity of the Department of Geology and Mines to undertake robust geo-hazard assessments, most notably landslides. Despite recent improvement in the technical capacity of the DGM, however, systemic assessments in the country with regards to high risk landslide or flood areas have not been undertaken to date, let alone integrating future additional risks posed by climate change with a changing precipitation patterns and subsequent runoff water. In addition to the larger Phuentsholing area, the box-cutting area, between Surrey and Gelephu Tshachu-hot spring, along Gelephu-Zhemgang national highway, is another high risk landslide area, but economically important since it is the second principal transport route connecting the central-east region of the country to India. Like Phuentsholing, there has been no systemic mapping of this vulnerable area. Currently, the investment of RGoB (through DANTAK) of the construction of the Rafe-Khosala by-pass in the Zhemgang-Trongsa section of the national highway, amounting to US$ 5,982,833, is being planned, but without a proper risk assessment that takes into considerations future climate patterns, identification of adequate (re)alignment options and stabilization measures is seriously hampered.

88. The Flood Engineering and Management Division (FEMD) under Department of Engineering Services of the Ministry of Works and Human Settlement (MoWHS) has recently been established to lead

research on and design of protective measures for flash floods in the country. The FEMD is presently developing its capacity and methodology for flash flood research, monitoring and protective measures design.

89. In summary, the planned public investments of more than $40 million on key road infrastructures and expansion of Phuentsholing City, which are all located in the single most important economic hub for the country, are under a significant threat imposed by the changing rainfall and temperature patterns and subsequent changes in the stability of landslides and frequency/intensity of floods due to climate change.

Additionality:

90. LDCF resources will be used to reduce the imminent risk of flashfloods in Pasakha Industrial Area (Output 1.1) and landslides in Phuentsholing area (Output 1.2) by undertaking direct engineering measures. During the preparatory phase of the project, the FEMD has produced a preliminary assessment report of the Barsa watershed based on historic data, which has identified issues posing a critical threat to the PIA (Annex 3). The assessment identified preliminary mitigation measures including watershed management to reduce erosion and sediment flows and stabilization of two landslides which pose a risk of blocking the Barsa river, as well as river and flood plain protection works to protect the access road and industrial estate itself from flash floods. At the same time the FEMD has evaluated past protective measures to ensure lessons are drawn from successes and failures and a more structural approach is used in the design of sustainable protective measures (Annex 3). These lessons will also feed into the assessment and design work during the implementation stage, which will use different inputs to analyses such as rainfall runoff, peak discharge, river system analysis, and sediment transport, taking into considerations of more intense rainfall in short intervals under climate change. The detailed design of the measures, the prioritization of the works to be implemented under the project, as well as the implementation of protective measures will all be part of the project implementation phase. The technical design and construction works will be implemented jointly with the landslide stabilization works under output 1.2 (see below).

91. To mitigate climate-induced risks of landslides, Phuentsholing Thromde and the DGM have selected four critical landslide sites in Phuentsholing, including Rinchending, for which stabilization measures will be financed by LDCF resources. Annex 4 presents the site selection and assessment report produced by DGM during the preparatory phase. The detailed engineering design for stabilization of the landslides and flood protection in PIA measures requires high standards and therefore international expertise (combined with in-country expertise) will be sought. Considering the highly technical nature of the detailed design work, the development of the ToR and tender package for the detailed design consultancy, as well as the bid evaluation and award, will be supported by an international consultant recruited through UNDP. The draft ToR for the international consultant is provided in Annex 3.2 and includes also further technical supervision support to the project for the implementation of the detailed design consultancy and subsequent construction packages (which articulates the need to take into account future climate change – especially peak rainfall and associated runoff/discharge – and associated needs to integrate the necessary redundancies in the engineering design), as well as the preparation of a technical documentation of lessons and recommendations. The international consultant will be recruited at the start of the project, to ensure that the detailed design consultancy can commence as early as possible. The

detailed design consultancy will be implemented under authority of Phuentsholing Thromde, with support from the overall project management.

92. Furthermore DGM will, with support of the LDCF resources, also conduct risk-hazard mapping exercises in four other risk prone areas in Bhutan (output 1.3), which will ensure that the mapping methodology can be further improved and systemized for a nation-wide application in the future and threats to existing assets and human life can be adequately assessed. The methodology of assessments and data collection will be carried out in a way that is compatible with the ongoing assistance programmes to enhance the information management capacity within these departments while integrating climate risks in the assessments. DGM will use the process of risk-hazard mapping to develop indicators and thresholds for slope instability to be used nationally for planning purposes as well as for early warning systems. The expansion of the hydro-met network to a nationwide weather station network, supported under Outcome 3, provides the opportunity to link localized rainfall and temperature patterns to the stability of different geological conditions. Furthermore for already existing landslides and unstable areas, the data from weather stations will be linked to the (increased) risk of slope failure. For both purposes, it is required to develop thresholds for geological conditions linked to rainfall/temperature pattern data, so as to have more clarity on when risks increase up to a level that precautionary action is required.

93. The LDCF support to Phuentsholing Thromde and DGM will thus not only safeguard existing assets and future investments under Phuentsholing Thromde, but will also strengthen Bhutan's capacity to address other risk prone areas along the main Highways and near population centers. The LDCF resources will thus also ensure that the Phuentsholing-Thimphu Highway and the national road network as a whole will become more climate resilient and less vulnerable to landslides and closures.

Outputs and Indicative Activities under Outcome 1

<u>Output 1.1:</u> Pasakha Industrial Area protected from flooding events through watershed management activities, slope stabilization measures, river bank protection works, river training works and development of flood buffer zones.

94. The preliminary assessment conducted by FEMD (Annex 3) includes a hydrological model of the Barsa watershed, which poses the main climate change threat. Based on this general assessment a further detailed technical assessment will be implemented, including further data collection (including projected climate parameters such as rainfall), to design the detailed technical protective measures required the Barsa watershed and river bed, with the objective to strengthen the climate resilience of the access to and investments on the PIA. As mentioned, for this purpose a consulting team will be procured, for which the work will be combined with key activity 1 under output 1.2, landslide stabilization. The budgets for these consulting services are reflected under Output 1.2.

Key activities to achieve output 1.1.

1.1.1. Procure international consultant for the development of the tender package for the detailed design consulting services for PIA and landslide stabilization measures, as well as technical supervision of design and construction works [combined with key activity 1 under output 1.2];

1.1.2. Conduct a detailed technical assessment of Barsa watershed, including Barsa river modeling, to identify and prioritize protective measures to be implemented under the project. Develop detailed technical designs and tender package for construction of selected measures and implementation supervision arrangements [implemented by a consulting team combined with key activities 2 and 3 under output 1.2];
1.1.3. Conduct an environmental screening or impact assessment of the proposed works, including identification of potential adverse impacts, formulating necessary mitigation measures, and integrating them in the technical designs and plans;
1.1.4. Develop a watershed management plan for Barsa river focusing on upstream catchment management as well as downstream flood mitigation and construct selected protective measures through outsourcing to contractors, ensure quality monitoring and adjustment of works if and when required;
1.1.5. Document technical assessment and design approach of protective measures implemented, develop guideline and good practice document for nationwide application [included in the ToR of detailed design consultancy];
1.1.6. Provide capacity strengthening support to FEMD and Phuentsholing Municipality on technical assessment and design approach for flood protection measures, as well as on monitoring and maintenance of implemented measures [included in the ToR of detailed design consultancy].

<u>Output 1.2:</u> Climate-induced landslide risk in Phuentsholing Township reduced through slope stabilization measures in selected critical landslide areas.

95. Annex 4 presents the DGM report on the selection of most critical landslides in the Phuentsholing area, as well as proposed measures for stabilization. This site selection and -assessment report will be the basis for detailed design of landslide stabilization measures, to be taken up under the project implementation phase through a consulting contract. Considering the complexity of the factors causing slope instability of the existing landslides, as well as past unsuccessful attempts to stabilize these landslides, the consulting team (comprising also of an international geotech expert) to be procured for the technical design will also assess and validate the (technical and financial) feasibility of stabilization of the selected landslides. Building on the preliminary assessment results presented in Annex 4, the assessment that will be carried out during the project implementation will take into account the impact of more intensive rainfall episodes on existing landslide-prone slopes. Based on this assessment and validation a final decision will be made on which landslides to select (location and number) for detailed technical design and implementation under the project.

Key activities to achieve output 1.2.

1.2.1. Procure the international consultant for the development of the tender package for the detailed design consulting services for PIA and landslide stabilization measures, as well as technical supervision of design and construction works [combined with key activity 1 under output 1.1];
1.2.2. Conduct an assessment of the (technical and financial) feasibility of stabilization of the proposed four landslides (by integrating climate risks in the assessment) and develop a final proposal for decision-making by the Project Management on landslides to be selected for stabilization measures under the project. Develop detailed technical designs and tender package for construction of stabilization measures on selected landslides, including

implementation supervision arrangements [this activity will be implemented by a consulting team and will be combined with key activity 1 under output 1.1];

1.2.3. Conduct an environmental screening or impact assessment of the proposed works;

1.2.4. Construct selected stabilization measures through outsourcing to contractors, ensure quality monitoring and adjustment of works if and when required;

1.2.5. Document technical assessment and design approach of landslide stabilization measures (to be) implemented, develop guideline and good practice document for nationwide application [included in the ToR of detailed design consultancy];

1.2.6. Provide capacity strengthening support to DGM and Phuentsholing Municipality on technical assessment and design approach for flood protection measures, as well as on monitoring and maintenance of implemented measures [included in the ToR of detailed design consultancy].

<u>Output 1.3:</u> Integrated risk hazard assessment and mapping completed in four critical landslide- and flood-prone areas in Bhutan with data collection and presentation standards compatible with national database

96. DGM will conduct risk-hazard mapping exercises in four other risk prone areas in Bhutan, which will ensure that the mapping methodology can be further improved and systemized and threats to existing assets and human life can be adequately assessed. These areas are: Phuentsholing-Barsa watershed; Wamrong/ Moshi area in Trashigang dzongkhag; Lamsorong area on Samdrup Jongkhar-Trashigang highway; and Box-cutting area (between Surrey and Gelephu Tshachu) along Gelephu-Zhemgang highway. DGM will also set up research with landslide monitoring sites and will collaborate with DHMS to link hydro-met data from nearby weather stations (output 3.1) to its slope stability research in order to develop thresholds for specific rainfall events in specific geological en hydrological circumstances, which will feed into the early warning system of DHMS (outcome 3), as well as the disaster response protocols of DDM (output 2.4).

Key activities to achieve output 1.3.

1.3.1. Develop the technical specifications and methodology for integrated geo-hazard risk assessment and mapping in the form of a technical manual that can be used for reference and training. This is to be done bearing in mind that it establishes coherent and consistent technical approach and standards for carrying out the assessment and mapping;

1.3.2. Form technical team(s) for the assessment and mapping and train these teams in the application using the technical manual as the principal training resource;

1.3.3. Carry out integrated geo-hazard risk assessment and mapping of the selected critical areas (desk studies as well as field visits), and produce reports and maps to visualize risk hazards and to aid planning of risk mitigation measures in these areas with the intent to incorporate the risk mitigation priorities in the RGoB's next FYP;

1.3.4. Develop a research proposal, based on international good practice, for landslide monitoring and threshold development based on geological conditions and rainfall/temperature patterns. Select landslides in different geological zones, linked to hydro-met data from adjacent weather stations (DHMS). Identify equipment required for landslide monitoring and purchase adequate numbers for selected areas/landslides. Implement field research in selected areas/landslides and conduct regular monitoring. Compile and analyze data and over time determine thresholds

and reliability bandwidths for slope failure risk based on geological conditions and rainfall/temperature patterns;

1.3.5. Share findings and recommendation of landslide threshold research with DHMS, and integrate the thresholds developed into the National Weather and Flood Forecasting and Warning Center (NWFFWC) to enable early warnings based on localized rainfall patterns and events. Share findings and recommendations also with other relevant agencies and local governments so as to create an understanding of the need to balance increased risks with development opportunities and restrictions.

1.3.6. Conduct a national workshop to disseminate the findings and recommendations of the integrated risk hazard assessment of the selected critical areas and the landslide research with special sessions on capacity development of local governments for the use of the assessment reports and maps for development planning and disaster preparedness and response (especially those in which the respective assessment areas are located).

2.5.3. Project Outcome 2

Outcome 2: Community resilience to climate-induced risks strengthened in at least four Dzongkhags

Co-financing amount for Outcome 2

Mongar water sources expansion	US$1,500,000
Water resource inventory	US$340,000
JSP/Tarayana rural development	US$175,000
Tarayana 'livelihood programme'	US$671,000
Tarayana in-kind co-financing	US$156,000
DDM-CBDRM support	US$587,000
Total co-financing	**US$3,429,000**

LDCF grant requested: US$ 1,898,800

Baseline:

97. Over the years, Bhutan has made a marked improvement in the areas of providing access to water and sanitation. Today 90 per cent of the population has access to safe drinking water and 95 percent has access to improved sanitation, according to the Annual Health Bulletin 2013 issued by the Ministry of Health. However, these statistics fail to capture the multidimensional challenges related to water access. For example, access to water facilities does not necessarily mean secured availability of water all year round. Many communities, both in rural areas and urban centers, face water shortages particularly in the dry winter periods, while water quality often deteriorates during monsoon.

98. During the mid-term review of the 10th Five-Year Plan undertaken by the RGoB, almost every Dzongkhag highlighted the issue of water scarcity during the dry seasons and the need to tap into alternative sources such as groundwater or rainwater in recent years. The simulation undertaken in the SNC process indicates that ensuring continuous availability of freshwater will be even more challenging

in the future under climate change: 11 out of 20 Dzongkhags are projected to experience declining dry season rainfall in the next 40 years.

99. Mongar is one of the areas that most acutely experience the impact of water shortages. It is the second largest town in eastern Bhutan and is being promoted as a regional hub for the eastern region in keeping with RGoB's policy of regionally balanced development. Consequently, the population is rapidly increasing. As the municipality's population expanded significantly from 1,012 residents in 1993 to 6,000 in 2008, water distribution system has seen ad hoc additions to existing network leading to high leakages and suboptimal distribution network in general. Presently, during the dry season, the water production of the town already falls short by 88,000 liters daily[21], which is being met simply through reduced use of water or through other ad hoc means. The baseline assessment undertaken during the PPG phase identified that water loss in the distribution can be as high as 60% (Annex 6). While UN-HABITAT has recently assisted the town in installing a rainwater storage system in community buildings with a total storage capacity of $150m^3$ (150,000 liters), this represents only 1% of the additional capacity the town needs to ensure continued supply of safe drinking water to all of its residents. At present, the water supply to Mongar town is provided from two sources i.e. from Yakpugang and Yagang. However, these water sources are reportedly starting to dry up yearly by 0.2 liters per second[22]. To address increasing water shortages and gradual drying up of existing water sources for Mongar town, the RGoB has earmarked US$ 1.5 million during the 11th FYP for Mongar municipality to invest in expansion of its water supply network by accessing more water sources. However, if the municipality continues to rely on an inefficient patchwork water distribution system, with high water leakage, it is likely that the planned investment on identifying and linking to new water sources will be significantly undermined.

100. The challenge of water access, and future shortages, also has a profound bearing on the quality of lives and viability of livelihoods in rural areas. With topographic constraints in accessing perennial rivers, only about 18% of the cultivated area is estimated to be irrigated[23]. Moreover, with the possibility of expanding arable areas physically impossible, the country needs to increase the unit productivity in agriculture if it is to achieve the key targets envisioned in its 11th Five-Year Plan – an annual GDP growth of 9-10%, self-sufficiency in food by 75%, and reduction in income poverty rate to 5%. Promotion of on-farm water management in rural areas is explicitly mentioned as an important intervention in the 11th FYP. Despite government's continuous effort to increase the unit productivity of agriculture, the actual performance in recent years has shown gradual decline, and it is shown that crop failure through erratic monsoonal rain is partially responsible.

101. A compounding factor of declining performance of agricultural productivity is extreme weather events – landslides, floods, wind-/hail-storms and forest fires – that lead to loss of crops, arable lands and livelihood assets. As discussed in earlier sections, the occurrence of extreme events (like the Phuentsholing/Pasakha flashfloods in 2000 and Cyclone Aila in 2009) shows a severe and increasing trend of damages to rural livelihoods. Forest fires pose a high risk particularly during prolonged dry spells during winters and soaring temperatures in the spring (April-May). The Department of Forests and Park Services estimates that wild fires have severely damaged more than 70,700 hectares (ha) of forests or

[21] NAPA: Update of Projects and Profiles, 2012.

[22] Personal communication with Mongar Municipal Authority as cited in PPG-TA Study Report

[23] FAO Aquastat; Accessed from http://www.fao.org/nr/water/aquastat/data/factsheets/aquastat_fact_sheet_btn_en.pdf

approximately 1.8% of total landmass, since 2000 at the rate of close to 5,900 ha each year. Dzongkhags such as Wangduephodrang, Mongar, Lhuentse, Trashigang, Thimphu and Paro, where resinous pine forests are predominant, have shown higher occurrence of forest fires. Table below presents the total areas of forests lost due to forest fires between 2000/01 to 2011/12.

Most forest fire prone dzongkhags by area burnt		**Most forest fire prone dzongkhags by number of incidents**	
Dzongkhag	**Forest Area burnt (acre)**	**Dzongkhag**	**No. of forest fire incidents**
Wangduephodrang*	58,429	Thimphu	116
Mongar	23,636	Trashigang	73
Trashigang	21,795	Mongar	70
Lhuentse	17,438	Wangduephodrang	68
Trashi Yangtse	12,598	Lhuentse	58
Thimphu	11,752	Trashi Yangtse	43

Source: Forest Fire Management Program, DoFPS, December 2012

Forest fires in Bhutan are, by and large, human-induced. The causes include burning of agricultural debris, land clearing activities for farming, activities directed towards inducing fresh flush of grasses for livestock grazing, extraction of non-wood forest products, industrial development, human negligence, and, in a few cases, arson. Climatic factors such as rising temperature, prolonged dry periods, and strong winds exacerbate the risks of forest fire.

102. RGoB's ongoing efforts in addressing these two interlinked issues of slow and sudden onsets of disasters can be observed in several areas. First, the Water Resources Coordination Division in the NECS is currently undertaking a national water resources inventory, with technical assistance and financial support from ADB and Bhutan Trust Fund – totaling US$ 340,000 – with a specific objective to enhance the national and local knowledge on the country's water resources and to strengthen water-related planning capacity in the future. This includes an assessment of the overall water demand by households and agriculture, challenges in water access, availability of water resources, and generic trends of climate change impacts on water availability. While this inventory will generate important data on water availability in the country, however, it produces only a "snap shot" of current status of water resources and does not involve analysis of future water availability under climate change scenarios and seasonal variations. Moreover, the emphasis of the ongoing inventory is to establish the baseline information for the first time in the country, rather than building dzongkhag administrations capacity to replicate/repeat the inventory in the future, which limits the ability of the national and sub-national government to monitor and analyze dynamic changes with external stimulus such as climate change, land-use change, population increase, etc.

103. Second, the RGoB is bolstering Disaster Risk Management capacities at both national and local levels through the recently adopted Disaster Management Act (developed through the support of the first LDCF-financed project), as well as through a capacity development programme aiming to strengthen disaster risk management capacity of local institutions and adaptive capacity of local communities to increasing disaster events, most notably climate-induced hazards. The DM Act stipulates that each Dzongkhag would be required to establish a Dzongkhag Disaster Management Committee (DDMC) as the responsible entity for prevention, mitigation, preparedness, response and capacity building for various

disasters within the Dzongkhag. It also mandates each Dzongkhag to establish a Disaster Management and Contingency Plan based on various hazard assessments and a Critical Disaster Management Facility for expeditious and effective response to disaster events. This marks a significant departure in the way Bhutan addresses risks of natural disasters: From a reactive approach that is early response- and centrally-driven to a more anticipatory approach that is risk management/reduction-driven in which sub-national/local administrations play an increasing role. To kick-start the capacity development process at the Dzongkhag level, DDM introduced the concept of Community-Based Disaster Risk Management (CBDRM) which was piloted in four dzongkhags of Punakha, Wangdue Phodrang, Gasa, and Bumthang with financial support from the first LDCF project. This includes the formation of Dzongkhag Disaster Management Awareness and Planning Team (DDMAPT) and of Dzongkhag- and Gewog-level Disaster Management Committees.

104. To expand the CBDRM capacity building efforts based on the standardized approach established by the GLOF project, the RGoB has mobilized resources from different donors and domestic sources covering the various dzongkhags as follows:

- First LDCF project (GLOF) – Gaza, Punakha, Wangdi, Bumthang
- Joint Support Programme – Sarpang and Tsirang
- UNDP/BRAP climate risk fund project - Zhemgang
- Mangdechu Hydropower Project Authority – Trongsa
- ADB Project through Education Ministry – Mongar
- Earthquake Risk Reduction Project – Samdrup Jongkhar and Thimphu
- Bhutan Recovery and Reconstruction Project – Lhuentse, Trashigang, and Trashi Yangtse
- RGoB – Haa and Paro

105. DDM has sequenced and coordinated with these initiatives and so far built CBDRM capacity in 16 out of 20 dzongkhags. Complementary to these initiatives, the World Bank, through the Global Facility for Disaster Reduction and Recovery (GFDRR), is currently strengthening the national-level capacity within DDM to coordinate the cross-sectoral team for effective implementation of the DM Act. As noted above, a growing emphasis on disaster risk management (as opposed to post-disaster response) and an increasing responsibility for sub-national administrations in this regard will, in principle, ensure more effective coordination during and enhanced preparedness for extreme events, whether or not they are climate induced. At the same time, however, improved understanding about climate information, risks and hazards (such as a threshold rainfall value beyond which a landslide risk in a particular locality needs to be communicated with community members) needs to be continuously feed into the DDMC or Gewog DMC arrangements and respective contingency plans. Currently, the existing arrangements and contingency plans established through the initiatives above are based on the *observed* disaster trends in the country rather than on localized future trends. This is largely due to the unavailability of localized climate information as described in the barrier section.

106. To respond to the risks from forest fires, the Department of Forests and Park Services (DoFPS) has instituted a separate Forest Fire Management Programme (FFMP) to deal with the issue of forest fires and has amongst others mobilized a pilot volunteer system for forest fire prevention and suppression. The Program has so far mobilized a volunteer system for forest fire management on a pilot basis in Thimphu dzongkhag, with a total registration of 622 volunteers, or village level forest fire management groups

(VLFFMG), as of June 2013. It also engages in forest fire awareness campaigns and training programs every year but has not been able to undertake them in a comprehensive and systematic manner due to fund and institutional constraints. As the risk management for forest fires is quite distinct from other types of disasters and require technical understanding of forest ecosystems and forest fire ecology, the trainings are currently provided by DoFPS, not by DDM. However, the general coordination between DoFPS and DDM at the sub-national and local level, where there is a common public services delivery system, is expected to improve during the implementation of the DM Act as DDMCs will be responsible for coordinating all types of natural disasters including forest fires, floods, landslides, strong winds, cyclones and earthquakes. The FFMP is currently undertaking training and awareness programmes targeting local communities and field forestry staff, and has community-based forest fire management initiatives (e.g. prescribed burning trials) in a few pilot sites in the eastern part of the country, where forest fire occurrence is highest. These are not yet systematically planned and designed and the FFMP does not have adequate personnel and funds for providing covering the entire country.

107. To strengthen community's resilience to such climate hazards and disasters, the CSO sector is also gradually expanding their community-led services in complementarity to the traditional Government-led development approach. At present the Tarayana Foundation is the only civil society organization working from a holistic livelihoods perspective on poverty alleviation and micro-scale physical infrastructure development in rural areas such as community-level rainwater harvesting. Tarayana has mobilized resources (for example from JSP - $175,000; Helvetas - $356,000; and ADB - $315,000) to implement its signature 'Livelihood Programme' which aims at improving the livelihoods of rural communities by empowering small and remote communities to engage in income generating activities; product development and marketing; and by providing basic services to selected vulnerable households, which includes access to water and sanitation facilities and decent shelter. Their primary entry point in building community capacity is through a formation of self-help groups. While their development support contributes to establishing an important building block for rural advancement through solidarity building, awareness raising, and capacity building, community resilience to climate change impacts (especially water scarcity) has not been sufficiently incorporated in their operations.

Additionality:

108. Building on recent legislative development in disaster risk management, in which sub-national/ local administrations (Dzongkhags and Gewogs) are envisaged to play a greater role in DRM and DRR, the LDCF funds will be used to enhance community resilience to climate risks posed by both slow and sudden onset of natural disasters. In particular, improving resilience to varying water availability will be the primary focus within the context of slow onset of disasters while a range of extreme/sudden climate risks, such as floods, landslides, forest fires, windstorms, will be covered in the context of building the capacity of local communities and supporting government institutions for preparedness for and response to sudden onset of disasters.

Building community resilience to future variability in water availability

109. To build resilience of communities to emerging impacts of climate change in terms of increasing variability in water availability, LDCF resources will be used to increase water harvesting/storage capacity, improve water system design, and strengthen water use efficiency. This will be achieved in at

least four Dzongkhags, both in urban and rural settings, where current and future impact of climate change on water availability is considered greatest.

110. Mongar Municipality has been selected as the urban center where LDCF interventions will take place given the ongoing water scarcity and climate change projections that make it one of the most vulnerable municipalities in terms of access to water sources. The Department of Engineering Services under the MoWHS conducted, during the project preparation phase, a study on Mongar's water demand, water source availability and projected climate change impacts. Based on these assessments a seasonal water scarcity balance was produced with projections for years to come, up to 2053. From these projections it was verified that for substantial and increasing periods in a year Mongar will face severe water shortages.

111. RGoB's planned investment of US$1.5 million for tapping into new water sources for Mongar Municipality under the 11th FYP is considered the baseline activity for this component, and LDCF resources will be used to ensure that expanded volume of freshwater is delivered to the residents of Mongar efficiently under increased variability in precipitation in the future. As described in the baseline section above, the ongoing water shortage challenge in Mongar is caused by rapidly increasing population and the water distribution system that was not originally designed with a view to 'branch out' from the core system to accommodate to an increasing population. To deal with an increasing likelihood of water shortages under climate change with some uncertainty factor especially expected population growth in the future, LDCF resources will be used to strengthen the existing core water catchment/retention/distribution system with 50 year water demand/supply projections while additional system elements, such as supply extension to access additional sources, larger water storage facilities, and new harvesting technologies, are designed, put in place, and linked to the existing core system when needed (due to exacerbating climate change impacts or population growth). The upgraded system is to be designed as a backbone system that provides the flexibility to take in, store and distribute additional water tapped in from the planned new source as well as additional sources in the future to meet water demands projected up to 2053.This way of designing urban water supply systems, which are up-scalable in response to dynamic environmental and social circumstances, is new to Bhutan. If successfully implemented this design approach can be up-scaled to other Municipalities with existing or anticipated water issues. LDCF contribution of US$460,000 will be used to strengthen the core system and some supply extension (to meet the existing water demand) while the RGoB investment of US$1.5 million will be used to tap into new sources and connected with the improved core system. The executive summary of the PPG-technical study report for Mongar water supply system is provided in Annex 6 and the full report can be accessed from UNDP or MoWHS.

112. In rural settings, to address the urgent community needs for increased resilience to water scarcity, holistic community approaches will be developed to strengthen water harvesting, retention and storage capacity as well as increasing water use efficiency through awareness raising. Considering the limitations of public structures in stimulating and facilitating community development and empowerment processes, this subcomponent will leverage the baseline development project of 'livelihood programme' carried out by the Tarayana Foundation, one of the few CSOs working in local development at the community level in Bhutan. LDCF resources will finance measures to improve water harvesting, retention and storage, and will be delivered through Tarayana's ongoing 'livelihood programme' (valued at US$ 827,000 plus US$

175,000 from JSP's financial support) that is operational in Mongar, Samtse and Pema Gatshel dzongkhags[24]. The LDCF resources will therefore not only contribute to building/strengthening rural water infrastructures for dealing with local water stress and scarcity, they will also highlight and clarify the importance and complementarity of CSOs in local development work in Bhutan and address the issue of climate change-induced water scarcity within the overall context of sustainable livelihoods and poverty reduction. Rural water harvesting will be approached through active engagement of local communities by mobilizing and training local self-help groups to install, utilize and maintain the water harvesting systems. The capacity of Tarayana Foundation and dzongkhag administrations will also be built so as to equip them with the knowledge and skills to train and technically backstop the local self-help groups. The installed water harvesting systems will be monitored, their comparative advantages and disadvantages analyzed, and best practices and lessons learnt documented to inform future up-scaling. Given that rural women have the primary responsibility for water collection and water-dependent household chores of cooking and caring of children, water harvesting interventions will integrate women-friendly approaches and methods. From year 2 to 4 of the project implementation, when monitoring and testing of the technical rainwater harvesting options are carried out (Activity 2.1.10), the information from community-level water resource inventory (Output 2.2), which take into considerations the impacts of future climate change projection on water availability, will also feed into the community dialogue so that climate risks that are pressuring freshwater risks are sufficiently conveyed to community members. The proposal from Tarayana for this output is presented in Annex 7.

Water resource inventory

113. The work on building community resilience to future water resource availability, both in urban and rural settings, will be supplemented by a detailed water resource inventory and climate modeling of water availability in four selected dzongkhags. To ensure full alignment with the adaptation investments in resilient water infrastructures, the 'climate smart inventory' will be carried out in the same four dzongkhags (See Table 1 in Section 1.3). Building on the baseline water inventory financed by ADB and Bhutan Trust Fund (US$340,000), this inventory and climate modeling will be conducted by NECS under Output 2.2 in collaboration with Dzongkhag staff and members of the multi-sector technical group that has been formed for the national water resources inventory. The focus of the inventory and modeling is multifaceted: First, capacity of the group will be strengthened by carrying out additional inventory of community-level water resources in four selected dzongkhags, which are currently not covered by the national level inventory in the baseline project. Second, the resultant information from the community-level inventory will be supplemented by hydrological and surface water analysis of the river and GIS mapping of the community-level water resources. These maps will be the basis of discussions with local communities for identifying and understanding the risks of climate change and possible adaptation measures (e.g. Payment for Environmental Services, community-based water harvesting). Thirdly, climate risks and resilience measures can subsequently be reflected in local development plans and the Community Disaster Management Plan of respective Gewogs and villages. Furthermore, based on the information derived from community-level water resources inventory and climate-modeling of water availability and further field assessment, a watershed management strategy and plan will be developed to ensure that the water sources are sustained with sound conservation and land use practices.

[24] In addition to these three dzongkhags where the baseline project is operational, LDCF resources will also be invested in Tsirang dzongkhag.

114. Through LDCF project funds, international TA will be engaged for development of technical standards and methodologies for GIS analysis, mapping and climate-modeling of water resources, and training of a core group of Bhutanese in these technical areas so that this trained group is equipped with the knowledge and skills to train and technically backstop the dzongkhag staff. Enhanced climate information generated through Outcome 3 will feed into continuous updates of water resource inventory that will be carried out by these staff. The GIS analysis reports and maps, climate modeling reports, etc. will create essential knowledge base on water resources and enhance water resources planning capacity. The proposal from NECS for this output is presented in Annex 8.

Local climate-induced disaster management

115. This component of the project will expand the DDM's CBDRM capacity building efforts that have been financed by domestic funds and various donors to date. So far, DDM has been able to mobilize funds to establish DDMC in 16 out of 20 dzongkhags. Through LDCF financial support, DDM will carry out CBDRM trainings in the remaining four dzongkhags. Through this, all dzongkhags in Bhutan will have fulfilled the mandate set in the DM Act, as far as the DRM arrangement is concerned. In addition, the same capacity building support, including the establishment of Gewog DMC, will be brought down to lower administrative level of Gewogs in one of these four Dzongkhags. Currently, as per the DM Act, establishment of Gewog-level DMCs is encouraged but not mandated. However, in the future, as climate change impacts become increasingly more visible, enhancing the CBDRM capacity at the lower administrations will be critical as they represent the front line of supporting community resilience building.

116. In principle, the CBDRM capacity building at both dzongkhag and gewog levels will follow the established methodologies to ensure consistency across all geographical regions. This will involve establishment and strengthening of Dzongkhag Disaster Management Committees and Thromde/ Gewog Disaster Management Sub-Committees, and training of dzongkhag/ gewog elected functionaries and government staff. A range of activities are envisaged under this Output such as assistance to formulating Dzongkhag Disaster Management and Contingency Plans, training of community members on search and rescue, establishing communication protocol and critical disaster management facilities, establishing and training forest fire volunteers and village level forest fire management groups (VLFFMG), and carrying out mock drills with particular focus on clarifying roles and responsibilities of DRM institutions and community members at the time of (a) receipt of warning; (b) evacuation; and (c) de-warning. Based on strong evidence from other parts of the world, women are more likely than men to fall victim of natural disasters while they also play a significant role especially in disseminating information within the community. Therefore, women's participation in the capacity building and awareness raising activities and mock drills will be encouraged (and gender disaggregated progress reported) while women's specific role will also be identified and communicated during this process. Project activities will be designed by building on and improving the pilot-level support that is currently being provided by the GLOF project, and by coordinating closely with other UNDP and World Bank assistance that is currently being designed. Furthermore DDM will conduct two mock-drills in each of the four focus districts (one in year 3 and one in Year 4) to strengthen and evaluate existing and required capacities and to learn lessons for further improvement of the awareness and training package. All these activities combined will ultimately lead to increased adaptive capacity of local communities to various localized climate-induced hazards ranging from droughts, flashfloods, landslides, forest fires, windstorms, disease, etc. Considering this

diversity DDM will clearly need to coordinate extensively with different sector Ministries during implementation, also beyond the formal institutional mechanisms. The proposal from DDM for this output is presented in Annex 9.

117. Considering the large negative impact of forest fires and the high risk of occurrence in Bhutan, the LDCF resources will also specifically address forest fire management through support to FFMP of DoFPS. Given the distinct risks of forest fires, exacerbated by climate change, from other natural disasters, the target dzongkhags under this subcomponent are different from those four dzongkhags described above. To be specific, the following dzongkhags have been selected based on the historic occurrence of forest fires (see table above): Wangduephodrang; Mongar; Trashigang; and Thimphu. Project support will include formulation of dzongkhag/gewog forest fire management plans, formation and training of VLFFMGs, and capacity development of DoFPS in terms of capacity for forest fire management training, advocacy and awareness-raising, research, and watch and alert system. As described in the baseline section above, due to the technical nature of forest fire management, the technical support will originate from the DoFPS, not DDM, to the village level forest fire management groups (VLFFMG). However, at the sub-national level, all activities on both CBDRM and forest fire management are coordinated by the DDMC and Gewog DMC.

118. It is important to note that, apart from expanding the ongoing CBDRM and forest fire management capacity building initiatives promoted by DDM and DoFPS, respectively, LDCF's additional contributions in addressing the additional risks of climate change are the following: In the course of the CBDRM and FFMP capacity building process during the project implementation, enhanced understanding about climate risks and hazards will influence the design of the Contingency Plan. More specifically, through Output 3.1 and 3.2, DHMS/ the National Weather and Flood Forecasting and Warning Center will enhance its ability to monitor and analyze localized, real-time weather parameters and strengthen the disaster warning communication protocol. Also through Output 1.3, DGM will carry out risk hazard assessments and establish rainfall thresholds for issuing warning about geo-hazard or flood risks, which will feed into the communication protocols of NWFFWC. These Outputs will jointly enable the dissemination of climate risks to DDMCs and Gewog DMCs faster and more accurately. However, the current CBDRM support in establishing a Contingency Plan does not reflect the enhanced climate data monitoring and dissemination capacity at the central level. Thus, LDCF resources will be used to refine/update Contingency Plans and DMC arrangements in the four dzongkhags targeted under this project, as well as the dzongkhags that are being or have been supported by the following baseline development projects: UNDP/RBAP climate risk fund project (US$100,000) and UNDP-supported Joint Support Programme (US$87,000). Moreover, experience from integrating the real-time weather monitoring and risk hazard assessments into Contingency Plans and DMC arrangements will be shared with the WB/GFDRR, that is currently supporting DDM at the national level ($400,000), so that the process of strengthening the CBDRM will be later replicated in all other dzongkhags.

Outputs and Indicative Activities under Outcome 2

<u>Output 2.1:</u> Climate-resilient water harvesting, storage and distribution systems designed, built and rehabilitated in at least four dzongkhags, including one municipality.

119. Based on the comprehensive technical study conducted on projected climate change impacts and water source availability, the LDCF resources will be utilized to make the core municipal water supply system climate resilient and up-scalable to ensure that the baseline RGoB investment in accessing an additional source of water (from Reyond) is delivered and managed effectively under prolonged dry spells. This allows for efficient investment in system expansion, based on climate resilience measures as well as monitoring of actual climate trends. This technical work on expanding the Mongar water supply system and making it more climate-resilient and up-scalable will be supplemented by capacity development support and a watershed management plan for the Yakpugang water catchment area.

Key activities to achieve output 2.1.

2.1.1. Prepare detailed technical design and tendering package for upgrading of Mongar municipality's core water supply system to tap in new water source and with the flexibility of tapping in additional water sources in the future to meet the needs of strengthened climate resilience;

2.1.2. Upgrade Mongar municipality's core water supply system based on the approved technical design, ensuring adherence to specified standards, including mitigation of potential environmental and social impacts;

2.1.3. Develop technical guideline for effective management and use of the upgraded water supply system, and provide capacity development support to Mongar Municipality on effective management and use of the system;

2.1.4. Develop a watershed management plan for Yakpugang water catchment area, outlining a comprehensive set of conservation and land use practices to ensure sustainability of water resources, based on the detailed water resource inventory of the catchment area conducted by NECS under output 2.3 and additional field assessment.

120. For water harvesting, storage and distribution systems in rural areas, the following indicative activities are planned:

2.1.5. Conduct analysis of water availability, use and demand at the community level in the targeted project sites as well as projected climate change impacts on water sources in these areas based on the information generated by national water resources inventory and further field studies in the target communities;

2.1.6. Examine the most viable options for water harvesting, and design technical models best suited to the target areas. Potential options include: household-based rooftop water harvesting with tank or cistern storage; community-based rooftop water harvesting with community tank or cistern storage; integrated rooftop-home yard water harvesting; micro-catchment water harvesting integrating soil and water conservation methods such as vegetative strips and contour bunds;

2.1.7. Mobilize local communities and form local self-help groups for the installation and management of the selected water harvesting, storage and distribution systems;

2.1.8. Train Tarayana and dzongkhag (district) staff so that they can in turn train and technically backstop local self-help groups in the installation, operation and maintenance of the selected water harvesting, storage and distribution systems in the targeted rural areas;

2.1.9. Procure equipment and materials, and install the selected water harvesting, storage and distribution systems in a phased manner in the selected project areas, supported with training of the local self-help groups in the installation, utilization and maintenance of the systems;

2.1.10. Monitor and test the installed technical options/ models, documenting comparative advantages and disadvantages, lessons learnt and best practices, and leading to recommendations for improvements for future scale-up in other rural areas.

<u>Output 2.2:</u> Community-level water resources inventory completed and maintained by Dzongkhag Administrations.

121. The Water Resources Coordination Division, NECS, is leading and coordinating a multi-sector taskforce to carry out the national water resources inventory. The inventory is scheduled to complete in June 2014. This project will build on the national water resource inventory, focusing on the GIS interpretation and mapping of the national water resources inventory data, downscaling of the inventory and mapping to dzongkhag level in four selected dzongkhags, and climate modeling of water availability projections under different potential climate scenarios in these dzongkhags.

Key activities to achieve output 2.2.

2.2.1. GIS analysis and mapping of water resources based on the data secured from the national water resources inventory, leading to production of National Water Resources Inventory Report and maps. This will involve international TA for technical specification of GIS interpretation and mapping of the water resources inventory data and training of staff from relevant central government agencies;

2.2.2. The national water resources inventory will be down-scaled to community level in 4 dzongkhags for detailed inventory and GIS mapping of community level water resources. The detailed inventory at the dzongkhag level would additionally involve measurement of seasonal water flows and quality of the major community-level water resources. This will lead to development of detailed community-level water resources plans and maps in the selected dzongkhags. The central government staff trained in GIS interpretation and mapping of water resources will train the dzongkhag staff in the selected dzongkhags;

2.2.3. Climate modeling of water availability projections under different potential climate scenarios will be carried out in the above 4 dzongkhags, overlaying water resources inventory data sets with climate data sets (acquired from output 3.1). This activity will require international TA to assist WRCD/NECS in the formulation of the technical specification for the GIS-based climate modeling and for training of a group of staff from relevant central agencies to create in-house knowledge and skills for the modeling. Subsequently, this group of trained staff will train the dzongkhag staff to carry out the climate-modeling;

2.2.4. A national seminar will be convened to disseminate and discuss the results and products of the national and dzongkhag-level water resources inventories and GIS-modeling of water availability under different potential climate scenarios in the project-targeted dzongkhags.

<u>Output 2.3:</u> Disaster management institutions at various levels established and trained in four dzongkhags for better preparedness, and response to, climate-induced disasters

122. Based on the DM Act, the project will support the establishment and strengthening of the disaster management institutions and development of the instruments up to dzongkhag level in four dzongkhags, viz. Dagana, Pema Gatshel, Samtse, and Chhukha dzongkhags. Furthermore, the same CBDRM approach will be applied down to thromde/gewog level in Chhukha dzongkhag. For forest fire management, LDCF resources will be used to strengthen forest fire management at local levels in keeping with the National Forest Fire Management Strategy which emphasizes on the preventive aspect of forest fire management through environmental education, awareness-raising, and engagement with the public and local communities. Enhanced understanding about climate risks and disaster warning capacity (through Output 1.3, 3.1 and 3.2) will be fully reflected in the CBDRM and forest fire management capacity building process in the four target dzongkhags as well as two other dzongkhags (financed through the baseline development projects of UNDP/JSP and UNDP/RBAP), which will significantly increase the adaptive value of the baseline projects. The experience and lessons from this process will be shared at the national level so that DDM will be able to continue to strengthen the CBDRM approach in the other dzongkhags.

Key activities to achieve output 2.3.

2.3.1 Capacity development of DDM in relation to its role and functions for establishment and strengthening of disaster management institutions at local levels. This will include:
- Training and facilitation capacity for community-based disaster risk management;
- Awareness and advocacy materials;
- Research and information on disasters and disaster risks including forest fires;
- Supporting instruments (guidelines, standard operating procedures, etc) for the implementation of Disaster Management Act.

2.3.2 Capacity development of FFMP in terms of:
- Training and facilitation capacity for community-based forest fire management
- Development of awareness and advocacy materials
- Research and information development on the impact of climate risks on forest fires
- Improving Watch and Alert system
- Review and update of National Forest Fire Management Strategy taking into account the experiences and lessons learnt from the project and other related initiatives.

2.3.3 Research on wind- and rain-storm hazards and their impacts on housing structures to come up with specific recommendations for integrating wind- and rain-storm resilience in overall construction design, standards, practices and training programs. This will be followed by integration of wind- and rain-storm resilience in overall construction design, standards, practices and training programs, and support to such integrated training programs;

2.3.4 Establishment of communication protocol and Critical Disaster Management Facility in 4 dzongkhags (Chhukha, Samtse, Dagana and P'Gatshel) and 1 Thromde (Phuentsholing);

2.3.5 Sensitization and training workshops for DDMCs of the aforesaid 4 dzongkhags on: (a) institutional, policy and legal frameworks, and coordination mechanisms for DRM; and (b) planning process and guidelines for formulation of Dzongkhag Disaster Management and Contingency Plan (this will invite representatives from DDMCs from the dzongkhags that are supported by the baseline projects);

2.3.6 Establishment of Thromde Disaster Management Sub-Committee in Phuentsholing, and Gewog Disaster Management Sub-Committees in 2-3 selected gewogs in Chhukha dzongkhag, and sensitization and training workshops for the these Sub-Committees on: (a) institutional,

policy and legal frameworks, and coordination mechanisms for DRM; and (b) planning process and guidelines for formulation of Dzongkhag Disaster Management and Contingency Plan;

2.3.7 Formulation of: (a) Dzongkhag Disaster Management and Contingency Plans in Chhukha, Dagana, Pema Gathshel, and Samtse dzongkhags; and (b) Phuentsholing Thromde Disaster Management and Contingency Plan and Gewog Disaster Management and Contingency Plans in 2-3 selected gewogs in Chhukha dzongkhag (this will invite representatives from DDMCs from the dzongkhags that are supported by the baseline projects); (c) Integration of institutional provision to reflect real-time climate information from DHMS

2.3.8 Training of first responders and Search and Rescue Teams in the targeted 4 dzongkhags and Phuentsholing Thromde (as part of the Critical Disaster Management Facility);

2.3.9 Development of Dzongkhag and Gewog Forest Fire Management Plans and institution of VLFFMGs in four most forest fire prone dzongkhags. This will include:

- Planning process, guidelines and training materials for the above
- Training on the above for LG functionaries and forestry staff
- Formulation of Dzongkhag and Gewog Forest Fire Management Plans reflecting the additional real-time climate information from DHMS
- Establishment of VLFFMGs in 4-6 pilot villages in each of the 4 dzongkhags
- Training of VLFFMGs and provision of basic firefighting equipment and safety gears to them.

2.3.10 Establishment of Forest Fire Volunteer Programs in two additional dzongkhags for voluntary public sensitization/ awareness creation, forest fire suppression, and post fire rehabilitation activities.

2.3.11 Lessons/experience sharing on improving the new/existing CBDRM at the national level.

2.5.4. Project Outcome 3

Outcome 3: Relevant information about climate-related risks and threats shared across climate-sensitive sectors on a timely and reliable basis.

Co-financing amount for Outcome 3

Finnish TA on GLOF and weather forecast	US$708,000
DHMS Departmental Budget (2014-2017)	US$5,200,000
Total co-financing	**US$5,908,000**

LDCF grant requested: US$ 4,410,400

Baseline:

Hydro-met network, weather forecasting and early warning

123. Due to the mountainous terrain in Bhutan, climate varies largely from the high mountain peaks towards the southern belt of Bhutan bordering the Indian flood plains. Furthermore, because of the different exposures of valleys and gorges to sun and climatic activity, local climate tends to vary dramatically over short distances (micro-climates). The existing hydro-meteorological network managed by DHMS is presently only a broad network, mostly developed for hydro-power project assessments and

management and is far from accommodating the variable of local climate over the country. With climate change increasingly impacting the predictability and patterns of rainfall, the availability of more accurate and localized climate data becomes increasingly important for Bhutan's rural population, agricultural production and disaster preparedness and response. The existing hydro-met network consists of 26 river gauging stations, 90 meteorological stations and 15 flood warning stations[25], many of which were established some 20 years back when technology was comparatively limited. Of these, only 10 of the river gauging stations and 13 of the meteorological stations are automatic stations. Moreover, apart from the three real-time Automated Weather Stations (AWSs) recently installed with DANIDA assistance, all other weather stations has no real-time data transmission functionality. This means that the data are manually retrieved from a data logger twice a day (at 9am and 3pm), compiled and sent to the capital on a monthly basis, which makes it impossible to use this information for generation of early warning information.

124. The infrastructural needs in the context of providing climate-related risk information are being gradually addressed by DHMS with RGoB funding as well as developmental assistance. For example, through the financial assistance of the first LDCF project with DHMS put in place 17 early warning sirens dedicated for GLOF risks (three in Lunana in the vicinity of the Thorthormi glacial lake and 14 along the Punakha-Wangdi valley downstream). These are linked to four hydro-met monitoring stations, which check water levels of the Thorthormi lake, and two AWSs. The first LDCF project also established a control station in Wangdu, which gathers and synthesizes data collected from these monitoring stations. This network put under early warning coverage 875 households and a number of private and public buildings in the Punakha-Wangdi valley such as two new large hydropower plants that are currently under construction.

125. DANIDA recently completed its assistance programme to DHMS through which three real-time AWSs and two Automated Water Level Stations (AWLSs) with wireless data transmission facility were installed. The system, for the first time in the country, enabled officials in the Department of Hydro-Meteorological Service to monitor local weather conditions in real time in three locations (Trashigang, Bumthang and Thimphu). The programme also assisted in the establishment of the National Weather and Flood Forecasting Warning Centre (NWFFWC) within DHMS. The NWFFWC is now equipped with the facility to receive and store data transmitted from the real-time AWS and AWLS. The assistance from DANIDA provided the critical initial step for the RGoB to modernize the operation of DHMS and strengthen the quality, availability, reliability and timeliness of transfer of climate information.

[25] Department of Energy, Ministry of Economic Affairs (2011). Application for Japan's Technical Cooperation. (Unpublished).

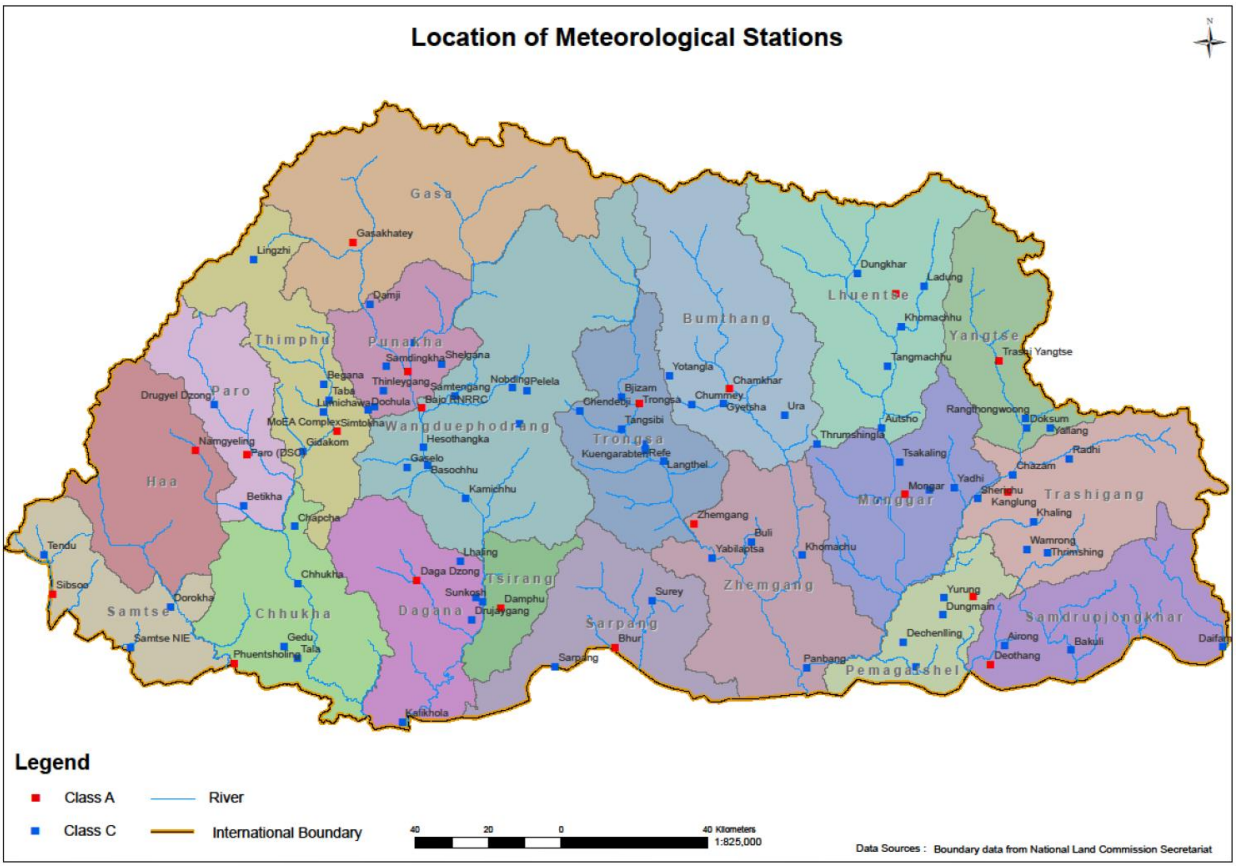

Figure 6, Locations of existing meteorological stations in Bhutan

126. DHMS is implementing with US$ 108,000 support from the Finnish Government the project "Regional Flood Information System in the Hindu Kush Himalayan Region", which is a regional project implemented through ICIMOD. The project contributes some resources to upgrading and expansion of the hydro-met network and data management system, but its main aim is to strengthen capacity for sharing regional information for saving lives and properties due to floods in the region. The project duration is 2 years and it started in early 2012. The Finnish Government is also providing TA support to DHMS with a value of US$ 600,000 to strengthened capacity for managing and producing high quality weather information and data services in the coming years.

127. The Government has requested JICA support for strengthening the capacity of the DHMS and the NWFFWC regarding data management and climate/weather information production. JICA has approved US$ 2,550,000 for this purpose, and "The project for Capacity Development of GLOF and Rainstorm Flood Forecasting and Early Warning in the Kingdom of Bhutan" will commence in the end of 2013 and continues over a period of three years[26]. The project has the following Outputs:

- Capacity of NWFFWC on GLOF/rainstorm flood risk assessment, flood forecasting and warning as well as emergency information sharing among relevant agencies is enhanced;

[26] Minutes of the meeting between the Japanese detailed planning survey team and the authorities concerned for the Government of the Kingdom of Bhutan on Japanese Technical Cooperation for The project for Capacity Development of GLOF and Rainstorm Flood Forecasting and Early Warning in the Kingdom of Bhutan, Thimphu October 18, 2012; Including Annexes with project description.

- Early Warning System for GLOF/rainstorm is developed and maintained in the pilot basins of Mangdechhu and the Chamkharchhu;
- Emergency response capacity against GLOF/rainstorm flood at central and local level is enhanced in the pilot basins.

130. The proposed support to DHMS through the JICA project comprises:

- Dispatch of experts: watershed disaster management (Chief Advisor), meteorology/climate change adaptation, hydrology/glaciology, flood hazard map/GIS, weather forecasting, information network/early warning system, community disaster management;
- Training: on-the-job by experts and technical training in Japan;
- Equipment: limited EWS infrastructure, as automated weather and water level monitoring stations, in part of the Mangde Chhu and Chamkar Chhu river basins.

131. The JICA support will therefore strengthen capacity of DHMS over the coming three years with high relevance for utilization and coordination with the LDCF project proposed investments in the hydro-met network as well as the NWFFWC, specifically on:

- Data analysis and integration, monitoring and alert;
- Operation and maintenance of NWFFWC, integrated weather forecasting and EWS;
- Weather forecasting and flood warning prediction;
- Hydro-met network functioning and response capacity, river basin flood modeling exercises;
- Equipment installation, data management protocol;
- Operation and maintenance manual and training of (field) staff;
- Flood emergency response, link to local government and community disaster response;
- Warning and evacuation drills;

132. DHMS is furthermore in the process of designing support from World Bank Non-Lending Technical Assistance (NLTA) to conduct a study of modernizing Hydro-met Services in Bhutan[27]. The details of the NLTA support (US$ 200,000) are yet to be decided, will be designed by DHMS to avoid overlap with the LDCF project, and will be at a strategic level in the areas of:

- Strengthening DHMS' design capacity for upgrading and expanding the existing hydromet observation network;
- Develop plans to improve lead time for forecasting (weather, drought, floods, landslides);
- Identify actions that need to be put in place institutional arrangements, management systems and capacity, to manage disasters and climate change appropriately.

The World Bank NLTA will likely commence in the last quarter of 2013 and the overall duration of the support will be for one year.

133. Despite these positive developments in terms of strategic and capacity development support to DHMS, it is clear that the existing network of early warning system and donor assistance is disproportionately GLOF-focused and the total areas covered by early warning system is limited compared with the degree of risks of future hydro-meteorological extreme events under a changing

[27] RGoB-The World Bank, Hydromet modernization for strengthening disaster preparedness and climate resilience, consultation mission, July 29 – August 2, 2013, Draft Aide Memoire

climate. Furthermore the coverage is also still inadequate for localized climate monitoring and weather forecasting critical for Bhutan's development adaptation to climate change (Annex 11). At the same time the institutional capacity within NWFFWC/DHMS is still limited to manage, analyze, and synthesize the weather information and translated it to a user friendly format, whether it is early warning information for sudden onset of disasters, seasonal monsoon forecast for farmers and agricultural extension officers or seasonal risk information for forest fires.

134. To strengthen the public service delivery capacity in this area and leverage these ongoing and future donor assistance, the RGoB has allocated in the 11th Five Year Plan a budget outline of US$ 5,200,000 for DHMS. It will be used to further strengthen its capacity and services regarding weather data collection, analysis, weather forecasting and early warning. The RGoB is acutely cognizant that DHMS needs to enhance its analytical and infrastructural capacity in the long run to collect and monitor weather parameters from all 205 gewogs across the country and to analyze and forecast highly localized weather (a 1-10 days range), carry out a seasonal forecast (1-6 months), and carry out climate prediction/projection (a few years to a decade). Required weather parameters for this commonly include rainfall, temperature, wind speed, wind direction, humidity, atmospheric pressure, cloud height, snow depth, and solar radiation. However, despite these positive developments in terms of strategic and capacity development support from various donors to DHMS, it is clear that the existing network of early warning system and donor assistance is disproportionately GLOF-focused, and the investments are on upgrading and expanding the existing hydro-met network as well as capacity building within the NWFFWC to improve data analysis and to transform raw weather/water data into demand-based user friendly climate risk information, are emerging only recently (such as the JICA support).

Climate change knowledge sharing and policy influencing

135. In an ideal scenario, enhanced weather forecast, seasonal forecast and climate projection should ultimately lead to an improved prediction of climate change impacts on and mitigation measures in various climate-sensitive sectors. Establishment of rainfall thresholds for landslide or flood hazard warning, an Output under Outcome 1, is one such an example. A drought warning based on a seasonal forecast disseminated to farming households or water-scarce community, or adjusting a health sector strategy based on a decadal climate projection are few other examples. Carrying out such impact analyses and developing mitigation measures inevitably require cross-sectoral coordination and collaboration. The National Environment Commission is the national agency mandated to coordinate climate change activities among other environmental issues like developing environmental policies, environment related laws and regulation, environmental assessment and regulations for development activities, to coordinate and monitor cross-sectoral issues related to water, mineral resources and waste management. The Climate Change Division within the NEC leads and coordinates in principle all climate change related strategies and activities in the country to address the increasing climate change challenges with adequate national responses. The Multi-Sectoral Technical Committee on Climate Change (MSTCCC) serves as the national forum for discussion and coordination of matters related to climate change in Bhutan. Members of the Committee were also the task force members for formulating the Bhutan NAPA: Update of Project and Profiles 2012. There are around 17 committee members and it is made of a diverse group of individuals from various sectors, agencies, NGO and CSO. The MSCTCCC members also serve as the focal persons for the various sectors concerned with climate change in Bhutan. Experience so far from the MSTCCC indicates that members have only a basic understanding of climate change issues.

136. As in many countries capacities for climate change adaptation are, however, still emerging and often within specific sector contexts. Furthermore central level knowledge is not always translated into ground level adaptation practice, while on-the-ground experience and learning does not always reach policy level decision-making. The divide between national level and community level, as well as sectoral fragmentation is also visible in Bhutan. For example the Ministry of Agriculture and Forests (MoAF) has built considerable knowledge and experience within its own sector, often through sector based development projects, on climate resilient agricultural production and the impacts of climate change on forests. Still large adaptation potential is unexplored because of the weak link between agricultural production (research) and positive effects of accurate weather forecasting or community disaster preparedness and response. In turn DHMS and DDM have at present little understanding on demand for weather forecasting and community disaster response capacity and its potential cross-sectoral benefits. NEC has therefore a clear role to play in bringing, through structured coordination, demand and supply together, to bridge sectoral divides and to develop more strategic action towards collaborative adaptation capacity.

137. Furthermore the integration of climate change adaptation as well as mitigation within different sectors shows different success. Those sector benefitting from global development programmes often have strategies in place, but others who are left on their own are only still vaguely aware of the potential impacts of climate change within their sector and of how to address them. There is thus a need to strengthen the capacity of NEC for knowledge management (collaborative knowledge development) and for supporting sectors in integrating climate resilience within policies and plans (evidence-based policy influencing). An important but often still ignored part of the institutional landscape in Bhutan, which needs to be pro-actively engaged in these processes, are Civil Society Organizations and community based organizations. These are increasingly acknowledged as important for community engagement and implementation, but their voice is often still overlooked at policy level.

Additionality:

Hydro-met network, weather forecasting and early warning

138. The Department of Hydro-Meteorological Services will use the LDCF funds to invest in upgrading and expansion of the existing hydro-met network as well as strengthening the capacity of the NWFFWC to utilize information generated by the upgraded network. DHMS will establish a network with national coverage of real-time automated weather stations, automated flood warning stations, as well as of snow gauge measurement equipment to monitor climate change impact on high altitude snow coverage essential for Bhutan's ecosystems and economic development, all linked to the NWFFWC. During the PPG phase the DHMS has conducted a detailed assessment of requirements in terms of equipment specifications, network design and coverage, and a plan to avoid duplications with the past and ongoing JICA-support in this area (see below), on the basis of which a detailed investment plan has been prepared (Annex 11) for the development of the network and systems, as well as for core capacities required.

139. For the design of the expansion and upgrading of the hydro-met network and NWFFWC, DHMS divided the country into a southern, central and northern region. In the northern region, although there are a few settlements, the presence of glacier lakes with potential hazards for GLOF, as well as the glaciers, glacier lakes and snow in this region which are source of fresh water as well as important climate

regulation functions of the country makes it an important region to cover more extensively. Due to the absence of telecommunication network, the equipment installed in this region will be data-logger as well as snow gauging equipment. The central region is heavily populated, and there are settlements, agricultural land and other important socio-economic infrastructures along the major rivers such as health facilities, public offices, schools, national highways and airport. Given the high concentration of economic assets, and good telecommunication and road networks, more stations will be installed. The southern region has settlements with high density of population, large commercial centers, industrial estates, schools, hospitals etc. The elevation of this region ranges from 100 – 1000 meters above sea level. The region towards the border of India is comparatively flat and the southern foothills rise sharply from the small stretches of these flat lands. Therefore, common problems in this region are huge sediment deposits, flash floods during monsoon, landslides, high intensity rainfall, thunderstorms, water borne & vector borne diseases (as the water and heat are trapped). Thus, a higher concentration of AWLS will be installed in this area. The stretches of flat lands are also used intensively for rice cultivation and other crops.

140. Based on the considerations above, the following proposed list of investments has been compiled to significantly enhance the country's capacity to predict more accurately future climate-induced hazards as well as to disseminate risk information more quickly.

1. **Automatic Weather Stations (AWS) – Total investment US$ 1,900,000**
   - 47 AWS with real-time data transfer capability);
   - 11 AWS with real-time data transfer capability and with snow gauge measurement facilities;
   - 2 AWS without real-time data transfer capability and with snow gauge measurement.
2. **Automatic Water Level Monitoring Stations (AWLS) – Total Investment US$ 1,300,000**
   - 35 AWLS - Bubbler with real-time data transfer capability;
   - 4 AWLS - Radar with real-time data transfer capability;
   - On six sites in critical sub-basin outlets a cable system for discharge measurement will be incorporated within the AWLS, to help flood forecasting and -modeling works;
3. **Investment in equipment for NWFFWC and early warning system – in total US$ 117,000**
   - NWFFWC equipment [US$ 75,000];
   - Equipment for two river-basin based control rooms [US$ 22,000];
   - Data back-up system [US$ 20,000]
4. **Site verification, Installation, calibration, testing and commissioning of the Hydro-Meteorological Station network and NWFFWC – in total US$ 259,500**
5. **Collaborative Research on Snow and Glaciers in Bhutan – in total US$ 43,800**
6. **Capacity Development for DHMS and key stakeholders - US$ 236,800**
   - AWS, AWLS, NWFFWC and ICT systems – US$ 70,000;
   - Technical evaluation and recommendation on overall system performance US$ 20,000
   - Snow and glacier research – US$ 6,800;
   - River basin modeling – US$ 16,000;
   - Weather and early warning information, demand sensitization – in total US$ 10,000;
   - Climate data processing, modeling, interpretation and demand supply - focus on weather forecasting, climate data availability and disaster management – US$ 100,000.

141. The maps in Annex 11 show the proposed locations of the proposed weather and flood measurement equipment, which comprise the most vulnerable locations in Bhutan, as well as those of high human and economic value. The equipment will be integrated within the existing network and NWFFWC and thus linked to the 24/7 integrated early warning system (covering multi-hazards especially flashfloods and landslides), which operate automatically based on the predetermined intensity of climate parameters. As part of the implementation, site assessments will be undertaken prior to the installation of AWS/AWLS and EWS, to determine and calibrate the trigger threshold on climate parameters within the NWFFWC system.

142. Considering the further strategic design and technical support DHMS will receive over the coming year from JICA and World Bank, for the hydro-met network, the NWFFWC as well as the DHMS organization itself, the final decision on system design, equipment requirements and specifications will only be taken after both these projects have finalized the (joint) comprehensive overall design, ensuring adequate integration of all elements and functionalities. Only after the full design has received support from all parties (MoE/DHMS, UNDP/GEF, JICA and World Bank) and equipment requirements and specifications have been validated, will purchase of equipment under the LDCF project commence. Furthermore since JICA will provide a large TA and capacity development support to DHMS, the capacity development support under the LDCF project will be limited to those essential technical capacities for the adequate functioning of the systems the LDCF project will invest in and which are not covered by JICA or World Bank. The LDCF project will thus invest in capacity development on ICT systems operation and maintenance under Output 3.1, and under Output 3.2 on snow and glacier research, river basin research, demand sensitization and on climate data processing, interpretation and demand supply with a focus on weather forecasting and generating useful climate data. The capacity development overview, developed by DHMS and presented in Annex 11, will therefore only be a reference for prioritization of these latter capacity development activities, under Output 3.2.

143. Regarding enhancement of the disaster management capacity, a communication protocol with specific roles and responsibilities within and beyond DHMS at the time of emergency will be formulated. This will be done in close alignment with the landslide monitoring research conducted under Outcome 1 by DGM as well as the community-level disaster contingency plan development and implementation that is supported under Outcome 2. The multi-agency work under all three outcomes combined will thus ultimately ensure that, when the risk of landslides is reported particularly high in a given area because of landslide stability or flash flood thresholds determined and rainfall data collected in real time, early warning information is issued to the particular locality, which will bring into effect the contingency plan in the respective Dzongkhag/Gewog/Chiwog. Again, care will be given by DHMS that this work will be conducted jointly with the JICA support, which has a similar mandate on community disaster communication protocol development. With the (1) enhanced data collection capacity through the nation-wide network of AWS/AWLS/landslide monitoring, (2) early warning network to communicate real-time threat of hydro-meteorological threats, and (3) strengthened operational/human resource capacity within DHMS/NWFFWC to manage, monitor and analyze climate data which are increasingly becoming more unpredictable, it is envisaged that communities of Bhutan will be better equipped to prepare for, and respond to, growing threats of climate change induced hazards. Building thus on past investments as well as solid complementarity with JICA and World Bank support, the LDCF resources will facilitate a

transformational change in Bhutan in the way climate information is gathered, analyzed and disseminated, to ultimately save lives, livelihoods and strengthen climate resilience in years to come.

144. In addition to the capacity to collect/monitor and analyze climate information within DHMS/NWFFWC and within the context of disaster risk management, LDCF resources will also be used to build capacity to interpret processed climate information within climate-sensitive sector agencies and local administrations. Such agencies include disaster management, agriculture, hydropower, civil aviation, road, tourism, and local governments. In particular, at least 100 officials from these agencies will be trained on climate information interpretation for the purposes relevant for the sector.

Climate change knowledge sharing and policy influencing

145. The LDCF resources will be used to strengthen the capacity of NEC and the MSTCCC to more strategically and collaboratively address climate change within the development of Bhutan, as well as for capturing climate change related good practice and (cross-)sector knowledge for dissemination and evidence-based policy influencing. As described in the baseline section, the cross-sectoral coordination/collaboration within the context of climate change adaptation is limited to the time of the production of NAPA documents (original and update). As more accurate and timely climate risk and hazard information becomes available partially through the support from this project, the nature of coordination/collaboration will need to change. In this regard, multi-stakeholder process facilitation skills will be strengthened to support more meaningfully partners with co-development of good adaptation practice, learning and deriving clear lessons from the diverse (LDCF project) interventions. To increase the influence of NEC on sector policies and up-scaling of good practice, furthermore more strategic advocacy and lobbying capacity will be built. NEC will also use LDCF resources to compile and produce practical guidance and recommendations on climate change adaptation strategies and activities in Bhutan and how to integrate CC and adaptation within sector policies. This will ensure that multi-sectoral coordination/collaboration process that is strengthened through LDCF financial support is properly captured and institutionalized.

Outputs and Indicative Activities under Outcome 3

<u>Output 3.1:</u> Enhanced quality, availability and transfer of real-time climate data in all dzongkhags.

146. The DHMS will upgrade and expand the existing hydro-met network as well as the NWFFWC. DHMS will establish a network with national coverage of real-time automated weather stations, automated flood warning stations, as well as of snow gauge measurement equipment to monitor climate change impact on high altitude snow coverage essential for Bhutan's ecosystems and economic development, all linked to the NWFFWC.

Key activities to achieve output 3.1.

3.1.1 Based on the strategic design support from JICA and World bank, finalize systems design, equipment requirements and technical specifications for the expansion of the hydro-met network and NWFFWC. Tender and procure equipment and components for installation/ upgrading of the real-time automated weather stations, water level stations, and early warning stations, including operation and maintenance support and supplier provided capacity development of key staff;

3.1.2 Install and test the integrated system with various equipment and components and develop whole hydro-met network, early warning system and NWFFWC;

3.1.3 Develop operation and maintenance guidelines and manuals and provide technical capacity development of operators and other staff;

3.1.4 Conduct an external technical evaluation of the overall hydromet network and NWFFWC systems in regards to its technical functioning and its performance/ability towards achieving the agreed objectives of providing climate data for DDM's early warning system as well as making climate data accessible for local development. This evaluation will be conducted towards the end of the installation and testing phase (first quarter of year 3);

Output 3.2: Increased effectiveness of NWFFWC through improved capacity to analyze, manage and disseminate climate information in a timely manner

147. Building upon the investments under output 3.1, DHMS in close collaboration with JICA and World Bank, will strengthen its capacity to operate and manage the systems and to generate improved weather forecasting, early warning and climate related information for increased climate resilience.

Key activities to achieve output 3.2.

3.2.1 Develop data analysis and presentation standards based on data collection streams and information demand, develop thresholds and communication protocols with specific roles and responsibilities within and beyond DHMS for disaster warning and emergency response, in close alignment with the landslide monitoring research conducted under Outcome 1 by DGM as well as the community-level disaster contingency plan development and implementation by DDM supported under Outcome 2. Develop communication protocols for weather forecasting information;

3.2.2 Conduct collaborative research on climate change related trends and projection, including on snow and glacier behaviour under climate change conditions and on river basin modelling;

3.2.3 Conduct market research to determine weather and climate (change) data demand and develop sustainability strategy for demand delivery and cost-recovery of investments/maintenance of the network of hydrological and meteorological stations. Develop a collaboration plan with climate-sensitive sectors such as agriculture, hydropower, travel and tourism for climate information service, develop and implement a system of producing and disseminating daily/weekly/monthly/annual weather bulletins and reports. Capacity development for all stakeholders on analysis of climate data and providing relevant information to various climate-sensitive sectors;

3.2.4 Strengthen weather content development and reporting in broadcast (TV and radio) and print media by providing more detailed and localized analysis of climate data for public weather and climate information. Development and operation of an internet-based national weather and climate information portal for the general public with relevant climate content;

3.2.5 Organize national/sub-national trainings targeting at least 100 officers from climate-sensitive sectors and sub-national administrations on climate information interpretation.

Output 3.3: Policy makers and development professionals have systematic access to evidence-based information on climate risks and hazards through cross-government knowledge sharing and coordination mechanisms.

148. The capacity of NEC and the Multi-Sectoral Technical Committee on Climate Change will be strengthened to more strategically and collaboratively address climate change within the development of Bhutan, as well as for capturing climate change related good practice and (cross-)sector knowledge for dissemination and evidence-based policy influencing.

Key activities to achieve output 3.3.

3.3.1. Formulation of a Capacity Development Plan for national climate change adaptation and mainstreaming coordinated for NEC and the Multi-Sectoral Technical Committee on Climate Change (MSTCCC) and key government agencies for dealing with climate change adaptation, joint knowledge development and adaptive learning;

3.3.2. Implement selected CD activities identified within the Capacity Development Plan, with priority to those related to collaborative capacities (multi-stakeholder) and support to and leveraging from LDCF project interventions;

3.3.3. Develop a national framework for climate change adaptation using the outputs derived from the LDCF project and other projects and initiatives. This framework will comprise more practical guidance and recommendations on climate change adaptation strategies and activities in Bhutan and how to integrate CC and adaptation within sector policies;

3.3.4. Produce publications on climate change adaptation and resilience experiences for cross-sectoral evidence-based policy influencing, planning and mainstreaming.

2.6. Key Indicators, Risks and Assumptions

148. The Project Results Framework in Section 3 details indicators, baseline, targets and sources of verification at the Objective and Outcome levels. Some of the indicators presented are from the LDCF Adaptation Monitoring and Assessment Tool (AMAT) to enable GEF/LDCF to align objective and outcomes from this project with its strategic focus areas. Project risks are provided in Annex 14.

149. At the level of the **Project Objective**, the indicators, risks and assumptions are as follows:

Project Objective: To enhance national, local and community capacity to prepare for and respond to climate-induced multi-hazards to reduce potential losses of human lives, national economic infrastructure, livelihoods, and livelihood assets.

Indicators:

- Level of capacity of local communities to prepare for and respond to climate-induced risks.
- Availability of climate information and the level of their use for preparedness and reduction of impacts

148. At the level of the **three outcomes**, the indicators, risks and assumptions are the following:

Outcome 1: Risk from climate-induced floods and landslides reduced in Bhutan's economic and industrial center Phuentsholing and Pasakha Industrial Area.

Indicators:

- Frequency of climate-induced floods causing damage in the industrial hub of the country, Pasakha.
- Number of active and unstable landslides in Phuentsholing area
- Vulnerability and risk perception index [AMAT 1.2.14]
    - o Proportion of men in households that perceive landslides and floods as a major concern;
    - o Proportion of women in households that perceive landslides and floods as a major concern;
    - o Proportion of industrials units that perceive floods as a major concern;

Outcome 2: Community resilience to climate-induced disaster risks (droughts, floods, landslides, windstorms, forest fires) strengthened in at least four dzongkhags.

Indicators:

- Water resource inventories, water harvesting technology and additional water storage capacity available in some the most drought-prone communities of Bhutan
- Existence and operationalization of disaster management committees at the local level

Outcome 3: Relevant information about climate-related risks and threats shared across development sectors for planning and preparedness on a timely and reliable basis.

Indicators:

- Availability and the level of use of localized climate information.
- Number and location of real-time weather observation, forecasting and warning stations that feed data into the NWFFWC
- Number of sectors using climate information to make their development policies and plans climate resilient

2.6. Cost-Effectiveness

149. The following alternative project design options to obtain the same project objective have been considered and evaluated upon their cost-effectiveness:

- Sectorally-driven approach to removing immediate risks imposed by climate change

  This option, which would involve the same government agencies but implemented in a compartmentalized approach, would be expected to generate similar results in the short-run. In this approach, DGM would focus on landslide risk management, FEMD on flood management, DDM on CBDRM training, DHMS on weather monitoring, etc, without cross-sectoral coordination and knowledge sharing. Such an approach is not uncommon in the context of other cross-cutting development issues such as gender where relevant agencies typically have their own gender strategy, if at all, and little coordination across them. However, within the context of climate change, in the long-run, such an approach is likely to lead to a sub-optimal development impact. For example, without proactively facilitating knowledge exchange between DGM and DHMS with associated technical assistance to enable them to leverage each other's expertise, it is likely that a locally-specific landslide warning, which integrate real-time weather information, would be more difficult to

generate, exposing community members to greater climate risks. Similarly, a lack of tripartite coordination among DHMS, FEMD and DDM would mean that the CBDRM capacity building facilitated by DDM would likely to continue to rely on past observational trends of natural disasters rather than integrating the scenario-based evacuation trainings (e.g. flood warning beyond a rainfall event beyond a specific threshold, which in turn was established through the joint assessment of the locality by FEMD and DHMS). It is evident from this that the approach that is proposed in this project, in which cross-sectoral coordination is facilitated in specific Outcomes as well as through enhanced coordination capacity support provided to NEC, additional adaptive benefits can be expected.

- Reducing climate risks only through the implementation of hard adaptation measures without the use of complementary ecosystem based measures and community-based capacity building for DRM
  This option would seek reducing imminent risks of extreme events (landslides, floods, and droughts) only through direct engineering approach. This option was immediately rejected as the costs involved in such an approach would be higher by an order of magnitude. Moreover, in a country like Bhutan where geological conditions are inherently fragile and environmental conditions (such as the existence of many glaciers, gorges, rivers and high mountain ranges) vulnerable to changes in climatic conditions, it is almost inevitable that there will be residual damages of climate change (those that cannot be abated with adaptation measures) and developing preparedness to climate-induced extreme events and climate resilience will be critical.

150. The proposed project design, as presented, was deemed the most cost-effective amongst these alternatives considered. The basis for the considerable cost-effectiveness of the project design is explained in further detail below. In particular, it has been designed to maintain a balance across various elements that contribute to increasing the overall preparedness of the Bhutanese society to future climate risks. These elements include removal of imminent hazards, amplified by climate change, of landslides and floods in Phuentsholing and Pasakha Industrial Areas, economically one of the most important parts of the country; building community resilience to creeping risks of climate change represented by water shortages, which is expected to widen the 'safety buffer' to maintain the viability of livelihoods against smaller, but increasingly more frequent fluctuations in freshwater availability; building the national capacity in monitoring, analyzing, and presenting dynamic changes in weather and climate; and facilitating the exchanges of climate information in a meaningful manner across climate-sensitive sectors.

2.7. Sustainability

Institutional sustainability

151. The long-term viability and sustainability of the project will depend greatly on institutional sustainability. The project has strong government support at both central and local levels. Various stakeholders from the government and civil society were involved in the NAPA update process leading to a broad consensus over immediate and urgent adaptation priorities, many of which constitute the proposed LDCF project. Reflecting the acute understanding within the RGoB that capacities to address climate change concerns need to be strengthened across many sectors, this project has been designed in a programmatic manner and all project outcomes have activities designed to build technical capacities within respective ministries/departments. Most importantly, institutional capacities of DGM and FEMD will be strengthened not only for more technically-robust engineering solutions for geo-hazard or flood

risks, but also to integrate real-time climate information into the assessments they undertake. DDM will be supported in carrying out its mandate of building DRM capacity within sub-national administrations but with additional and/or more accurate climate risk information that will be made available through Outcome 3 of this project. NWFFWC/DHMS will be supported in expanding and upgrading the hydro-met network as well as its capacity in translating weather data into climate risk information in coordination with other relevant technical ministries/departments. It is important to note that the engagement of partners in the programmatic approach adopted in the implementation of the project goes beyond sectoral agencies. More specifically, in the implementation of landslide and flood risk reduction measures in Phuentsholing/PIA and water security enhancement measures in Mongar will be implemented by Phuentsholing and Mongar municipalities, respectively. They will coordinate activities while technical support will be provided by sectoral departments from the capital. This implementation arrangement mirrors the ways in which public services, including those for climate change adaptation, is and will be actually delivered. This is a notable difference from the approach commonly adopted in donor-funded projects in which sectoral departments take a leading role in the implementation. Hence, through the implementation of the project, the two municipalities will gain experience in coordinating with technical agencies from the capital in delivering climate change adaptation services to the residents.

152. In addition to the build-up of technical institutional capacities that this project will contribute to, the NEC, in the role of the Implementing Partner and the national coordination agency for climate change issues, will build its capacity for coordinating multi-sectoral partners in addressing the cross-cutting issues that originate from climate change. While NEC has been playing the coordination role for meeting multilateral environmental agreements, such as the production of national communications and NAPA, this project offers the first opportunity for NEC, and the members of the Multi-Sectoral Technical Committee on Climate Change (MSTCCC), to coordinate actual response to climate change adaptation needs across sectors. NEC will capture lessons from this project and by the end of the project implementation develop a climate change adaptation framework which is a compilation of guidance and recommendations for strengthening Bhutan's climate resilience in the participating sectors. Publications that captures the experience of cross-sectoral coordination for climate change adaptation are also planned, which will contribute to institutionalizing the lessons from the project.

153. Last but not least, elements of institutional sustainability can be found in some of the project activities that will be carried out at the grass-roots level. Community capacity building in addressing both slow and sudden onset of climate extreme events will be achieved by building the capacity of lower-level administrations and a Civil Society Organization. The emergence of the CSO sector in Bhutan is lagged behind compared with neighboring countries but their comparative advantage over government agencies in mobilizing and hand-holding vulnerable communities and building community resilience is likely to become more pronounced in the future. Through this project, one of the leading NGOs, Tarayana Foundation, in the country will be engaged for promoting rural water harvesting solutions. It is expected that experience from this project will be expanded by Tarayana beyond the life of this project.

Environmental Sustainability

154. The project outcome and outputs are all geared towards increasing environmental sustainability of development activities in Bhutan. The investments in Phuentsholing area in landslide stabilization, flood management as well as the work of DGM and FEMD will all result in increased climate resilience and

stabilization of existing environmental hazards. It is important to note that solutions that will be put in place for both landslide and flood risk reduction will seek to maximize ecosystem functions by combining ecosystem-based approach with an engineering approach such as bio-engineering erosion control and watershed management. Under Outcome 2, the project activities will contribute to increasing water use efficiency in urban and rural settings, as well as create increased capacity to sustainably utilize fresh water availability in the light of increased pressure of climate change on natural resources. This will in the short-term counter existing overexploitation and inefficient utilization of increasingly scarce natural resources; and in the long-term facilitate regeneration of environmental resources because of the increased understanding of the critical importance of Bhutan's natural resources for climate resilience, among both government officials and community. Lessons and good practice from the project regarding environmental sustainability and climate resilience will furthermore be shared broadly and up-scaled cross-sectoral, to increase the project impact. UNDP operational procedures (in particular, the Environment and Social Screening procedures) will also be applied and all significant environmental risks will be identified in advance, be eliminated through design alternatives or managed to offset such risks to acceptable levels. As a whole the project will thus have a positive effect on environmental sustainability of development in Bhutan and in such cases where environmental risks of specific project activities are identified, these will be addressed adequately.

Social Sustainability

155. Overall the project will improve the public service delivery in some of the MDG relevant sectors. Water supply and agricultural production will be improved by developing (and constructing) climate resilient water harvesting approaches, by providing accurate localized weather and climate information, and by raising community awareness about and providing tools for efficient water use. The community-led approach of Tarayana Foundation for the rural water harvesting approach will ensure that inter- and intra-households diversity is adequately addressed in a comprehensive manner, including gender. Women will especially benefit from improved access to natural resources and especially water for agriculture, domestic consumption and sanitation, given their major role in water provision of families. The time saving effect of better water supply will also contribute to enhanced income generating activities of those women. The same holds true for other vulnerable groups, which are currently disproportionally affected by climate variability, e.g. the elderly and children. The community-led approach and its results will be documented and lessons shared to create a higher understanding of and support for community-led development approaches in Bhutan. As part of this process, the critical role of civil society organizations in sustainable development and the need for partnerships between Government and non-state actors, will also be further promoted and strengthened. The CBDRM approach that will be expanded and strengthened in four dzongkhags will also fully take into considerations differential impacts on and roles of women at the time of natural disasters.

Financial sustainability

156. Ensuring financial sustainability of the adaptive investments undertaken in the proposed project was one of the key aspects of the project design, especially for the hydro-met infrastructure that will be expanded/upgraded under Outcome 3. Activity 3.2.3 has been designed for this purpose: During the course of the project implementation, exploratory research will be carried out to seek cost-recovery options for the O&M of the infrastructure and a sustainability strategy will be developed. This is likely to entail options such as the sales of accurate climate/weather information to sectors where the value of such

information is high, such as travel and tourism, hydropower, agriculture, or potentially insurance. At the same time, budgeting of part of the O&M costs in the five-year plan will also be explored during the project implementation. Strengthened evidence-based advocacy that will be led by NEC through Outcome 3 is expected to facilitate this discussion. For example, there are significant recurring expenditures borne by both private and public entities in mitigating the risks of landslides and floods especially in industrial estates, and if forgone expenditures on such risk mitigation measures due to LDCF investments can be computed, the value of maintaining the infrastructures financed by LDCF becomes much more visible.

2.8. Replicability

158. The project interventions have immense replicability value. The flood and landslide risk mitigation outcome will be applicable in several locations along the southern region of the country, where similar geo-physical conditions and risks of floods and landslides exist in combination with economic importance for industrial development. Similarly, the water shed management, water harvesting, storage and distribution systems piloted through this project will provide the much-needed visibility of viable water use. Low-cost water harvesting technology options can be replicated in many rural and urban areas where water scarcity is a serious impediment to local development and livelihoods. Also the climate change resilience water supply system design, to be implemented in Mongar municipality, which is designed innovatively as an up-scalable system where elements can be added depending on existing and future climate-induced water scarcity projections, has 'replicability' at the center of its core principle. Such an option has never been tried in Bhutan, but if proven successful, many growing municipalities in the country can relatively easily replicate it. The Disaster Management Act makes establishment of disaster management institutions and development of community-based disaster management plans mandatory in every dzongkhag and gewog. This will hugely open up the scope of replicating the dzongkhag and gewog-level disaster management committees and community-based disaster management plans piloted through this project. In addition the multi-sectoral approach to capturing and disseminating CC information and generating practical knowledge can be of great value for countries with a similar context as Bhutan.

2.9. Stakeholder Involvement Plan

159. Various stakeholders at national as well as local level will be engaged during the implementation of the project activities. Through the programmatic approach adopted in the implementation of this project, key stakeholders span not only across sectors at the national level, but will also involve two municipalities and a CSO at the subnational level.

160. Tarayana Foundation, a CSO with strong experience of working with grassroots communities in sustainable livelihoods and community empowerment, will play a pivotal role in mobilizing and forming local self-help groups for rural water harvesting (Output 2.1) and training these local groups in selected rural water harvesting technologies, thus building local community capacity and ownership. The community-level water resources inventory (Output 2.2) will among other things involve household surveys on drinking and irrigation water conditions at the community level, collaboration with dzongkhag staff for field surveys and analysis of data, and will rely on a multi-disciplinary technical group drawn from relevant sectors for technical guidance and backstopping. The disaster risk management output

(Output 2.3) will entail working directly with, and training, Disaster Management Committees and Sub-committees at dzongkhag/ gewog/ thromde levels for formulation of Dzongkhag/Gewog/Thromde Disaster Management and Contingency Plans and establishment of Critical Disaster Management Facilities. Communication protocol will also be established for coordinated preparedness and response to disasters, involving all key stakeholders at central and local levels. Setting up of VLFFMGs will provide grassroots level socio-institutional setup for directly engaging with, and building capacity of, local stakeholders for forest fire management. In addition, the formulation of dzongkhag/ gewog forest fire management plans will entail training on formulation process and guidelines, and technical backstopping to the dzongkhag and gewog officials. Planning process and guidelines will be developed among other things to provide a clear vision, approach and suite of participatory tools and techniques to actively engage local stakeholders in the formulation of various local level plans for disaster risk management and forest fire management.

161. Outputs 3.2 and 3.3 seeks to foster dissemination of climate information across various climate-sensitive sectors and improve access to, and cross-government sharing of, climate information for informed policy-making. A major emphasis will be on strengthening the MSTCCC and key government agencies for dealing with climate change (mitigation and adaptation), joint knowledge development and adaptive learning. This is expected to improve the quality of coordination and dialogue between multiple stakeholders at the policy-making level.

162. In keeping with the national execution (NEX) agreement between the UNDP and RGoB, all government stakeholders will be directly involved in project execution and implementation of planned activities. At the end of each project year, an Annual Review and Planning Workshop (ARPW) will be conducted to take stock of project implementation, share lessons, foster synergy between various project outcomes and outputs and with other relevant projects, fine-tune project implementation, and prepare Annual Work Plan (AWP) and Budget for the year ahead. The ARPW will be organized by the Project Management Unit (PMU) and involve the principal responsible agencies, supporting technical agencies, relevant development partners, UNDP CO, and the UNDP Asia-Pacific Regional Center. Furthermore, there will be a number of formal mechanisms, such as Project Board, Project Implementation Team and Technical Advisory Group meetings, to ensure coordination and communication between various stakeholders.

163. Table 3 below provides an outline of the key stakeholder agencies and their role in the project:

Agency	**Type**	**Role in PPG**	**Role in Implementation**
National Environment Commission Secretariat	Cross-sector government body	Coordination, strategic guidance and logistical support in general, and inputs to the design of activities for output 2.2.	The **PMU** will be housed in NECS for overall project coordination and management, including monitoring of project progress and reporting. In addition, implementation of activities for outputs 2.2 and 3.3 and, hence, the **lead responsible agency** for delivery of these outputs
Gross National Happiness Commission Secretariat	Cross-sector government body	Strategic guidance, national review and endorsement as national GEF operational focal point and as apex national	Overall monitoring of delivery of GEF/LDCF financing and project implementation.

Agency	Type	Role in PPG	Role in Implementation
		planning and international assistance coordination body.	
Phuentsholing Thromde	Municipal authority (local government)	Local knowledge inputs to the technical assessments for outputs 1.1 and 1.2.	Management and implementation of activities for outputs 1.1 and 1.2. and, hence, the **lead responsible agency** for delivery of these outputs. Given the relatively high project investments involved in these outputs and the limited in-house capacity, a Output Management Unit will be created within Phuentsholing Thromde.
Department of Geology and Mines – DGM (Ministry of Economic Affairs)	Government technical department	Technical assessment for designing activities for output 1.2 and technical guidance for identification of sites for output 1.3.	Technical support and guidance for implementation of activities for output 1.2; and implementation of activities for outputs 1.3 and 1.4 and, hence, the **lead responsible agency** for delivery of outputs 1.3 and 1.4
Department of Engineering Services – DES (Ministry of Works and Human Settlement)	Government technical department	Technical assessment for designing activities for output 1.1 and 2.1.	Technical support and guidance for implementation of activities for output 1.1 and 2.1.
Mongar Municipality	Municipal authority (local government)	Local knowledge inputs to the technical assessment for output 2.1.	Implementation of activities related to Mongar town water harvesting, storage and distribution system under output 2.1 and, hence, the **lead responsible agency** for delivery of this part of output 2.1
Tarayana Foundation	Civil society organization	Inputs to the design of activities for output 2.1	Implementation of activities related to rural water harvesting, storage and distribution systems under output 2.1 and, hence, the **lead responsible agency** for delivery of this part of output 2.1
Local communities	n/a	Inputs to the design of the overall project design.	They represent the ultimate beneficiaries of the project. In addition, they will contribute to the implementation through: provision of labor for construction of community-level rainwater harvesting infrastructure; participation in mock-drills; membership in search and rescue volunteer groups and VLFFMG.
Department of Disaster Management (Ministry of Home and Cultural Affairs)	Government technical department	Inputs to the design of activities for output 2.3 (climate-induced disasters other than forest fire).	Implementation of activities for output 2.3 (climate-induced disasters other than forest fire) and, hence the **lead responsible agency** for the delivery of this part of output 2.3
Department of Forests and Park Services (Ministry of Agriculture and Forests)	Government technical department	Inputs to the design of activities for output 2.3 (forest fire-related), and to the technical assessment for output 2.1.	Implementation of activities for output 2.3 (forest fire-related) and hence the **lead responsible agency** for the delivery of this part of output 2.3
Department of Hydro-Meteorology Services (Ministry of Economic Affairs)	Government technical department	Technical assessment for designing activities for output 3.1, and inputs to the design of activities for output 3.2	Implementation of activities for outputs 3.1 and 3.2 and, hence, the **lead responsible agency** for delivery of these outputs
Dzongkhag Administrations	District civil authority	Local knowledge inputs to the design of activities for outputs 2.1,	Collaboration in implementation of activities for outputs 2.2 and 2.3. Mobilization of local

Agency	Type	Role in PPG	Role in Implementation
		2.2 and 2.3	communities for their inputs and engagement in project activities.
Gewog Administrations	Local government	Local knowledge inputs to the design of activities for outputs 2.1, 2.2 and 2.3	Collaboration in implementation of activities for outputs 2.2 and 2.3. Mobilization of local communities for their inputs and engagement in project activities.
Association of Bhutanese Industries (ABI)	Non-profit private sector organization	Local knowledge inputs to the technical assessment for output 1.1.	Co-financing (output 1.1) and collaborative and advisory support to activities for output 1.1
Bhutan Trust Fund for Environment Conservation	National funding facility	Update on BTF support to national water resources inventory	Co-financing (output 2.2)
Japan International Cooperation Agency	Bilateral donor agency	Update on JICA assistance for outputs 3.1 and 3.2 to ensure coordination and synergy	Co-financing (outputs 3.1 and 3.2)
Norwegian Agency for Development Cooperation	Bilateral donor agency	Update on NORAD assistance for capacity development of DGM to develop synergy with output 1.2	Co-financing (output 1.3)
World Bank-Global Facility for Disaster Reduction and Recovery	International financing facility	Update on GFDRR assistance for activities related to output 2.3 to develop synergy	Co-financing (output 2.3)
UNDP GEF and UNDP CO	GEF international implementing agency	Supervision, strategic guidance and logistical support	Oversight and monitoring as GEF/LDCF international implementing agency, coordination of delivery of GEF/LDCF funds, co-financing

Table 3, Key Stakeholder Agencies and their Role in the Project

3 Project Results Framework

Bhutan CPAP Outcomes
The project directly corresponds to the following outcomes as defined in the UNDAF - Bhutan One UN Programme (2014-2018):
- ⇨ UNDAF Outcome 1: By 2018, sustainable and green economic growth that is equitable, inclusive, climate and disaster resilient and promotes poverty reduction, and employment opportunities particularly for vulnerable groups enhanced.
  - ⇨ Output 1.1: Policies and studies for integrated natural resource management, climate change adaptation/mitigation and poverty-environment nexus developed.
  - ⇨ Output 1.2: National and local institutions and individuals are better prepared and able to respond to and reduce climate change-induced and other disaster risks.

Outcome Indicator (CPAP 2008-2012)
- ⇨ 1.1 - % of government expenditure / budget allocation for environment + disaster risk reduction
- ⇨ 1.2 - No. of trained District Disaster Response Teams in place; and No. of dzongkhags, geogs and municipalities with Disaster Management Plans (incl. cont. plans) in place

Primary Applicable Key Environment and Sustainable Development Key Result Area
- ⇨ National and local institutions and individuals are better prepared and able to respond to and reduce climate change-induced and other disaster risks

Applicable SOF (e.g. GEF) Strategic Objective and Programme
- ⇨ Least Developed Countries Fund (LDCF) National Adaptation Programme of Action (NAPA)

Applicable SOF (e.g. GEF) Expected Outcomes: N/A

Applicable SOF (e.g. GEF) Outcome Indicators: N/A

Project Strategy	Indicator	Baseline	End of Project Target	Source of Verification	Risk/ Assumption
Project Objective: To enhance national, local and community capacity to prepare for and respond to climate-induced multi-hazards to reduce potential losses of human lives, national economic infrastructure, livelihoods, and livelihood assets.	Level of capacity of local communities to prepare for and respond to climate-induced risks. Availability of climate information and the level of their use for preparedness and reduction of impacts	- Local disaster mgt institutions functional in 16 of 20 dzongkhags - Mock-drills not widely adopted except 1 # of mock-drills under LDCF GLOF project; - No real-time localized weather data available to local institutions and communities - No community-level seasonal water resources inventory available	Communities capacity to prepare for and respond to localized climate-induced risks enhanced : - Existence of functional local disaster mgt institutions; - Adequate response to scenario-based early earning mock-drills (4 no. in Years 3 and 4, in 4 dzongkhags) - Availability of real-time localized weather data (measured in four sample dzongkhags) - Availability of seasonal water resource inventory (measured in 5-6 gewogs)	▪ Mid-term and Terminal Evaluation Reports; ▪ Project Progress Reports; ▪ Government reports; ▪ On-line materials (website, electronic reports). ▪ Bhutan Broadcasting Corporation ▪ DHMS web portal ▪ Success rate and evaluation report of mock-drills	Risks: ▪ Difficulty in coordinating the various outcomes and outputs implemented by different agencies, leading to silo approach; ▪ Complex technical and organizational management of the processes and results. Assumption: ▪ Government funding is available to sustain and consolidate the interventions after the conclusion of the project.

Project Strategy	Indicator	Baseline	End of Project Target	Source of Verification	Risk/ Assumption
Outcome 1: Risk from climate-induced floods and landslides reduced in Bhutan's economic and industrial center Phuentsholing and Pasakha Industrial Area.	Reduced damage from floods in the industrial hub of the country, Pasakha.	Climate-induced floods and landslides impact industrial operations and socio-economic activities in several parts of the country, of which Pasakha Industrial Area, Phuentsholing Urban Area and the Phuentsholing-Thimphu Highway are among the most impacted; Floods in the past (1996, 1998 and 2000) have incurred heavy damages on some of the industrial units in Pasakha and the BFAL/BCCL residential colony. River dredging is carried out annually to remove excessive silt during the monsoons but is only an interim and partial measure.	Erosion in Barsa watershed and sedimentation and flooding in Barsa river is reduced due to comprehensive mitigation measures, reducing the occurrence of floods resulting in damages by 25% Reduced annual cost of riverbed dredging in Pasakha Industrial Area by 30%	▪ Project progress and evaluation reports; ▪ Government 11th Five Year Plan review report(s); ▪ Results of the risk perception survey ▪ Barsa watershed management plan ▪ Landslide stabilization technical design and construction reports ▪ Government and PIA damage assessment reports in the event of flood disaster; ▪ Geo-hazard assessment reports and maps. ▪ Research findings on thresholds developed for slope stability and climatic conditions; ▪ Media reports;	Risks: ▪ Flood risk mitigation and slope stabilization measures may have a long gestation period and not show visible results by the end of the project period; ▪ Widespread geologic fragility in the area and extreme rainfall events may trigger flood and landslide problems at levels and in areas not envisaged in the project. ▪ Theft/ vandalism of materials used for slope stabilization structures (e.g. galvanized iron mesh used in gabion walls) by miscreants, especially given the proximity/ contiguity of the landslide areas to the porous international border.
	Number of active and unstable landslides in Phuentsholing area	Existing large active landslides are common in the Phuentsholing area, despite past stabilization measures.	Four critical landslide sites in Phuentsholing-Rinchending area stabilized and contained within existing boundaries, safeguarding economic assets		
	Vulnerability and risk perception index [AMAT 1.2.15] o Proportion of men in households that perceive landslides and floods as a major concern; o Proportion of women in households that perceive landslides and	GNH Survey 2010 reports that 29% of the surveyed population perceive landslides as a major concern and 26% perceive floods as a major concern; 50.9% of the interviewed Phuentsholing and Pasakha residents perceive landslides as a major concern (or 58.7% for	Proportion of men in households that perceive landslides and floods as a major concern reduced by 30% Proportion of women in households that perceive landslides and floods as a major concern reduced by		

	floods as a major concern; ○ Proportion of industrials units that perceive floods as a major concern;	male and 33.9% for female), and 49.6% perceive floods as a major concern (or 55.4% for male and 36.8% for female) (based on ad hoc preliminary survey during PPG); 30% of the surveyed industrial units in Pasakha perceived landslides as a major concern, and 20% perceived floods as a major concern - based on ad hoc preliminary survey during PPG; Interventions to reduce the risks from climate-induced floods and landslides are piecemeal and partial and not integrated in local planning processes.	30% Proportion of industrial units that perceive floods as a major concern reduced by 30%		
Output 1.1: Pasakha Industrial Area protected from climate-induced floods through watershed management measures, river bank protection works and development of flood buffer zones					
Output 1.2: Climate-induced landslide risk in four critical areas in Phuentsholing-Rinchending area reduced through Integrated slope stabilization measures					
Output 1.3: Integrated geo-hazard assessment and mapping carried out in four critical landslide- and flood-prone areas in Bhutan, using data standards compatible with the national database					
Output 1.4: Thresholds for landslide slope failure determined in different geological zones, through research correlating geological instability with rainfall data from weather stations					
Project Strategy	**Indicator**	**Baseline**	**End of Project Target**	**Source of Verification**	**Risk/ Assumption**
Outcome 2: Community resilience to climate-induced disaster risks (droughts, floods, landslides, windstorms, forest fires) strengthened in at least four dzongkhags.	Water resource inventories, water harvesting technology and additional water storage capacity available in some the most drought-prone communities of Bhutan	Bhutan Water Policy (2003) specifies assessment and inventory of national water resources as a special area of attention for informed water resources management. However, no systematic water resources inventory has taken place due to limited funds and technical capacity; Several villages and urban centers in various dzongkhags	Up-to-date community-level water resource inventory and database in place in at least four dzongkhags, feeding into national water resources inventory/database; One Municipal water supply system made climate resilient, serving 6,000 beneficiaries;	▪ Project progress reports; ▪ Government 11th Five Year Plan review report(s); ▪ Project evaluation reports. ▪ Water resources inventory report and database. ▪ Local-level disaster management plans.	Risk: Limited in-country experience and know-how of climate-resilient water harvesting technology may lead to inappropriate technology choices

		experience water scarcity. Simulation undertaken in the Second National Communication process project declining non-seasonal rainfall in 11 out of 20 dzongkhags between 2010-2039;	20 villages/ hamlets have adopted climate-resilient water harvesting approaches, -technology and efficient water management practices, therewith reducing water scarcity for some 420 rural households.		
	Existence and operationalization of disaster management committees at the local level	The Disaster Management Act (2013) stipulates the creation of disaster management committees and formulation of disaster management plans at national and local levels, but have been established at present in four pilot dzongkhags only. Forest fire is a recurrent phenomenon, destroying around 6,000 ha of forests annually. The national forest fire management strategy has been approved recently but there is no community-based forest fire management plan and mechanism to systematically guide effective and coordinated forest fire management at the local level.	Local-level disaster management committees (DMCs) established, capacitated and functional in at least four dzongkhags prone to climate-induced disasters; Climate-induced disaster management plan developed, including for forest fire management, and integrated in local development plans and programmes in four dzongkhags.		<u>Risk:</u> Local administrations allocate low priority to establishing and strengthening local institutions for disaster management, because of existing high workload <u>Assumption:</u> Local Governments and administrations have adequate existing capacity to build upon for disaster management
<u>Output 2.1</u>: Climate-resilient water harvesting, storage and distribution systems designed, built or rehabilitated in at least four dzongkhags and one municipality					
<u>Output 2.2</u>: Community-level water resource inventory completed, maintained, and used for water resource management planning in at least four dzongkhags					
<u>Output 2.3</u>: Disaster management institutions at various levels established and trained in four dzongkhags for better preparedness and response to climate-induced disasters					
<u>Outcome 3</u>: Relevant information about climate-related risks and threats shared across development sectors for	Availability and the level of use of localized climate information. [AMAT 2.1.2.1]	The current network of meteorological stations is limited to 24 stations, of which only 3 are automated. Existing infrastructure for climate risk	Network with national coverage of minimum # 60 new real-time weather stations and # 45 new flood measurement stations	▪ Project progress reports; ▪ Government 11th Five Year Plan review report(s); ▪ Project evaluation	<u>Risks:</u> ▪ Compatibility of different elements (equipment) of the hydromet network and NWFFWC

planning and preparedness on a timely and reliable basis.		warning is highly GLOF-risk related.	established.	reports; ▪ Meteorological data and records; ▪ Day-to-day broadcast of weather reports and forecasts. ▪ Web portal analysis ▪ Interviews with policy staff of different sectors and inventory/analysis of new policy documents on relevant sectors	▪ Support from JICA changed, delayed or cancelled <u>Assumptions:</u> ▪ In-country capacity is available or built for operation and maintenance of the hardware; ▪ Spares are readily available in the event of damage or disrepair. <u>Risk:</u> Sectors unwilling to integrate climate risks into policies and activity designs, because of more challenging complexity and likely higher budget requirements and thus in the short-term less perceived benefits
	Number and location of real-time weather observation, forecasting and warning stations that feed data into the NWFFWC;	The NWFFWC is in a nascent stage supported by a small network of meteorological stations and with insufficient capacity to analyze, manage, and disseminate climate information in a timely manner.	NWFFWC operational, with a core team of at least 10 members trained and established for climate data analysis, management and dissemination;		
	Number of sectors using climate information to make their development policies and plans climate resilient	Demand for and use of localized climate information is yet unclear and undervalued	Climate data/ information user training provided to at least 100 staff of key data user agencies, e.g. disaster management, agriculture, forestry, hydropower, civil aviation, road transport, and tourism, and local government institutions. Updated weather forecasting and localized climate information disseminated on a daily basis through web-portal, media and other means		
		Due to sector fragmentation little exchange of knowledge, lessons and experiences takes place, existing platforms are shaped around national programmes (like NAPA working group) but do not function adequately outside the framework of these programmes due to limited capacity of NECS for multi-stakeholder process facilitation and sector leadership	At least three evidence-based policy influencing documents disseminated through NECS National climate change policy framework in place (CC adaptation and synergies), with gender segregated policies and monitoring framework		

Output 3.1: Enhanced quality, availability and transfer of real-time climate data in all dzongkhags for climate resilient development planning and local disaster management
Output 3.2: Increased effectiveness of National Weather and Flood Forecasting and Warning Center (NWFFWC) through improved capacity to analyze, manage and disseminate localized climate information in a timely manner
Output 3.3: Policy makers and development professionals have systematic access to evidence-based information on climate risks and hazards through cross-government knowledge sharing and coordination mechanisms

4 Budget and Work Plan

Award ID:	00076998	**Project ID(s):**	00088072
Award Title:	PIMS 4760 FSP LDCF: Addressing the Risks of Climate-induced Disasters through Enhanced National and Local Capacity for Effective Actions		
Business Unit:	BTN10		
Project Title:	Addressing the Risks of Climate-induced Disasters through Enhanced National and Local Capacity for Effective Actions		
PIMS no._____	4760		
Implementing Partner (Executing Agency)	Royal Government of Bhutan, National Environment Commission		

GEF Outcome/Atlas Activity	Responsible Party/ Implemen-ting Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (US$)	Amount Year 2 (US$)	Amount Year 3 (US$)	Amount Year 4 (US$)	Total (US$)	See Budget Note:
OUTCOME 1: Risks from climate-induced floods and landslides reduced in Bhutan's economic and industrial hub Pasakha Industrial Area.	Phuent-sholing Thromde DGM	62160	LDCF GEF	71200	International Consultants	12,500	7,500	7,500	15,000	42,500	1A
				71600	Travel	3,000	3,000	3,000	3,000	12,000	1B
				71600	Travel	35,400	25,350	25,250	16,200	102,200	1C
				71400	Contractual Services – Individual	14,400	14,400	14,400	14,400	57,600	1D
				72100	Contractual Services Companies	855,000	1,482,000	1,182,000	609,000	4,128,000	1E
				72200	Equipment & Furniture	90,000				90,000	1F
				72500	Supplies	3,000	6,000	6,000	3,000	18,000	1G
				74200	AV & Print Production Costs	1,500	-	-	6,000	7,500	1H
				75700	Training, Workshop & Conf.	39,000	40,000	50,000	48,000	177,000	1I
					Total Outcome 1	**1,053,800**	**1,578,250**	**1,288,150**	**714,600**	**4,634,800**	
OUTCOME 2: Community resilience to climate-induced risks strengthened in at least four Dzongkhags	Mongar Municipa-lity Tarayana NECS DDM	62160	LDCF GEF	71200	International Consultants	60,000	7,000	25,000	14000	106,000	2A
				71300	National Consultants	9,100	-	16,800	8,400	34,300	2B
				71600	Travel	17,000	40,000	26,300	13,800	97,100	2C
				72100	Contractual Services – Companies	75,000	230,000	160,000	-	465,000	2D
				72200	Equipment & Furniture	33,000	91,000	83,000	42,000	249,000	2E
				72300	Materials and Goods	-	100,000	108,000	21,900	229,900	2F
				72400	Comm. & AV Equipment	-	32,000	32,000	15,000	79,000	2G
				72500	Supplies	1,800	2,500	6,500	6,000	16,800	2H
				72800	IT Equipment	10,000	5,000	-	-	15,000	2I
				74200	AV & Print Production Costs	39,100	40,500	8,000	13,000	100,600	2J
				75700	Training, Workshop & Conf.	130,000	150,000	130,000	96,100	506,100	2K

					Total Outcome 2	**375,000**	**698,000**	**595,600**	**230,200**	**1,898,800**	
OUTCOME 3: Relevant information about climate-related risks and threats shared across climate-sensitive sectors on a timely and reliable basis.	DHMS NECS	62160	LDCF	71600	Travel	2,000	5,000	5,000	-	12,000	3A
				71600	Travel	3,600	127,600	103,800	37,300	272,300	3B
				72100	Contractual Services – Companies	15,000	32,750	45,000	20,000	112,750	3C
				72400	Comm. and AV Equipment	-	1,000	2,000	16,000	19,000	3D
				72800	IT Equipment	810,000	2,522,000	-	-	3,332,000	3E
				74200	AV & Print Production Costs	-	4,500	10,000	10,000	24,500	3F
				75700	Training, Workshop & Conf.	50,000	98,000	105,000	59,800	312,800	3G
				74500	Miscellaneous Expenses	80,000	80,000	80,000	85,050	325,050	3H
					Total Outcome 3	**960,600**	**2,870,850**	**350,800**	**228,150**	**4,410,400**	
PROJECT MANAGE-MENT	NECS	62160	LDCF	71300	National Consultants	9,000	9,000	9,000	9,000	36,000	4A
				71300	National Consultants	-	-	10,000	10,000	20,000	4B
				71200	International Consultants	-	-	20,000	25,000	45,000	4C
				71600	Travel	8,000	8,000	8,000	8,000	32,000	4D
				72100	Contractual Services Companies	32,000	23,000	31,900	43,000	129,900	4E
				72200	Equipment & Furniture	10,000	3,500	-	-	13,500	4F
				72500	Supplies	6,200	8,000	8,000	8,000	30,200	4G
				74200	AV & Print Production Costs	5,000	15,000	20,000	40,000	80,000	4H
				75700	Training, Workshops & Conf.	14,500	35,000	45,000	45,000	139,500	4I
				74100	Professional services	6,000	3,000	3,000	3,000	15,000	4J
				74500	UNDP Direct Project Services	2,500	1,200	1,200	1,200	6,100	4K
					Total Project Management	**93,200**	**105,700**	**156,100**	**192,200**	**547,200**	
					LDCF – OUTCOMES TOTAL	**2,389,400**	**5,147,100**	**2,234,550**	**1,172,950**	**10,944,000**	
					LDCF- PM TOTAL	**93,200**	**105,700**	**156,100**	**192,200**	**547,200**	
					LDCF PROJECT TOTAL	**2,482,600**	**5,252,800**	**2,390,650**	**1,365,150**	**11,491,200**	

SUMMARY OF FUNDS AND CO-FINANCING:

	Relevant Outputs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	TOTAL
GEF LDCF		**2,482,600**	**5,252,800**	**2,390,650**	**1,365,150**	**11,491,200**
OUTCOME 1: Risks from climate-induced floods and landslides reduced in economic/industrial hubs						
Construction of National Highways						
Construction of Damchu-Chukha bypass road (DANTAK) under Phuentsholing-Thimphu HWY	1.2 & 1.3	3,163,889	3,163,889	3,163,888		9,491,666
Construction of Fafe-Khosala bypass road under Zhemgang-Trongsa HWY		1,994,277	1,994,277	1,994,279		5,982,833
Department of Roads - Operation and Maintenance		88,867	88,867	88,867	88,865	355,466
Expansion of Phuentsholing City						
Phuentsholing Thromde's capital investments for expansion and industrial development	1.1 & 1.2	6,343,216	6,343,216	6,343,216	6,343,216	25,372,864
DGM TA support from Norway	1.2 & 1.3	1,000,000	1,000,000	1,000,000	1,000,000	4,000,000
Sub-total for Outcome 1		**12,590,249**	**12,590,249**	**12,590,250**	**7,432,081**	**45,202,829**
OUTCOME 2: Community resilience to climate-induced disaster risks strengthened						
Mongar water resource expansion	2.1	375,000	375,000	375,000	375,000	1,500,000
Water resource inventory	2.2	120,000	110,000	110,000		340,000
JSP/Tarayana rural development	2.1	175,000				175,000
Tarayana in-kind co-financing	2.1	39,000	39,000	39,000	39,000	156,000
Tarayana's 'livelihood programme'						
Through Helvetas	2.1	178,000	178,000			356,000
Through ADB		157,500	157,500			315,000
CBDRM Capacity Building						
JSP's support in Sarpang and Tsirang Dzongkhags	2.3	87,000				87,000
UNDP/RBAP's support in Zhemgang Dzongkhag		100,000				100,000
WB/GFDRR capacity building and assessment for DDM at the national level		150,000	125,000	125,000		400,000
Sub-total for Outcome 2		**1,381,500**	**984,500**	**649,000**	**414,000**	**3,429,000**
OUTCOME 3: Climate information shared across climate-sensitive sectors on a timely and reliable basis						
DHMS/NWFFWC TA from Finland						
Finnish Meteorology Institute support in weather forecasting	3.1 & 3.2	200,000	200,000	200,000		600,000
Finnish ICIMOD support		108,000				108,000
DHMS Department Budget	3.1 & 3.2	1,300,000	1,300,000	1,300,000	1,300,000	5,200,000
Sub-total for Outcome 3		**1,608,000**	**1,500,000**	**1,500,000**	**1,300,000**	**5,908,000**
Total co-financing		**15,579,749**	**15,074,749**	**14,739,250**	**9,146,081**	**54,539,829**
Total		**18,062,349**	**20,327,549**	**17,129,900**	**10,511,231**	**66,031,029**

Budget Note

Note	Description of cost item
	OUTCOME 1
1A	Cost for Technical Advisor (85 days) for design of RFP for detailed design consultancy for watershed and river protection works in Pasakha, as well as for landslide stabilization works in Phuentsholing, including technical supervision of consulting services and civil works.
1B	International travel cost for the Technical Advisor, 4 missions of US$ 3,000 each over 4 year
1C	Vehicle hire by Phuentsholing Thromde (US$ 53,000 for the entire duration of the project; or US$ 13,250/year); in-country DSA for Technical Advisor during missions (US$ 2,000 / mission); Travel cost for hazard mapping and landslide monitoring by DGM (US$ 41,200)
1D	Fulltime Engineer (1200/month) for technical supervision support to Phuentsholing Thromde as part of the Phuentsholing Implementation Team
1E	Detailed design consulting services for watershed and river protection works in Pasakha, as well as for landslide stabilization works in Phuentsholing (US$250,000); Environmental screening/assessment (US$5,000); Watershed stabilization and river protection works under Pasakha (US$420,000); Landslide stabilization works under Phuentsholing Thromde (US$3,400,000); Laboratory testing for hazard mapping and landslide monitoring by DGM (US$53,000)
1F	Equipment for hazard mapping and landslide monitoring by DGM (US$ 90,000)
1G	Office stationaries and supplies for the Phuentsholing Implementation Team (US$ 2,400/year); Office stationaries and supplies for hazard mapping and landslide monitoring by DGM (US$ 8,400)
1H	Production of technical manual on risk hazard mapping and geotechnical reports and maps (US$ 7,500)
1I	Capacity development of Phuentsholing Thromde urban planners and engineers on civil works procurement, geology, landslide stabilization and river protection works (US$ 160,000); Training of the hazard mapping team, workshops for disseminating research findings and lessons on hazard mapping and landslide monitoring (US$ 17,000)
	OUTCOME 2
2A	• International/ regional expert for rural water harvesting [@US$500/day for 140 days: US$70,000] • International/ regional expert for water resources information management and GIS [US$600/day for 60 days: US$ 36,000]
2B	• Development of technical guidelines and training on the utilization and management of the upgraded, climate-resilient water supply system for Mongar town [US$280/day for 20 days: US$5,600] • Development of watershed management strategy and plan for Yakpugang catchment area [US$280/day for 40 days: US$11,200] • Development of planning process, guidelines and training modules on formulation of dzongkhag/ gewog forest fire management plans and formation of VLFFMGs [US$260/day for 35 days: US$9,100] • Review and update of national forest fire management strategy [US$280/day for 30 days: US$8,400]
2C	Travel cost involved in: (a) airfare of international/ regional expertise [US$ 15,300]; (c) per diem and vehicle hire for field travel by staff of DES/MoWHS [US$ 7,700], Tarayana [US$ 16,150], WRCD/NECS [US$ 6,900], DDM/MoHCA [US$ 16,800], and FFMP/DoFPS/MoAF [US$ 20,750] for monitoring, backstopping and other field activities; and (d) per diem for field travel of dzongkhag staff for field data collection on community-level water resources [US$ 13,500].
2D	Contractual services for companies for technical design and up-gradation plan of Mongar town water supply system and for construction of the system [US$ 465,000].

Note	Description of cost item
2E	Costs of scientific instruments of water flow and quality measurements [US$ 25,000], first-aid/ medical instruments and tools, safety, and search and rescue equipment and tools for Critical Disaster Management Facilities [US$ 150,000], and forest fire gear, equipment and tools [US$ 74,000].
2F	Materials and goods for installation of water harvesting systems in rural settlements (US$ 180,900) and construction of forest fire watch towers (US$ 49,000)
2G	Costs of radio communication and AV equipment for Critical Disaster Management Facilities (US$ 75,000) and of equipment needed for the forest fire water watch and alert system (US$ 4,000).
2H	Office supplies and stationery for production of project-related documents pertaining to rural water harvesting (US$ 5,000), community-level water resources inventory and mapping (US$ 3,800), and CBDRM (US$ 8,000).
2I	Cost of hardware, software and IT supplies for establishment and operationalization of disaster information management system at DDM (US$ 15,000)
2J	Printing production, including cost of layout and design and translation (where relevant) of: (a) bilingual technical manual on rural water harvesting models/ systems [US$ 3,600]; (b) water resource inventory and climate-modelling reports and maps [US$ 4,500]; (c) research reports on wind- and rain-storm hazards and on forest fires [US$ 3,000]; (d) knowledge and training resources, and advocacy/ awareness-raising materials on CBDRM and forest fire management [US$ 58,000]; (e) guidelines, SOPs on CBDRM and forest fire management [US$ 29,500]; and (f) updated National Forest Fire Management Strategy [US$ 2,000].
2K	Training and workshop costs pertaining to climate-resilient water harvesting (US$ 55,000), community-level water resources inventory, mapping and climate-modeling (US$ 27,000), CBDRM (US$ 305,000), and forest fire management (US$ 119,100). These include short-term regional training, in-country training workshops, community training, community sensitization and mobilization meetings, stakeholder consultations, and capacity development support to volunteers.
	OUTCOME 3
3A	International travel for collaborative snow and glacier research (US$ 12,000 over 3 years)
3B	Installation by DHMS of AWS, AWL stations and whole Hydromet network and systems (US$ 255,000); DSA and transport cost for snow and glacier research (US$17,300)
3C	Development of a O&M manual and site station handbook for whole Hydromet network and systems (US$ 22,750); External technical evaluation and recommendations for overall DHMS system performance (US$ 25,000); Development of DHMS internet-based national weather forecast and climate information portal (US$ 20,000); Development of data standards and communication protocols for weather forecasting, disaster warning and emergency response (US$ 25,000); Development of a demand survey and sustainability and cost-recovery strategy for DHMS (US$ 20,000);
3D	Data transfer cost for calibrating and testing hydromet network and NWFFWC systems (US$ 4,000); production of a capacity development plan and national framework for climate change adaptation (US$15,000)
3E	Snow and glacier research equipment & extension KITs (US$ 15,000); Establishing Automatic Weather Stations at 60 locations (US$ 1,900,000); Establishing Automatic Water Level Stations at 45 locations (US$ 1,300,000); Upgrading National Weather Forecasting and Flood Warning Centre (US$ 75,000); Establishing two river basin control rooms (US$ 22,000); Establishing data back-up system (US$ 20,000)
3F	O&M manual and site station handbook (US$ 4,500); publications on climate change adaptation and resilience experiences for cross-sectoral evidence-based policy influencing, planning and mainstreaming (US$ 20,000)
3G	Capacity development: DHMS technical staff at HQ and field on AWS, AWLS, NWFFWC and ICT systems - operation, repair and maintenance (US$ 70,000); snow and glacier research (US$ 6,800); river basin modelling (US$ 16,000); DHMS on climate data processing, modelling, interpretation and demand supply - focus on weather forecasting, climate data availability and disaster management (US$ 100,000); demand sensitization workshops (US$ 10,000); multi-stakeholder capacity development workshops (US$ 100,000)
3H	Approximately 2.8% of the total project budget is allocated for contingencies related to inflation, currency exchange fluctuations and other external shocks and contingencies, which would increase the cost of travel and materials.

Note	Description of cost item
	PROJECT MANAGEMENT
4A	Senior Programme Officer at the PMU within NECS (US$ 750/month) for 48 months
4B	National consultant for external mid-term evaluation (US$10,000 lump sum) and terminal evaluation (US$10,000 lump sum)
4C	International consultant for external mid-term evaluation (US$20,000 lump sum) and terminal evaluation (US$25,000 lump sum)
4D	Fuel and operational expenses for NEC vehicle to be used for PM (US$ 16,000); DSA of NEC project management staff (US$ 8,000); vehicle rental (US$ 8,000)
4E	Development of baselines for selected outcome indicators (US$ 15,000); monitoring studies and progress assessments (US$ 11,000); Capturing and documenting lessons, good practice and producing strategic recommendations (US$ 103,900)
4F	Office and field monitoring equipment (US$ 13,500)
4G	Stationery & other office supplies (US$ 30,200)
4H	Production of research documents, knowledge products and project reports (US$ 80,000)
4I	Capacity development of project stakeholders, workshops, seminars, conferences (US$ 108,500); Inception workshop and annual progress review meetings (US$ 31,000)
4J	HACT assessment in Year 1 (US$ 3,000); Annual audit (US$ 3,000/year)
4K	Recruitment and contract management of Senior Programme Officer for the PMU in NECS; recruitment and contract management of the Technical Advisor; recruitment and contract management of the consulting team for the detailed design of flood protection and landslide mitigation works under Outcome 1; procurement of goods required for the delivery of the different outcomes under the project, as requested by the implementing partners. DPC will be charged annually based on Universal Price List/Local Price List. LOA for UNDP support services will be finalized during Inception workshop.

5 Management Arrangements

5.1 Project Execution and Oversight

164. The project will be nationally executed in accordance with the National Execution (NEX) Manual agreed between the UNDP and Royal Government of Bhutan (RGoB). National execution is an arrangement whereby the government, in principle, assumes full ownership and responsibility for the formulation and effective management, or execution, of all aspects of UNDP-assisted projects and programmes. It implies that all management aspects of the project are the responsibility of the national authority. However, the national authority remains accountable to UNDP for production of the outputs, achievement of objectives, use of resources provided by UNDP, and financial reporting. UNDP Bhutan in turn remains accountable for the use of resources to the UNDP Executive Board and the project donors.

165. The project will be implemented over a period of four years beginning in the first quarter of 2014, more or less at the same time RGoB's Eleventh Five-Year Plan will commence in practice (budgets are foreseen to be approved by the newly elected Government by fourth quarter 2013). At the policy and upstream management level, a **Project Board** (PB) will be established to provide high-level guidance and oversight to the project. The PB will be chaired by the Government Secretary of the NEC and made up of senior representatives from all key national implementing agencies, UNDP and other key partner agencies such as JICA. The PB will be responsible for high-level management decisions and policy guidance required for implementation of the project, including recommendations and approval of project plans, budget and revisions. The PB decisions are to be made in accordance to standards that ensure efficiency, cost-effectiveness, transparency, effective institutional coordination, and harmony with overall development policies and priorities of the Royal Government of Bhutan, UNDP and their development partners. The ToR for the Project Board is presented in Annex 12.

166. At the operational and programmatic level, the project will be supported by a **Technical Advisory Group** (TAG). The TAG, will be a multi-disciplinary team of technical people from various government agencies and implementing partners, to provide technical advice and support to the project. Such a group is deemed necessary especially given the technical intricacy of various project interventions and that no single agency is self-sufficient in the technical expertise that would be required for guidance in the implementation of these interventions. Key tasks of this group will be to: ensure the technical soundness of the planned activities, in particular those involving civil works; ensure technical coordination between various implementing agencies, where such coordination is necessary and where opportunities for synergy exist; provide guidance where technical issues are confronted; and ensure that the project activities are carried out in accordance with existing technical standards and norms. It will be chaired by the Project Director. The ToR for the Technical Advisory Group is presented in Annex 12.

167. For project implementation monitoring and support a **Project Working Group** (PWG) will be established of which all responsible parties are member. The PWG will meet on a quarterly basis and will present and discuss progress in terms of achievements as well as financial. The PWG will also coordinate and contribute to project progress reporting of the PMU. The ToR of the PWG is presented in Annex 12.

5.2 Project Management Unit

168. The National Environment Commission Secretariat will host the **Project Management Unit** (PMU). The PMU will be responsible for overall coordination with the various national implementing agencies for the delivery of project outputs in a timely and effective manner. It will facilitate project-related planning activities such as preparation of annual work plans and be responsible for overall project monitoring and reporting. ToR for the PMU is detailed in Annex 12.

169. The PMU will be made up of the following positions:

- **Project Director** for operational direction, supervision and management of the project. This position will be held by the Chief of the chosen Division of NECS;
- **Project Manager** for coordination, monitoring and reporting of project activities. A mid-level professional from the chosen Division of NECS will be appointed as the Project Manager;
- **Project Support Officer** for project administration and day-to-day support to project management. An additional staff will be recruited for this position on a contract basis for the full duration of the project;
- **Project Accountant** for management of project funds and their delivery to the various national implementing agencies. An accountant of the government agency housing the PMU will be appointed as the Project Accountant;

5.3 Responsible Parties

170. The NEC has designated the following agencies as Responsible Parties who will bear a direct responsibility for the achievement of relevant Outputs:

Phuentsholing Thromde

171. Phuentsholing Thromde is the local municipal authority for administration and delivery of urban development services in Phuentsholing township. The Thromde has an in-house engineering section responsible for all urban development works within its extended municipal administrative boundaries. Because the flood protection measures to be constructed in Barsa water shed and -river under **output 1.1** and the slope stabilization works to be constructed under **output 1.2** are within the municipal boundary, the Phuentsholing Thromde is the most appropriate agency to take responsibility for implementation of Outputs 1.1 and 1.2. The Phuentsholing Thromde will establish a Project Technical Team (PTT) headed by a Project Engineer (Head of the engineering section of Phuentsholing Thromde) with one full-time engineers and one part-time engineer (both LDCF funded). Because of the high technical expertise required the design work of stabilization and flood protection measures will be outsourced to a consulting firm (with international expertise included), who will also supervise the construction works. The PTT will supervise the consulting team as well as conduct overall quality monitoring of all construction works. The PTT will receive technical guidance from DES/MoWHS and DGM/MoEA, both of which have been involved in the design of outputs 1.1 and 1.2 during the PPG stage. PTT will also ensure coordination amongst identified baseline and co-financing projects within the larger Phuentsholing area to ensure identified synergy and complementary will materialize.

Mongar Municipal Authority

172. Mongar municipal authority will be responsible for implementation of the climate resilient and up-scalable water supply system in Mongar Municipality under **output 2.1** in accordance with the technical design and recommendations of the UISD/MoWHS. The fund flow for activity implementation from the LDCF project (PIU) will be directly to Mongar Municipality, similar to Phuentsholing Thromde under outcome 1.

Tarayana Foundation

173. The Tarayana Foundation is a registered civil society organization and works primarily with marginal communities in the rural areas to improve their livelihoods and quality of life. It will be responsible for the implementation of the community-led approach for developing innovative rural water harvesting solutions in four Dzongkhags under **output 2.1** (water harvesting, storage and distribution systems).

Water Resources Coordination Division, National Environment Commission Secretariat

174. The WRCD will be the lead agency for the implementation of **output 2.2** (water resources inventory in four dzongkhags). It will coordinate with other water-related agencies such as the Department of Hydro-Meteorology Services, the Watershed Management Division of the Department of Forests and Park Services, as well as with the respective dzongkhags for synergy. WRCD will also ensure coordination amongst identified baseline and co-financing projects to ensure these are all geared towards successful implementation of the water resource inventory.

Department of Disaster Management, Ministry of Home and Cultural Affairs

175. The DDM has the overall mandate for policy support, coordination and technical assistance in the field of disaster risk management, including those emanating from climate events. It will be the lead agency for the implementation of **output 2.3** (community-based disaster risk management) except for forest fire management. DDM will also ensure coordination amongst identified baseline and co-financing projects to ensure identified synergy and complementary for implementation of the DM Act will materialize.

Forest Fire Management Section, Ministry of Agriculture and Forests

176. The FFMS under the Department of Forests and Park Services is the national agency responsible for management and protection of forest resources against wild fires. The FFMS will be the lead agency responsible for implementation of the **forest fire management aspects of output 2.3** (community-based disaster risk management).

Department of Hydrometeorology Services, Ministry of Economic Affairs

177. The DHMS has been established with the objective to observe and understand weather, climate and hydrology, and provide meteorological and hydrological data and information for sustainable planning and development, environmental conservation, and disaster risk management. The department will be the lead implementing agency for **outputs 3.1 and 3.2**, concerning the establishment of the nationwide hydro-met network, the NWFFWC and the provision of localized weather forecasts and climate information. DHMS will also ensure coordination amongst identified baseline and co-financing projects to ensure identified synergy and complementary of provided support will materialize.

National Environment Commission Secretariat

178. The NECS as overall responsible agency in Bhutan for climate change adaptation, will be responsible for implementation of **output 3.3**, knowledge management, cross-sector coordination and evidence-based policy influencing on climate resilience. The NECS is also responsible for overall project implementation and management, as discusses above under 'Project Management Unit', as well as for ensuring coordination amongst responsible parties and with base-line and co-financing projects.

179. See Annex 13 for a schematic presentation of the project management arrangement.

5.4 Technical Support and Guidance

179. The following central government agencies will have a direct role in providing technical support and guidance to the national implementing agencies:

Department of Geology and Mines, Ministry of Economic Affairs

180. The DGM is the agency primarily dedicated to technical assistance in the field of geology and mines, including geo-tech assessments and management of geo-hazards. The DGM will be responsible for the implementation of **output 1.3** (geo-hazard risk assessment and mapping of four critical areas in the country), as well as for **output 1.4** (thresholds for landslide slope failure determined in different geological zones, through research correlating geological instability with rainfall data from weather stations). DGM will furthermore be responsible to provide technical guidance to Phuentsholing Thromde for implementation of outputs 1.1 and 1.2, including on the documentation of good practice and approaches for up-scaling.

Flood Engineering and Mitigation Division, Ministry of Works and Human Settlement.

181. The FEMD is a recently established division responsible for technical assistance in the field of flood modeling and engineering. The division conducted the preliminary assessment of the Barsa watershed and river, for the design of output 1.1. The FEMD will not have direct implementation responsibilities, but will provide technical guidance to Phuentsholing Thromde for the implementation of output 1.1, including on the documentation of good practice and approaches for up-scaling.

Urban Infrastructure Services Division, Ministry of Works and Human Settlement

182. The UISD is a division responsible for urban water supply and has been involved in the design of the climate resilient water supply system of Mongar Municipality during the PPG phase. The UISD will not have direct implementation responsibilities, but will provide technical guidance to Mongar Municipality for the detailed design and implementation of output 2.1, including on the documentation of good practice and approaches for up-scaling.

Dzongkhag Administrations of Mongar, Tsirang, Pema Gatshel and Samtse

183. Outputs 2.1, 2.2, 2.3 and 2.4 will be implemented within the administrative boundaries of these four Dzongkhags. The Dzongkhag Administration will not have direct implementation responsibilities, but will provide facilitation support to responsible parties for the implementation of the concerned outputs, including on the development of good practice and approaches for up-scaling within the dzongkhags.

Technical Advisor

184. Because of the high specialist nature of the river protection and landslide stabilization works to be designed and constructed under Outcome 1, an international expert will be recruited to develop the detailed TORs, technical specifications and the tender package for the consultancy firm who will do the detailed design of the flood protection measures and landslide stabilization measures in Phuentsholing and Pasakha. This international expert will also be engaged in validation of the technical designs, in yearly periodic technical supervision and monitoring support of the construction works (mitigation measures) and in documentation of lessons and good practice. The main function of this position will thus be to technically assist and advise the PMU and the national implementing agencies on the technical aspects of implementation of outcome 1. The ToR of the international expert is provided in Annex 12.

185. In addition to the above agencies and the Project Technical Advisor, the project will field technical consultants for the implementation of various outputs. The ToRs of these consultants are provided in the respective Annexes.

5.5 Audit Arrangements

186. In keeping with the HACT Framework, the project will be audited at least once in its lifetime. The Royal Audit Authority (RAA) will be responsible for carrying out audit(s) of the project. The RAA will use its own auditors to carry out the project audit(s). However, in instances if such arrangement is not feasible, project audit may be carried out by an external auditor engaged by the RAA. The RGoB will be responsible for covering the cost of project audit. However, UNDP may exceptionally approve the use of project funds if the audit is carried out by an external auditor. In such case, the project must include adequate financial provision for the audit in its budget. The RAA, however, will remain the responsible agency for the project audit.

187. The Ministry of Finance (MoF) and UNDP will be responsible for initiating, facilitating and coordinating the audit process. The MoF, in consultation with UNDP, will schedule the project for audit and include it in the list of the projects to be audited in a given year when an audit of the project is due or deemed necessary. The MoF and UNDP will convey, well in advance, the schedule of the project audit to the PMU and other national project implementing authorities and to the RAA for necessary action. The RAA will conduct the project audit in the manner prescribed in the RGoB's "General Auditing Rules and Regulations of Bhutan" and in conformity with UNDP Guidelines (and HACT Framework) and internationally accepted common auditing standards[28]. The project will be audited in accordance with UNDP Financial Regulations and Rules and Audit Policies.

5.6 UNDP Direct Project Support Services

188. Apart from the standard project implementation support and oversight provided by UNDP to the implementation of GEF projects, as outlined above under 'Project Execution and Oversight', the UNDP may provide the following specific support services on the request of the Royal Government of Bhutan.

[28] International Standards on Auditing published by the International Federation of Accountants.

The services are charged on an item by item basis against UNDP's Universal Price List (UPL) and during the inception phase of the project, the request will be formalized in the form of a Letter of Agreement (LoA).

- Recruitment and contract management of Project Support Officer for the PMU in NECS;
- Recruitment and contract management of the international Technical Advisor under Outcome 1;
- Recruitment and contract management of the consulting team for the detailed design of flood protection and landslide mitigation works under Outcome 1;
- Procurement of goods required for the delivery of the different outcomes under the project, as requested by the implementing partners.

6 Monitoring and Evaluation Framework

189. 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 3 of this project document is aligned with the AMAT and UNDP M&E frameworks.

6.1. Project Inception and Implementation

190. A Project Inception Workshop will be conducted within two months from the date of commencement of the project. This workshop will involve the full project team, implementation partners, co-financing partners, the UNDP-CO and representation from the UNDP Regional Advisor, as well as UNDP HQ as appropriate.

191. A fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's strategic results framework (SRF). This will include reviewing the SRF (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

192. Additionally, the Project Inception Workshop will: (i) introduce project staff with the UNDP-GEF team which will support the project during its implementation, namely the CO and responsible UNDP/GEF Regional Advisor; (ii) detail the roles, support services and complementary responsibilities of UNDP-CO and RCU staff vis à vis the project team; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR), Tripartite Review Meetings, as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the project team on UNDP project related budgetary planning, budget reviews, and mandatory budget rephasings.

193. The Workshop will also provide an opportunity for all parties to understand their 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 and decision-making structures will be discussed again, as needed, in order to clarify for all, each party's responsibilities during the project's implementation phase.

6.2. Monitoring and Reporting

194. The Project Management Unit in conjunction with the UNDP-GEF team will be responsible for the preparation and submission of the following reports that form part of the monitoring process:

Inception Report

195. A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed Annual Work Plan for the first year divided in quarterly time-frames detailing the

activities and progress indicators that will guide implementation during the first year of the project. This Work Plan would include the dates of specific field visits, support missions from the UNDP-CO, the UNDP/GEF Regional Advisor or consultants, as well as time-frames for meetings of the project's decision making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

196. The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may affect project implementation. When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, the UNDP Country Office and UNDP/GEF Regional Advisor will review the document.

Annual Project Report (APR)

197. The APR is a UNDP requirement and part of UNDP's Country Office central oversight, monitoring, and project management. It is a self-assessment report by project management to the CO and provides input to the country office reporting process and the ROAR, as well as forming a key input to the Tripartite Project Review. An APR will be prepared on an annual basis prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work.

198. The format of the APR is flexible but should include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome;
- The constraints experienced in the progress towards results and the reasons for these;
- The three (at most) major constraints to achievement of results;
- AWP, CAE and other expenditure reports (ERP generated);
- Lessons learned;
- Clear recommendations for future orientation in addressing key problems in lack of progress.

199. Each of the responsible parties (for all outputs) will develop the APR for his/her output and submit these to the Project Management Team, who will then compile the individual reports in one overall project APR.

Project Implementation Review (PIR)

200. The PIR is an annual monitoring process mandated by the GEF and conducted in an online/web-based format. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by the CO together with the national project management team. The PIR cycle is from July-June and ideally prior to the TPR. The

PIR should then be discussed in the TPR so that the result would be a PIR that has been agreed upon by the project, the executing agency, UNDP CO and the Bangkok Regional Center.

Quarterly Progress Reports

201. Short reports outlining main updates in project progress will be provided quarterly to the UNDP Country Office, who will share these with the UNDP-GEF regional office.

Periodic Thematic Reports

202. As and when called for by UNDP, UNDP-GEF or the Implementing Partner, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNDP and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. UNDP is requested to minimize its requests for Thematic Reports, and when such are necessary will allow reasonable timeframes for their preparation by the project team.

6.3. Independent Evaluations

Mid-Term Evaluation

203. An independent Mid-Term Evaluation of the project will be conducted after completion of the first two years. The Mid-Term Evaluation 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 evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-EEG, and in line with UNEG Guidelines. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

Terminal Evaluation

204. Three months prior to the final Project Board meeting, an independent Terminal Evaluation will take place in accordance with UNDP and 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 Evaluation, if any such correction took place). It 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-EEG, and in line with UNEG Guidelines.

205. 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). The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation. 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.

6.4. Indicative M&E Work Plan and Budget

The indicative monitoring and evaluation plan and corresponding budgets is provided in Table 5 below.

Type of M&E activity	**Responsible Parties**	**Budget US$ (excluding project team staff time)**	**Time frame**
Inception Workshop (IW)	PMU UNDP CO UNDP HQ	5,000	Within first two months of project start up
Inception Report	PMU UNDP CO	Included in the workshop budget	Immediately following IW
Measurement of Means of Verification for Project Purpose Indicators	PMU will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members	tbd	Start, mid and end of project
Measurement of Means of Verification for Project Progress and Performance (measured on an annual basis)	Oversight by UNDP CO/GEF Regional Advisor and Project Director Measurements by national implementing agencies at central and local levels	tbd	Annually prior to APR/PIR and to the definition of annual work plans
APR and PIR	PMU UNDP-CO UNDP-GEF	None	Annually
TPR and TPR report	Government Counterparts UNDP CO PMU UNDP-GEF Regional Advisor	None	Every year, upon receipt of APR
Project Board Meetings	PMU UNDP CO	None	Following Project IW and subsequently at least once a year

Technical Advisory Group Meetings	PMU UNDP CO	None	At least twice a year during project duration
Annual Review and Planning Meetings	PMU UNDP CO	32,000	Once a year 8,000
Periodic status reports	PMU	12,000	To be determined by the PMU and UNDP CO, yearly 3,000
Technical reports	PMU Hired consultants as needed	Tbd	To be determined by the PMU and UNDP-CO
Mid-term External Evaluation	PMU UNDP- CO UNDP-GEF Regional Advisor External Evaluators (i.e. international/ national consultants)	30,000	Two years after project implementation.
Terminal Evaluation	PMU UNDP- CO UNDP-GEF Regional Advisor External Evaluators (i.e. international/ national consultants)	30,000	At the end of project implementation
Terminal Report	PMU UNDP-CO	None	At least one month before the end of the project
Lessons learned / Knowledge Management	PMU UNDP-GEF Regional Advisor (suggested formats for documenting best practices, etc)	120,000	Yearly 30,000
Audit	UNDP-CO Project team	15,000	To be determined by the PMU and UNDP CO
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	UNDP Country Office UNDP-GEF Regional Advisor (as appropriate) PMU, National Implementing Agencies		as and when necessary
TOTAL INDICATIVE COST Excluding project team staff time and UNDP staff and travel expenses		**US$ 244,000**	

Table 5, Indicative project monitoring and evaluation plan and corresponding budgets

7 Legal Context

This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Royal Government of Bhutan and the United Nations Development Programme, signed by the parties on 14 July 1978. The host country implementing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government co-operating agency described in that Agreement.

The UNDP Resident Representative in Thimphu is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP-GEF Unit and is assured that the other signatories to the Project Document have no objection to the proposed changes:

(a) Revision of, or addition to, any of the annexes to the Project Document;
(b) Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
(c) Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
(d) Inclusion of additional Annexes and attachments only as set out here in this Project Document.

List of Annexes

Annex 1:	**Climate Change scenarios for Bhutan**
Annex 2:	**Stakeholder Consultation Process**
Annex 2.1:	National Stakeholders Consultative Workshop on Strengthening Hydro-met Services
Annex 3:	**Flood protection measures for Pasakha Industrial Area**
Annex 3.1:	Technical Report FEMD
Annex 3.2:	Draft ToR of FEMD on Pasakha protection measures (reference only)
Annex 4:	**Landslide stabilization in Phuentsholing – Rinchending area**
Annex 5:	**Selection of areas for integrated geo-hazard assessment and mapping**
Annex 6:	**Mongar Municipality climate resilient water supply design**
Annex 7:	**Climate resilient water harvesting for rural areas**
Annex 8:	**Water resource inventory**
Annex 9:	**Capacity Development of local Disaster Management Institutions**
Annex 10:	**Capacity Development for Forest Fire Management**
Annex 11:	**Design and Capacity Development Hydromet network and NWFFWC**
Annex 12:	**Project Staffing, Consultants and Outline ToRs**
Annex 13:	**Project Implementation Organogram**
Annex 14:	**Project Risks and Risk Mitigation Matrix**
Annex 15:	**Environmental and Social Screening Report**
Annex 16:	**Co-financing Agreements**