



UNDP Project Document

Government of Bhutan

United Nations Development Programme

PIMS no. 3722

**Reducing Climate Change-induced Risks and Vulnerabilities from
Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys**

Brief description

The most significant climate change impact in Bhutan is the formation of supra-glacial lakes due to the accelerated retreat of glaciers with increasing temperatures. The risk of potential costly economic damages on key development sectors such as agriculture, hydropower, and forestry by Glacial Lake Outburst Floods (GLOFs) is mounting. Climate change is attributed as the primary reason that water levels in glacial lakes approach dangerous thresholds. This poses a new dimension to the existing range of threats to lives, livelihoods, and development. The objective of this project is the reduction of climate change-induced Glacial Lake Outburst Flooding (GLOF) risk in the Punakha-Wangdi and Chamkhar Valleys in Bhutan. Recognizing the need for systematizing the country's disaster risk management system to account for climate change induced GLOF hazards, the Government of Bhutan seeks to integrate long-term climate change-induced risks into the existing disaster risk management framework. readjust it with a view on greater effectiveness and longer term planning. The project will integrate climate risk projections into existing disaster risk management practices and implement corresponding capacity development measures. It will demonstrate practical measures to reduce climate change-induced GLOF risks from the potentially dangerous Thorthormi glacier lake, and facilitate replication of the respective lessons learned in other high-risk GLOF areas, both within and outside Bhutan. Complementary to this risk reduction effort, the project will ensure that early warning mechanisms for the Punakha-Wangdi Valley, which is currently not equipped to handle the full extent of potential GLOF risks, is expanded to incorporate coverage of this growing threat. Lessons learned from this initiative will enable upscaling of early warning systems in other disaster-prone areas downstream of potentially hazardous glacier lakes.

Table of Contents

ACRONYMS.....	III
SECTION I: ELABORATION OF THE NARRATIVE.....	1
PART I: SITUATION ANALYSIS.....	1
<i>Summary</i>	1
<i>Context</i>	2
<i>Baseline Analysis</i>	4
<i>Threats, Root Causes, and Barriers Analysis</i>	6
<i>Stakeholder Analysis</i>	9
PART II: STRATEGY	11
<i>Institutional, Sectoral, and Policy Context</i>	11
<i>Project Rationale and Policy Conformity</i>	12
<i>Project Goal, Objective, Outcomes and Outputs/activities</i>	13
<i>Project Indicators, Risks, and Assumptions</i>	19
<i>Expected National and Local Adaptation Benefits</i>	19
<i>Country Ownership: Country Eligibility and Country Drivenness</i>	20
<i>Sustainability</i>	20
<i>Replicability</i>	20
PART III: MANAGEMENT ARRANGEMENTS	21
PART IV: MONITORING AND EVALUATION PLAN AND BUDGET	22
PART V: LEGAL CONTEXT	29
SECTION II: STRATEGIC RESULTS FRAMEWORK (SRF) AND GEF INCREMENT	31
PART I: STRATEGIC RESULTS FRAMEWORK, SRF (FORMERLY GEF LOGICAL FRAMEWORK) ANALYSIS	31
PART II: ADDITIONAL COST ANALYSIS	40
<i>Project Background</i>	40
<i>Additional Cost Assessment</i>	40
SECTION III: TOTAL BUDGET AND WORKPLAN	43
SECTION IV: ADDITIONAL INFORMATION	46
PART I: OTHER AGREEMENTS	46
PART II: ORGANIGRAM OF PROJECT.....	46
PART III: TERMS OF REFERENCE FOR KEY PROJECT GROUPS, STAFF, AND SUB-CONTRACTS.....	47
PART IV: STAKEHOLDER INVOLVEMENT PLAN	58
PART V TO X: OTHER ADDITIONAL INFORMATION	ERROR! BOOKMARK NOT DEFINED.
ANNEXES.....	68
ANNEX 1: List of Baseline Studies and Reports on Initiatives to Reduce GLOF Risks.....	68
ANNEX 2: Hazard Zonation Maps and Vulnerability of Punakha-Wangdi Valley Communities.....	71
ANNEX 3: Hazard Zonation Maps of Chamkhar Valley.....	74
ANNEX 4: Assessment for the GLOF Early Warning System in Punakha-Wangdi Valley.....	78
ANNEX 5: Ongoing Disaster and Climate Risk Management Programs Relevant to the Proposed Project.....	104
ANNEX 6: Socio-Economic Data in Bhutan.....	107
ANNEX 7: GLOF Risk in the Lunana Region of Bhutan.....	108
ANNEX 8: Preliminary Design and Feasibility of GLOF Risk Mitigation at Thorthormi Lake.....	111
ANNEX 9: Reports of Stakeholder Consultations during the PPG Phase.....	147
ANNEX 10: Budget Notes.....	168
ANNEX 11: Adaptation Learning Mechanism: Lessons Learned Note – PPG Phase.....	173
ANNEX 12: Endorsement and Co-Financing Letters.....	182

Acronyms

APF	Adaptation Policy Framework
ALM	Adaptation Learning Mechanism
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
CBOs	Community-Based Organizations
CCA	Common Country Assessment
CRM	Climate Risk Management
DADM	Department of Aid and Debt Management
DDMC	Dzongkhag Disaster Management Committee
DGM	Department of Geology and Mines
DMD	Disaster Management Division
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ELOS	Extended Line of Sight
EWS	Early Warning System
GDMC	Gewog Disaster Management Committee
GEF	Global Environment Facility
GLOF	Glacial Lake Outburst Flood
IEC	Information, Education, and Communications
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
MDG(s)	Millennium Development Goal(s)
NAPA	National Adaptation Programs of Action
NCDM	National Committee for Disaster Management
NDRMF	National Disaster Risk Management Framework
NGO	Non-Governmental Organization
PB	Project Board
PM	Project Manager
PMU	Project Management Unit
PRSP	Poverty Reduction Strategy Paper
PSC	Project Steering Committee of the PPG phase
RGOB	Royal Government of Bhutan
SAARC	South Asian Association for Regional Cooperation
SNC	Second National Communication
TSAT	Technical Support and Advisory Team
UNDP	United Nations Development Program
UNDAF	United Nations Development Assistance Framework
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations
V&A	Vulnerability and Adaptation
VRA	Vulnerability Reduction Assessment

SECTION I: ELABORATION OF THE NARRATIVE

PART I: Situation Analysis

Summary

1. Bhutan's development is highly dependent on climate-sensitive sectors such as agriculture, hydropower and forestry. The most significant climate change impact in Bhutan is the formation of supra-glacial lakes due to the accelerated retreat of glaciers with increasing temperatures. The risk of potential disasters inflicted by Glacial Lakes Outburst Floods (GLOFs), which pose a new dimension of threats to lives, livelihoods and development, is currently mounting as the water levels in several glacier lakes approach critical geostatic thresholds. Although current (baseline) disaster management policies, risk reduction and preparedness plans in Bhutan are able to address recurrent natural hazards in the country, they are not yet geared to deal with the new dimension of GLOF threats.
2. At the individual and organizational level, there are capacity deficits on the expected distribution and effects of potential GLOF impacts and on the changing requirements this poses on early warning systems. Current disaster mitigation and preparedness initiatives (including early warning systems) are not geared for the efficient management of risks by rising water levels in glacier lakes, nor to trigger early warning of potentially dangerous drainage segment downstream of potentially hazardous glacier lake overflows.
3. Addressing these constraints, the components of the proposed project comprise the three most urgent priorities from the recently concluded National Adaptation Programme of Action (NAPA) process in Bhutan. Recognizing the need for systematizing this disaster risk management system to account for GLOF hazards, the Government of Bhutan seeks to integrate long-term climate change induced risk planning into the existing disaster risk management framework and readjust it with a view on greater effectiveness and longer-term anticipatory capacities. The project will integrate climate risk projections into existing disaster risk management practices and implement corresponding capacity development measures on different levels (national, district and community). The project will demonstrate a practical approach to reduce GLOF risks from Thorthormi glacier lake, which has a worst-case-scenario outburst projection as early as 2010 and thus is one of Bhutan's most dangerous glacier lakes. The lessons learned in this climate change risk reduction project will facilitate replication of GLOF risk reduction in other high risk areas, both within and outside Bhutan. Complementary to this demonstration, the project will ensure that the existing early warning system in the Punakha-Wangdi Valley, which is also among the most vulnerable valleys downstream of potentially hazardous glacier lakes and currently not equipped to handle the full extent of potential GLOF risks, is expanded to take sufficient account of this growing risk. Lessons learned from this initiative will enable up-scaling of early warning systems in other disaster-prone areas downstream of potentially hazardous glacier lakes.
4. At the national level, the expected adaptation benefits of this project include improved government capacity to deal with dynamic, climate-induced hazards and to design, implement, evaluate and replicate systems for GLOF risk reduction and preparedness. Vulnerability of communities in high risk GLOF areas will be reduced as the project will catalyze cost-effective management of glacier lake levels and adjustment of communal early-warning systems to climate change-induced hazards.
5. Without LDCF support, vulnerable communities in Bhutan will face an increased risk of climate-induced GLOFs. The National Disaster Management Framework will have insufficient capacity to deal with dynamic vulnerabilities that grow as temperature increases and water levels in glacier lakes

in Bhutan reach critical, disaster-prone thresholds (scientific evidence suggests such critical developments as little as 3 years away). The baseline scenario is that government and disaster management authorities in Bhutan manage recurrent risks based on seasonality and historic hazard occurrences. They will remain unprepared (in terms of technical capacity and tried and tested options) to systematically adjust planning and management frameworks to the new climate risk dimension.

6. The proposed project ensures that Bhutan's disaster management framework does not get stuck in a baseline stage, where hazard mapping exercises and disaster management activities reflect a static, short-term, and reactive approach. As glacier lake levels in Bhutan are linked to climate change projections, activities are necessary to build capacity, demonstrate, and adjust systems to safeguard against new and additional risks. LDCF support will be instrumental in demonstrating a specific model of vulnerability reduction which could then be replicated in other disaster-prone areas. In particular, LDCF support will enable adaptation of national, regional, and local disaster management procedures to growing GLOF risk, demonstration, and replication of GLOF mitigation by glacier lake input/output management, and adaptation of early warning systems to the new risk patterns downstream of potentially hazardous glacier lakes.
7. The project is based on UNDP's comparative advantage in capacity building. Since 2004, UNDP has supported disaster-risk management in Bhutan through institutional capacity development at all levels and with a range of stakeholders from different government departments. The project will be able to efficiently connect to the central policy processes that currently shape Bhutan's approach on how to deal with future climatic hazards. UNDP's Bureau for Crisis Prevention and Recovery (BCPR) supports national counterparts to develop both a disaster risk perspective and the human, financial, technical, and legislative capacity; civil society preparedness; and coordination systems required to effectively manage and reduce risk. In an effort to promote integrated development approaches, UNDP brings together partners working on both climate change and disaster risk reduction. Hence, the project will be able to efficiently connect to the central policy processes that currently shape Bhutan's approach on how to deal with future climatic hazards.

Context

8. Bhutan's entire northern upper land has glacier/snow-fed lakes in the mountaintops. With a majority of Bhutan's population and infrastructure development concentrated in large river valleys, climate-induced GLOFs could cause significant human and economic devastation. Of the range of hazards that Bhutan is vulnerable, none is more significant than the formation of supra-glacial lakes due to the accelerated retreat of glaciers. Rising mean temperature, attributed by the scientific community to climate change, is the main cause of glacial retreat. According to the IPCC's Fourth Assessment Report, eleven of the last twelve years (1995 -2006) rank among the 12 warmest years in the history of global surface temperatures records since 1850¹. These rapid changes are correlated with a faster rate of glacier melt. The result of these changes is that glaciers in Bhutan are receding at a rate of almost 30-60 meters per decade. The melting ice from these receding glaciers is increasing the volume of water in glacial lakes, and the melting of ice-cored dams is destabilizing them, pushing the hazard risk for GLOFs to critical levels.
9. Seasonal climatic variations have become more pronounced in Bhutan. Numerous scientific studies highlight greater variability in rainfall and temperature over the past decades, and that there is

¹ IPCC, 2007. *Climate Change 2007: The Physical Science Basis – Summary for Policy Makers*. Geneva: WMO and UNEP. The IPCC projects that temperatures will continue to rise by 0.2°C per decade, with an increase by the end of the century of up to 4°C, as compared to the period between 1980-1999. Temperature increases range from 1.1-6.4°C depending on the scenario used, with a best estimate of 1.8-4.0°C.

significantly greater warming at higher elevations.^{1, 2} On average, air temperatures in the Himalayas are 1°C higher now than in the 1970s, rising by 0.06°C per year.³ There is a direct correlation between the increases in spring land temperatures and decreases in the spring snow cover. Satellite records show a significant decrease in snow cover by about 10% since 1966 in the northern hemisphere.⁴ Precipitation is increasingly falling as rain and further contributing to increasing water levels in glacial lakes. Rainfall in Bhutan's is driven by the Indian summer monsoon cycle. The period from 1990-2003 was marked by exceptionally high rainfall years as in 1998, 2000, and 2002, while a drought struck in 2001.⁵ With massive flood induced landslide disasters in 2000, 2003, and 2004,⁶ there has been sufficient evidence that underscores the need for planning increasing climate variability in the future.

10. Temperatures in Bhutan are expected to rise steadily through the early to the middle of the 21st century. With increasing seasonal precipitation variability, the threats of monsoonal rain flooding and rain-triggered landslides have increased. Increasing proportions of precipitation will likely fall as rain rather than snow, and precipitation is likely to occur in more intense and erratic events, worsening risk of floods. Glaciers will also continue to melt, increasing flood risks.
11. This increased risk of GLOFs threatens lives and livelihood resources in Bhutan. A significant portion of the country's revenue is derived from hydropower, which has involved huge investments in infrastructure and requires sustainable water resources. The Basochu hydropower project and upcoming Punachangchu hydroproject are located in the Punakha-Wangdi Valley and Chamkhar Valley (see Annex 6). The revenue from hydropower export to India constitutes 45% of the country's revenue, with projections that this share will increase to 60%.⁷ While hydropower is the backbone of the economy, other sectors are highly vulnerable to the adverse effects of climate change, including GLOF risks. For example, heavy monsoon floods in the year 2000 negatively affected economic growth by more than 2%.⁸ Agriculture in Bhutan provides livelihoods and employment to 79% of the population. The majority of the people practice subsistence farming on marginal lands with average land holdings ranging from 1-4 acres⁹, which are extremely vulnerable to flood impacts.
12. The proposed project will address climate risks in two Sub Basins—Pho Chhu and Chamkar Chhu—which represent the two most GLOF-vulnerable areas in the country and pose a major threat to life and infrastructure in downstream communities in the Punakha-Wangdi and Chamkhar valleys respectively (see hazard zonation maps in Annex 2 and Annex 3). Approximately 10% of the Bhutanese population lives in these two valleys.¹⁰ The Pho Chhu flows into Puna Tshang Chhu, the country's longest river, along which there are emerging townships, important historical structures, major hydropower projects, farmland, and public infrastructural projects. The Chamkhar valley is an important emerging urban, tourist, and economic hub.

2 Liu, X. and B. Chen, 2000. "Climatic Warming in the Tibetan Plateau During Recent Decades," in *International Journal of Climatology* 20: 1729-1742.

3 Shrestha, A.B. et al., 1999. Maximum temperature trends in the Himalayas and its vicinity, *Journal of Climate*, Vol. 12, 2775-2787.

4 IPCC, 2001. *Climate Change 2001: The Scientific Basis*, Geneva: UNEP and WMO

5 Dewan Abdul Quadir, Md, et al., Climatic Characteristics of Temperature and Precipitation of Bhutan, SAARC Meteorological Research Center, Dhaka, Bangladesh

6 Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT Database for Natural Disasters

7 ADB, 2007. *Asian Development Outlook 2007*, section on Bhutan, pp. 167-169. Manila: Asian Development Bank

8 Planning Commission, RGOB, 2002. *9th Plan Main Document 2002-2007*.

9 MOA, 2000. RNR Statistics 2000 Vol 1

10 Office of the Census Commissioner, RGOB, Population and Housing Census of Bhutan 2005

13. As noted in Bhutan's *Initial National Communication* and *National Adaptation Programme of Action* (NAPA), climate change is likely to have adverse impacts on the country's progress towards environmentally sound economic and social development¹¹ and needs to be addressed through planful and integrated measures such as the proposed project. Efforts to reduce risks to climate change and other hazards in Bhutan take place at an important juncture of the country's history when decentralization policies are implemented. Bhutan's new constitution will be adopted in 2008, at the same time that elections will be conducted for the first time in the country. One of the key aims of the constitution is to empower decision-making and action at the district levels, since those officials have a stronger understanding of their region's circumstances and needs.
14. The recently completed United Nations Common Country Assessment (CCA) highlights Bhutan's vulnerability to climate change and the need to build national capacity to address this issue. The proposed project aims at the reduction of climate change-induced vulnerability and enhancement of adaptive capacity, and supports Bhutan's UN Development Assistance Framework (UNDAF), which places environmental sustainability and disaster management (UNDAF Outcome 5) as one of the country's key priorities for the period 2008-2012.¹² As stated in the UNDAF: "*The UN will focus on supporting capacity strengthening of key government agencies to implement disaster management framework, mainstream disaster/climate risk reduction into plans and policies and to strengthen national and local capacity for disaster preparedness and response systems.*" Within this priority, the UN aims to build Bhutan's capacity to integrate environmental concerns in policies and plans, and to strengthen disaster and climate risk management. The project will also contribute to achieving the Millennium Development Goals (MDGs) by reducing vulnerability of the poor and ensuring environmental sustainability.
15. The expected adaptation benefits of the project in terms of improved government capacity to deal with dynamic, climate-induced hazards through risk reduction and preparedness contribute to UNDP's global adaptation goal in Thematic Area 4 on Disaster Risk Management. Specifically, the project will contribute to Outcome 1 "Policies and plans revised using scenario planning to shift development emphasis from high-risk to lower-risk areas"; Outcome 3 "Measures piloted to reduce vulnerability, including improved settlement construction and drainage systems"; and Outcome 4 "Disaster response improved through deployment of early warning systems and upgrading of disaster response plans".

Baseline Analysis

16. Baseline activities to address the risks imposed by climate change-induced rising water levels in Thorthormi lake are limited. At present, the Bhutanese government is unable, on its own, to bear the total cost of reducing the threat of flooding from rising water levels. The baseline costs incurred have focused on studies on glacial lakes and potential threats along with detailed planning of stability analyses and alternatives for lowering of lake waters (see Annexes 1 and 8). Various projects are ongoing or planned to develop capacity on flood monitoring, water management, disaster and climate risk management, and GLOF assessment (see Annex 5). The government, together with bilaterals and other UN agencies, has made a commitment of US\$4,036,224 towards baseline development activities in the context of this project.

¹¹ NEC, 2000. Initial National Communication under the United Nations Framework Convention on Climate Change. Thimphu: National Environment Commission.

¹² United Nations and RGOB, 2007. United Nations Development Assistance Framework for the Kingdom of Bhutan: 2008-2012. Thimphu: UN and RGOB

17. To date, there has been limited progress on the establishment of comprehensive hazard/vulnerability zonation with respect to GLOFs, and on the linkage of appropriate early warning systems to the detected risk patterns. In part, this has been due to insufficient information. This has somewhat been addressed through a hazard zonation and vulnerability mapping exercise conducted on the upper Punakha-Wangdi Valley in 2002. This hazard zonation has been extended and updated in the PPG phase of the proposed project (see Annex 2). The need for a GLOF monitoring program throughout the country focusing on the known lakes with potential GLOF risks has already been stressed in the earlier inventory works in Bhutan (Mool and other, 2001). Several methods were highlighted in their work on monitoring, mitigation and early warning systems, but to date, little else has taken place.
18. Without an effective early warning system in place, inclusive of systematic alignment with a public response system, the impacts of a GLOF event could be very severe. The current early warning system in place relies on a basic manual system of personnel equipped with wireless phones keeping watch at specific locations along the main rivers. In case of a flood, the person upstream sounds an alarm through the phone system. The biggest problem of the current early warning system is that it could prove ineffective if downstream stations remain unattended at the time of a flood. In addition, GLOF events represent a different dimension of flooding hazards, as they transport larger quantities of water and debris at higher velocities and can affect different drainage systems simultaneously. As a result, communities and the government downstream could be caught unawares, which would result in substantial human, material and immaterial losses. The current early warning system will need to be overhauled and upscaled to a functioning and technically sound system which is able to trigger an alarm at all times and evoke strong social responses once an alarm has been sounded.
19. The issues of GLOF mitigation and early warning are closely linked to an existing requirement of making the Disaster Management systems and policies in Bhutan more anticipatory and supportive of long-term climate change risk management strategies. Although Bhutan's disaster management framework provides for hazard mapping exercises and disaster management activities at different levels, it mainly reflects a static, short-term, and reactive approach. Baseline disaster management policies, risk reduction and preparedness plans in Bhutan address recurrent natural hazards in the country, but are not yet geared to deal with the emerging climate change induced GLOF threats. At the individual and organizational level, there are capacity deficits on the expected distribution and effects of potential GLOF impacts and on the changing requirements this implies for early warning and response systems. Current disaster mitigation and preparedness initiatives are not geared for the efficient management of risks by rising water levels in glacier lakes, nor to trigger early warning signals in potentially dangerous drainage segments downstream of potentially hazardous glacier lake overflows.
20. Recognizing the need for making systematic efforts towards managing disaster risks, the Royal Government of Bhutan is adopting a strategy of holistic disaster management through the National Disaster Risk Management Framework (NDRMF) and other activities, as detailed in Annex 5. However, there remain gaps in Bhutan's capacity to adequately address new risks that are imposed with climate change.
21. In conclusion, the baseline in Bhutan with regard to GLOF risks is characterized as follows:
 - Bhutan is in the beginning stages of establishing a National Disaster Risk Management Framework, but there is a need to systematically incorporate climate change and the impact it would have on the country's natural hazards, including GLOF;
 - Little institutional capacity currently exists in DMD and its partner agencies to assess and integrate climate change knowledge into disaster risk management and practice, at the national, regional, and local levels;

- Scientific research has identified increasing risk of GLOFs due to climate change and 25 potentially dangerous lakes with a worst case scenario of a GLOF event involving Thorthormi lake as early as 2010;
 - Communities along the Punakha-Wangdi Valley and Chamkhar Valley are highly vulnerable to GLOFs, with vulnerabilities being compounded by poverty, increasing pressure on natural resources, high-risk settlement patterns, and the need for greater education and public awareness;
 - There are preliminary feasibility assessments of artificial lowering of glacial lake waters and regional experiences of similar mitigation works in other countries, but due to a lack of resources for a systematic and planful implementation of concrete mitigation measures on glacier lakes identified as priority hazards, the capacities in government to implement, monitor and replicate such measures are still limited;
 - The PPG phase of the proposed project has produced an assessment of an appropriate GLOF early warning system for the Punakha-Wangdi Valley, but there is still a lack of knowledge about the actual operation, maintenance and testing requirements associated with such a system.
22. Without LDCF support, vulnerable communities in Bhutan will face an increased risk of climate-induced GLOFs. The National Disaster Management Framework will have insufficient capacity to deal with dynamic vulnerabilities that grow as temperature increases and water levels in glacier lakes in Bhutan reach critical, disaster-prone thresholds. The baseline scenario is that government and disaster management authorities in Bhutan will be able to continue managing recurrent risks, based on seasonality and historic hazard occurrences, but that they will remain unprepared (in terms of technical capacity and tried and tested options) to systematically adjust planning and management frameworks to new climate risk dimensions.

Threats, Root Causes, and Barriers Analysis

23. Climate change is contributing to increased melting of glaciers and the formation of glacial lakes in Bhutan. Recent studies suggest rates of glacial retreat in the Himalayas as high as 30 to 60 metres per decade¹³, and the melting of glaciers leading to alarming volumes of water in downstream glacial lakes. Increased temperature also causes melting of ice-cored moraine dams to the point that the ridges can no longer resist the pressure. The concern is that when the current holding capacity of the lakes reaches a critical threshold, loose glacial debris that act as dams or barriers could fail and lead to flash floods that result in severe adverse impacts on downstream communities.
24. An inventory of glaciers, glacial lakes, and glacial lake outburst floods (GLOFs) in Bhutan, prepared by a team of Bhutanese and foreign experts in 2001, identified 677 glaciers and 2,674 glacial lakes.¹⁴ The study also revealed a total of 24 glacial lakes posing potentially high risk for GLOFs. Eight of these 24 lakes are located in the Pho Chhu Sub Basin and three are located in the Chamkhar Chhu Sub Basin. An update of the UNEP/ICIMOD GLOF inventory in 2007, shows that the number of high-risk glacial lakes has increased to 25, and the team identified 983 glaciers and 2,794 glacial

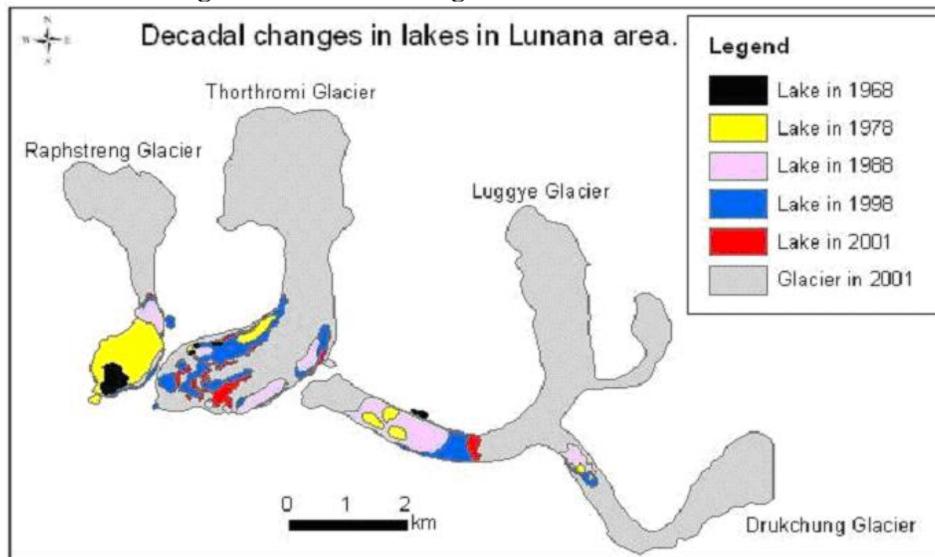
¹³ D. Cyranoski, The Long-range Forecast, *Nature*, vol. 438, November 2005

¹⁴ ICIMOD and UNEP, 2001. *Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods: Monitoring and Early Warning Systems in the Hindu Kush-Himalayan Region – Bhutan*, Kathmandu: ICIMOD

lakes.^{15, 16} This is in line with findings in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report that climate change is contributing to glacier melt.¹⁷

25. One of the glacier lakes currently facing a high risk of outburst flooding is Thorthormi lake in Bhutan's northern Lunana area (see Figure 4 below). Thorthormi glacier had no supraglacial ponds on it during the 1950s but now there are numerous supraglacial ponds, which are enlarging and becoming interconnected. The Thorthormi glacier is therefore considered as one of the most critical growing glacial lakes with GLOF threat in the near future. The area measured 1.28 km² in 2001 from satellite image (Geocover) and still it is observed to be steadily growing in size. Thus the assemblage of supraglacial lakes, which lie on Thorthormi glacier, has made it one of the most dangerous lakes in Bhutan.
26. A team of experts from Bhutan's Department of Geology and Mines (DGM) and the Institute of Geology of the University of Vienna, Austria, carried out detailed field assessments in the headwaters of the Pho Chhu Sub Basin. They found a serious and immediate threat of GLOF from the Thorthormi and Raphstreng lakes¹⁸. Several interconnected supraglacial lakes are observed near the terminus of the Thorthormi glacier. Due to rapid melting of the glacier, these lakes are expanding into one large proglacial lake (see Annex 7 on glacial lake expansion in Lunana). The worst-case scenario projects the collapse of the wall separating the Thorthormi and the Raphstreng Lakes as early as 2010. This could result in a massive GLOF with a flow of over 53 million cubic meters of water. This is more than twice the volume of the 1994 GLOF event that caused huge devastation downstream.

Figure 4: Decade changes in lakes in Lunana area



Source: DGM, 2007

¹⁵ ICIMOD and UNEP, 2007. *Impact of Climate Change on Himalayan Glaciers and Glacial Lakes: Case Studies on GLOF and Associated Hazards in Nepal and Bhutan*, Kathmandu: ICIMOD

¹⁶ DGM, 2007. *Glacial Lake Outburst Floods and Associated Hazards, Mitigation Measures Adaptation to Debris Flows in the Bhutan Himalaya: With an example of Pho Chu Basin*. Not yet published.

¹⁷ IPCC, 2007. *Climate Change 2007: The Physical Science Basis – Summary for Policy Makers*. Geneva: WMO and UNEP. Globally, the melting of glaciers and ice caps has in turn raised sea levels at a rate of 0.50 mm per year from 1963 to 2003, which increased to 0.77 mm per year in the decade from 1993 to 2003.

¹⁸ Iwata, S., Y. Ageta, N. Naito, A. Sakai, C. Narama, and Karma (2002) *Glacial Lakes and Their Outburst Flood Assessment in the Bhutan Himalaya*. *Global Environmental Research*, Vol. 6, No.1, pp. 3-17

27. Together the Punakha-Wangdi and Chamkhar Valleys provide 8.1% of the country's total agricultural area. Considering that only 7.8% of Bhutan's land area is suitable for farming, the risk of decreased agricultural output is high.¹⁹ The Pho Chhu Sub Basin was seriously impacted by GLOFs in 1957, 1960 and 1994. The GLOF in 1994 was especially devastating to the Punakha-Wangdi valley. There are virtually no written records of the 1957 and 1960 GLOFs. The 1994 GLOF damaged more than 1,700 acres of agriculture and pasture land, washed away five mills and 16 yaks, destroyed six tons of food grains, washed away houses, caused critical infrastructure damage and killed 22 people.
28. The vulnerability of communities in the Punakha-Wangdi Valley is substantially compounded by poverty. Despite steady economic progress, 31.7% of all Bhutanese and 38.3% of the rural population is defined as living below the national poverty line of 740 Ngultrum (approximately US\$16) per month (see Annex 6).²⁰ In the targeted region, people tend to settle in areas at high risk of GLOF—steep slopes or flood-prone river beds. Based on the hazard zonation maps produced and vulnerability assessments conducted during the PPG phase, the project team has identified at least 40 communities in the Punakha-Wangdi Valley and Chamkhar Valley as vulnerable to GLOF. This includes a population of at least 1,335 and 3,500 in the respective valleys. To assess the impact of future GLOF events in the two valleys, DGM conducted a detailed socio-economic survey. The data for the socio-economic survey on infrastructure, population, land use, and livestock were collected from each household, and then recorded as shown in Annexes 2 and 3.
29. In defining the additionality for this project, it is important to understand that GLOF risk is additional to the current flooding risk, which may also be related to non-climatic drivers such as ice avalanches or rockfalls after an earthquake. Landslides and debris flows released by seismic activity or previous torrential rainfall can, for example, build up ephemeral dams across river courses and result in the impoundment of immense volumes of water. This water can get released by subsequent overtopping of, or breaking through, the earth dam, resulting in catastrophic landslides and flooding. Climate change-induced acceleration of glacier melting and the resulting large volumes of water being stored behind moraine walls with limited geostatic stability are a strong additional component to this baseline risk, and it substantially increases the risk of compound disasters.
30. Barriers to effectively addressing the additional and rapidly increasing disaster risk dimension, which is introduced by the rapid formation and filling-up of glacier lakes, are in three main areas:

Disaster management policy: The first key barrier to effective GLOF risk management lies in the fact that stakeholders implementing the National Disaster Risk Management Framework (NDRMF) in Bhutan have not yet been able to fully project the dynamic, growing vulnerabilities downstream of dangerous glacial lakes and integrate these longer-term climate change considerations in their planning. Government and disaster management authorities have been used to managing recurrent risks, based on seasonality and historic hazard occurrences. In terms of technical capacity and tried and tested options to deal with new and rapidly growing risk dimensions and compound flooding disasters, the existing planning and management frameworks need to be adjusted to the new climate risk dimension.

Disaster mitigation technology and practices: Activities are necessary to build capacity, demonstrate, and adjust systems to safeguard against new and additional climate risks. As glacier lake levels in Bhutan are linked to climate change projections and warming temperatures, LDCF support

¹⁹ World Bank, "Bhutan: Priorities for agricultural and rural development". www.worldbank.org, accessed on 7 July 2007.

²⁰ National Statistical Bureau, 2004. *Poverty Analysis Report Bhutan*. Exchange rate of 46.2 Nu to 1 US\$ in June 2003.

will be instrumental in demonstrating a specific model of vulnerability reduction through effective input/output management of glacier lake levels, which will be replicated in other disaster-prone areas of Bhutan and beyond.

Disaster preparedness: Current flood early warning systems and concepts are not geared for the efficient management of risks by rising water levels in glacier lakes, nor to trigger and receive early warning messages at any potentially dangerous drainage segment downstream of potentially hazardous glacier lakes.

31. The system boundary for the project has been defined through stakeholder consultations and activities such as the NAPA process, the PPG phase of this project, and previous assessments of climate change risk and vulnerability in Bhutan. Using the APF approach, the Punakha-Wangdi Valley has been identified as a priority system in terms of its vulnerability to GLOF and its catalytic potential for replication of adaptation benefits to other vulnerable areas, such as the Chamkhar Valley. The project encompasses the national, district, and local levels and responds to the identified barriers in a three-pronged approach. First, it aims to build capacity for disaster risk management at the national, regional, and local levels, with a focus on the skills and knowledge to integrate climate change risks. This will enhance adaptive capacity, enabling the key institutions and their partners to take actions that reduce the risks to communities of future climate change impacts. The second component of the proposed project mitigates the GLOF risk from a specific lake and strengthens the technical expertise needed to reduce Bhutan’s risks from future climate change-induced GLOFs. The third component includes an early warning system for GLOF risks in Punakha-Wangdi Valley and builds capacity for community-based disaster preparedness for GLOFs and other climate risks that vulnerable populations face. The knowledge and skills gained through this proposed project will be shared within Bhutan and with other countries facing similar hazards through the Adaptation Learning Mechanism.

Stakeholder Analysis

32. The project team held stakeholder consultations throughout the PPG phase to ensure ownership and gather feedback on the project design. The main consultations include the PPG inception workshop on 24 January 2007; stakeholder meetings on 16 February 2007 and 27 September 2007; visits to Dzongkhag administrations in February 2007, meetings with communities undertaken during vulnerability assessments. See Annex 9 for reports from these meetings.

Agency/Name	Role in project
Department of Geology and Mines (DGM) Mr. Dowchu Dukpa, Project Manager	DGM has executed all technical aspects regarding design of the FSP, in close collaboration with the Disaster Management Division and other stakeholders. The agency was involved in contributing to all Outcomes of the PPG process, and will be involved in all FSP Outcomes.
Disaster Management Division (DMD) Ms. Karma Doma	DMD has participated in the Project Steering Committee meetings of the PPG phase and will provide coordination and guidance during implementation of the FSP, particularly to facilitate logistics and labor mobilization for all Outcomes. It will collaborate closely with DGM to incorporate climate change issues into the DRM framework and training materials for Outcome 1.
National Environment Commission (NEC) Mr. Jigme and Thinley Namgyal	NEC took the lead in designing and implementing the NAPA process in Bhutan and provided information on climate change vulnerabilities. NEC has participated in the Project Steering Committee meetings of the PPG Phase and will ensure policy coordination. As the agency prepares the Second National Communication to the UNFCCC, it will continue to provide input on

Agency/Name	Role in project
	vulnerabilities related to climate change and disasters, particularly in designing awareness and training for local staff and communities.
Planning Commission	For long-term sustainable development following the project, the Planning Commission will be crucial towards integration of the hazard zonation maps into development plans for the Punakha-Wangdi Valley and Chamkhar Valley. It will also help ensure that successful approaches and outcomes of this project will contribute to Bhutan's adaptation to climate change. For this project, the Planning Commission will provide guidance in ensuring the resources for enhancing climate resilience complement ongoing development activities.
The <i>Dzongkhag</i> Administrations	All the relevant district-level administration offices will work closely with DGM and DMD in all of the districts where the project activities will be implemented.
Local communities	Local communities in the Punakha-Wangdi Valley and Chamkhar Valley, as well as in the upstream region near the Thorthormi Lake, will be important stakeholders during the FSP implementation.
National Committee on Disaster Management	Through the DMD, the NCDM will provide the policy directions into which climate-resilient DRM will be incorporated.
UNDP Country Office Mr. Karma Chogyal	The UNDP Bhutan office will act as overall coordinator and monitor project funds. It will help mobilize and coordinate support from other partners through a global network.

33. See Section IV, Part IV for more details on stakeholder involvement and responsibilities.

PART II: Strategy

34. Recognizing the need for systematizing the country's disaster risk management system to account for GLOF hazards, the Government of Bhutan seeks to integrate long-term climate change induced risks into the existing disaster risk management framework and readjust it with a view on greater effectiveness and longer-term planning. The project will integrate climate risk projections into existing disaster risk management practices and implement corresponding capacity development measures. The project will implement demonstrative and practical measures for reducing climate change-induced GLOF risks from the potentially dangerous Thorthormi glacier lake. The lessons learned will facilitate replication in other high risk GLOF areas, both within and outside Bhutan. Complementary to this demonstration, the project will ensure that the existing early warning system in the Punakha-Wangdi Valley, which is not equipped to handle the full extent of potential GLOF risks, is expanded to incorporate coverage this growing risk. Lessons learned from this initiative will enable up-scaling of early warning systems in other disaster-prone areas downstream of potentially hazardous glacier lakes.

Institutional, Sectoral, and Policy Context

35. Efforts to reduce risks to climate change and other hazards in Bhutan will take place at an important juncture of the country's history when decentralization policies are implemented. Bhutan's new constitution will be adopted in 2008, at the same time elections will be conducted for the first time in the country. One of the key aims of the constitution is to empower decision-making and action at the district levels, since those officials have a stronger understanding of their region's circumstances and needs. While the thrust on decentralization presents the opportunity to pursue community disaster resilience based on a participatory approach, lack of local capacity in terms of knowledge, skills, and experience remains a major impediment. There is an urgent need to strengthen understanding and capacity in Dzongkhags, Dungkhags, and Gewogs to adapt to climate change risks.
36. In the context of the country's overall development goals and objectives, the proposed project will contribute to the socio-economic development and environmental sustainability objectives envisioned in *Bhutan 2020*, a vision document to maximize Gross National Happiness—a distinctive Bhutanese philosophy that guides the development process in the country. The project also contributes to objectives outlined in the *Ninth Five Year Plan*, the UN Common Country Assessment, the Millennium Development Goals, and Bhutan's *Poverty Reduction and Strategy Paper (2004)*, which emphasizes equitable development between income groups and regions and strengthening grassroots organizations that will support participation in decision-making.
37. The Royal Government of Bhutan developed the National Disaster Risk Management Framework (NDRMF) out of a conviction that “disaster management by its nature has to compete with other national priorities and development needs. On the other hand, development cannot be sustainable unless disaster prevention arrangements are integrated resolutely into national planning and policy frameworks.” The NDRMF was developed through a consultative process beginning in January 2005 and has the following three main objectives: 1) To promote a disaster risk management approach instead of an ad hoc reactive approach to dealing with disasters; 2) To recognize the respective roles of different organizations in DRM and provide support to their work within the NDRMF; and 3) To establish linkages between DRM and ongoing activities in different development sectors.
38. Although no legislation specifically for disasters existed before the NDRMF, disaster risk management has also been addressed through policies for environmental management, water, land

use, and infrastructure development.²¹ Regarding disaster response, informal arrangements were in place, such as community ties and families providing assistance to each other. Also, the general mandates of dzongkhag and dungkhag offices involved them in small-scale disaster response for their areas of responsibility, and community groups would organize relief and mobilize volunteer actions.

39. The government has constituted a National Committee on Disaster Management (NCDM), which is an inter-ministerial coordination mechanism to oversee the implementation of the NDRMF and provide all necessary policy directions. Implementation of the framework involves every administrative wing of the government as well as the general population to nurture a mindset of disaster prevention, mitigation, and preparedness in the pre-disaster phase while at the same time developing speedy and effective disaster response capabilities at all levels of administration and among the common people.²² Overall, the NDRMF will aim to establish the institutional context for managing disaster risks in Bhutan at the national, regional, and local levels. See Section I, Part I; Section IV, Part IV, and Annex 5 for details on other relevant institutions and stakeholders.

Project Rationale and Policy Conformity

40. Taking into consideration all the different dimensions of climate vulnerability, the NAPA process in Bhutan recommended a national disaster management strategy as their top priority, followed by lowering of the waters of the Thorthormi Lake to mitigate the immediate threat posed by the Thorthormi and Raphstreng Lakes as the second priority. Detailed assessments of the hazard potential of GLOFs have identified the Thorthormi and Raphstreng glaciers and their lakes to have a high probability of a worst-case scenario of a GLOF originating in the Thorthormi area by 2010.²³
41. Based on the principle that adaptation will be more successful if it accounts for both current and future climate risks, this project is going to use both the hazard-based and adaptive capacity approaches of the Adaptation Policy Framework (APF), while also drawing on the policy-based approach. The project takes into account the existing risks to vulnerable communities from GLOFs as well as the anticipated glacial floods that climate change is projected to bring. Using the hazard-based approach, project partners have assessed the probability of the hazard (GLOFs) occurring, together with the vulnerability of the target population.
42. This project presents a GEF Alternative that is consistent with the objectives of the Least Developed Countries Fund (LDCF). The project will implement priority interventions in Bhutan's NAPA, and therefore satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. It will catalyze and leverage additional co-financing resources from bilateral and other multilateral sources. The project requests the LDCF to finance the additional costs of achieving sustainable development imposed on the GEF-eligible countries by the impacts of climate change. It is country-driven, cost-effective, and will integrate climate change risk considerations into disaster preparedness and risk management plans and policies, priority interventions that are eligible under the LDCF guidelines. The project focus of expanding early warning systems to accommodate climate change risks; monitoring of conditions for and development of response strategies and measures to respond to GLOFs; and improving local awareness and understanding of communities and other key

²¹ Examples include the Environment Assessment Act, 2000; Regulation for Environmental Clearance of Projects; Regulation on Strategic Environmental Assessment, 2002; Mines and Minerals Act; Land Act; Bhutan Water Policy; and the Building Code of Bhutan, 2003.

²² DLG, 2006. National Disaster Risk Management Framework: Reducing disaster risks for a safe and happy Bhutan. Thimphu: Ministry of Home and Cultural Affairs

²³ Brauner, M., D. Leber, H. Hausler, 2003. Glacier Lake Outburst Flood (GLOF) Mitigation Project, Lunana, Bhutan: Technical Mitigation Measures Thorthormi Outlet. Department of Geological Sciences, University of Vienna, Austria

stakeholders about the necessity and benefits of preparedness for climate change risks are aligned with the scope of expected interventions as articulated in the LDCF programming paper and decision 5/CP.9. As climate impacts fall disproportionately on the poor, the project recognizes the link between adaptation and poverty reduction (GEF/C.28/18, 1(b), 29).

Project Goal, Objective, Outcomes and Outputs/activities

43. 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 Glacial Lake Outburst Floods (GLOFs) in the Punakha-Wangdi and Chamkhar Valleys.
44. This project supports the UNDP's global objective for Thematic Area 4 on Disaster Risk Management within the *Monitoring and Evaluation Framework for Adaptation to Climate Change*²⁴: "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." It also supports MDG Goal 8, Target 14: "Address the special needs of landlocked countries and small island developing States" and MDG 1: "Eradicate Extreme Poverty and Hunger".

OUTCOME 1: Improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys

Without GEF intervention (baseline)

45. Without a comprehensive DRM in place, the impacts of a GLOF event are projected to be very severe. Capacity deficits exist at the national, regional, and local levels for addressing the expected effects of GLOF impacts and in meeting the requirements for early warning systems. Climate change risks have been noted in the existing DRM framework, but no comprehensive DRM guidelines exist at the district and local levels. Consequently, DRM focal points are not adequately equipped to incorporate long-term climate risk planning into their ongoing activities, and the vulnerable communities in the Punakha-Wangdi Valley and Chamkhar Valley have not received information or training on climate-resilient community-based disaster risk management. Furthermore, Bhutan has been able to respond to small-scale disasters in the past through informal institutional arrangements (as described in Section I on institutional and policy frameworks), but meeting the challenges of climate change and likely increased future disaster risks requires more robust mechanisms.
46. Baseline activities include RGOB's development, with UNDP support, of the NDRMF, which will result in disaster management guidelines and cover all districts. Another RGOB/UNDP project will strengthen institutional and community-level capacity to plan and implement earthquake risk reduction strategies and disaster recovery preparedness—skills that are transferrable to other types of natural disasters. Baseline data on natural hazards has been compiled by DMD, climate information is available in the initial national communication to the UNFCCC, and DGM has established a database on GLOF hazards during the PPG phase. The NAPA has already outlined urgent adaptation priorities that guide disaster management efforts. See Annex 5 for other baseline activities.

With GEF intervention (additionality argument)

47. The project will address the needs to incorporate climate change into ongoing disaster risk management decision making and practices. All national DRM focal points, district authorities, and

²⁴ UNDP, 2007. *Monitoring and Evaluation Framework for Adaptation to Climate Change*. Draft document.

communities in the target area will be able to prioritize, plan, and implement measures to minimize potential losses from GLOF disasters. The existing DRM frameworks of Bhutan will consequently demand, encourage, and reward long-term climate risk planning. With a focus on Punakha and Wangdi Phodrang, the project will address current institutional limitations, lack of access to timely and reliable information on climate-related hazards, and the need for bolstering local adaptive capacities.

Outputs and Indicative Activities

Output 1.1 – Climate-resilient DRM legislation, policy frameworks, and sectoral plans

Indicative Activities under Output 1.1:

- 1.1.1 Inter-ministerial working group to incorporate climate change risk management considerations into existing and new legislation, policy frameworks, and sectoral plans
- 1.1.2 Develop and institutionalize comprehensive DRM guidelines, including climate risks, for use at the district and community levels
- 1.1.3 Revise the existing National Disaster Management Act, incorporating climate risk issues for GLOF, and submit it for endorsement
- 1.1.4 Identify, and take advantage of, opportunities to integrate long-term climate risk planning into the NDRMF and DRM guidelines

Output 1.2 – Capacities for climate risk planning strengthened at the district (Dzongkhag) administrative level

Indicative Activities under Output 1.2:

- 1.2.1 Develop and implement a capacity building roadmap for national, district, and local DRM focal points to integrate long-term climate risk planning into their daily activities. Based on DRM guidelines, develop training materials that include climate risk reduction strategies, early warning systems, preparedness, and response planning, for use at the Dzongkhag and Gewog levels
- 1.2.2 Train DDMCs on climate change resilient DRM in each target Dzongkhag
- 1.2.3 Formulate and institutionalize three Dzongkhag Disaster Management plans
- 1.2.4 Form Gewog Disaster Management Committees (GDMCs) to do what...
- 1.2.5 Train GDMC members on climate change resilient DRM (training conducted by DDMCs)

Output 1.3 – Information on climate hazards and vulnerabilities (with a focus on GLOFs) in Bhutan systematically captured, updated, and synthesized

Indicative Activities under Output 1.3:

- 1.3.1 Update content on DGM's database on climate hazards and vulnerabilities, which was established during the PPG phase, and ensure accessibility and usage by relevant government departments
- 1.3.2 Train relevant sectoral departments on information available and accessing the database
- 1.3.3 Continue updating DGM's website with information on climate risks and GLOFs

- 1.3.4 Conduct annual briefing workshops for relevant government departments and other stakeholders on the status of GLOF and climate risks in Bhutan
- 1.3.5 Develop, print, and disseminate a catalogue of climate risk information available in the database

Output 1.4 – Vulnerable communities are aware of, and prepared for, climate-related disasters

Indicative Activities under Output 1.4:

- 1.4.1 Identify focal points in each target community for GLOF awareness campaign and training activities
- 1.4.2 Develop awareness campaign and training materials
- 1.4.3 Implement awareness campaign and training in Punakha, Wangdi, and Chamkhar Valley communities

OUTCOME 2: Reduced risks of GLOF from Thorthormi Lake through an artificial lake level management system

Without GEF intervention (baseline)

48. Thorthormi Lake is among the most hazardous of Bhutan's 25 lakes with a high risk of GLOF. The surface area of the lake in 2001 measured 1.28 km² and is still expanding, and its water volume is outpacing the drainage capacity. At present the Bhutanese government is unable, on its own, to bear the total cost of reducing the threat of flooding from rising water levels. The RGOB has funds to periodically monitor the stability of the moraine dam of the glacial lake, and flood monitoring staff are currently stationed in the Lunana region. Baseline activities have focused on studies on glacial lakes and potential threats, along with preliminary stability analyses, exploring alternatives for lowering lake waters, and mapping hazards in vulnerable areas (see Annex 1 for studies and reports resulting from baseline activities). No artificial lowering system of glacier lake levels has yet been established and continuously maintained. Although studies (e.g. by ICIMOD) have produced periodic inventories of GLOF risk, there is no systematic mechanism to capture knowledge on reducing the risks of GLOFs with a view of replication in Bhutan's other vulnerable areas.

With GEF intervention (additionality argument)

49. This Outcome addresses the additional risk of flooding imposed by climate change on top of regular flooding hazards in the Punakha-Wangdi valley. Thorthormi lake acts as a reservoir for global warming-induced additional runoff of glacier melt - waters, and thus presents an additional risk on top of the current natural hazard baseline in the Lunana area. The project will reduce the risk of climate change-induced GLOF through artificially lowering the water level in Thorthormi Lake. The successful implementation and replication of this measure, training of staff, and the lessons learned will contribute to improving Bhutan's adaptive capacity to reduce risks in other dangerous glacier lakes affected by climate change.

Outputs and Indicative Activities

Output 2.1 – Engineering and safety plans for climate change risk reduction measures on Thorthormi Lake are in place

Indicative Activities under Output 2.1:

- 2.1.1 Confirm the geostatic status of the moraine dam and update geotechnical assessments on the most appropriate location for the mitigation channel
- 2.1.2 Prepare a safety and evacuation plan in case of a collapse of the Lake
- 2.1.3 Assess the economic, environmental and social impact of risk reduction measures on the project site, surrounding areas, and downstream of the project site
- 2.1.4 Prepare an engineering plan, including the location of the channel along the moraine dam, procedures, required equipment, etc.
- 2.1.5 Convene a PB meeting to 1) review the safety and engineering plans, and 2) joint decide on the continuation of the risk reduction measures on the basis of geostatic updates.

Output 2.2 – Artificial lowering system of Thorthormi Lake waters implemented

Indicative Activities under Output 2.2:

- 2.2.1 Conduct a meeting of relevant departments and organizations to present the engineering and safety plans
- 2.2.2 Identify available workforce
- 2.2.3 Assess wages and contract workers
- 2.2.4 Procure materials, rations, and other necessities
- 2.2.5 Transport materials to the worksite and prepare worksite for mitigation works
- 2.2.6 Implement excavation activities according to the engineering plan

Output 2.3 – Water levels of Thorthormi Lake and status of artificial lowering system are regularly monitored and maintained

Indicative Activities under Output 2.3:

- 2.3.1 Institutionalize a monitoring system, including systems and staff
- 2.3.2 Design and conduct training module on monitoring and maintaining the appropriate water flow
- 2.3.3 Conduct training for current monitoring staff and establish a process for training future monitoring staff
- 2.3.4 Establish guidelines for field reports on the status of the lake level and artificial lowering system
- 2.3.5 Undertake monitoring missions by DGM staff to Thorthormi Lake at least twice per year and disseminate reports to relevant stakeholders

Output 2.4 – Technical knowledge and lessons in the artificial lowering of glacier lake levels captured and documented for use in future projects

Indicative Activities under Output 2.4:

- 2.4.1 Document process used for planning and establishing the artificial glacial lake lowering system
- 2.4.2 Conduct an evaluation of the lowering system, focusing on the operational lessons learned and potential for replication within Bhutan

- 2.4.3 Draft a manual on lowering glacial lake water levels
- 2.4.4 Hold a national lessons learned workshop to share the project's results and experiences with relevant stakeholders
- 2.4.5 Develop an agreement with a plan to transfer the technology and replicate the glacial lake management system in at least one other GLOF-vulnerable region in Bhutan

OUTCOME 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings

Without GEF intervention (baseline)

- 50. The current flood early warning system in the Punakha-Wangdi Valley relies on two monitoring personnel from the Department of Energy's Flood Warning Section keeping watch near the glacial lakes in Thanza, Lunana, or other specific locations along the main rivers, who have been requested for those postings by DGM or the RGOB. Once there is a flood, the personnel must alert officials downstream by means of wireless phones. The biggest problem of the current early warning system is that it could prove ineffective if the monitoring personnel are unable to send a warning by phone, or if downstream stations remain unattended at the time of a flood. The current system would provide insufficient warning for potential climate change-induced GLOFs, and communities are not sufficiently prepared for GLOF disasters. There are no sensors or siren towers in Punakha-Wangdi Valley, no DRM focal points have been trained in GLOF early warning, and no GLOF evacuation areas have been identified. As a result, communities and the government downstream are not able to receive and react to GLOF early warning messages in a timely and appropriate manner.
- 51. During the PPG phase, DGM staff visited the Norwegian Water Resources and Energy Directorate (NVE) and Norwegian Geotechnical Institute (NGI) to observe a flood early warning system in place in Norway. A comparative assessment of that system and its suitability for implementation in Bhutan was conducted, then a site assessment to determine potential locations for sirens and sensors (see Annex 4).

With GEF intervention (additionality argument)

- 52. The project will enhance the resilience of vulnerable populations in Punakha-Wangdi Valley by establishing an early warning system for GLOFs and other flash floods that are likely to increase under climate change. The current early warning system will be upgraded to have technically sound mechanisms in place that could trigger an alarm at all times. Communities will be prepared to take the appropriate actions to minimize human and material losses. The successful implementation of this measure, training of staff and community members, and the lessons learned will contribute to Bhutan's adaptive capacity and preparedness regarding climate change-induced GLOFs.

Outputs and Indicative Activities

Output 3.1 – Technical components for a GLOF early warning system in the Punakha-Wangdi valley installed and operational

Indicative Activities under Output 3.1:

- 3.1.1 Develop a plan for an early warning system that incorporates climate change risk management needs;

- 3.1.2 Tender and procure components (sensors, siren towers, and communications equipment) for the Punakha-Wangdi Valley GLOF early warning system
- 3.1.3 Survey appropriate sensor and siren tower locations in the Punakha-Wangdi Valley and draft plan for construction works
- 3.1.4 Install and test sensor and siren towers
- 3.1.5 Prepare contingency plan, including backup EWS

Output 3.2 – Institutional arrangements in place to operate, test, and maintain the GLOF EWS

Indicative Activities under Output 3.2:

- 3.2.1 Train DDMC members on the functioning, testing, and maintenance of the EWS
- 3.2.2 Train EWS focal points
- 3.2.3 Develop and operationalize the GLOF EWS maintenance schedule and mechanism

Output 3.3 – Awareness of communities in the Punakha-Wangdi Valley on operation of the EWS

Indicative Activities under Output 3.3:

- 3.3.1 Design and implement community awareness workshops on EWS in each target community
- 3.3.2 Plan and conduct mock drills, involving all relevant DRM actors for a simulated GLOF in the Punakha-Wangdi Valley
- 3.3.3 Set in place appropriate regulatory and economic incentives schemes to induce behavioral changes that are necessary for the EWS to be effective.

Output 3.4 – Safe GLOF evacuation areas identified and publicized in each vulnerable community in the Punakha-Wangdi Valley

Indicative Activities under Output 3.4:

- 3.4.1 Identify evacuation sites in each target community
- 3.4.2 Develop safe evacuation protocols that are coordinated between all relevant actors
- 3.4.3 Design and implement an awareness campaign for safe evacuation procedures, ensuring awareness of evacuation sites

Output 3.5 – Technical knowledge and lessons in the installation and operation of GLOF EWS captured and documented for use in future projects

Indicative Activities under Output 3.5:

- 3.5.1 Conduct an evaluation of the GLOF EWS, with a focus on the operational lessons learned and potential for replication
- 3.5.2 Draft a manual on GLOF EWS and evacuation
- 3.5.3 Disseminate project results through publications and an instructive video
- 3.5.4 Develop replication plans for an EWS in the Chamkhar Valley

OUTCOME 4: Enhanced learning, evaluation and adaptive management

Without GEF intervention (baseline)

53. There is currently a limited pool of knowledge and expertise regarding climate change adaptation in Bhutan. There are effective institutional mechanisms for knowledge sharing on disaster risk management; however, the elements of climate risk management must be incorporated. Without the project, best practices for the implementation of adaptation and building adaptive capacity would not take place in a systematic manner.

With GEF intervention (additionality argument)

54. The project will enhance the learning and knowledge exchange, enabling the replication of effective disaster risk reduction measures and adaptation to climate change both within Bhutan and with other countries facing climate change-induced GLOF risks. Activities include contributing to the Adaptation Learning Mechanism and hosting an international workshop on GLOFs.

Outputs and Indicative Activities

Output 4.1 – Project lessons captured in, and disseminated through, the Adaptation Learning Mechanism

Indicative Activities under Output 4.1:

- 4.1.1 Capture lessons learned from the project on a continual basis
- 4.1.2 Synthesize results of activities under Outputs 2.4 and 3.5 and contribute to the ALM

Output 4.2 – Project knowledge shared with other GLOF-prone countries

Indicative Activities under Output 4.2:

- 4.2.1 Develop workshop concept paper
- 4.2.2 Conduct workshop with relevant partners
- 4.2.3 Publish proceedings

Project Indicators, Risks, and Assumptions

55. Indicators for the project, based on UNDP's *Monitoring and Evaluation Framework for Adaptation to Climate Change*, attempt to measure the reduced vulnerability of the Punakha-Wangdi Valley population in response to climate change-induced GLOF risk, as well as the increased adaptive capacity of Bhutan's disaster management sector. The project assumes that a GLOF event will not occur during the project implementation period; the government will continue to support climate-resilient DRM; staff turnover will not negate training benefits; and weather conditions permit at least five months of mitigation work in the Thorthormi lake region.

56. For more information, see the Strategic Results Framework in Section II.

Expected National and Local Adaptation Benefits

57. At the national level, the expected adaptation benefits include improved government capacity to deal with dynamic, climate-induced hazards and to design, implement, evaluate and replicate systems for GLOF risk reduction and preparedness. Vulnerability of communities in high risk GLOF areas will be reduced as the project will catalyze cost-effective management of glacier lake levels and adjustment of communal early-warning systems to climate change-induced hazards. In the process of achieving enhanced disaster preparedness, community members and community-based organizations (CBOs) will be strengthened for improved communication, public awareness, and response to GLOF early warnings.

Country Ownership: Country Eligibility and Country Drivenness

58. As described in paragraphs 17 and 39-45, the project fits the objectives of the LDCF, Bhutan's national development priorities, the UNDAF, and MDGs. Bhutan, one of the 48 LDCs, is a Party to the United Nations Framework Convention on Climate Change (UNFCCC), having ratified it on 25 August 1995. Bhutan is eligible for technical assistance from UNDP, and this project is endorsed by the national operational focal point.

59. This project has emerged from the recently concluded NAPA process in Bhutan. The methodology used to develop the NAPA was a widely consultative process involving stakeholders at the national and regional levels from the dzongkhags, agriculture, forestry, livestock, environment, roads, health, geology and mines, finance, planning, and home affairs. See Section I, Part I and Section IV, Part IV for stakeholder involvement in project preparation.

60. The project conforms to UNDP's comparative advantage in capacity building. Since 2004, UNDP has supported disaster-risk management in Bhutan through institutional capacity development at all levels and with a range of stakeholders from different government departments. UNDP's Bureau for Crisis Prevention and Recovery (BCPR) supports national counterparts to develop both a disaster risk perspective and the human, financial, technical, and legislative capacity; civil society preparedness; and coordination systems required to effectively manage and reduce risk. In an effort to promote integrated development approaches, UNDP brings together partners working on both climate change and disaster risk reduction. Hence, the project will be able to efficiently connect to the central policy processes that currently shape Bhutan's approach on how to deal with future climatic hazards.

Sustainability

61. 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 process and some of those agencies are keen on carrying forward the implementation of the top identified priorities. The long-term viability and sustainability of the project will depend greatly on institutional sustainability. This will be achieved through capacity building at all levels, following the principle of developing a DRM program and not a mere project. The capacity-building components of the project will empower stakeholders at all levels, from communities to regional authorities to national government agencies, to deal with climate change impacts and enhance adaptive capacities of the Bhutanese people beyond the duration of the project.

Replicability

62. Additional human and financial resource requirements to sustain the activities initiated through the integrated DRM program will be incorporated into Bhutan's national human resource plan and budget for the Tenth Five-Year Plan (July 2007-June 2012). These resources will help sustain and expand the DRM program into other GLOF and climatic disaster-vulnerable areas throughout the country. Each

of the main outcomes for the FSP have replicability components built into the outputs. The capacity built for an integrated DRM in the Punakha-Wangdi Valley and Chamkhar Valley will be used to develop a national DRM system over time. The application of institutional, legislative, and policy frameworks within the two valleys will allow for an evaluation and learning process for creation of national strategies. Similarly, capacity built at the intermediate and local levels amongst various stakeholders in these two valleys will allow for rapid replication of the DRM program into other districts of Bhutan.

63. The experiences and lessons learnt from the artificial lowering of Thorthormi Lake waters and the GLOF early warning system will prove invaluable in the years to come. This is by no means the last lake to pose GLOF threats. As climate change becomes more pronounced, Bhutan will be exposed to greater GLOF threats. Capacity built at the national level through this project will help Bhutan deal with GLOF problems by effectively adapting to this particular hazard risk. Careful monitoring of performance, efficiency, cost-effectiveness and robustness will prove useful in developing similar systems in the future. In particular, the community-based elements of the early warning system installed in Punakha-Wangdi Valley utilizes widely available technology, and can be replicated in other valleys. In addition, this project will add to the Adaptation Learning Mechanism initiative developed by UNDP-GEF aiming to integrate adaptation best practices and improved learning amongst different countries and regions.

PART III: Management Arrangements

64. The project will be implemented over a period of four years beginning in 2008. The project will be nationally executed under UNDP National Execution (NEX) procedures. One of the lead executing agencies for the project will be the Ministry of Economic Affairs' Department of Geology and Mines (DGM), which has the governmental mandate and expertise to address GLOF risks. DGM's activities include geological mapping, mineral exploration, and geotechnical services such as geologic hazard and risk assessments. Since the 1994 GLOF, DGM has been actively involved in the monitoring of glaciers and glacial lakes. The other executing agency will be the Ministry of Home and Cultural Affairs' Disaster Management Division (DMD), which is the focal agency for disaster management in Bhutan, including climate change-induced risks. DMD, formerly the Department of Local Governance, has staff in each district. They will be responsible for the timely delivery of inputs and outputs and for coordination with all other relevant agencies.

65. As identified in Bhutan's National Capacity Self-Assessment (NCSA), these management arrangements will support the strengthening of institutions responsible for climate change adaptation issues, specifically as related to disaster risks from glacial lake outburst floods. Coordination with other agencies, such as the National Environment Commission, will further enhance the dissemination of learning on adaptation.

66. The project will receive high level guidance and oversight from a **Project Board (PB)**, which will be chaired by the Secretary, Ministry of Economic Affairs, as the home ministry for lead executing agency DGM. The PB is the group responsible for making management decisions on a consensus basis for a project when guidance is required by the Project Manager, including approval of project revisions. Project assurance reviews by this group are made at designated decision points during the running of a project (e.g. Indicative Activity 2.1.5), or as necessary when raised by the Project Manager. The TOR of the PB is presented in Section IV, Part III.

67. A **Technical Support and Advisory Team (TSAT)** will provide technical support to the project during the implementation of activities related to artificial water lowering of Thorthormi Lake (Outcome

2). The TSAT will meet once before the implementation of the work at the site and as and when required hereafter. It will provide technical advice and backup support to the Project Management Unit (PMU) during the implementation of work at the site. The team will be headed by the Project Director, as assigned from the DGM. The Project Manager from DGM will be a member of the TSAT. The TOR of the TSAT is presented in Section IV, Part III.

68. A **Project Management Unit (PMU)** will play the key role in project execution. It will be headed by two **Project Managers (PMs), one each from DGM and DMD**. The Project Managers will work under the direction of the Project Director assigned from the DGM. The two project managers will be responsible for the outputs to be delivered by their respective agencies, as well as the application of all UNDP administrative and financial procedures and for the use of UNDP-GEF funds. The Project Manager from DGM will also be responsible for consolidating technical and monitoring and evaluation reports as defined in Section I, Part IV, and submitting them to UNDP-CO. The TORs of both Project Managers are presented in Section IV, Part III.

69. Responsibilities by Outputs as outlined in the Strategic Results Framework (Section II, Part I) and the Stakeholder Involvement Plan (Section IV, Part IV) are as follows:

- **DGM** will be responsible for delivering **Outputs 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, and 3.5**.
- **DMD** will be responsible for delivering **Outputs 1.1, 1.2, 1.4, 3.2, 3.3, and 3.4**.

70. Additional technical support would be provided through access to regional experts or institutions from the region as and when the Project Management Team identifies the need. UNDP will provide support, particularly for compiling lessons learned and sharing experiences internationally.

71. The project will seek to link with and complement other programs for disaster and climate risk management, governance and participation, and poverty reduction in Punakha-Wangdi Valley, as described in Section I, Part II. See Section IV for the organigram of the project and stakeholder involvement.

72. In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including among others, project hardware and vehicles purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgment to GEF. The UNDP logo should be more prominent—and separated from the GEF logo if possible, as UN visibility is important for security purposes.

PART IV: Monitoring and Evaluation Plan and Budget

73. Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Country Office (UNDP-CO) with support from UNDP-GEF. The Strategic Results Framework in Section II provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

74. The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities.

Monitoring and Reporting

Project Inception Phase

75. A Project Inception Workshop will be conducted with the full project team, relevant government counterparts, co-financing partners, the UNDP-CO and representation from the UNDP Regional Technical Advisor, as well as UNDP HQ as appropriate.
76. 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.
77. Additionally, the purpose and objective of the Inception Workshop (IW) will be to: (i) introduce project staff with the UNDP-GEF *expanded team* which will support the project during its implementation, namely the CO and responsible UNDP/GEF Regional Technical 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.
78. The IW 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.

Monitoring responsibilities and events

79. A detailed schedule of project reviews meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Tripartite Reviews, Project Board Meetings, (or relevant advisory and/or coordination mechanisms) and (ii) project related Monitoring and Evaluation activities.
80. Day to day monitoring of implementation progress will be the responsibility of the Project Managers from DGM and DMD based on the project's Annual Work Plan and its indicators, with overall guidance from the Project Director. The Project Team will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.
81. The Project team will fine-tune the progress and performance/impact indicators of the project at the Inception Workshop with support from UNDP-CO and assisted by the UNDP-GEF Regional Technical Advisor. Specific targets for the first year of implementation, progress indicators, and their means of verification will be developed at this Workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. The local implementing agencies will also take part in the Inception Workshop in which a common vision of overall project goals will be established. Targets and indicators for

subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the project team.

82. Measurement of impact indicators related to global benefits will occur according to the schedules defined in the Inception Workshop. The measurement of these will be undertaken through subcontracts or retainers with relevant institutions, or through specific studies that are to form part of the projects activities, or periodic sampling such as with sedimentation.
83. *Periodic monitoring of implementation progress* will be undertaken by the UNDP-CO through quarterly meetings with the project proponent, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.
84. UNDP Country Offices and UNDP-GEF RCUs as appropriate, will conduct yearly visits to the project field sites based on an agreed upon schedule to be detailed in the project's Inception Report / Annual Work Plan to assess first hand project progress. Any other member of the Project Board can also accompany, as decided by the PB. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the project team, all SC members, and UNDP-GEF.
85. *Annual Monitoring* will occur through the ***Tripartite Review (TPR)***. This is the highest policy-level meeting of the parties directly involved in the implementation of a project. The project will be subject to Tripartite Review (TPR) at least once every year. The first such meeting will be held within the first twelve months of the start of full implementation. The project proponent will prepare an Annual Project Report (APR) and submit it to UNDP-CO and the UNDP-GEF regional office at least two weeks prior to the TPR for review and comments.
86. The APR will be used as one of the basic documents for discussions in the TPR meeting. The project proponent will present the APR to the TPR, highlighting policy issues and recommendations for the decision of the TPR participants. The project proponent also informs the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

Terminal Tripartite Review (TTR)

87. The terminal tripartite review is held in the last month of project operations. The project proponent is responsible for preparing the Terminal Report and submitting it to UNDP-CO and UNDP/GEF Regional Technical Advisor. It shall be prepared in draft at least two months in advance of the TTR in order to allow review, and will serve as the basis for discussions in the TTR. The terminal tripartite review considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can be captured to feed into other projects under implementation or formulation.
88. The TPR has the authority to suspend disbursement if project performance benchmarks are not met. Benchmarks will be developed at the Inception Workshop, based on delivery rates, and qualitative assessments of achievements of outputs.

Project Monitoring Reporting

89. The Project Manager, DGM, in conjunction with the UNDP-GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and strictly related to monitoring, while (g) through (h) have a broader function and the frequency and nature is project specific to be defined throughout implementation.

(a) Inception Report (IR)

90. A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/Annual Work Plan 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 Technical 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.

91. 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 effect project implementation.

92. 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 Technical Advisor will review the document.

(b) Annual Project Report (APR)

93. 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.

94. 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

(c) Project Implementation Review (PIR)

95. The PIR is an annual monitoring process mandated by the GEF. 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 project. The PIR can be prepared any time during the year (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 concerned RC.
96. The individual PIRs are collected, reviewed and analysed by the RCs prior to sending them to the focal area clusters at the UNDP-GEF headquarters. The focal area clusters supported by the UNDP-GEF M&E Unit analyse the PIRs by focal area, theme and region for common issues/results and lessons. The TAs and PTAs play a key role in this consolidating analysis.
97. The focal area PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.
98. The GEF M&E Unit provides the scope and content of the PIR. In light of the similarities of both APR and PIR, UNDP-GEF has prepared a harmonized format for reference.

(d) Quarterly Progress Reports

99. Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF regional office by the project team. See format attached.

(e) Periodic Thematic Reports

100. 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.

(f) Project Terminal Report

101. During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs of the Project, lessons learnt, objectives met, or not achieved, structures and systems implemented, etc. and will be the definitive statement of the Project's activities during its lifetime. 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 activities.

Independent Evaluations

102. The project will be subjected to at least two independent external evaluations as follows:-

Mid-term Evaluation

103. An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards 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 UNDP/GEF Regional Technical Advisor.

Final Evaluation

104. An independent Final Evaluation will take place three months prior to the terminal tripartite review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the UNDP/GEF Regional Technical Advisor.

Learning and Knowledge Sharing

105. Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums. In addition:

- The project will participate, as relevant and appropriate, in UNDP-GEF sponsored networks, organized for senior personnel working on projects that share common characteristics. UNDP-GEF shall establish a number of networks, such as the Adaptation Learning Mechanism, that will largely function on the basis of an electronic platform.
- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.
- The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identify and analyzing lessons learned is an ongoing process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP-GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.
- Results from the program will be disseminated within and beyond the program intervention zone through a number of existing information sharing networks, in particular, the ALM. The ALM lessons learned template will be adapted to be used by the project. To support this goal, adaptation-related activities from the project will contribute knowledge to the ALM, such as the following:
 - Best practices in integrating adaptation into national and local development policy, and project design and implementation mechanisms.

- Lessons learned on removing the most common barriers to adaptation, with special attention to the roles of local partners, international partners, UNDP, and GEF in designing and implementing projects
- The conditions for success (or failure), including replication and scaling up.

106. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identifying and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP shall provide a format and assist the project team in categorizing, documenting, and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

Indicative Monitoring and Evaluation Work Plan and Corresponding Budget

Type of M&E activity	Responsible Parties	Budget US\$ Excluding project team Staff time	Time frame
Inception Workshop (IW)	Project Manager, DGM UNDP CO UNDP HQ	\$3,000	Within first two months of project start up
Inception Report	Project Team UNDP CO	None	Immediately following IW
Measurement of Means of Verification for Project Purpose Indicators	Project Manager, DGM, will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members	To be finalized in Inception Phase and Workshop.	Start, mid and end of project
Measurement of Means of Verification for Project Progress and Performance (measured on an annual basis)	Oversight by UNDP/GEF Regional Technical Advisor and Project Director Measurements by regional field officers and local IAs	To be determined as part of the Annual Work Plan's preparation.	Annually prior to APR/PIR and to the definition of annual work plans
APR and PIR	Project Team UNDP-CO UNDP-GEF	None	Annually
TPR and TPR report	Government Counterparts UNDP CO Project team UNDP-GEF Regional Technical Advisor	None	Every year, upon receipt of APR
Project Board Meetings	Project Manager UNDP CO	None	Following Project IW and subsequently at least once a year
Periodic status reports	Project team	\$3,000	To be determined by Project team and UNDP CO

Technical reports	Project team Hired consultants as needed	\$4,000	To be determined by Project Team and UNDP-CO
Mid-term External Evaluation	Project team UNDP- CO UNDP-GEF Regional Technical Advisor External Consultants (i.e. evaluation team)	\$30,000	At the mid-point of project implementation.
Final External Evaluation	Project team, UNDP-CO UNDP-GEF Regional Technical Advisor External Consultants (i.e. evaluation team)	\$30,000	At the end of project implementation
Terminal Report	Project team UNDP-CO External Consultant	None	At least one month before the end of the project
Lessons learned (Outputs 2.4, 3.5, and 4.1)	Project team UNDP-GEF Regional Technical Advisor (suggested formats for documenting best practices, etc)	\$40,000	Yearly
Audit	UNDP-CO Project team	None	Yearly
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	UNDP Country Office UNDP-GEF Regional Technical Advisor (as appropriate) Government representatives		Yearly
TOTAL INDICATIVE COST Excluding project team staff time and UNDP staff and travel expenses		US \$110,000	

PART V: Legal Context

107. 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.

108. 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:

109. Revision of, or addition to, any of the annexes to the Project Document;

110. 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;
111. 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
112. Inclusion of additional Annexes and attachments only as set out here in this Project Document.

SECTION II: STRATEGIC RESULTS FRAMEWORK (SRF) AND GEF INCREMENT

PART I: Strategic Results Framework, SRF (formerly GEF Logical Framework) Analysis

Project Strategy	Objectively verifiable indicators				
Goal	To enhance adaptive capacity to prevent climate change-induced GLOF disasters in Bhutan				
	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
Objective: To reduce climate change-induced risks of Glacial Lake Outburst Floods (GLOFs) in the Punakha-Wangdi and Chamkhar Valleys	Reduction of vulnerability to climate change-induced GLOFs in the Punakha-Wangdi and Chamkhar Valleys	Capacity deficits exist for addressing the expected effects of GLOF impacts and in meeting the requirements for early warning systems. Recent scientific findings project a potential large-scale GLOF in the Punakha-Wangdi Valley as early as 2010	<ul style="list-style-type: none"> DRM stakeholders in Bhutan on the national, regional and local level are able to project climate-induced GLOF risks downstream of potentially hazardous glacier lakes and are able to prioritize, plan and implement efficient mitigation and preparedness options 	Qualitative-based surveys (QBS)/Interviews DRM Legislation Impact assessment by the end of the project	Stakeholders are able to perceive reductions in vulnerability over the time-scale determined by project duration No flooding disasters in target communities occur throughout the project lifetime
Outcome 1: Improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys	Percentage of national DRM focal points, district authorities, and communities able to prioritize, plan, and implement measures to reduce human and material losses from potential GLOFs Percentage of personnel reporting DRM frameworks support adaptation efforts	Capacities at the national, regional, and local levels to plan for and react to potential GLOFs are extremely low.	<ul style="list-style-type: none"> By the end of Year 2, 100% of the national DRM focal points, and 90% of district and community DRM focal points in Punakha-Wangdi Valley and Chamkhar Valley are able to prioritize and plan measures to minimize potential losses from GLOFs By the end of the project at least 90% of personnel interviewed report that DRM frameworks support their 	QBS	Government remains supportive to link longer-term climate risk planning with current disaster risk management initiatives

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
	Existence of DRM legislations and policies that support adaptation and GLOF preparedness		<p>efforts to plan and implement measures to adapt to climate change.</p> <ul style="list-style-type: none"> • By the end of the project, at least three DRM legislation and policies are formulated inclusive of climate-induced GLOF risks and demand long-term mitigative and preparedness planning 	Review of DRM policies and plans at the national, district, and community levels	
Output 1.1: Institutionalized climate-resilient DRM legislation, policy frameworks, and guidelines	Number of DRM legislation, policy frameworks, and guidelines that incorporate long-term climate risk planning	<p>Climate change risks are noted in the current NDRMF.</p> <p>No Disaster Management Act</p> <p>No comprehensive disaster management guidelines for Dzongkhag and Gewog Disaster Management Committees</p>	<ul style="list-style-type: none"> • By end of the project, NDRMF integrates longer-term climate risk planning • By the end of the project, Disaster Management Act formulated incorporating GLOF and other climate risk issues • By the end of the project, DRM guidelines integrate longer-term climate risk planning 	Review of Disaster Management Act, DRM policies, plans, and institutional structures	Government continues to support climate-resilient DRM.
Output 1.2: Strengthened capacities for climate risk planning at the district (dzongkhag) administrative levels	<p>Number of dzongkhag and gewog Disaster Management Committees in project areas incorporating long-term climate risk planning into their ongoing DRM responsibilities</p> <p>Number of dzongkhag disaster management</p>	DRM focal points at the dzongkhag level do not possess adequate knowledge and skills to plan and implement climate-resilient DRM measures	<ul style="list-style-type: none"> • By end of Year 2, 3 dzongkhag Disaster Management Committees and gewog DMCs in the project area are trained on climate change and GLOF risk management • By end of Year 2, 	<p>Training reports and follow-up QBS with staff</p> <p>Dzongkhag/Thromde DRM plans</p>	Turnover of staff does not counteract benefits of capacity building efforts

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
	plans in place that incorporate GLOF mitigation and preparedness		Dzongkhag/Thromde Disaster Management plans in Punakha, Wangdi, and Bumthang are developed to account for GLOF hazards		
Output 1.3: Information on climate hazards and GLOF vulnerabilities in Bhutan systematically captured, updated and synthesized	Number of government departments actively accessing and utilizing climate risk information	Initial national communication to UNFCCC, NAPA, and NDRMF available Basic DGM database on GLOF hazards established during the PPG phase	<ul style="list-style-type: none"> National database on GLOF vulnerability and climate risk information in Bhutan systematically and continually updated Within 2-3 years of start of project implementation an information management system exists and by the end of the project a survey of key stakeholders reveals that they have access to relevant information on adaptation to climate change. Annual workshop to present information on climate change-induced GLOF risks to relevant government departments Updated DGM website 	Database of relevant information QBS with key stakeholders	Data is provided in an accessible format for use by different government departments
Output 1.4: Raised awareness of vulnerable communities to climate-related GLOF risks	Percentage of households in target communities who are able to take precautionary measures and react to potential GLOFs in a way to minimize human and material	No communities are trained in preparing for and reacting to potential GLOFs	<ul style="list-style-type: none"> By the end of Year 1, all GLOF-vulnerable communities in the Punakha-Wangdi and Chamkhar Valleys identify disaster and climate risk management focal points By the end of Year 3, 80% 	List of focal points Training reports and QBS	Communities' training needs are correctly assessed and delivered in an accessible and culturally sensitive manner

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
	losses		of households in the target area are able to take precautionary measures for potential GLOFs		
Outcome 2: Reduced risks of GLOF from Thorthormi lake through an artificial lake level management system	Level of GLOF risk from Thorthormi Lake	Thorthormi Lake is among the most hazardous of Bhutan's 25 lakes with a high risk of GLOF	<ul style="list-style-type: none"> • By the end of the project, Thorthormi Lake is no longer considered at high risk of GLOF, as scientifically assessed at the project's completion 	Satellite data and field survey of lake Scientific assessment	No natural disasters in project area Workforce availability Climatic conditions permit at least five months of excavation work each year
Output 2.1: Engineering and safety plans for risk reduction measures on Thorthormi lake developed	Availability of an up-to-date engineering and safety plan for GLOF mitigation works	Feasibility study of technical mitigation measures for Thorthormi lake from 2004	By the end of Year 1: <ul style="list-style-type: none"> • 1 geotechnical assessment report confirming current status of moraine dam • 1 safety and evacuation plan • 1 engineering plan outlining the detailed location for mitigation works • 1 EIA report • Approval of engineering and safety plans by PB 	Engineering plan Safety and evacuation plan	No natural disasters in project area Climatic conditions permit the geotechnical assessment to take place
Output 2.2: Lowered Thorthormi Lake water levels	Artificial lowering system for lake water levels in place	No artificial lowering system of glacier lake levels is installed and continuously maintained Surface area of lake in 2001 measured 1.28 km ² and is still expanding	By the end of the project, the water level of Thorthormi lake is lowered by 5 meters	Satellite data, field survey, level readings	Availability of work force Regular seasonal variations of glacier melt do not greatly exceed average No natural disasters in project area

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
		Water volume of Thorthormi lake is outpacing its drainage capacity			
Output 2.3: Water levels of Thorthormi lake and status of artificial lowering system regularly monitored and maintained	<p>Number of local staff trained in the input/output management of Thorthormi lake water levels</p> <p>Number of field survey reports detailing status of lake level and lowering system</p>	No staff has been trained in how to artificially regulate glacier lake levels	<ul style="list-style-type: none"> • By the end of the project, 10 DGM, and DOE staff trained in monitoring of water flows and functioning of lowering system • At least two monitoring reports are produced and disseminated per year on the status of lake level and lowering system 	<p>Training reports</p> <p>Satellite data and field survey reports</p>	<p>Staff turnover does not negate training benefits</p> <p>Government continues to allocate resources to maintain artificial lowering system</p>
Output 2.4: Captured and documented technical knowledge and lessons in the artificial lowering of glacier lake levels for use in future projects	<p>Number of follow-up projects planned</p> <p>Number of successful national technology transfer initiatives</p> <p>Number of project reports published and disseminated</p>	<p>DGM database of feasibility reports on lowering glacial lakes</p> <p>No systematic capturing of knowledge on the establishment, monitoring, and maintenance of artificial glacial lake lowering systems</p>	<ul style="list-style-type: none"> • By the end of the project, a comprehensive evaluation of the operation and potential replication of the glacier lake level management system is conducted • By the end of the project, all relevant lessons for the lowering and management of glacier lake levels are captured in the DGM database • By the end of the project, national agreement to embark on at least 1 follow- 	<p>Evaluation report</p> <p>DGM database</p> <p>Meeting minutes, evidence of policy dialogue and active stakeholder engagement</p>	<p>Continued assessment of GLOF risks in Bhutan</p> <p>National ownership of glacier lake management technology</p> <p>National political agreement for follow-up plan on GLOF risk management</p> <p>National agreement on other project sites</p>

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
			<p>up project for the artificial lowering and management of glacier lake levels in Bhutan</p> <ul style="list-style-type: none"> • By the end of the project, DGM embarks on an active technology transfer and project replication campaign to install glacier lake management systems in at least 1 other region of Bhutan • By the end of the project, project lessons are captured, published and disseminated to all districts in Bhutan with GLOF vulnerabilities 	Dissemination plan and accompanying publications	<p>with GLOF risk as priority hazard</p> <p>Artificial lowering system in the target area contains elements that can be replicated elsewhere</p>
Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings	<p>Number of vulnerable communities in Punakha-Wangdi Valley reached by early warning system</p> <p>Percentage of households receiving and responding to warnings in time to avoid human losses</p>	<p>No GLOF early warning system for Punakha-Wangdi Valley in place</p> <p>Vulnerable households are not able to receive and react to GLOF early warning messages</p>	<ul style="list-style-type: none"> • By the end of the project, 90% of households in target communities are able to receive and respond to early warnings and take the appropriate actions following the warning. 	<p>Rehearsal observations</p> <p>QBS with households</p>	<p>No tampering with early warning system installations</p> <p>Functioning backup systems in place</p>
Output 3.1: Technical components for a GLOF early warning system in Punakha-Wangdi Valley installed and operational	Number of sensors and siren towers installed and tested regularly	No sensors or siren towers in Punakha-Wangdi Valley	<ul style="list-style-type: none"> • By the end of Year 1, a set of GLOF sensors installed, tested, and maintained in at least two locations north of Wolathang • By the end of Year 3, 8 siren 	<p>Survey of sensor/siren tower locations</p> <p>Physical presence of</p>	<p>Procurement proceeds on schedule</p> <p>Transport of building materials not delayed by seasonal climate extremes</p>

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
			towers at Samdingkha, Punakha, Khuruthang, and Wangdi installed, tested and maintained <ul style="list-style-type: none"> • By the end of Year 2, contingency plans and backup systems for operation of early warning systems are in place 	infrastructure Testing results	
Output 3.2: Established institutional arrangements to operate, test, and maintain the GLOF early warning system	EWS and response plan integrated in the Dzongkhag Disaster Management plans Number of early warning focal points identified and trained Early warning system remains operational	No focal points trained on GLOF early warning system	<ul style="list-style-type: none"> • By the end of Year 1, at least two early warning focal points in both of the target districts identified and trained in the testing and maintenance of the early warning system • By the end of Year 2, DDMCs in target area trained on EWS/response plans • By the end of Year 3, functioning of the GLOF early warning system is tested at least monthly 	Training reports Field tests Rehearsals under different conditions	Staff turnover does not negate training benefits Government continues to allocate resources for maintenance and continuous testing of early warning system
Output 3.3: Raised awareness of communities in the Punakha-Wangdi valley on operation of early warning system	Percentage of households in vulnerable communities aware of the new GLOF early warning system and able to effectively respond to warning messages	No awareness by vulnerable communities in the Punakha-Wangdi Valley on GLOF early warning procedures	<ul style="list-style-type: none"> • By the end of the project, at least 90% of households in the target area are aware of the operation of the GLOF early warning system are able to correctly receive and interpret early warning signals • By the end of the project, at 	QBS Rehearsal observations and planning protocols	Messages are delivered in an appropriate way to enhance awareness, receptiveness and understanding Messages are delivered in a concerted, coordinated

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
			least 1 full-scale GLOF early warning drill in all target vulnerable communities before the project closure		and consistent manner
Output 3.4: Raised awareness of safe GLOF evacuation areas in each vulnerable community in the Punakha-Wangdi Valley	Number of safe GLOF evacuation areas designated and accessible	No GLOF evacuation areas identified Communities do not know where to safely congregate in the event of a GLOF disaster	<ul style="list-style-type: none"> • By the end of Year 2, GLOF evacuation areas identified for each target community • By the end of Year 2, designation of, and accessibility to, all safe GLOF evacuation areas ensured and maintained 	<p>QBS</p> <p>Maps and signs indicating way to safe areas</p> <p>Disaster simulation exercise reports</p>	<p>At least two sufficiently safe evacuation points exist in and around target communities</p> <p>All DRM stakeholders cooperate in simulation exercises</p>
Output 3.5: Technical knowledge and lessons in the installment and operation of GLOF early warning systems captured and documented for use in future projects	<p>Evaluation of experiences with the operation and testing of the GLOF early warning system</p> <p>Number of instructive materials developed</p>	<p>No structured evaluation of GLOF early warning systems in Bhutan available</p> <p>No instructive materials available</p> <p>No systematic capturing of knowledge on the establishment, monitoring, and maintenance of GLOF early warning systems</p>	<ul style="list-style-type: none"> • By the end of the project, a comprehensive evaluation of the operation and potential replication of the GLOF early warning system is conducted • By the end of the project, all relevant reports on GLOF early warning systems are included in DGM database • By the end of the project, lessons learned are disseminated to all GLOF-vulnerable DDMCs by means of publications and instructive videos • By the end of the project, replication plan for early warning system in Chamkhar Valley developed 	<p>Evaluation report</p> <p>DGM database</p> <p>Instructive materials</p> <p>Replication plan</p>	<p>Government ownership of GLOF early warning technology</p> <p>National political agreement for follow-up plan on GLOF early warning</p>

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
Outcome 4: Enhanced learning, evaluation and adaptive management	Number of proposals, papers, and other documents that incorporate learning from the project	Experiences regarding climate change-induced GLOF mitigation and preparedness in Bhutan have not been systematically captured and shared	<ul style="list-style-type: none"> By the end of the project, GLOF mitigation and early warning initiatives or studies draw on learning from experiences in Bhutan 	ALM platform Proposals, papers, and other documents	The ALM is operational and circumstances in Bhutan apply to future GLOF mitigation and preparedness initiatives
Output 4.1. Project lessons captured and disseminated through the Adaptation Learning Mechanism	Number of contributions by the project to the ALM	No contribution by Bhutan to the ALM	<ul style="list-style-type: none"> By the end of the project, all project monitoring and evaluation reports are screened for inclusion in the ALM By the end of the project, key project lessons disseminated through ALM 	ALM platform	The ALM is operational to facilitate learning
Output 4.2. Project knowledge shared with other GLOF-prone countries	Number of organizations actively involved in knowledge transfer activities across borders	No systematic knowledge transfer on GLOF risks from Bhutan to other countries	<ul style="list-style-type: none"> By the end of the project, organization and hosting of 1 international workshop on GLOF risk reduction 	Workshop proceedings	Other regions and countries believe experiences from the project will be valuable for future GLOF mitigation and preparedness initiatives

Part II: Additional Cost Analysis

Project Background

113. The most significant climate change impact in Bhutan is the formation of supra-glacial lakes due to the accelerated retreat of glaciers with increasing temperatures. The risk of potential disasters inflicted by GLOFs, which pose a new dimension of threats to lives, livelihoods, and development, is mounting as the water levels approach critical thresholds. Various scientific studies and the initial National Communication of Bhutan to the United Nations Framework Convention on Climate Change (UNFCCC) highlight GLOFs as a major threat. The components of the proposed project comprise the three most urgent priorities from the recently concluded National Adaptation Programme of Action (NAPA) process in Bhutan.

Additional Cost Assessment

Baseline

114. Current disaster management policies, risk reduction, and preparedness in Bhutan address recurrent natural hazards in the country, but are not yet geared to deal with the new dimension of GLOF threats. The Royal Government of Bhutan, with the support of UNDP, has developed the National Disaster Risk Management Framework to consolidate and strengthen disaster mitigation, preparedness, and response in the country. All departments of the Bhutanese government are actively involved in policy work on disaster risk reduction, either through involvement in the drafting of legislation or through participation in a range of complementary programs. There is no artificial water lowering system in place for Thorthormi lake, but studies have been conducted to evaluate the feasibility of such a system. Although a flood early warning system exists for Punakha-Wangdi Valley, it could not provide sufficient warning for a GLOF and vulnerable communities are not prepared to take the appropriate actions following a GLOF warning.

Additional Cost Reasoning

115. Recognizing the current capacity deficits to address new risks emerging from climate change, the Government of Bhutan seeks to integrate long-term climate risks into the existing DRM framework and readjust it with a view on greater effectiveness and longer-term planning. The project will also implement demonstrative and practical measures for reducing climate change-induced GLOF risks from the potentially dangerous Thorthormi glacier lake, as well as ensure the existing early warning system is expanded to cover this growing risk. The lessons learned will facilitate replication in other high risk GLOF areas, both within and outside Bhutan.

116. At the national level, the project would improve government capacity to deal with dynamic, climate-induced hazards and to design, implement, evaluate, and replicate systems for GLOF risk reduction and preparedness. Vulnerability of communities in high risk GLOF areas will be reduced as the project will catalyze cost-effective management of glacier lake levels and adjustment of communal early-warning systems to climate change-induced hazards.

Systems Boundary

117. The project targets the national, district, and local levels for activities to improve government capacity for incorporating long-term climate risk planning into Bhutan's disaster risk management framework, with a special focus on Punakha, Wangdi, and Bumthang districts. Activities to mitigate GLOF risk will focus on Thorthormi lake and the surrounding areas, while activities to reduce human

and material losses through an improved GLOF early warning system will focus on vulnerable communities in the Punakha-Wangdi Valley.

Summary of Adaptation Benefits and Costs

Cost/Benefit	Baseline (B)	Alternative (A)	Project and Additional costs (A-B)
BENEFITS			
Current mitigation works on glacial lake levels are not systematic and the set-up of early warning systems is not sufficient to cope with large-scale GLOF events. There are still capacity deficits in planning for the expected distribution and effects of potential GLOF impacts.	Disaster risk management is being addressed by several organizations, led by the DMD, MOHCA, under the umbrella of the NDRMF. Some GLOF studies have been conducted, and measures for reducing GLOF risks have been suggested.	The project seeks to integrate long-term climate risk planning into the NDRMF and increase capacity on the local, district, and national levels to manage increasing GLOF risks. Specifically, it will address the urgent and immediate needs to prevent climate change-induced GLOF disasters in the Punakha-Wangdi Valley with a view to building Bhutan's capability to address similar risks in the future.	
COSTS			
Outcome 1: Improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys	Climate change risks have been noted in the current NDRMF, but no comprehensive disaster management guidelines exist for Dzongkhag or Gewog Disaster Management Committees and district DRM focal points do not possess adequate knowledge and skills to plan and implement climate-resilient DRM measures. RGOB: 320,000 UNDP: 450,000 Co-financing: \$770,000	The project will support investment in improved institutional capacities at all levels for climate-resilient disaster risk management, and systematic alignment between disaster and climate risk reduction initiatives. Alternative: \$1,065,000	GEF: \$295,000
Outcome 2: Reduced risks of GLOF from Thorthormi lake through an artificial lake level management system	Thorthormi Lake is among the most hazardous of Bhutan's 25 lakes with a high risk of GLOF. There is a lack of resources and capacity to systematically establish and maintain an artificial lowering system of glacial lake water levels.	Thorthormi Lake is no longer considered at high risk of GLOF, as scientifically assessed at the project's completion. There will be strengthened capacity for maintaining a lowered lake water level, and the applied mitigation measures will be replicable in other regions of Bhutan.	

Cost/Benefit	Baseline (B)	Alternative (A)	Project and Additional costs (A-B)
	RGOB: 1,925,000 WWF: 30,000 UNDP: 26,224 Austria: 500,000 Co-financing: \$2,481,224	Alternative: \$4,719,236	GEF: \$2,238,012
Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings	There is a lack of resources and capacity to systematically establish and maintain a GLOF early warning system for Punakha-Wangdi Valley, and vulnerable households are not able to receive and react to GLOF early warning messages. RGOB: 360,000 UNDP: 50,000 Austria: 260,000 Co-financing: \$670,000	Households in target communities are able to receive and respond to GLOF early warnings and take the appropriate actions following the warning. The applied preparedness measures will be replicable for other regions of Bhutan. Alternative: \$1,502,038	GEF: \$832,038
Outcome 4: Enhanced learning, evaluation and adaptive management	There is no systematic knowledge transfer on GLOF risks within Bhutan or from Bhutan to other countries. RGOB: 40,000 Austria: 40,000 Co-financing: \$80,000	There will be documented knowledge, such as evaluations and guidelines, accessible for stakeholders in Bhutan and other GLOF-prone regions. Alternative: \$100,000	GEF: \$20,000
Project evaluation	No evaluations conducted on project. RGOB: 35,000 Co-financing: \$35,000	Project management and monitoring and evaluation of the project activities and impacts. Alternative: \$95,000	GEF: \$60,000
TOTAL COSTS	Co-financing: \$4,036,224	Alternative: \$7,481,274	GEF: \$3,445,050

Co-financing costs include cash and in-kind contributions

SECTION III: TOTAL BUDGET AND WORKPLAN

118. In terms of the GEF funding portion, the financing instrument will be the LDCF. The proposed project cost is US\$7,481,274, out of which US\$3,445,050 is proposed from the LDCF. Co-financing amounting to US\$4,036,224 is secured from the Royal Government of Bhutan, the Government of Austria, WWF Bhutan, and UNDP Bhutan.

TOTAL BUDGET AND WORKPLAN

Award ID:	00045605
Project ID:	00053899
Business unit	BTN10
Project title:	Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys
Implementing partner (executing agency)	<ul style="list-style-type: none"> • Department of Geology and Mines, Ministry of Economic Affairs • Disaster Management Division, Ministry of Home and Cultural Affairs

GEF Outcome/Atlas Activity	Responsible party/ implementing agent	Fund ID	Donor name	Atlas budgetary account code	ATLAS budget description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See budget note ²⁵		
OUTCOME 1: improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys	DGM	62000	GEF Trustee	71600	travel	2,500	2,500	3,000	4,000	12,000	1.1		
				74200	Printing & Publication	8,750	8,750	8,750	11,750	38,000	1.2		
	DMD	62000	GEF Trustee	71200	Int. Consultant	40,000				40,000	1.3		
				71600	Travel		26,000	27,500	10,000	63,500	1.4		
				72500	Supplies	2,000	1,500	1,500	1,000	6,000	1.5		
				72400	Communication & Audio visual equipments								
						500	500	500		1,500	1.6		
				74500	Misc	27,500	22,500	24,500	9,500	84,000	1.7		
		74200	Audio visual & printing, publication charges			8,000	13,500	12,000	16,500	50,000	1.8		
					Sub Total GEF	89,250	75,250	77,750	52,750	295,000			

²⁵ See Annex 10 for budget notes

GEF Outcome/Atlas Activity	Responsible party/ implementing agent	Fund ID	Donor name	Atlas budgetary account code	ATLAS budget description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See budget note ²⁵
OUTCOME 2: GLOF risk from Thorthomi lake reduced through an artificial lake level management system (Output: 2.1 & 2.2-2.4)	DGM	62000	GEF Trustee	71400	Contractual Services	14,490	0	0	0	14,490	2.1
				71600	Travel	8,085	0	0	0	8,085	2.2
				72100	Contractual Services	2,640	0	0	0	2,640	2.3
				74500	Miscellaneous	3,000	0	0	0	3,000	2.4
				71400	Contractual Services	325,365	325,365	325,365	325,365	1,301,460	2.5
				71600	Travel	65,890	65,890	85,890	85,890	303,560	2.6
				72100	Contractual Services	120,285	72,047	72,047	72,047	336,426	2.7
				72200	Equipments & Furniture	44,427	1,010	1,010	1,010	47,457	2.8
				72300	Materials & Goods	30,000	18,000	18,000	18,000	84,000	2.9
				72400	Communications	1,500	1,500	1,500	1,500	6,000	2.10
				72500	Supplies	1,250	1,250	5,746	6,250	14,496	2.11
				73400	Rental & Maintenance of other	10,381	10,381	14,381	15,000	50,143	2.12
				74200	Printing & Publication cost			3,000	10,000	13,000	2.13
				74500	Miscellaneous	3,755	2,500	2,500	10,000	18,755	2.14
74700	Contingency	8,000	8,000	8,000	10,500	34,500	2.15				
					Sub Total GEF	639,068	505,943	537,439	555,562	2,238,012	
OUTCOME 3: Vulnerable communities in the Punakha-Wangdi Valley are able to receive GLOF early warnings in time to reduce human and material losses	DGM	62000	GEF Trustee	71400	Contractual Services	4,500	1,688	0	0	6,188	3.1
				71600	Travel	5,000	10,000	15,000	49,540	79,540	3.2
				72100	Contractual Service-Companies	149,100	90,712	0	0	239,812	3.3
				72200	Equipments & Furniture	136,186	0	0	0	136,186	3.4
				72400	Communications and Audio Visual Equipment	156,240	0	0	0	156,240	3.5
				72500	Supplies	2,000	2,000	3,000	3,000	10,000	3.6
				72800	Information Technology Equipment	15,000	0	0	0	15,000	3.7
				74200	Audio Visual and Printing Production Costs	5,000	5,000	5,000	5,000	20,000	3.8
				74500	Miscellaneous Expenses	1,000	1,400	1,600	4,000	8,000	3.9

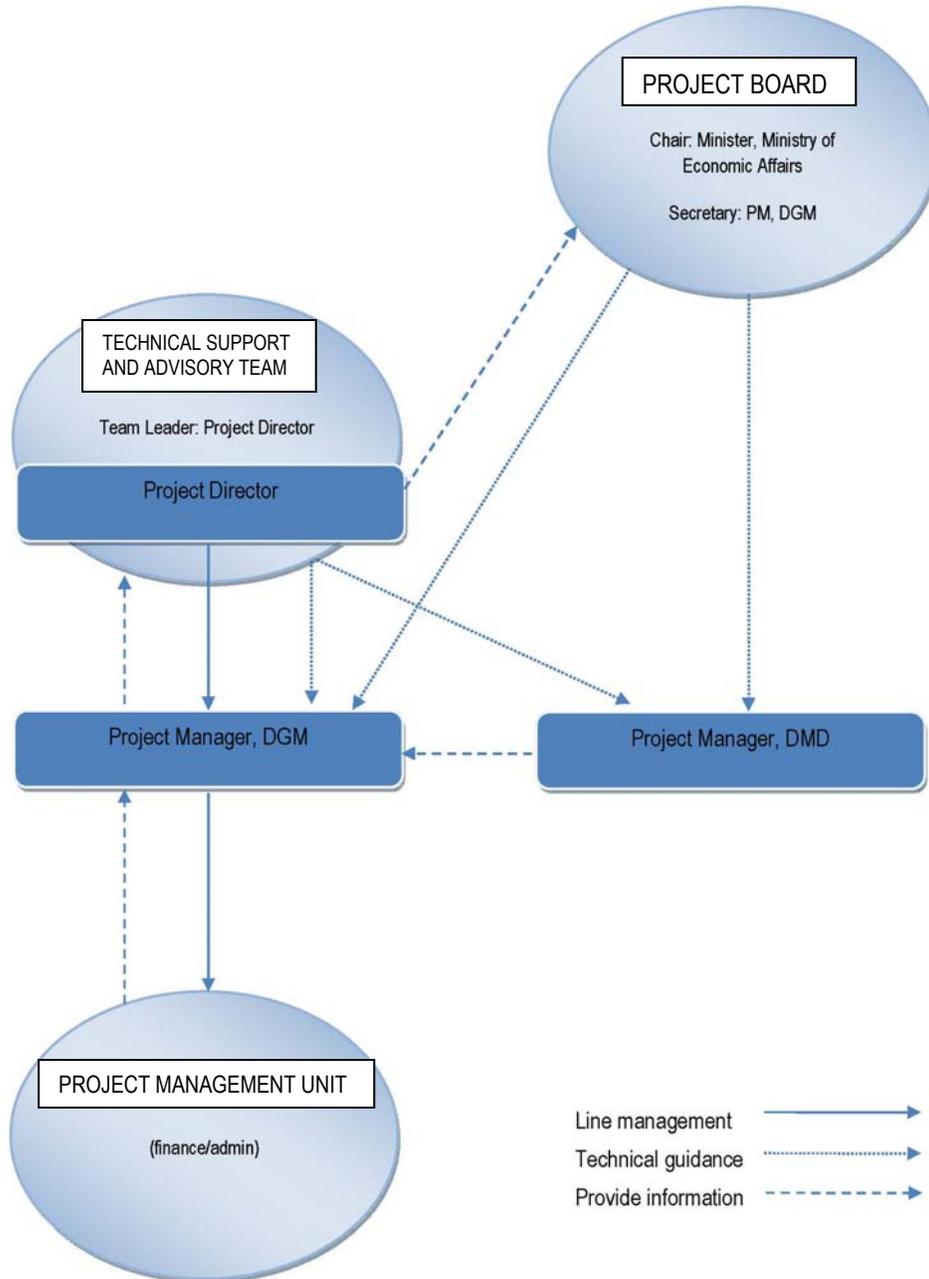
GEF Outcome/Atlas Activity	Responsible party/ implementing agent	Fund ID	Donor name	Atlas budgetary account code	ATLAS budget description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See budget note ²⁵
	DMD	62000		71200	Int. Consultant			15,000	15,000	30,000	3.10
				71600	travel			11,016	11,016	22,032	3.11
				72500	Supplies			2,000	2,000	4,000	3.12
				74500	Misc			20,020	20,020	40,040	3.13
				74200	Audio Visual & printing , publication charges			2,000	3,000	5,000	3.14
				72100	Contractual services			20,000	20,000	40,000	3.15
				73000	Overhead expenses					10,000	10,000
					Sub Total GEF	474,026	110,800	104,636	142,576	832,038	
OUTCOME 4: Learning, evaluation and adaptive management	UNDP-NEX								0	0	
	DMD	62000	GEF Trustee	74525	Misc				20,000	20,000	4.1
					Sub Total GEF				20,000	20,000	
Monitoring Evaluation	UNDP-NEX			71600	Travel	5,000	2,500		2,500	10,000	5.1
				72100	Int. Consultant		15,000		15,000	30,000	5.2
				72100	Local Consultant		7,500		7,500	15,000	5.3
				74500	Misc		2,500		2,500	5,000	5.4
					Sub Total GEF	5,000	27,500	0	27,500	60,000	
TOTAL						1,207,344	719,493	719,825	798,388	3,445,050	

SECTION IV: ADDITIONAL INFORMATION

PART I: Other Agreements

See Annex 12 for the following letters: RGOB GEF Focal Point endorsement of the project; RGOB co-financing of USD 2.68 million; Austria co-financing of EUR 600,000; WWF Bhutan co-financing of USD 30,000; and UNDP co-financing of USD 526,224.

PART II: Organigram of Project



PART III: Terms of Reference for Key Project Groups, Staff, and Sub-contracts

118. Relevant information on the project background, objectives, activities, and expected outputs of the project are provided in the project document, which can be referred to for more detailed information. The project document is to be considered an integral part of these Terms of References.

Project Board (PB)

The Project Board is the group responsible for making by consensus management decisions for a project when guidance is required by the Project Manager, including recommendation for approval of project plans and revisions. PB decisions should be made in accordance to standards that shall ensure best value to money, fairness, integrity transparency, and effective international competition. Project reviews by this group are made at designated decision points during the running of a project, or as necessary when raised by the Project Manager. This group is consulted by the Project Manager for decisions when PM tolerances (normally in terms of time and budget) have been exceeded.

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

The PB is the group responsible for making management decisions on a consensus basis for a project when guidance is required by the Project Manager, including approval of project revisions. Project assurance reviews by this group are made at designated decision points during the running of a project (e.g. Indicative Activity 2.1.5), or as necessary when raised by the Project Manager. The PB will be composed of the following members:

- Secretary, Ministry of Economic Affairs (Chairperson)
- Director, Department of Geology and Mines
- Representative, Disaster Management Division
- Representative, Planning Commission
- Representative, National Environment Commission
- Representative, Ministry of Finance
- Representative, Ministry of Home and Cultural Affairs
- Representative, Department of Energy
- Representative, Department of Roads
- Representative, WWF
- Representative, UNDP
- Project Managers, DGM and DMD, as member Secretaries

The PB will normally meet once a year, including at least four times during the project period (at the inception phase, to review the engineering and safety plan for Outcome 2, at the mid-term phase, and at the end of the project period). It may also meet exceptionally as needed.

The primary task of the PB will be to set up policies and provide guidance and direction for the Project. Specific responsibilities of the PB are the following:

- Policy and institutional coordination at the national level. It will provide overall policy guidance to the implementation of the project and facilitate an effective communication and decision-making between the Executing Agency and other actors;
- Monitor project implementation to ensure that it remains in-line with the approved project document, goals, objectives and financial rules and regulations of UNDP-GEF.
- Ensure the project objectives and outputs are achieved as outlined in this project document.

Technical Support and Advisory Team (TSAT)

The Technical Support and Advisory Team (TSAT) will provide technical support to the project during the implementation of activities related to artificial water lowering of Thorthormi Lake (Outcome 2). The TSAT will be composed of the following members:

- Project Director, DGM (Team Leader)
- Representative, DMD
- Representative, Park Management
- Representative, Ministry of Health
- Representative, Ministry of Home and Cultural Affairs
- Representative, National Environment Commission
- Representative, Department of Roads
- Project Manager, DGM
- Representative, UNDP

The TSAT will meet at least once before the implementation of the work at the site and as and when required hereafter. Specific responsibilities are the following:

- Ensure the technical soundness of the safety and evacuation plan developed under Activity 2.1.2
- Ensure the technical soundness of the engineering plan developed under Activity 2.1.4 for artificially lowering the water level at Thorthormi lake
- Provide technical advice and backup support to the Project Management Unit (PMU) during the implementation of work at the site.
- Monitor implementation of activities at the project site during the artificial lowering of the Thorthormi Lake.
- Ensure artificial lowering proceeds according to the engineering and safety plans as developed under Activities 2.1.2 and 2.1.4.

Project Director

The Project Director will be responsible for overseeing project implementation and ensuring that the project goal, objectives, and outputs are achieved. Specific responsibilities include the following:

- Ensure that RGOB inputs to the project are forthcoming in a timely and effective manner
- Lead the Technical Support and Advisory Team (TSAT)
- Supervise consultants and monitor and assess their outputs. Technical endorsement from the Project Director will be essential for release of consulting payments.
- Supervise and provide guidance to the Project Managers in project implementation.

Qualifications

- Familiar with climate change and adaptation issues in Bhutan and the main actors and stakeholders in this field
- Proven experience in the implementation of projects regarding glaciers, glacial lakes, and disaster risk reduction
- Proven ability to lead multi-disciplinary technical teams
- Excellent working knowledge of spoken and written English
- Willingness to travel as appropriate

Project Manager, DGM

The Project Manager from DGM will play a key role in project execution. The Project Manager reports to the Project Director, will receive guidance from the TSAT and PB, and is responsible for the day-to-day management, coordination, and supervision of the overall project implementation. The Project Manager will be appointed by the executing agency and will be in charge and responsible for the following:

- Coordinate project implementation, monitor work progress, and ensure timely delivery of **Outputs 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, and 3.5**
- Liaise with Project Manager, DMD, to ensure project implementation, monitor work progress, and ensure timely deliver of Outputs 1.1, 1.2, 1.4, 3.2, 3.3, and 3.4
- Liaise with relevant stakeholders in Thimphu, Gasa, Punakha, Wangdi, and Bumthang related to activities for the Outputs under DGM's responsibility
- Prepare a detailed work plan for the project at the outset of implementation, in coordination with the Project Manager, DMD, and revise at least annually
- Organize and conduct stakeholder meetings, technical trainings, and others as necessary
- Liaise with experts to provide technical input on early warning, GLOF mitigation, disaster preparedness, and climate change for the development of guidelines, training materials, public awareness materials, and others as necessary
- Assist in the identification, selection and recruitment of consultants and other experts for the Outputs under DGM responsibility
- Supervise, coordinate, and facilitate the work of all national and international consultants retained for the different activities related to the Outputs listed above
- Participate in PB meetings and follow up on the outcomes of such meetings and report on progress related to the Outputs under DGM's responsibility
- Control expenditures and assure adequate management of resources for the overall project
- Prepare technical specifications for equipment required for the project and manage procurement for Outputs under DGM's responsibility
- Identify relevant, on-going activities by other government and non-government agencies, and establish linkages
- Build partnerships with international/regional institutions and national organizations
- Prepare technical progress reports and other monitoring reports as described in the M&E plan for the overall project, with inputs from the Project Manager, DMD. Reports should contain assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements

Qualifications

- Understanding of climate change, adaptation, GLOFs, and disaster management issues in Bhutan and the main actors and stakeholders in this field
- Proven experience with the implementation of development projects, particularly in the field of disaster risk reduction and water management
- Proven ability to manage, monitor, and troubleshoot comparable projects
- Excellent working knowledge of spoken and written English
- Willingness to travel as appropriate

Project Manager, DMD

The Project Manager from DMD will play a key role in project execution. The Project Manager is responsible for the day-to-day management, coordination, and supervision of the project implementation for select Outputs as detailed below. The Project Manager, DMD, will be appointed by the executing agency. S/he will receive guidance from the Project Director, TSAT, and PB, and will be in charge and responsible for the following:

- Coordinate project implementation, monitor work progress, and ensure timely delivery of **Outputs 1.1, 1.2, 1.4, 3.2, 3.3, and 3.4**
- Liaise with relevant stakeholders in Thimphu, Gasa, Punakha, Wangdi, and Bumthang related to activities for the Outputs under DMD's responsibility
- Prepare a detailed work plan for the Outputs above at the outset of implementation, in coordination with the Project Manager, DGM, and revise at least annually
- Liaise with the Project Manager, DGM, to incorporate technical input on early warning, GLOF mitigation, disaster preparedness, and climate change for the development of guidelines, training materials, public awareness materials, and others as necessary
- Assist in the identification, selection and recruitment of consultants and other experts for the Outputs above
- Supervise, coordinate and facilitate the work of all national and international consultants retained for the different activities related to the Outputs listed above
- Participate in PB meetings and follow up on the outcomes of such meetings and report on progress related to the Outputs above
- Control expenditures and assure adequate management of resources for the Outputs above
- Identify relevant, on-going activities by other government and non-government agencies, and establish linkages
- Build partnerships with international/regional institutions and national organizations
- Provide input to the Project Manager, DGM, for technical progress reports and other monitoring reports as described in the M&E plan for the overall project. Reports should contain assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements

Qualifications

- Familiar with climate change, adaptation, and GLOF issues in Bhutan
- Understanding of disaster management and capacity building needs and methodologies appropriate for stakeholders in Bhutan
- Familiar with the main actors and stakeholders in this field
- Proven experience with the implementation of development projects, particularly in the field of disaster risk reduction
- Proven ability to manage, monitor, and troubleshoot comparable projects
- Excellent working knowledge of spoken and written English
- Willingness to travel as appropriate

Full terms of reference for the following positions will be developed based on project needs.

International Consultant, Disaster Management Policy and Institutional Framework

The International Consultant will assist DMD in its responsibilities for Outcome 1: Improving national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys. S/he will report to the Project Manager, DMD, for the following specific tasks:

- Review relevant information on disaster management and climate change in Bhutan
- Assess institutional needs for disaster management at the dzongkhag level
- Assist DMD in drafting by-laws for Dzongkhag Disaster Management Committees
- Assess disaster risks in target dzongkhags, options for reducing disaster risks, and options for building disaster management capacity taking long-term climate risks into account
- Assist DMD in the development of local disaster management plans in target Dzongkhags
- Develop guidelines for integrating climate risk information into district and gewog development plans
- Develop a training module on climate change-resilient DRM

Qualifications

- Understanding of disaster management and capacity building needs and methodologies appropriate for stakeholders in Bhutan
- Familiar with the main actors and stakeholders in this field
- 10 years experience in disaster management and policymaking
- Experience building capacity on disaster management
- Willingness to travel as appropriate

International Consultant, Early Warning Information and Communications

The International Consultant will assist DMD in its responsibilities for Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings. S/he will report to the Project Manager, DMD, for the following specific tasks:

- Assess information and communication needs in Punakha-Wangdi Valley related to the GLOF early warning system
- Develop appropriate content for posters, DVDs, information booklets, and other needed materials
- Collaborate with audio-visual firm to produce materials

Qualifications

- Understanding of disaster management, public awareness, and effective communication approaches
- Experience working in community settings in Bhutan
- 10 years experience in community-based disaster preparedness, including early warning

International Consultant, Mid-Term Evaluation

The International Consultant will be recruited to conduct the mid-term evaluation of the project for the Monitoring & Evaluation component. S/he will report to the Project Manager, DGM, and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the mid-term evaluation
- Assess the progress towards achievement of the project objectives as outlined in the initial project document
- Look into the relationship between this project and other relevant projects to reduce climate change-induced GLOF risks as well as other climate change risks
- Assess the structure and performance of the project management team and support provided by UNDP
- Identify lessons learned from the implementation of the project's activities
- Provide guidance and specific recommendations on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project
- Provide guidance and specific recommendations for future support in the area of climate change adaptation and disaster risk management (as applicable) for both the RGOB and UNDP to consider
- Produce the mid-term evaluation report
- Present the findings for relevant stakeholders

Qualifications

- Familiarity with the challenges developing countries face in adapting to climate change
- 10 years of relevant field-based experience in monitoring and evaluation of projects
- Familiarity with a participatory approach in project monitoring and evaluation
- Familiarity with Bhutan or similar countries
- Excellent writing and analytical skills

National Consultant, Mid-Term Evaluation

The National Consultant will be recruited to conduct the mid-term evaluation of the project for the Monitoring & Evaluation component. S/he will report to the Project Manager, DGM, and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations
- Assess the progress towards achievement of the project objectives as outlined in the initial project document
- Look into the relationship between this project and other relevant projects to reduce climate change-induced GLOF risks as well as other climate change risks
- Assess the structure and performance of the project management team and support provided by UNDP
- Identify lessons learned from the implementation of the project's activities
- Provide input on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project

- Provide inputs for recommendations on future support in the area of climate change adaptation and disaster risk management (as applicable) for both the RGOB and UNDP to consider
- Provide inputs to the International Consultant for the mid-term evaluation report
- Present the findings for relevant stakeholders

Qualifications

- Understanding of climate change adaptation and disaster management in Bhutan
- At least 5 years of work experience in the development sector in Bhutan
- Excellent communication in English and Bhutanese (oral and written)

International Consultant, Final Evaluation

The International Consultant will be recruited to conduct the mid-term evaluation of the project for the Monitoring & Evaluation component. S/he will report to the Project Manager, DGM, and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the final evaluation
- Assess the progress towards achievement of the project objectives as outlined in the initial project document
- Look into the relationship between this project and other relevant projects to reduce climate change-induced GLOF risks as well as other climate change risks
- Assess the structure and performance of the project management team and support provided by UNDP and to what extent recommendations from the mid-term evaluation were implemented
- Identify lessons learned from the implementation of the project's activities in the following areas:
 - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time
 - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved
 - Efficiency – the extent to which results have been delivered with the least costly resources possible
 - Results – the positive and negative, and foreseen and unforeseen, changes to and effects produced by a development intervention. In GEF terms, results include direct project outputs, short-to medium term outcomes, and longer-term impact including replication effects and other, local effects
 - Sustainability – the likely ability of an intervention to continue to deliver benefits for an extended period of time after completion. Projects need to be environmentally as well as financially and socially sustainable.
- Provide guidance and specific recommendations for future support in the area of climate change adaptation and disaster risk management (as applicable) for both the RGOB and UNDP to consider
- Produce the final evaluation report
- Present the findings for relevant stakeholders

Qualifications

- Familiarity with the challenges developing countries face in adapting to climate change

- 10 years of relevant field-based experience in monitoring and evaluation of projects
- Familiarity with a participatory approach in project monitoring and evaluation
- Familiarity with Bhutan or similar countries
- Excellent writing and analytical skills

National Consultant, Final Evaluation

The National Consultant will be recruited to conduct the mid-term evaluation of the project for the Monitoring & Evaluation component. S/he will report to the Project Manager, DGM, and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations
- Assess the progress towards achievement of the project objectives as outlined in the initial project document
- Look into the relationship between this project and other relevant projects to reduce climate change-induced GLOF risks as well as other climate change risks
- Assess the structure and performance of the project management team and support provided by UNDP and to what extent recommendations from the mid-term evaluation were implemented
- Identify lessons learned from the implementation of the project's activities in the following areas:
 - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time
 - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved
 - Efficiency – the extent to which results have been delivered with the least costly resources possible
 - Results – the positive and negative, and foreseen and unforeseen, changes to and effects produced by a development intervention. In GEF terms, results include direct project outputs, short-to medium term outcomes, and longer-term impact including replication effects and other, local effects
 - Sustainability – the likely ability of an intervention to continue to deliver benefits for an extended period of time after completion. Projects need to be environmentally as well as financially and socially sustainable.
- Provide input on specific recommendations for future support in the area of climate change adaptation and disaster risk management (as applicable) for both the RGOB and UNDP to consider
- Provide input to the International Consultant for the final evaluation report
- Present the findings for relevant stakeholders

Qualifications

- Understanding of climate change adaptation and disaster management in Bhutan
- At least 5 years of work experience in the development sector in Bhutan
- Excellent communication in English and Bhutanese (oral and written)

Audio-Visual Firm

The audio-visual (AV) firm will assist DMD in its responsibilities for Outcome 1: Improving national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys. The firm will document various activities throughout the project and create audio-visual materials for public awareness campaigns. This will provide lessons learned and educational resources. The audio-visual firm will report to the Project Manager, DMD. Specific tasks include the following:

- Document training and consultative workshops
- Liaise with DMD and assigned technical consultants on the appropriate design and content for AV materials
- Produce audio-visual materials, such as videos, posters, and booklets, on climate change, change change risks, GLOFs, and disaster risk reduction

Qualifications

- Experience producing public awareness and educational materials
- Experience working in community settings

Construction Firm, Early Warning System

The construction firm will assist DGM in its responsibilities for Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings. The firm will report to the Project Manager, DGM, and construct GLOF early warning towers in the Punakha-Wangdi Valley according to a detailed plan that will be developed during the project. Specific tasks include the following:

- Develop a detailed engineering plan building on the estimate included in “Assessment of early warning systems in Punakha-Wangdi Valley” (Annex 4)
- Construct the early warning towers and related infrastructure
- Ensure that RGOB environmental guidelines are followed in the process of constructing the towers
- Develop a maintenance plan for the continued operation of the towers by RGOB
- Provide training as necessary to RGOB staff

Qualifications

- Experience nationally or regionally on early warning systems and construction
- Understanding of requirements for construction and infrastructure maintenance in mountainous environments

Construction Firm, Evacuation Sites

The construction firm will assist DMD in its responsibilities for Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings. The firm will report to the Project Manager, DMD, and ensure clear access to evacuation sites in the Punakha-Wangdi Valley according to a detailed plan that will be developed during the project. Specific tasks include the following:

- Ensure clear access to identified community evacuation sites where communities will escape in the event of a GLOF warning
- Remove hindering vegetation, construct pathways, and install signage for easy navigation by community members
- Ensure that RGOB environmental guidelines are followed in the process of clearing access to evacuation sites
- Develop a maintenance plan for continued access to evacuation sites, which will be implemented by community members
- Provide training as necessary for maintenance of pathways to the local disaster management committee and community members

Qualifications

- Experience in forest management and construction
- Understanding of requirements for construction and infrastructure maintenance in mountainous environments

PART IV: Stakeholder Involvement Plan

An overview of stakeholders' roles in disaster risk management, climate change, and GLOFs is provided in the table below.

Institution	Contact information	Main responsibility	Role in PPG and FSP
Department of Geology and Mines (DGM)	Mr. Dowchu Dukpa Project Manager T: +975-2-323096/ 322879/ 323349 F: +975-2-323013/ 326134 E: dawchu@gmail.com www.mti.gov.bt/dgm/dgm.htm	Responsible for geological mapping, providing engineering geological services, and carrying out scientific studies and monitoring of natural hazards that are prevalent in the Himalayan environment.	<p>DGM will execute all technical aspects regarding implementation of the FSP, in close collaboration with the Disaster Management Division, MoHCA and other stakeholders. The agency was involved in contributing to all Outcomes of the PPG process, and will be involved in all FSP Outcomes. DGM will participate in the Project Board meetings and chair the meetings.</p> <ul style="list-style-type: none"> • Output 1.3: Information on climate hazards and vulnerabilities (GLOF) in Bhutan systematically captured, updated and synthesized • Output 2.1: Engineering and safety plans for mitigation works on Thorthormi lake reduce risks to workforce and downstream population • Output 2.2: Artificial lowering system of Thorthormi Lake waters implemented • Output 2.3: Water levels of Thorthormi lake and status of artificial lowering system are regularly monitored and maintained • Output 2.4: Technical knowledge and lessons in the artificial lowering of glacier lake levels captured and documented for use in future projects • Output 3.1: Technical components for a GLOF early warning system in Punakha-Wangdi Valley is installed and operational <p>Output 3.5: Technical knowledge and lessons in the installment and operation of GLOF early warning systems captured and documented for use in future projects</p>
Disaster Management Division (DMD, MoHCA)	Ms. Karma Doma Tshering Senior Program Officer T: +975-2-326935/ 322301/	DMD, MoHCA, is the nodal agency for coordinating disaster management activities at the national, <i>Dzongkhag</i> , and	DMD, MoHCA, has participated in the Project Steering Committee meetings during the PPG and will provide coordination and guidance during

Institution	Contact information	Main responsibility	Role in PPG and FSP
	322015/ 325173 F: +975-2-327864 E: kdtdly@hotmail.com	<p><i>Gewog</i> levels. In keeping with the priority accorded to decentralized local governance, DMD facilitates and strengthens the decentralization of administration and program implementation in the country.</p>	<p>implementation of the FSP, particularly to facilitate logistics and labor mobilization for all Outcomes. It will collaborate closely with DGM to incorporate climate change issues into the DRM framework and training materials and is also directly responsible for the delivery of project outputs under Outcome 1 “Improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys”.</p> <ul style="list-style-type: none"> • Output 1.1: Climate-proofed DRM legislation, policy frameworks, and guidelines • Output 1.2: Capacities for climate risk planning strengthened at the district (dzongkhag) administrative levels • Output 1.4: Vulnerable communities are aware of, and prepared for, climate-related disasters • Output 3.2: Institutional arrangements in place to operate, test, and maintain the GLOF early warning system • Output 3.3: Awareness of communities in the Punakha-Wangdi valley on operation of early warning system • Output 3.4: Safe GLOF evacuation areas in each vulnerable community in the Punakha-Wangdi Valley identified and locations known to community members

Institution	Contact information	Main responsibility	Role in PPG and FSP
National Environment Commission (NEC)	<p>Mr. Thinley Namgyal Program Officer T: +975-2-334951 F: +975-2-334952 E: tnamgyal@nec.gov.bt www.nec.gov.bt</p> <p>Mr. Tshering Tashi Joint Director E: ttashi@nec.gov.bt T: +975-2-323384/ 324323/ 326386 F: +975-2-323385 www.nec.gov.bt</p>	NEC oversees and guides environmental management within overall national development.	NEC took the lead in designing and implementing the NAPA process in Bhutan and provided information on climate change vulnerabilities. NEC has, and will continue to, participate in the Project Board meetings and ensure policy coordination. As the agency prepares the Second National Communication to the UNFCCC, it will continue to provide input on vulnerabilities related to climate change and disasters, particularly in designing awareness and training for local staff and communities.
Planning Commission	<p>Ms. Tenzin Wangmo Senior Planning Officer Planning, Monitoring, and Coordination Division T: +975-2-322503 (ext. 119) M: +975-17621461 E: twangmo@pc.gov.bt</p> <p>Ms. Jambay Zangmo Program Officer Development Cooperation Division T: +975-2-326776 E: jzangmo@mof.gov.bt</p>	The Planning Commission and its Secretariat formulate overall development strategies and coordinate sectoral activities, policies, and programs, and formulate Five-Year Plans and programs. The Commission is also responsible for aid management, coordinating inter-ministerial development programs, and monitoring and evaluating programs at the macro-level.	<p>For long-term sustainable development following the project, the Planning Commission will be crucial towards integration of the hazard zonation maps into development plans for the Punakha-Wangdi Valley and Chamkhar Valley. It will also help ensure that successful approaches and outcomes of this project will contribute to Bhutan's adaptation to climate change. The Planning Commission has, and will continue to, participate in the PB and relevant meetings and workshops.</p> <p>For this project, the Planning Commission will provide guidance in ensuring the resources for enhancing climate resilience complement ongoing development activities.</p>
Ministry of Finance		The MoF has the mandate to ensure effective national resources allocation and management	The MoF will participate in the PB and other relevant meetings and workshops.
Department of Roads, Ministry of Works and Human Settlement	Mr. N.K. Giri Deputy Executive Engineer M: +975-17621820	The Department of Roads has the mandate to plan, construct, and maintain the road network within the country.	The Department of Roads will participate in all relevant planning and dissemination workshops, the design and evaluation of the engineering plan,

Institution	Contact information	Main responsibility	Role in PPG and FSP
	E: nmkgiri@yahoo.com http://www.dor.gov.bt/	Climate risk information is critical input to the Department's decision-making for new road construction and alignment.	and will assist in identifying and fielding an engineer to supervise mitigation works at Thorthomi lake.
Department of Energy (DoE), Ministry of Economic Affairs (MEA)	Mr. Karma Chopel Head/Chief Engineer Hydro-Met Services Division T: +975-2-328280 F: +975-2-324834 E: hmsd@druknet.bt	The DoE is the focal national agency for the collection, analysis, and dissemination of all weather and climate information. The Department is also responsible for maintaining flood warning systems in the country.	The DoE will identify staff to participate in all GLOF EWS-related training. After the completion of the project, it will be responsible for maintenance of the EWS. The DoE will also participate in all relevant meetings and workshops.
The <i>Dzongkhag</i> Administrations	<p>Punakha: Mr. Pema Wangda Budget Officer Dzongkhag Administration T: +975-5-584198 M: +975-17615225 F: +975-5-584121</p> <p>Wangdi: Mr. Tshering Choden Environment Officer Dzongkhag Administration T: +975-2-481596 M: +975-17604575 F: +975-2-481654 tsheringchoden@nec.gov.bt chodentshering@hotmail.com</p> <p>Gasa: Mr. Chencho Environment Officer Dzongkhag Administration T: + 975-2-688187 M: +975-17652025 F: +975-2-688207 E: chencho_dorji@hotmail.com</p> <p>Bumthang:</p>	The Dzongkhag Administrations are responsible for coordinating all development activities in their respective Dzongkhags. Plans are underway to form Dzongkhag Disaster Management Committees that will in turn lead the formation and capacity building of the Gewog Disaster Management Committees.	Punakha, Wangdi, Gasa, and Bumthang Dzongkhags will form major partners for the implementation of all FSP outcomes. They will assist the project team in mobilizing labor for the mitigation works, and in organizing community awareness and preparedness workshops and trainings. They will also participate in relevant meetings and workshops.

Institution	Contact information	Main responsibility	Role in PPG and FSP
	Mr. Rinchen Wangdi Dzongkhag Forest Officer Dzongkhag Administration T: + 975-3-631268/ 631461 M: +975-17661802 E: rwangdidzfo@yahoo.com		
Local communities (Punakha, Wangdi, Gasa, and Chamkhar)	Ms. Karma Doma Tshering Senior Program Officer DMD, MoHCA T: +975-2-326935/ 322301/ 322015/ 325173 F: +975-2-327864 E: kdtly@hotmail.com	Local communities will be the most affected by the impact of climate change particularly in the event of a GLOF.	Local communities in the Punakha-Wangdi Valley and Chamkhar Valley, as well as in the upstream region near the Thorthormi Lake, will be important stakeholders during the FSP implementation. Local communities will participate in the implementation of most of the FSP outcomes.
National Committee for Disaster Management (NCDM)	Chairperson – Cabinet Minister on a rotational basis Members – All Secretaries Vice Chairperson – Home Minister Dasho Mr. Penden Wangchuk Secretary MoHCA T: +975-2-322502 F: +975-2-325049	The Committee on Disaster Management is an inter-ministerial coordination mechanism reporting to the Council of Cabinet Ministers. At the ministerial level, the NCDM will oversee the implementation of the NDRMF.	Through the DMD, MoHCA, the NCDM will provide the policy directions into which climate-resilient DRM will be incorporated.
Jigme Dorji Wangchuck National Park (JDNP) Management	Mr. Kinley Tshering Park Manager T: +975-2-688301 M: +975-17675699	The JDNP, as part of the protected area system in the country, is responsible for the protection of the biological and cultural resources within the park and ensures that development activities do not negate conservation efforts.	The JDNP Management will provide guidance in undertaking activities within the national park. It will also participate in assessing potential environmental impacts of the project.
Department of Agriculture	Mr. Chencho Norbu Director Department of Agriculture E: cnorbu@gmail.com	The Department of Agriculture is responsible for all design and implementation of agricultural development programs.	As agriculture is one of the most climate-sensitive sectors, the DoA will participate in all relevant meetings and workshops.

Institution	Contact information	Main responsibility	Role in PPG and FSP
World Wildlife Fund (WWF Bhutan)	Mr. Karma Tenzin Program Officer T: +975-2-323528 (ext. 108) E: ktenzin@wwfbhutan.org.bt	WWF Bhutan assists the RGOB in the conservation of biological diversity and the enhancement of national capacity for preserving the country's pristine environment.	WWF Bhutan will provide co-financing for the FSP and has participated in stakeholder consultations during the PPG. It will participate in Project Board meetings and all other related workshops and meetings.
International Centre for Integrated Mountain Development (ICIMOD)	Representative T: +977 1500 3222	ICIMOD works to develop knowledge and provide integrated solutions for improving resource management and supporting sustainable livelihoods in mountain environments.	ICIMOD will provide technical expertise for assessments related to GLOF risk and environmental impacts. They will also participate in activities for sharing experiences and knowledge on GLOFs and climate change.
UN Volunteers	Ms. Junko Taguchi UNV Program Officer UNDP Bhutan Tel: +975-2-322424 (ext. 164) E: junko.taguchi@undp.org	UNV interventions in DRM focus mainly on community involvement and capacity development. UNV supports the mobilization of volunteers, networking, promoting community volunteerism for service delivery, and creating links between the government and communities.	UNV will participate in relevant meetings and, when requested, will assist in mobilizing volunteers for activities on community disaster management, awareness raising, and community capacity building.
UNDP Country Office	Mr. Karma Chogyal Program Associate Energy, Environment, and Disaster Management Unit T: +975-2-322424 (ext. 171) F: +975-2-322657 E: karma.chogyal@undp.org	UNDP Bhutan works to ensure that progress is based on people's needs, their efforts, and their rights. It supports the people and RGOB to build their capacity to meet development challenges, in pursuit of Gross National Happiness.	The UNDP Bhutan office will act as overall coordinator and monitor project funds. It will help mobilize and coordinate support from other partners through a global network. UNDP will also be responsible for the sharing of lessons from the project into the Adaptive Learning Mechanism (ALM). <ul style="list-style-type: none"> • Output 4.1: Project lessons captured in, and disseminated through, the Adaptation Learning Mechanism • Output 4.2: Project knowledge shared with other GLOF-prone countries

119. Stakeholders in the PSC have been involved throughout the preparation and implementation of the PPG phase of the project, including the following key meetings (see Annex 9 for reports of these meetings):

- The Inception Workshop was held on 24 January 2007 in Punakha and attended by representatives of the PSC.
- Members of the project team met with Dzongkhag administrators on 15 February 2007, as well as during visits throughout the PPG phase.
- A second stakeholder meeting was held on 16 February 2007 in Thimphu to discuss progress on the PPG outputs and the design of the FSP.
- A third stakeholder meeting was held on 27 September 2007 in Thimphu to continue discussing the design of the FSP and PPG results.
- Members of the project team met with community members during vulnerability assessments and hazard zonation activities of the PPG phase.

120. Project Board members, as well as bilateral donors, UN agencies, and other relevant organizations, will be involved throughout the project for monitoring and evaluating the effectiveness of project outcomes. A schedule of M&E activities will be developed in collaboration with partners at the appropriate milestones.

121. Efforts have been made to ensure that project activities are designed in a participatory manner with local stakeholders in Punakha-Wangdi Valley and Chamkhar Valley. During implementation, this will be a vital aspect to ensure that activities to promote climate-resilient disaster risk management are sustained beyond the project's life.

122. **Regional partners** – Over the last decade a number of mechanisms for regional and international cooperation in the area of disaster risk management have either been established or significantly strengthened. Two important regional mechanisms that concern South Asia—South Asian Association for Regional Cooperation (SAARC) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)—have begun to assign higher priority to disaster risk management as an area of cooperation. At the same time, regional resource centers such as the Asian Disaster Preparedness Centre (ADPC) in Bangkok, Thailand, the Asian Disaster Reduction Centre (ADRC) in Kobe, Japan, and the International Centre for Integrated Mountain Development (ICIMOD) in Katmandu, Nepal, are potential partners who can contribute to disaster risk management efforts in Bhutan.

123. **United Nations** partners – UNDP is supporting Bhutan to build capacity for both disaster risk management and climate change issues. In support of the NDRMF, UNDP will help strengthen institutional capacity at the national and local levels. It will be providing technical support for CBDM, pilot initiatives, public awareness at dzongkhag, gewog, and thromde levels. UNEP, the World Food Programme, WWF, and other international organizations also provide support through national or regional projects.

Institutional framework for addressing climate change issues

124. NEC is the focal point within the RGOB for all climate change-related activities and has been the principal coordinator for the Initial National Communication, first greenhouse gas (GHG) inventory, National Capacity Self-Assessment (NCSA), and the National Adaptation Programmes of Action (NAPA).

125. All of these assessments and planning processes were conducted with the participation of multi-sectoral taskforces, which led to local capacity building. For example, during NAPA formulation, five working groups were formed and were led by representatives of the relevant ministries:

- Agriculture and Livestock (Ministry of Agriculture, Policy and Planning Division)
- Forestry and Biodiversity (Ministry of Agriculture, Department of Forests)
- Health (Ministry of Health, Department of Public Health)
- Water Resources and Energy (Bhutan Water Partnership)
- Natural Disasters and Infrastructure (Ministry of Economic Affairs, Policy and Planning Division, with members from DMD and DGM)

126. Technical support for climate change is also provided by UNDP, UNEP, and other organizations for research, assessments, and planning. Bhutan is now in the process of preparing its Second National Communication, which will provide information on climate risks for national and sectoral planning processes.

127. Despite the progress made so far, there is a need to step up disaster risk reduction and preparedness as climate change impacts increase and communities become more vulnerable to potential disaster risks. One of NEC's key contributions to disaster management is spearheading the NAPA. The NAPA process showed that Bhutan is highly vulnerable to the adverse impacts of climate change and identified immediate and urgent adaptation needs.

128. Taking into consideration these immediate and long-term climate change-induced disaster risks, the proposed project is being designed as an integrated DRM program in the two most vulnerable areas, the Punakha-Wangdi Valley and Chamkhar Valley. The integrated DRM program, along with the two main priorities identified in the NAPA process, also encompass several components of the different prioritized projects from the NAPA process, including the hazard zonation project for the Chamkhar and the lower Punakha-Wangdi Valley and an early warning system for the Punakha-Wangdi Valley.

129. With regard to gender equality, women are clearly struggling to find a place in the new decentralization process and have emerged as a minority in decision-making positions. Given the generally egalitarian gender relations in Bhutan, this will be an area of focus for the proposed project. In other countries in Asia, women play a key role in community-based disaster management (CBDM), and this approach can be used for this project as well.

- SIGNATURE PAGE

Country: BHUTAN

UNDAF Outcome(s)/Indicator(s): OUTCOME 5 (MDG 7)

Expected Outcome(s)/Indicator (s): CT OUTCOME 2 / Output 2.1., 2.2., 2.3.

Implementing partner:

(Designated institution/Executing agency)

Royal Government of Bhutan, Ministry of Economic Affairs, Department of Geology and Mines (DGM)

Royal Government of Bhutan, Ministry of Home and Cultural Affairs, Disaster Management Division (DMD)

Other Partners:

n/a

Programme Period: 2008 - 2012 Programme Component: UNDAF Outcome 5/CT Output 2.2 Project Title: Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys Project ID: 00059841 Project Duration: 2008 - 2012 Management Arrangement: NEX
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Total budget:	7,481,274
Allocated resources:	
LDCF:	3,445,050
Government	2,680,000
Regular (UNDP)	526,224
Other:	
Donor: Austrian Government	800,000
Donor: WWF	30,000

Agreed by (Government): _____

Agreed by (Implementing partner/Executing agency): _____

Agreed by (UNDP): _____