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

**MID-TERM REVIEW**

Final Report, 15th September 2010

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**Cover Page Photos**

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| **Top:** | Workers at Thorthormi glacial lake © Department of Geology and Mines, 2009. |
| **Middle:** | Wangdi bridge, Puna Tsang Chhu © Ugen P. Norbu, 2010. |
| **Bottom:** | Community-based disaster risk management training in Punakha © Ugen P. Norbu, 2010. |

# Preface

This report sets out the findings, conclusions and recommendations of the mid-term review of the Project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys’. It is in compliance with the terms of reference for the assignment. The findings, conclusions and recommendations are solely those of the author and expressed as an independent evaluator.

The author extends his appreciation to all who assisted in the mid-term review, particularly Anne Erica Larsen and Karma Loday Rapten of UNDP Bhutan Country Office, Gernot Laganda of UNDP Asia- Pacific Regional Centre in Bangkok, Dowchu Dukpa of the Department of Geology and Mines, Chencho Tshering of the Department of Disaster Management, and Karma Dupchu of the Department of Energy. Thanks are also due to all the interviewees – government officials, international development partner representatives and most importantly the local community members – for the valuable information and insights that they candidly shared with the author.

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# Glossary

**Acronyms and Abbreviations**

ACO Austrian Coordination Office for Development Cooperation

ALM Adaptation Learning Mechanism

AWP Annual Work Plan

BCPR UNDP Bureau for Crisis Prevention and Recovery

BGAN Broadband Global Area Network

CBDRM Community-based Disaster Risk Management

cCAP Common Country Action Plan

CO Country Office

COP Conference of Parties

DDM Department of Disaster Management (Ministry of Home and Cultural Affairs)

DDMAPT *Dzongkhag* Disaster Management Awareness and Planning Team

DDMC *Dzongkhag* Disaster Management Committee

DoE Department of Energy (Ministry of Economic Affairs)

DGM Department of Geology and Mines (Ministry of Economic Affairs)

ECHO European Commission Humanitarian Aid Department

EIA Environmental Impact Assessment

EOC Emergency Operation Centre

EWS Early Warning System

FACE Funding Authorization and Certification of Expenditures

FGD Focus Group Discussion

GDMC *Gewog* Disaster Management Committee

GEF Global Environment Facility

GHG Greenhouse Gas

GLOF Glacial Lake Outburst Flood

GNH Gross National Happiness

GNHCS Gross National Happiness Commission Secretariat

GSM Global System for Mobile Communication

IP Implementing Partner

JICA Japan International Cooperation Agency

JST Japan Science and Technology Agency

LDCF Least Developed Countries Fund

MTR Mid-term Review

NAPA National Adaptation Programme of Action

NDRMF National Disaster Risk Management Framework

NECS National Environment Commission Secretariat

PHPA Puna Tsang Chhu Hydropower Project Authority

QBS Qualitative-based Survey

RGoB Royal Government of Bhutan

SRF Strategic Results Framework

SSI Semi-structured Interview

ToR Terms of Reference

TSAT Technical Support and Advisory Team

UNDAF United Nations Development Assistance Framework

UNDP United Nations’ Development Programme

WWF World Wide Fund for Nature (World Wildlife Fund in Canada and the United States)

**Bhutanese Terms**

*Chiwog* Basically a village; but where a village is too large it may be divided into two or more *chiwogs* and, where villages are too small, two or more villages may be combined to form a *chiwog.*

*Dzong* A monastery-fortress, which usually functions s as the district headquarters for public administration as well as for monastic affairs.

*Dzongda* District Administrator

*Dzongkha* Bhutan’s national language

*Dzongkhag* District

*Gewog* Smallest geographic unit of public administration made up of a block of *chiwogs*

*Gup* Head of a *gewog*, elected by the local community

*Mangmi* Deputy to the *gup*, elected by the local community

*Tshogpa* Representative of a *chiwog*

# Executive Summary

The Project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys’ is a five-year project funded by the Least Developed Countries Fund, UNDP, the Austrian Government, and WWF. The project has been conceived to support the Royal Government of Bhutan to integrate long-term climate change-induced risk reduction planning and management into the existing disaster management framework and practices, and implement corresponding capacity development measures at the national, *dzongkhag* and *gewog* levels focusing on Punakha-Wangdi and Chamkhar valleys, which are among Bhutan’s most vulnerable valleys downstream of potentially dangerous glacial lakes. It also aims to demonstrate a practical approach to reduce GLOF risks from Thorthormi lake, considered one of most dangerous glacial lakes in the country. Complementary to this demonstration, the project seeks to ensure that an upgraded Early Warning System is established in the Punakha-Wangdi valley taking sufficient account of the growing risk of climate change-induced GLOFs in the area.

The Mid-term Review found the project to be highly relevant in the overall development context. It supports the overarching Bhutanese development philosophy of Gross National Happiness, specifically contributing to the main GNH objectives of sustainable socio-economic development and environmental conservation. It is also in line with the United Nations Development Assistance Framework, directly supporting UNDAF Outcome 5 outlined in the Common Country Action Plan (2008-2012) agreed between the United Nations System and the Royal Government of Bhutan. In the context of global environmental work, it directly relates to the objective of supporting pilot and demonstration projects for adaptation to climate change outlined in the Climate Change Focal Area Strategy and Strategic Programming for GEF-4. Very importantly, the project addresses multiple key adaptation needs and priority projects identified in the Bhutan National Adaptation Programme of Action.

Overall progress against project outputs/ targets as specified in the Strategic Results Framework is good. Progress has been made in the implementation of activities for legislation development, training, awareness-building and planning for community-based disaster risk management, geotechnical and environmental impact assessments and planning for artificial lowering of the water level of Thorthormi lake, and site assessments and re-planning for an automated GLOF Early Warning System at a more comprehensive scale than initially intended. The Disaster Management Bill has been finalized, translated into Dzongkha and submitted for deliberation and ratification at the upcoming parliamentary session in winter (November/December) 2010. An orientation workshop and a training of trainers’ workshop on community-based disaster risk management for the members of the *Dzongkhag* Disaster Management Committees and *Dzongkhag* Disaster Management Awareness and Planning Teams have been conducted in each of the three *dzongkhags* covered by the project. These trained members have, in turn, conducted training workshops on community-based disaster risk management for the members of the *Gewog* Disaster Management Committees. The water level of Thorthormi lake had been reduced by 86 cm and that of the two subsidiary lakes by 47 cm and 41 cm in the 2009 working season, which was truncated by one month due to delay caused by the occurrence of Cyclone Aila in May 2009. In the 2010 working season, until mid August, the water level of Thorthormi lake had been further reduced by 43 cm and that of the subsidiary lakes by 59 cm and 20 cm. The installation of the automated GLOF Early Warning System has been delayed due to change in the implementation responsibility from the Department of Geology and Mines to the Department of Energy, lack of in-house experience within the Department of Energy for technical planning and detailed costing of an automated GLOF Early Warning System, lack of clarity in tendering procedures on a turn-key basis, and change in government procurement rules and regulations. Nevertheless, the automated GLOF Early Warning System is now on a firm footing for installation with all the requisite procedural works completed and a schematic plan in place for a more comprehensive system than initially planned under the project. The automated GLOF Early Warning System will now have sensors at six locations instead of the initially planned two and siren towers at 17 locations instead of the initially planned eight locations. It will also build in real-time weather data collection and forecasting, thus enhancing the utility of the system.

Activities pertaining to a few outputs/ targets have not been implemented as planned. These include the national database on GLOF risks and vulnerabilities, and a GLOF website. It was given to understand that the development of a national GLOF database has become redundant due to the parallel conception of a project ‘Study on GLOFs in Bhutan Himalayas’, supported by the Japan International Cooperation Agency and the Japan Science and Technology Agency, which also aims to establish a similar database and at a more detailed and comprehensive scale than planned under this project. The planned GLOF website is also not in place. It was informed that a provisional GLOF website was created but it was not updated regularly and had become defunct at the time of the mid-term review. The Department of Geology and Mines intends to develop a fully functional GLOF website and have it in place by 2011.

There is a high level of country ownership of the project. The Project Board, chaired by the Secretary of the Ministry of Economic Affairs and consisting of representatives from various relevant central government institutions, *dzongkhag* administrations in the project area, and project financing agencies, has functioned effectively. It has met eight times since the commencement of the project and has been expeditious in decision-making and providing guidance for project implementation. All the three project implementing partners, namely the Departments of Geology and Mines, Energy, and Disaster Management have appointed project managers to coordinate and ensure the delivery of the project outputs and targets assigned to the respective agencies. A senior official from the Department of Geology and Mines serves as the Project Director. He is also the team leader of the Technical Support and Advisory Team, which comprises representatives from the three project implementing partners and from the Ministries of Home and Cultural Affairs, Health, and Works and Human Settlement, National Environment Commission Secretariat, Jigme Dorji National Park, and the UNDP Country Office. The Technical Support and Advisory Team meets annually to discuss and prepare for the activities related to artificial lowering of the water level of Thorthormi lake. For the community-based risk management training, awareness-building and planning, the project activities are implemented through the existing institutional set-up at the *dzongkhag* and *gewog* levels. The project has received high government priority. Many of the government administrative procedures were fast-tracked to enable timely commencement of project activities.

The sustainability and replicability of the project interventions can be considered high. This can be mainly attributed to the use of existing government institutional set-up and human resources for project implementation, and the high level of stakeholder ownership and engagement in the project through project management structures (the Project Board and the Technical Support and Advisory Team) and training, awareness-creation and planning for community-based disaster risk management. Furthermore, the project has considerable demonstration value and replicability because of it being the first of its kind in the world and the presence of similar GLOF risks in other parts of the country as well as in many other countries with comparable geophysical conditions. In fact, a Climate Change Adaptation Fund project is under formulation to address GLOF risks in Pakistan drawing on the approach and lessons of this project.

Weakness was observed in the area of documentation and reporting of the technical/programmatic aspects of the project. This is a major concern especially with respect to the capacity development component, which involves change in knowledge, skills, attitude, and behaviour. It will be difficult to assess these non-physical changes without good documentation of the progressive results, lessons and issues.

A good deal of media and communications products exists but these are highly skewed in favour of the project component pertaining to the artificial lowering of Thorthormi lake. The capacity development component especially has received very little media attention or communication focus despite significant amount of work having gone into it.

A key concern is the significant mismatch between annual planned budgets and actual disbursements. In 2008, only 11.3 per cent of the planned budget was disbursed. In 2009, budget disbursement improved but it was still just 42.6 per cent of the planned budget. As of June 2010, against the total external project fund of US$ 4,671,274 a cumulative sum of US$ 1,095,729.25 had been disbursed to the project implementing partners. This translates to only 23.5 per cent of the total external fund.

Another major concern pertains to the health and safety of the workers and staff members involved in the artificial lowering of the water level of Thorthormi lake. The high altitude, harsh climate, difficult accessibility, and fragile terrain pose considerable health and safety risks to the workers and field staff. In the 2010 working season, two workers had died due to altitude sickness while on the way to Thorthormi lake and another worker succumbed to death after a short sickness at the work site. The Project Board has discussed and decided additional health and safety measures for the return trek of the workers and field staff after the completion of the current phase of excavation work in October 2010. Nevertheless, there is a need for more comprehensive health and safety measures and to that effect it is strongly recommended that a strategy be developed soon after the return of the workers and field staff from the 2010 working season. Ideas that may be considered in the strategy include: appointment of additional medical staff in the field team and in-country training for them on altitude sickness and other common ailments at high altitude by a medical expert in the particular field, improved clothing and camping equipment necessary for protection against harsh weather conditions, and procurement of additional health and safety equipment, including more number of inflatable high-altitude pressure/ Gamow bags.

The MTR recommends some changes in the project’s Strategic Results Framework as project circumstances and needs have slightly changed since its conception. The recommended changes pertain to Outcome 1 and associated Outputs 1.1 and 1.3, and to Output 2.3 of Outcome 2. Recommendation is also made to strengthen project monitoring and reporting especially in linking Annual Work Plans and quarterly progress reports to the project outputs and targets and not just the broad outcomes. Some of the project results require to be assessed by means of Qualitative-based Survey. These surveys will have to be scheduled and budgeted in the upcoming Annual Work Plans. To increase the expeditiousness of procedural work and prevent delays in fund disbursements, the UNDP Country Office and the project implementing partners will need to discuss and jointly examine the causes of delay and implement corrective measures to address them. Also, a joint review of the financial aspects of the project by the UNDP Country Office and the project implementing partners is recommended to forecast anticipated expenditures under various outcomes/ outputs for the remaining project period and for early detection of any adjustments required in the budget programming. This will help rationalized allocation and planning of budget resources for the remaining project period. It is also recommended that a workshop be conducted within 2011 to take stock of and discuss the knowledge and experience accrued through the project. Particularly important will be to capture knowledge and lessons pertaining to capacity development for community-based disaster risk management as this component is less discernible than the artificial lowering of Thorthormi lake and GLOF-EWS components. Recommendation is also made for formal partnership with the JICA/JST supported project ‘Study on GLOFs in Bhutan Himalayas’ to develop inter-project synergy and address GLOF issues in Bhutan in a more integrated and comprehensive manner.

Early consultations with potential donors need to be initiated to prepare and plan for replication of the project interventions in other areas that face similar GLOF challenges and risks. The community-based disaster risk management training curriculum, which has been developed and is being implemented through the project, needs to be overhauled especially taking into account the need to use more visual training methods to overcome literacy constraints of the local communities and to enhance the focus on the practical aspects of community-based disaster risk management. An ‘ecological footprint’ study is recommended to assess the extent of adverse environmental impacts of the project, identify environmental management trade-offs, and draw lessons for future environmental management of similar projects. Monitoring of the glacial lakes is recommended as a key area to focus in future GLOF work in Bhutan since potential GLOF risks will change over time. Since physical monitoring of GLOF risks is basically impossible due to the rugged mountain terrain and lack of physical communication infrastructure, virtual monitoring tools and techniques such as the use of time-series satellite/ radar maps need to be considered for GLOF projects in the future.

# 1. Introduction

## 1.1 Purpose of the Review

The Mid-term Review (MTR) was carried out with the purpose of examining the performance of the project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys’. The MTR included an assessment of the progress in project implementation measured against planned outputs and targets described in the Strategic Results Framework (SRF) of the signed project document as well as an initial assessment of the potential development impacts of the project. It also analyzes underlying causes and issues related to non-achievement of intended targets, if and where they have occurred.

The MTR has examined the adequacy, efficiency and effectiveness of project implementation, assessed the achievability of project results and the early signs of project benefits, and discussed key issues and concerns. Finally, specific recommendations are offered for necessary adjustments in the work plan and implementation approach for the remaining project period.

The terms of reference (ToR) for the MTR, providing details on its objectives and scope, is attached as Appendix 1.

## 1.2 Methodology

The MTR was based on analysis of information obtained through the following approaches and sources (Figure 1):

* **desk study** of existing documentary materials;

Figure 1: MTR Approach Framework

* **semi-structured interviews** of key informants in government implementing partner agencies, UNDP Bhutan Country Office, and international development partner agencies;
* **focus group discussions** with *dzongkhag* staff and local community functionaries; and
* **direct observation** of project sites and activities.

The review was carried out by Ugen P. Norbu, an independent planning and evaluation consultant with a professional background in the field of conservation and related community development issues. Over the past eight years, Ugen has completed numerous consulting assignments for UNDP, UNEP, DANIDA, World Bank, Japan International Cooperation Agency, Development Fund of Norway, and WWF.

### 1.2.1 Desk Review

A wide range of documents were reviewed during the course of the MTR. These primarily included the project document, the project inception report, annual project work plans, quarterly and annual progress reports, and minutes of the Project Board (PB) meetings. Additional documents such as technical reports, training materials, policy and legal documents, project publications, donor reports, media articles, and audio-visual products were also reviewed to gain supplementary information, insights and clarifications.

A complete list of documents that were reviewed or referred to is provided in Appendix 2.

### 1.2.2 Semi-structured Interviews

Information and views on the project were secured from key informants through semi-structured interviews (SSIs) using the project SRF as the introductory basis. SSIs were held with the PB chairperson and members, officials in the government implementing partner (IP) agencies, representatives of international development partner agencies, and staff of UNDP Bhutan Country Office (CO) as well as the Regional Technical Advisor for Climate Change Adaptation of the UNDP Asia-Pacific Regional Centre. Altogether, SSIs were held with 25 people (full list provided in Appendix 3). In addition, meetings were held with representatives of the Japan International Cooperation Agency (JICA) Bhutan Office and the UNDP/ECHO Regional Project on GLOF Risk Reduction in the Himalayas to learn about their activities that have complementary value to the Project.

### 1.2.3 Focus Group Discussions

During the project site visits from 9th to 12th July 2010, a series of focus group discussions (FGDs) were held to elicit first-hand information and views from people in the field in a participatory manner. These FGDs were held with:

* *Dzongkhag* staff of Punakha, who were members the *Dzongkhag* Disaster Management Awareness and Planning Team (DDMAPT), on 9th July 2010, at Punakha *Dzongkhag* Administration Office. This FGD had eight participants;
* Local community functionaries, who were members of the *Gewog* Disaster Management Committees (GDMCs) of Chhubu, Tewang and Zomi *gewogs*, on 11th July 2010, at Samdingkha. There were 20 participants at this FGD[[1]](#footnote-1);
* *Dzongkhag* staff of Wangdiphodrang, who were members of the DDMAPT and *Dzongkhag* Disaster Management Committee (DDMC), on 12th July 2010, at Wangdiphodrang *Dzongkhag* Administration Office. Six *dzongkhag* staff participated in this FGD.

Appendix 3 lists the names of the participants at the above FGDs.

### 1.2.4 Project Site Visits

Visits to project sites and activities were undertaken in the company of project managers from the IPs, namely Chencho Tshering of the Department of Disaster Management (DDM) and Karma Dupchu of the Department of Energy (DoE), and UNDP Bhutan Programme Analyst, Anne Erica Larsen, who is the UNDP focal person for the project. The sites that were visited included areas identified as GLOF high-risk zone and evacuation sites along Puna Tsang Chhu, Wangdiphodrang Flood Warning Station, Wangdiphodrang bridge where river level monitoring is carried out, and identified sites for installation of the automated GLOF Early Warning System (EWS) siren towers. A scheduled trip to Damji, Gasa *dzongkhag*, had to be abandoned due to incessant rains and resultant land slides en route.

Appendix 4 outlines the itinerary of the MTR.

### 1.2.5 Debriefing on Preliminary Observations and Findings

Upon return from the project site visits, a debriefing meeting was organized by the Department of Geology and Mines (DGM) on 14th July 2010, for the MTR consultant to present his preliminary observations and findings to a group of people representing IPs and UNDP CO. The debriefing meeting, chaired by the Director General of DGM, provided the MTR consultant with an opportunity to elicit initial feedback, and seek additional information and clarifications. The names and organizations of the attendees are listed in Appendix 3. A separate meeting was held with the Resident Representative and Deputy Resident Representative of UNDP Bhutan to debrief them on preliminary MTR observations and findings, and seek their feedback.

## 1.3 Structure of the Review

The MTR is structured as per the standard requirements of UNDP/GEF project evaluations, with some slight adaptations to suit project conditions and needs. It is presented in three parts: the first part provides the background of the MTR and an overview of the development context of the project; the second part presents the main findings; the third part provides key conclusions on the project and offers recommendations for corrective actions in the project design and implementation and follow-up actions to reinforce or enhance project benefits.

# 2. The Project and Its Development Context

## 2.1 Overall Context

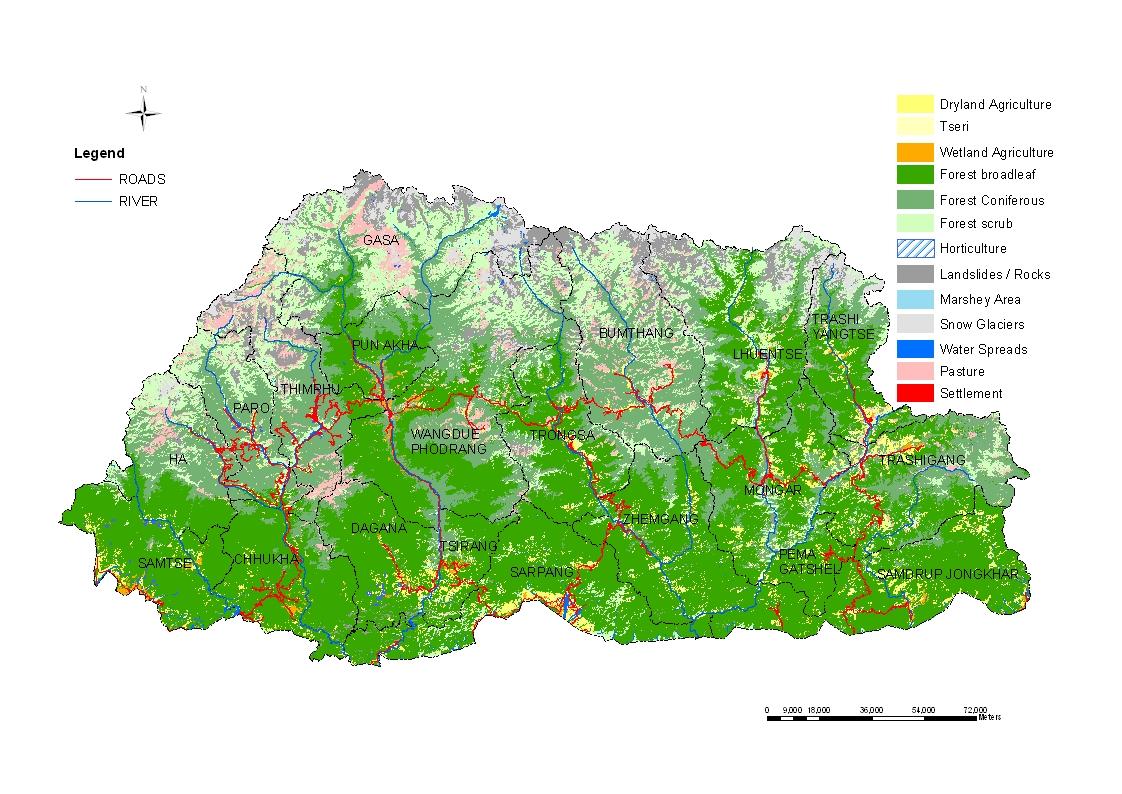
Bhutan is a landlocked, mountainous country located in the Eastern Himalaya. Perpetual snow and glaciers cover 7.5 per cent of the country’s territory[[2]](#footnote-2). The entire northern mountain reaches are speckled with numerous glacier/snow-fed lakes. The country reportedly consists of 677 glaciers and 2,674 glacial lakes[[3]](#footnote-3).

Figure 2: Land Cover Map of Bhutan

*Source: Ministry of Agriculture, 2007*

Of the range of hazards that Bhutan is vulnerable to, 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. These rapid changes in climate are correlated with a faster rate of glacier melt. The ensuing effect is that glaciers in the Himalaya, such as 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 glacial lake outburst to critical levels. Bhutan is known to have 24 potentially dangerous lakes[[4]](#footnote-4). Eight of these are located in Pho Chhu Sub-basin, seven in Mangde Chhu Sub-basin, five in Mo Chhu Sub-basin, three in Chamkhar Chhu Sub-basin, and one in Kuri Chhu Sub-basin. With a majority of Bhutan’s population, economic activities and infrastructure development concentrated in large river valleys, climate-induced GLOFs could cause colossal human and economic devastations. Furthermore, numerous hydropower projects – existing, under construction and planned – are located downstream in these sub-basins. GLOF events would, therefore, take a huge toll on hydropower investments and revenue, which make up 45 per cent of the country’s total revenue[[5]](#footnote-5). Additional impacts would be on agriculture, which is the rural economic mainstay and occurs considerably on farmlands along the riversides, and on riparian habitats that harbour many wildlife species such as the critically endangered white-bellied heron *Ardea insignis*.

## 2.2 Project Description

### 2.2.1 General Overview

The Project has been conceived to support the Royal Government of Bhutan (RGoB) to integrate long-term climate change-induced risk reduction planning and management into the existing disaster risk management framework and practices, and implement corresponding capacity development measures at different levels (national, district and community), focusing on Punakha-Wangdi and Chamkhar valleys, which are among the most vulnerable valleys downstream of potentially dangerous glacial lakes. The project also aims to demonstrate a practical approach to reduce GLOF risks from Thorthormi lake in the headwaters of Pho Chhu sub-basin, which had a worst-case-scenario outburst projection as early as 2010 and thus is considered one of Bhutan’s most dangerous glacial lakes. Complementary to this demonstration, the project seeks to ensure that an upgraded EWS is established in the Punakha-Wangdi valley taking sufficient account of the growing risk of climate change-induced GLOFs.

Project implementation commenced in June 2008 and is scheduled to conclude in December 2012. The project has a total budget of US$ 7,351,274 with LDCF financing of US$ 3,445,050. The RGoB contribution is US$ 2,680,000. Other funding agencies include the Austrian Development Cooperation (US$ 800,000), UNDP (US$ 396,224) and WWF (US$ 30,000).

### 2.2.2 Project Objective, Outcomes and Expected Outputs

The **goal** of the project is to enhance adaptive capacity to prevent climate change-induced GLOF disasters in Bhutan. The **objective** of the project is to reduce climate change-induced risks of GLOFs in the Punakha-Wangdi and Chamkhar Valleys.

To achieve the project objective, four outcomes have been identified. The outcomes and corresponding outputs are outlined below:

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

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

*Output 1.2: Capacities for climate risk planning strengthened at the district (dzongkhag) administrative level*

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

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

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

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

*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*

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

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

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

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

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

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

**Outcome 4:** Enhanced learning, evaluation and adaptive management

*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*

### 2.2.3 Project Stakeholders and Target Beneficiaries

The stakeholders and target beneficiaries of the project include various RGoB agencies, local government institutions, local communities especially those that are directly vulnerable to GLOF events and related risks in Punakha-Wangdi and Chamkhar valleys, international development partner agencies, downstream hydropower projects, and UNDP.

The role and stake of various project stakeholders and target beneficiaries are briefly explained below:

**Department of Geology and Mines (Ministry of Economic Affairs)**

The DGM was the nodal government agency during the formulation of the project. The Project Director, who is responsible for overall project coordination and management, is from the DGM. With regards to project implementation, the agency is one of the three IPs with the responsibility of delivering Outputs 1.3, 2.1, 2.2, 2.3, and 2.4. A project manager has been assigned from the DGM to manage and coordinate the delivery of these outputs.

**Department of Energy (Ministry of Economic Affairs)**

The DoE came into picture during the implementation phase. The agency took over the delivery of Outputs 3.1 and 3.5 from the DGM and Output 3.2 from the DDM. These outputs essentially make up the GLOF-EWS component of the project. A project manager has been assigned from the DoE to manage and coordinate the delivery of these outputs.

**Department of Disaster Management (Ministry of Home and Cultural Affairs)**

The DDM was involved during the formulation of the project, particularly in developing Outcome 1 and related outputs. The agency is responsible for delivery of Outputs 1.1, 1.2, 1.4, 3.3, and 3.4. A project manager has been assigned from the DDM to manage and coordinate the delivery of these outputs.

**National Environment Commission Secretariat**

The NECS was the lead agency that developed Bhutan NAPA, which was used as a key input for formulation of the project. The agency is in the final stage of completing the Second National Communication to the UNFCCC, which will provide new information on vulnerabilities related to climate change and associated disasters that can be used to enhance project implementation and/or replication. A representative from the NECS sits on the PB.

**Gross National Happiness Commission Secretariat**

For long-term sustainability, the role of GNHCS as the overall planning and resource-coordinating body is crucial in facilitating the mainstreaming of project interventions in regular government plans and programmes and ensuring complementary resources to do so. The GNHCS also has the overall role of monitoring externally-funded projects and is a member of the PB.

***Dzongkhag* Administrations of Punakha, Wangdi, Gasa, and Bumthang**

The role of the *Dzongkhag* Administrations is vital in institutionalizing climate change-induced disaster risk management at the local level. The project works closely with these institutions in local capacity development and planning for community-based disaster risk management (CBDRM). DDMCs and DMAPTs have been formed for CBDRM training, awareness and planning at local level. Furthermore, administrative and logistical support from the *Dzongkhag* Administrations is hugely important for the implementation of field activities, especially those pertaining to the artificial lowering of the water level of Thorthormi lake. The *Dzongdas* of Punakha, Gasa and Wangdi are members of the PB.

**Local communities**

Several communities, both upstream and downstream of Punakha-Wangdi and Chamkhar valleys are vulnerable to GLOF events and related risks. The project has identified 21 vulnerable communities in Punakha-Wangdi valley and nine in Chamkhar valley. In addition, local community leaders such as *Gup*, *Mangmi* and *Tshogpa*, who run the *gewogs*, play a very important role in awareness-building and logistical support for project activities. These vulnerable communities benefit directly from the project primarily through training and awareness programmes.

**Austrian Coordination Office for Development Cooperation (ACO)**

Austria, through the University of Vienna, has collaborated with the DGM to carry out extensive studies on glacial lakes and GLOF risks during 2002-2003. Information from these studies and resultant capacity development of DGM staff have been valuable in the formulation and implementation of the project. Furthermore, Austria had provided external financing for the construction of Baso Chhu Hydropower Project, which is located in the GLOF-risk zone of Punakha-Wangdi valley. The ACO is a member of the PB and provides project co-financing from the Government of Austria.

**WWF Bhutan Programme**

WWF is a project co-financier and a member of the PB. The conservation organization has helped to raise awareness on the artificial lake level management of Thormithormi lake through media and advocacy work.

**UNDP Country Office**

The UNDP CO is responsible for the coordination and delivery of financial and technical assistance in support of project implementation. The UNDP CO is monitoring financial and technical project progress and coordinates reporting to the GEF Secretariat on behalf of the project. It also functions as a mobilizer and coordinator of support from other partners through a global network. Outcome 4, which pertains to overall project knowledge management, is primarily coordinated by the UNDP CO.

**Hydropower Projects**

At the present, there are two hydropower projects along Puna Tsang Chhu. One of these, Baso Chhu Hydropower Project, is already in operation while the other, Puna Tsang Chhu I, is under construction. In 2009, the Puna Tsang Chhu Hydropower Project Authority (PHPA) committed Nu 10 million (approximately US$ 217,390) to the DoE to supplement funds required for installation of a comprehensive automated GLOF EWS in the Punakha-Wangdi valley.

# 3. Findings

## 3.1 Project Design

### 3.1.1 Project Relevance in the Overall Development Context

The project is aligned very well with Bhutan’s overarching development philosophy of Gross National Happiness (GNH). It directly contributes to the GNH pillars of sustainable socio-economic development and environmental conservation, as identified in *Bhutan 2020* – the vision document to maximize GNH. It also indirectly contributes to the other two GNH pillars of cultural preservation and good governance by way of reducing GLOF hazards and related risks to cultural properties (especially the historic Punakha *Dzong*)[[6]](#footnote-6) and development of awareness, knowledge and skills for climate-related disaster risk management at the national, *dzongkhag* and community levels using existing decentralized governance structures.

Within the framework of the Common Country Action Plan (cCAP), 2008-2012, agreed between RGoB and the United Nations System, the project directly contributes to UNDAF Outcome 5: By 2012, national capacity for environmental sustainability and disaster management strengthened (which corresponds to Millennium Development Goal 7). It also indirectly supports UNDAF Outcomes 1 and 4 which pertain to income generation, employment, capacity development and good governance.

In the context of global environment work, the project directly relates to the objective of supporting pilot and demonstration projects for adaptation to climate change outlined in the Climate Change Focal Area Strategy and Strategic Programming for GEF-4.

The Bhutan National Adaptation Programme of Action (NAPA), prepared in 2005-2006, has identified a number of key adaptation needs and priority projects. This project addresses the following key adaptation needs and priority projects identified in the Bhutan NAPA document:

**Key Adaptation Needs**

* Installation of EWS and hazard mapping of key watershed areas;
* Artificial lowering of lake levels, especially Thorthormi lake;
* Implementation of Pho Chhu hazard zonation plan;
* Capacity building, including awareness creation, to respond to future disasters and coping mechanisms;
* Capacity building in risk assessment from GLOF.

**Priority Projects**

* Artificial lowering of Thorthormi lake;
* Weather Forecasting System to serve farmers and agriculture[[7]](#footnote-7);
* GLOF hazard zoning pilot scheme;
* Installation of EWS in Pho Chhu basin.

### 3.1.2 Strategic Results Framework

The SRF in general was found to be well-formulated. The project effectively captures the GLOF-relevant components identified in the Bhutan NAPA document and integrates them in the SRF. However, since project conception, a few developments have taken place influencing project circumstances. Furthermore, there is better inference of indicators and targets now than during project formulation. Some changes, therefore, were found necessary in the SRF to reflect new project circumstances and needs. These changes have been recommended in Section 4.2.

### 3.1.3 Potential for Replication

The project was noted to have high potential for replication (or adaptation) in other regions of the country. With the exception of financing, the project was being almost entirely implemented through the use of national technical and human resources, and within the existing institutional set-up of development governance. The experiential knowledge and skills accrued from the project have built the confidence and capacity of the Bhutanese to plan and implement similar projects in other areas that face similar GLOF challenges. These areas include: Mangde Chhu sub-basin; Mo Chhu sub-basin; Chamkhar Chhu sub-basin; and Kuri Chhu sub-basin. The current project covers Pho Chhu sub-basin, which has eight potentially dangerous glacial lakes, and down stream areas along Puna Tsang Chhu up to Kame Chhu. The following table provides comparative information on potential areas for replication:

|  |  |  |
| --- | --- | --- |
| **Potential Area for Replication** | **No. of potentially dangerous glacial lakes** | **Downstream hydropower projects** |
| Mangde Chhu sub-basin | 7 | Mangde Chhu (670 MW) – construction scheduled to commence in 2010 |
| Mo Chhu sub-basin (together with Pho Chhu sub-basin feeds into the larger Puna Tsang Chhu river basin) | 5 | Same as Pho Chhu sub-basin (covered by the present project):   * Baso Chhu, u/s (24 MW) – existing * Baso Chhu. l/s (40 MW) – existing * Puna Tsang Chhu I (1,200 MW) – under construction * Puna Tsang Chhu II (990 MW) – construction scheduled to commence in 2010 * Sunkosh Reservoir (4,060 MW) – construction scheduled to commence in 2011 |
| Chamkhar Chhu sub-basin | 3 | Chamkhar Chhu I (670 MW) – construction scheduled to commence in 2012 |
| Kuri Chhu sub-basin | 1 | Kuri Chhu (60 MW) – existing |

*Source: ICIMOD, 2001, and DoE, 2009, respectively for the information on potentially dangerous glacial lakes and hydropower projects.*

The project is also replicable in a number of other countries especially in the Himalayan region given the existence of a high number of potentially dangerous glacial lakes in these countries with geophysical conditions similar to Bhutan. In addition to the 24 potentially dangerous lakes in Bhutan, the Report ‘Formation of Glacial Lakes in the Hindu Kush-Himalayas and GLOF Risk Assessment’ produced by the International Centre for Integrated Mountain Development in May 2010 has compiled a list of 179 potentially dangerous glacial lakes in various parts of China, India, Nepal, and Pakistan. As a matter of fact, a Climate Change Adaptation Fund project is currently under formulation to reduce GLOF risks in Pakistan drawing on the approach and lessons from the GLOF project in Bhutan.

## 3.2 Project Progress

### 3.2.1 Outcome 1

Two key achievements were conspicuous under this outcome: (a) formulation of the Disaster Management Bill 2010; and (b) capacity development of local authorities and communities for disaster management through formation of DDMCs, DDMAPTs and GDMCs in the project area, training of the member of these groups in CBDRM, and establishment of basic Emergency Operation Centres (EOCs) at the *dzongkhag* level.

The project has been able to develop the previously existing framework for Bhutan’s Disaster Management Bill into an elaborate and detailed legal document. A Bhutanese consultant was engaged and a series of workshops were conducted to develop the draft legislation. The workshops included a workshop for various relevant sectors and selected *dzongkhag* administrations, an internal workshop for the staff of DDM, a presentation workshop for the Ministry of Home and Cultural Affairs, and a final presentation of the Bill to the Cabinet ministers. The Bill has been translated into Dzongkha and submitted to the National Cabinet. It is expected to be deliberated and ratified at the 2010 winter session (November/ December) of the National Parliament. Although the project intent was to formulate a Disaster Management Bill that incorporated GLOF and other climate risk issues, it was noted that the Bill, by purpose and structure, cannot be GLOF-specific as it was not a technical document but essentially a legal document that provided for institutional structures and administrative mechanisms to manage disasters and associated risks. The MTR considered that the National Disaster Risk Management Framework (NDRMF), rather than the Disaster Management Bill, was the appropriate policy tool to integrate GLOF and other climate risk issues. The existing NDRMF was produced in 2006. The DDM is expected to review and update the NDRMF by 2011 as several developments, especially in terms of institutional changes and accumulated experience and technical knowledge in disaster risk management, have occurred since the document was earlier produced. The information and experiences accrued on GLOF and related climate risks through this project are expected to be valuable in the revision of the NDRMF.

DDMCs, DDMAPTs and GDMCs have been formed in the three *dzongkhags*, namely Punakha, Wangdi and Bumthang, covered by the project area. In each of these *dzongkhags*, the DDM has conducted an orientation workshop and a training of trainers’ workshop on CBDRM for the DDMC and DDMAPT members. A Bhutanese consultant was engaged by the DDM to assist in the development of CBDRM guideline[[8]](#footnote-8) and CBDRM training of DDMCs and DDMAPTs. In Punakha and Wangdi, the trained members of the DDMAPTs have in turn completed CBDRM training for the GDMC members. *Chiwog*-level CBDRM training have also started in some areas of Punakha and Wangdi *dzongkhags*. An Emergency Safety and First-Aid Handbook has been produced and 4,300 copies of the handbook have been printed and distributed to schools, *dzongkhag* and *gewog* administrations, various government and private agencies, and security organizations.

All three *dzongkhags* in the project area have been provided with radio communications and basic search and rescue equipment as a part of the establishment of EOCs, which are currently located in the respective *dzongkhag* administration offices. Radio communications equipment have also been procured to set up a central EOC within the DDM. In addition, the DDM have designated community focal persons in all the 21 GLOF-vulnerable communities identified along Puna Tsang Chhu from Wolathang in Punakha to Lhamoizingkha in Dagana. These community focal persons have been equipped with mobile phones and recharge vouchers for use in the event of hazard occurrence.

The MTR noted that no activities related to development and establishment of a national GLOF database have taken place. It was explained that the development and establishment of such a database had become redundant due to parallel conception of the project ‘Study on GLOFs in Bhutan Himalayas’ supported by the Japan International Cooperation Agency (JICA) and the Japan Science and Technology Agency (JST). The JICA/JST supported project is expected to materialize in a more detailed and comprehensive national GLOF database than planned under this project.

A DGM website featuring a webpage on the GLOF project was developed but it was done on a provisional basis and not regularly updated. At the time of the MTR, the webpage was defunct reportedly due to some malfunction in the internet system of the Ministry of Economic Affairs which hosts the website.

### 3.2.2 Outcome 2

The initial period of the project was primarily used to undertake preparatory activities and fulfil the administrative, financial and planning requirements to commence activities for the artificial lowering of the water level of Thorthormi lake. To begin with, a detailed geotechnical assessment of the excavation site was carried out by an 11-member Bhutanese team. Based on the results of the geotechnical assessment, an Engineering and Safety Plan was prepared and presented to the PB and subsequently to the National Cabinet for approval. An Environmental Impact Assessment (EIA) of the activities for the artificial lowering of the glacier lake was carried out and the EIA report was submitted to the National Environment Commission Secretariat (NECS) for environmental clearance. Concurrently, procurement of field equipment, rationalization and processing of workers’ wages and supplementary benefits (rations, insurance, medical supplies), and other logistical works were carried out. All government approvals and clearances for commencing activities for the artificial lowering of Thorthormi lake were secured by March 2009. Procurements for all necessary goods and services were concluded by mid June 2009.

Excavation works to lower the water level of Thorthormi lake commenced in the first week of August 2009, delayed by a month due to the occurrence of Cyclone Aila (May 2009) which damaged the trail to Thorthormi lake at several places. In the truncated working season of two months in 2009, the project reduced the water level of Thorthormi lake by 86 centimetres (cm), and that of the two subsidiary lakes by 47 cm and 41 cm. In 2010, excavation work began on time and until mid August the water level of Thorthormi lake had been reportedly further reduced by 43 cm, and that of the subsidiary lakes by 59 cm and 20 cm. At the current rate, the target of lowering the lake water level by 5 metres by the end of the project, currently scheduled in December 2012, appears to be somewhat ambitious. However, the achievability of the target will be more reliably known only after the completion of the ongoing working season in October 2010.

A team of 12 members, which includes five staff from the DGM, one from the Department of Roads, two from Ministry of Health, one each from Gasa *Dzongkhag* and Jigme Dorji National Park, and two from Royal Bhutan Army are stationed full-time at the excavation site during the working season for technical supervision of the work and for health and safety services to the workers. The on-site engagement has provided experiential training to the concerned technical staff for the monitoring of water flows and the functioning of the lowering system as targeted by the project.

Monitoring reports on the artificial lowering of the Thorthormi lake are produced on an annual basis. These reports are distributed to all the project stakeholders and relevant development agencies. The planned target was to produce at least two monitoring reports each year. However, given the brief working season of two-four months per year, the target was found to be superfluous as one report per year was found sufficient to capture all relevant lessons learned from the brief annual seasons of fieldwork. The monitoring reports are expected to aid the evaluation of the operation and potential replication of glacial lake level management system, which is targeted to take place by the end of the project.

### 3.2.3 Outcome 3

Activities under this particular outcome have been beset with delays. Although the need to transfer the EWS component from the DGM to DoE was recognized and decided early on during project implementation as documented in the project inception report and the minutes of the first PB meeting, formal inter-agency transfer of the implementation responsibility for the EWS component could occur only in mid-January 2009[[9]](#footnote-9). Subsequently, lack of in-house experience within the DoE for detailed planning and costing of automated GLOF-EWS, lack of clarity on tendering procedures for procurement of an EWS on a turnkey basis, and change in RGoB’s procurement rules and regulations in the interim period further delayed planned activities pertaining to establishment of the GLOF-EWS. The project has eventually been able to complete tendering procedures and award the work on a turnkey basis for the installation of GLOF-EWS and technical support in terms of training and guidance on operation and maintenance to a Bhutanese firm USD Enterprise in joint venture with Sutron Corporation, United States. The installation and testing of the automated GLOF-EWS has been rescheduled for completion by June 2011.

The EWS schematic plan and a revised implementation schedule are in place, site assessments have been carried out in Lunana, Punakha and Wangdi, and sites for the sensors and siren towers have been identified and acquired following government procedures. The automated GLOF-EWS is now to be established at a more comprehensive scale than earlier targeted under the project. Sensors will be placed at four lake sites, and at Thanza in Lunana and at Dangsa upstream of Punakha. The siren towers will be constructed at 17 sites – three in Lunana region and 14 along Punakha-Wangdi valley starting at Wolathang in the north and ending at Kamechhu in the south. Comparatively, the re-planned GLOF-EWS will have sensors at four additional locations and siren towers at nine additional sites than what was earlier planned under the project. Consequently, fund required for the GLOF-EWS has increased. The total contractual cost is US$ 1,044,740 while a total of US$ 842,038 is available from the project for the GLOF-EWS. A sum of Nu 10 million (about US$ 217,390) has been mobilized from the PHPA to cover the additional cost. However, the DoE has estimated additional fund requirement of US$ 43,480 to meet the costs of monitoring and quality control of the installation and trialling of the GLOF-EWS. The DoE also considers possibility of cost for additional works not covered under the scope of the contract. The expedience (especially from the ‘sustainability’ viewpoint) of meeting these additional funding requirements from the project requires to be deliberated between the IPs and UNDP CO.

In case of satellite communication failure (which is said to be very rare), Broadband Global Area Network (BGAN) has been integrated as a back-up in the schematic plan of the EWS. In addition, a proposal for integration of GSM technology into the EWS for activation of the sirens is under discussion. Besides being a back-up option, the integration of GSM technology would considerably reduce operational costs related to activation of sirens and data acquisition. An annual maintenance contract for three years after the one-year warranty period has also been worked out with the contractors but is subject to availability of funds. The existing manual EWS will also be retained as a back-up.

The existing institutional set-up for the manual EWS will be used and enhanced for the GLOF-EWS. Training and awareness building of the DDMCs, DMAPTs and GDMCs on the GLOF-EWS and testing of the system are scheduled to be implemented and completed within six months after installation of the system.

GLOF hazard zoning of the Punakha-Wangdi and Chamkhar valleys has been completed, identifying high-risk zone and evacuation sites. The GLOF hazard zone maps are ready but information dissemination is in its early stage. A government circular for GLOF-resilient land use planning, based on the GLOF hazard zoning, has been disseminated to the local authorities of Punakha, Wangdi and Bumthang. This represents a significant policy-level outcome of the project, as it restricts new construction in the high-risk zone. However, for effective enforcement of the circular, it is crucial that the Disaster Management Bill is enacted soon so that there is a legal basis to support such regulatory measures. Dissemination of information on GLOF hazard zones and awareness-building on precautionary measures are expected to take place vigorously in Punakha-Wangdi valley in conjunction with the public trialling of the automated GLOF-EWS after the system is installed.

### 3.2.4 Outcome 4

During the MTR, there was little scope to assess the outputs and targets under this outcome as they were scheduled for achievement by the end of the project. There were, however, a number of media and advocacy materials that provided insights and knowledge on the issues and challenges associated with the artificial lowering of Thorthormi lake and reduction of GLOF risks and vulnerabilities. These included the WWF Publication ‘The Cost of Climate Change: The story of Thorthormi lake’[[10]](#footnote-10), WWF/Bhutan Broadcasting Service’s documentary ‘The Cost of Climate Change’, GEF documentary production ‘Bhutan: Silent Tsunami’[[11]](#footnote-11), and UN TV’s documentary ‘Tsunami from the Sky’[[12]](#footnote-12). These materials have immense promotional value and potential to generate global interest and resources to support similar activities in the future. For instance, the evaluator picked up from YouTube a 3-minute news story run by the Nepal News channel on the artificial lowering of Thorthormi lake highlighting the importance of Bhutan’s experience for other countries in the region that face similar challenges[[13]](#footnote-13). The news story was based on the WWF publication on Thorthormi lake and included brief interviews with some of the environmentalists in the region. In addition, the Bhutanese print media have covered project work in Thorthormi lake on a number of occasions and the Bhutanese delegation showcased the project at COP 15 in Copenhagen, December 2009. In the run-up to COP 15, the prestigious *Nature* journal featured an article ‘When the Ice Melts’ narrating Bhutan’s endeavour to alleviate the risks of GLOF from Thorthormi lake[[14]](#footnote-14).

Appendix 6 takes stock of the progress towards project outputs/ targets specified in the SRF.

## 3.3 Project Management and Implementation

### 3.3.1 Country Ownership/ Drivenness

The project displays a very high level of country ownership and drivenness. This is abundantly evident in government co-financing and institutional arrangements for project management. Government co-financing of US$ 2,680,000 constituted 36.5 per cent of the total project cost. In addition, with support from UNDP, the RGoB leveraged US$ 830,000 in co-financing from other external donor agencies. The government IPs (DGM, DoE and DDM), have received guidance and support from the PB, chaired by the Secretary of the Ministry of Economic Affairs and made up of members from various relevant government agencies and international project partners. The IPs have appointed project managers to coordinate and ensure the delivery of the project outputs and targets assigned to the respective agencies. A senior official of the DGM serves as the Project Director to oversee project implementation and ensure that project objective, outcomes and outputs are achieved as planned. The PB was seen as proactive and expeditious in decision-making and providing guidance for project implementation. PB meetings have been held on eight occasions since the commencement of the project, far exceeding the requirement stipulated in the ToR[[15]](#footnote-15).

As required in the project document, a multi-disciplinary Technical Support and Advisory Team (TSAT) was set up to provide technical guidance and backstopping specifically for the preparation and implementation of activities pertaining to artificial lowering of the water level of Thorthormi lake (Outcome 2). This was deemed necessary in view of the technical and logistical intricacies involved in the field operations. The TSAT, led by the Project Director, comprised representatives from various government agencies, which apart from officials from the IPs included representatives from the Ministries of Home and Cultural Affairs, Health, and Works and Human Settlement, NECS, and Jigme Dorji National Park. A representative of UNDP CO was also a TSAT member. TSAT meetings have been held at three occasions: the first in 2008 before the preparation of the engineering and safety plan, the second in 2009 after the completion of the engineering and safety plan and before the commencement of the first phase of excavation work, and the third in 2010 after the completion of the first phase of excavation work and before the commencement of the second phase.

The ownership at the *dzongkhag* and community level can also be rated as highly satisfactory. The project has successfully integrated CBDRM training and planning in the existing institutional set-up at the *dzongkhag* level. In absence of a full-time *dzongkhag* staff for disaster risk management, the *dzongkhag* administrations in the project area have appointed the *Dzongkhag* Environmental Officers as interim focal points. The DDMCs and DDMAPTs were basically made up of existing *dzongkhag* staff. During the FGDs with the members of DDMCs and DDMAPTs of Punakha and Wangdi, the MTR observed much interest and commitment among them for activities related to awareness-creation and planning for CBDRM despite the fact that these activities were over and above their regular functions and responsibilities. Several of the members suggested that CBDRM-related interactions with local communities helped them to understand the ground realities and obtain information and insights which can also be useful for their respective sectoral programmes such as community forestry and agriculture.

Over the course of the review, it was emphasized that the project received high priority from the RGoB. Many of the government administrative procedures, such as processing of higher wage and supplementary benefits for the workers, review and approval of engineering and safety plan, and environmental clearance, were fast-tracked to enable timely commencement of the project activities.

### 3.3.2 Efficiency

In general, implementation of the project was noted to be efficient. The project was integrated into the existing institutional set-up of the RGoB; particularly encouraging was the use of the existing institutional structure and staff at the *dzongkhag* level for awareness-building and planning for CBDRM. Existing human resources within the IPs were used and no additional staff had been recruited for the purpose of the project. In-country technical capacity developed through earlier GLOF studies and field activities was used profusely to implement the activities pertaining to artificial lowering of the water level of Thorthormi lake. This existing in-country technical expertise has been further strengthened through hands-on knowledge and experience accrued consequentially by Bhutanese personnel through their direct engagement in technical planning, supervision and implementation of the activities.

The role of the DoE and the importance of the agency’s direct involvement in the project, specifically in relation to the delivery of Outputs 3.1 and 3.5 pertaining to EWS, were realized early on during the start of the project and a decision was made promptly in the very first PB meeting for the DGM to hand over the implementation and delivery of these outputs to the DoE. Although it may have led to some delay in commencement of the EWS component, the inter-agency transfer of implementation responsibility was appropriate and advantageous as the DoE is better-placed in terms of institutional mandate and structure to deal with the responsibility of installing and maintaining the EWS, and mobilizing additional resources to do so. This move has facilitated the integration of the GLOF EWS into existing institutional arrangements and programmes for flood warning that are currently managed by the DoE. Mobilization of additional US$ 217,390 from the PHPA for the automated EWS by the DoE has enabled the project to expand the coverage of the system and establish it at a more comprehensive scale than originally planned. Furthermore, the project is now in a position to integrate real-time weather data collection and forecasting into the automated EWS to enhance the utility of the system and integrate a BGAN system as back-up in case satellite communication failure occurred. These initiatives reflect prudence on the part of the IPs and the catalytic role of the project in leveraging additional resources.

It was also noted that the IPs did not make use of international technical assistance, although provisions were in the project document to employ international consultants for disaster management policy and institutional framework and for early warning information and communication. The former was converted to hiring two qualified national consultants: one for the formulation of the Disaster Management Bill and the other for CBDRM guideline development and training. The latter provision to employ an international consultant for early warning communications has become redundant as the GLOF-EWS has been contracted out on a turnkey basis, which includes technical support.

### 3.3.3 Documentation and Project Reporting

Project documentation and reporting were among the few areas where the project was found lacking to some extent. The quarterly progress reports made available to the evaluator were found to be largely abstract. The first Project Implementation Report (PIR) for the project in 2009 does not provide adequate details and perceptive information while the PIR for 2010 was under preparation at the time of the MTR. Interactions during SSIs and FGDs suggested that there were lot more experiences and important lessons accrued from the project than were actually documented and reported. For instance, there were some valuable observations from the *dzongkhag* staff on the content and conduct of CBDRM training programmes but the progress reports do not reflect such observations.

The importance of documentation of project experience and reporting of project progress are accentuated by the fact that this project is the first of its kind in the world. Achievements and lessons learnt from the project, therefore, have enormous significance not only for Bhutan but also for many other countries around the world that face similar challenges from climate change.

It was observed that the hard components of the project, especially the activities related to the artificial lowering of the water level of Thorthormi lake, were more visible in various existing documents and media products. On the other hand, the soft components such as awareness-creation, training, and planning for disaster risk management, were less discernible in terms of documentation although significant work was taking place in that respect with the local authorities and communities.

### 3.3.4 Sustainability

The following factors are expected to contribute to the sustainability of the interventions implemented through the project:

* The project has relied on existing institutional arrangements and human resources for project implementation. In-country technical capacity developed through earlier GLOF field activities has been used profusely and further reinforced through experiential learning as a result of direct engagement of a Bhutanese team in the technical studies, planning, supervision and implementation of activities. The integration of capacity development component to complement the hard components, namely the artificial lowering of Thorthormi lake and establishment of GLOF-EWS, also suggests that at the end of the project there will be improved capacity in terms of legislation, policy, guidelines, trained personnel, and better public awareness to continue with various interventions after the conclusion of the project.
* The training and awareness programmes on CBDRM are aimed inter alia at enabling local authorities and communities to develop *dzongkhag*- and *gewog*-level disaster management plans. The intent is to eventually mainstream the activities outlined in these management plans into the overall *dzongkhag* and *gewog* development plans and programmes. This approach is expected to enable the local authorities to internalize and continue project-supported activities as a part of regular government programme after project completion.
* A key deliverable aimed by the project is the Disaster Management Act. The Disaster Management Bill has been finalized and submitted to the Parliament for deliberation and ratification into an Act. The Bill is expected to be deliberated and ratified at the upcoming Parliamentary session, scheduled to take place in winter (November/December) 2010. If and when ratified, the legislation will provide legitimacy to the DDMCs and GDMCs that the project has helped set up in Punakha, Wangdi and Bumthang, and strengthened through training and awareness programmes. Furthermore, the legislation will provide for appointment of *Dzongkhag* Disaster Management Officers on a full-time basis to facilitate and assist the implementation of disaster management plans and activities at the *dzongkhag* level.
* Adaptive engagement of other stakeholders during the course of project implementation, for instance the inclusion of the *Dzongdas* of Punakha, Wangdi and Gasa *dzongkhags* in the PB and the mobilization of additional funds from the PHPA for the GLOF-EWS, is expected to have enhanced local ownership and commitment for the sustainability of project interventions.

### 3.3.5 Other Issues

**Health and Safety**

Project activities pertaining to the artificial lowering of the water level of Thorthormi lake entail immense health and safety risks due to high altitude, harsh climate, difficult accessibility, and fragile terrain. Despite preventive measures such as medical screening and briefing on altitude sickness and other health risks and the presence of medical staff in the field team, three workers have died so far – all in 2010 working season. Two of them died due to altitude sickness while on their way to Thorthormi lake while the third succumbed to death after a short illness at the work site in August 2010[[16]](#footnote-16). These deaths have resulted in media scrutiny and generated some adverse media reports on the health and safety measures undertaken by the project. The PB convened a special meeting on 14th July 2010 to discuss and decide additional safety measures for the workers and payment of monetary compensation to the families of the deceased workers. To further increase safety for the workers and government staff during the 2010 working season, the project has decided to establish additional camp sites attended by health assistants when the workers are scheduled to return from Thorthormi lake in October 2010. A local businessman has donated an inflatable high-altitude pressure/ Gamow bag, which is used by trekkers and mountaineers in the event of altitude sickness. For the future phases of the excavation work, the project management is examining additional safety measures such as mandatory acclimatization stopovers for workers along the route to Thorthormi lake.

**Gender Equity**

The project offers little scope for gender-specific intervention. Nevertheless, the MTR noted an inadvertently high level of involvement of women in the project particularly in the DDMCs and DDMAPTs. Both in Punakha and Wangdi *dzongkhags* that were visited for the MTR, the *dzongkhag* focal persons for disaster management were women. In addition, about 30 to 40 per cent of the DDMC and DDMAPT members are estimated to be women. However, conversely, while meeting with the GDMC members of Chhubu, Tewang and Zomi *gewogs* in Punakha *dzongkhag* it was observed there was not a single women member in the GDMCs. On query, the GDMC members explained that the local women were reluctant to participate as GDMC members since their domestic responsibility of taking care of the children and home did not allow them the time required to carry out the responsibilities of a GDMC member, which periodically involved arduous travel and overnight absences from home.

Of the 586 participants of CBDRM trainings held at *dzongkhag* and *gewog* levels, more than 24 per cent of the participants were women. Despite the immense physical difficulties involved in the excavation work at Thorthormi lake, 20 local women were voluntarily engaged in the workforce of 340 workers during the 2010 working season[[17]](#footnote-17). There is no discrepancy in wage and benefits between men and women workers.

**Poverty Reduction**

Agriculture is the economic mainstay of the rural communities in Bhutan. In the event of a GLOF from Thorthormi lake, it is estimated that half of the fertile Punakha-Wangdi valley will be submerged under water destroying vast expanses of prime farmlands[[18]](#footnote-18). This will have considerable bearing on poverty, which is predominantly a rural phenomenon with 30.9 percent of the rural population in the country living below the total poverty line according to the Poverty Analysis Report 2007 produced by the National Statistics Bureau. Furthermore, loss of livestock and homes, destruction of riparian forests and grazing lands used by the local communities, and damage to rural roads and other vital public infrastructures will negate rural development efforts and aggravate the poverty situation. In addition, the project provides employment to more than 300 people every year for the artificial lowering of the water level of Thorthormi lake. Most of these people basically belong to families with inadequate livelihood.

**Governance**

The participation of local communities and local authorities is pivotal for the successful implementation of the project. Recognizing this, the project has been making use of the existing decentralized governance set-up at the *dzongkhag* and *gewog* levels to secure local community participation. Locally elected community functionaries are actively involved in the project activities particularly for awareness-creation and planning for CBDRM. Interactions with these functionaries during the MTR suggested that they have sufficient awareness of the GLOF issues and an intimate understanding of the local opportunities and challenges involved in implementing disaster risk management at the community level. Also, the project is working with the *dzongkhag* and *gewog* administrations to integrate CBDRM plans into the mainstream *dzongkhag* and *gewog* development plans using a participatory approach.

**Linkage/ Synergy with other Projects**

A great deal of similarity was noted between the activities of Outcome 1 of the project and those of the Regional GLOF Risk Reduction Project, which is jointly funded by the UNDP Bureau for Crisis Prevention and Recovery (BCPR) and the European Commission Humanitarian Aid department (ECHO). It was learnt that many of the CBDRM activities were implemented on a cost-sharing basis with the UNDP/ECHO Regional GLOF Risk Reduction Project. Given this situation, the MTR infers that the project will need to exercise careful planning to avoid duplication and instead ensure synergy with the activities supported by the UNDP/ECHO Regional GLOF Risk Reduction Project. However, it was also noted that the Regional Project is scheduled to conclude in December 2010. This, therefore, limits the scope for any persistent duplication or synergy.

Another project that has significant linkage to the project outcome is the ‘Study on GLOFs in Bhutan Himalayas’ supported by the JICA and JST. The JICA/JST supported project, among other things, is expected to develop a detailed and comprehensive national GLOF inventory and database, which was initially planned under this project although expectedly at a less elaborate scale and depth. At the same time, the JICA/JST project expects to benefit from the knowledge and information accrued through this project. Collaboration between the two projects will be mutually-beneficial and is, therefore, recommended.

## 3.4 Project Finances

### 3.4.1 Budget Procedures

The project funds are managed by the UNDP CO. Annual project budgets are planned at the time of preparing Annual Work Plans (AWPs), and accordingly reflected in the AWPs. In the first year of the project, funds were released by the UNDP CO to the GNHCS, which would in turn release it to the Department of Public Accounts, Ministry of Finance, and which would release it onward to the DDM, DGM and DoE. From the second year of project implementation onward, project funds were released directly to the DPA without having to channel through GNHCS, thus shortening the fund release procedures.

The disbursements are conducted on a quarterly basis upon receipt of fund requests. The project IPs are required to use Funding Authorization and Certification of Expenditures (FACE) forms to request advances/cash transfers and to report expenditures. The FACE forms are supported by quarterly progress reports on project implementation. Budget release and reporting on a quarterly basis have been useful for the GNHCS and UNDP CO as the agencies were able to keep regular track of project finances and monitor project implementation and delivery. However, for the project IPs, considerable time was used up in fulfilling procedures for reporting and budget acquisition. This resulted in shortened time for implementation of planned activities and affected project implementation. The problem had eased to a certain extent since the requirement of channelling project funds through GNHCS was pulled out but still considerable time, i.e. 30 to 40 per cent of every quarter, was reportedly expended on procedural work related to project finances and reporting[[19]](#footnote-19).

### 3.4.2 Fund Disbursements and Expenditures

As of June 2010, a cumulative sum of US$ 1,095,729.25 had been disbursed to the project IPs. This translates to 23.5 per cent of the total external project funds[[20]](#footnote-20). A breakdown of financial disbursements and expenditures (all amounts in US$) is provided below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **Annual Planned Budgeta** | **Disbursement to IAs** | **Cumulative Disb. % of Project Budgetb** | **Expenditure Reported by IPs** | **Cumulative Exp. % of Project Budgetb** |
| 2008 | 1,412,344.00 | 160,087.46 | 3.4 | 43,450.21 | 0.9 |
| 2009 | 1,501,527.00 | 639,953.68 | 17.1 | 682,220.74 | 15.5 |
| 2010 | 1,872,400.00 | 295,688.11 | 23.5 | 200,428.65 | 19.8 |

*Source: UNDP CO, Energy and Environment Unit*

Of the total disbursed funds, 84.5 per cent have been reported as expended. In 2008, the reported expenditure was just 27.1 per cent of the disbursed funds. However, in 2009 and 2010, the reported expenditures have improved significantly. Low expenditure in 2008 was largely due to most activities being preparatory entailing little expenditure and the non-utilization of fund earmarked for the GLOF-EWS as the component was decided for transfer from the DGM to DoE. Subsequently, in 2009, the cumulative expenditures increased from 0.9 per cent to more than 15.5 per cent as physical activities pertaining to the artificial lowering of the water level of Thorthormi lake got underway although the delay in commencement of the excavation work and consequent cutback in the 2009 working season at the excavation site due to Cyclone Aila in May 2009 did affect financial expenditures.

There is a considerable gap between annual planned budget and actual disbursements. In 2008, only 11.3 per cent of annual planned budget was actually disbursed. In 2009, budget disbursement improved but it was still just 42.6 per cent of the annual planned budget[[21]](#footnote-21).

## 3.5 Project Ratings

|  |  |  |
| --- | --- | --- |
| **Project Aspects** | **Rating** | **Reasons** |
| Attainment of intended results | 3 | Most of the mid-project output-level targets have been achieved and in a few cases exceeded initial targets as per change in project needs. However, concurrently, a few delays have occurred especially affecting the installation of the GLOF-EWS and consequent activities. A few activities, e.g. the national GLOF database, have not been implemented due to change in project circumstances. In addition, the target of lowering the water level of Thorthormi lake by 5 metres by the end of the project, i.e. December 2012, appears somewhat ambitious in view of the slow progress due to Cyclone Aila in May 2009 and persistent rains at the work site in the 2010 working season. |
| Cost-effectiveness | 2 | Administrative and personnel costs were limited due to use of existing government institutional set-up and human resources.  The multiplier approach used for CBDRM training by conducting ToTs for DDMCs and DDMAPTs would have reduced training time and costs.  Use of national consultants in lieu of international consultants allowed the project to engage more consulting assistance than initially planned because of relatively lower cost of national consultants.  In-house technical capacity was used for planning, including field assessments and studies, and supervision of the artificial lowering of Thorthormi lake, thus moderating project costs and enhancing sustainability and replicability. The project also enabled the DoE to leverage additional funds for the establishment of a comprehensive GLOF-EWS.  Engagement of the local authorities and communities and development of their capacities are expected to contribute to the replicability and sustainability of the project interventions. |
| Implementation approach | 2 |
| Sustainability | 3 |
| Replicability | 3 |
| Coverage | 2 | Project covers the area which is considered the most vulnerable to GLOF and related risks in the country. The coverage of the re-planned GLOF-EWS is very comprehensive and more than double of what was originally planned under the project. |
| Impact on disaster risk management | 3 | It is premature to assess the project impact but there were signs of increased awareness and personnel capacity for activities to reduce GLOF risks and vulnerabilities. Periodic media coverage of the excavation work at Thorthormi lake is expected to have inculcated greater public awareness of, and interest in, climate change impacts and GLOF challenges. Being the first of its kind in the world, the project potentially has significant international demonstrative value. It was reported that Pakistan is developing a similar project based on Bhutan’s approach.  The project will also have positive impacts on the security of agricultural lands, riparian resources, rural infrastructure, and hydropower investments along Puna Tsang Chhu. This in turn will create a reliable environment for poverty reduction and economic growth in the project area. |
| Impact (general) | 3 |
| Stakeholders’ participation | 2 | All key government agencies are either directly involved in project implementation or as part of the PB. The *dzongkhag* administrations in the project area are directly involved in capacity development activities and indirectly in other project activities as part of the PB. All co-financing agencies are also involved in the PB. Local community focal persons have been identified in all the GLOF-vulnerable communities of the project area. CBDRM training and awareness programmes are directed towards the local communities with special emphasis on those who are GLOF-vulnerable.  The participation of PHPA has also been secured through mobilization of additional funds for the GLOF-EWS. |
| Country ownership/ drivenness | 2 | A high level of country ownership/ drivenness is evident from the functioning of the PB, which has met frequently and taken expeditious decisions to facilitate project implementation. Government co-financing constituted 35.8 per cent of the total project costs. The project was given considerable priority and many government procedures were fast-tracked to allow timely commencement of the project activities particularly those pertaining to the artificial lowering of Thorthormi lake. Commitment and interest of the local government authorities were also visible from interactions during the FGDs. |
| Financial planning | 5 | There were considerable differences between annual planned budgets and actual disbursements. Project implementation was also affected by the significant amount of time that went into procedural work pertaining to reporting and fund release. |
| Monitoring and evaluation | 4 | Quarterly reporting and fund disbursement allowed UNDP CO and GNHCS to constantly monitor project funds and project implementation. A number of documents informed project progress. These included the PIRs, QPRs, Annual Report compiled for the ACO, and minutes of the PB meetings. The PIR for 2009 was incomplete and for 2010 was under preparation. The QPRs were found to be a bit too abstract and lacking in analysis of lessons. |
| **Overall Project Rating** | **3** |  |

Note: 1= excellent; 2= very good; 3= good; 4= satisfactory; and 5= unsatisfactory

# 4. Conclusions and Recommendations

## 4.1 Conclusions

The MTR draws the following key conclusions:

* The project is **highly relevant in the overall development context**. It supports Bhutan’s overarching development philosophy of GNH, directly contributing to the main GNH objectives of sustainable socio-economic development and environmental conservation. It also directly supports UNDAF Outcome 5 outlined in cCAP 2008-2012 and relates to the objective of supporting pilot and demonstration projects for adaptation to climate change outlined in the Climate Change Focal Area Strategy and Strategic Programming for GEF-4. Finally, the project addresses multiple key adaptation needs and priority projects identified in the Bhutan NAPA.
* Overall, **project progress is good** when assessed against planned outputs/targets. A few delays have occurred and these were largely due to changes in project implementation arrangements, government financial procedures, and the occurrence of Cyclone Aila (May 2009) which damaged the trail to Thorthormi lake. Most of the project outputs and targets are achievable by the end of the project. However, progress made by the end of the 2010 work plan will be crucial as this will provide a more reliable indication of the achievability of the project results for a couple of major reasons. Unlike in 2009, the project was able to commence work on artificial lowering of Thorthormi lake on time in 2010 and, therefore, will be able to have a more accurate measure of the physical work that can be achieved in one normal working season. Also, the GLOF EWS, which is a key project component, is now in a more firm position for implementation with all the major preparatory and procedural work completed.
* The project demonstrates **sound adaptive management decisions** **and prudence** such as the transfer of the GLOF-EWS from the DGM to DoE, upgrading of the GLOF-EWS for more comprehensive coverage on the basis of additional resource mobilisation, and the use of national consultants instead of international consultants so that the project could engage more requisite consulting assistance.
* The use of existing government institutional set-up, human resources and previously-built technical capacity for management and implementation of project activities bodes well for the **sustainability and replicability** **of project interventions**. These are further enhanced by the high level of stakeholder ownership and engagement in the project.
* **Documentation and reporting of the technical/ programmatic aspects of the project is weak** and this becomes a major concern especially with respect to the capacity development component. It is generally difficult to assess the results of capacity development given that they relate to change in knowledge, skills, attitude, and behaviour which are not physical products. Without good documentation of the progressive results, lessons and issues, it becomes even more difficult to assess the non-physical products of a project.
* Project **communication work is highly skewed in favour of the project component pertaining to the artificial lowering of Thorthormi lake**. This is evident from the fact that virtually all media and advocacy products that exist on the project focus primarily on Thorthormi lake and the work that is being done to lower its water level. On the other hand, the capacity development for CBDRM has received little media attention or communication focus despite significant amount of work having gone into it.
* There is considerable **mismatch between expenditure planning and actual financial delivery** as evident from the low financial disbursement and expenditure figures against annual planned budgets in 2008 and 2009.

## 4.2 Recommendations

### 4.2.1 Corrective actions in project design and implementation

* Some changes in project design/SRF are recommended as project circumstances and needs have slightly changed since project conception and also in view of new inferences through project implementation. The recommended changes are specified below:

**Outcome 1, Indicator 2:**

Existing statement: Percentage of personnel reporting DRM frameworks support adaptation efforts.

Recommended change: Percentage of DRM focal points at *dzongkhag*, *gewog* and community levels reporting that the Disaster Management Act, revised NDRMF and CBDRM guidelines support adaptation efforts.

Justification for the change: ‘Personnel’ as expressed in the existing statement is vague. Replacing it with DRM focal points at *dzongkhag*, *gewog* and community levels make the indicator specific and measurable. Furthermore, there is a need to specify the DRM frameworks. Hence, the Disaster Management Act, revised NDRMF and CBDRM guidelines are suggested as more specific deliverables.

**Outcome 1, Target 2:**

Existing statement: By the end of the project, at least 90 per cent of personnel interviewed report that DRM frameworks support their adaptation efforts.

Recommended change: By the end of the project, DRM focal points at *dzongkhag*, *gewog* and community levels report that the Disaster Management Act, revised NDRMF and CBDRM guidelines support their adaptation efforts.

Justification for the change: Change in this target is linked to Outcome 1, Indicator 2. Hence, the reason for the previous recommended change also applies to this change.

**Outcome 1, Target 3:**

Existing statement: By the end of the project, at least three DRM legislation and policies and formulated inclusive of climate-induced GLOF risks and demand long-term mitigative and preparedness planning.

Recommended change: By the end of the project, the DM Act and revised NDRMF are formulated inclusive of climate-induced GLOF risks and long-term mitigative and preparedness planning.

Justification for the change: The basis for ‘at least three DRM legislation and policies’ is not understood. Furthermore, in case of legislations and policies, it is more appropriate to name the targeted laws and policy documents than to specify a number as target.

**Outcome 1, Output 1.1, Target 2:**

Existing statement: By the end of the project, DM Act formulated incorporating GLOF and other climate risk issues.

Recommended change: By the end of the project, DM Act formulated providing comprehensive legal basis for the management of all disaster risk issues in Bhutan, including those pertaining to GLOFs.

Justification for the change: The DM Act, by purpose and structure, is limited to be disaster- and issue-specific. That notwithstanding, the DM Act provides the legal framework to support various institutional and administrative mechanisms for disaster management. A key mechanism would be the NDRMF, which can be specific to various disasters and related risks and issues including those pertaining to GLOFs.

**Outcome 1, Output 1.3, Target 1:**

Existing statement: National database on GLOF vulnerability and climate risk information in Bhutan systematically and continually updated.

Recommended action: This target needs to be reviewed by the project management after verification with JICA. If it confirms to be redundant, it is recommended to remove this output target and undertake a respective budget revision.

Justification for the recommended action: The target appears to be redundant due to conception of the JICA/JST/DGM study project on GLOFs in Bhutan, which is also expected to develop a national GLOF inventory and database and probably in more detail than planned through this project.

**Outcome 1, Output 1.3, Target 2:**

Existing statement: 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.

Recommended action: The target needs to be re-examined and re-formulated.

Justification for the recommended action: No activity pertaining to this activity has been implemented or initiated. The IPs were not clear as to what was meant by ‘information management system’ as referred to in the target. Furthermore, it appears to have some overlap with the Second National Communication, which will include information on climate change risks and vulnerabilities, and adaptation needs.

**Outcome 1, Output 1.3, Target 3:**

Existing statement: Annual workshops to present information on climate change-induced GLOF risks to relevant government departments.

Recommended change: Biennial workshops to present information on climate change-induced GLOF risks to relevant government departments

Justification for the recommended action: Annual workshops were considered too ambitious given that information accumulated each year on GLOF risks is limited. Instead, the IPs have expressed that an information-sharing workshop every two years would be sufficient.

**Outcome 2, Output 2.3, Target 2:**

Existing statement: At least two monitoring reports are produced and disseminated per year on the status of lake level and lowering system.

Recommended change: At least one monitoring report is produced and disseminated per year on the status of lake level and lowering system.

Justification for the recommended action: The target of ‘at least two monitoring reports’ is superfluous given that work on artificial lowering of lake level is limited to 3-4 months in a year.

* Strengthen monitoring and reporting especially in relation to the SRF. It is recommended that the AWPs and quarterly progress reports are linked to the expected outputs and targets and not just the broad outcomes. This will ensure that the AWPs and progress reports are consistent with the SRF. Furthermore, progress reports will need to be more perceptive to capture progressive results, lessons and issues that emanate from project implementation.
* Some of the project results, especially those related to capacity development, require to be assessed through QBS. According to the SRF (refer Annex 5), the QBS are to occur either halfway of the project or towards the end of the project.

The following project targets require QBS to be carried out at halfway of the project. These QBSs will need to be scheduled and budgeted in the 2011 AWP:

* Outcome 1, Target 1;
* Outcome 1, Output 1.2, Target 1;
* Outcome 1, Output 1.4, Target 2;
* Outcome 3, Output 3.3, Target 1; and
* Outcome 3, Output 3.4, Target 1.

The following project targets require QBS to be carried out towards the end of the project. These QBSs will need to be scheduled and budgeted in the AWP of the final year of the project:

* Outcome 1, Target 2;
* Outcome 3, Target 1; and
* Outcome 3, Output 3.3, Target 1
* Project implementation is affected by the considerable amount of time that goes into procedural work pertaining to reporting and fund releases. Delays in fund release have reportedly occurred from time to time. To increase the expeditiousness of procedural work and prevent delays in fund disbursements, the UNDP CO and the IPs need to coordinate and jointly examine the causes of delay, and implement corrective measures to address these causes.
* The vast gaps that exist between annual planned budgets and actual disbursements need to be jointly examined by the UNDP CO and the IPs. It is recommended that a joint review of the financial aspects of the project be carried out as soon as the financial reporting for the current AWP is completed and projections of anticipated expenditures under various outcomes/outputs be made for the rest of the project period. This is expected to aid early detection of any adjustments required in the budget programming and enhance financial planning. While financial disbursements and expenditures are way below planned budgets, some activities such as the GLOF-EWS may require additional fund. A joint review and projection of future expenditures for the rest of the project period would help rationalize budget allocation.
* It would be useful to carry out activities to progressively build up and analyze knowledge and lessons that can be fed into the Adaptive Learning Mechanism (ALM). It is recommended that a workshop be conducted within 2011 to take stock of and discuss the knowledge and experience accrued through the project. Particularly important will be to capture knowledge and lessons pertaining to capacity development for CBDRM as this component is less discernible than the artificial lowering of Thorthormi lake and GLOF-EWS components.
* Linkage between the various project components/ outcomes needs to be enhanced so that the project is implemented in a more integrated manner. Particularly important is the linkage between the capacity development component and the EWS component as the capability of the local authorities and communities to effectively respond to the EWS will be of utmost importance.
* Formal partnership with the JICA/JST supported project ‘Study on GLOFs in Bhutan Himalayas’ is recommended to develop inter-project synergy and address GLOF issues in Bhutan in a more integrated and comprehensive manner.
* In view of the deaths that have occurred due to altitude sickness and other ailments in the ongoing 2010 working season, it is strongly recommended that a detailed strategy be developed and implemented to improve health and safety measures for the workers and field staff during the trek to Thorthormi lake and at the excavation site. This strategy must be developed soon after the return of the workers and field staff from the current phase of the excavation work. Some ideas that may be considered in the strategy include:
* appointment of additional medical staff in the field team;
* more intensive sensitization of workers on health and safety measures and strict imposition of safety rules such as mandatory stopovers during the trek;
* more rigorous medical check-up as a part of the workers’ recruitment process;
* in-country training of medical staff team members on altitude sickness and other common ailments at high altitude by a medical expert in the particular field[[22]](#footnote-22);
* first-aid training on common high-altitude ailments and injuries for a core group of 15 to 20 workers to support the medical staff team members in extending medical aid as and when required;
* improved clothing and camping equipment necessary for protection against harsh weather conditions; and
* procurement of additional health and safety equipment, including more number of inflatable high-altitude pressure/ Gamow bags.

### 4.2.2 Proposals to reinforce or enhance project benefits

* Early consultations with potential donors are recommended to prepare and plan for replication of the project interventions in other areas that face similar GLOF challenges and risks. A logical future proposal would be to build upon the GLOF-EWS established through the project to cover the Mo Chhu sub-basin by installing sensors in the headwaters and linking them to the siren network established by the project. Other potential areas for replication of the mitigation works are the Mangde Chhu and Chamkhar Chhu sub-basins.
* An overhaul of the existing CBDRM training curriculum, especially taking into account the need to use more visual training methods to overcome literacy constraints of the local communities and focus on the practical aspects of CBDRM, seems necessary so that the training lessons are hands-on. The training curriculum will also need to be complemented with appropriate training tools and materials (e.g. flip chart, poster, illustrated handbook). CBDRM training curriculum is being implemented through the project but there is a need to revamp it in view of the suggestions from the DDMAPT members to integrate more visual training methods and provide greater emphasis on the practical aspects.
* One of the good practices associated with the project is the implementation of an EIA study to identify potential adverse environmental impacts and implement necessary mitigation measures. It was given to understand that it was not always possible to fully implement certain mitigation measures, such as collection of waste and bringing them all the way to Thimphu, because of logistical constraints. An ‘ecological footprint’ study towards the end of the project may be useful to assess the scale of environmental impacts created by the project, identify environmental management trade-offs, and draw lessons for future environmental management of similar projects. Environmental management trade-offs may be necessary as it may so happen that some of the ecological footprints may actually be too small to warrant logistically-difficult and cumbersome mitigation measures. On the other hand, it may also be the case that certain environment impacts are substantial enough to require special mitigation measures despite logistical difficulties and associated costs.
* A key area to focus in future GLOF work in Bhutan is the monitoring of the glacial lakes given that potential GLOF risks will change, and probably increase, over time. Since physical monitoring of GLOFs is basically impossible due to the rugged mountain terrain, harsh weather and lack of physical communication infrastructure, virtual monitoring tools and techniques such as use of time-series satellite/ radar maps need to be considered for GLOF projects in the future.

# Appendices

## Appendix 1: Terms of Reference for the Mid-term Review

**1. Project background**

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.

Linked to these concerns, the ‘Reducing Climate Change-induced Risks and Vulnerabilities from

Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys’ was set up in order to reduce climate change-induced Glacial Lake Outburst Flooding (GLOF) risk. The project is anticipated to contribute to risk reduction, improved safety and increased awareness in the involved districts through three components covering practical measures to reduce climate change-induced GLOF risks from the potentially dangerous Thorthormi glacier lake, expansion of early warning mechanisms in the Punakha-Wangdi Valley and systematization and long-term planning of Bhutan’s legal framework and awareness on disaster risk management.

The objective of the project is to integrate climate risk projections into existing disaster risk management practices and implement corresponding capacity development measures. The objective aims to demonstrate and facilitate replication of the respective lessons learned in other high-risk GLOF areas, both within and outside Bhutan. Sustainability of the resulting benefits will be assured through institutional and policy improvements and adaptive learning, dissemination and awareness.

**2. Project objectives and expected outputs**

The long-term objective of the project is to enhance adaptive capacity to prevent climate change-induced Glacial Lake Outburst (GLOF) disasters in Bhutan.

In order to achieve this objective the project will improve national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys, reduce risks of GLOF from Thorthormi Lake through an artificial lake level management system and reduce human and material losses in vulnerable communities in the Punakha-Wangdi Valley through installation of a GLOF early warning system.

**3. Mid-Term Review objectives**

The purpose of Mid-Term Review is to examine the performance of the project since the beginning of its implementation. The review will include both the evaluation of the progress in project implementation, measured against planned outputs set forth in the Project Document in accordance with rational budget allocation and the assessment of features related to the process involved in achieving those outputs, as well as the initial and potential impacts of the project. The review will also address underlying causes and issues contribution to targets not adequately achieved.

The Mid-Term Review is intended to identify weaknesses and strengths of the project design and to come with recommendations for any necessary changes in the overall design and orientation of the project by evaluating the adequacy, efficiency, and effectiveness of its implementation, as well as assessing the project outputs and outcomes to date. Consequently, the review mission is also expected to make detailed recommendations on the work plan for the remaining project period. It will also provide an opportunity to assess early signs of the project success or failure and prompt necessary adjustments.

The review mission will also identify lessons learnt and best practices from the project which could be applied to future and other on-going projects.

**4. Scope of the Mid-Term Review**

The scope of the Mid-Term Review will cover all activities undertaken in the framework of the project. The evaluators will compare planned outputs of the project to actual outputs and assess the actual results to determine their contribution to the attainment of the project objectives. The evaluation will diagnose problems and suggest any necessary corrections and adjustments. It will evaluate the efficiency of project management, including the delivery of outputs and activities in terms of quality, quantity, timeliness and cost efficiency. The evaluation will also determine the likely outcomes and impact of the project in relation to the specified goals and objectives of the project.

The evaluation will comprise the following elements:

1. Assess whether the project design is clear, logical and commensurate with time and resources available;
2. A summary evaluation of the project and all its major components undertaken to date and a determination of progress towards achievement of its overall objectives;
3. An evaluation of project performance in relation to the indicators, assumptions and risks specified in the logical framework matrix and the project document
4. An assessment of the scope, quality and significance of the projects outputs produced to date in relation to expected results;
5. An analysis of the extent of the extent of cooperation on engendered and synergy created by the project in each of its component activities;
6. An assessment of the functionality of the institutional structure established and the role of the PROJECT BOARD, the Technical Support and Advisory Team and working groups;
7. Identification and, to the extent possible, quantification of any additional outputs and outcomes beyond those specified in the project document;
8. Identification of any programmatic and financial variance and/or adjustments made during the first two years of the project and an assessment of their conformity with decisions of the Project Board and their appropriateness in terms of overall objectives of the project;
9. An evaluation of project coordination, management and administration provided by the PMO. This evaluation should include specific reference to:
   * Organizational/institutional arrangements for collaboration among the various agencies and institutions involved in project arrangements and execution;
   * The effectiveness of the monitoring mechanisms currently employed by the project managers in monitoring on a day to day basis the progress in project execution;
   * Administrative, operational and/or technical problems and constraints that influenced the effective implementation of the project and present recommendations for any necessary operational changes; and
   * Financial management of the project, including the balance between expenditures on administrative and overhead charges in relation to those on the achievement of substantive outputs.
10. A qualified assessment of the extent to which project outputs to data have scientific credibility;
11. An assessment of the extent to which scientific and technical information and knowledge have influenced the execution of the project activities;
12. A prognosis of the degree to which the overall objectives and expected outcomes of the project are likely to be met;
13. Lessons learned during project implementation;
14. Recommendations regarding any necessary corrections and adjustments to the overall project work plan and timetable for the purposes of enhancing the achievement of project objectives and outcomes.

**5. Review methodology**

The Mid-Term Review will be conducted in a participatory manner working on the basis that its essential objective is to assess the project implementation and impacts in order to provide basis for improvement in the implementation and other decisions.

The mission will start with a desk review of project documentation and also take the following process:

1. Desk review of project document, outputs, monitoring reports 9such as Project Inception Report, Minutes of Project Board and Technical Support and Advisory Team meetings, Project Implementation Report, Quarterly Progress Reports, mission reports and other internal documents including financial reports and relevant correspondence);
2. Review of specific products including datasets, management and action plans, publications, audiovisual materials, other materials and reports;
3. Interviews with the Project Managers and other project staff; and
4. Consultations and/or interviews with relevant stakeholders involved, including governments representatives, local communities, NGO’s, private sector, donors, other UN agencies and organizations.

**6. Review team**

Two consultants with the following qualifications shall be engaged to undertake the evaluation working concurrently according to the planned schedule. The international consultant, who will have in depth understanding of UNDP and GEF projects including evaluation experience, will be designated as the team leader and will have the overall responsibility of organizing and completing the review, and submitting the final report. The national consultant will provide supportive roles both in terms of professional back up, translation and conduct of local meetings.

The collection of documents is to be done by National Consultant prior to commencing the work. The International Consultant has the overall responsibility for completing the desk review prior to the country mission to Bhutan, and for submitting the final report following the country mission. The consultants will sign an agreement with UNDP Bhutan and will be bound by its terms and conditions set in the agreement.

Qualifications of Team Leader (International consultant)

1. International/regional consultant with academic and professional background in fields related to Climate Change Adaptation/Disaster Management. A minimum of 10 years of relevant experience is required;
2. Substantive experience in reviewing and evaluating similar projects, preferably those involving UNDP/GEF or other United Nations development agencies or major donors;
3. Excellent English writing and communication skills. The consultant must bring his/her own computing equipment;
4. Demonstrate ability to assess complex situations, succinctly distils critical issues, and draw forward-looking conclusions and recommendations;
5. Highly knowledgeable of participatory monitoring and evaluation processes, and experience in evaluation of technical assistance projects with major donor agencies;
6. Ability and experience to lead multi disciplinary and national teams, and deliver quality reports within the given time;
7. Familiarity with the challenges developing countries face in adapting to climate change;
8. Familiarity with Bhutan or similar countries; and
9. Excellent in human relations, coordination, planning and team work.

Qualifications of National consultant

1. Academic and professional background in fields related to Climate Change Adaptation/Disaster Management. A minimum of 5 years of working experience in the development sector in Bhutan is required;
2. Understanding of climate change adaptation and disaster management in Bhutan;
3. Demonstrated skills and knowledge in participatory monitoring and evaluation processes;
4. Experience in monitoring and evaluation of conservation and development projects, supported by UN agencies and/or major donor agencies;
5. Proficient in writing and communicating both in English and in Dzongkha. Ability to interpret to the international counterpart and also to translate necessary written documents to English;
6. Should hold a valid Bhutanese consultancy license; and
7. Excellent in human relations, coordination, planning and team work.

**7. Proposed schedule**

The review will take place in July 2010 and it requires a 12-day country mission in Bhutan as well as a desk review (prior to the country mission) and drafting and finalization of the report (following the country mission). The consultants will be paid on lump sum basis including international travel and DSA upon satisfactory delivery. The draft Final Report should be submitted to UNDP and UNDP/GEF-LDCF for circulation to relevant agencies within two weeks after the completion of the review mission to Bhutan. The consultants will finalize the report within two weeks upon receiving comments and feedback from stakeholders compiled by UNDP and UNDP/GEF-LDCF. A detailed schedule is attached as Annex 1 (tentative).

**8. Deliverables**

The review team will produce the following deliverables to UNDP, UNDP/GEF-LDCF and the Project Board:

1. A presentation of the findings to key stakeholders;
2. An executive summary, jointly prepared by the consultants, including findings and recommendations;
3. A detailed evaluation report covering 4. Scope of the Mid-term review (items a-n) with detailed attention to lessons learnt and recommendations; and
4. List of annexes prepared by the consultants including TOR’s, itinerary, List of Persons interviewed, summary of field visits, list of documents reviewed, questionnaire and summary of results, co-financing and leveraged resources, etc.

The report together with the annexes shall be written in English and shall be presented in electronic form in MS Word format.

**9. Estimated costs**

The total costs for the Mid-Term Review is estimated at US$32,500 which includes consultant fees, their daily subsistence allowances, transportation costs including international air fares.

**10. Rating project success**

The evaluators may also consider assessing the success of the project based on outcome targets and indicators and using the performance indicators established by GEF for Climate Change Adaptation projects. The following items should be considered for rating purposes:

* + Achievement of objectives and planned results
  + Attainment of outputs and activities
  + Cost-effectiveness
  + Coverage
  + Impact
  + Sustainability
  + Replicability
  + Implementation approach
  + Stakeholders participation
  + Country ownership
  + Acceptability
  + Financial planning
  + Monitoring and evaluation
  + Impact on disaster risk management

The evaluation will rate the success of the project on a scale from 1 to 5, with 1 being the highest (most successful) rating and 5 being the lowest. Each of the items above should be rated separately with comments and then an overall rating given. The following rating system is to be applied:

Rating: Achievement:

1= excellent 90-100%

2= very good 75-90%

3= good 60-74%

4= Satisfactory 50-59%

5= unsatisfactory 49% and below

## Appendix 2: Documents Reviewed/ Consulted

**Project Documents**

Annual Project Reports for the Austrian Coordination Office for Development Cooperation submitted in 2008 and 2009

Annual Report 2009 on the Artificial Lowering of Thorthormi Lake in Lunana under the Project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi Valley’ , DGM/RGoB.

Minutes of Project Board meetings dated 23 July 2008, 16 February 2009, 1 June 2009, 4 August 2009, 16 September 2009, 18 January 2010, and 16 March 2010.

Minutes of the Project Technical Support and Advisory Team meetings dated 23 July 2008 and 12 February 2009.

Project Annual Work Plans for 2008, 2009 and 2010, UNDP

Project Document: Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi Valley, December 2007, UNDP/RGoB.

Project Implementation Reports for 2009 and 2010 (draft), UNDP.

Project Inception Report: Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi Valley, July 2008, RGoB/ UNDP.

Quarterly Operational Reports for April-June 2008, July-September 2008, October-December 2008, January-March 2009, April-June 2009, July-September 2009, October-December 2009, and January-March 2010, UNDP-GEF.

**Technical Reports**

Environmental Impact Assessment of the Artificial Lowering of Thorthormi Lake in Lunana under the Project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi Valley’, March 2009, DGM/RGoB.

Report on the Engineering and Safety Plan for the Thorthormi Lake Mitigation under the Project ‘Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi Valley’, 2009, DGM/RGoB.

Site Assessment Report for the Installation for the GLOF Early Warning System in the Punakha-Wangdi Valley, September 2008, DoE/RGoB.

Site Assessment Report for the Installation for the GLOF Early Warning System in the Lunana Region, August 2009, DoE/RGoB.

**Policy/Legislation**

Disaster Management Bill of the Kingdom of Bhutan, 2010.

National Disaster Risk Management Framework, 2006, Ministry of Home and Cultural Affairs.

**Other Relevant Documents**

Asian Development Outlook 2007, Asian Development Bank.

Atlas of Bhutan: Land cover and area statistics of 20 *dzongkhags*, 1997, Ministry of Agriculture.

Bhutan 2020: A vision for peace, prosperity and happiness, 1999, RGoB.

Bhutan Hydropower Sector Study: Opportunities and strategic options, 2008, Energy Sector Management Assistance Programme, World Bank.

Bhutan National Adaptation Programme of Action, NECS.

Climate Change Focal Area and Strategic Programming for GEF-4.

The Cost of Climate Change: The story of Thorthormi lake in Bhutan, 2008, WWF publication.

Formation of Glacial Lakes in the Hindu Kush-Himalayas and GLOF Risk Assessment, 2010, International Centre for Integrated Mountain Development.

Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods in Bhutan, 2001, International Centre for Integrated Mountain Development.

Poverty Analysis Report 2007, National Statistics Bureau, Royal Government of Bhutan.

## Appendix 3: People Consulted/ Interviewed

**Royal Government of Bhutan**

Central Government Agencies

Dasho *Sonam Tshering*, Secretary, Ministry of Economic Affairs (Chairperson, Project Board)

*Yeshey Dorji*, Officiating Director General, Department of Geology and Mines (Project Director)

*Dowchu Dukpa*, Head, Seismology and Geophysics Section, Geological Survey of Bhutan, Department of Geology and Mines (Project Manager, DGM)

*Yeshey Wangdi*, Director General, Department of Energy

*Karma Drupchu*, Head, Hydrology Section, Hydromet Division, Department of Energy (Project Manager, DoE)

*Tashi Dorji*, Policy Coordination Division, Department of Energy

*A.V.K. Rao*, Technical Maintenance Officer, Flood Warning Section, Department of Energy

*Ugyen Tenzin*, Chief Programme Officer, Department of Disaster Management

*Karma Doma Tshering*, Senior Programme Officer, Department of Disaster Management

*Chencho Tshering*, Assistant Programme Officer, Department of Disaster Management (Project Manager, DDM)

*Sonam Deki*, Programme Officer, Department of Disaster Management

*Thinley Namgyal*, National Environment Commission Secretariat (member, Project Board)

*Jambay Zangmo*, Gross National Happiness Commission Secretariat (member, Project Board)

*Tshering Penjor*, Gross National Happiness Commission Secretariat (member, Project Board)

Punakha *Dzongkhag* Administration

*Sonam Chophel*, Civil Registration Officer (member, DMAPT)

*Sonam Tshering*, Information Communication Technology Officer (member, DMAPT)

*Ugyen*, *Dzongkhag* Livestock Officer (member, DMAPT)

*Jigme Choki*, *Dzongkhag* Environment Officer (*Dzongkhag* DRM Focal Person)

*Ugyen Tshomo*, *Dzongkhag* Planning Officer (member, DMAPT)

*Pemo*, Accounts Officer (member, DMAPT)

*Tshering Norbu*, Assistant Administrative Officer (member, DMAPT)

*Pema Wangda*, Budget Officer (member, DMAPT)

Wangdi *Dzongkhag* Administration

*Dechen Zangmo*, *Dzongkhag* Civil Registration Officer (member, DMAPT)

*Karma,* *Dzongkhag* Education Officer (member, DMAPT)

*Dorji Gyeltshen*, *Dzongkhag* Livestock Officer (member, DMAPT)

*Kin Gyeltshen*, *Dzongkhag* Forestry Extension Officer (member, DDMC and DMAPT)

*Kaloo Dukpa*, *Dzongkhag* Health Officer (member, DDMC and DMAPT)

*Dorji Khandu*, Staff on job attachment

Government Field Staff

*Tshering Tobgay*, Agriculture Extension Agent, *Gewog* RNR Centre, Samdingkha

*Singye*, Forest Beat Officer, Samdingkha

*Sengay Dorji*, Rain Gauge Reader, Flood Warning Station, Wangdiphodrang

*R.B. Ghalley*, Rain Gauge Reader, Flood Warning Station, Wangdiphodrang

**United Nations Agencies**

*Claire Van der Vaeren*, Resident Coordinator, UN System/ Resident Representative, UNDP Bhutan Country Office

*Bakhodir Burkhanov*, Deputy Resident Representative, UNDP Bhutan Country Office

*Karma L. Rapten*, Head, Energy and Environment Unit, UNDP Bhutan Country Office

*Anne E. Larsen*, Programme Analyst, Energy and Environment Unit, UNDP Bhutan Country Office

*Gernot Laganda*, Regional Technical Advisor, Climate Change Adaptation, UNDP Asia- Pacific Regional Centre, Bangkok

*Sarat Panda*, Disaster Risk Reduction Specialist, UNDP Regional GLOF Risk Reduction Project in the Himalayan Region, Bhutan Field Office

**Other International Development Agencies**

*Emi Doyle*, Project Formulation Advisor, Japan International Cooperation Agency, Bhutan Office

*Vijay Moktan*, Programme Director, WWF Bhutan Programme

*Phurba Lhendup*, Programme Officer, WWF Bhutan Programme (member, Project Board)

*Christian Mazal*, Counsellor/ Head of Office, Austrian Coordination Office for Development Cooperation, Thimphu

*Ramesh Chhetri*, Programme Officer, Austrian Coordination Office for Development Cooperation, Thimphu

**Local Community Functionaries**

*Namgay Thinley*, community disaster management focal point, Wolathang

*Kencho*, community disaster management focal point, Samdingkha

*Namgay*, *Tshogpa*, Samdingkha

*Khandu*, Jawangkha *Tshogpa*, Chhubu *gewog*

*Tshering Dorji*, *Tshogpa*, Chhubu *gewog*

*Sonam*, *Tshogpa*, Samdingkha

*Kinley Penjor*, Tsekha *Tshogpa*, Zomi *gewog*

*Khandula*, Eusekha *Tshogpa*, Zomi *gewog*

*Chimi Wangchuk*, Tana, Zomi *gewog*

*Leki*, Jibjokha *Tshogpa*, Tewang *gewog*

*Tshering Tobgay*, Gaydrung, Tewang *gewog*

*Tshechu*, *Mangmi*, Zomi *gewog*

*Naphay*, *Mangmi*, Zomi *gewog*

*Damchu Gyetshe*, *Mangmi*, Chhubu *gewog*

*Sep*, business community representative, Samdingkha, Tewang *gewog*

*Phurba Namgay*, *Gup*, Zomi *gewog*

*Doley*, *Gup*, Chhubu *gewog*

*Tawchu*, *Gup*, Tewang *gewog*

**Attendees at the Debriefing Meeting, 14 July, 2010, DGM Conference Hall**

*Sonam Yangley,* Director General, Department of Geology and Mines

*Yeshey Dorji,* Department of Geology and Mines (Project Director)

*Dowchu Dukpa*, Head, Geology Division, Department of Geology and Mines (Project Manager, DGM)

*Jamyang Chhophel*, Geologist, Geology Division, Department of Geology and Mines

*Akemi Yoda,* Project Coordinator, JICA/JST Project on Study of GLOFs in the Bhutan Himalayas, Department of Geology and Mines

*Karma Chhophel*, Head/ Specialist, Hydromet Division, Department of Energy

*Karma Dupchu*, Head, Hydrology Section, Hydromet Division, Department of Energy (Project Manager, DoE)

*A.V.K. Rao*, Technical Maintenance Officer, Flood Warning Section, Department of Energy

*Chencho Tshering*, Programme Officer, Department of Disaster Management (Project Manager, DDM)

*Anne E. Larsen*, Programme Analyst, UNDP Bhutan Country Office

## Appendix 4: Itinerary of the Mid-term Review

| **Dates** | **Time** | **Program** | **Remarks** |
| --- | --- | --- | --- |
| ***Desk review*** | | | |
| 1-4/07/2010 |  | Collection and review of existing documents related to the project  Preparation for MTR | UNDP CO made the documents available to the consultant in soft copies |
| ***Meetings with stakeholders*** | | | |
| 05/07/2010 | 12:00-15:00 | PIR training for project managers and UNDP CO staff by the Regional Technical Advisor for Climate Change, UNDP-APRC | Consultant attended the PIR training as an observer to familiarize with reporting issues |
| 15.00-17.00 | Introductory MTR meeting with UNDP Bhutan Environment Unit staff |
| 06/07/2010 | 9.30-10.00 | Meeting with chairman of the Project Board, Secretary MoEA | DGM coordinated the appointments with respective agencies (DGM, DoE and DDM planned internal meetings) |
| 10.00-11.30 | Department of Geology and Mines |
| 11.30-13.00 | Department of Energy |
| 14.00-15.30 | Department of Disaster Management |
| 07/07/2010 | 9.30-10.30 | GNH Commission Secretariat |
| 11.00-12.00 | National Environment Commission Secretariat |
| 14.00-15.00 | WWF Bhutan Programme |
| 15.30-16.30 | JICA Bhutan Office |
| 08/07/2010 | 9.30-10.30 | Austrian Coordination Office for Development Cooperation |
| 11.00-12.00 | UNDP Environment Unit and Regional Technical Advisor for Climate Change, UNDP-APRC |
| 12.00-13.00 | UNDP Regional Climate Risk Reduction Project (GLOF) |
| ***Field trip*** | | | |
| 09/07/2010 | 09.00 | Travel to Punakha | Scheduled trip to Damji on 10/07/2010 was abandoned due to bad road conditions caused by incessant rains |
|  | 14.00-16.00 | Meeting with *dzongkhag* staff of Punakha for focused group discussion |
| 10/07/2010 | 08:00–13:00 | Travel to Rimchhu, Punakha *Dzong* area, Khuruthang, Bajo, and Wangdiphodrang to see areas identified as red zone and for evacuation and to visit Flood Warning Station and river level monitoring site at Wangdi |
| 11/07/2010 | 08:00–09.30 | Travel to Samdingkha |
| 10:00-13:00 | Meeting at Samdingkha with *gewog* functionaries of Chhubu, Tewang and Zomi *gewogs* for focused group discussion |
| 14.00-17.00 | Visit to sites identified for installation EWS siren towers |
| 12/07/2010 | 09.30-11.30 | Meeting with *dzongkhag* staff of Punakha for focused group discussion |
| 12.30-15.00 | Visit to Khuruthang to observe CBDRM training being conducted by DDM |
|  | 15.30 | Return to Thimphu |
| ***Debriefings and report writing*** | | | |
| 13/07/2010 |  | Work on the presentation of the preliminary findings of the evaluation and draft report |  |
| 14/07/2010 | 11.00-14.00 | Presentation of the preliminary findings of the evaluation:   * Introduction by the Project Director * Presentation of the findings by the consultant * Discussions | Venue at DGM Conference Hall and invitations coordinated by DGM |
| 17.00-17.30 | Debriefing with UNDP Senior management |
| 15/07-07/08/2010 |  | Preparation of draft report, additional desk review and consultations |  |
| 09/08/2010 |  | First draft of the evaluation report to be submitted by the consultant |  |
| 2 weeks upon receiving comments and feedback from UNDP |  | Incorporation of comments/feedback into the report by the consultants | UNDP CO compiled comments from stakeholders and forwarded them to the consultant |
|  | Submission of the final report to the RGoB/UNDP CO |

## Appendix 5: Strategic Results Framework of the Project

| **Project Strategy** | **Objectively verifiable indicators** |
| --- | --- |
| **Goal** | **To enhance adaptive capacity to prevent climate change-induced GLOF disasters in Bhutan** |

| **Outcomes/ Outputs** | **Indicator** | **Baseline** | **Target** | **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 | * 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  Existence of DRM legislations and policies that support adaptation and GLOF preparedness | Capacities at the national, regional, and local levels to plan for and react to potential GLOFs are extremely low. | * 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 efforts to plan and implement measures to adapt to climate change. * 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 | QBS  Review of DRM policies and plans at the national, district, and community levels | Government remains supportive to link longer-term climate risk planning with current disaster risk management initiatives |
| 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 | Climate change risks are noted in the current NDRMF.  No Disaster Management Act  No comprehensive disaster management guidelines for *Dzongkhag* and *Gewog* Disaster Management Committees | * 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 | Number of *dzongkhag* and *gewog* Disaster Management Committees in project areas incorporating long-term climate risk planning into their ongoing DRM responsibilities  Number of *dzongkhag* disaster management plans in place that incorporate GLOF mitigation and preparedness | DRM focal points at the *dzongkhag* level do not possess adequate knowledge and skills to plan and implement climate-resilient DRM measures | * 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, *Dzongkhag*/Thromde Disaster Management plans in Punakha, Wangdi, and Bumthang are developed to account for GLOF hazards | Training reports and follow-up QBS with staff  *Dzongkhag*/Thromde DRM plans | Turnover of staff does not counteract benefits of capacity building efforts |
| 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 | * 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 losses | No communities are trained in preparing for and reacting to potential GLOFs | * 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% of households in the target area are able to take precautionary measures for potential GLOFs | List of focal points  Training reports and QBS | Communities’ training needs are correctly assessed and delivered in an accessible and culturally sensitive manner |
| **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 | * 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:   * 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 km2 and is still expanding  Water volume of Thorthormi lake is outpacing its drainage capacity | 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 |
| Output 2.3: Water levels of Thorthormi lake and status of artificial lowering system regularly monitored and maintained | Number of local staff trained in the input/output management of Thorthormi lake water levels  Number of field survey reports detailing status of lake level and lowering system | No staff has been trained in how to artificially regulate glacier lake levels | * 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 | Training reports  Satellite data and field survey reports | Staff turnover does not negate training benefits  Government continues to allocate resources to maintain artificial lowering system |
| Output 2.4: Captured and documented technical knowledge and lessons in the artificial lowering of glacier lake levels for use in future projects | Number of follow-up projects planned  Number of successful national technology transfer initiatives  Number of project reports published and disseminated | DGM database of feasibility reports on lowering glacial lakes  No systematic capturing of knowledge on the establishment, monitoring, and maintenance of artificial glacial lake lowering systems | * 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-up project for the artificial lowering and management of glacier lake levels in Bhutan * 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 | Evaluation report  DGM database  Meeting minutes, evidence of policy dialogue and active stakeholder engagement  Dissemination plan and accompanying publications | Continued assessment of GLOF risks in Bhutan  National ownership of glacier lake management technology  National political agreement for follow-up plan on GLOF risk management  National agreement on other project sites with GLOF risk as priority hazard  Artificial lowering system in the target area contains elements that can be replicated elsewhere |
| **Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings** | Number of vulnerable communities in Punakha-Wangdi Valley reached by early warning system  Percentage of households receiving and responding to warnings in time to avoid human losses | No GLOF early warning system for Punakha-Wangdi Valley in place  Vulnerable households are not able to receive and react to GLOF early warning messages | * 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. | Rehearsal observations  QBS with households | No tampering with early warning system installations  Functioning backup systems in place |
| 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 | * 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 towers at Samdingkha, Punakha, Khuruthang, and Wangdi installed, tested and maintained * By the end of Year 2, contingency plans and backup systems for operation of early warning systems are in place | Survey of sensor/siren tower locations  Physical presence of infrastructure  Testing results | Procurement proceeds on schedule  Transport of building materials not delayed by seasonal climate extremes |
| 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 | * 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 | * 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 least 1 full-scale GLOF early warning drill in all target vulnerable communities before the project closure | 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 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 | * 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 | QBS    Maps and signs indicating way to safe areas  Disaster simulation exercise reports | At least two sufficiently safe evacuation points exist in and around target communities  All DRM stakeholders cooperate in simulation exercises |
| 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 | Evaluation of experiences with the operation and testing of the GLOF early warning system  Number of instructive materials developed | No structured evaluation of GLOF early warning systems in Bhutan available  No instructive materials available  No systematic capturing of knowledge on the establishment, monitoring, and maintenance of GLOF early warning systems | * 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 | Evaluation report  DGM database  Instructive materials  Replication plan | Government ownership of GLOF early warning technology  National political agreement for follow-up plan on GLOF early warning |
| **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 | * 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 | * 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 | * 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 |

## Appendix 6: Progress against outputs/targets specified in the SRF

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| **Outcome 1:** Improved national, regional, and local capacities to prevent climate change induced GLOF disasters in the Punakha Wangdi and Chamkhar Valleys | | |
| **Output** | **Planned Targets** | **Current Status of Progress** |
| Output 1.1: Climate-resilient DRM legislation, policy frameworks, and sectoral plans | * By the 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 issues. | * NDRMF planned for review and revision in 2011 to incorporate new developments and experiences and insights accrued from the project. * Disaster Management Bill finalized, translated into Dzongkha and submitted for deliberation and ratification by the Parliament. Deliberation of the Bill postponed to the winter 2010 parliamentary session. However, the Bill, by purpose and structure, cannot be GLOF-specific. * CBDRM guideline in draft form. |
| Output 1.2: Capacities for climate risk planning strengthened at the district (*dzongkhag*) administrative level | * By the 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 the end of year 2, *Dzongkhag*/Thromde Disaster Management Plans in Punakha, Wangdi and Bumthang are developed to account for GLOF hazards. | * DDMCs and DDMAPTs of Punakha, Wangdi and Bumthang trained in CBDRM. * GDMCs in Punakha and Wangdi trained in CBDRM. * *Dzongkhag* and *Gewog* Disaster Management Plans are under preparation, following CBDRM training. |
| Output 1.3: Information on climate hazards and vulnerabilities (with a focus on GLOFs) in Bhutan systematically captured, updated and synthesized | * 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 | * Not implemented because the DGM considered that this target will be more comprehensively realized through the joint JICA/JST/DGM project on study of GLOFs in Bhutan Himalayas. * Information management system does not exists per se but various documents produced through the project are being maintained in the DGM library and soft copies are intended to be posted on the project website when it becomes fully functional. * Commensurate with information availability, instead of annual workshops, DGM plans to have two workshops – one in 2010 and the other towards the end of the project. * A web page on GLOF and the project created under the DGM website. However, at the time of MTR, the DGM website was not functional due to malfunction in the internal internet system. |
| Output 1.4: Vulnerable communities are aware of, and prepared for, climate-related disasters | * By the end of year 1, all GLOF-vulnerable communities in Punakha-Wangdi and Chamkhar valleys identify disaster and climate risk management focal points. * By the end of year 3, 80% of the households in the target area are able to take precautionary measures for potential GLOFs. | * Disaster and climate risk management focal points identified in each of the 21 GLOF-vulnerable communities in Punakha-Wangdi valley. * QBS on the level of community preparedness to be carried out after the installation and subsequent mock-trialling of the automated GLOF EWS. |
| **Outcome 2:** Reduced risks of GLOF from Thorthormi lake through an artificial lake level management system | | |
| **Output** | **Planned Targets** | **Current Status of Progress** |
| Output 2.1: Engineering and safety plans for climate change risk reduction measures on Thorthormi Lake are in place | By the end of year 1:   * 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 the Project Boards | * A detailed geotechnical assessment of the excavation site was carried out by an 11-member Bhutanese team and report of the assessment produced in 2008. * Engineering and Safety Plan produced based on the results of the aforesaid geotechnical assessment. The Plan was approved by the National Cabinet in March 2009. * EIA report, containing recommendations to address potential adverse environmental impacts, produced and in use. The EIA report received clearance from the NECS in March 2009. |
| Output 2.2: Artificial lowering system of Thorthormi Lake waters implemented | * By the end of the project, the water level of Thorthormi lake is lowered by 5 metres. | * In 2009, water level of the lake was lowered by 0.86 metres against the year’s target of 1.67 metres. The shortfall occurred due to implementation delay caused by damages to the trail at several locations by Cyclone Aila (May 2009). In 2010 working season, until mid August the water level of the lake had been further lowered by 43 cm. |
| Output 2.3: Water levels of Thorthormi Lake and status of artificial lowering system are regularly monitored and maintained | * 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. | * A group of five DGM staff and one DoR staff stationed at the work site are trained by virtue of direct involvement in the monitoring and lowering of lake water level. * One monitoring report produced and disseminated each year. Two monitoring reports per year were found unnecessary given that artificial lowering activities were limited to 3-4 months of working season in a year. |
| Output 2.4: Technical knowledge and lessons in the artificial lowering of glacier lake levels captured and documented for use in future projects | * By the end of the project, a comprehensive evaluation of the operation and potential replication of glacial lake level management system is conducted. * By the end of the project, all relevant lessons for the lowering and management of glacial lake levels are captured in the DGM database. * By the end of the project, national agreement to embark on at least 1 follow-up project for the artificial lowering and management of glacial lake levels in Bhutan. * By the end of the project, DGM embarks on an active technology transfer and project replication campaign to install glacial lake management system 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. | * Data for the planned evaluation are being accrued through the annual monitoring reports. * There is no DGM database to capture lessons learnt. However, the DGM maintained all field/ technical reports as a part of their library resources and intended to post soft copies on the project website when it becomes fully functional. |
| **Outcome 3:** Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings | | |
| **Output** | **Planned Targets** | **Current Status of Progress** |
| Output 3.1: Technical components for a GLOF early warning system in the Punakha-Wangdi valley installed and operational | * 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, eight siren towers at Samdingkha, Punakha, Khuruthang, and Wangdi installed, tested and maintained. * By the end of Year 2, contingency plans and backup systems for operation of EWS are in place. | * Installation of, and technical support for, EWS commissioned to a Bhutanese firm, USD Enterprise in joint venture with US-based Sutron Corporation, on a turn-key basis. The EWS will include GLOF sensors at six locations and 17 siren towers. Three siren towers are to be located in Lunana region and the rest 14 in Punakha-Wangdi valley starting from Wolathang in the north and ending at Kamechhu in the south. * Broadband Global Area Network (BGAN) is integrated as a back-up. In addition, proposal for integration of GSM technology is under discussion. The existing manual EWS will also be retained as a back-up. |
| Output 3.2: Institutional arrangements in place to operate, test, and maintain the GLOF EWS | * By the end of year 1, at least two EWS focal points in both of the target districts identified and trained in the testing and maintenance of the EWS. * 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 EWS is tested at least monthly. | * DoE staff stationed at Thorthormi lake site and at Wangdi Flood Warning Station as a part of their regular function related to flood warning. * Training of staff and DDMCs to take place consequent to the installation of the EWS. * Staff training and testing of GLOF EWS integrated in the work awarded to the contractors on a turnkey basis. |
| Output 3.3: Raised awareness of communities in the Punakha-Wangdi valley on operation of early warning system | * 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 and able to correctly receive and interpret early warning signals * By the end of the project, at least 1 full-scale GLOF early warning drill in all target vulnerable communities before the project closure | * Local communities are to a varying extent aware about the existing manual EWS and response requirements. With regards to the automated EWS, awareness-raising activities are to take place after the system is physically in place. * A QBS is also planned to assess community awareness and preparedness for correct response to the GLOF-EWS. |
| Output 3.4: Raised awareness of safe GLOF evacuation areas in each vulnerable community in the Punakha-Wangdi Valley | * 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 | * GLOF evacuation areas identified for the vulnerable communities. |
| Output 3.5: Technical knowledge and lessons in the installation and operation of GLOF EWS captured and documented for use in future projects | * By the end of the project, a comprehensive evaluation of the operation and potential replication of the GLOF EWS is conducted. * By the end of the project, all relevant reports on GLOF EWS are included in the 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 EWS in Chamkhar valley developed. | * GLOF-EWS planning capacity in place for potential replication of GLOF-EWS as a result of experiential learning accrued from project implementation. This capacity will be used in conducting a comprehensive evaluation of the operation and potential replication of the GLOF EWS by the end of the project. * There is no DGM database per se to capture lessons learnt on GLOF-EWS. However, the DoE maintained all field/ technical reports as a part of their library resources for future use and reference. |
| **Outcome 4:** Enhanced learning, evaluation and adaptive management | | |
| **Output** | **Planned Targets** | **Current Status of Progress** |
| Output 4.1: Project lessons captured and disseminated through the Adaptation Learning Mechanism (ALM) | * 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. | * Project reports and information are being accumulated for future analysis and inclusion in ALM. |
| Output 4.2: Project knowledge shared with other GLOF-prone countries | * By the end of the project, organization and hosting of one international workshop on GLOF risk reduction. | * A project proposal to reduce GLOF risks in Pakistan is being developed using Bhutan’s experience and approach |

1. Two government field staff – an agriculture extension agent and a forest beat officer – were also present as observers. [↑](#footnote-ref-1)
2. Source: Atlas of Bhutan: Land cover and area statistics of 20 dzongkhags, 1997, Ministry of Agriculture. [↑](#footnote-ref-2)
3. Source: Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods in Bhutan, 2001, International Centre for Integrated Mountain Development. [↑](#footnote-ref-3)
4. Source: Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods in Bhutan, 2001, International Centre for Integrated Mountain Development. [↑](#footnote-ref-4)
5. Source: Asian Development Outlook 2007, Asian Development Bank (pp. 17-19). [↑](#footnote-ref-5)
6. Built in 1637-38 by Shabdrung Ngawang Namgyal, it is the second-oldest *dzong* in the country. [↑](#footnote-ref-6)
7. Originally not intended but real-time weather data collection and forecasting were integrated in the EWS to enhance the utility of the system. [↑](#footnote-ref-7)
8. The guideline was ‘work in progress’ and not ready for sharing with the evaluator. So, it was premature to assess the extent to which they have incorporated climate risk planning, as targeted by the project. [↑](#footnote-ref-8)
9. Source: Quarterly Progress Report, January-March 2009. [↑](#footnote-ref-9)
10. <http://assets.panda.org/downloads/the_cost_of_climate_change__24_nov.pdf> [↑](#footnote-ref-10)
11. <http://www.thegef.org/gef/gefvideo> [↑](#footnote-ref-11)
12. <http://www.linktv.org/video/5455/un-21st-century-bhutan-tsunami-from-the-sky> [↑](#footnote-ref-12)
13. [www.youtube.com/watch?v=pxX-QF21ne4](http://www.youtube.com/watch?v=pxX-QF21ne4)) [↑](#footnote-ref-13)
14. <http://www.nature.com/news/2009/091021/full/4611042a.html> [↑](#footnote-ref-14)
15. The ToR requires the Project Board to normally meet once a year, including at least four times during the project period. [↑](#footnote-ref-15)
16. The exact cause of the death of the third person was not known at the time of writing this report as the medical investigation was yet to be completed. [↑](#footnote-ref-16)
17. The figures on women participation/ involvement have been derived from the draft Project Implementation Report for 2010. [↑](#footnote-ref-17)
18. Source: The Cost of Climate Change: The story of Thorthormi lake in Bhutan, 2008, WWF publication. [↑](#footnote-ref-18)
19. Generally, four to five weeks of every quarter (three months) reportedly went into procedural work including follow-up with various agencies. [↑](#footnote-ref-19)
20. The total external project funds do not take into account RGoB co-financing. The total external project funds work out to US$ 4,671,274 (i.e. US$ 7,351,274-US$ 2,680,000) [↑](#footnote-ref-20)
21. No observation has been made on fund disbursement in 2010 as only half of the year had passed at the time of MTR. [↑](#footnote-ref-21)
22. If the requisite medical expert is not available within the country, arrangement could be made to hire medical expert from other countries such as India, Nepal or China. [↑](#footnote-ref-22)