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MINUTES OF MEETING

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

9th Project Board Meeting

Date: January 11, 2011

Location: Conference Hall, DoE, Ministry of Economic Affairs, Thimphu

The 9th Project Board (PB) Meeting for GLOF risk reduction project was held on July 11, 2011 at Department of Energy (DoE) Conference Hall, Thimphu. The board chairman, Dasho Sonam Tshering, Secretary, Ministry of Economic Affairs in his opening remarks highlighted the importance of the project and also emphasized on the cooperation extended by all the stakeholders for successful implementation of various activities under the project. The chairman further acknowledged the active participation of the board members for addressing various issues submitted by the concerned project management units.

This was followed by adaptation and rectification of the 8th PB meeting. The project manager (DGM) informed the floor that the 8th PB minutes has been signed and distributed to all the PB members. The Project manager then requested the board members if there were any comments or issues from members. Since there were no comments from the members, the Chairman informed the floor that the 8th PB meeting minutes is adopted.

Next in line with meeting agenda, various presentations were made by the presenters from UNDP, DGM, DoE and DDM

1. Presentation by Dr. Tandi Dorji, UNDP Consultant on "Health and Safety Assessment" for Lunana GLOF mitigation component (project outcome 2)

Following the unfortunate deaths of 3 workers due to high-altitude sickness between June-August 2010, and based on the instruction from the 8th PB meeting to suggest recommendations to improve safety aspects, the project management and UNDP initiated an independent Health and Safety Assessment related to the mitigation team and works in Lunana. Dr. Tandi Dorji conducted the Health and Safety Assessment (report attached-Annexure 3) from October-November 2010. The report examines the health and safety measures and procedures in place, the incidents that took place in 2010 and the response taken. Finally, the assessment suggests 27 recommendations to improve the health and safety of the mitigation workers and team.

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Dr Tandri in his presentation informed the board that the assessment was conducted with an objective to review the existing arrangements—particularly after the 3 unfortunate incidents that took place in 2010—and recommend further measures to improve health and safety aspects of the project. The UNDP consultant in his findings highlighted on the existing norms and procedures related to the health and safety aspects established by the project. These includes medical screening, high altitude gears, ration provisions for the workers, emergency evacuation setup, medical referrals mechanisms, medical personnel, and list of drug and medical equipments available at the project site. Dr. Tandri also presented the three death incidents and on the subsequent actions and investigations carried out by the project. Further the consultant highlighted information and issues collected through interviews with the project workers. Finally, the consultant submitted 27 recommendations to improve the health and safety aspects of GLOF mitigation work in Lunana.

Discussions and approval related to the Health and Safety Assessment

The PB chairman thanked the UNDP consultant for the comprehensive Health and Safety Assessment report and presentation. The chairperson, however, cautioned that recommendations should take into account ground realities and affordability by the project. It was also noted that financial resources to implement all recommendations should be available, since DGM has only spent an estimated 45% of their total budget within 3 out of 5 years of project implementation. The following recommendations were discussed in more details:

- The board members unanimously agreed on the recommendations of the requirement to actively involve the project doctor and the representative from the Ministry of Health (MoH) for preparation of health and safety arrangements. The chairperson, after acknowledging the support rendered by MoH, informed the floor that MoH is not obligated to carry out such activities but emphasized that their unstinting support is highly appreciated and is crucial for successful implementation of the project.
- To further improve the health and safety aspects of the project, the board agreed to include one additional health representative in the multi-disciplinary team — bringing the total number of health representatives to 3 members (1 doctor, 1 HA, and 1 additional HA or GNM to be present during the journeys back and forth to the project site and on standby in case of emergencies). Ex-country training of the health representatives on high altitude medicine and rescue techniques was also approved.
- Establishment of medical transit camps at Rodophu and Tarina and one day mandatory acclimatization halt at Rodophu was approved. It was noted that efforts should be made for the workers to travel in larger groups with informally appointed group leaders with experience from high-altitude environments. This approach should be organized from the departure at Damji and when proceeding from the transit camps.
- The Board emphasized that the project management should ensure strict adherence to existing Occupational and Health Standards (OHS) in consultation with the Ministry of Labor and Human Resources (MoLHR). However, it was not felt necessary to include MoLHR in the PB.

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- Regarding provision of additional field gears such as improved rain gear and gum boots, sleeping bag, sleeping mats and jacket, DGM expressed that the GLOF project is already one of the most generous projects in terms of equipments and payments in Bhutan. Additional provisions of equipment and wages may set too high expectations and precedence for similar projects in the future. Due to this implication, DGM discouraged to provide sleeping bags, sleeping mats and jackets. However, it was also pointed out that the Health and Safety Assessment report found cases of hyperthermia amongst the workers, and that hyperthermia has aggravated the symptoms of high-altitude sickness. The PB directed the project management, the project doctor and MOH to discuss the issue further and to examine cost implications of providing the recommended equipment.
- On the adequateness of the project insurance coverage, the PB directed the project management to look into the issue of whether the project staff/workers are under-insured.
- Pertaining to the proposal to increase the wages of workers during the journey to the project site to allow workers to hire ponies for the journey to carry equipment and rations, the board agreed to continue with re-stocking of rations as practiced in 2010, and to consider re-stocking of rations at the transit camps instead.
- Screening of workers should be strengthened as per the recommendations, however DGM pointed out that the recommended age limit of 50 years should be relaxed for project field staff. This should be discussed further and captured in the revised criteria.

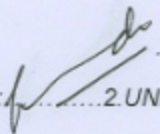


In principle, the Project Board endorsed most recommendations of the Health and Safety Assessment as captured in the attached overview of recommendations and actions required (annexure 4) - however a number of recommendations are subject to further discussions between the project management, the project doctor and MoH.

2. Mid Term Review (MTR), by Anne Erica Larsen, UNDP

UNDP was requested to present the recommendations of the Mid Term Review (MTR) of the GLOF project conducted by an independent consultant from June-September 2010 (MTR report attached-annexure 5). The MTR rates the overall project implementation as good, however there is a need to improve in particular the financial planning and documentation of project implementation.

In order to make the necessary adjustments for the remaining project period, the following recommendations from the MTR were presented to the PB. The MTR management response template attached describes the action planned for each recommendation:

- Changes in the Strategic Results Framework (revised logframe attached-annexure 6)
- Strengthen monitoring and reporting
- Establish baseline (where needed) through QBS
- Address procedural delays in terms of release of fund

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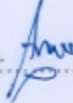

- Better financial planning to reduce gaps between planned budgets and expenditures
- Documentation of lessons learnt
- Enhance linkages among components
- Address linkages to JICA/JST-GLOF Project
- Improve and Safety of mitigation team and workers
- Conduct early consultations with donors regarding replication
- Review of CBDRM curriculum
- Conduct Environmental Impact Assessment by the end of the project
- Use of virtual monitoring tools and techniques to monitor Glacial lakes

The PB endorsed the revised logframe (attached-annexure 6) and the MTR recommendations (management response template attached-annexure 7). The project management was instructed to ensure that all recommendations are being followed up and adequately addressed. UNDP moreover highlighted the need to improve documentation of project activities (reports, photos, etc.), and to ensure coordination between the different project outcomes. These should be presented as related to the project as a whole, instead of 3 separate components. The planned project workshop, quarterly coordination meetings as well as a new focus on outcomes instead of IPs could help to improve this approach. Regarding the financial planning, UNDP informed that UNDP and the project managers will review the AWP for 2011 and may suggest downscaling budget initially, as the budget can be revised later by a note to file endorsed by the project board or the project director and UNDP.

3. Presentation by Karma Toeb, Team Leader, Multi-Disciplinary team

Mr. Karma Toeb, Multi-disciplinary team leader for the GLOF risk mitigation work in Lunana presented achievements and challenges in 2010 and proposals for 2011 mitigation work. In 2010, the water level of Thorthormi main lake has been lowered by 1.37m; subsidiary lake 1 and lake 2 were reduced by 1.2m and 2.30m, respectively. He informed the floor that in 2010 the project could not achieve the target of lowering water level reduction by 2m mainly due to delay in procurement of project goods and materials and unfavorable weather conditions. The team leader also informed the members that based on lessons learnt from 2009 and 2010 field work, work at site can be carried out for 3 months (July-September) and therefore the project will plan for 3 months working duration in 2011, with a realistic target of 1.4m water level reduction at the main lake.

Because of delays in implementation of activities due to unavoidable circumstances, the team leader informed the members that the project might have to seek approval for extension for one year to achieve the overall target of lowering the Thorthormi lake water level by 5m at the end of the project. The Board agreed that working at such harsh environment with unpredictable weather conditions poses significant challenges and therefore, the non-achievement of the set target is justifiable. The Board also agreed that working duration should not be restricted to 3 months, but should be kept flexible depending on weather conditions at the site. On the request for extension of project period beyond 2012, the board members instructed the project management to put up the proposal later based on guidance from GEF-LDCF.

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4. Presentation by Dowchu Dukpa, Project Manager, GLOF Project, DGM

The project manager, DGM highlighted financial and physical achievements of the artificial lowering project at Thorthormi Lake. The Annual Work Plan (AWP) for 2011 was also presented to the project board. The project manager then submitted requests for budget re-appropriations for endorsement by the PB, which include re-appropriation of Nu.690,531.98 from materials and goods (72300) and Nu.26,778.02 from communication and audio visual equipment (72405) to contractual services-individual(71405); Nu.64,772.06 from communication and audio visual equipment (72405) to rental and maintenance of other equipments (73410).

The Board was informed about the auditing of the project components under MoEA covering 2008-2010 fiscal years. The project manager informed that minor issues related to procurement procedural lapses were sorted out and settled during audit exit meeting. The project manager also informed the board that all payments for 2010 field activity are up-to-date and cleared, including ex-gratia and insurance payment for the three deceased project workers. DGM finally informed the board members about the request submitted by DYT chairperson of Wangdue Dzongkhag to consider giving preference to people from high altitude areas during recruitment of workers for the project.

The chairperson commended on the works carried out by the project management—especially related to the positive outcome of the project auditing. The chairperson emphasized the need to continue the good work for the successful implementation of the project. The budget re-appropriation submitted by the project manager was endorsed by the project board.

Summary of key decisions and approval

The following are the summary of key decisions taken during the 9th Project Board meeting for the DGM component on artificial lowering of Thorthormi lake:

- Health and safety recommendations in principle adopted by the project Board (refer point 1 of the minutes), but subject to further discussion by the project management, the MoH representative and the project doctor.
- MTR recommendations to be addressed as per the management response prepared by UNDP, in line with the recommendations of the consultant
- Working duration at the site to be kept flexible depending on weather condition
- Budget re-appropriation request endorsed

5. Presentation by the Department of Energy (DoE) Ministry of Economic Affairs:

The Project Manager DOE presented the physical and financial progress of the GLOF EWS System component including the Annual work Plan (AWP) of 2011-2012.

DOE informed the Project Board that civil works in the Punakha-Wangdue were completed in November 2010 and installation of equipment will be carried out in January 2011. DoE also appraised the board that civil works in Lunana started, but could not be completed 2010, because transportation of materials (such as cement, siren poles, MS angle iron etc.) were hampered by the heavy rain fall in

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the month of July and August 2010 that washed away bridges and foot paths between Gasa and Laya. DOE apprised PB that Contractor has submitted a time extension request, which is being reviewed the project management. The works in Lunana will therefore be completed in 2011. DOE also informed the meeting that upon successful completion of Factory Acceptance Test (FAT) in USA, all the equipments and accessories were delivered to Bhutan, and a joint verification and inspection of the equipment was done at Thimphu on 29 December 2010.

DoE apprised the meeting that the MoEA-auditing for the DoE-project component for the period 1 January 2009 to 30 June 2010 was completed and all memos were settled.

DoE informed that expenditure for the DoE-project component in 2010 was mainly incurred for DOE counterparts travel to Punakha-Wangdue valley and Lunana for supervision of works and travel to USA for the factory acceptance test. In addition, DOE has so far released mobilization advance (7% of Contract Price) = Nu. 36,41,624.00 and secured material advance (10% of Contract Price) = 4,805,837.00 to the Contractor.

Financial progress of this component is low at this point of time due to the payment schedule, which allows all the payments to be made only after installation, testing and commissioning of the full system. In addition, the advances made cannot be recorded as expenditures before settling of bills by the contractor, as per the audit recommendations. The contribution from Austria (ACO) allocated to DoE in 2010 (100,000 Euros) could not be disbursed as planned due to delays and the contractual agreement for the EWS. Based on agreement with ACO, this amount can be carried over to 2011.

DoE apprised the meeting that the installation, testing and commissioning of equipment in the Punakha-Wangdue valley will be carried out from 18-28 January 2011 by M/s Sutron Corporation. DoE informed that the Department of Disaster Management (DDM) can therefore initiate awareness campaign on the operation of EWS between March-May 2011.

Summary of key decisions and approval

- With regards to the delay in installation of GLOF EWS Equipments' in Lunana due to bad weather conditions in 2010, the PB directed DoE to ensure that the EWS is installed and operational within 2011
- DoE submitted a request for procurement of trekking gear for DoE Counterparts to travel to Lunana for the installation, testing and commissioning of GLOF EWS and the PB endorsed Nu. 30,000.00 (Thirty thousand only) towards procurement of trekking gear. To reduce the procurement procedures and costs, PB directed DoE to use the same quotations as DGM.
- The low financial delivery under the project outcome can be justified by the delays in tendering and implementation, and the fact that the advances of Nu 4.8 million can only be recorded as an expenditure upon submission of bills by the contractor. DoE expect to report this during or by the end of 1st quarter 2011. Since the outstanding amount has already been paid as an advance, DoE will need to request for an additional fund release in the first quarter 2011 (app. Nu 5 million) to settle bills under the same tendering contract.

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- The Austrian contribution of 100,000 Euros for 2010 can be carried over to 2011.
- DoE raised a concern about the Security and Safety of Equipment installed. All the siren towers and water level equipment are located in inhabited areas. Physical security is therefore a concern, and it was proposed that physical security should be entrusted to nearby beneficiaries. The PB directed DoE to discuss the concern directly with the concerned dzongkhag administration in collaboration with DDM, MoCHA.
- DoE informed that the EWS installation in Punakha-Wangdue will be finalized in January-February 2011, and therefore the Department of Disaster Management (DDM) may initiate awareness campaigns on the operation of EWS between March-May 2011. The PB directed DoE and DDM to ensure information sharing and close coordination under project outcome 3.
- DoE also informed that there still a fund deficit for the EWS (app. Nu. 2-3 million). Additional fund for the component may be requested either from the project or from PHPA-II. The PB will discuss this issue again after a financial review of the project planned in the first quarter 2011.

6. Presentation by Project Manager, Department of Disaster Management (DDM)

The Project Manager, DDM presented the physical and financial progress report for the DDM components under outcome 1 and 3, including the Annual Work Plan for 2011.

DDM informed the board about the successful competition of the demarcation of hazard zones and identification of safe evacuation area along Punatsang Chu basin from Samdingkha to Hesothangkha by the Glaciology Division under the Department of Geology. DDM expressed their appreciation to the DGM for carrying out the demarcation of hazard zones and identification of GLOF safe site. DDM have requested DGM to carry out hazard zonation mapping up stream of Wolathang and downstream from Hesothangkha till Lamozingkha as well as for Chamkhar valley.

The board was also informed that the 21 community focal persons for the manual early warning system have been provided with telephone vouchers for 6 months. CBDRM planning processes are also underway under both Punakha, Wangdue and Bumthang districts.

Regarding the DM Bill, DDM informed that the draft bill was presented to the Cabinet in the winter session 2010. The draft bill was sent back to the MoHCA with a request for an additional review by an international expert before the end of March 2011, for resubmission and discussion at the Summer session 2011. A request for budget re-appropriation worth US\$ 20,000 to this activity was requested and endorsed, as well as a request to UNDP to assist in identifying and recruiting a suitable expert.

The PIR and MTR 2010 highlighted that a baseline survey is required to establish a baseline before and after installation of the EWS for a number of indicators under both outcome 1 and outcome 3. A QBS is planned in the AWP 2011 and need to be conducted as a priority in the first quarter of 2011. UNDP has offered to help DDM to develop the terms of reference for the survey.

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DDM expressed a need for capacity building of the department. UNDP also informed that there are a number of important and relevant events taking place related to climate change adaptation and disaster management where DDM's participation will be important. DDM was advised to present a proposal for re-appropriation to GNHC or at the next board meeting, based on a financial review of the DDM project-components and availability of funds.

Summary of key decisions and approval

- The Project Board instructed DDM to send a formal request to DGM to carry out the hazard zonation mapping. DGM was requested to allocate time for this activity.
 - The request for budget allocation of US\$ 20,000 for review of the DM Bill was endorsed by the PB under outcome 1. UNDP will assist with the recruitment/identification of a suitable international expert to carry out the review, based on a formal request from DDM
- UNDP presented a request to the PB to allocate budget for construction of the Emergency Operation Centre (EOC) in Punakha. UNDP informed that initially the construction of the dzongkhag EOC was committed from the Regional Climate Risk Reduction Project implemented directly through UNDP. However due to the delays in construction and the completion of this project, the UNDP is no longer in a position to support the construction. Withdrawal of the contract may result in legal problems for Punakha district as the contractor has already started the work. EOCs have earlier been supported through the project, and therefore the Project board directed DDM to verify the availability of funds and re-appropriate up to US\$ 31,000 to the activity. Based on verification by DDM, US\$ 30,500 was allocated to the Punakha EOC.
- UNDP requested DDM and concerned districts to improve the submission of documentation of activities carried out, in particular at the district level.

7. Annexures

1. List of participants
2. Meeting Agenda
3. Health and Safety Assessment Report
4. Recommendations of Health and Safety Assessment endorsed
5. MTR Report
6. Revised Strategic Results Framework (logframe) endorsed
7. MTR management response endorsed

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Annex-1

List of Participants 9th Project Board Meeting

Sl. No.	Name	Designation/Agency	Email
1	Dasho Sonam Tshering (Chairperson)	Secretary, Ministry of Economic Affairs	sting@druknet.bt
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5	Namgay Wangchuk	Director, DDM, MoHCA	
6	Ugyen Dophu	Director, Department of Public Health, MoH	
7	Kuenzang N. Tshering	Dasho Dzongda, Punakha Dzongkhag	
7	Dasho Sonam Jigme	Dzongdag, Gasa Dzongkhag	sjigme@gmail.com
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15	Tshewang Lham	GNH Commission	
16	Jamyang Chopel	Dy.Project Manager, GLOF Project, DGM	
17	Chado Rinchen	DGM, MoEA	
18	Karma Toeb	DGM, MoEA	
19	Dr. Rinzin	DMO, Punakha Dzongkhag	
20	Dr. Tandi Dorji	UNDP Health and Assessment Consultant	



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AGENDA FOR THE 9TH PROJECT BOARD MEETING(Annex-2)

"Reducing Climate Change-Induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdue and Chamkhar Valleys"

Venue : Department of Energy, Conference Hall

Date : 11th January 2011 (Tuesday)

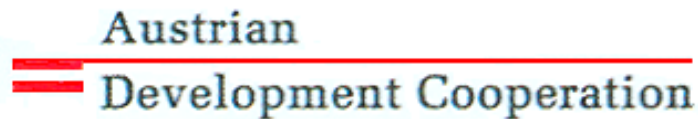
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|----|--------------|---|
| 1 | 10:00-10:10 | Opening by Dasho Sonam Tshering, Secretary, MoEA
(Chairperson) |
| 2 | 10:10-10:15 | Rectification/Adoption of minutes of 8 th PB meeting |
| 2 | 10:15-10:40 | Presentation by Dr. Tandi Dorji, UNDP consultant on Health
and Safety Assessment for Lunana Project |
| 4 | 10:40-11:05 | Presentation by Mitigation Project Team Leader/Project
Engineer, on the progress in 2010 and targets for 2011 |
| 5 | 11:05--11:30 | Presentation by Dowchu Dukpa, Project Manager, GLOF
on overall achievements and challenges in 2010; Annual Work
Plan (AWP) for 2011 and other issues; Project Mid Term
Review and Auditing (2008-2010) |
| 6 | 11:30-11:50 | Tea Break |
| 7 | 11:50-12:15 | Presentation by Karma Dupchu, GLOF Project Manager,
Department of Energy on GLOF early warning system |
| 8 | 12:15-12:40 | Presentation by Chencho Tshering, GLOF Project Manager,
DDM, MoHCA |
| 9 | 12:40-13:30 | Discussions |
| 10 | 13:30 | Lunch |

(Annex-3)

UNDP – Reducing Climate Change-induced Risks and Vulnerabilities in Punakha-Wangdi and Chamkar valleys

Health and Safety Assessment

UNDP



ABBREVIATIONS

ALS	Advanced Life Support
BBS	Bhutan Broadcasting Service
BMI	Body Mass Index
DDM	Department of Disaster Management
DSA	Daily Subsistence Allowance
ECG	Electro-cardio-gram
FGD	Focus Group Discussion
GEF	Global Environment Facility
GLOF	Glacial Lake Outburst Flood
GNM	General Nurse Midwifery
HA	Health Assistant
JDWNRH	Jigme Dorji Wangchuk National Referral Hospital
LDCF	Least Developed Countries Fund
MoEA	Ministry of Economic Affairs
MoH	Ministry of Health
MoLHR	Ministry of Labour and Human Resources
MoU	Memorandum of Understanding
PB	Project Board
PMU	Project Management Unit
RBA	Royal Bhutan Army
RGoB	Royal Government of Bhutan
TA	Travelling Allowance
ToR	Terms of Reference
TSAT	Technical Support and Advisory Team
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WWF	World Wildlife Fund

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EXECUTIVE SUMMARY

1. Climate change has placed Bhutan at high risk from Glacial Lake Outburst Floods (GLOF) due to rapid retreat of glaciers and formation of supra glacial lakes which have approached dangerous thresholds. Recognizing the catastrophic consequences on development, human lives and their livelihood, the project “Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys’ was set up beginning in 2008, and to be completed in 2012. The project is implemented by the Department of Geology and Mines, Department of Energy and the Department of Disaster Management with financial assistance of LDCF, managed by Global Environment Facility (GEF) along with co-financing from WWF, Government of Austria and RGoB. Since 2009, approximately 340 workers along with a multi-disciplinary team have been working manually at Lunana to lower the level of Thorthormi Lake with a target to reduce 5 meters over the next three years. While there was no mortality in 2009, three people lost their lives in 2010, two enroute to Lunana and one at the project camp site in Thanza. Being deeply concerned of these unprecedented events, UNDP has initiated this independent review to make a comprehensive health and safety assessment and to propose concrete recommendations to further improve the existing safety measures.
2. The assessment was conducted in the month of October for duration of two weeks, this being the most opportune time to meet the workers and the team members who were returning at the end of the annual project in 2010. A rapid assessment methodology was used, incorporating multiple techniques such as a comprehensive desk review, in-depth interviews with stakeholders, key informant interviews using a pre developed semi structured questionnaire and Focus group discussions (FGD). A total of 33 workers were interviewed using the questionnaire while project team members were interviewed using a questionnaire guide. Two focus group discussions were held, one among the workers and the other among the multi-disciplinary team members. Consultative discussions were held with all the stakeholders and a separate analysis of the three deaths as well as all newspaper stories was also conducted.
3. The assessment revealed that the overall coordination of the project was managed efficiently by the Project management unit (PMU) under the guidance of the Project Board (PB) and the Technical Support and Advisory team (TSAT). The project documents and the minutes of the meeting showed that health and safety was discussed well in advance and there was emphasis to ensure that workers were well protected. However there was poor representation of health personnel in both the PB and the TSAT. There were no criteria in selecting the project medical team and there was no continuity in 2008 and 2009 with different doctors appointed in the two years. Although the medical team in both 2009 and 2010 was the same, they did not receive any training in high altitude illnesses nor were they adequately supported (technically) by the Ministry of Health. The team members were chosen based on their posting, rather than on technical expertise and experience. Since the existing team members have now gained valuable experience in the two years of the project, they need to be supported with training to equip them with critical knowledge which will be beneficial now and for any future projects. With much of the country lying in the high altitude belt, such training will help build capacity so that in-country training maybe organized according to need.

4. Health and safety planning was also done minimally with only fleeting references to the occupational health and safety (OHS) standards developed by the Ministry of Labour and Human Resources (MoLHR). The concerned agency, the department of Labour was not involved at any stage and there is confusion among the partners on the regulatory authority of such standards. As a result there was practically no monitoring and evaluation of OHS of the workers in the project. Even the midterm evaluation report of the project carried out in 2010, did not report on the health and safety aspects of the project. An evacuation and safety plan was discussed by both the PB and the TSAT, however it was not developed and therefore a written plan of action for medical response in the event of any casualty was never instituted.
5. Medical screening was also not well organized with only a medical certificate asked for in 2009, with a more detailed screening being conducted in 2010. There were no proper guidelines on the process of medical screening and there was poor coordination between the project and the JDWNRH where all workers had to be screened. Medical screening was not done stringently in many instances and mitigation workers complained of the long delays (up to 7 days) to complete the screening and obtain a medical certificate. Workers were not screened on a set of well defined criteria and instances of unfit workers slipping through the process were noted by the project doctor. Surprisingly none of the multidisciplinary team members were asked to undergo medical screening and the requirement for a medical certificate was not applied to them.
6. The nutritional status of the workers was not assessed as part of the screening. The quality and quantity of the rations was planned and approved by a nutritionist from the MoH although workers complained about the quantity of dried fish not being enough. Carrying rations for the recommended duration of days during the journey (9 days) was seen as being difficult and as a result many workers shed their load and walked faster to cover the distance in shorter time. This could have exacerbated and exposed many workers to developing altitude illness. Communication facilities were also limited with only one satellite phone with the team at Lunana. Evacuating patients from Lunana was a challenge given the long distance, lack of adequate facilities and absence of any communication equipment with the evacuation team.
7. Protective gears issued to the workers were of inferior quality and did not provide adequate protection especially against the cold weather. Several cases of hypothermia were seen by the health workers at the project site and this may have also played a major role in the three mortality cases that occurred in 2010. While the PB recommended same quality of gears for both multidisciplinary team and workers, the range of protective gears and quality was not the same. A group personnel accident insurance policy was established for all the workers and the team members; however there was unawareness of the details of the policy, leading to not claiming payments for some genuine cases. Documentation of illnesses and reporting of such accidents was also not done as per requirements of the Royal Insurance Corporation of Bhutan (RICB).
8. Majority of the workers on the project came from rural areas of Bhutan and there was good representation from all districts across the country. They were mostly farmers, uneducated and with meager income, therefore the good pay (Nu 500/day) given by the project was the motivating factor for most workers. There were some workers who were school drop outs and had substantial income

and they were more likely to state adventure and service to the country as motivating factors. While many had worked at high altitude in the past, nearly half of the workers experienced altitude illness especially after reaching Rodophug. Workers were given adequate time to reach Lunana however there was no monitoring or any support during the journey. Rations were restocked for the workers at Taksemakhag to enable them to cope with the load, however there were instances where workers either sold or bartered rations. There was also no arrangement for any medical assistance enroute to Lunana except during the return journey in 2010, mainly in response to the casualties. The medical services provided at the site were adequate and there were minimal suggestions for improvements.

9. A detailed desk review of the casualties was conducted which showed that all three had died from the effects of altitude illness. The project had responded adequately given the circumstances and all the final rites were conducted appropriately. The support extended by the project to the immediate family members was appropriate. An in-depth analysis of all media (newspaper) reports was conducted which showed that while the project received much attention, there were a lot of inaccuracies and flaws in the facts provided. Particular papers tended to be critical while some remained neutral. There was no official spokesperson appointed by the project and as a result the source of information in many instances came from multiple and often unreliable sources.
10. Several recommendations have been made to improve the occupational health and safety measures for the workers and the team. While this is relevant and important for the next two years of the project, these same recommendations could also be applied for any such projects at high altitude and in the same region.
11. In conclusion, while the project has been successfully implementing the Thorthormi lake mitigation project in Lunana, the three deaths in 2010 prompted the UNDP to review the safety measures for the workers of the project. The present assessment found the health and safety measures of the project to have been discussed and given priority, however at the field level there was oversight, lack of adequate monitoring and there is scope for further strengthening and improvement.

1. 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 through:

- 1) Systematization and long-term planning of Bhutan’s legal framework and awareness on disaster risk management
- 2) Artificial lowering of the potentially dangerous Thorthormi glacier lake
- 3) Expansion of early warning mechanisms in the Punakha-Wangdi Valley.

The project is implemented by the Department of Geology and Mines, Department of Energy and the Department of Disaster Management with financial assistance of LDCF managed by Global Environment Facility (GEF) along with co-financing from WWF, Government of Austria and RGoB. The project began in 2008 with the first phase being to set up “engineering and safety plans”, where the excavation site was re-assessed and a detailed engineering safety plan for the excavation as well as safety measures for the workers were drawn up.

Following this, from 2009 onwards, a mitigation team consisting of over 340 workers and a multidisciplinary project team began working from June-October every year to lower the lake-level manually by means of controlled drainage. The camp- and worksite of the project is located at high altitude of above 4,000 m where climatic conditions are harsh. Considering the environment in which this project is being undertaken, occupational health and safety was given high priority. The project has been able to utilize its past experiences with the lowering of Raptreng Tso, in streamlining and improving the health services for the workers. The selection of the workforce is preceded by medical screening and orientation on the causes and effects of altitude sickness. On the way to the worksite, the workers were provided with equipments and rations and assisted by medical staff. Despite these safety precautions, three unfortunate incidents took place between June-August 2010 leading to three casualties. Being concerned with the unprecedented and unfortunate events, UNDP initiated this independent review to make a comprehensive health and safety assessment and to make concrete recommendations.

1. OBJECTIVES

The broad objective of the assessment was to conduct an independent review of the incidents that took place in June-August 2010 in relation to the artificial lowering of Thorthomi Lake leading to three casualties.

More specifically the assessment was undertaken to:

1. Review the appropriateness of the precautions taken by the project to ensure workplace health and safety, prior to departure of the workforce to the project site in 2009 and 2010;
2. Review the appropriateness of the response and actions taken by the project team following the incidents;
3. Provide recommendations to improve the safety of the workers and project staff involved in the mitigation works.

2. METHODOLOGY

The assessment took place over two weeks, covering the period from 6 – 22 October 2010. The methodology used for the assessment involved using research strategies that are adopted for rapid assessments. This included the following:

- **Desk review:** An in-depth review of all project documents, reports and records was undertaken in Thimphu that included all the minutes of the Project Board (PB) and the Technical Support and Advisory Team (TSAT) meetings. Information about the project and references for the desk review was provided by UNDP, Department of Geology and Mines and JDWNR Hospital. All media reports related to the project were also collected and analyzed.
- **Consultation with stakeholders:** A number of consultative meetings was held with stakeholders both in groups as well as through appointments
- **Key informant interview:** Interviews were held using a pre designed questionnaire with workers and project staff involved in the project. While 29 interviews were held face to face, 4 interviews were conducted by telephone.

To get more insight and broader information on project aspects, separate interviews were conducted with project staff including in depth interviews with the two medical personnel of the multidisciplinary team

- **Focus Group Discussion:** Two FGD were held, one at Damji with labourers and the other in Thimphu with the multidisciplinary team.

Timeline of the Reducing Climate Change-induced Risks and Vulnerabilities in Punakha-Wangdi and Chamkar valleys project 2008-2010

Date	Occasion/Place	Events
12 th Dec -07	Project Proposal	Project planned and documented
23 rd Jul -08	1st PB meet	Discusses need for good communication, insurance (Group Personal Accident Insurance), protective gear and development of an emergency evacuation scheme. A contingency fund of US \$ 34,500 made available.
Sep-Oct 08	Lunana	Review and assess Engineering and safety plan by first team to Lunana
23 rd Jul -08	1st TSAT Meet	Terms of reference for the Multi disciplinary team developed and approved
Jan 09	2008 Multi disciplinary team report	Health recommendations submitted by 2008 team doctor for the next phase with workers and included in the final report (Refer Annexure 5)
12 th Feb -09	2nd TSAT Meet	Recommends screening of workers, medical certification and provision of first aid training for team and workers. DGM also asked to draw up pre-arrangements with authorities concerned for evacuation in case of an emergency
16 th Feb -09	2nd PB meet	Discusses need for organized medical screening and fitness certificate. Instructs PMU to coordinate with MoH on this. PMU points out the poor quality of procured items for the review team in 2008. In the detailed recommendations made to the Board, occupational and health safety is referred to the technical report of the "engineering and safety plan" carried out in 2008.
1-Jun-09	3rd PB Meeting	Approves Insurance, directs procurement of medical supplies through proper channel and fixing a life for the gear supplied to the workers.
Aug 09	Lunana	More than 300 workers and multi disciplinary team begin work on Thorthormi lake
4-Aug-09	4 PB Meet	No health issues discussed
Sept 09	Lunana camp site	Worker suffers dart injury and is evacuated by Helicopter
16 sep 09	5 th PB Meet	Discusses injury and evacuation of patient. DDM presents the completeness of the emergency safety and first aid handbook. Chairman emphasis on the proper planning of workers returning in October.
Dec 09	Medical report	Tem doctor submits medical report and recommends stringent medical screening including laboratory investigation, sets upper age limit of 50 years, and curb alcohol and drug abuse by workers
18 th Jan 10	6 th PB Meet	Recommends self declaration form for obtaining medical history and recruiting those with experience. Instructs PMU to submit a detailed list of issues, proposals and recommendations for next PB meeting
16 Mar 10	7 th PB Meet	A number of approvals were made that included; 1. Increased salt and sugar rations as well as addition of milk powder and fish for workers and staff.

Date	Occasion/Place	Events
		<ol style="list-style-type: none"> 2. Distribution of rations in phases, one at Damji and the other at Taksemakhag. 3. Additional gumboot and working gloves as well as wet suits for workers
19 Jun 10	Damji	Workers report at Damji and begin proceeding to Lunana in groups
25 Jun 10	Taksemakhag	One worker (Mr Sherab) succumbs to altitude illness after remaining for 2 days at Rodophug
26 Jun 10	Tarina	Another worker (Mr Subba) also succumbs to the complications of altitude illness, all alone in a cave
1-Jul-10	Thimphu	Meeting between Project Director, Project Manager and UNDP to discuss 2 fatalities
Jul 10		Businessman donates Gamow bag
14-Jul-10	8 th PB Meet	Discussed the two fatalities en-route to Lunana and the responses taken by PMU. Approved cash support to families of deceased and recommends the development of comprehensive additional safety measures including provision safety measures while workers return from Lunana.
25 Jul 10	Thanza	One worker suffers broken leg and has complication. With bad weather and helicopter evacuation not possible, patient is evacuated by road accompanied by project doctor.
23 Aug 10	Thanza	One worker (Mr Karma) dies at camp site from effects of altitude illness and its complications
25 Aug 10	Press release	Press release on "Additional safety measures for Thorthormi mitigation workers"

3. BACKGROUND AND OBSERVATIONS

4.1 Overall coordination of the project

The coordination and implementation of the three year project was managed by the Department of Geology and Mines, Ministry of Economic Affairs (MoEA) under a Project Management Unit (PMU). A Project Board was constituted with members representing relevant stakeholders including the Ministry of Health (MoH). All management decisions including approval of project plans and revisions were taken by the Board through consensus.

Primary Task of the Project Board (PB)

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

A Technical Support and Advisory Team (TSAT) were formed to provide technical support to the project. With personnel from the environmental health program (Department of Public Health), the MoH was also represented in the TSAT.

Responsibilities of the TSAT

- Ensure the technical soundness of the safety and evacuation plan
- Ensure the technical soundness of the engineering plan
- Provide technical advice and backup support to the Project Management Unit during the implementation of work at the site
- Monitor implementation of activities at the project site during the artificial lowering of the Thorthomi lake
- Ensure artificial lowering proceeds according to the engineering and safety plans

While the PMU was mainly responsible for the coordination and implementation of the project, a multidisciplinary team was formed for carrying out the work at the site in Lunana. A Medical doctor and a Health Assistant were recruited as part of this multidisciplinary team. The ToR for the medical doctor was drawn up by the TSAT in its first meeting in July 2008.

ToR: Medical Doctor for the project

The medical doctor will coordinate with the team members and shall carry out the following medical related services at the project site:

First Year (2008)

- Provide basic medical services to the team
- Indent the basic medical requirements for more than 300 people working at Lunana for four months and submit to the project management through the team leader by mid-December 2008

2009-2012

- Arrange medical facilities in line with the indent prepared in 2008 in consultation with project management.
- Conduct health screening for the workers prior to recruitment
- Provide basic medical services
- Submit yearly medical report to the team leader by December every year till the completion of the project.

In 2008 a multidisciplinary team spent two months in Lunana assessing and reviewing the engineering and safety plan of the project. The team comprised of the following officials;

1. Karma Toeb, Team Leader, DGM
2. N.K Giri, Civil Engineer
3. Phuntsho Norbu, Engineering Geologist
4. Dr. Tshering Tamang, District Medical Officer, Gasa
5. Ugyen Thinley, Surveyor
6. Lobzang Gyenden, Geologist
7. Ram Chandra, Gasa Dzongkhag Representative
8. Tika Tamang, Survey Assistant
9. Dowchu Dukpa, Project Manager
10. Tashi Tshering, Geophysicist
11. Namgay Wangchuk, Blaster

Observation:

Although there was strong emphasis by the PB on the safety of workers for the project¹, there was no comprehensive plan or strategy developed and inputs from the MoH regarding incorporating health and safety standards were minimal.

The Director of Public Health was appointed as Board member and his presence in the Board meetings was irregular. There was limited communication between the Project Board and the Ministry of health regarding decisions taken by the Board and it was left to the Director of public health to make all

¹ Minutes of the 1st PB meeting, 23rd July 2008

necessary medical arrangements. These two factors hampered better coordination between the Project and the MoH especially in providing more technical guidance related to health safety.

The TSAT has met three times from the project start-up on 2008 to date, however again the representative from the MoH attended only once and the inputs given were again limited. A medical doctor with technical experience and knowledge in high altitude/disaster/critical care/emergency medicine as opposed to a Program manager would have been more relevant to the TSAT, given the technical support required to advise the project.

While the ToR for the medical doctor provided a list of responsibilities, there were no criteria set for requirements of qualification/experience or training for such a challenging project. The doctors appointed by the MoH in 2008 and 2009/2010 were newly graduated medical officers posted in Gasa. Since the project site was in Gasa Dzongkhag, the medical officer of Gasa Dzongkhag was, by default, entrusted with the huge task of organizing medical procedures and supplies for the mammoth project, which was a challenge for the young medical officers, considering the lack of experience in managing such projects or working in such altitudes.

4.2 Planning of Health and safety measures

Right from the outset of the project in 2008, the Project Board in its first meeting in July 2008 highlighted the importance of safety, considering the harsh environment of Lunana and concluded that safety of the workers should not be compromised.² Towards this, health and safety measures were adopted in stages mostly through experience gained with the progress of the project. Some of these plans included provision of appropriate protective gear, a comprehensive insurance scheme to cover accidents and death, an emergency contingency fund of approximately US \$ 34,500 allocated to the project and an emergency evacuation scheme to be developed by the Board. The engineering and safety plan phase in 2008 outlined very briefly in one paragraph, the occupational and safety measures for workers at the project site.

Occupational and safety measures for the workers¹

Given the cold climatic condition, high altitude and difficult working environment at the working sites, the workers should be provided with proper working gears and medical facilities at site. Most of the time, the workers have to carry out the work under water at freezing temperature. Therefore, it is proposed that a special team comprising of about 20 workers be formed who will be working on need basis under the high water level. This group shall be provided with water proof trousers. The minimum necessary working gears for the labourers are blankets, gumboots, raincoats, hand gloves, sunglasses/goggles and helmets.

The Medical Officer for the project in 2008 also provided a report and some broad recommendation on community health measures (water and sanitation), medical examination and certificate of fitness for labourers, protective gear and establishment of an infirmary at the site, all of which were established subsequently. (Refer to Annex 5 for details of the report and recommendations).

² Minutes of the 1st PB Meeting, 23 July 2008.

The TSAT in its second meeting in February 2009 also made several recommendations pertaining to health and safety aspects of the project and the workers. Among these were the following:

- All workers were to be screened by asking them to produce medical fitness certificates
- An arrangement was to be made with concerned authorities for evacuation in case of any emergency
- Boiled water (instead of provision of clean drinking water) was recommended for the workers while discussing sewage and garbage disposal
- The MoH was to provide first aid training to the project team as well as to the workers

The PB in its second meeting on 19th February 2009 directed the PMU to coordinate with the MoH in organizing medical screening for the labourers “keeping in mind the convenience of everyone involved”.³ A memorandum of understanding (MoU) was also recommended to be signed between the Royal Bhutan Army (RBA) and Ministry of Foreign Affairs to facilitate emergency responses. Although this was not signed, there was general understanding of the procedure to be adopted by all agencies should the need arise for initiating emergency response.

In its 8th meeting in July 2010, the PB recommended additional safety measures for the 2011 (mostly in response to the three deaths that took place in 2010) such as “mandatory acclimatization of one day each at Taksemakhang (3,500m) and at Rodophu (4,200m); positioning of medical staff and Gamow bags or Portable Altitude Chamber (PAC) at strategic places along the route (Taksemakhang or Rodophu)”.⁴ The Board further directed the PMU to prepare further comprehensive safety proposals for 2011 and to submit it to the Board for approval.

A Gamow bag was also donated to the project in August 2010 and was kept on standby during the return trip. It is planned to be kept for emergency purposes on the route to Lunana in 2011.

Observation:

The Department of Labour, which is the regulator and authority on occupational and health safety (OHS), was not involved in the planning or monitoring of the health and safety of the workers of the project. There was no communication between the related agencies and misunderstanding exists on the scrutiny, oversight and monitoring of such health and safety measures of the project.

The Ministry of Health, which is another key actor for OHS, was poorly represented and along with irregular attendance at the planning stages failed to provide crucial technical support to the project. While the 2008 team provided some recommendations, it was very general and did not specify the medical requirements, roles and responsibilities of the service providers and the procedures to be adopted. As a result there was no follow-up on key decisions taken by the PB such as preparation of an emergency evacuation plan, protocol for medical screening and provision of training on first aid.

The occupational and safety plan was not developed comprehensively. It did not include important information as recommended by the MoLHR in its general rules and regulations on OHS (2006) such as

³ Minutes of the 2nd PB Meeting 19 Feb 2009

⁴ Minutes of the 8th PB Meeting, 14th July 2010

listing potential hazards and risks, procedure for preventing, eliminating and limiting these risks, identifying an emergency management plan and specifying training and information to be provided to the workers.⁵

There was no written evacuation plan despite recommendations from both the PB as well as the TSAT. Standard Operative Procedures (SOP) to be followed for medical casualties (accidents, medical emergencies and death) was not developed. As a result, evacuation and referral of patients took considerable time. Although helicopter evacuation was in place, it was dependent on weather conditions and prolonged procedures for approval by a number of agencies often delayed timely referrals.

Medical screening for workers and referrals of patients

The first mitigation team of 2009 consisted of 344 workers (241 registered in Thimphu, 18 from Sephu/Laya and 85 from Lunana). Medical screening was conducted and medical certificates from JDWNRH (Jigme Dorji Wangchuk National Referral hospital) were furnished by the workers. The District Medical Officer of the Gasa was nominated for the project despite being newly graduated with no prior experience of planning and managing the health aspects for such a huge project or of working in high altitudes. In the accompanying medical report, six workers were found to have been referred from Lunana for health reasons, and additionally there were workers who were of old age and 2 cases of epilepsy. An emergency referral also had to be made for a dart injury on the head, for which a helicopter was used, the cost being approximately Nu 731,500 and which has been submitted to the PB for its decision in the next meeting. The project thus recommended in its report for the inclusion of the project medical doctor in the recruitment of workers and to screen those unfit to work at Lunana.

In addition a detailed “Issues, Proposals, Recommendations and Budget Requirements” was prepared by the project management and submitted to the PB in its 6th meeting on January 18th 2010 and further discussed in its 7th meeting on March 16th 2010.

With the valuable experience gained from the 2009 project, the board members in January 2010, during its 6th PB meeting, discussed on the development of a self declaration form for attaining medical history of the workers. To shorten the recruitment time, it was also recommended that past workers with good track record be retained for the 2010 project. The PB also recommended collecting detailed medical history of the workers. This was approved by the Board at its 7th meeting in March 2010. The project doctor also made a list of investigations and specific screening to be carried out for every worker as listed below:

- Chest X-ray to rule out lung diseases
- Blood sugar levels (fasting and random) for diabetes
- ECG to rule out heart diseases
- Blood pressure for hypertension
- Kidney function tests and liver function tests to rule out any kidney and liver disorders

⁵ MoLHR. General rules and regulation on occupational health and safety in construction, manufacturing, mining and service industries; 2009

- The mental status of the person

The project doctor was also recommended to be on the selection committee for workers.

At JDWNRH a medical officer was identified to screen workers of the project and a room was prepared for the same. However, there was a huge rush of workers coming at the same time to undergo screening and so an informal arrangement of limiting the number of workers screened to 30 workers/day was adopted. Many workers who had to bear the expenses of living in hotels thus went to see other medical doctors in the hospital for obtaining medical certificates. The large number of investigations also severely affected the hospital in terms of laboratory reagents and X-ray films. The project had agreed to make payments for the tests; however the hospital provided all the services free of cost.

Observation:

While budget for trainings related to other topics was allocated, training for Medical personnel within the multidisciplinary team and for first aid training for project staff was never considered. Both the doctors had not availed any specialized training in altitude medicine or emergency medicine. This in part was due to the MoH or the medical team not indicating their need for such training.

There was no continuity of the Medical officer, with the 2008 doctor being replaced in 2009 and 2010. The reason for this was that the MoH (parent organization) had the authority to nominate the doctor for the project. At the same time the PMU did not communicate its desire to maintain continuity of staff for the benefit of the project.

There was delay in referring patients from Lunana. While it took 3 days for the helicopter evacuation of a patient with penetrating injury on the head by dart in 2009, it took 6 days of strenuous walking for evacuating a patient with broken tibia and suspected pulmonary embolism in 2010. There were no guidelines for such emergency evacuation and the decision was taken at the site based on immediate needs. As a result while the patient benefitted by having the only project doctor accompany him to Punakha, the project site workers and staff were left in the care of the Health Assistant.

While a checklist for investigation was developed, similar checklists for medical history and examination were not in place. The hazardous conditions under which workers were going to work was also not communicated to the medical officers in the hospital, who treated all workers coming for screening as any other general medical screening.

A list of diseases contraindicated for working in high altitude was not prepared and thus medical officers screening workers did not have adequate knowledge and the requirements for high altitude when issuing medical fitness certificates.

Medical screening was not conducted stringently and there was poor coordination between the project team and the JDWNRH where all the workers were medically examined. The risks for the workers and the high degree of physical fitness required to undertake strenuous work at high altitudes was not impressed upon the medical officers screening workers at the hospital. As a result there were several referrals from Lunana in 2010 because of cases that are contraindicated for work at high altitude (i.e. epilepsy) which could have been avoided with more stringent and systematic medical screening.

While screening was being planned for workers, the medical and health conditions of the Project staffs were never considered in the plans and they (except for Army officials) were not screened. Upper age limits as recommended by the Medical doctor was not followed for the staff.

There was no medical representation during 6th, 7th and 8th PB meetings where important health related issues and decisions were made following the “Issues, Proposals, Recommendations and Budget Requirements” submitted by the project management after the 2009 phase.

Nutrition

Nutritional status of the workers was not assessed as part of the medical screening in both 2009 and 2010. A case of malnutrition was referred out from Lunana in 2009. Following this the project requested the MoH to review the diet by a nutritionist at the JDWNRH and make recommendations regarding the appropriateness of the listed food items in 2010. In reply the MoH approved the diet and requested the project to consider adding glucose and high energy fluids.

Sl no	Items	Quantity provided 2009	Quantity provided in 2010
1	Rice	27 Kg/person/month	27 Kg/person/month
2	Dal	3 Kg/person/month	3 Kg/person/month
3	Salt	0.5 Kg/person/month	1 Kg/person/month
4	Dry chili	0.5 Kg/person/month	0.5 Kg/person/month
5	Tea leaves	0.25 Kg/person/month	0.25 Kg/person/month
6	Dalda	1.5 Kg/person/month	1.5 Kg/person/month
7	Sugar	1 Kg/person/month	1.5 Kg/person/month
8	Potato	5 Kg/person/month	5 Kg/person/month
9	Milk powder	-	1 Kg/person/month
10	Fish	-	0.5 Kg/person/month

For the journey to the project site workers are issued three days ration from Damji and are restocked at Taksemakhang for the rest of 6 days journey. At the project site beside these, workers and staff also purchased additional vegetables such as lettuce and meat from the local people, although the prices were said to be exorbitant. None of the workers complained about the variety of rations provided though some requested for additional quantities of fish which was expressed as being less.

Observation:

The quality and quantity of the food items are appropriate from a medical point of view. However from the key informant interviews with the workers, the quantity of fish was expressed as not being enough.

The nutritional status of the workers were not assessed as part of the medical screening

Although the project has provided adequate measures to allow workers to cope with the load they have to carry en-route, by giving rations at two locations it has been reported that workers tend to sell/reduce the rations to make the load lighter for the journey. Instead of carrying rations for the official number of travel days required to reach the work site, they make haste to cover the journey to Lunana in less number

of days and thereby avoid carrying appropriate rations. This has often compromised the nutritional needs of the workers en route.

Communication:

The Board approved satellite phones for communication purposes and one Thuraya satellite phone was procured at a cost of US \$ 1185. The phone was to be kept at Project base in Lunana and to be used in case of emergency only. In 2009, the DDM informed the project that it had 2 satellite phones and offered to share it with the project staff. Accordingly during the 3rd PB meeting on 1st June 2009, the Board deferred further purchase of satellite phones and recommended the use of the DDM phones.

In 2010, the PMU again submitted the requirement for the purchase of one satellite phone (estimated cost Nu 60,000), especially for easing communication during emergency evacuation by road of patients. The board approved in principle, however requested the Management to look into the possibility of using the old HF sets of the Bhutan Telecom. The satellite phone was finally purchased, however because of the lack of SIM card, it could not be put to use in 2010.

Observation:

Adequate communication was absent during evacuation of patients from Lunana in both 2009 and 2010.

There was no communication link enroute to Lunana, especially at Rodophug and Tarina where workers are most prone to develop altitude illness and where the fatalities had taken place in 2010.

Quality of protective gears for workers

In its second meeting the PB noted the poor quality of purchased items for the teams that went to Lunana in 2008. A list of field gear that should be provided for workers as well as project team was made as reflected in the table below.

Sl No	Items	Project staff	Workers	Comments
1	Jacket	1		Branded goods were purchased to get good quality gears and these were given on alternate years only. (twice during the project cycle of 4 years)
2	Sleeping bag	1		
3	Mattress	1		
4	Trekking boot	1		
5	Gumboots	2	2 pairs	
6	Rucksack	1		
7	Water bottle	1		
8	Snow goggles	1		
9	Rain coat	1 (rain gear)	1	
10	Long Johns	2		
11	socks	2		

12	umbrella	1		
13	Helmet	1	1	
14	Blanket	-	1	
15	Working Hand gloves	1 (hand gloves)	2 pairs	

The PB also instructed the project in its 7th PB meeting in March 2010, to procure the same quality of field gears for both workers and the staff. Analyses of the information gathered during interviews with the workers, showed that majority of the workers were not happy with the quality of gumboots and raincoats issued. The gumboots broke easily and the size issued did not conform to everyone. The largest size issued was “8”, whereas there were some who required size “9”, and so they had to return to Punakha and Wangdi to barter their issued gear for the right sizes. This preempted some workers to take different routes to Lunana, via Goenshari and Nikachhu. Most of the complaints however centered on the quality of raincoats, which did not provide adequate protection against the rain. There was also more rainfall during 2010 as compared to 2009 and the medical personnel reported several cases of hypothermia. This is a cause of concern as hypothermia can be severe and can complicate other coexisting medical conditions. Similarly the issuing of gloves was delayed and the quality of gloves was also expressed as being poor. The PB approved water proof clothing, however the supplier could not deliver the selected quality and as a result no water proof suits were distributed.

Observation:

The quality of the field gears for the workers was of inferior quality and did not provide adequate protection against the cold and rain.

The gumboots procured did not have a variety of sizes especially size 9 upwards making it difficult with this shoe size to wear proper gears during fieldwork. Some workers also returned to Punakha and Wangdi to barter the project gears with the right size from the shopkeepers.

Although a written statement on the entitlements of workers was made through the media most workers were not aware about the items or the quality prior to their recruitment, which compromised adequate preparation among some of the workers. A few returned to their villages after recruitment to prepare adequately for the trip. As a result some took a different path from Nika chhu to Lunana placing them at risk and also becoming a liability for the project.

Several cases of hypothermia were observed by the health workers among the workers and it played a significant role in causing the death of the two workers who died enroute in 2010. Besides the one blanket per worker provided by the project, there was no other item for protecting workers against cold.

Insurance (Group Personnel Accident)

The Board approved insurance coverage for personnel of the project that covered both death and accident, and noting the difference between labourers and project staff, specified that amounts to be proposed should not be based on position but on the nature of risk involved. All of the workers including the

project staff were aware about the insurance policy however it was erroneously presumed to be for death only. The detail of the insurance policy including coverage for both permanent and temporary disability was not read and not informed to the project workers.

The policy clearly states that compensation will be payable to the insured person for:

- (1) Accidental death –Nu 108,000 (Capital sum)
- (2) Permanent disablement – Payable sum ranges from 2-100 % of the capital sum depending on the body part disabled
- (3) Temporary disablement – payable sum per week is calculated as 0.65 % times the capital sum insured for a maximum period of 52 weeks from the time of injury

Information regarding bodily injury, death or any condition relating to the claim must be informed to the corporation within one week of the injury with details of the injury and the probable duration of disability.

All three deaths that occurred in 2010 were approved for payment of insurance cover; however there were a number of cases (fractures of the limb with pulmonary embolism, and torn ligaments) that were also eligible for financial compensation and deserved to be compensated.

Observation:

Insurance cover was adequate for all workers and the sum insured was in line with government regulations. However details were not understood by the insured workers and the staff. The sum insured could have also been increased based on the salaries being paid to the workers.

Majority of the workers including project multidisciplinary team were of the opinion that it covered only death, while in the policy covered both permanent and temporary disability. There is a need to make all members of the team aware of the policy and to maintain accurate documentation for claiming insurance payments.

Medical supplies

The medical equipments and medicines required for the project was prepared by the project medical officer in consultation with the MoH. The board in its 3rd meeting on June 1st 2009 recommended the use of current procurement procedures of the MoH in purchasing medicines for the project. While there was no shortage or stock out of essential medicines and equipment, the project medical doctor did not receive additional support from the MoH and the JDWNRH.

Observation:

Project medical doctor did not receive additional support from MoH and JDWNRH in preparing for the project. Additional crucial equipments such as umbo bags and airway tubes could have been useful.

Profile of workers

Information on the profile of the worker was collected from in depth interviews with 31 workers and 2 project staff. All the workers who reported to Damji on the second day of payment at Damji were recruited and additionally 4 interviews were conducted over telephone. The latter was mainly employed to gather information from female workers who could not be recruited at Damji.

The workers for the project were recruited from all over the country and in the small sample for the assessment; there were people from 13 districts with the majority coming from Western region. Both males and females were recruited although the number of women was considerably low. Two thirds of the workers were married and had children (ranging from 1-5) while one third was unmarried. Most of the workers joined the project for financial reasons although a small number expressed adventure and service to the nation as motivating factors. 78 % of the informants stated farming as their occupation and their average monthly income ranged from Nu 2000-4000. A small number of respondents stated business as their occupation and their income was comparatively higher with a range of 5000-50,000. This group was also more likely to state adventure and service to the nation as motivating factors for joining the project. Majority (60 %) of the workers were uneducated.

One third of the workers had heard about the project from friends and they were more likely to have worked in both 2009 and 2010. A small number of workers had also worked on the Raptreng Tso project in the late 1990's. The rest had heard about the project from the media (BBS TV and Radio) and among them majority had no experience of staying and living at altitudes above tree line. The main concerns before undertaking the journey and work at Lunana, was of their own abilities to reach the work site, the harsh conditions that they would encounter, altitude illness and support of friends. Having supportive and reliable friends was expressed as a strong pre-requisition to travel and work on such a project with special emphasis on supportive friends during the journey.

More than 97 % of those surveyed said that they received adequate information about the work environment and the journey, mostly from friends and project staff at the time of registration and again at Damji before starting the journey to the project site. They were also aware that they needed to be medically certified. Except for the project staff, all the workers went to JDWNRH for medical screening.

The table below highlights the screenings undertaken by the sample:

Medical screening	YES	NO
Medical screening taken	31 (94%)	2 (6%)
Asked questions about past medical illness and medications	19 (58%)	14 (42%)
Physical examination	27 (82%)	6 (18%)
Blood pressure recorded	32 (97%)	1 (3%)
X ray	31(94%)	2 (6%)
Blood test	31 (94%)	2 (6%)
Know of anyone being declared unfit to work	13 (40%)	20 (60%)

Majority (97%) of the respondents said that they had received health information and advice on altitude illness from the project and health workers; however some workers did not understand the information

being given. Considering that majority of the workers were uneducated, it is likely that they did not read the instructions given in the pamphlet (in English and Dzongkha) and did not pay attention during briefings at Thimphu and Damji.

More than 85 % (28) of the respondents said that they would return again next year to work for the project, although some expressed their interest only if certain conditions such as protective gear and rations were improved.

Journey to Lunana

The project management had specifically recommended the Damji-Gasa-Laya-Lunana route and informed the workers that it was a nine day trek. Workers were instructed to proceed in groups, to ascend gradually, to stay on the clear tracks and to refrain from plucking and smelling shrubs and flowers which could predispose to altitude illness. They were given information on the availability of shelter, firewood and also on what to do in case of experiencing altitude illness. Health workers distributed medicines (Paracetamol and acetazolamide) to workers and instructed them to take them before ascending the high pass - Gangla Karchung.



From the interviews it was observed that majority of the workers covered the distance in 7 days (30%) while 10 % of the surveyed group took 5 days which was the least number of days taken. The reason stated for this was the need to carry fewer rations as load. All the people traveled in groups that ranged

from 3-22 people. While the majority took the recommended route there was one group that went via Nikachhu. The reason for this was that the group members were all from Wangdi Phodrang, who returned to their village and after preparing adequately (borrowing sleeping bags, getting right size gumboots, additional ration) proceeded via Nikachhu which was less expensive for them.

About 43 % of the workers experienced altitude sickness in the form of headache, vomiting, loss of appetite and lethargy. The most frequent place for this was at Rodophug followed by Thanam and then Gangla Karchung. Most took medicines or drank extra fluid to overcome altitude illness. Only 1 person returned to lower altitude. Many of the respondents said that it is difficult to return as there were no friends or personal along the route back if they fell back and therefore many committed themselves to push on. All were aware about the 2 fatalities that took place enroute and attributed altitude illness, lack of supportive friends, poor diet, lack of medical facility and the cold as factors for the cause of death.

Suggestions to prevent such incidents included setting up medical facilities and appointment of medical staff enroute especially before ascending Gangla karchung. Project staff and some workers also recommended provision of good meal at some of the camps on the way. Payment entitled for workers while travelling (TA) is also seen as being low with no distinction of DSA and TA.

Observation:

Although briefing on the route and the risks were provided by the project team, there was inadequate planning of the briefing methods and no monitoring to make it more effective.

Workers trekking to Lunana were not monitored. The risk of the long journey was not assessed properly and the plans were mainly guided by past experiences. While attempts to reduce the ration load were taken by providing restocking means of ration at Taksemakhang, many workers continued to ascend rapidly which was not monitored.

Setting up of medical facilities enroute was not foreseen as no untoward incidents had occurred in the past. It was only after the fatalities that transit camps with medical attention were set up while returning. Although useful it may not be as useful since most workers would have been adequately acclimatized by then.

The payment made during travel (Nu 300/day) is less than the payment at work site (Nu 500/day) and does not provide opportunity for workers to hire pony for carrying rations. Some of the workers expressed their desire to hire pony however they were limited by lack of adequate funds.

Health at Project site

A makeshift infirmary was set up in Thanza at the camp site. There were adequate medicines and equipments to cater to the needs of the workers. The clinic was open in the morning between 6-7 am and again in the evening between 5-6 pm. The Medical officer manned the infirmary while the Health Assistant provided medical cover at the work site in Thorthormi lake site. Besides catering to the workers, the project clinic also provided medical services to the people of Lunana which was an additional benefit

to the community and did not compromise on the services provided to the workers. Most of the medical conditions consisted of minor injuries, common cold and occasional altitude related illnesses. All of the workers were satisfied with the services provided at the project site, although few suggestions included having a medical doctor permanently at the work site. The Project doctor had to accompany a seriously ill patient all the way to Punakha and could not return because of road block on the way. Some suggestions also included the recruitment of a third medical person especially during evacuation of patients.

On the death of the third worker at Lunana camp site, many of the workers attributed it to the effects of altitude however some placed religion and spiritual beliefs as contributing factors. The monk in the team was therefore seen as being important. Moreover, he was indispensable in performing the cremation rites for the deceased.

Observation:

Health facility at the project site was adequate.

The number of health workers was however not adequate especially when one health workers had to accompany evacuated patients. The medical officer had made recommendation for the inclusion of a GNM nurse in 2009, which was not considered in 2010. The absence of the medical doctor during and after the fatal case reduced the quality of medical care and diverted extra work load on the HA

The monk is an important member of the multi-disciplinary team providing serenity and confidence by performing religious puja's.

4. REPORT ON THE THREE CASUALTIES

Since the project began in 2008 there were no casualties in the first two years and in 2010 there were three casualties. Although health and safety measures had improved this year compared to the past two years, the casualties still occurred. Two of the cases occurred enroute to Lunana and the third case occurred at the campsite. Each of the cases is discussed below, following review of the available documents and interviews with the project staff including acquaintances of the deceased.

Case 1: Late Mr Sherab

Mr Sherab was a 24 year old male from Gongdu, Mongar and had joined the project as a casual worker. He had completed the medical screening and had been certified fit on May 14th 2010 and further verified by the project medical personnel on 19th May 2010. He had proceeded to Lunana from Damji and from the accounts given by other workers he was already ill by the time he reached Taksemakhang. Despite advices to return, he continued to ascend to Rodophug where he developed acute mountain sickness. He was instructed to rest and again failed to descend. Despite his apparent deteriorating condition he remained at Rodophug for two days accompanied by two co-workers. The Army camp at Taksemakhang was informed about his plight by one friend who returned to get help and on the same night was

evacuated with the help of the army to Taksemakhang. On arrival at 10 pm, the nursing assistant recorded crepitations in both lung fields, generalized swelling of the body and un-recordable blood pressure with low feeble pulse. Supportive treatment was given by the nursing assistant however his condition continued to worsen with tachycardia, feeble pulse and increased respiratory rate (Shock?). He succumbed to his illness at 3.45 am on 25th June 2010. Both the medical record and the police report recorded high altitude sickness as the cause of death.

Response by the project

The project multidisciplinary team including the medical doctor had proceeded ahead of the workers to Lunana (to prepare camp site) and was informed of Mr Sherab's fate by workers reporting for work. Information was immediately relayed to the project management in Thimphu, who instructed the Health Assistant (HA) immediately to move to Taksemakhang. The HA reached Taksemakhang only on 27th and so was unable to render any assistance. The project then contacted his relatives and also informed the police about the incident and made arrangements for them to take over the body. They were given the option to transfer the body from Taksemakhang to wherever they chose for performing the last rites, however it would take few days for that. After close consultation with the relatives it was decided to perform the cremation at Taksemakhang. The PB approved a compensation sum of Nu 45,000 (Nu 25,000 as semso and Nu 20,000 as cremation expenses). Insurance payment was also duly processed.

Case 2: Late Mr Indra Bahadur Subba

Late Mr Subba was 23 years of age hailing from Tsholingkhar Tsirang and had recruited for causal work at Lunana project. He was certified medically fit to work in Lunana and verified by the team doctor on June 20 2010 and had proceeded to Lunana via Laya. From the accounts he had experienced altitude illness while ascending Gangla karchung and had not heeded advice from friends to return. With support and help from co-workers he crossed Gangla Karchung, however at the summit his condition began to deteriorate and while descending he was unable to walk. He was carried by friends up to Tarina where he was left on his own in a cave with few extra clothes and blankets. It is not known how many more days he survived and his death was reported to the officials by other workers on arrival at the camp site in Lunana. According to medical and police reports he succumbed to the effects of mountain illness on 26th June 2010.

Response by Project

The project team at Lunana was informed of the case of Mr Subba by workers reporting at Lunana and the team immediately contacted the management at Thimphu. The team Doctor then travelled to Tarina (leaving the project site with no health worker as the HA was still in Damji at that time) where the body was examined in detail. In the meantime the project management contacted the relatives and also informed the police. The detailed report was submitted to the project management and the cause of death was recorded as complications of High altitude illness. After consulting with relatives, his cremation was conducted at Tarina by the team monk. Insurance payment was duly processed.

Following this death, a meeting was held between the Project Director, Project Manager and UNDP Management was held on 1st July 2010 which subsequently led to a special PB meeting on 14th July to discuss the casualties and further strengthen the safety measures.

Case 3: Late Mr Karma

Late Mr Karma was 33 years old and was registered as being from Lumang Trashigang. He had also joined the project as a casual worker. He was certified fit to work and had been working at the project site since July 2010. He had reported being ill during the trek to Lunana. He fell ill on 22nd of August and reported at the infirmary on the morning of 23rd with complaints of severe vomiting and headache. He was examined by the HA and was found to have stable vital parameters and was offered symptomatic treatment and advised bed rest. He returned in the afternoon again with recurrent vomiting and features of acute abdomen. The differential diagnosis noted by the HA was Obstructed gut, Appendicitis, Peritonitis, upper gastro-intestinal bleed and acute pancreatitis. He was admitted in the infirmary and given intensive care including IV fluids, Oxygen and IV antibiotics. His condition deteriorated by 8 pm by which time the HA had sought consultation with doctors at JDWNRH, who advised same treatment to be continued. There was acute abdomen and patients' vitals began to fall. By 8.30 he started vomiting copious amounts of blood and finally succumbed to his illness at 8.40 pm on 23rd August 2009.

Response by project

The project team followed the same procedure as for the others by informing the management, relatives and the police. A committee comprising of four members from among the multidisciplinary team as per the instructions of the management convened at Thanza on 26th August and scrutinized the circumstances under which the deceased had died. The committee found no foul play and agreed with the medical diagnosis. Cremation was conducted on the 26th in the presence of relatives, workers and officials. The rites were performed by the Sungkhop and all rituals were performed accordingly. Insurance payment was also made appropriately.

Observation:

Response taken by the project in response to the deaths was adequate under the given circumstances. The project staff in Lunana camp site immediately contacted PMU and together made decisions on further steps such as sending a team to investigate and recover the bodies, contacting relatives and police, and performing cremation rites. The PMU in Thimphu sent instructions and supported the police and relatives to reach the site of the accidents and coordinated further steps.

There was no protocol/standard operative procedure in case of casualties or death. In the absence of such incidents having taken place in the past, the project was not well prepared.

The Medical Officer was unfortunately absent at the time of the three casualties

The medical reports do not contain much information and there is no consistency in reporting the circumstances and findings of examinations carried out on the body. Important information such as medical certificate records and details of medications are also not maintained. Similarly police report is available for one case (Late Mr Subba) only, while a committee was formed to investigate the

circumstances of the death that took place at the camp site. Insurance reports are not available for any of the three deaths and RICB relied totally on the medical reports to make their payment.

Communication was limited during travel to Lunana and information regarding casualties' enroute was often delayed, as seen in the case of Late Mr Subba's case.

5. ANALYSIS OF MEDIA REPORTS

NEWSPAPER	ARTICLE	REPORTER	DATE	INCORRECT FACTS	SOURCE	THEME OF ARTICLE
Business Bhutan	Was that too much to ask for?	Tshering Wangchuk	9-Oct-10	Late Sherab had fallen ill and died at Laya	Lamsang's report	Story of late Sherab, from drayang to Lunana project and to his passing away
	Proper education on altitude sickness needed	Karma Kuenga	28-Sep-10	Workers not given any briefing on altitude illness	Opinion	Explains in lay terms, Symptoms of altitude illness
	Three deaths challenge Bhutan's commitment to climate change	Editorial	18-Sep-10	Government did not provide money, budget has to be used stringently, poorly organized project	Lamsang's report	Critical on the value of human lives and downplaying of the deaths
	Thorthormi men to pack bags for lake-lowering	Phuntsho Wangdi	15-Sep-10	Project supplies shoes and sleeping bags for workers	Interview with Dawchu Drukpa	Recruitment of workers, how much they will earn and the work environment
	Thorthormi's sacrificial lambs	Tenzing Lamsang	11-Sep-10	Only medical person Dr Rinzi. Second death recorded as having fallen sick in Laya for 2 days before dying in Laya. Lack of guidance on altitude illness cause of death. Workers made to sleep under tarpaulin and stand in knee deep water	Interview with Dr Rinzi	Critical on the safety measures and protective gears of workers

NEWSPAPER	ARTICLE	REPORTER	DATE	INCORRECT FACTS	SOURCE	THEME
Kuensel	Big bucks hard knocks	Samten Wangchuk	19-Oct-10	Work relatively easy for women	Interview with workers	interview with two workers who would go back and two who would not and their reasons
	Thanza cashes in	Samten Wangchuk	18-Oct-10	Exaggeration of the costs and the amount of alcohol consumed. Number of pony required for project 100/month	Interview with Tenzin Thinley (teacher at Lunana) and workers	Cost of commodities gone up steeply because of the project. School pays for pony 300, project 400 and JICA 600
	Labours of Lunana	Samten Wangchuk	13-Oct-10	Lunana is 3-10 days away depending on which part of Bhutan you are from. Staff deducted 4 days salary for one day absenteeism. Health workers sent genuinely ill patient to work	Interview with workers and Karma Toeb	Describes Thanza and lists complaints of workers such as protective gears, rations and treatment of workers. Clarification by team leader
	1.3 m down after 3-month stint	Ugen penjor and Pema Dorji	7-Oct-10	Dawchu Dukpa just returned from Lunana	Interview with Karma Toeb	Description of the project and the work
	Second death in as many weeks	Tashi Dema	7-Jul-10	Died on 29 June	Interview Dawchu	Report on the death of Mr Subba
	Altitude sickness claims one life	Tashi Dema and Gyem Thinley	29-Jun-10		Interview Mr Chador store in charge	Report on the death of Mr Sherab
	2-m reduction target in Phase III	Ugen penjor	11-Apr-10		Interview Karma Toeb and Dawchu	Report on the Lunana project and experience of 2009

NEWSPAPER	ARTICLE	REPORTER	DATE	INCORRECT FACTS	SOURCE	THEME
Bhutan Observer	Thorthormi water level brought down 43 cm	Sonam Pelden	3-Sep-10	Worker died of liver failure and altitude illness. For altitude, illness there is no medication except to descend. Project to put in place mandatory stop overs enroute	Interview Dawchu	
	Up against the raw nature	Sonam Pelden	21-Oct-09	Work started at 7 am	Interview with workers	Description of the hardships encountered by workers- protective gear, rations, expenses on commodities and return journey
	Thorthormi water level brought down	Sonam Pelden	9-Oct-09		Interview with Dawchu	Description of the project

A total of 12 articles appeared in the media regarding the project, with the maximum number of stories reported by Kuensel (7) followed by Business Bhutan (5) and Bhutan Observer (3). Bhutan Today and the Journalist did not cover the project. In general, the articles written by Business Bhutan were very critical of the project starting from the planning, preparation and the implementation of the project. They questioned the project's ability to provide safety and protection of the workers and lamented on the poor quality and inadequacy of the protective gears, rations and shelter provided to the workers. The stories were written by a number of people although the main source of information for the articles seems to be the one written by reporter Tenzing Lamsang. He had based his entire story from an interview with the project Medical Officer. The misconstrued facts are reflected in the table above.

Kuensel articles were more balanced and had fewer inconsistencies than the other papers. The archives also contained articles written in 2009. The stories covered a range of issues ranging from plight of workers to the change in the local pricing of commodities. It provided more accurate information and this could be because the stories were written following interviews with the project staff and the workers. Bhutan Observer wrote three stories, two in 2009 and one in 2010. In the 2009 articles, it described the hardships and the project environment at Lunana while the third article written in 2010 towards the end of the project was critical about the number of deaths during the project phase. There were fewer inconsistencies as most of the information was written after interviewing project staff. Two topics for discussion appeared in the online discussion forums, one each in Kuenselonline and Bhutan times. Both the discussions did not receive any significant participation and centered on the need to pay workers more and to provide more safety for the workers.

A notable finding from all of the articles written by a number of papers is the absence of an official spokesman for the project. In the absence of such a person, the reporters received their information from a number of people within the project and also among the workers. This resulted in inconsistent figures and could have resulted in bias. The only time the project gave a press release was on the "additional safety measures for Thorthormi mitigation workers" following the death of Mr Karma towards the end of August 2010.

Observation:

In general, there was wide coverage of the Lunana project by three papers in the country, although the structure and theme of the articles varied across the papers. Business Bhutan was most critical of the project while Kuensel and Bhutan Observer were more balanced and neutral.

There was no official spokesperson for the project and as a result a number of people in the project including staff and works gave independent interviews. This resulted in several inconsistencies between dates and facts related to the project.

There was no plan to inform and meet the press regularly on the progress of the project. The only time the project made any press release was on additional safety measures following the death of the one worker towards the end of the August.

Newspaper reporters did not always report on the facts and there were some incorrect facts presented by almost all of the papers. The response of the general public to these papers has not been assessed although few replies to the stories in the respective online version of the stories and also on discussion forums showed that people sympathized with the workers and the need to provide better safety measures.

6. CONCLUSIONS

The risk of glacial lake outburst floods (GLOF) is high in Bhutan and lake Thorthormi has been recognized as being of immediate danger. To mitigate the danger from GLOF, the RGoB initiated the 'Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys' project with financial assistance of LDCF, managed by Global Environment Facility (GEF) along with co-financing from WWF, Government of Austria and RGoB. The project began in 2008 and since 2009 a multidisciplinary team along with 340 casual workers have been working manually to reduce the level of the lake. The project has fielded a medical team and has instituted health and safety measures in place, however there were three deaths among the workers in 2010. This assessment was thus commissioned by UNDP to review the appropriateness of the health and safety measures and to make recommendations to strengthen it.

A rapid assessment of the safety measures was undertaken including interviews with workers and project staff. Every aspect of the project starting from the planning and coordination to the actual health and safety measures in the field was carefully considered. Details of the route, quality of the protective gears, rations and medical conditions encountered were carefully assessed. A description of the three fatalities and the responses taken by the project has also been described including insurance claims. An analysis of the media reports was also conducted to evaluate the accuracy and relevancy of reporting. In conclusion, while the project had taken several measures to ensure health and safety of the workers, there are several areas that could be improved and strengthened. The details of these improvements have been provided as concrete recommendations in the next section.

7. RECOMMENDATIONS

Coordination of Health and safety measures:

1. Relevant health representatives need to be appointed on both the Project board and the TSAT. The most relevant person for the providing technical support to the project is Dr Gosar Pemba, Anesthesiologist, JDWNRH, who is also the health focal person for Disaster management in the country. Since all major decisions are made by the project and which meets more often than the TSAT, it is recommended that Dr Gosar be made a member of the PB. The team doctor could be member of the TSAT. The members should also attend all the PB meetings regularly. All health decisions taken should be formally communicated to the MoH.
2. A detailed health plan for the project should be developed that includes the following:
 - a. Medical requirements such as medicines, equipments, personnel
 - b. Standard operating procedures for emergency evacuation of patients, referral, managing fatalities, documenting health records, medical screening etc.
 - c. Occupational and health safety standards
3. The ToR of the medical personnel should be broadened to include relevant experience, training and also enable the project to have authority in selecting the medical officer for the project.
4. The Department of Labour, Ministry of labour and Human Resources must be involved in the development and monitoring of OHS standards for the staff and workers of the project
5. An official spokesperson for the project should be appointed who will liaise with the media and ensure accurate dissemination of information.
6. The purchase of medicines and equipments should be undertaken much earlier so that the medical team is free to participate and undertake the medical screening of the works and the staff.

Medical Screening

7. There must be more stringent and well documented medical screening. Forms for recording medical history and examination must be developed and recorded for each person that is involved with the project at Lunana. (Template of such forms are provided as Annex 2)
8. The medical certificate must be issued based on the exclusion of a pre determined list of diseases/conditions that are contraindicated for work at high altitude. (Suggested list as Annex 3)
9. The Project Medical team should conduct the medical screening and certify all workers. The Medical team should be based at JDWNRH for the duration of period that workers undergo screening (1 week-10 days)
10. It is likely that medical screening will be charged from 2011 given that such procedures are now included under the special consultation services and conducted after working hours in the hospital. Whatever be the process, the project should officially write to JDWNRH and arrange for a faster process to complete medical screening for workers. The estimates for payment of such charges are listed as Annex 4.
11. The members of the multidisciplinary team must also undergo medical screening and the same criteria must be applied for fitness certification.

Medical team for the Project

12. While a medical doctor and a health assistant is seen as being adequate at the project site, their presence, especially of the doctor should be ensured continuously for the duration of the project. A replacement should be identified before hand and kept on standby, to be sent to the project site in case the team doctor is unable to return for long periods.
13. Additional medical personnel should be recruited to look after transit camps set up along the route to Lunana, one at Rodophug and another at Tarina at the time of movement of people.
14. Having gained valuable experience, the medical team for the project should be retained. However it is imperative that they receive training that covers altitude medicine and advanced life support (ALS). This should be considered a pre-requisite for taking up work in Lunana and at all high altitude areas in the future.

Briefing and educating workers

15. All workers for the project, both staff and labours, should receive proper briefing and information on the health and safety measures in place. This should include planned structured briefings at Thimphu, at the time of registration and at Damji before departing for Lunana. Suggested timings for this activity (at Damji) is to hold two sessions each day, 7-8 am and again at 1-2 pm. This will make it convenient for the workers and also make the groups smaller for more effective delivery of information.
16. While the guidelines developed in 2010 are useful, additional information could be added and it must be borne in mind that significant numbers of people are unable to read.

Nutrition

17. The nutritional status of the workers should be assessed as part of the medical screening and cases identified as under-nutrition or obesity should be prevented from being recruited. Assessment again at the conclusion of the project may be considered.
18. In the absence of fresh green vegetables and fruits in the diet, regular supplements with vitamins maybe considered by the medical technical team.

Communication

19. Two satellite phones should be made available for the multidisciplinary team at Lunana. During the time of travel, one phone should be kept at Rodophug to maintain communication in times of emergencies. Thereafter it can be taken to Lunana, to be used during evacuation of patients and during emergencies.

Protective gear for workers

20. Providing better quality raincoats and gumboots maybe considered for the workers. The stocks should also have various sizes to suit the needs of all workers.
21. Workers should be provided with sleeping bags and camping mattresses in place of the Indian blanket. Provision of jacket may also be considered.

Group Personnel Accident Insurance

22. The details of the insurance cover needs to be read and explained to all the workers including the staff. Awareness on the types of accident eligible for insurance payment will encourage documentation and timely reporting to the respective organization.

Selection of Workers

23. As in the past, it is suggested that workers be chosen from able, experienced and motivated people. Occupation and usual income of a worker may be used as a screen to see motivating factors and determination. Past experience along with good track record should definitely be given priority.

Facilities enroute at the beginning and when returning from Lunana

24. Transit camps must be set at Rodophug and at Tarina to provide medical assistance during the time that project worker are moving towards Lunana. The camps should be provided with appropriate emergency health facilities including portable hyperbaric chambers such as the Gamow bag to manage altitude illnesses on both sides of the Gangla Karchung. Since the project already has one bag, it is recommended that another be procured. Trained health worker and communication facilities (at least at Rodophug) should be provided.
25. All workers should be mandated to halt one day at Rodophug to acclimatize. Mechanisms to ensure that all workers abide to this may be instituted such as registration on arrival and when leaving. In the absence of adequate shelter, pitching of additional tents may be considered to make it easier for the workers.
26. Payment to workers while travelling is less and should be increased to at least Nu 500/day which is the normal payment for work at the project site. The increase maybe advocated as additional payment to encourage hire of pony for carrying rations. There could be coordination to make ponies available for workers at the time of travel to Lunana.
27. Restocking of rations for workers at Taksemakhang is helpful and it is suggested that this practice be continued.

References

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8. ANNEXURES

ANNEX 1: STAKEHOLDERS CONSULTED

Name	Designation	Agency
Karma Rabten	Asstt. Resident Representative	Energy, Environment & Disaster Mgt, UNDP
Anne Erica Larsen	Programme Analyst	Energy, Environment & Disaster Mgt, UNDP
Yeshey Dorji	Project Director	Department of Geology and Mines MoEA
Dawchu	Project Manager	Department of Geology and Mines MoEA
Dr Pandup Tshering	Superintendent	JDWNRH, Thimphu
Dr Chandra	Medical Officer	UNICEF
Ms Pema	Nutritionist	Dept of Public Health MoH
Mr Suman	Chief Labour Officer	Department of Labour MoLHR
Mr Choki Drakpa	Legal Officer	RCSC
Dr Rinzin	Medical Officer	Chief Medical Officer Punakha
Sangay Dorji	Health Assistant	Gasa BHU-I
Tshering Dorji	Major	Royal Bhutan Army
Dzongchu	Lama	Central Monastic Body
Karma Tenzin	Project Engineer	DGM
Karma Toeb	Team leader	Lunana Project, DGM
Phuntsho Norbu	Engineer Geologist	DGM
Lobsang Gyenden	Store Incharge	Thanza camp
Tshering Tenpa	Peljab	Royal Bhutan Army
Phunthsok	AFO	DGM
Thukten Dorji	ADM Assisstant	Gasa Dzongkhag
Longchup	Tsepe Lupon	Central Monastic Body
Wangchuk Namgyal	General manager	RICB
Kunzang Gyeltshen	Assistant Manager	General insurance, RICB
29 workers	Casual workers	Project Management
2 project staff	Multi disciplinary team	Project Management

ANNEX 2: MEDICAL SCREENING GUIDELINE

Purpose

The purpose of this document is to describe the contents and procedure of the medical examination to be taken by the staff and workers of Lunana Project who are going to work at the high altitude (4100-meter) site.

Scope

This document applies to all people working at high-altitude sites of the Project. The Occupational and health safety measures adopted by the project require that all staff and workers assigned to work at high-altitude sites take this medical examination.

Procedure

The medical examination shall take place not more than three months prior to taking up duty at the Project site starting from Damji, Gasa. The applicant must register at the Project Management Office Department of Geology and Mines, Thimphu first and after initial screening proceed to JDWNRH for formal medical screening including laboratory investigations. S/he must provide all relevant information failing which the project shall not be liable for any related consequences. The detailed medical history and physical examination will be conducted initially by the project medical team and then issue a laboratory investigation form. On completion of the laboratory investigation the results will be analyzed by the medical team, following which a medical certificate stating fitness to work at high altitude will be issued for the current year. The examining physician completes the General Clinical Examination form.

The Project Management will designate a medical team for the purpose of screening and documenting the health status of each staff and worker. The team leader and medical doctors so appointed will be knowledgeable in high altitude medicine.

The medical examination should be repeated and fitness to work at high altitude recertified under the following conditions:

- On an annual basis. Prior experience of work with the project at Lunana will not be an exception for not obtaining medical certificate
- Prior to starting work again at high altitude, if an illness raises doubts as to the fitness of the person to work at high altitude,

FORM- A. PRE-EXAMINATION MEDICAL HISTORY QUESTIONNAIRE**CONFIDENTIAL**

Important: The examining physician must ask and record all the answers to the questions set out below. The worker must be informed on the furnishing of all answers truthfully and completely so as to make a proper assessment in the best interest of the worker. If it should transpire that a worker or staff has replied untruthfully or incompletely, whether with intent, or through serious negligence, or that he has withheld information concerning a significant illness or disability, then such member may forfeit retroactively certain benefits such as insurance claims, travelling and daily subsistence allowances.

Name _____ Sex: M F Date of birth/Age _____

Marital status _____ Number of children _____ District _____

Profession _____ Income/month _____

Contact in case of Emergency (Name and telephone) _____

Have you worked for the project in the past: YES NO (If YES, year _____)

If no, do you have experience staying in high altitude (>2500m): YES NO

Have you ever had health problems related to staying in high altitude? _____

Personal history

1. Do you suffer, or have you ever suffered, from:

Diseases of the blood (anaemia, leuco-granulopenia, leukaemia, tendency to haemorrhage: nose, teeth, stools) etc. _____

Diseases of the lymphatic glands (glands swollen and painful, permanently or intermittently) _____

Heart diseases (shortness of breath, cyanosis, known lesion, high blood pressure) _____

Lung diseases (infectious, acute or chronic (tuberculosis)) _____

Diseases of digestive system, liver and pancreas (of all kinds) _____

Diseases of the genito-urinary system (chronic infections, nephritis, stones) _____

Diseases of the nervous system (tremor, fatigue, depression, mental trouble, epilepsy) _____

Disorders of the metabolism and the endocrine glands (diabetes, gout, etc. diseases of the thyroid and adrenal gland) _____

Eye diseases (cataract, glaucoma, retinitis, ablation) _____

Chronic ear, nose and throat diseases _____

Allergies (asthma, hay fever and neurodermatitis) _____

Infectious diseases (Rheumatic fever, hepatitis, and other serious illnesses) _____

Osteo-articular diseases (spinal column). _____

For feminine personnel

Any gynecological diseases _____

Are you currently pregnant? _____

Have you suffered from any other diseases not mentioned above? (if so, give details) _____

2. Do you take any medicine regularly? (if so, give details) _____

3. Are you or have you ever been in the habit of taking drugs or alcoholic drinks? (if so, state which and what amount per day). _____

5. Have you ever undergone an operation? (If so, give particulars) _____

6. Date of your last vaccination against Tetanus: _____

I have understood the questions asked of me and I have provided the answers truthfully and to the best of my knowledge. I am aware that any untruthful or withheld answers may place me at risk from adverse medical conditions at high altitude while undertaking the assignment with the project and may result in the forfeiture of certain benefits.

Name and Signature of worker _____

Name and Signature of the Medical Officer _____

This questionnaire will be kept in your individual medical file of the Project medical team and will be treated confidentially.

FORM- B. GENERAL CLINICAL EXAMINATION

Name _____ Sex: M F Date of birth/Age _____

Nutritional Status

Weight: _____ Height: _____ BMI: _____

1. Head

Pharynx normal abnormal

Thyroid gland (goiter) normal abnormal

2. Respiratory system

Thorax: normal abnormal

Auscultation normal abnormal

Percussion normal abnormal

3. Cardio-vascular system

Pulses (rhythm, strength) normal abnormal

Blood pressure _____/_____ mmHg

Varicose veins normal abnormal

Arteries normal abnormal

4. Digestive system

Abdomen normal abnormal

Liver normal abnormal

Spleen normal abnormal

5. Nervous system

Patellar reflexes normal abnormal

Sensibility normal abnormal

Achilles reflexes normal abnormal

Romberg normal abnormal

Plantar reflexes normal abnormal

FORM - C: SUGGESTED LABORATORY INVESTIGATION

Attach the report of the following laboratory investigations to the medical report

1. Blood
 - Complete hemogram (CBC)
 - Glucose levels in both fasting and after food samples
 - Renal function test (urea and creatinine levels)
 - Liver function test (AST, ALT, Alkaline phosphatase, Bilirubin)
 - Cholesterol, serum
 - Gamma-GT
 2. EKG (electrocardiogram)
 3. Chest X-ray
-

FORM – D: CERTIFICATION OF FITNESS TO WORK AT HIGH ALTITUDE

RESULTS OF HIGH ALTITUDE PHYSICAL EXAMINATION

_____ bearing employee ID number _____ was
Employee Name

examined on _____ and has been determined to be medically
Date

qualified for high altitude activity: **YES** **NO**

YEAR: _____

Name and Signature of Examining Physician

Date

ANNEX- 3: GUIDELINE FOR MEDICAL CERTIFICATION

People with the following medical history or condition should not be allowed to work at high altitude. This list is a suggestion and should be finalized after a consultative meeting among technically qualified and experienced medical personnel.

Contraindications for high altitude access:

Absolute contraindications: (permanent conditions not subject to change; one condition is sufficient for a contraindication)

1. Background of cerebral ischemia.
2. Chronic respiratory insufficiency.
3. Severe renal insufficiency (Creatinine clearance less than 40 ml/min)*.
4. Unstable coronary artery disease.
5. Malign arterial hypertension.
6. Pulmonary arterial hypertension (any etiology).
7. Hemoglobinemia greater than 18.7 gr/dl in men, or greater than 18 gr/dl in women.
8. Severe anemia (Hb less than 8 gr/100ml).
9. Thromboembolisms or blood clots.
10. Background of pulmonary and/or cerebral edema resistant to prophylaxis by acetazolamide, nifedipine and/or corticoids.
11. Epilepsy with seizure in the last year.
12. Morbid obesity (BMI \geq 40)
13. Serious uncompensated arrhythmias (e.g. high-frequency, severe ventricular arrhythmias in general, symptomatic WPW, supraventricular arrhythmias with compromised hemodynamic).
14. Pregnancy.
15. Recent (less than 6 months) acute myocardial infarction.
16. Decompensated cardiac insufficiency, or grade III or IV compensated.

Relative contraindications: (modifiable in the short term)


1. Well-controlled epilepsy, no seizure in last year.
2. Compensated psychiatric disorders.
3. Presence of cardiovascular risk factors.
4. Insulin-dependent diabetes mellitus.
5. Decompensated type-II diabetes mellitus.
6. Severe hypertriglyceridemia (greater than 800 mg%).
7. Decompensated systemic arterial hypertension.
8. Any uninvestigated cardiac pathology.
9. Other anemia's (with hemoglobinemia greater than 8gr/dl).

Creatinine clearance (Cockcroft formula) = $\frac{(140 - \text{Age}) \times \text{Weight (KG)}}{72 \times \text{serum creatinine}}$
The result is expressed in ml/min, and the figure is multiplied by 0.85 for women.

Body mass index (BMI) = $\frac{\text{Weight (kg)}}{\text{Height (meters)}^2}$

ANNEX 4: COST ESTIMATE FOR IMPLEMENTING THE RECOMMENDATION

Activity	Rate	Number of people/item	Total cost Nu	US \$
<i>Medical Screening</i>				
Printing of medical forms			3500	78
DSA for Medical Team	500/day	3	15,000	333
Charges for medical screening	1000/person	350	3,50,000	7,778
Training of Project medical team		3		15,000
<i>Protective gears for workers</i>				
Sleeping bags	3000	340	10,20,000	22,666
Camping mat	750	340	2,55,000	5667
Jacket	2000	340	6,80,000	15,111
Better quality raincoat and gumboots	1000	340	3,40,000	7,555
<i>Transit camps</i>				
Recruitment of additional staff	1250/day	2	50,000	1,111
Transportation of equipment	400/pony	20	80,000	1778
Support staff	500/day	2	20,000	445
<i>Enroute travel</i>				
Payment increased	500/day	340	12,24,000	27,200
Additional day Rodophug	500	340	1,70,000	3,777
Gamow bag	108,000	1	108,000	2400
TOTAL			43,15,500	95,900

 Optional and could be considered

ANNEX 5: Health Report and Recommendations, 2008

Submitted by Dr. Tshering Tamang, District Medical Officer, Gasa BHU

The report is based on observations made during my entire stay with the team in the month of September and October. Recommendations are made as relevant to health and diseases.

Lunana geog lies at the high altitude and reaching the working site requires a number of days crossing high mountains. Conditions prevalent in this region and overall health of the working man are discussed.

Camp

As it involves three hundred working laborers, diseases may erupt from overcrowding and sanitation. Therefore, in the camp there should be

1. Provision of safe and clean drinking water
2. Sanitation - toilets and waste disposal pits
3. Too many or over congestion of workers under same shed should be avoided
4. Personal hygiene at all levels to be maintained - will be assessed by health worker from time to time

Laborers

Recruitment of workers should be preferably selected from those living in high altitude. Workers from lower region may suffer from altitude associated sickness both on travel and site. During recruitment the workers should be free from acute and chronic illness as these would pose problems and also reduce the working capacity.

A detailed medical examination should be carried out by the medical officer at any medical center before recruitment, and once a month in working site. Personal hygiene at all levels to be maintained - will be assessed by health worker from time to time.

Occupational hazards

This means that, conditions or diseases occurring as a result of ones occupation. Injuries and accidents related to working with boulders may be anticipated. First-Aid and temporary treatment would be given at the site by the health worker. A helmet and protective attire should be provided. Since job involves working in cold water, hand utility gloves and water resistant high boots are necessary. Frost bites and cold sores due to cold water will be checked.

Health facilities

An infirmary has to be established, accommodating at least one patient during emergency and enough space for storing medicines and some necessary equipment. A separate disposal pit for infected used materials from medical procedures should be in place. Indent of drugs should be made yearly according to need and previous balance. Health worker are to be kept separately. Additional health worker along with a medical officer have to be deployed.

ToR for additional HW

A health worker preferably GNM or HA has to work side by side with the medical officer as sometimes emergency needs so. The HW has to treat minor illness and provide aid at the site for work. He has to be competent in procedures and aware of illnesses common on high altitude. And indent drugs yearly as instructed by MO. The HW can be appointed from Gasa BHU as it would be easier on journey.

Emergencies

In situations where any medical emergencies arise, the department should provide services to evacuate the patient as early as possible in order to save life. The facilities like satellite communication for every consultation and helicopter service have to be in place. The cases which couldn't be handled at Lunana have to be transferred to better facilities.

ANNEX 6: MEDICAL REPORT FOR 2009 PROJECT

Submitted by Dr Rinzin, Team Doctor

General Medical Scenario

Following are the medical scenario in general;

1. Common illness

High Altitude Sickness was common illness during the initial stage of the Project because most of the labourers were not acclimatized properly as they came from low altitude areas. Once the work started blunt traumas on hands and feet, minor cuts and bruises, dislocation of joints, diarrhea, headache, gastritis, and common cold were on rise. Apart from the labourers, the local people (Lunaps) were also seen with majority of them suffering from chronic gastritis, essential hypertension and other mild ailments.

2. OPD cases

Daily a minimum of 30 patients has to be seen on out-patient basis among the labours irrespective of the local people (Lunaps) in Lunana. Sometimes the number of patients seen in day is quite high depending on the casualties at the work site. Work related injuries come in first followed by other illnesses. Very few patients needed admission and referral to the centers with facilities.

3. Patient referral

During the 3 months stay in Lunana, 6 labourers were referred to higher centers for further management due to lack of facilities. Referring a patient was not that easy. It was one of the major problems that the team had to face. The patient needs an escort and few people to carry him for the whole 8 to 9 days to reach the referral centre, so this leads to loss of some man power at the project site. More over the project didn't want to keep a patient for longer duration as it could become a liability for them. Following are the details regarding the referred patient.

- a. 66 year old man with complaints of breathlessness and chronic cough
- b. A young man who as then diagnosed a diabolle
- c. Suspected case of Pulmonary TB
- d. A person hit by a dart on the head
- e. Severely malnourished person
- f. Chronic UTI patient with suspected kidney damage

Recommendations for the future

According to the above report and on my own experience I would like to recommend few things on medical ground for the smooth running of the project in future.

1. Labours to undergo following tests from the hospitals

- i. Chest x-ray to rule out lung diseases
- ii. Blood sugar levels (fasting and random) for diabetes
- iii. ECG to rule out heart diseases
- iv. Blood pressure for hypertension
- v. Kidney function tests and liver function tests to rule out any kidney and liver disorders
- vi. The mental status of the person. This year, there was one labourer suffering from depression and was on anti depressants a medicine.

2. The maximum age of the labour not to exceed 50 years.

An old man aged 66 years from Wangdue Phodrang was diagnosed with heart problem when he complained of cough and breathlessness while walking uphill and while applying minimum effort at worse. I've seen few other labourers who have crossed 55 years of age. So it would be better if people of his age are not recruited as a labourer to work in such high altitude.

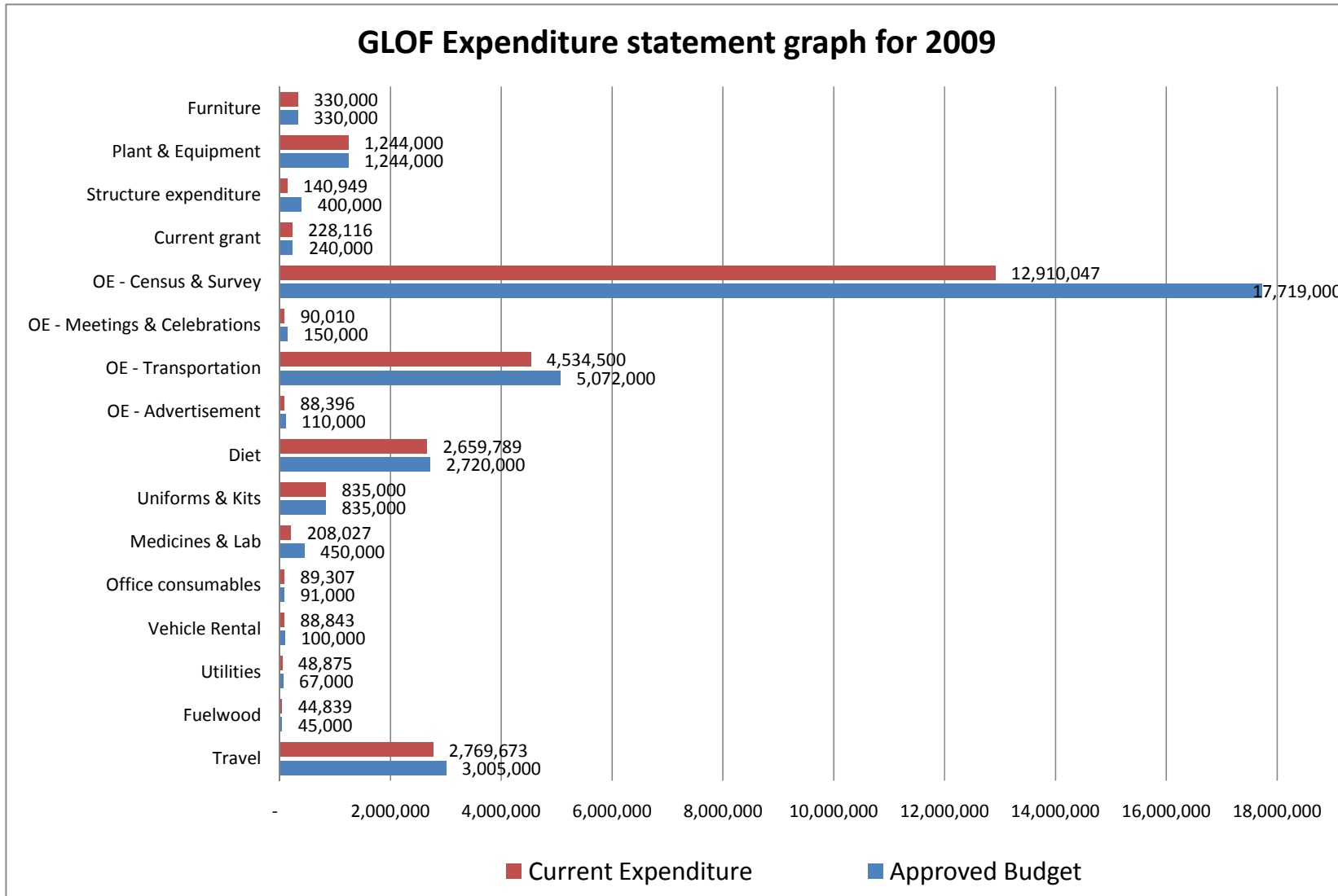
3. Ask for the history of epilepsy in the labourer

Persons with epilepsy are not advisable to work in such harsh working environment where they have to deal with water and boulders. This time, there were two labourers on antiepileptic drugs. Before the end of the project they went out of stock from their medicines. Luckily we had the drugs they were taking and didn't have any problem, so to prevent casualties, I think it would be better if the project prohibits people having this disorder from working in such condition.

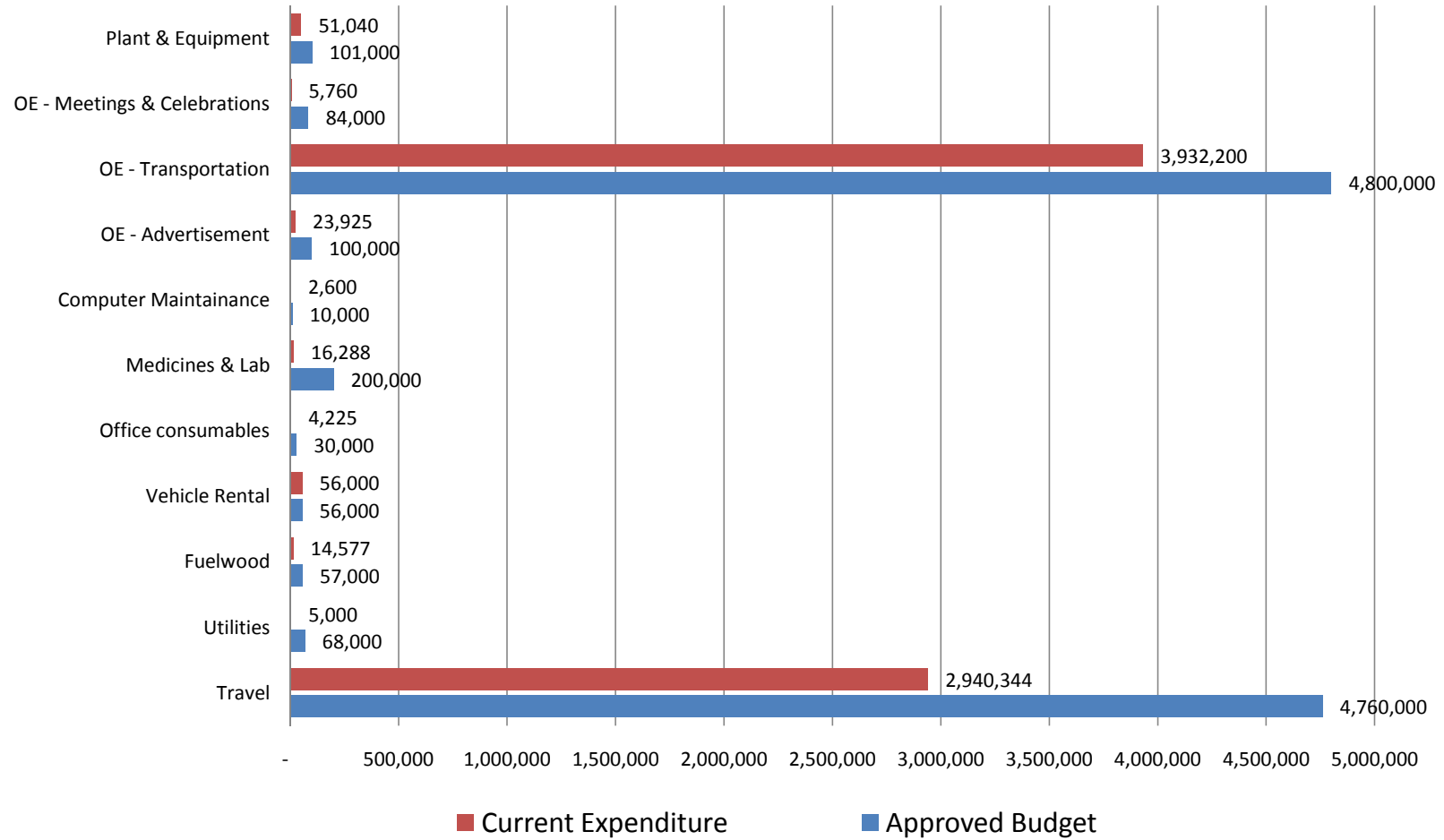
4. Labourer's drinking habits and drug addicts

This was one of the major problems that we had this year. Most of the fights in the labour camp and loss of man power was due to alcoholics and drug abusers. From medical point of view it's a serious issue among the young generation where they can indulge into fights and even cause death to few of their mates. So, I think this should be looked upon very seriously by the project.

ANNEX 7: COST BREAKDOWN OF PROJECT; 2009 & 2010



GLOF Expenditure statement graph for 2010



A. INDEPTH INTERVIEW QUESTIONNAIRE

Kuzu-zangpo, I would like to ask you some questions about your experience of working with the project and in particular about the medical aspects. This will help the project to improve safety and address health concerns of the workers in the future. Your name will not be reflected anywhere in the report. Are you willing to take part in the survey?

Questionnaire Identification Number: _____

Respondent: 1. Worker 2. Project Staff Specify Designation: _____

Profile

Place of residence: _____

District: _____

Age: _____ years

Sex: 1. Male 2. Female

Marital Status: _____

Number of children: _____

Occupation: _____

Average income/month: Nu _____

Education Status: _____

Prior to Recruitment

1. How did you come to know about the work at Lunana?

2. Did you work in the Lunana project previously?

YES (If yes, Year: _____) NO

3. If no, did you ever stay at altitudes above tree line? YES NO

4. What were your concerns about working in Lunana?

5. Did you get information about conditions at the project from anyone before recruitment?

YES NO

6. If Yes, from whom did you get the information?

7. Did you know that you had to be medically certified to work at Lunana? YES NO

Medical screening

8. Where did you go for your medical check?

9. Describe the process of medical check.

Were you asked questions about past medical illnesses? YES NO

Did you undergo a physical examination? YES NO

Was your Blood pressure measured? YES NO

Did you have an X-Ray? YES NO

Did you have a blood test? YES NO

Do you know of anyone who was declared unfit to work? YES NO

Do you have any suggestions to improve the medical check for workers?

After recruitment

10. Was health advice given about travelling and working at high altitude? YES NO

11. How was the information given?

12. Did you understand the information given to you? YES NO

13. If NO, why?

14. If YES, What health information was given about altitude illness?

15. Do you think you received all the health information you needed to work in Lunana?
YES NO

16. If NO, what additional information is required for workers going to Lunana?

17. Are you aware about the insurance policy in case of accident? YES NO

18. Were you happy with the equipments and gear provided to you to travel and work in Lunana?
YES NO

19. Please list other things that you find important and which could be provided by the project?

Travel to Lunana

20. How many days did you take to reach Lunana? _____ days

21. Which route did you take? _____

22. Were you in a group or did you travel alone? Alone Group

23. If in a group, how many people were in the group? _____ people

24. Did you experience altitude sickness? YES NO

25. If YES, What did you do?

26. What were the difficulties/challenges you faced on the way?

27. Do you know of any death that occurred on the way? YES NO

28. If YES, what do you think was the cause of death?

29. Please suggest some actions that could be taken to reduce and prevent casualties en-route to project site

At project site

30. Did you have enough rations at Lunana? YES NO
31. Did you have adequate shelter? YES NO
32. Did you have any health problems at Lunana? YES NO (skip to Q39)

33. If Yes, list main health problems experienced?

34. Did you seek medical care at Lunana? YES NO

35. Were you satisfied with the health services provided at Lunana? YES NO

36. If No, why?

37. Do you have any suggestions to improve health facilities for workers at project site?

B. Additional Questions for Project staff

What were the challenges/difficulties for workers travelling and working in Lunana?

What measures were in place to prevent any casualty/accident?

What was immediately done after the report of casualty?

Enroute

At project site

Your opinion of medical services provided by the project/MoH? Any suggestions for improvement?

How can we improve health services so that casualties can be prevented in the future?

ENROUTE

AT PROJECT SITE

Any other comments:

C. Additional Questions for HEALTH STAFF

Health team members (List in order of seniority)

1. _____
2. _____
3. _____
4. _____

How was medical screening conducted for workers? (Process)

What was your role in the screening process?

Did you receive any training or have experience in high altitude medicine?

YES

NO

If YES, Describe:

Was there a checklist for physical examination? YES (verify) NO

Was there a checklist for laboratory investigation including X ray and ECG? YES NO

Did you examine the workers prior to their travel to Lunana? YES NO

How was the medical history collected? (Self administered/Medical officers in hospitals/project team?)

Are there records of the medical history? YES NO

What were the challenges/constraints of providing health care during the project?

Number of patients referred for treatment to higher center? _____

What additional services/equipments/personnel are required to improve health care for the project?

Suggestions to improve health services for the project...

ENROUTE TO LUNANA

AT PROJECT SITE

Any other comments:

Checklist for health services for Reducing Climate change-induced risks and vulnerabilities in Punakha-Wangdi and Chamkhar valleys

Indicator	YES	NO	Comments
Was there a medically qualified person in the project board?			
Did the person attend all the board meetings?			
Were the project medical team in decision making?			
Was there a minimum age for workers? What was the age?			
Was there a proper health screening for workers?			
Were all workers screened adequately?			
Was there coordination between project medical team and referral/district hospitals?			
Was there adequate laboratory investigation			
Were the workers provided with appropriate health information?			
Was there a proper health plan in place including evacuation of emergency patients?			
Was there any health guidelines developed?			
Appropriate health messages that is readily understood			
Were risks adequately explained to the workers			
Was there health insurance			
Were health services provided en-route to the site at Lunana			
Were workers given adequate times for acclimatization?			
Did the works have proper ration and diet?			
Was occupational health and safety included in the project plan			
Did the team have adequate medical supplies?			

Reducing Climate Change-induced Risks and vulnerabilities from GLOF (Annex-4)

The following recommendations of the Health and Safety Assessment were endorsed by the Project Board (11 January 2010)

Recommendations	Cost implication	Timeframe	Responsible	Actions/ Comments
1. Relevant health representatives need to be appointed on both the Project board and the TSAT. The most relevant person for providing technical support to the project is Dr Gosar Pemba, Anesthesiologist, JDWNRH, who is also the health focal person for Disaster management in the country. Since all major decisions are made by the project and which meets more often than the TSAT, it is recommended that Dr Gosar be made a member of the PB. The team doctor could be member of the TSAT. The members should also attend all the PB meetings regularly. All health decisions taken should be formally communicated to the MoH.	-	Following the PB endorsement from January 2011 and onwards	Project Director, DGM project manager, MoH	Request MoH to appoint relevant health representatives
2. A detailed health plan for the project should be developed that includes the following: <ol style="list-style-type: none"> a. Medical requirements such as medicines, equipments, personnel b. Standard operating procedures for emergency evacuation of patients, referral, managing fatalities, documenting health records, medical screening etc. c. Occupational and health safety standards 	-	January - April 2011	Health representatives of PB and TSAT in cooperation with MoH	Development of detailed health plan, including medical requirements, SOP for emergencies, and OHS standards
3. The ToR of the medical personnel should be broadened to include relevant experience, training and	-	January-February 2011	Project Director and	Review of TOR

also enable the project to have authority in selecting the medical officer for the project.			project manager DGM	
4. The Department of Labour, Ministry of Labour and Human Resources must be involved in the development and monitoring of OHS standards for the staff and workers of the project	-	January-February 2011	Project Director, Project manager DGM	Letter/ discussions with MoLHR
5. An official spokesperson for the project should be appointed who will liaise with the media and ensure accurate dissemination of information.	-	January 2011 onwards	Project Director (in consultation with project managers, team leader, UNDP)	
6. The purchase of medicines and equipments should be undertaken much earlier so that the medical team is free to participate and undertake the medical screening of the works and the staff.	-	January-April 2011	Project medical team, project manager DGM	Purchase of medicines and equipments
7. There must be more stringent and well documented medical screening. Forms for recording medical history and examination must be developed and recorded for each person that is involved with the project at Lunana. (Template of such forms are provided as Annex 2)	3,500 Nu (Printing of medical forms)	January-April 2011	Project Director and manager, Health representatives of PB and TSAT in cooperation with MoH	Review/develop template for medical screening
8. The medical certificate must be issued based on the exclusion of a pre determined list of diseases/conditions that are contraindicated for work at high altitude. (Suggested list as Annex 3)	-	January-April 2011	Project doctor	Review list and include as part of medical screening template
9. The Project Medical team should conduct the medical	15,000 Nu	May 2011	Health	Letter/

screening and certify all workers. The Medical team should be based at JDWNRH for the duration of period that workers undergo screening (1 week-10 days)	(DSA for medical team (500 Nu/day for 3 persons))		representatives of PB and TSAT in cooperation with MoH; Project medical team	discussion and agreement with JDWNRH
10. It is likely that medical screening will be charged from 2011 given that such procedures are now included under the special consultation services and conducted after working hours in the hospital. Whatever be the process, the project should officially write to JDWNRH and arrange for a faster process to complete medical screening for workers.	Nu 350,000 (1,000 Nu/person x 350 persons as charges for medical screening)	January-February 2011 (letter/discussion) May 2011 (screening)	Project Director in cooperation with health representatives of PB and MoH	Letter/discussion and agreement with JDWNRH Criteria for medical screening of the multi-disciplinary team to be reviewed
11. The members of the multidisciplinary team must also undergo medical screening and the same criteria must be applied for fitness certification.				
12. While a medical doctor and a health assistant is seen as being adequate at the project site, their presence, especially of the doctor should be ensured continuously for the duration of the project. A replacement should be identified before hand and kept on standby, to be sent to the project site in case the team doctor is unable to return for long periods.	-	February-April 2011	Project manager DGM, Project Director in cooperation with health representatives of PB and MoH	Identify /recruit additional personnel
13. Additional medical personnel should be recruited to look after transit camps set up along the route to Lunana, one at Rodophug and another at Tarina at the time of movement of people.	50,000 Nu			
14. Having gained valuable experience, the medical team for the project should be retained. However it is	675,000 Nu (training of 3	March-April 2011	Project manager	

imperative that they receive training that covers altitude medicine and advanced life support (ALS). This should be considered a pre-requisite for taking up work in Lunana and at all high altitude areas in the future.	persons ex-country – if in-country training costs will be less)		DGM, Project Director in cooperation with health representatives of PB and MoH	
15. All workers for the project, both staff and workers, should receive proper briefing and information on the health and safety measures in place. This should include planned structured briefings at Thimphu, at the time of registration and at Damji before departing for Lunana. Suggested timings for this activity (at Damji) is to hold two sessions each day, 7-8 am and again at 1-2 pm. Travel in larger groups with informally appointed group leaders, having experience from high-altitude environments, should also be organized from the departure at Damji.	-	June 2011	Multi-disciplinary team, project management unit	Briefing prior to departure from Damji, and documentation of the briefing
16. While the guidelines about health and safety developed in 2010 are useful, additional information could be added and it must be borne in mind that significant numbers of people are unable to read.	-	April-May 2011	Project manager DGM/project doctor in cooperation with health representatives of PB and MoH	Review and update of guidelines, also including insurance information
17. The nutritional status of the workers should be assessed as part of the medical screening and cases identified as under-nutrition or obesity should be prevented from being recruited. Assessment again at	-	January-April 2011	Project manager DGM / project doctor, health representa-	Review part of the review of medical screening

the conclusion of the project may be considered.			tives of PB and TSAT in cooperation with MoH	
18. In the absence of fresh green vegetables and fruits in the diet, regular supplements with vitamins maybe considered by the medical technical team.	-	January-April 2011	Project manager DGM /project doctor in cooperation with health representatives of PB and MoH	Assessment part of the health plan
19. Two satellite phones should be made available for the multidisciplinary team at Lunana. During the time of travel, one phone should be kept at Rodophug to maintain communication in times of emergencies. Thereafter it can be taken to Lunana, to be used during evacuation of patients and during emergencies.	-	June-September 2011	Project manager and Project Director	Review of the use of 2 phones already available Additional phone available with DDM Possibility of use of phone from JDNP
20. Providing better quality raincoats and gumboots maybe considered for the workers. The stocks should also have various sizes to suit the needs of all workers.	340,000 (340 sets at 1,000 Nu each)	January-May 2011	Project Director, project manager DGM	Purchase
21. Workers should be provided with sleeping bags and camping mattresses in place of the Indian blanket. Provision of jacket may also be considered.	Sleeping bag: 1,020,000 Nu. Camping mat 255,000 Nu Jacket 680,000 Nu	January – May 2011	Project Director, project manager DGM	Subject to further discussion between the project

				management, the project doctor and MoH
22. The details of the insurance cover needs to be read and explained to all the workers including the staff. Awareness on the types of accident eligible for insurance payment will encourage documentation and timely reporting to the respective organization.	-	June 2011	Project manager DGM	Part of briefing of workers at Damji
23. As in the past, it is suggested that workers be chosen from able, experienced and motivated people. Occupation and usual income of a worker may be used as a screen to see motivating factors and determination. Past experience along with good track record should definitely be given priority.	-	February-April 2011	Project Director, project manager DGM	
24. Transit camps must be set at Rodophug and at Tarina to provide medical assistance during the time that project worker are moving towards Lunana as well as while returning from the site. The camps should be provided with appropriate emergency health facilities including portable hyperbaric chambers such as the Gamow bag to manage altitude illnesses on both sides of the Gangla Karchung. Since the project already has one bag, it is recommended that another be procured. A trained health worker should be stationed and communication facilities (at least at Rodophug) should be provided.	Transit camps 100,000 nu Gamow bag 108,000 Nu	June-September 2011 January-May 2011	Project Director, project manager DGM in cooperation with health representatives of PB/TSAT	Prepare set-up and transportation to transit camps and purchase equipments
25. All workers should be mandated to halt one day at Rodophug to acclimatize. Mechanisms to ensure that all workers abide to this may be instituted such as	170,000 Nu	June 2011	Project Director, project	Plan mechanism for registration of workers at

registration on arrival and when leaving. In the absence of adequate shelter, pitching of additional tents may be considered to make it easier for the workers.			manager DGM in cooperation with health representatives of PB/TSAT	transit camp
26. Payment to workers while travelling is less and should be increased to at least Nu 500/day which is the normal payment for work at the project site. The increase maybe advocated as additional payment to encourage hire of pony for carrying rations. There could be coordination to make ponies available for workers at the time of travel to Lunana.	Total 1,224,000 Nu (additional costs are app. Nu. 700,000 for additional cost of Nu. 200 per person per day during journey = Nu.200 *11 days * 350 workers		Project Director, project manager DGM	Not approved Instead the PB recommended to ensure restocking of rations at additional locations (transit camps)
27. Restocking of rations for workers at Taksemakhang is helpful and it is suggested that this practice be continued.	-	June 2011	Project Director, project manager DGM	Continue good practice, and expand with more locations
Total costs	4,315,500 Nu (95,900 US\$)			
Recurrent costs:	Nu 3,532,500 (yearly)			
One-time expenditures (Gamow bag and training)	Nu 783,000 (2011)			



Austrian
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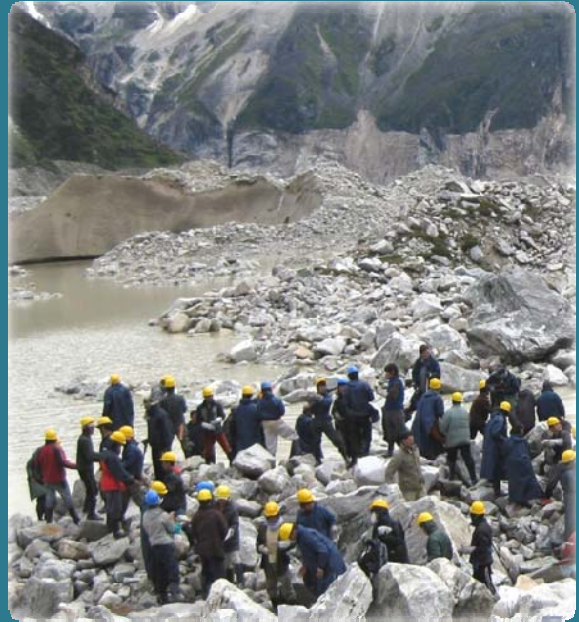


(Annex-5)
**Project on Reducing Climate Change-
induced Risks and Vulnerabilities from
Glacial Lake Outburst Floods in the
Punakha-Wangdi and Chamkhar
Valleys in Bhutan**

MID-TERM REVIEW

Final Report, 10th September 2010

Prepared by
Ugen P. Norbu
Norbu Samyul Consulting
Thimphu



Cover Page Photos

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.

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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	<i>Dzongkhag</i> Disaster Management Awareness and Planning Team
DDMC	<i>Dzongkhag</i> 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	<i>Gewog</i> 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

<i>Chiwog</i>	Basically a village; but where a village is too large it may be divided into two or more <i>chiwogs</i> and, where villages are too small, two or more villages may be combined to form a <i>chiwog</i> .
<i>Dzong</i>	A monastery-fortress, which usually functions as the district headquarters for public administration as well as for monastic affairs.
<i>Dzongda</i>	District Administrator
<i>Dzongkha</i>	Bhutan's national language
<i>Dzongkhag</i>	District
<i>Gewog</i>	Smallest geographic unit of public administration made up of a block of <i>chiwogs</i>
<i>Gup</i>	Head of a <i>gewog</i> , 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 four-year project funded by the Global Environment Facility, 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 the 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 Bhutan’s most dangerous glacial lakes. 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 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 far 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* level. 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.

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 projects 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 visible 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.

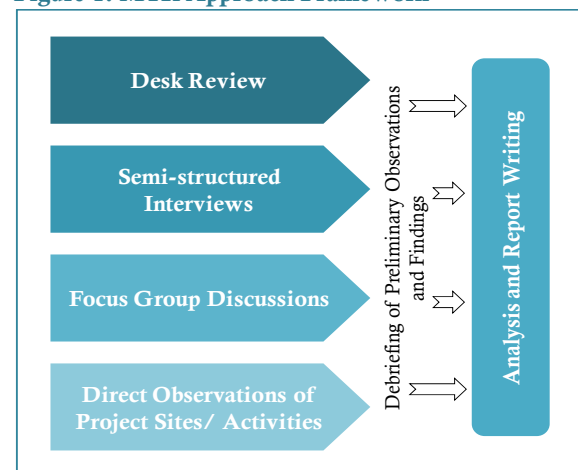
The terms of reference (ToR) for the MTR, providing details on its objectives and scope, is attached as Appendix 1.

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;
- 👉 **semi-structured interviews** of key informants in government implementing 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.

Figure 1: MTR Approach Framework



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 FGD¹;
-  *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 Two government field staff – an agriculture extension agent and a forest beat officer – were also present as observers.

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

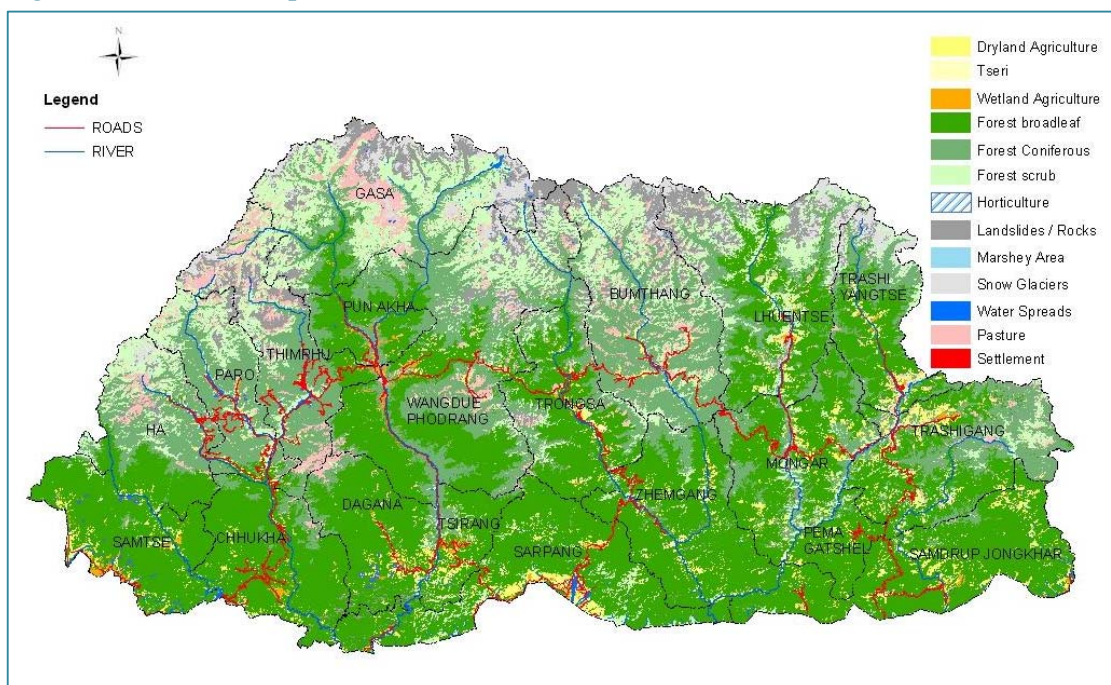
The MTR is structured as per the standard requirements of UNDP/GEF project evaluations, with some slight adaptations to suit project conditions and needs. It is presented in three parts: the first part provides the background of the MTR and an overview of the development context of the project; the second 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 territory². The entire northern mountain reaches are speckled with numerous glacier/snow-fed lakes. The country reportedly consists of 677 glaciers and 2,674 glacial lakes³.

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 lakes⁴. 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

² Source: Atlas of Bhutan: Land cover and area statistics of 20 dzongkhags, 1997, Ministry of Agriculture.

³ Source: Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods in Bhutan, 2001, International Centre for Integrated Mountain Development.

⁴ Source: Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods in Bhutan, 2001, International Centre for Integrated Mountain Development.

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 revenue⁵. 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

⁵ Source: Asian Development Outlook 2007, Asian Development Bank (pp. 17-19).

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 Project Broad.

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 publications and a TV documentary production.

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 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 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.


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;

⁶ Built in 1637-38 by Shabdrung Ngawang Namgyal, it is the second-oldest *dzong* in the country.

-  Weather Forecasting System to serve farmers and agriculture⁷;
-  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): <ul style="list-style-type: none"> • 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 • Sankosh 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.

⁷ Originally not intended but real-time weather data collection and forecasting were integrated in the EWS to enhance the utility of the system.

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 extremely 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 guideline⁸ 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 equipments as a part of the establishment of EOCs, which are currently located in the respective *dzongkhag* administration offices. Radio communications equipments 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 detail 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 equipments, 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

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.

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.

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 Thorthortmi lake are produced on an annual basis. These reports are distributed to all 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 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 2009⁹. 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

⁹ Source: Quarterly Progress Report, January-March 2009.

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 the 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, WWF/Bhutan Broadcasting Service’s documentary “The Cost of Climate Change”, GEF documentary production “Bhutan: Silent Tsunami”¹¹, and UN TV’s documentary “Tsunami from

¹⁰ http://assets.panda.org/downloads/the_cost_of_climate_change_24_nov.pdf

¹¹ <http://www.thegef.org/gef/gefvideo>

the Sky”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 challenges¹³. 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 lake¹⁴.

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 35.8 per cent of the total project costs. 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 ToR¹⁵.

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

¹² <http://www.linktv.org/video/5455/un-21st-century-bhutan-tsunami-from-the-sky>

¹³ www.youtube.com/watch?v=pxX-QF21ne4

¹⁴ <http://www.nature.com/news/2009/091021/full/4611042a.html>

¹⁵ The ToR requires the Project Board to normally meet once a year, including at least four times during the project period.

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 DDMAPT were basically made up of existing *dzongkhag* staff. During the FGDs with the members of DDMCs and DDMAPT 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 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 visible 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 next 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 during the trek and at the work site, 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 late August 2010¹⁶. 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 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.

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.

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 season¹⁷. 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 farmlands¹⁸. 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*

¹⁷ The figures on women participation/ involvement have been derived from the draft Project Implementation Report for 2010.

¹⁸ Source: The Cost of Climate Change: The story of Thorthormi lake in Bhutan, 2008, WWF publication.

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 knowledge and information accrued through this project will be valuable to the JICA/JST 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 reporting¹⁹.

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 funds²⁰. A breakdown of financial disbursements and expenditures (all amounts in US\$) is provided below:

Year	Annual Planned Budget ^a	Disbursement to IAs	Cumulative Disb. % of Project Budget ^b	Expenditure Reported by IPs	Cumulative Exp. % of Project Budget ^b
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 budget²¹.

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.

¹⁹ Generally, four to five weeks of every quarter (three months) reportedly went into procedural work including follow-up with various agencies.

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)

²¹ No observation has been made on fund disbursement in 2010 as only half of the year had passed at the time of MTR.

Cost-effectiveness	2	Administrative and personnel costs were limited due to use of existing government institutional set-up and human resources.
Implementation approach	2	
Sustainability	3	The multiplier approach used for CBDRM training by conducting ToTs for DDMCs and DDMAPT's 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.
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 <i>dzongkhag</i> 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 related 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 with other ongoing initiatives, 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 AWP's and quarterly progress reports are linked to the expected outputs and targets and not just the broad outcomes. This will ensure that AWP's 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 visible 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.

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 sub-basin and Chamkhar 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 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:

- a. Assess whether the project design is clear, logical and commensurate with time and resources available;
- b. 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;
- c. An evaluation of project performance in relation to the indicators, assumptions and risks specified in the logical framework matrix and the project document
- d. An assessment of the scope, quality and significance of the projects outputs produced to date in relation to expected results;
- e. An analysis of the extent of the extent of cooperation on engendered and synergy created by the project in each of its component activities;
- f. 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;
- g. Identification and, to the extent possible, quantification of any additional outputs and outcomes beyond those specified in the project document;
- h. 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;
- i. 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.
- j. A qualified assessment of the extent to which project outputs to data have scientific credibility;
 - k. An assessment of the extent to which scientific and technical information and knowledge have influenced the execution of the project activities;
 - l. A prognosis of the degree to which the overall objectives and expected outcomes of the project are likely to be met;
 - m. Lessons learned during project implementation;
 - n. 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:

- a. Desk review of project document, outputs, monitoring reports (such 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);
- b. Review of specific products including datasets, management and action plans, publications, audiovisual materials, other materials and reports;
- c. Interviews with the Project Managers and other project staff; and
- d. 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:

- a. A presentation of the findings to key stakeholders;
- b. An executive summary, jointly prepared by the consultants, including findings and recommendations;
- c. A detailed evaluation report covering 4. Scope of the Mid-term review (items a-n) with detailed attention to lessons learnt and recommendations; and
- d. 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:

<u>Rating:</u>	<u>Achievement:</u>
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. Raptan, 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 Drukpa, 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 Drupchu, 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 <i>dzongkhag</i> staff of Punakha for focused group discussion	
10/07/2010	08:00–13:00	Travel to Rimchhu, Punakha <i>Dzong</i> 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 <i>gewog</i> functionaries of Chhubu, Tewang and Zomi <i>gewogs</i> for focused group discussion	

Dates	Time	Program	Remarks
	14.00-17.00	Visit to sites identified for installation EWS siren towers	
12/07/2010	09.30-11.30	Meeting with <i>dzongkhag</i> 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: <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> • DRM stakeholders in Bhutan on the national, regional and local level are able to project climate-induced GLOF risks downstream of potentially hazardous glacier lakes and are able to prioritize, plan and implement efficient mitigation and preparedness options 	Qualitative-based surveys (QBS)/Interviews DRM Legislation Impact assessment by the end of the project	Stakeholders are able to perceive reductions in vulnerability over the time-scale determined by project duration No flooding disasters in target communities occur throughout the project lifetime
Outcome 1: Improved national, regional, and local capacities to prevent climate change-induced GLOF disasters in the Punakha-Wangdi and Chamkhar Valleys	Percentage of national DRM focal points, district authorities, and communities able to prioritize, plan, and implement measures to reduce human and material losses from potential GLOFs Percentage of personnel reporting DRM frameworks support adaptation efforts 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.	<ul style="list-style-type: none"> • By the end of Year 2, 100% of the national DRM focal points, and 90% of district and community DRM focal points in Punakha-Wangdi Valley and Chamkhar Valley are able to prioritize and plan measures to minimize potential losses from GLOFs • By the end of the project at least 90% of personnel interviewed report that DRM frameworks support their 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	Number of DRM legislation, policy	Climate change risks are noted in	<ul style="list-style-type: none"> • By end of the project, NDRMF integrates 	Review of Disaster Management Act, DRM	Government continues to support

Outcomes/ Outputs	Indicator	Baseline	Target	Sources of Verification	Risks and Assumptions
climate-resilient DRM legislation, policy frameworks, and guidelines	frameworks, and guidelines that incorporate long-term climate risk planning	the current NDRMF. No Disaster Management Act No comprehensive disaster management guidelines for <i>Dzongkhag</i> and <i>Gewog</i> Disaster Management Committees	longer-term climate risk planning <ul style="list-style-type: none"> 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 	policies, plans, and institutional structures	climate-resilient DRM.
Output 1.2: Strengthened capacities for climate risk planning at the district (<i>dzongkhag</i>) administrative levels	Number of <i>dzongkhag</i> and <i>gewog</i> Disaster Management Committees in project areas incorporating long-term climate risk planning into their ongoing DRM responsibilities Number of <i>dzongkhag</i> disaster management plans in place that incorporate GLOF mitigation and preparedness	DRM focal points at the <i>dzongkhag</i> level do not possess adequate knowledge and skills to plan and implement climate-resilient DRM measures	<ul style="list-style-type: none"> By end of Year 2, 3 <i>dzongkhag</i> Disaster Management Committees and <i>gewog</i> DMCs in the project area are trained on climate change and GLOF risk management By end of Year 2, <i>Dzongkhag/Thromde</i> Disaster Management plans in Punakha, Wangdi, and Bumthang are developed to account for GLOF hazards 	Training reports and follow-up QBS with staff <i>Dzongkhag/Thromde</i> 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	<ul style="list-style-type: none"> National database on GLOF vulnerability and climate risk information in Bhutan systematically and continually updated Within 2-3 years of start of project implementation an information management system exists and by the end of the project a survey of key stakeholders reveals that they have access to relevant information on adaptation to climate change. Annual workshop to 	Database of relevant information QBS with key stakeholders	Data is provided in an accessible format for use by different government departments

Outcomes/ Outputs	Indicator	Baseline	Target	Sources of Verification	Risks and Assumptions
			<p>present information on climate change-induced GLOF risks to relevant government departments</p> <ul style="list-style-type: none"> Updated DGM website 		
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	<ul style="list-style-type: none"> By the end of Year 1, all GLOF-vulnerable communities in the Punakha-Wangdi and Chamkhar Valleys identify disaster and climate risk management focal points By the end of Year 3, 80% of households in the target area are able to take precautionary measures for potential GLOFs 	<p>List of focal points</p> <p>Training reports and QBS</p>	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	<ul style="list-style-type: none"> By the end of the project, Thorthormi Lake is no longer considered at high risk of GLOF, as scientifically assessed at the project's completion 	<p>Satellite data and field survey of lake</p> <p>Scientific assessment</p>	<p>No natural disasters in project area</p> <p>Workforce availability</p> <p>Climatic conditions permit at least five months of excavation work each year</p>
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	<p>By the end of Year 1:</p> <ul style="list-style-type: none"> 1 geotechnical assessment report confirming current status of moraine dam 1 safety and evacuation plan 1 engineering plan outlining the detailed location for mitigation works 1 EIA report Approval of engineering and safety plans by PB 	<p>Engineering plan</p> <p>Safety and evacuation plan</p>	<p>No natural disasters in project area</p> <p>Climatic conditions permit the geotechnical assessment to take place</p>
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	By the end of the project, the water level of Thorthormi lake is lowered by 5 meters	Satellite data, field survey, level readings	<p>Availability of work force</p> <p>Regular seasonal variations of glacier melt do not greatly exceed average</p>

Outcomes/ Outputs	Indicator	Baseline	Target	Sources of Verification	Risks and Assumptions
		lake in 2001 measured 1.28 km ² and is still expanding Water volume of Thorthormi lake is outpacing its drainage capacity			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	<ul style="list-style-type: none"> By the end of the project, 10 DGM, and DOE staff trained in monitoring of water flows and functioning of lowering system At least two monitoring reports are produced and disseminated per year on the status of lake level and lowering system 	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	<ul style="list-style-type: none"> By the end of the project, a comprehensive evaluation of the operation and potential replication of the glacier lake level management system is conducted By the end of the project, all relevant lessons for the lowering and management of glacier lake levels are captured in the DGM database By the end of the project, national agreement to embark on at least 1 follow-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 	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

Outcomes/ Outputs	Indicator	Baseline	Target	Sources of Verification	Risks and Assumptions
			<ul style="list-style-type: none"> By the end of the project, project lessons are captured, published and disseminated to all districts in Bhutan with GLOF vulnerabilities 		
Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings	<p>Number of vulnerable communities in Punakha-Wangdi Valley reached by early warning system</p> <p>Percentage of households receiving and responding to warnings in time to avoid human losses</p>	<p>No GLOF early warning system for Punakha-Wangdi Valley in place</p> <p>Vulnerable households are not able to receive and react to GLOF early warning messages</p>	<ul style="list-style-type: none"> By the end of the project, 90% of households in target communities are able to receive and respond to early warnings and take the appropriate actions following the warning. 	<p>Rehearsal observations</p> <p>QBS with households</p>	<p>No tampering with early warning system installations</p> <p>Functioning backup systems in place</p>
Output 3.1: Technical components for a GLOF early warning system in Punakha-Wangdi Valley installed and operational	Number of sensors and siren towers installed and tested regularly	No sensors or siren towers in Punakha-Wangdi Valley	<ul style="list-style-type: none"> By the end of Year 1, a set of GLOF sensors installed, tested, and maintained in at least two locations north of Wolathang By the end of Year 3, 8 siren 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 	<p>Survey of sensor/siren tower locations</p> <p>Physical presence of infrastructure</p> <p>Testing results</p>	<p>Procurement proceeds on schedule</p> <p>Transport of building materials not delayed by seasonal climate extremes</p>
Output 3.2: Established institutional arrangements to operate, test, and maintain the GLOF early warning system	<p>EWS and response plan integrated in the <i>Dzongkhag</i> Disaster Management plans</p> <p>Number of early warning focal points identified and trained</p> <p>Early warning system remains operational</p>	No focal points trained on GLOF early warning system	<ul style="list-style-type: none"> By the end of Year 1, at least two early warning focal points in both of the target districts identified and trained in the testing and maintenance of the early warning system By the end of Year 2, DDMCs in target area trained on EWS/response plans By the end of Year 3, functioning of the GLOF early warning 	<p>Training reports</p> <p>Field tests</p> <p>Rehearsals under different conditions</p>	<p>Staff turnover does not negate training benefits</p> <p>Government continues to allocate resources for maintenance and continuous testing of early warning system</p>

Outcomes/ Outputs	Indicator	Baseline	Target	Sources of Verification	Risks and Assumptions
			system is tested at least monthly		
Output 3.3: Raised awareness of communities in the Punakha-Wangdi valley on operation of early warning system	Percentage of households in vulnerable communities aware of the new GLOF early warning system and able to effectively respond to warning messages	No awareness by vulnerable communities in the Punakha-Wangdi Valley on GLOF early warning procedures	<ul style="list-style-type: none"> By the end of the project, at least 90% of households in the target area are aware of the operation of the GLOF early warning system are able to correctly receive and interpret early warning signals By the end of the project, at least 1 full-scale GLOF early warning drill in all target vulnerable communities before the project closure 	<p>QBS</p> <p>Rehearsal observations and planning protocols</p>	<p>Messages are delivered in an appropriate way to enhance awareness, receptiveness and understanding</p> <p>Messages are delivered in a concerted, coordinated and consistent manner</p>
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	<p>No GLOF evacuation areas identified</p> <p>Communities do not know where to safely congregate in the event of a GLOF disaster</p>	<ul style="list-style-type: none"> By the end of Year 2, GLOF evacuation areas identified for each target community By the end of Year 2, designation of, and accessibility to, all safe GLOF evacuation areas ensured and maintained 	<p>QBS</p> <p>Maps and signs indicating way to safe areas</p> <p>Disaster simulation exercise reports</p>	<p>At least two sufficiently safe evacuation points exist in and around target communities</p> <p>All DRM stakeholders cooperate in simulation exercises</p>
Output 3.5: Technical knowledge and lessons in the installment and operation of GLOF early warning systems captured and documented for use in future projects	<p>Evaluation of experiences with the operation and testing of the GLOF early warning system</p> <p>Number of instructive materials developed</p>	<p>No structured evaluation of GLOF early warning systems in Bhutan available</p> <p>No instructive materials available</p> <p>No systematic capturing of knowledge on the establishment, monitoring, and maintenance of GLOF early warning systems</p>	<ul style="list-style-type: none"> By the end of the project, a comprehensive evaluation of the operation and potential replication of the GLOF early warning system is conducted By the end of the project, all relevant reports on GLOF early warning systems are included in DGM database By the end of the project, lessons learned are disseminated to all GLOF-vulnerable DDMCs by means of publications and instructive videos By the end of the project, replication plan for early warning system in Chamkhar Valley developed 	<p>Evaluation report</p> <p>DGM database</p> <p>Instructive materials</p> <p>Replication plan</p>	<p>Government ownership of GLOF early warning technology</p> <p>National political agreement for follow-up plan on GLOF early warning</p>

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

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

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
<u>Output 1.1:</u> Climate-resilient DRM legislation, policy frameworks, and sectoral plans	<ul style="list-style-type: none"> ➤ 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. 	<ul style="list-style-type: none"> ➤ 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.
<u>Output 1.2:</u> Capacities for climate risk planning strengthened at the district (<i>dzongkhag</i>) administrative level	<ul style="list-style-type: none"> ➤ By the end of year 2, 3 <i>Dzongkhag</i> Disaster Management Committees and <i>Gewog</i> DMCs in the project area are trained on climate change and GLOF risk management. ➤ By the end of year 2, <i>Dzongkhag</i>/Thromde Disaster Management Plans in Punakha, Wangdi and Bumthang are developed to account for GLOF hazards. 	<ul style="list-style-type: none"> ➤ DDMCs and DDMAPTs of Punakha, Wangdi and Bumthang trained in CBDRM. ➤ GDMCs in Punakha and Wangdi trained in CBDRM. ➤ <i>Dzongkhag</i> and <i>Gewog</i> Disaster Management Plans are under preparation, following CBDRM training.
<u>Output 1.3:</u> Information on climate hazards and vulnerabilities (with a focus on GLOFs) in Bhutan systematically captured, updated and synthesized	<ul style="list-style-type: none"> ➤ National database on GLOF vulnerability and climate risk information in Bhutan systematically and continually updated. ➤ Within 2-3 years of start of project implementation, an information management system exists and by the end of the project a survey of key stakeholders reveals that they have access to relevant information on adaptation to climate change. ➤ Annual workshop to present information on climate change-induced GLOF risks to relevant government departments. ➤ Updated DGM website 	<ul style="list-style-type: none"> ➤ 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 exist 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	<ul style="list-style-type: none"> ➤ 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. 	<ul style="list-style-type: none"> ➤ 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	<p>By the end of year 1:</p> <ul style="list-style-type: none"> ➤ 1 geotechnical assessment report confirming current status of moraine dam; ➤ 1 safety and evacuation plan; ➤ 1 engineering plan outlining the detailed location for mitigation works; ➤ 1 EIA report; ➤ Approval of engineering and safety plans by the Project Boards 	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> ➤ By the end of the project, the water level of Thorthormi lake is lowered by 5 metres. 	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> ➤ By the end of the project, 10 DGM and DoE staff trained in monitoring of water flows and functioning of lowering system. ➤ At least two monitoring reports are produced and disseminated per year on the status of lake level and lowering system. 	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> ➤ By the end of the project, a comprehensive evaluation of the operation and potential 	<ul style="list-style-type: none"> ➤ Data for the planned evaluation are being accrued through the annual

<p>lowering of glacier lake levels captured and documented for use in future projects</p>	<p>replication of glacial lake level management system is conducted.</p> <ul style="list-style-type: none"> ➤ 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. 	<p>monitoring reports.</p> <ul style="list-style-type: none"> ➤ 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.
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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
<p><u>Output 3.1:</u> Technical components for a GLOF early warning system in the Punakha-Wangdi valley installed and operational</p>	<ul style="list-style-type: none"> ➤ By the end of Year 1, a set of GLOF sensors installed, tested, and maintained in at least two locations north of Wolathang. ➤ By the end of Year 3, 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. 	<ul style="list-style-type: none"> ➤ 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.
<p><u>Output 3.2:</u> Institutional arrangements in place to operate, test, and maintain the GLOF EWS</p>	<ul style="list-style-type: none"> ➤ 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 	<ul style="list-style-type: none"> ➤ 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.

	monthly.	
<u>Output 3.3:</u> Raised awareness of communities in the Punakha-Wangdi valley on operation of early warning system	<ul style="list-style-type: none"> • By the end of the project, at least 90% of households in the target area are aware of the operation of the GLOF early warning system 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 	<ul style="list-style-type: none"> ➤ 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.
<u>Output 3.4:</u> Raised awareness of safe GLOF evacuation areas in each vulnerable community in the Punakha-Wangdi Valley	<ul style="list-style-type: none"> • By the end of Year 2, GLOF evacuation areas identified for each target community ➤ By the end of Year 2, designation of, and accessibility to, all safe GLOF evacuation areas ensured and maintained 	<ul style="list-style-type: none"> ➤ GLOF evacuation areas identified for the vulnerable communities.
<u>Output 3.5:</u> Technical knowledge and lessons in the installation and operation of GLOF EWS captured and documented for use in future projects	<ul style="list-style-type: none"> ➤ 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. 	<ul style="list-style-type: none"> ➤ 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
<u>Output 4.1:</u> Project lessons captured and disseminated through the Adaptation Learning Mechanism (ALM)	<ul style="list-style-type: none"> ➤ By the end of the project, all project monitoring and evaluation reports are screened for inclusion in the ALM. ➤ By the end of the project, key project lessons disseminated through ALM. 	<ul style="list-style-type: none"> ➤ Project reports and information are being accumulated for future analysis and inclusion in ALM.
<u>Output 4.2:</u> Project knowledge shared with other GLOF-prone countries	<ul style="list-style-type: none"> ➤ By the end of the project, organization and hosting of one international workshop on GLOF risk reduction. 	<ul style="list-style-type: none"> ➤ A project proposal to reduce GLOF risks in Pakistan is being developed using Bhutan's experience and approach

Reducing Climate Change-induced Risks and Vulnerabilities from GLOF (Annex-6)

Revisions endorsed at the 9th PB meeting 11/11 2011

Revised STRATEGIC RESULTS FRAMEWORK (SRF)

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

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

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
Output 1.3: Information on climate hazards and GLOF vulnerabilities in Bhutan systematically captured, updated and synthesized	Number of government departments actively accessing and utilizing climate risk information	Initial national communication to UNFCCC, NAPA, and NDRMF available Basic DGM database on GLOF hazards established during the PPG phase	<ul style="list-style-type: none"> • National database on GLOF vulnerability and climate risk information in Bhutan systematically and continually updated • Within 2-3 years of start of project implementation an information management system exists and by the end of the project a survey of key stakeholders reveals that they have access to relevant information on adaptation to climate change. • Biennial workshops 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	<ul style="list-style-type: none"> • By the end of Year 1, all GLOF-vulnerable communities in the Punakha-Wangdi and Chamkhar Valleys identify disaster and climate risk management focal points • By the end of Year 3, 80% 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	Level of GLOF risk from Thorthormi Lake	Thorthormi Lake is among the most hazardous of Bhutan's 25 lakes with a high risk of	<ul style="list-style-type: none"> • By the end of the project, Thorthormi Lake is no longer considered at high risk of GLOF, as scientifically 	Satellite data and field survey of lake Scientific assessment	No natural disasters in project area Workforce availability

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
through an artificial lake level management system		GLOF	assessed at the project's completion		Climatic conditions permit at least five months of excavation work each year
Output 2.1: Engineering and safety plans for risk reduction measures on Thorthormi lake developed	Availability of an up-to-date engineering and safety plan for GLOF mitigation works	Feasibility study of technical mitigation measures for Thorthormi lake from 2004	By the end of Year 1: <ul style="list-style-type: none"> • 1 geotechnical assessment report confirming current status of moraine dam • 1 safety and evacuation plan • 1 engineering plan outlining the detailed location for mitigation works • 1 EIA report • Approval of engineering and safety plans by PB 	Engineering plan Safety and evacuation plan	No natural disasters in project area Climatic conditions permit the geotechnical assessment to take place
Output 2.2: Lowered Thorthormi Lake water levels	Artificial lowering system for lake water levels in place	No artificial lowering system of glacier lake levels is installed and continuously maintained Surface area of lake in 2001 measured 1.28 km ² and is still expanding 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	No staff has been trained in how to artificially regulate glacier lake levels	<ul style="list-style-type: none"> • By the end of the project, 10 DGM, and DOE staff trained in monitoring of water flows and functioning of lowering system • At least one monitoring reports are produced and disseminated 	Training reports	Staff turnover does not negate training benefits Government continues to allocate resources to maintain artificial lowering system

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
	reports detailing status of lake level and lowering system		per year on the status of lake level and lowering system	Satellite data and field survey reports	
Output 2.4: Captured and documented technical knowledge and lessons in the artificial lowering of glacier lake levels for use in future projects	<p>Number of follow-up projects planned</p> <p>Number of successful national technology transfer initiatives</p> <p>Number of project reports published and disseminated</p>	<p>DGM database of feasibility reports on lowering glacial lakes</p> <p>No systematic capturing of knowledge on the establishment, monitoring, and maintenance of artificial glacial lake lowering systems</p>	<ul style="list-style-type: none"> • By the end of the project, a comprehensive evaluation of the operation and potential replication of the glacier lake level management system is conducted • By the end of the project, all relevant lessons for the lowering and management of glacier lake levels are captured in the DGM database • By the end of the project, national agreement to embark on at least 1 follow-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 	<p>Evaluation report</p> <p>DGM database</p> <p>Meeting minutes, evidence of policy dialogue and active stakeholder engagement</p> <p>Dissemination plan and accompanying publications</p>	<p>Continued assessment of GLOF risks in Bhutan</p> <p>National ownership of glacier lake management technology</p> <p>National political agreement for follow-up plan on GLOF risk management</p> <p>National agreement on other project sites with GLOF risk as priority hazard</p> <p>Artificial lowering system in the target area contains elements that can be replicated elsewhere</p>

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
Outcome 3: Reduced human and material losses in vulnerable communities in the Punakha-Wangdi Valley through GLOF early warnings	<p>Number of vulnerable communities in Punakha-Wangdi Valley reached by early warning system</p> <p>Percentage of households receiving and responding to warnings in time to avoid human losses</p>	<p>No GLOF early warning system for Punakha-Wangdi Valley in place</p> <p>Vulnerable households are not able to receive and react to GLOF early warning messages</p>	<ul style="list-style-type: none"> By the end of the project, 90% of households in target communities are able to receive and respond to early warnings and take the appropriate actions following the warning. 	<p>Rehearsal observations</p> <p>QBS with households</p>	<p>No tampering with early warning system installations</p> <p>Functioning backup systems in place</p>
Output 3.1: Technical components for a GLOF early warning system in Punakha-Wangdi Valley installed and operational	<p>Number of sensors and siren towers installed and tested regularly</p>	<p>No sensors or siren towers in Punakha-Wangdi Valley</p>	<ul style="list-style-type: none"> By the end of year 2, site survey in the Punakha-Wangdue and Lunana and tendering process initiated By the end of year 3, tendering process completed and supply of equipments and civil works in both Punakha-Wangdue valley and Lunana completed. By end of year 4, EWS completed and operational including sensors in Lunana and Dangsa, in total 17 siren towers and control station in Wangdue By the end of Year 4, contingency plans and backup systems for operation of early warning systems are in place 	<p>Survey of sensor/siren tower locations</p> <p>Physical presence of infrastructure</p> <p>Testing results</p>	<p>Procurement proceeds on schedule</p> <p>Transport of building materials not delayed by seasonal climate extremes</p>
Output 3.2: Established institutional arrangements to operate, test, and maintain the GLOF early warning system	<p>EWS and response plan integrated in the Dzongkhag Disaster Management plans</p> <p>Number of early warning focal points</p>	<p>No focal points trained on GLOF early warning system</p>	<ul style="list-style-type: none"> By the end of Year 1, at least two early warning focal points in both of the target districts identified and trained in the testing and maintenance of the early warning system 	<p>Training reports</p>	<p>Staff turnover does not negate training benefits</p> <p>Government continues to allocate resources for maintenance and continuous testing of</p>

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
	identified and trained Early warning system remains operational		<ul style="list-style-type: none"> • 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 	Field tests Rehearsals under different conditions	early warning system
Output 3.3: Raised awareness of communities in the Punakha-Wangdi valley on operation of early warning system	Percentage of households in vulnerable communities aware of the new GLOF early warning system and able to effectively respond to warning messages	No awareness by vulnerable communities in the Punakha-Wangdi Valley on GLOF early warning procedures	<ul style="list-style-type: none"> • By the end of the project, at least 90% of households in the target area are aware of the operation of the GLOF early warning system are able to correctly receive and interpret early warning signals • By the end of the project, at least 1 full-scale GLOF early warning drill in all target vulnerable communities before the project closure 	QBS Rehearsal observations and planning protocols	<p>Messages are delivered in an appropriate way to enhance awareness, receptiveness and understanding</p> <p>Messages are delivered in a concerted, coordinated and consistent manner</p>
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	<p>No GLOF evacuation areas identified</p> <p>Communities do not know where to safely congregate in the event of a GLOF disaster</p>	<ul style="list-style-type: none"> • By the end of Year 2, GLOF evacuation areas identified for each target community • By the end of Year 2, designation of, and accessibility to, all safe GLOF evacuation areas ensured and maintained 	QBS Maps and signs indicating way to safe areas Disaster simulation exercise reports	<p>At least two sufficiently safe evacuation points exist in and around target communities</p> <p>All DRM stakeholders cooperate in simulation exercises</p>
Output 3.5: Technical knowledge and lessons in the installment and operation of GLOF early warning systems captured and documented for use in future projects	<p>Evaluation of experiences with the operation and testing of the GLOF early warning system</p> <p>Number of instructive materials developed</p>	<p>No structured evaluation of GLOF early warning systems in Bhutan available</p> <p>No instructive materials available</p> <p>No systematic capturing</p>	<ul style="list-style-type: none"> • By the end of the project, a comprehensive evaluation of the operation and potential replication of the GLOF early warning system is conducted • By the end of the project, all relevant reports on GLOF early warning systems are 	Evaluation report DGM database	Government ownership of GLOF early warning technology

	Indicator	<i>Baseline</i>	<i>Target</i>	Sources of verification	Risks and Assumptions
		of knowledge on the establishment, monitoring, and maintenance of GLOF early warning systems	<p>included in DGM database</p> <ul style="list-style-type: none"> • By the end of the project, lessons learned are disseminated to all GLOF-vulnerable DDMCs by means of publications and instructive videos • By the end of the project, replication plan for early warning system in Chamkhar Valley developed 	<p>Instructive materials</p> <p>Replication plan</p>	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	<ul style="list-style-type: none"> • By the end of the project, GLOF mitigation and early warning initiatives or studies draw on learning from experiences in Bhutan 	ALM platform Proposals, papers, and other documents	The ALM is operational and circumstances in Bhutan apply to future GLOF mitigation and preparedness initiatives
Output 4.1. Project lessons captured and disseminated through the Adaptation Learning Mechanism	Number of contributions by the project to the ALM	No contribution by Bhutan to the ALM	<ul style="list-style-type: none"> • By the end of the project, all project monitoring and evaluation reports are screened for inclusion in the ALM • By the end of the project, key project lessons disseminated through ALM 	ALM platform	The ALM is operational to facilitate learning
Output 4.2. Project knowledge shared with other GLOF-prone countries	Number of organizations actively involved in knowledge transfer activities across borders	No systematic knowledge transfer on GLOF risks from Bhutan to other countries	<ul style="list-style-type: none"> • By the end of the project, organization and hosting of 1 international workshop on GLOF risk reduction 	Workshop proceedings	Other regions and countries believe experiences from the project will be valuable for future GLOF mitigation and preparedness initiatives

UNDP Management Response Template (Annex-7)

Mid-Term Evaluation of “Reducing Climate Change-induced Risks and Vulnerabilities in Chamkar and Punakha-Wangdi valleys”

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Position: *Head*

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Overall comments: The MTR recognized that the project is highly relevant in the overall development context and that 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 and the key adaptation needs and priorities identified in the Bhutan NAPA. Overall, project progress is good when assessed against planned outputs/targets and an assessment of the project management and administration revealed a high level of stakeholder ownership and engagement. Documentation and financial planning need improvement. 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.

Recommendation for Corrective Actions in project design and implementation (section 4.2.1)

Evaluation Recommendation or Issue 1: <i>Project Design</i>				
Management Response: The Strategic Results Framework (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. In order to reflect new project circumstances and needs and to improve the quality of project monitoring and reporting, the MTR recommended a review of the project SRF.				
Key Action(s):	Time Frame	Responsible Unit(s)	Tracking*	
			Status	Comments
The changes recommended in section 2.4.1 of the MTR (page 26-28) will be reviewed and presented for endorsement at the 9 th Project Board meeting scheduled for 11 January 2011.	January 2011	Project Director, UNDP CO and Project Board (PB)	Completed	Endorsement of the PB will be captured in the minutes of 9 th PB meeting.
Evaluation Recommendation or Issue 2: <i>Project monitoring and reporting</i>				
Management Response: The MTR recommends strengthening of monitoring and reporting especially in relation to the SRF. It is recommended that the AWP’s and quarterly progress reports are linked to the				

expected outputs and targets and not just the broad outcomes. This will ensure that the AWP's 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking	
			Status	Comments
The AWP 2011 is linked to the outputs of the revised SRF. Furthermore, quarterly progress reports should be linked to the expected outputs and targets as per the revised SRF to ensure consistency, and should be more perceptive to capture progressive results, lessons and issues that emanate from project implementation. Documentation of activities should also be addressed during the quarterly coordination meetings.	January 2011 and onwards	Project Director, Project managers DGM, DoE, DDM	On-going	
Evaluation Recommendation or Issue 3: <i>Establishing baseline information</i>				
Management Response: The MTR observed that some of the project results, especially those related to capacity development under outcome 3, require to be assessed through QBS. Since no baseline was established at the beginning of the project, a baseline QBS need to be carried out as well as an assessment towards the end of the project.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking	
			Status	Comments
Baseline QBS should be conducted in the 1 st quarter of 2011 to establish the baseline for comparison with the QBS to be conducted by the end of the project.	April 2011	Project manager DDM		
Evaluation Recommendation or Issue 4: <i>Project Implementation</i>				
Management Response: The MTR found that project implementation is affected by the considerable amount of time that goes into procedural work pertaining to reporting and fund releases. 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking	
			Status	Comments

Based on discussions between UNDP and the project managers following the MTR, timely fund releases and reporting have already improved. A UNDP HACT training on reporting was conducted in October 2010 and attended by the project managers/accountants to improve reporting. The UNDP CO will ensure efficient use of staff twinning arrangement to ensure swift approval of fund releases. Quarterly coordination meetings (refer issue 7) will also help to improve financial reporting, financial planning and fund releases.	On-going Quarterly coordination meetings to be conducted from January 2011 and throughout the project period	UNDP CO, Project managers DGM, DoE and DDM	On-going	
Evaluation Recommendation or Issue 5: <i>Financial planning</i>				
Management Response: The MTR found that 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 therefore recommended that a joint review of the financial aspects of the project be carried out as soon as the financial reporting for the 2010 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking	
			Status	Comments
Joint review of the financial aspects of the project should be carried out following the completion of financial reporting for the 2010 AWP, and again following the completion of the EWS and the 4 th phase of the mitigation works in the beginning of 2012.	March 2011 and January 2012	Project Director; Project managers DGM, DoE and DDM, UNDP CO		
Evaluation Recommendation or Issue 6: <i>Lessons learnt and workshop</i>				
Management Response: The MTR recommends 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
Conduct workshop within the 1 st and 2 nd quarter of 2011.	May 2011	Project Director, Project managers DGM, DDM, DoE		
The ALM profile from 2008 should be updated capturing lessons learned, issues and best practice.	September 2010	UNDP CO	Completed	ALM updated in September 2010
Evaluation Recommendation or Issue 7: Project linkages				
Management Response: The MTR recommends that linkages between the various project components/ outcomes need 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
Project linkages and coordination should be improved through quarterly coordination meetings taking place at the beginning of each quarter, also addressing linkages, challenges and overlaps, planned field work, etc.	Quarterly coordination meetings to be conducted from January 2011 and throughout the project period	Project Director; Project managers DGM, DoE and DDM, UNDP CO	On-going	First coordination meeting conducted on 6 January 2011
Project managers should share their quarterly progress reports with each other for mutual information.	From January 2011 and onwards	Project managers DGM, DDM and DoE	On-going	
Evaluation Recommendation or Issue 8: Formal partnership				
Management Response: The MTR recommends establishment of a 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
The JICA/JST project is based within the Department of	Mid-2012	Project Director DGM,		

Geology and Mines, and the two projects have the same Project Director ensuring coordination. Moreover, Department of Energy is in dialogue with JICA regarding the EWS and a possible expansion (refer issue 10). UNDP is also in regular contact with JICA regarding GLOF-related activities. The Project Director will ensure the ongoing coordination with JICA/JST – also including other project staff during the technical workshop conducted by JICA/JST in March 2011, and the project workshop where JICA/JST will be invited. While a formal partnership is not deemed necessary, the project should ensure that the JICA/JST inventory is part of the database and information management system developed under the project.		project manager DGM		
Evaluation Recommendation or Issue 9: <i>Health and Safety</i>				
Management Response: In view of the deaths that occurred due to altitude sickness and other ailments in the 2010 working season, the MTR 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking	
			Status	Comments
An independent Health and Safety Assessment to assess the safety measures deployed in the response to the incidents in 2010 has been conducted, including recommendations to improve health and safety for the mitigation team.	November 2010	UNDP CO, Project Director, Project manager DGM	Completed	
Review recommendations of the Health and Safety Assessment and endorse decisions. Actions and yearly budget to carry out the decisions will be incorporated in the Annual Work plan for 2011.	January 2011	Project Board	Completed	Endorsement of the PB will be captured in the minutes of 9 th PB meeting.
Recommendations and proposals to reinforce or enhance project benefits (section 4.2.2)				
Evaluation Recommendation or Issue 10: <i>Project replication</i>				
Management Response: Early consultations with potential donors are recommended by the MTR in order 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.				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
The replication/follow-up to the project is also part of the targets set in the project logframe, and all project stakeholders are exploring possible avenues in dialogue with potential donors. Department of Energy submitted a proposal to JICA in July 2010 for set-up of a GLOF-EWS in the Mangchhu and Chamkarchhu. If approved the project will be implemented before the end of 2013. DDM is also discussing with ADRC regarding a GLOF EWS for Mochhu basin.	Ongoing until mid-2012	Project Director, project managers DGM, DoE, DDM, UNDP CO		
Evaluation Recommendation or Issue 11: <i>CBDRM training curriculum</i>				
Management Response: 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, is deemed necessary by the MTR to improve the trainings. The training curriculum will also need to be complemented with appropriate training tools and materials (e.g. flip chart, poster, illustrated handbook).				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
DDM has reviewed the CBRDM curriculum with technical assistance from a national consultant in 2010. The CMDRM ToTs and training are completed in the 3 target districts under the project, but will be continued in other districts as part of other projects/programmes. To ensure sustainability and national coverage of the CBDRM trainings, the reviewed curriculum and further improvement of training methods and materials should be used and pursued under other projects/programmes, in particular the WB and planned GFRDD-funded project. By the end of the project, documentation capturing the lessons learnt of the CBDRM training and planning processes should be prepared and disseminated.	Mid-2012	Project manager DDM		
Evaluation Recommendation or Issue 12: <i>Environmental Impact Assessment</i>				

<p>Management Response: The MTR highlighted that 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. An ‘ecological footprint’ study towards the end of the project is recommended 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.</p>				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
An EIA assessment should be conducted by the end of the project, if resources are available (based on financial review in January 2012).	End 2012	Project Director, project manager DGM		
<p>Evaluation Recommendation or Issue 13: <i>Project replication</i></p>				
<p>Management Response: The MTR recommends monitoring of the glacial lakes as a key area in future GLOF work in Bhutan, 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.</p>				
Key Action(s)	Time Frame	Responsible Unit(s)	Tracking Status	Comments
This point is already being addressed by the JICA/JST project as well as other activities conducted by the Department of Geology and Mines.	-	-	-	-

* The implementation status is tracked in the ERC.