Initial Environmental Examination

March 2014

BHU: SASEC Road Connectivity Project

Phuentsholing Bypass Road

Prepared by the Ministry of Economic Affairs, Royal Government of Bhutan for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 17 March 2014)

Currency unit	–	Ngultrum (Nu)
Nu1.00	=	$
$1.00	=	Nu

ABBREVIATIONS

ADB	–	Asian Development Bank
BOD	–	biological oxygen demand
CFO	–	Chief Forestry Officer
DO	–	dissolved oxygen
DOFPS	-	Department of Forest and Park Services
DOR	–	Department of Roads
DOT	–	Department of Trade
EAA	–	Environmental Assessment Act (2000)
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ES	–	Environmental Specialist
IEE	–	initial environmental examination
MEA	–	Ministry of Economic Affairs
MMP	–	Materials Management Plan
MOAF	–	Ministry of Agriculture and Forests
MOWHS	–	Ministry of Works and Human Settlements
PBR	-	Phuentsholing Bypass Road
PMU	–	Project Management Unit
PT	-	Phuentsholing Thromde
REA	–	Rapid Environmental Assessment
RECOP	-	Regulations for Environmental Clearance of Project 2002
RGOB	–	Royal Government of Bhutan
SEMP	–	Specific Environmental Management Plan
SPS	–	ADB Safeguard Policy Statement (2009)
SR	–	Sensitive Receiver
TA	–	Technical Assistance
TOR	–	Terms of Reference
TSP	–	total suspended particulate
TSS	–	total suspended solids
TOR	–	Terms of Reference
TMP	–	Traffic Management Plan

WEIGHTS AND MEASURES

dB (A)	decibel (A-weighted)
masl	meters above sea level
km	kilometre
km/h	kilometre per hour
m	meter
m^3	cubic meter

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EXECUTIVE SUMMARY

1. The Royal Government of Bhutan (RGOB) has requested the Asian Development Bank (ADB) to provide financing to facilitate investments to support the Phuentsholing Bypass Road. Phuentsholing Thromde1 (PT) will be the implementing and executing agency for development of Phuentsholing Bypass Road (PBR).

2. This report is the initial environmental examination (IEE) for the Project and complies with the provisions of ADB's Safeguard Policy Statement (SPS 2009). The IEE has been carried out to ensure that the potential adverse environmental impacts are appropriately mitigated and to present the environmental assessments for the Project. The Phuentsholing Bypass Road (PBR) will be an improvement of about 1.8 km of the existing roads in Phuentsholing and additionally about 1 km of roads and two new bridges providing crossings over the Om Chhu River for the associated roads (Figures 1 & 2).

3. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the project area, (ii) identify potential environmental impacts from the proposed works, (iii) evaluate and determine the significance of the impacts, (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental impacts, and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. This IEE is submitted to ADB by the PT and before the proposals are agreed to be financed by ADB the final IEE report will be disclosed to the public through the ADB website and to the public in Bhutan by PT.

4. **Project Description.** The proposed works will require widening, reconstruction and a new section of road and additional crossing over the Om Chhu River. The total road length of the road is about 2.8km and the span of the bridge will need to be wide enough to cross the Om Chhu River which is about 80m wide near the crossing point. The works will generally be within or adjacent to existing road corridor for 1.8 km. About 1.0 km will be new construction. The Project will include construction of (i) earthworks to facilitate replacement of existing roads and upgrading of the PBR carriageway and extended road base, and surfacing works (ii) construction of bridges and viaduct over the river (iii) construction, renewing and reconstructing culverts and drains serving the PBR route (iv) providing better crossing drains and better side drains and lead off drainage facilities.

5. Detailed design of the project is likely to start by the beginning of 2015; while the construction work will begin by third quarter of 2015 and end by the mid of 2019.

6. **Categorization.** The project is classified as Category B in accordance with ADB's Safeguard Policy Statement (2009), as no significant impacts are envisioned.

7. The focus of this IEE is on the key physical activities in the above outputs which would *cause environmental impacts* as defined by SPS, 2009. This IEE is based on field reconnaissance surveys, secondary sources of information, and public consultation undertaken specifically for this study.

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1 Thromde – Muncipality

8. **Implementation Arrangements.** Phuentsholing Thromde (PT) is the implementing agency and the Phuentsholing Bypass Road (PBR) will be implemented through the Project Coordination Unit (PCU). Under the PCU there will be two Project Implementation Units (PIUs) responsible for day-to-day operation of each subproject, viz. one for Phuentsholing Mini Dry Port (MDP) and Alay Land Customs Station (LCS) and one for Phuentsholing Bypass Road (PBR). Project Manager (PM) heading the PIU will be the environmental focal person for the PT at the PIU level, who is responsible for ensuring the compliance of environmental conditions of the project. Construction Supervision Consultant (CSC) hired is part of the PCU. It includes Team Leader (the Engineer) supported by Survey Engineer, Bridge Engineer, Material Engineer, Quantity Surveyor, Environmental Specialist (ES), Resettlement Specialist (RS), and resident engineers (RE) and site inspectors (SI). Each PIU will have respective RE and SI that includes PBR. RE and SI will be main the persons who will carry out the daily monitoring of construction works; and ensure the implementation of environmental mitigation measures as prescribed in the EMP, by the contractor. The contractor through its Project Manager/engineer will be responsible for submission of monthly EMP compliance report. Similarly, RE will also submit the monthly project progress report which includes the section on compliance of environmental terms and conditions. ES will carry out intermittent environmental compliance monitoring of the project to ensure the environmental mitigation measures or conditions are adequately addressed. ES will be responsible for compiling and submitting the quarterly environmental compliance report to the PT through PCU; and semi-annual report to the ADB.

9. **Policy, legal, and administrative framework.** The Project shall comply with requirements of the ADB SPS 2009 and the Government's guidelines or initiatives on implementation of Environmental Assessment Act 2000 and the Regulation for Clearance of Projects (RECOP), 2002 under the Environmental Assessment Act 2000). The National Environment Commission (NEC) delegates powers to various competent authorities including MOWHS for issuances of environmental clearance for the projects as listed under the RECOP 2002. MOWHS can issue environmental clearance (EC) for PBR based on the IEE submitted by PT.

10. **Environmental management plan.** Mitigation measures, environmental monitoring, and capacity development are required to minimize the environmental impacts in the design, construction, and operational phases.

11. The environmental management plan (EMP) is prepared to ensure the negatives impacts are mitigated to the maximum feasible extent. The EMP which will form part of the bidding and contract documents and will include: (i) waste management and spoil disposal; (ii) temporary and permanent drainage; (iii) runoff control and excavation protection; (iv) noise and dust control; (v) temporary traffic management; and (vi) worker and public safety.

12. The construction and operation of the Phuentsholing Bypass Road (PBR) will have beneficial effects on the overall surrounding environment. The construction of PBR in combination with the construction of Mini Dry Port will remove congestion of Phuentsholing town; improve transport efficiency through shortening of transport distance; reduce greenhouse gas emission; minimize air pollution; and improve the regional trade and commerce.

13. **Information disclosure, consultation, and participation.** The stakeholder consultation process disseminates information to all key stakeholders, including the general public and authorities, through meetings and door-to-door surveys around the project area. Information was provided on the scale and scope of the project works, expected impacts, and the proposed

mitigation measures by means of consultations with local government departments, local authorities, and the general public by surveys. The 13. process also gathered information on relevant concerns of the authorities and local community so as to address these in the project implementation stage.

14. **Grievance redress mechanism (GRM).** A GRM will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM aims to provide a time bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

15. **Conclusion and recommendations.** The IEE study of the proposed development of Mini Dry Port reveals that the benefits from their implementation are more significant and long term in nature; against the adverse impacts, most of which could be mitigated or avoided. Therefore, this IEE is sufficient for approval of the proposed project. This project is recommended for implementation with incorporation of mitigation measures and environmental monitoring plan.

Figure 1: Location of Phuentsholing Bypass Road

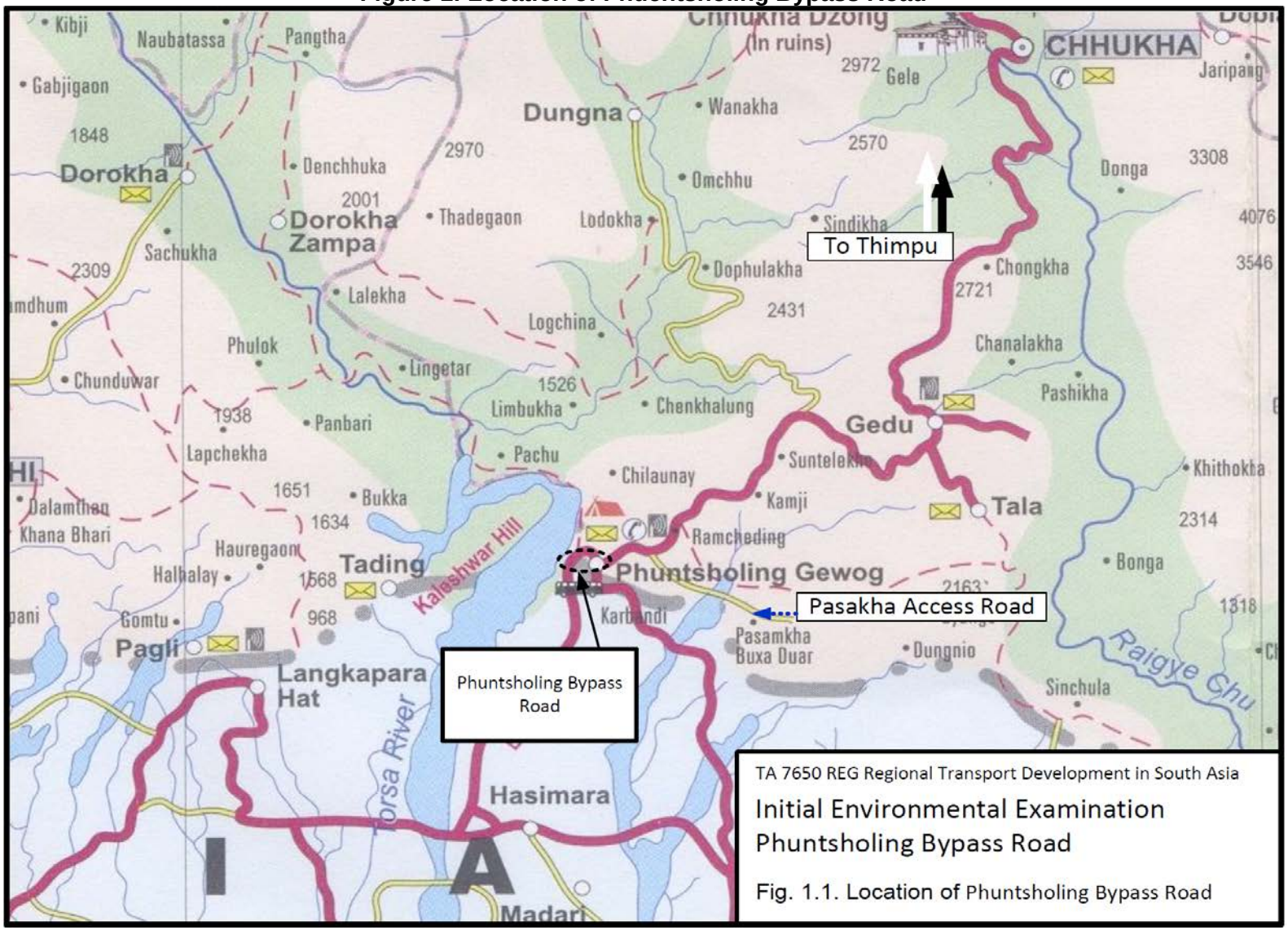
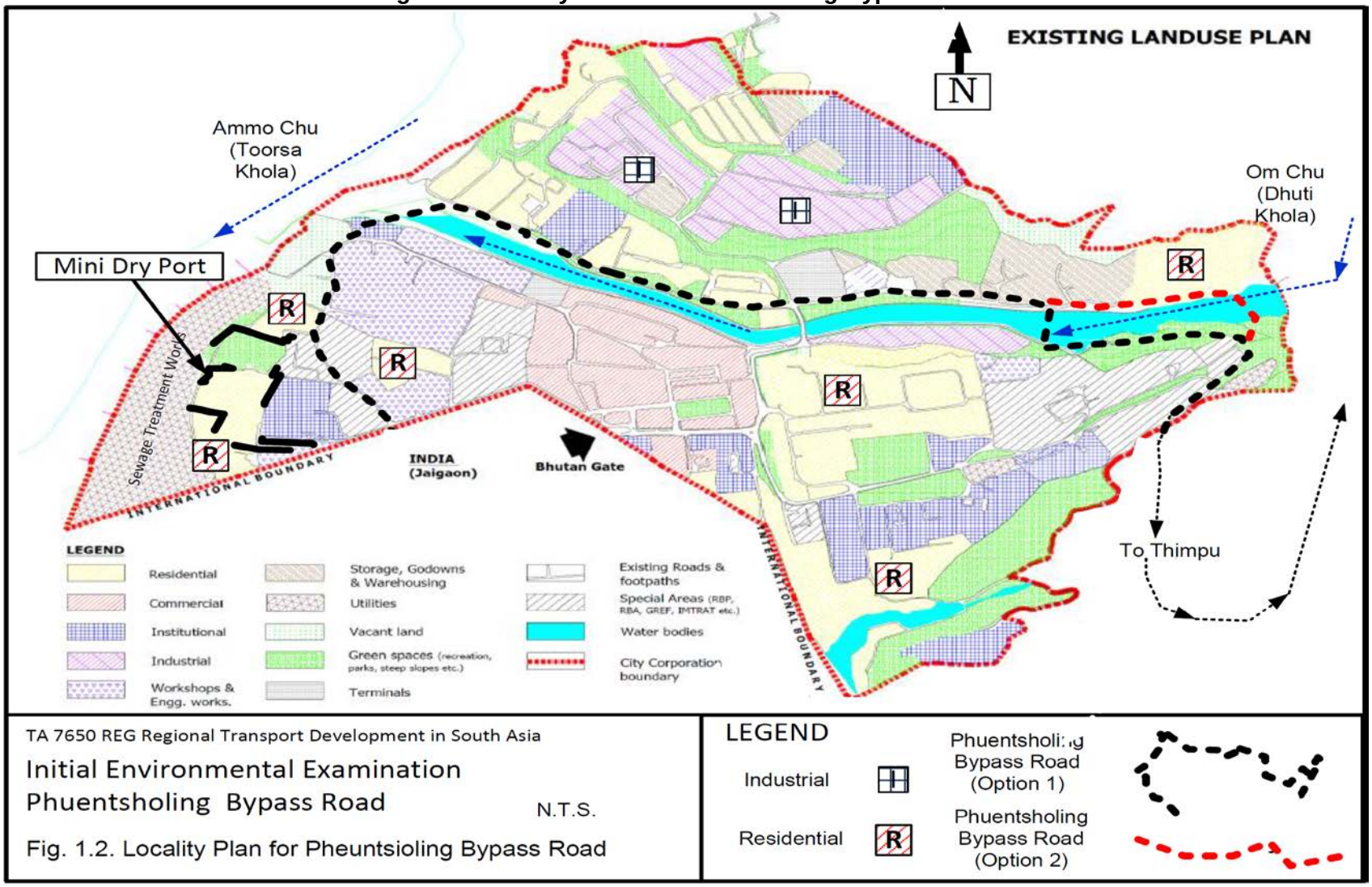


Figure 2: Locality Plan for Phuentsholing Bypass Road



I. INTRODUCTION

A. Project Background

1. South Asia Subregional Economic Cooperation (SASEC) involving four member countries; namely Bangladesh, Bhutan, India and Nepal; have entered into a regional cooperation to improve or develop regional trade and commerce through development of integrated land transport and related infrastructures. For Bhutan, project is identified as "SASEC Road Connectivity Project", which includes following components or sub-projects:

a) 68.3Km Nganglam-Deothang Highway (NDH);
b) 1.2Km Pasakha Access Road (PAR) including Land Custom Station (LCS) at Alay;
c) 2.8km Phuentsholing Bypass Road (PBR); and
d) Mini Dry Port (MDP) at Phuentsholing

2. 68.3km NDH is the major components of the SASEC Road Connectivity Project; and it is classified as an Environment Category A Project in line with ADB's Safeguard Policy Statement (SPS 2009) project classification system. The detailed Environment Impact Assessment (EIA) studies have been carried out; and accordingly the draft final EIA report has been disclosed on ADB website on 2nd December 2013. NDH is physically located at some 184km aerial distances from the other subprojects, which are located within the Phuentsholing Thromde (PT) or Municipality.

3. The three remaining subprojects – 1.2km Pasakha Access Road (PAR) including Alay Land Custom Station (LCS); 2.8km Phuentsholing Bypass Road (PBR); and Mini Dry Port are classified as Category B project requiring only the initial environmental examinations (IEE). This report presents the findings of initial environmental examination for the proposed widening and rehabilitation of 1.8km existing road; 1km new of construction including the construction of flyover bridge over Om Chhu River.

B. Purpose of the Study

4. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the project area, (ii) identify potential environmental impacts from the proposed works, (iii) evaluate and determine the significance of the impacts, (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental impacts, and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. The IEE is done under the guidance of the policies of the Asian Development Bank (ADB) and the Royal Government of Bhutan (RGoB) and includes chapters on description of the project, environmental impacts and mitigation measures, mitigation and monitoring plan, and public consultation procedures. The draft IEE was submitted to ADB and other stakeholders for review; and, it has been finalised during the detail design. The final IEE is submitted to ADB and National Environment Commission (NEC) for approval and further public disclosure.

C. Methodology Adopted for IEE

5. The IEE study has followed the guidelines of RGOB and ADB. The study has been conducted through review of secondary information collected from relevant agencies, and

primary information collected from the field survey in November 2012. Public consultations and disclosure were carried out and the concerns of affected persons are documented. The relevant Phuentsholing Thromde (PT) officials were contacted to verify information collected and also to solicit their concerns. Based on the analysis of information the impacts have been predicted, mitigation measures prepared and monitoring plan has been developed.

D. Description of Project

6. 2.8km Phuentsholing Bypass Road or PBR will connect the proposed Mini Dry Port (MDP) at lower Phuentsholing and the first hairpin bend of Phuentsholing-Thimphu Highway. The bypass will also connect to the future proposed second border gate with India.

7. PBR construction activities will include i) widening and rehabilitation of 1.8km of the existing access road; ii) 1km of new road construction; iii) construction of flyover bridge; iii) construction of river training and check dams for minimizing the flow velocity; iv) construction of road side drains and culverts; and v) road surfacing works.

E. Construction Approach

8. PAR widening and reconstruction will be based on Environment Friendly Road Construction (EFRC) Technology with the principle of balance cut and fill. Excess excavated materials will be disposed off in the pre-identified approved disposal sites. Civil and Bioengineering techniques will be applied to rehabilitate degraded area along Om Chhu River as well as the completed dumpsites. Climate change adaptation (CCA) measures of improved slope stabilization, proper river trainings and embankments, and adequate drainage constructions will be carried out.

F. Project Cost and Implementation Schedule

9. The estimated cost for PBR is Nu. 406 million including design and supervision costs.

10. The construction of PAR is scheduled to by third quarter of 2015 and expected to be completed by mid of 2019.

II. POLICY AND LEGAL FRAMEWORK

A. Environmental Regulatory Compliance

11. The implementation of the Project will be governed by Asian Development Bank Safeguard Policy Statement (SPS, 2009) and the environmental laws, policies and regulations of the Government of Bhutan (RGOB).

12. **Asian Development Bank.** The ADB SPS stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of Project preparation. For this, the ADB SPS categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The Project has been categorized as B. Accordingly this IEE is prepared to address the potential impacts in line with the SPS. Stakeholder consultation was an integral part of the IEE and an environmental management plan (EMP) specifying mitigation measures to be adhered to during implementation of the Project has been prepared.

13. Royal Government of Bhutan. The implementation of the Project will also be governed by laws, regulations, and standards for environmental assessment and management of Royal Government of Bhutan (RGOB). Table 2.1 summarizes the main requirements of RGOB for environmental management that will apply to the Project.

Table 1: Government Environmental Policies, Laws, Regulations, and Standards

Statute	Outline	Relevance
Environmental Assessment Act, 2000	This Act establishes procedures for the assessment of potential effects of projects on the environment, and aims to determine measures to reduce potential adverse effects and to promote environmental benefits.	• To ensure that all foreseeable impacts on the environment, including cumulative effects are fully considered prior to any irrevocable commitments of resources or funds. • To ensure that all feasible alternatives are fully considered.
Regulation for the Environmental Clearance of Projects, 2002	Regulation for Environmental Clearance defines responsibilities and procedures for the implementation of the Environmental Assessment Act, 2000 for issuance and enforcement of environmental clearances.	• To ensure that all projects are implemented in line with the sustainable development policy of the Royal Government of Bhutan • To ensure that all feasible means to avoid or mitigate damage to the environment are implemented; and • To ensure that concerned people benefit from projects in terms of social facilities.
National Environment Protection Act, 2007	The aim of this Act is to enable an effective system of conserving and protecting Bhutan's environment. This system is constituted of the National Environment Commission or other designated Competent Authorities and advisory committees responsible for independently regulating and promoting sustainable development in an equitable	• The Act provides a framework for developing measures and standards to protect Bhutan's environmental quality. Guidance relevant to this project includes: • Handling of hazardous substances: No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed under national and international instruments. • Discharge of environmental pollutants: No person shall discharge or emit or be permitted

Statute	Outline	Relevance
	manner.	to discharge or emit any pollutants in excess of such standards as may be prescribed.
Waste Prevention and Management Act of Bhutan, 2009	This Act defines the institutional framework for preventing and managing waste in Bhutan. It sets out the principles, measures, mechanisms and responsibilities for reduction, segregation, and appropriate disposal of waste to protect the country's environment.	• Waste management requirements of relevance to the proposed development include: • Non-hazardous waste: Implementing agencies shall ensure that the reduction, reuse, recycling and disposal of non-hazardous waste are addressed in an environmentally sound manner. • Hazardous waste: Implementing agencies shall prevent manufacturing of products with potential to generate hazardous waste. The agencies shall also ensure that the reduction, storage, treatment, and disposal of hazardous waste are addressed in an environmentally sound manner.
General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006	OHS Rules and Regulations aims 'to assure safe and healthful working conditions for working men and women as well as other persons present at workplaces from work related risks to their health, safety, and well being	During Construction and operation stage of the project.
The Labour and Employment Act of Bhutan, 2007	The labour and employment act of Bhutan 2007 provide policies and programs in the areas of employment promotion, labour protection and relations, vocational education and training, and occupational standards setting and certification.	The proposed development will adhere to the policies provided under different sections of the Act.
The Forest Act (1969).	The first environmental legislation in Bhutan. It brought all forest resources under government custody to regulate utilization.	This was repealed with the enactment of the FNCA in 1995
Forest and Nature Conservation Act (FNCA) 1995	Allows community stewardship of forests and aims to provide protection and sustainable use of forests, wildlife, and related natural resources.	Schedule I of the Act, lists those wild animals and plants that are given full protection under the Act. The FNCA establishes that all forests in Bhutan are Government Reserved Forests (GRF), and prohibits any development activity in these areas except with a permit.

Statute	Outline	Relevance
Forest and Nature Conservation Rules (FNCR) 2000	Under powers established by the FNCA, the Ministry of Agriculture promulgated the FNCR in 2000, which was revised in 2006.	Amongst other things the FNCR allows for: • Allotment of land and land rights in GRF; • Prohibitions, restrictions and concessions in GRF; • Transport and trade of forest produce; • Declaration and administration of protected areas; • Protection of wildlife and use of certain wild species; • Prevention of forest fires, land clearance, and activities potentially impacting soil, water and wildlife resources; and • Enforcing penalties for offences related to these and other aspects of the FNCR.
Land Act 1979 (Revised 2007)	The Land Act 1979 provides the basis for land tenure in Bhutan was revised in 2007 to streamline many provisions in the Land Act. One major Change was the establishment of an autonomous National Land Commission Secretariat which has been given full responsibility for all matters pertaining to land registration. Land categories have been reduced to seven including i) Chhuzhing (wetland), ii) Kamzhing (dry land) including orchard, iii) Khimsa (Residential land), iv) Industrial land, v) Commercial land, vi) Recreational and vii) Institutional land.	Under this Act, there are provisions for acquisition of land by the Government, if it is required for the benefit of the country. In such cases, the affected person will be compensated with substitute land from the same Dzongkhag or given cash compensation depending on the land classification as per the prevailing land compensation rate determined by the Act. If a house is acquired, compensation is paid on the basis of an evaluation carried out by a qualified engineer appointed by the competent authority.

14. The policy, legal, and administrative frameworks relevant to the environmental assessment of infrastructure projects in Bhutan have been established by the following laws and regulations: (i) the National Environmental Protection Act of 2007, (ii) the Environmental Assessment Act of 2000, and (iii) Regulation for Environmental Clearance of 2002. At the national policy level, environmental protection and conservation is a constitutional mandate to: (i) protect, conserve, and improve the pristine environment; (ii) safeguard biodiversity; and (iii) prevent pollution and ecological degradation.

15. The National Environmental Protection Act of 2007 is the overall law on environmental protection and specifies the powers, functions, and operational framework of the National Environment Commission (NEC), the government agency with responsibility for all issues related to the environment. Their mandate includes the maintenance of environmental quality through the enforcement of environmental standards and promotion of best environmental management practices to address pollution and environmental hazards.

16. The Environmental Assessment Act of 2000 was enacted to establish procedures for the assessment of the potential effects of strategic plans, policies, programs, and projects on the

environment, and for the determination of policies and measures to reduce potential adverse effects and to promote environmental benefits. Under this law, no development consent can be issued without first seeking an environmental clearance. The permission is given under Chapter III of the act and is issued in writing by the secretariat or the competent authority, to let a project proceed, which includes terms to ensure that the project shall be managed in an environmentally sound and sustainable way.

17. The Application for Environmental Clearance Guidelines for Highways and Roads and Guideline for Urban Development have been promulgated by the NEC. Project information consistent with an initial environmental examination (IEE) report will be required under general provisions including requirements for no-objection certificates that are provided by affected parties that include but are not necessarily limited to those presented in Table.2.

Table 2: No Objection Statements required

Agency/concerned people to issue NOC	Yes / No	Why/when
Dzongkhag /City Corporation	Yes	Dzongkhag Administrative approval
Department of Culture	Yes	Project is located within 50m of a cultural or religious site
DoF	Yes	Project involves felling of trees, or riverside quarrying or small-scale quarrying
Nature Conservation Division	No	Within boundary of a Protected Area
Municipal Authority	No	Within 50m of a public park
Department of Health	No	within 50m of hospital
Department of Energy	Yes	Project will require the relocation of power transmission line
Bhutan Telecom Authority	Yes	Project will require relocation of telephone lines
National Environment Commission	Yes	All new road construction projects need an environmental clearance from NEC. However, the EC will be issued only upon receipt of all necessary No Objection statements enlisted above.

B. Environmental Clearance Requirements

18. Article 33.1 of the Environmental Assessment Act 2000, grants the competent authority (CA) a power to screen, issue or deny the environmental clearance (EC) of the activities or project listed under Annex 2 of RECOP 2002. However, the CA cannot issue EC to itself or the Departments directly under it; even for the listed activities of the RECOP. However, it can issue the clearance to organisation like Phuentsholing Thromde (PT); which is partially autonomous organisation.

19. However, the PT is obliged to fill up the standard IEE forms and submit it to the MOWHS along with the no objection certificates (NOC) from the affect persons/public and other stakeholders.

Table 3: Environmental Regulatory Compliance

Component Description	Royal Government of Bhutan		ADB	
	Competent Authority in accordance with ECR	Environmental Assessment	Category in accordance with SPS	Environmental Assessment
Proposed By-pass road Phuentsholing	MWHS/NACSQC - NEC	Environmental Information*	Category B **	IEE and EMP

ADB = Asian Development Bank, ECR* = Environmental Clearance Regulations, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, SPS = Safeguard Policy Statement. ** Nothing is envisaged at this stage that could cause reclassification to Category A.

C. Occupational Health and Safety

20. The Project will conform to the labour laws and occupational and health related rules as outlined in Table 4.

Table 4: Relevant Occupational Health and Safety Laws and Rules

Title	Year	Overview
Labour and Employment Act 2007, Bhutan	2007	The L&E Act, 2007 provides general legislation governing employment conditions and environment at work. The aim of the Act is to improve the work environment and working conditions in order to safeguard and maintain the employees' work ability, and to prevent occupational accidents, diseases, and other physical or mental health problems related to work. Employers are required to identify the hazards and risk factors at workplace, eliminate, and assess the effects of the remaining risks to the employees' health and safety. The Act describes the employers and employees general duties, rights and obligations in pursuing a healthy and safe workplace. The Act also emphasizes reporting system for workplace injury and diseases and the requirement of the enterprise to develop health and safety policy at the enterprise level.
Mines and Mineral Act, 1995	1995	The Department of Geologies and Mines under the Ministry of Economic Affairs are responsible for implementing the Mines and Mineral Act, 1995. Under the Mines and Mineral Act, 1995 the employers or lessees are responsible to ensure a safe and healthy working environment. They should report any workplace accident to the ministry. The ministry is also empowered to frame regulations and standards on health and safety in keeping with the view of national legislation on occupational health and safety.
Mines and Minerals Management Regulations 2002. (MoEA)	2002	This regulation clearly outlines Occupational Health and Safety procedures to be followed by the mining industries.
Road Safety and Transport Act, 1999	1999	The objectives of the Road Safety and Transport Act 1999 are to provide safe and efficient use of road systems and to provide an efficient and a safe public transport system. This responsibility is shouldered by the RSTA. The Act also describes general duties of the drivers related mainly to traffic safety signs and safety procedures in order to prevent transport accidents.
Electricity Act of Bhutan, 2001	2001	The Act provides authority to the Bhutan Electricity Authority to develop regulations, standards, codes, principles & procedures, which include performance standards, including minimum technical & safety requirements for construction, operation & maintenance of generation, transmission & distribution facilities.
Pesticides Act of Bhutan 2000	2000	The objectives of this act are to minimize deleterious effect of pesticides on human beings and the environment. Guidelines direct the import procedures of pesticides and the use of pesticides in a way that the effect on the environment is mitigated.
Food Act of Bhutan 2005	2005	The purpose of this act is to protect human health from consumption of food which has adverse effect on the health and to regulate and facilitate the import, export and trade of food in the country.
Regulations on		This regulation was framed under the Labour and Employment Act,

Title	Year	Overview
Occupational Health, Safety and Welfare (MoLHR)		2007. It prescribes standards and procedures on occupational health, safety and welfare for workplaces, instruments, vessels, appliances, apparatuses, tools, devices, electrical safety and other hazardous conditions. The objective of this regulation is to ensure safety, health and welfare for employees as well as other persons at workplaces, from work related risks to their health, safety and wellbeing.
Regulations on Occupational Health and Safety for Construction Industry (MoLHR)		Regulation on Occupational Health and Safety for the Construction Industry was framed under the Labour and Employment Act, 2007. This regulation establishes occupational health and safety standards and procedures on construction safety. It aims to ensure safety and health for employees, as well as other persons at the construction sites, from work related risks to their health, safety, and wellbeing. It also prescribes the roles and responsibilities of the workers and employers in ensuring health and safety at the site.
Regulation on Workers Compensation 2009 (MoLHR)	2009	Regulation on Workers Compensation was notified by MoLHR as empowered by the Labour and Employment Act, 2007. It establishes standards and procedures for compensation of employees and their dependents as a result of injury, diseases or death arising from their work or related to the tasks and duties they are required to perform. It aims to compensate employees or their dependents for a loss of earning capacity rather than compensate for a particular injury or disease, and provides for the payment of medical and related costs and the rehabilitation of employees to enable them to return to work as soon as possible.
Regulation on Hours of Work 2009 (MoLHR)	2009	This regulation was framed as per the Labour and Employment Act, 2007 and it provides the maximum working hour and related matters falling within the scope of the Labour Act. It prescribes a maximum of 8 working hours per day with 2 hours overtime per day.
Bhutan Building Rule 2002 (MWHS)	2002	The City Corporation Offices of the respective towns have the responsibility to enforce the Bhutan Building Rules, 2002, which make reference to aspects of safety on construction sites.

Source: Profile on the Occupational Health and Safety of Bhutan, March 2012

D. International Conventions

21. Bhutan is a party to several international conventions that are relevant to environmental management. Bhutan ratified the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change (25 August 1995). These international conventions explicitly reference the application of environmental assessment to address the effects of human activities. The Convention on Biological Diversity, in particular, promotes the use of appropriate procedures requiring environmental impact assessment of proposed projects that are likely to have significant adverse effects on biological diversity. Bhutan acceded to the Convention on Biological Diversity (CBD) on 10 October 2006, and became a Party to the Convention on 8 January 2007. It also acceded to the Convention to Combat Desertification (CCD) in 2003 and ratified the Framework Convention on Climate Change (FCCC) in 2006. Local conservation legislation is still in development.

E. Environmental Roles of Relevant Agencies

1. National Environmental Commission Secretariat (NECS)

22. NECS has overall responsibility for enforcing environmental assessment and management in Bhutan. Various functions and responsibilities have been delegated to

ministries and competent authorities. NECS will be directly involved in the environmental management of the proposed project as requested by the secretariat as there is no appropriate delegation of authority in this case. NECS will issue the environmental clearance and provide guidance when needed.

2. Ministry of Agriculture and Forest (MOAF)

23. MOAF is competent authority for certain type of project activities in its purview. In this project the Chief Forest Officer for the district in MOAF will be consulted regarding permission to cut trees.

3. District Environmental Committee (DEC)

24. A District Environmental Committee (DEC) consists of Dzongkhag planning officer, Dzongkhag forest officer, Dzongkhag land record officer, Dzongkhag agriculture officer, Dzongkhag environmental officer, and Dzongkhag engineer. The District Environmental Officer (DEO) is district official of NECS. DEC is responsible for issuing Environmental Clearance to some project activities mandated to the committee and for checking compliance of the projects to which it issues EC periodically. As part of its regular activities, NECS gives general training and orientation to DEOs before sending them to districts. These orientations focus mainly on Bhutan's environmental requirements.

III. DESCRIPTION OF THE PROJECT

A. Background

25. The Phuentsholing Bypass Road (PBR) is designed to provide an alternative urban thoroughfare to current route through the commercial centre of Phuentsholing. During the feasibility study, three options for the alignment were developed and investigated (Figures 3.1 and 3.2). From the origin at second proposed border gate till the crocodile farm; all three options have the same alignment. From the crocodile farm, all three alignment options have different Om chhu River crossing points – two bridges and one flyover options.

26. All three options follow a common alignment for the first 1.8km (till Crocodile farm) in the main section of the PBR. This section will run through existing road along the Om Chhu River, which will require significant road widening and improvement. The PBR will originate at the proposed second border gate with India[2] and run in a northerly direction to pass to the east of the proposed mini dry-port (MDP) and then run towards the south bank of the Om Chhu River crossing. The PBR over Om Chhu River will require a bridge (listed as "second bridge" on the figure 3.1 and 3.2) and will meet proposed future road junction of Samtse-Phuentsholing highway. From thereon, PBR will follow the existing road along the bank of Om Chhu River for almost 1.8km till the captive crocodile farm. Along its route, the proposed bypass road will cross the existing Om Chhu Bridge and the main road connecting the Industrial area of Phuentsholing. At the road crossing point; a roundabout is planned to be built to enable smooth traffic flow.

27. From the crocodile farm (km 1.8) till the termination point at the first zig of existing Phuentsholing – Thimphu National Highway, there are three alignment options with three different Om Chhu River crossing points.

a) **Option 1:** uses a bridge to cross the Om Chhu and runs on the south side of the river on embankment (2.8km long approx.).
b) **Option 2:** uses embankments and a bridge to cross to the south side of the river and another embankment (2.8km long approx.).
c) **Option 3:** uses rising viaduct structures and a flyover to cross to the south side of the river and another section of high structures (2.7km long approx.).

28. Alignment Option 3 is the preferred option but the river crossing type has changed from flyover with viaduct structure to a standard bridge crossing to join the National Highway leading to Thimphu from Pheuntsholing via the Royal Bhutan Police compound.

B. Existing Road

29. The existing road width is approximately 5m, except at Sherub Lam which is a 2-lane road with 1.5m footpath on the left hand side. Local land acquisition will be needed for road widening and realignment on sections of existing road (notably insides of curves), especially on the western section from 2nd India Gate to the second bridge. The hard shoulders are from 0.0 m to 1.0 m wide.

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2 The second border gate location is agreed in principal but is yet to be agreed by India/Bhutan authorities and is assumed not to be operational for the purposes of this study.

30. The three options have been examined for economic viability. The proposed widening and improvement is summarized in Table 6. In all the cases the widening will be by more than 11m; about 5m to 6m on each side up to a total width of 18m.

Table 5: Current and proposed widths on PBR

Road Location	Start (Km)	Finish (Km)	Length (m)	Current formation width (m)	Current pavement width (m)	Proposed pavement width (m)	Proposed formation width (m)*	Formation Widening required (m)[#]	Pavement Widening required (m)[@]
Option I	0.0	2.879	2.879	6.0-7.0	5.0	14.60	18.00	11.00-12.00	9.6
Option II	0.0	2.880	2.880	6.0-7.0	5.0	14.60	18.00	11.00-12.00	9.6
Option III	0.0	2.650	2.650	6.0-7.0	5.0	14.60	18.00	11.00-12.00	9.6

Source: TA 7650 Consultants. May 2013.* Proposed pavement and formation widths may be wider (up to 8m and 12m respectively) on some widened curves subject to detailed design.

C. Road geometry and alignment

31. The route of the proposed bypass of length of 2.8 Km extends from the proposed second gate with India to the main Thimphu highway at the water treatment plant at Kharbandi. There will be widening to 4 lanes and in a few places new construction of 4 lane highway. This will consist of 7 meter carriageway, 0.6 meter median and 1.7 meter shoulders (Figure 3.3) including footpath over drains. Widening of about 11 to 12 m will be required in most places (subject to detailed design).

32. The planned route starts in the west at the proposed 2nd India/Bhutan gate, near the future mini dry-port. The alignment follows existing roads to the proposed second bridge over the Om Chhu River to the north east and then follows the north embankment of the Om Chhu River passing, school, residential, old bridge, the market, workshops, residential and crocodile farm, before crossing back over the Om Chhu River to the south (proposed third bridge) and up the hill to join the Thimphu highway at the water treatment plant at Kharbandi. The new alignment will pass at a distance of <10m from a few of the dwelling blocks (Figures 1.2 & 3.3) that form the residential colonies.

33. This route passes through Phuentsholing between the commercial/CBD area to the south and the industrial area to the north. Further development is planned in the Amo Chhu redevelopment area on the Samtse road. The bypass will therefore serve a key urban access role, in addition to its transit function and will be the principal east-west urban arterial road for the city. Route selection was not included in the terms of reference for the feasibility study, however, given the hilly terrain immediately outside the built up areas of Phuentsholing to the north, finding new routes for the bypass outside of the main city highways would inevitably result in much engineering of the adjacent slopes and foothills and professional judgement suggests that such an approach would be much more costly.

34. PT performed an initial alignment design of the proposed bypass route in 2009, following the route indicated above, with the third bridge crossing of the Om Chhu adjacent to the archery ground, before climbing up the hill around the Royal Bhutan Police compound. This has formed the basis for study as Option 1 (bridge option) for this feasibility study.

35. This study has also assessed an alternative crossing of the Om Chhu River further upstream (east) with a direct link back to the Thimphu highway at the same location (Kharbandi

water treatment plant). This alternative entails construction of a much higher bridge crossing and elevated approaches, termed as Option 2 (bridge option).

36. The proposed bypass alignments, showing both options for third bridge crossing of Om Chhu are shown in Figures 3.1 and 3.3.

37. The Urban Roads Standard 2002 requires the bypass to be a primary road and part of the primary road network for the town. All long distance traffic movements through, to, from and within the town should be channelled onto these primary roads. The primary road standard indicates a 12m 4-lane dual carriageway of 18m total width, separated by a median for road lights and signs, possible drainage structure (in cambered sections) and central pedestrian islands. Design speed for primary roads is 40-50km/hr.

38. As the bypass will be the main thoroughfare of Phuentsholing (including the probable future itinerary of Asian Highway AH-48) and also have urban function as a main urban artery for local city traffic, a dual carriageway standard is appropriate. The bypass follows existing roads where possible with notable exceptions for: (i) second bridge crossing of the Om Chhu River near youth residential building; (ii) near the town market area; (iii) near the bus station; and (iv) connecting road back from Crocodile Farm to Thimphu Highway, including third bridge crossing (or flyover option).

39. Given that PBR has dual carriageway standard and mixed urban function, attention has been paid to ensuring sufficient provision for: (i) accessibility for existing urban roads, whilst ensuring traffic flow on the bypass itself; (ii) pedestrian sidewalks and passages across the bypass, to avoid it becoming a barrier to pedestrian movement across the city; and (iii) possible reserve or provision for cycle paths (whilst noting that non-vehicular traffic in Phuentsholing is currently limited due to a ban on cycle rickshaws).

40. Connectivity is principally ensured by suitable junctions to ensure availability of access points to/from the bypass. As it is a segregated carriageway, suitable provision has been made for turning movements and U-turns to access single-carriageway junctions from the opposing carriageway.

41. The proposed “second bridge” is currently being tendered for construction, through ADB Urban Infrastructure Project (Phuentsholing component). From the second bridge the proposed bypass follows the existing road Sherub Lam by the side of the Youth Hostel, school and residential colonies and intersects with the Bus Terminus road near NPPF colony. It then crosses the old bridge road and continues through the existing market by the side of the Bus Terminus to reach to Norgay Lam. The link from the NPPF intersection to Norgay Lam is occupied by a small market which is proposed to be relocated (to the truck park which is also being relocated currently). Elsewhere in this section land acquisition will also be required on the left side as well as adjustments to the embankment on the right and re-provisioning of infrastructure.

42. Elevation of the PBR is also a concern. The Om Chhu River is bordered by a high bund embankment for flood protection on the north bank which has been improved by successive flood protection measures (concrete walls and gabions etc.) although it is understood that

maximum flood level is considerably less than embankment height which was raised in the last Phuentsholing City flood in 2000[3]. The adjacent road Sherub Lam is currently at least 2-3m lower than this raised embankment. There is a paved footpath on top of the embankment. The adjacent buildings are also lower than Sherub Lam in places so to connect with access roads there will need to be filling and leveling. The junctions with bridge crossings (including existing bridge) will need to be at embankment height to ensure connection but there is lack of available space to reduce the designed PBR road level. To ensure local accessibility, current road levels have been retained and higher levels applied only at the bridge junctions.

D. Alignment options, Bridge locations and type of river crossings

43. The PBR includes two bridges in addition to the original bridge in Phuentsholing. The so called "second bridge" is on western side and is already included under ADB Urban Infrastructure Project. The third bridge is included in the present study and there are three options for locating this third crossing as shown in the drawings at the end of this chapter. The "third bridge" or viaduct crosses the River Om Chhu further east on an alignment that passes to the east of the archery ground.

44. The PBR is included in the urban development plan and land use map for Phuentsholing (2002-2017). The road is classified as an urban road that will be managed by PT.

45. Three alignment options have been identified by PT from the Crocodile Farm (Km 1.8) to Thimphu Highway (Km 2.8).

a) **In Option 1** (bridge option), a bridge is proposed near the Crocodile Farm on Norgay Road, connecting to the existing road on the archery ground side. Thereafter PBR passes along the south side of the archery ground and up to the Royal Bhutan Police compound adjacent to the water treatment plant, climbing an embankment before turning in a steep curve and returning to the main highway along the north side of the Bhutan Royal Police compound (land to be acquired). Maximum road grade is 6.4% (6.6% is maximum in the Urban Roads Standard 2002).

b) **In Option 2** (bridge), the location of the bridge is moved further east upstream to enable crossing directly across the river to the north side of the Royal Bhutan Police camp and join the Thimphu highway. Instead of flyover, the bridge has been proposed recently to reduce overall construction cost. The alignment before joining Phuentsholing-Thimphu highway passes in between water treatment pland and Royal Bhutan Police compound. The reservoirs will not be impacted; however, pipelines will be damaged during construction. Temporary arrangement will be made while carrying out construction works. While permanent restoration works will be done after the completion of construction.

c) **In Option 3**, the location of the bridge is in between Option 1 and Option 2. The bridge will also cross the Om Chhu River about 400m further upstream but with

3 Phuentsholing raindall data records 997mm of rainfall in the 3 days of 1-3 August 2000

the approach road from Crocodile Farm with a continuous gradient of about 6% all the way up to the Thimphu Highway. The flyover is proposed on a curve and will have more supporting structures rather than embankments to minimize acquisition of land.

46. Of the three alignments, option 2 with length tentative length of 2.8km and a bridge over Om Chhu, has been chosen by the PT. This alignment will be cheaper than option 3 which will require expensive lengthy flyover construction. Option 1 has been discarded since the technical feasibility was limited for the development 4-lane Bypass Road.

E. Hydrology and drainage

47. Rectangular concrete drains have been provided under footpaths on both sides of the sections of four lane divided highway (except bridges) to carry away surface water. Additional drains are provided in the central median for cambered sections of PBR.

48. About 1.8 km of the PBR follows the northern bank of the Om Chhu River. Rainfall is currently drained into the river through chutes and pipe culverts. Water will have to cross through the high bund on the edges using existing or reconstructed culverts. A new culvert has also been designed for the area currently occupied by the market adjacent to the Bus Terminal. The existing structure is an open earthen drain but drainage is prevented by the collapsed road embankment connecting to the bridge.

F. Bridge structures and design

49. Intense scouring may be expected for the proposed bridge or flyover foundation due to the high stream velocity and large amounts of debris carried by the flow. Bridge designs have therefore avoided piers in the river bed.

50. The second bridge near the youth hostel on the downstream side, of double span 2x23m with central pier, has already been designed by others and has been tendered for construction. The third bridge near the archery ground has also been designed under the same package with single span of 1x40m.

Third bridge of approximately about 50-60m span will be constructed about 400m upstream of Crocodile farm to cross over Om Chhu River and connect onto the Phuentsholing-Thimphu highway with continuous gradient of about 6%. Bridge construction will be challenging due to weak geology and constant bank erosion and flooding. Therefore, further study will be carried out the detailed design study. Boulders of all sizes are found in river bed and the damaged protection measures (broken embankment, collapsed gabions etc.) indicate the intensity of river flow and impact. Based on local enquiries and reaffirmed by officials, the highest recent flow was recorded in the year 2000 which flooded the surrounding area, including downtown Phuentsholing[4]. After this major event, protection measures (reinforced concrete retaining wall for bank protection, layers of gabions, slope pitching etc.) were constructed along the river particularly upstream of the existing bridge.

[4] Rainfall records for Phuentsholing show 997mm of rain in 3 days of 1-3 August 2000

G. Proposed upgrading

51. The road works will include (i) excavation and reconstruction of the embankment, slopes and retaining walls, (ii) widening and reconstruction of carriageways (2x7.0m wide) plus hard shoulders; (iii) repair and reconstruction of retaining walls and gabions (iv) ensuring drainage and access near residences and at other key areas is unimpaired by repair and extension of numerous culverts; (v) reconstruction and repair improvement road side drainage and (vii) installing slope stabilization and bioengineering measures, landscaping road signage and accessories and (viii) construction of the bridge or flyover. The waste disposal issues for the works should be manageable but there may be a surplus of cut materials in many areas, however a lot of these materials can generally be reused on the Project.

52. The works are generally expected to take place within approximately 10m of the centre line of the alignment subject to detailed design (allowing about 1m-2m temporary working space either side, where available).

H. Construction materials

53. The feasibility study team consulted with the local public works authority in Phuentsholing and clarified that there are established sources of fine and coarse aggregates for pavement and structural concrete near the project, and borrow materials likely to be used for road construction materials should also be available for the Project.

54. The materials from common and rock excavation work along the PBR are expected to be suitable as borrow soil. The excavation volume has not been estimated but it is likely to be exceeded by the required quantity of borrow soil for bulk fill, due to the material required for the embankments. Therefore it is assumed that borrow soil or bulk fill will be needed for construction.

1. Riverbed materials

55. Riverbed gravels in the several rivers (based on observation) should have enough strength as aggregates for asphalt concrete and suitable as mixture to any aggregates and sand. However, laboratory tests will be required to confirm its applicability for asphalt concrete. Sands from several rivers were observed as applicable for structural use.

2. Existing Quarries

56. A few small scale existing active areas and redundant small quarries are within short travelling distances from the PBR and aggregates are available but there is no hot mix plant near the Project area although bitumen is readily available. Contractors will need to install the necessary plant. The crushers and hot mix plant must have an environmental permit and be licensed (by NEC) before the construction works can begin. There are some quarries and borrow pits that have been used in the past for obtaining aggregates. If these quarries and pits can provide further quantities of suitable materials they can be reopened and NEC should be consulted to clarify if these locations also require an environmental permit and license before the construction works can begin.

I. Implementation Schedule and Cost Estimate

57. The PBR construction is intended to start by third quarter of 2015 and will be completed by mid of 2019.

58. According to the draft final report of June 2013 of “Regional Transport Development in South Asia – Bhutan Subregional Project (Phuentsholing))”, the Phuentsholing Bypass Road development cost is estimated to be Nu.406 million.

Figure 3: Plan for PBR showing Option 1 and Option 2

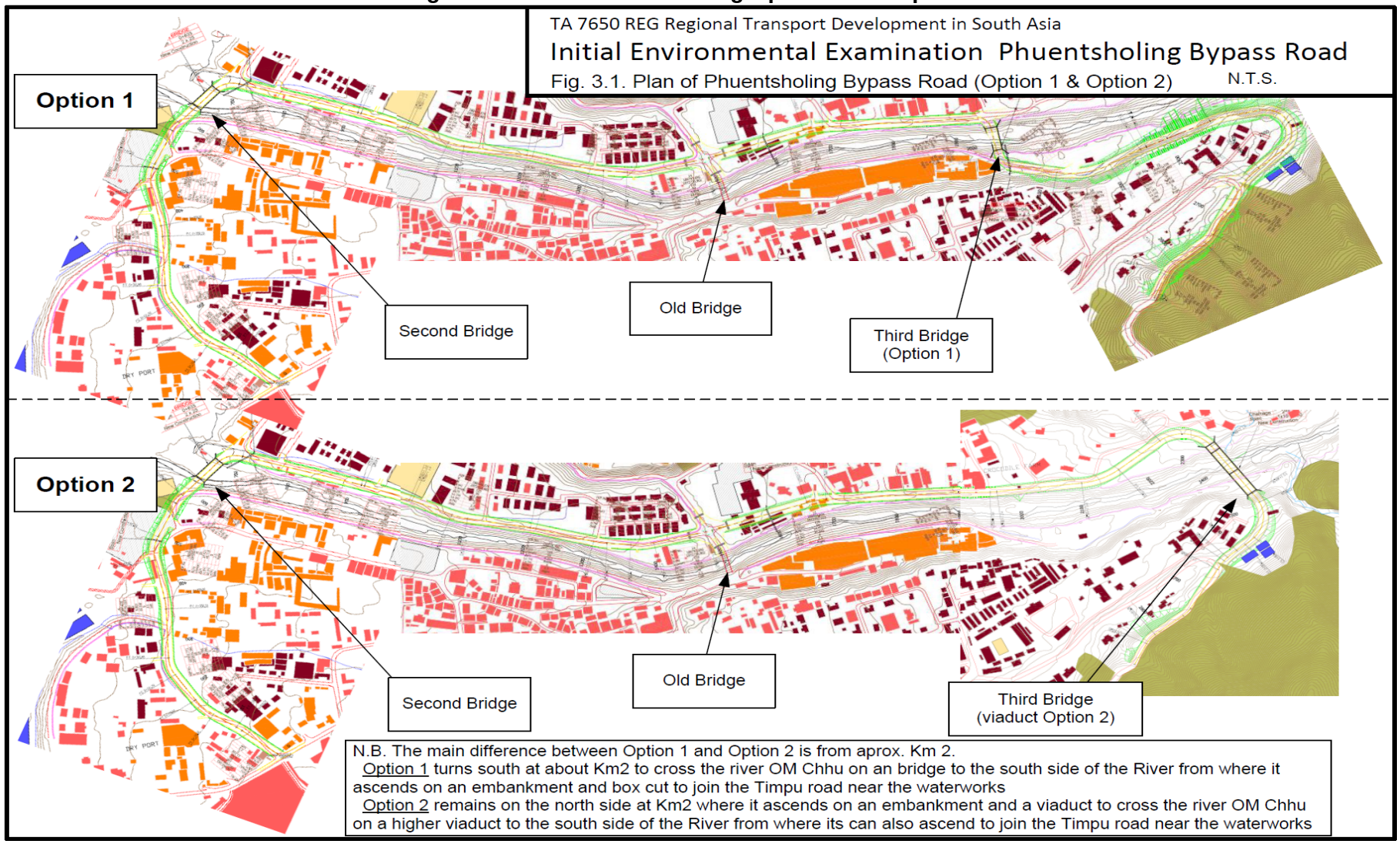


Figure 4: Plan for PBR showing Option 3

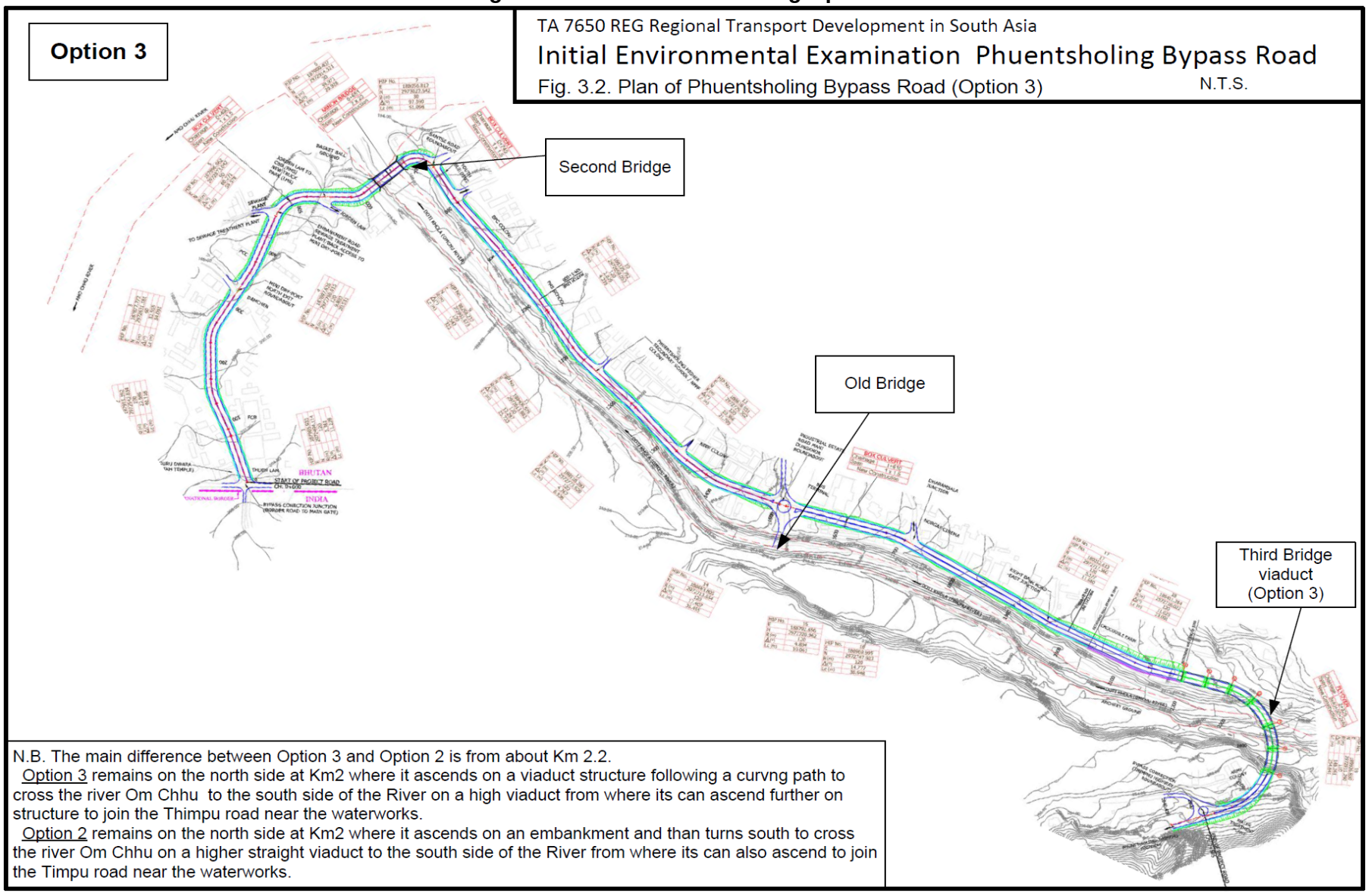


Figure 5: Typical cross sections for PBR

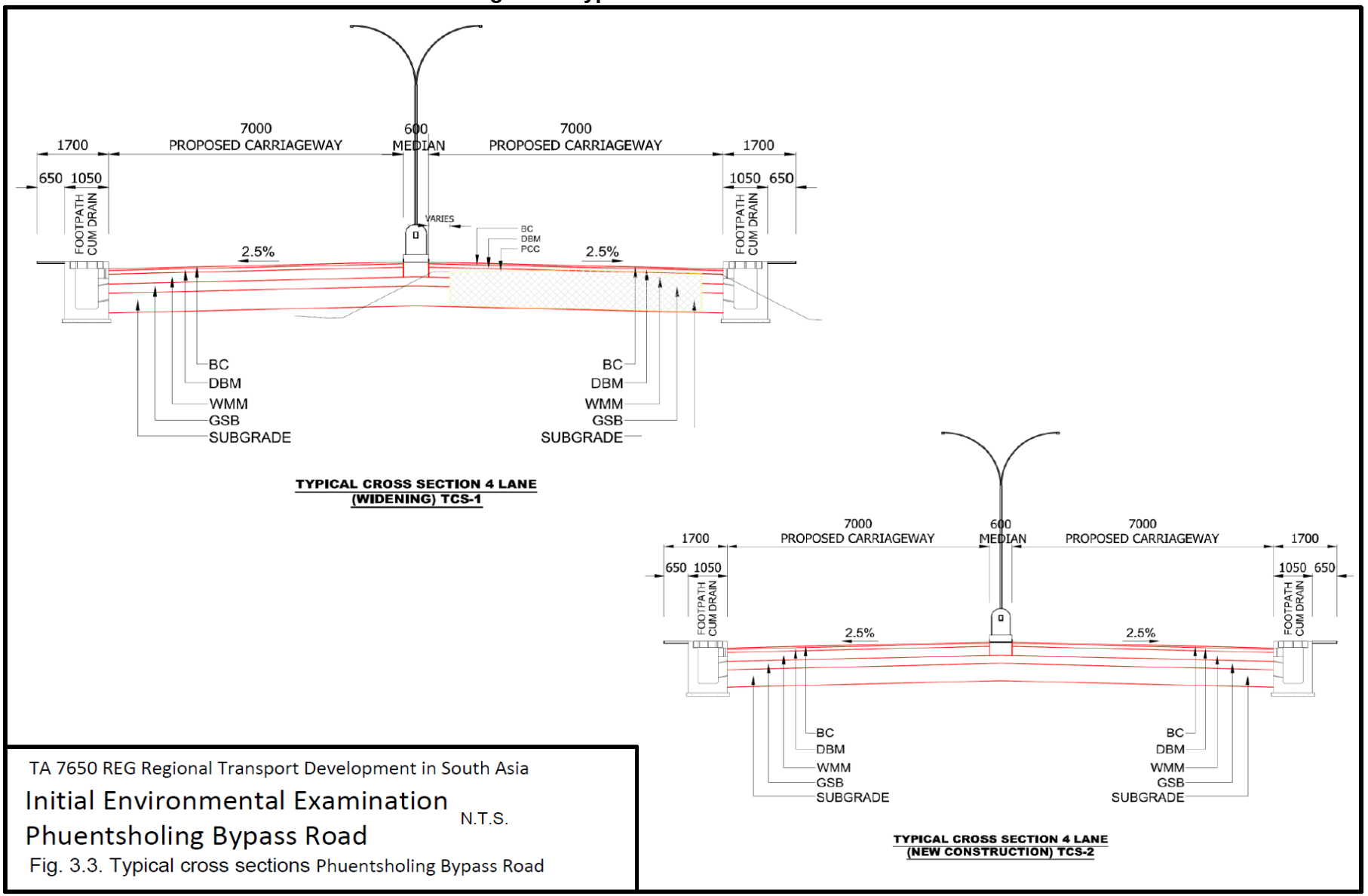
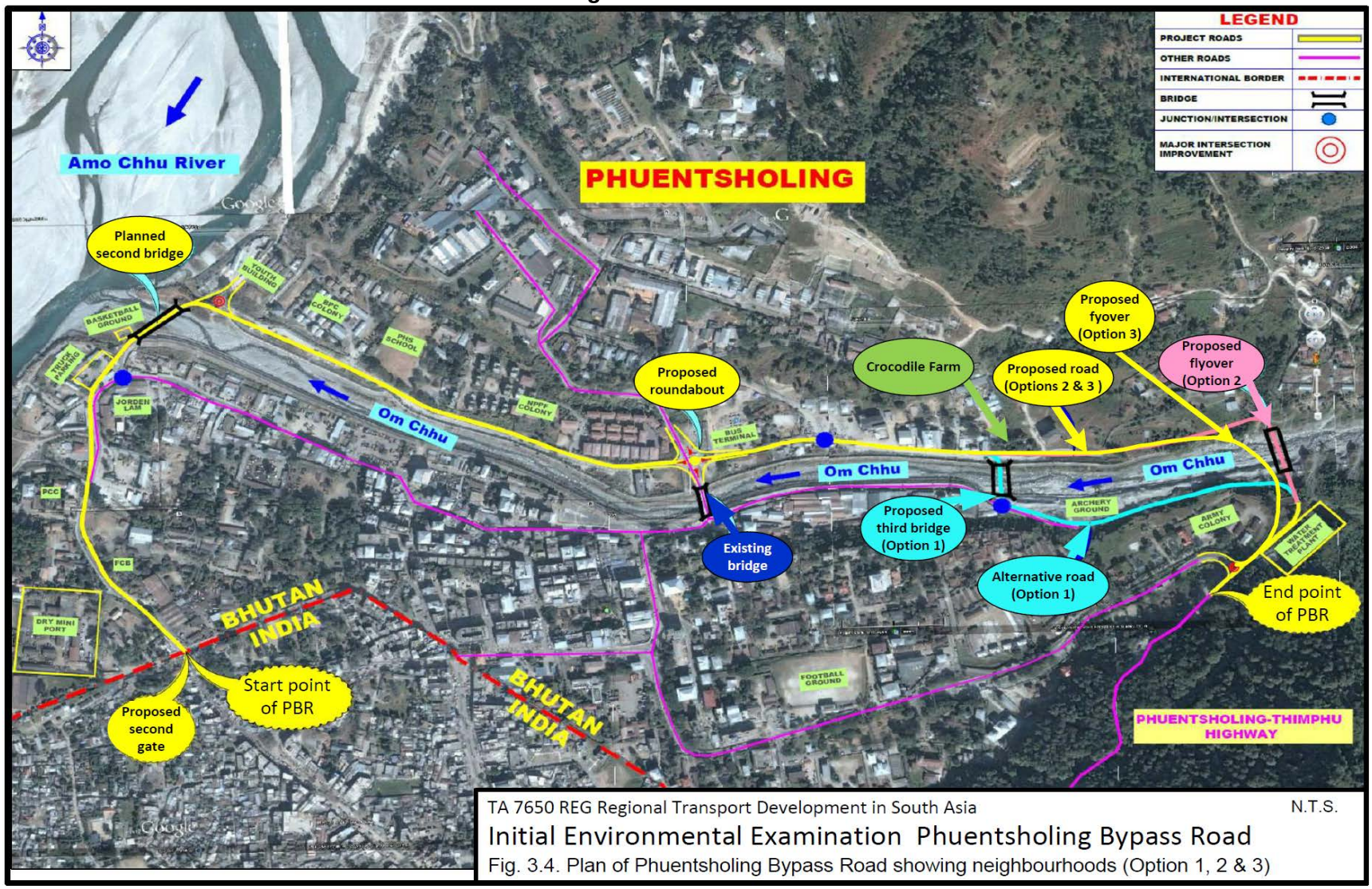


Figure 6: Plan of PBR



IV. DESCRIPTION OF ENVIRONMENT

A. Physical Environment

1. Topography

59. Bhutan is a landlocked and entirely mountainous country bordered by China in the north, the Indian states of Assam and West Bengal in the south, Sikkim in the west and Arunachal Pradesh in the east. The country has three geographical zones ranging from an altitude of 150m in the south to over 7000m on the northern border. The southern zone with below 2000m has low forest hills and dense tropical forests with a hot and humid climate. The central zone lies between 2,000m and 3,500m with a semi-tropical climate. The northern zone lies from east to west between 6,800m and 7,400m and is part of the eastern Himalayas.

60. Phuentsholing is in Chhukha District situated in the south of Bhutan at the edge of the Duar plain on the low spurs of the sub Himalayan foot hills. The geographical co-ordinates of Phuentsholing are 26 51' N 89 23' E and the city lies at an altitude of 160 metres above mean sea level. The distance from Thimphu is 176km and the nearest airport is Bagdogra (India), 4hrs drive from Phuentsholing.

61. The topography of Phuentsholing District is mostly hilly with occasional steeper slopes and mountainous sections. Phuentsholing City is hilly and is dominated by the Om Chhu River (Dhote Khola) that flows east to west through the centre between the industrial area to the north and the commercial border area to the south. The surrounding mountains and the Amo Chhu River (Toorsa River) and the plains to the West lead to India. The topography around the PBR is undulating to hilly.

2. Meteorology and Climate

62. Bhutan experiences four seasons: spring (March-May), summer (June-August), autumn (September-November) and winter (October-February). Annual rainfall is concentrated in the monsoon season from June to September. The autumn months of September to November bring shorter days and cooler evenings. However Phuentsholing is typical of the south which has a warmer sub-tropical to temperate climate

63. Surface air temperature data in Bhutan from 1985 to 2002 has shown a warming trend of about 0.5°C, mainly during the non-monsoon season. Analysis of data from 2000 to 2009 from meteorological stations of the four representative eco-floristic zones of Bhutan also shows a trend of rising mean summer and winter temperature. However, due to the short time-series data on temperature, it is difficult to quantify the annual rise in temperature. In Phuentsholing temperatures vary between 10°C in winter to 40°C in summer. Phuentsholing experiences warm subtropical climatic conditions and all four seasons with a heavy monsoon rain for about three months starting from June. The local climate is wet, and the highest rainfall of the country is reported to occur in the southern foothills, including Phuentsholing town, where it has been known to reach a total maximum of 4,400mm.

64. Unlike temperature, no consistent spatial trends have been observed in precipitation throughout the eastern Himalayan region. The changes in annual precipitation are quite variable, decreasing at one site and increasing at a nearby site. In Bhutan, no comprehensive precipitation observations are available to conclude any trends. However, rainfall fluctuations are largely random with no systematic change

detectable on either annual or monthly scale. A recent analysis of rainfall data from 2000 to 2009 across four eco-floristic zones of Bhutan shows annual fluctuations within regions without any detectable trend. A summary of total daily rainfall in Phuentsholing city (1996 to 2011) is given in Table 6.

65. Given the rainfall pattern over the region of the Project, it is important that season be considered in planning the implementation of the improvement programme. In order to avoid runoff and protect the works earthworks and major construction should be planned for the dry season (October to March) particularly for areas susceptible to flooding and landslides and for works near rivers.

Table 6: Summary of rainfall data

Year / Month	Total Jan-Dec	May - Sep	May - Sep (%)
	(mm)	(mm)	
1996	3554.8	3064.6	86
1997	4376.6	3828.6	87
1998	6699.0	6026.6	90
1999	4547.2	3865.2	85
2000	6106.4	5512.1	90
2001	4593.6	3623.6	79
2002	4691.4	4040.0	86
2003	4633.2	3545.0	77
2004	5034.8	4243.6	84
2005	2606.0	2259.9	87
2006	1975.9	1788.6	91
2007	3376.6	3105.6	92
2008	1681.4	1536.1	91
2009	3175.8	2582.3	81
2010	4181.8	3454.7	83
2011	3049.9	2749.0	90

Source: Meteorology Section, Hydrological Meteorological Services Division, Department of Energy, MTI, Thimphu, Bhutan.Annual Report Daily Rainfall, Station Number : Ph11150048, Phuentsholing, Elevation : 220.0m

3. Geology, and Soils

66. Bhutan covers two broad geological zones, the Lesser Himalayan belt along the southern and south-eastern border and the Tethyan belt further north. The Lesser Himalayan formation includes a wide range of sedimentary and low-grade metamorphic rocks, including argillites and metargillites, sandstones, quartzites, limestone, dolomite, and gypsum. The Tethyan formation mainly includes stronger gneisses that account for more than 70% of the country's bedrock and schists and marble, affording a relatively high degree of stability compared to other locations in the Himalayas. Chhukha district is in the Lesser Himalayan belt with tectonically active sedimentary and metasedimentary rocks, gneiss, schist, quartzite, and limestone. The "main central thrust" area falls close to Phuentsholing. Hence, it is underlain mostly with schistose rocks. The majority of the soil in and around the town is of weaker phyllites. This makes the soil texture very fine and the slopes very unstable.

67. Intermittent occurrence of heavy rain, slow erosion-deposition, rapid mass washing processes, including rock falls and landslides, the and weaknesses underlying in the rocks coupled with the steep terrain, make erosion and sedimentation significantly active geological processes in the Phuentsholing area and there are susceptible areas near the river and the escarpment near the third bridge / viaduct location none are known in the flat project area near the river and the MDP.

4. Seismicity

68. Bhutan is prone to a number of natural hazards due to fragile geological conditions, steep sloping terrain, great elevation differences, variable climatic conditions and active tectonic processes taking place in the Himalayas.

69. There is no detailed seismic micro-zonation of the country. However, since the north-eastern parts of India (next to Bhutan) fall under seismic zone V (seismically most active), it can reasonably be assumed that Bhutan is contiguous with this zone and either in seismic zone IV or V. Hence, there is a threat of a significant earthquake.

5. Surface Water

70. Bhutan has four major river basins, namely the Amo Chu (Toorsa), the Wang Chu (Raidak), the Punatshang Chu (Sunkosh) and the Drangme Chu (Manas). All these river systems are either directly or indirectly fed by permanent or seasonal snows, glaciers or high altitude lakes at their sources and surface runoff water from the monsoon rainfall. The subalpine lakes above 3,000masl constitute valuable high altitude wetland ecosystems in Bhutan but these are far from Phuentsholing. They are also valued for the diverse habitat provided and the willow, rhododendron bushes and juniper forests.

71. Phuentsholing urban area is divided by the River Om Chhu (Figure 1.1). This river rises in Bhutan, and discharges to the River Amo Chhu that crosses the Indian-Bhutanese border. Amo Chhu originates in China and flows through a well-defined valley system.

72. Phuentsholing lies on the east bank of the River Amo Chhu which emerges from its steep upstream reaches onto the Duar plain and broadens to a width up to one kilometre near Phuentsholing. High monsoon flows in the river are eroding the land along the western city limit, and expose the town to the danger of flooding from the river. The river banks have been protected with limited success. The potential of the flood and bank protection works could create 350ha of new land to provide an opportunity for the development of better and planned new township, integrated with the existing city[5]. River Om Chhu also has high flow and discharges can reach as high as 1000m^3/s, and flooding can occur.

73. River flows are the highest from May to September. When they do discharge they carry high sediment loads, depositing large quantities of gravels and sands in the lower reaches. During the wet season some of the culverts are inundated, cutting off roads. Water levels in the rivers drop to almost nothing in the dry season and have very low flow October to April unless there is unusually heavy rain.

74. The area does not provide any aquatic resources for subsistence or trade, but the streams in the hills provide water for drinking, bathing, and crop irrigation. The rivers are not navigable. Transportation is on the roads.

75. There are no major industries in the catchment area of the River Amo Chu but there are small to medium factories and a bitumen drum storage area just upstream of

[5] Detailed Feasibility Study and Engineering Design of Toorsa River Flood Mitigation Project

the confluence with the River Om Chhu and some factories upstream of the old bridge that discharge into the Om Chhu. The land use in the PBR project area is mixed with industries mainly located to the north of the River Om Chhu. Pollution loading from the industrial and residential sources appears to be moderate. Thus water quality in such a setting is moderate to good based on secondary sources[6].

76. Upstream of central Phuentsholing, Om Chhu River has generally good water quality and can be used for drinking after chlorination but near the Project road is subject to industrial pollution from industrial areas alongside the river in central Phuentsholing; however this water is not abstracted for further use but flows downstream to the confluence with the Amo Chu. No quarries are in operation near this Project stretch. Limestone exploitation nearby is from quarries in the nearby foothills and aggregates are also taken from the River Amo Chu. There are settlements and local mechanical, carpentry and other workshops near the banks of the river Om Chhu that will affect the water quality during implementation.

77. Water quality monitoring was not undertaken during the environmental assessment. The Bhutan Water Act (2011) regulates water pollution and is the appropriate standard for comparison purposes for impacts on water supply for human consumption. NEC has created standards for ambient water quality in Bhutan (Appendix C). The World Bank's Environmental, Health, and Safety (EHS) General Guidelines[7] will also apply to the implementation of the Project if World Bank's parameters are not included in NEC standards.

6. Water supply and sanitation

78. There are no data available on the groundwater potential. Ground water resources appear to be abundant with springs emerging from basement rocks near the landslide and fluvial deposits. Groundwater in landslide and alluvial deposits has been estimated at an exploitable rate of 3l/s/km^2. Currently water quality monitoring is only conducted in the four major river system of Bhutan. Generally, the state of Bhutan's ground water quality is still good but with expanding settlement along rivers, there are localized pollution problems. In the Project area ground water quality is anticipated to be good.

7. Water supply and sanitation

79. Phuentsholing Thromde (PT) is responsible for providing safe drinking water to the residents within the city. Piped water supply is available to all parts of the main city and some of the sub-urban areas. The outermost areas such as Damdara, Pipaldara are served through rural water supply schemes. Average daily demand is 7000m^3 per day with an estimated household consumption is 133l/d based on metered water consumption. The Amo Chhu filtration gallery and the Om Chhu intake were destroyed by the August 2000 flood and groundwater extraction was then initiated including rehabilitation of the surface water intakes to stabilize the water supply. Water supply was satisfactorily restored and is being developed and improved with donor assistance.

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[6] Detailed Feasibility Study and Engineering Design of Toorsa River Flood Mitigation Project

[7] World Bank Group, 2007. Environmental, Health, and Safety General Guidelines. Washington, DC.

80. The Thromde's water supply includes surface water and ground water. The existing water supply system comprises operational bore wells, four raw water streams, three treatment plants, 10 water reservoirs, one break-pressure tank, one fire flow tank (nearby the main booster station), approx. 12.0 km of raw water transmission lines and approximately 27km of distribution pipelines with more than 870 connections. Most of the existing water supply network was constructed in 1990´s. All the service area is supplied intermittently[8]. Thy bypass road project will run adjacent to two of the water reservoirs.

81. The drainage system in Phuentsholing was constructed in the 1990's. The present system is combined system, conveying both storm water runoff and household wastewater. The drains are usually lined open drains with a rectangular or trapezoidal profile. The implementation of drainage infrastructure has not been governed by City-wide drainage plans and universal standards. The present drains therefore are of different designs and lack conformity to an overall plan. Because the total connecting areas often are not known the sizes of the main and collector drains are found by "rule of thumb". These general conditions have amplified the adverse effects related to disrepair and the requirement for maintenance

8. Air Quality

82. Air pollution in Bhutan is a recent phenomenon and can be attributed to rapid urbanization and industrial developments. Diesel vehicles with poor engine maintenance and poor quality of fuel are also major sources for the urban air pollution.

83. Air quality monitoring was not undertaken for the Project. By observation in general, air quality near the PBR is acceptable but there are large amounts of dust being resuspended from the roads surface. However dust levels are not high enough to obscure vision significantly. Ambient air quality concerns are mainly limited to the industrial estates near Pasakha some 8km to the east. In this Project area the gaseous pollutants of carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) from traffic are well dispersed in the open terrain and there is potentially adequate dispersion in the wide open areas in the town to keep concentrations within the NEC standards (Appendix C). Air quality appears to be generally acceptable with the exception of dust. Dust arises owing to the poor condition of the existing roads and dust arising when vehicles pass over unsealed shoulders of roads in many places. Dust concentrations will be higher, if only intermittently, within about 10m of the Project when dust rises as vehicles pass around the site on unpaved roads until construction is complete. Dust from road surfaces will be reduced when the site is completed and all areas are sealed.

84. Ambient air quality monitoring is not being done in project area. NEC has completed air quality monitoring in the past at Pasakha industrial area. The concentrations of respirable particulate matter and gaseous pollutants concentrations at Pasakha were within the limits (NEC pers. comm.) at that time. In project area ambient air quality is expected to be better as there are less heavy traffic and industrial activities. These both are contributor to air quality through release of exhaust gases.

85. The areas around the PBR have a few potential sources of atmospheric pollution from domestic, commercial and industrial sources but these are not making

[8] Urban Development Plan-Phuntsholing

significant impacts on air quality based on observation. The main pollution id from Pasakha to the east. These areas are more polluted due to significant industrial development as well as emissions from workshops and poor waste disposal practices. World Bank's Environmental, Health, and Safety (EHS) General Guidelines[4] will apply to the implementation of the Project where there is no standard set by NEC.

9. Noise

86. Noise from vehicles is not a concern in most of the areas around the PAR as the sensitive receivers are set well back (<30m) from the road and uphill and at present traffic is confined to occasional vehicles. Noise levels are generally within acceptable limits for the public and there were no complaints about current noise levels from the public during consultation. There criterion for site noise for a mixed area in Bhutan is Leq65dB (A) (day) and Leq 55dB (A) (night, Appendix C). The World Bank standard applies an ambient criterion of Leq 55dB (A) for residential areas, hospitals and schools which is equivalent to the NEC standard for sensitive areas. Where the background exceeds the ambient standards the criterion is background +3dB(A). Based on observation in the settlements and towns where traffic runs throughout the day the criterion of Leq55dB(A) for residential, school and hospital sensitive receivers is potentially exceeded at some times. As the criteria are potentially exceeded at some times of the day it is recommended that in order to make a consistent assessment for all locations the existing criterion of background +3dB(A) will be applied in the assessment for both daytime and night time. This will meet the requirements of ADB SPS. However, there is a general presumption that there will be no night time working except in exceptional circumstances.

87. Data on measured noise levels is not available in the project area as NEC is measuring current noise levels only at Thimphu. Major contributors to the ambient noise levels are commercial activities and vehicular traffic. In the PBR project area these activities are not very high, therefore, noise is expected to be within the stipulated limits notified by NEC for Sensitive Areas (55 dB(A) during day, and 45 dB(A) during night).

B. Biological Environment

1. Forestry

88. Bhutan has significant natural forest resources. The subtropical plains and alpine terrain provide more rainfall than neighbours to the west which facilitates forest growth. The forests contain numerous deciduous and evergreen species, ranging from tropical hardwoods to predominantly oak and pine forests. About 87.7% of the Pemagatshel and 86.9% of Samdrup Jongkhar Dzongkhag are under original forest cover9. Pemagatshel has the slightly higher percentage of agriculture land (5.1%) than Samdrup Jongkhar (4.3%) in relation to its land area. Broadleaf forests are dominant in both Dzongkhags.

89. Forests are managed according to four types: government owned national forest, community forest, sokshing (registered to an individual person or household) and private tree plantations. Government forests are managed by the Department of Forests while community forest is managed by the village or a community. The sokshing (woodlots) and private forests are owned and managed by individuals, households and local

[9] As per NSB's Statistical Yearbook of Bhutan, 2011

communities. No forest management units (FMUs) are within the project area of influence. The project site is in the urban area where there are no forested areas. However, there are few trees the vicinity of the project.

90. The local forests are managed by the Department of Forests and Park Services (DOFPS) and there is a Divisional Forestry Office for Phuentsholing Thromde and Dungkhag, which has the headquarters at Gedu, one drive from Phuentsholing towards Thimphu. Forests are managed according to the instructions and quotas for cutting and planting received from the Ministry of Agriculture and forests (MOAF). The DOFPS indicated that the Sal forest area and that the mature trees can be removed with permission.

2. Fauna and Flora

91. The Phuentsholing Bypass Road development area falls complete within Phuentsholing Thromde or City limit. Hence there are no threatened or endangered floras or fauna in the project area. However, about chainage Km1.8 from the origin of PBR, there is a captive breeding centre of Gharial Crocodile (*Gavialis gangeticus*). IUCN red list classify Gharial as critically endangered species (http://www.iucnredlist.org/details/8966/0, accessed on 14 March 2014). There crocodile farm will not be damaged by road construction directly. However, construction noise and increased traffic movement during road operation may disturb the animal.

3. Trees

92. The existing road will be widened and thereby requiring approximate felling of about 164 planted trees along the existing road sides. The mature trees >10cm D.B.H. (diameter at beast height) were observed during the field reconnaissance in December 2012. The approximate locations of the trees for the sections of the alignment common to all options were noted on plan and are shown on Figures 4.1 and 4.2. There about 152 mature trees >10cm D.B.H. in the common sections of the alignment. By observation and from satellite imagery there about 50 to 60 mature trees >10cm D.B.H. in the alignment from the crocodile farm to the Bhutan Police Compound but these areas could only be viewed from a distance as there are no paths along this section of the alignment. The total number of trees requiring felling will be determined and confirmed during the detailed design.

C. Social-Cultural Environment

1. Human Issues and Quality of Life

93. **Land Use.** Phuentsholing is strategically located on the border with the Indian town of Jaigaon. Phuentsholing is a busy commercial and industrial area. It occupies the river terraces of the River Om Chhu and is confined by steeply rising foothills to the north and east and by the Amo Chhu to the west. Topography around the core of the town is generally undulating and hilly, but there is considerable and expanding residential development on the steeper mountainous periphery. Areas to the north of the city consist of steep slopes, with many of the slopes already denuded of trees to create space for housing development, thus leaving little room for further expansion. The land within the Phuentsholing Thromde boundary is 320ha, but only 180ha are suitable for development and are mostly already fully developed. Because of land constraints, development has already grown beyond the existing city boundaries to the elevated areas like Kabreytar, Damdara, and Kharbandi to the north and Pasakha to the east.

94. Due to rapid urbanization, more than half of Bhutan's population will reside in urban centers by 2020. There is a rapid influx of rural migrants, resulting in an urgent need for improved urban services. The urban centers such as Phuentsholing will be major drivers of economic growth; reliant on good infrastructure. Owing to the thriving trade and related development in Phuentsholing, the town has experienced rapid population growth and urbanization and now suffers overcrowding, traffic congestion and unhygienic conditions. Expansion is constrained by fragile hill slopes around the city, the flood prone River Amo Chhu and the international border.

95. A conceptual land use plan has been formulated, as the beginning of a process to develop a vision for the utilization of the land resource. Possible courses for development are10 (i) an extension of the existing town, continuing in the style of the existing town, (ii) extension of the existing town and redevelopment in a new form (iii) a fresh approach to development, setting an example for development in the 21st century, which would influence resource development of the existing city.

96. **Agriculture.** Agriculture in Bhutan has a dominant role in the economy of the country. In 2000, agriculture accounted for 35.9% of GDP of the nation. The share of the agricultural sector in GDP declined from approximately 55% in 1985 to 33% in 2003. However, agriculture remains the primary source of livelihood for the majority of the population. Approximately 80% of the population of Bhutan is involved in agriculture. Over 95% of the earning women in the country work in the agricultural sector. Agriculture in Bhutan is characterized by its labor intensive nature with relatively low intensity of farm inputs. Most of the peasants in the country are small and marginal.

97. Among the agricultural lands in the nation, an estimated 21% are irrigated, approximately 43% are rain fed, about 27% are used for shifting cultivation, approximately 8% are used for orchards and 1% is kitchen gardens.

98. Major crops cultivated in Bhutan are maize and rice. Maize accounts for 49% of total domestic cereal cultivation, and rice accounts for 43%. Rice is the major staple crop. Agriculture in the country includes cultivation of wheat and other minor cereal crops. Rice is the primary crop in those regions where proper irrigation is available. Other crops like wheat, barley, oil seed, potato and different vegetables are also cultivated in these lands. Maize is mainly cultivated in dry land regions at lower elevation[6]. Forests in the nation act as the source of livestock fodder and organic materials for the purpose of development of fertility. Forests are also responsible for regulating the availability of water for agricultural purpose.

2. Demographic characteristics and public health

99. Phuentsholing is the second largest city in Bhutan. In 2005 the total population of 20,537 has been projected to exceed 24,000 by 2013. The unprecedented growth of the city in 1986-1991 converted the surrounding forests and available agricultural land into residential, commercial, and other uses to accommodate the increasing population. The population is projected to reach 67,000 by the year 2027.[11].

[10] Urban Development Plan-Phuntsholing.
[11] Draft IEE-Urban Infrastructure Project-Phuentshilong road and Bridge Project

100. The public health condition is more or less similar throughout the PT. Most Bhutanese have access to potable drinking water in the urban areas (98%) and basic sanitation (91%). Widespread health concerns include diarrhea and pneumonia. Diabetes, alcohol-related liver disease and cancer are also prevalent. Less widespread are w malaria and tuberculosis. Among children under age 5, skin infections; conjunctivitis and intestinal worms are significant concerns. Influenza, including H1N1 ("swine flu") and H5N1 ("bird flu") strains, are present in Bhutan. As of 2009, there were 6 confirmed cases of H1N1, none of which were fatal. Bird flu, however, has resulted in at least one outbreak in Phuentsholing and remains a serious concern for the Ministry of Health.

101. Bhutan launched its telephone Health Help Centre in 2011 which has proved successful and provides emergency response and the Healthcare Helpline which dispenses medical advice. Both services accessible through land and mobile phones. Emergency responses are served by ambulances in Phuentsholing.

3. Cultural and historical sites, schools and housing

102. The Bhutan Himalayas straddle the watershed of the Brahmaputra river basin. The river is regarded with religious reverence and faithfully believed as the blessed water of Lha Tshangpa or Goddess Tshangpa, thus called as Tshangpo in its head water sources of the Autonomous Region of the Tibetan Plateau. Bhutan has four major river

103. **Kharbandi Goenpa**: This monastery was founded in 1967 by the Royal Grandmother, Ashi Phuntsho Choedron and Guru Rimpoche. From the monastery garden there is a fascinating view of Phuentsholing town and surrounding plains.

104. **Zangto Pelri:** this is a small temple built in the centre of Phuentsholing town, represents the heaven of Guru Rimpoche. On the ground level there are statues of the eight manifestations of Guru Rimpoche and paintings of Buddha's life. The next floor contains the eight Bodhisttavas and statues of Avalokiteshwara and Shabdrung Ngawang while on top floor, the main statue is of Amitabha.

105. **The Crocodile Farm**: This small farm/zoo is situated east of the old Norgay Cinema Hall approximately adjacent to Km1.7 of the proposed alignment. It was established during 1976 with two different species mugger crocodile & gharial crocodile. In total there are 21 crocodiles. The biggest Gharial crocodile is 276 kgs and 12 ft. length.

106. The Project district is home to a number of cultural and historical sites but generally not near the PBR. There are cemeteries and all are more than 10m outside the road corridor and more than 15m from the centerline and away from where the rehabilitation and improvement works would need to take place. During public consultation no sacred places or traditional heritage sites for local villagers were brought to the attention of the consultants.

107. Schools are located at some distance in many locations. Schools and colleges are particularly vulnerable to construction impacts and the scheduling of works should be scheduled after discussions with the principal to avoid impacts.

108. Residential properties are located at intervals and residential development is spread out in patches all around the PBR. The front facades of the houses are generally set back from the PBR site by >30m (outside the area of direct impact). No land

acquisition will be required or relocation of properties or resettlement does not seem to be a significant issue based on observation.

109. **Power Supply**. Electrical power is supplied in Phuentsholing Bhutan Power Corporation (BPC) grid. The low voltage distribution network runs on poles adjacent to the Project site and will need to be protected during the works. Some of these poles and lines may need to be reprovisioned before the improvement works commence to ensure continuity of power supply. The Project road works must be programmed not to create any impacts on these facilities and maintain security of power supply.

110. Given the status of Phuentsholing as the Gateway and Commercial Capital of Bhutan, the Bhutan Power Corporation (BPC) has been recommending adoption of underground (UG) cable network irrespective of higher costs. Selective adoption of UG is contemplated mainly from the view-point of safety in major cases and specific cases related to aesthetic considerations.

111. **Telecommunications**. The telephone system in Phuentsholing consists mainly of primary (UG & Aerial) and secondary (Aerial) networks with 5200 pairs of telephone line capacity. The primary or the UG network is laid underground. The capacity of the network is sufficient to meet the demand and is met as and when applied by the consumers. The future proposals include provision of UG secondary network in every building and replacement of the existing aerial network by underground network. Apparently, the Bhutan Telecom does not have a Master Plan of telephone network in Phuentsholing but their plan has been prepared based on the annual growth or demand.[12]

112. **Rail Transportation**. There are no railways in Bhutan but it is possible to travel close up to the Bhutan border by Indian Railway. Nearest major railway station is Alipurduar and Hashimara is also close by. Phuentsholing is half an hour drive from Hashimara.

113. **Roadways.** Jaigaon the Indian border town is 180 kilometers from Siliguri. Phuentsholing in Bhutan is approximately 182 kilometers by road from Siliguri. Phuentsholing is six / seven hour's drive from Bagdogra / New Jalpaiguri and seven hours drive from Gangtok or Darjeeling. The Royal Bhutanese Government runs bus services to Phuentsholing from Kolkata. These buses depart from Kolkata Esplanade bus station and reaches Phuentsholing via Siliguri. Phuentsholing is the only entry / exit point via road. The other is only entry point is in Assam.

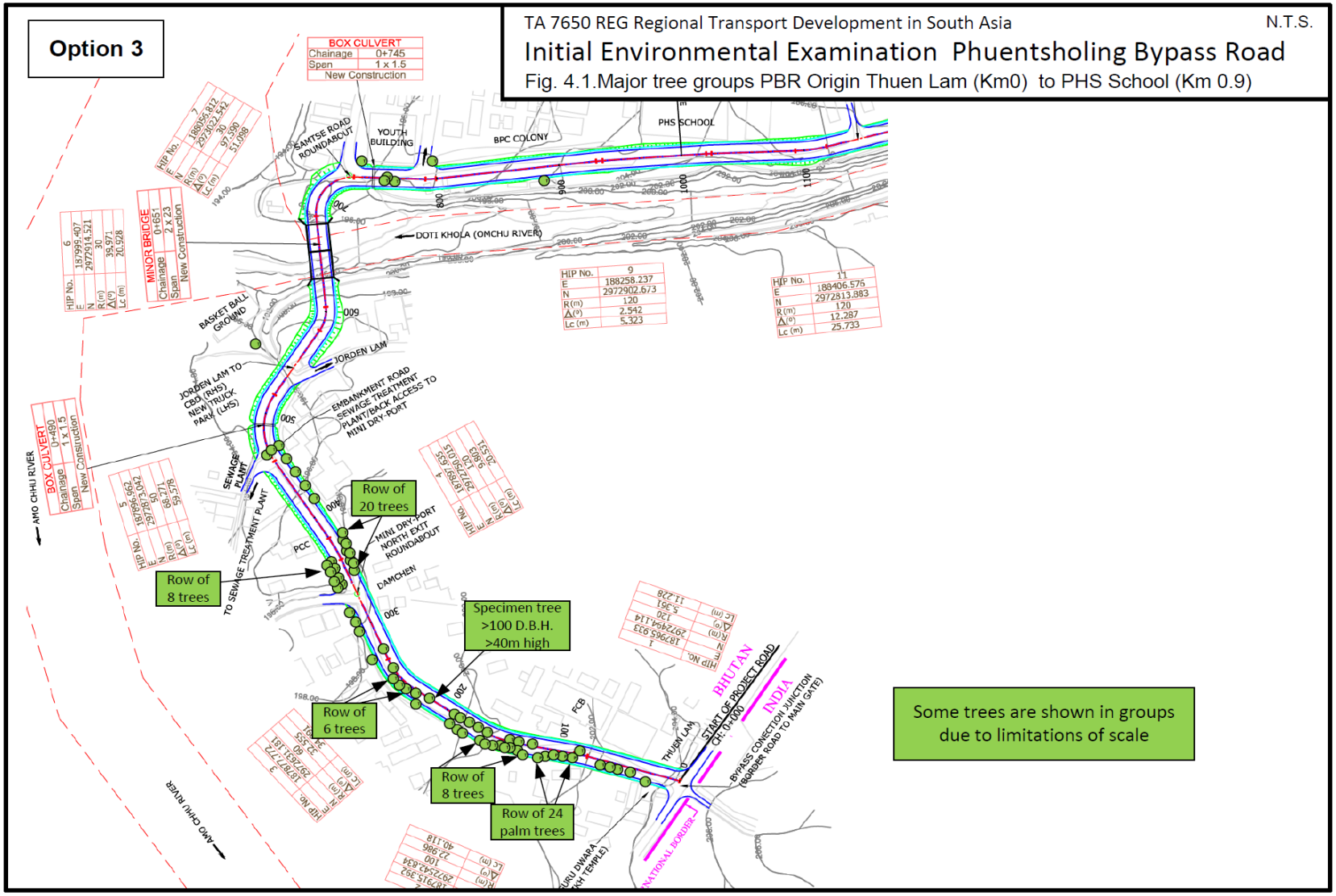
114. Phuentsholing is one of the few cities which are well connected with other parts of the country through national road network. It is connected with Thimphu, the capital of Bhutan and other important cities like Gedu, Chhukha, Paro, etc. through Thimphu – Phuentsholing Highway. The access is not easy due to difficult terrain, poor road conditions and the distance involved (170 kms – Thimphu). Being the gateway, it is also connected to other parts of Bhutan like Samdrup, Jhonkhar, Gelephu, and Samste etc. through the road networks of India.

[12] Urban Development Plan-Phuntsholing

115. Phuentsholing has good advantages due to connectivity with major commercial towns of India i.e. Siliguri, Kolkatta, Coochbehar, Guawahati etc. which allows a free flow of trade between India, Bhutan and Bangladesh.

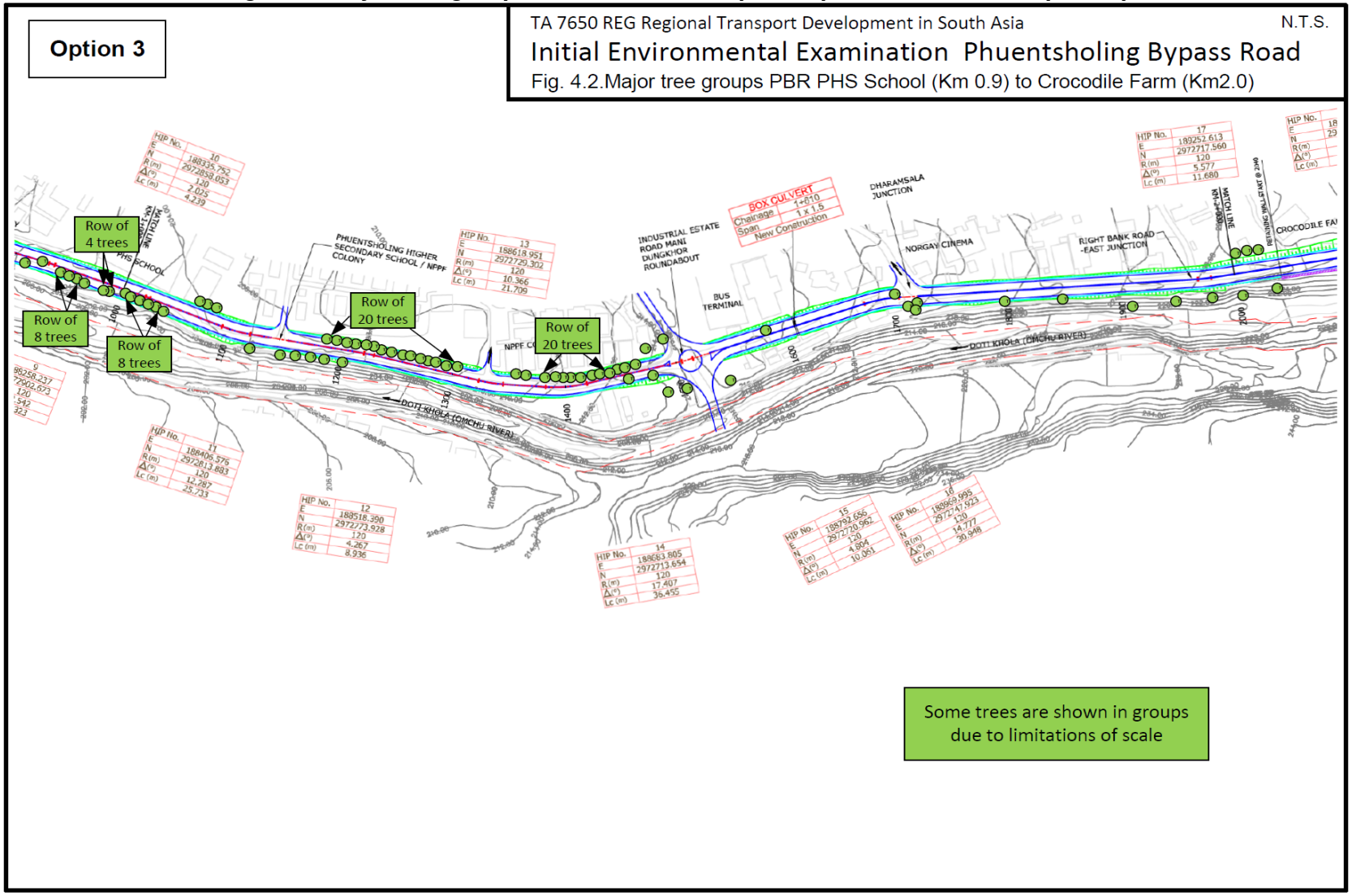
116. **Air Travel**. Bagdogra airport is 192 km from Phuentsholing. Bhutan's national air carrier, Druk Air, operates several flights per week from Bangkok, Bagdogra, Delhi, Kolkata and Kathmandu to Paro. Spectacular flights fly passengers through the stretch between Kathmandu and Bhutan. The flight passes along the Himalayan Range.

Figure 7: Major tree groups PBR Origin Thuen Lam (Km0) to PHS School (Km



0.9)

Figure 8: Major tree groups PBR PHS School (Km 0.9) to crocodile Farm (Km2.0)



V. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

117. This section discusses the potential environmental impacts of the proposed improvement of the PBR road stretch and identifies mitigation measures to minimize the impacts in the design, construction and operation.

118. **Physical Impacts**. The main physical issues relate to impacts such as earthworks, erosion control; sourcing and transportation of construction materials; noise, dust, spoil disposal, disposal of other hazardous waste, and water quality. The impacts will be mainly limited within the ROW for the PBR road.

119. The main physical impacts will come in the construction phase from activities including (i) excavation and reconstruction of the embankments and slope stabilization measures, (ii) widening and reconstruction of the single carriageway pavement to 18m to include pavements, (iii) construction of elevated viaducts, flyovers and bridges (iv) construction, repair and reconstruction of culverts (iv) ensuring road drainage and access near urban facilities and at other key areas is unimpaired by extension of numerous culverts; and (v) installing slope stabilization and landscaping and accessories. In the undulating areas there will also be some slope cutting which will give rise to some spoil for disposal. Fill materials from borrow pits and quarries will also be required.

120. **Biological Impacts.** There are no natural forests or wildlife habitat within the project area since the area falls completely within the built area of Phuentsholing Thromde/City. The major biological impacts therefore concerns only with man-made environment – (i)removal of existing roadside planted trees; and (ii) disturbance to the captive Gharial crocodile breeding centre during construction.

121. **Socio-economic Impacts**. In the short-term the proposed sub-project will potentially have positive impacts on local employment in Phuentsholing by creating a demand for unskilled construction workers for the development of infrastructure in the transhipment areas. This will result in improvement of the operational environment in the transhipment yards, which potentially would contribute to improve the working environment and facilitate better health and safety provisions if other management practices are introduced.

122. The potential environmental impacts in the design, construction and operational phases are assessed below. Where impacts are significant enough to exceed accepted environmental standards, mitigations are proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the Project. The environmental assessments are carried out in line with Safeguard policies of ADB and the regulations of RGOB. The EMP is presented in Table 8.2 as a matrix of mitigation and monitoring measures to prevent or minimize the impacts.

A. Design / Pre-Construction Phase

1. Detailed Design

123. Detailed design of the Phuentsholing Bypass Road is scheduled to be carried out by fourth quarter of 2014 through hired Design Consultant. The project design will incorporate the IEE study recommendations. EMP will be made integral part of the bidding and contract document. Environmental Mitigation measures will be itemized and put in the Bill of Quantities (BOQ).

2. Tree Felling

124. PBR will require 1.8 km of widening of existing road and about 1km of new road construction. Approximately about 160 trees will need to be removed to make way for PBR construction. Tree felling will be done with approval from Department of Forest and Park Services (DOFPS). The application for tree felling process has been initiated and approval will soon be accorded. Upon approval from the DOFPS, PT will carry out tree felling in accordance with procedure set forth in Forest and Nature Conservation Rules (2006). Only the necessary trees that marked by the DOFPS will be felled. The economically valuable timbers will be handed to the Natural Resource Development Corporation limited (NRDCL). PT in consultation with DOFPS will carry out compensatory plantation. Depending on the availability vacant or barren government land, compensatory ratio of minimum of 1:1 will be followed if area designated is small and for large area a ration 1:4 to be applied.

3. Environmental capacity development

125. Environment Division under PT is involved in management and operation of city's solid waste collection and disposal; sewerage treatment; water treatment and supply; and maintenance of drainage and footpaths. However, it is not involved in monitoring and supervision of any new projects; since it is the responsibility of the Engineering Division. Both the Divisions lack expertise and experiences in carrying out the environmental compliance monitoring of the projects. Under the current SASEC road connectivity project, personnel of Engineering Division who are part of the Project Coordination Unit (PCU); will be provided on the job training on environmental monitoring and reporting.

126. Moreover, as part of the overall capacity development, ADB will provide environmental baseline (air and noise) monitoring equipment and the required training on data collection and assessment. During the construction period, equipment will be placed with the respective PCU/CSC; and after the completion of project it will be handed over to the Engineering Division for PT.

127. PIU shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project EMP and any additional mitigation measures that may be required during construction phase.

4. Ambient environmental baseline data

128. As part of institutionalization and capacity building for environmental compliance monitoring and reporting, ADB will finance the procurement environmental monitoring equipment and provide the necessary training. Baseline data on air quality and noise levels will be collected before commencement of civil works. These data will help in assessing project impacts during implementation.

B. Construction Phase

129. The source of the construction impacts from the Project road will include (i) excavation and reconstruction of the embankments, (ii) widening and reconstruction of the single carriageway pavement (14.0m wide) plus median and hard shoulders; (iii) construction, repair and reconstruction of culverts (iv) ensuring road drainage is unimpaired by extension of numerous culverts; (v) ensuring temporary access near residential and government and community facilities and other key areas is maintained (vi) installing slope stabilization and

bioengineering measures, landscaping and accessories ; and (vii) bridge construction. In the steep areas there will also be some slope cutting which will give rise to significant amounts of spoil for disposal. In this IEE project construction supervision is assumed to be carried out by a PCU/PIU with the assistance of Construction Supervision Consultant (CSC).

5. Orientation of contractor

130. PMU shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project EMP, SEMPs and any additional mitigation measures that may be required during construction phase.

6. Drainage and hydrology

131. PBR follows Om Chhu River from second bridge till the third bridge (Flyover) crossing over Om Chhu River. The earthworks and excavation as well as flood protection and river training works along the Om Chhu River will cause erosion, siltation and thereby water pollution. During construction, the contractor will ensure the proper disposal of spoil and other waste. Hazardous waste such as oil and lubricants will be properly stored and sent for recycling. Solid municipal waste will be disposed off in a municipal landfill. Construction activities will be carried out only during dry season from late October till April.

7. Impact on Flora and Fauna

132. Project lies completely within the built-up area of Phuentsholing Thromde, hence there are no wildlife and habitat in natural condition. However, at chainage Km1.8, there is a captive Gharial Crocodile breeding center. Gharial crocodile is listed by IUCN as critically endangered crocodile species. Road construction will not physically damage the breeding center but the construction noise may disturb the animals during the construction. In order the reduce construction noise impact, 2m high by 30m long bund (concrete brick/stone wall) will be constructed stop noise from directly disturbing crocodiles.

8. Materials exploitation and management of quarry and borrow areas

133. As there are no identified quarries within the project area, construction materials particularly stone will be sourced from the nearby government approved, existing and operational quarries. Sand will be imported from the quarries in the neighbouring India state of West Bengal. There will be no direct of quarrying to the project area. No mitigation measures will be prescribed for the already operational quarries. Implementation of mitigation measures and subsequent monitoring is carried out by agencies like Dzongkhag/District authorities, Department of Geology and Mines (DGM); and National Environment Commission (NEC). Only mitigation measure that is applicable directly is maintenance of material transport vehicle; covering of materials; and spraying of water along haulage route. Water spraying can be done by tanker at least twice a day. Water can be sourced from Om Chhu or Amochhu Rivers.

9. Spoil Disposal

134. There will be limited excavation requirement and hence the limited spoil generation. The assessment indicates the possibility of achieving 100% balance cut and fill for PBR widening and construction. Therefore, identifying separate disposal sites was found unnecessary. The spoil generated from new construction and excavation site after chainage Km1.8 till the termination point at the junction with Thimphu-Phuentsholing National Highway will be piled and

reused in area wherever there is requirement of filling. Total filling will be required the second bridge till Km 1.8 (at Crocodile farm). The temporary spoil mound will be placed in safe area away from the settlement and river courses. If there are any excess spoil, the CSC along with the PIU will consult local authorities and identify the proper disposal site. Disposal area once complete will be re-vegetated using the local or native species.

10. General Construction Waste Management

135. Uncontrolled waste disposal will contaminate soil and water bodies, thereby harming the environment. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable. The contractors will ensure implementation of following measures.

i) In principle, the waste generation will be minimized at source.
ii) Waste products will be segregated, recycled and reused whenever possible.
iii) Recyclable waste will be sold to the scrap dealers.
iv) Organic waste such as plant materials will be composted
v) Residual non-hazardous waste will be disposed off in the municipal landfill.
vi) Construction/workers' camps will be provided with sufficient refuse bins.
vii) Burning of construction and domestic wastes will be prohibited.

136. Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited.

11. Hazardous materials and hazardous waste disposal

137. Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Oils and lubricants discharged to woodland can kill the roots and destroy the trees. Mitigation measures will seek to control access to and the use of hazardous substances such as oils and lubricants and control waste disposal. Contractor will carry out following measures to minimize the impacts:

i) Oil and lubricants will be safely stored. Secondary containment around fuel storage area will be ensured.
ii) Hydrocarbon, toxic material and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of RRGOB to prevent soil and water contamination.
iii) Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.
iv) Fuel and other hazardous substances will be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.
v) Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labeled and safely stored. The spent oil and batteries will be sold to recycling dealers.
vi) Hazardous materials will be stored away from water bodies and above flood level.
vii) Cleanup operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste
viii) All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.

12. Asphalt, hot mix plant, rock crushing and bitumen supply

138. The rock crushing activities will generate noise and dust and pavement works will generate gas and odour from the asphalt hot-mix plant and noise from the compaction of the pavement. Improvement the Project road will require significant amounts of rock based material and many tons of asphalt. Although the emissions from powered mechanical equipment that supply crushed rock and bitumen will be rapidly dispersed in the open terrain they will need to be sited carefully to avoid complaints. The works for the pavement in any section of the road are estimated by the TA Team to take only 3 to 4 weeks depending on the terrain and therefore emissions from mobile powered mechanical equipment for road surfacing will be short lived.

139. In order to maintain the existing air quality of the Project area in a condition acceptable to the local population compliance with the following mitigation measures will be implemented:

(i) Cement batching and aggregate mixing plant will be located as far as possible (preferably at least 500m) from settlements and habitation or as required by environmental regulations.
(ii) Construction zone through sensitive areas such as residential and school campus will be watered at least twice a day using tanker. Water will be sourced from Om Chhu/Amochhu River.
(iii) Where local roads are used for haulage they shall be kept in serviceable condition and any damage shall be repaired promptly without interference to local travel routes.
(iv) Storage sites, mixing plants, and bitumen (hot mix) plants will be placed at least 500m of the nearest human settlements.
(v) All hot-mix plants, crushers, and batching plants will be located in agreement with the local authority as well as the communities.

140. Due to the locations of the works fumes from bitumen and chemicals are likely to be well dissipated in the open terrain. However phenol compounds in the bitumen have a very low odor threshold and extremely low concentrations can cause nuisances. These are unlikely to accumulate to toxic levels but the plant for the supply of molten bitumen should be sighted as far away from sensitive receivers as is practicable. Asphalt plant and rock crusher activities (if required) will be controlled and hot-mix plants should not be located within 500m of any sensitive receiver, river bank or irrigation channel but located at convenient sites nearby but at least 500m (in the prevailing downwind direction) from sensitive receptors such as residences, schools, hospitals.

141. Bituminous materials will generally be applied using machines but if bituminous compounds are to be applied by hand labor methods and melted in heaters the fuel used shall be kerosene or diesel. Fuel wood will not be used for heating bitumen; neither will bitumen be used as fuel.

142. Bitumen drums will be stored in a dedicated area, not scattered along the works and any small accidental spills of bitumen or chemicals will be cleaned up immediately.

143. It is possible that contamination of soil may occur from oils and chemicals at bitumen plant sites, workshop areas, equipment washing-yards and along the roads works. As a matter of good environmental practice these materials should be cleaned up as soon as practicable.

144. The following practices will be adopted to minimize the risk of soil contamination:

i) The contractors will prevent soil contamination and will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination.
ii) Debris generated by the dismantling of existing pavement will be recycled subject to the suitability of the material.
iii) Bitumen will not be allowed to enter either running or dry streambeds and nor will be disposed of in drains or ditches or small unlined waste disposal sites prepared by the contractor.
iv) Bitumen storage and mixing areas will be protected against spills and all accidentally contaminated soil must be properly handled according to applicable national and local laws and regulations. As a minimum, these areas must be segregated, such that any spills can be immediately contained and cleaned up.
v) Any petroleum products used in the preparation of the bitumen mixture must also be carefully managed to avoid spills and contamination of the local water table and streams. Bitumen and other hydrocarbon residues will be disposed of as hazardous waste.
vi) All accidental spills of bitumen or chemicals will be cleaned up immediately with the top 2cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority.
vii) Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated off-site waste disposal sites identified and agreed with and the local community and local authorities.

13. Dust and Noise

145. Earthworks and rock crushing activities will be the main sources of dust. The works in any given section of the road will generally be of short duration and in most locations there will be sufficient buffer distance between the work corridor and the existing SRs (30m to 50m) such that no significant impact is expected from the construction works on residential sensitive receivers in terms of noise, vibration, and dust.

146. Whereas noise and dust were recognized as nuisances by the local population they were also considered acceptable nuisances in view of the likely short duration of the works and that there were good benefits from future improved road conditions. Nevertheless it is good practice to control all dusty materials at source so that nuisances do not occur and visibility on the adjacent road is not impaired and so that road safety can be maintained or improved. Water is available in the study area from the Om Chhu or Amochhu Rivers and based on observations of the river flow in the dry season (December) sufficient surplus water should be available from the nearby river to be sprayed suppress dust at all locations in the dry season. The mitigation measure will include:

i) Water sprinkling or spraying using tanker will be done twice a day to reduce dust generation.
ii) No work will be carried out during the night (2100 hrs to 0700 hrs).
iii) If works have given rise to complaints over dust, the contractor shall investigate the cause, report it in the monthly progress reports and review and propose alternative mitigation measures before works recommence.
iv) Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out.
v) Vehicles transporting soil, sand and other construction materials will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust.

Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PIU.

147. The need for large stockpiles should be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 100m of residences. If large stockpiles (more than 25 m^3) of crushed materials are necessary they should be enclosed with side barriers and also covered when not in use.

14. Blasting and vibration

148. No blasting will be carried out as the PBR construction area falls within the built up area of Phuentsholing Thromde. In the event, the blasting is required due to unavoidable circumstances then only non-explosive chemical based blasting material will be used for rock breaking. This will not generate any noise or vibration; hence there will be no impact human and the structures.

15. Erosion control and runoff

149. In order to avoid erosion and runoff the all excavation and earth works will be will be carried out dry season (November to April). Civil and bioengineering works will be applied to control the erosion. Following mitigation measures for slope stabilization will be carried out:

(i) Stockpile topsoil for use in immediate replanting and bioengineering after completion of engineering work.
(ii) Minimize damage and cutting of surrounding vegetation during slope formation.
(iii) Protect the cut slope with planted vegetation, bioengineering or conventional civil engineering structures as soon as practicable after cutting.
(iv) Prevent erosion and protect the cut slope with temporary or permanent drainage as soon as practicable after cutting.

150. In order to preserve the constructed slopes and other works and embankments from soil erosion and runoff.

i) Low embankments will be protected from erosion by seeding and planting indigenous grasses that can flourish under local conditions.
ii) High embankments, i.e. 2m high and above, will be considered for protection by constructing stone pitching or a riprap across the embankment immediately after the works are completed. This practice will also be applied along cross-drainage structures where embankments are more susceptible to erosion by water runoff.
iii) The contractors will also be required to include appropriate measures for slope protection, i.e. vegetation cover and stone pitching, as required in the detailed construction drawings and implement them accordingly.

16. River protection during bridge construction sand and culvert repair

151. The Project proposes to replace or repair culverts and construct new ones. Careless construction and poor materials control can cause blockage to rivers and streams. Therefore in areas along and near rivers and streams the following will be carried out:

i) Work will be programmed for the dry season.
ii) Earth and stones will be properly disposed of so that they do not block rivers and streams, resulting in adverse impact on water quality and flow regime.
iii) In culvert repair and demolition sites, the culvert structure will not be dropped into the river but alternative means will be used to avoid "dropping the culvert" into rivers/streams. This will be done by "sawing" appropriate sections of the culvert

and using cranes to lift these sections away or alternatively by construction of a platform onto which the culvert could be lowered.

iv) Cofferdams, silt fences, sediment barriers or other devices will be used as appropriate based on the design to prevent migration of silt during excavation and boring operations within streams. If cofferdams are used, these will be dewatered and cleaned to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.

v) Other erosion control measures above and covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction.

17. Water Quality

152. In order to prevent water contamination the following precautionary measures will be undertaken by the contractors:

i) Lubricants will be stored in containers /dedicated enclosures with a sealed floor >50m from water bodies.

ii) Solid waste from construction activities will not be thrown in rivers and.

iii) Construction storage/stockpiles will be provided with bunds to prevent silted run-off.

iv) Stockpiled materials will be covered to reduce run-off.

v) Work in rivers will be scheduled during dry season and work duration shall be as short as possible.

vi) Bare slopes will be stabilized immediately after works are completed.

vii) Stockpile areas and storage areas for hazardous substances will be located away from water bodies.

viii) Washing of machinery and vehicles in surface waters will be prohibited

18. Water Resources and Water Quality

153. Om Chhu and Amochhu Rivers are the two main water bodies within the project area. Amochhu River originates from Tibetan plateau and it is joined by Om Chhu River drains through north-west of the project area. During construction water quality of Om Chhu River will be directly affected by PBR construction activities. Dumping of construction and other hazardous wastes will degrade the river water quality and affect the downstream aquatic life. In order to avoid or minimize impact on water resources, the contractor will ensure the disposal of spoil (excavated earth) and other waste in a pre-identified disposal site. Hazardous waste such as oil and lubricants will be properly stored and sent for recycling. Solid municipal waste will be disposed off in a municipal landfill.

19. Construction camps and canteen facilities

154. Placement of construction camps to close to local community will result in unwanted interference in the community way of living. The competition for use of local resources (such as food supply, water supply and fuel wood) will increase; disadvantaging the local community. Therefore, construction camps will be placed in a proper location in consultation with PIU and the PT. Adequate drinking water supply, basic food items, and cooking fuel (such as kerosene) will be provided to ward off competition on local resources. For maintenance of proper health and hygiene; pit latrine and garbage cans will provided. Fishing, hunting and illegal tree felling will be totally prohibited. After completion of constructions, the abandoned campsite will be

cleaned and restored to the state. If a campsite is a government barren land then contractor will carry out compensatory plantation suitable local or native plant species.

20. Sanitation and Disease Vectors

155. Import of labourers will likely result in spread of communicable diseases such as HIV/AIDS, STDs, malaria and Tuberculosis (TB). Unhygienic living condition without proper sanitation facilities will increase potential harmful waterborne diseases. In order prevent health related impacts the contractor will implement following measures:

i) Measures to prevent proliferation of mosquitos will be implemented (e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.).
ii) Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside, to prevent proliferation of mosquitoes.
iii) Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.
iv) HIV-AIDS awareness or education will be implemented in line with social programmes and plans for the Project and HIV/AIDS awareness and prevention program shall be implemented in line with plans from the social work stream.
v) Sanitation facilities such as construction of pit latrine and solid waste collection disposal will be implemented.
vi) Health checkup or screening of the imported labourers will be carried out as per the existing practices to stop spread of TB.

21. Safety Precautions for Workers

156. Worker occupational health and safety is generally governed Labour and Employment Act of Bhutan 2007. Construction works will generally result in accidents and injuries or even demise of the workers if no health and safety measures are followed. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will be applied for occupation safety.

157. Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows:

(i) The contractor will conduct of training (assisted by PIU) for all workers on safety and environmental hygiene at no cost to the employees. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities.
(ii) The contractors will instruct and induct all workers in health and safety matters (induction course) including construction camp rules and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site will include safety and environmental hygiene.
(iii) Fencing on all areas of excavation greater than 1m deep and sides of temporary works shall be observed.
(iv) Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers.
(v) Reversing signals (visual and audible) shall be installed on all construction vehicles and plant.

(vi) Contractor will at all-time keep the first aid kit at the construction sites.
(vii) Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses

22. Public Safety

158. Public safety, particularly of pedestrians and children can be threatened by the excavation of the trenches for side drain construction. Construction sites near to settlement will be guarded on all sides by security personnel. Construction activities will be timed and provision for safe passage of school children and elderlies will be provided. The window period for local traffic and pedestrian will based on agreement between the local community and local authority. Excavated trenches/ditches and freshly cut steep side slopes will be clearly marked and fenced for the safety of passersby and workers alike. Project or construction vehicles will be briefed on speed limit within sensitive areas such as schools, commercial and residential areas. In event of accidents, the contractor will be responsible for immediate evacuation of injured person to the nearest medical center. The contractor shall bear medical and other expenses of the injured person.

23. Traffic Management

159. Construction activities are likely to cause hindrance in local traffic flow if not properly planned and executed. Contractor in consultation with PIU; local authorities (such as traffic police, Road Safety & Transport Authority and Phuentsholing Thromde); and local communities will come up with traffic management during construction. Work hours and traffic windows will be decided and implemented accordingly. Traffic flow during the rush hours (school and office opening and closing time) will be kept open. Assistance of traffic police will be sought during Pedestrian movement will be allowed uninterrupted; however under the proper guidance by the security personnel.

24. Archaeological and cultural artifacts

160. There are known archaeological or cultural sites within Project area except for one prayer wheel near the second bridge. This prayer wheel can be avoided so there will no impact on it.

25. Compensatory Plantation

161. Project or PIU in consultation with local government; Divisional Forest Office (DFO) and community will locate the government or even community barren for compensatory plantation. Compensatory plant using local or native tree species will be carried out to replace the trees felled during the construction. Ratio for compensation will be 1:1 if the area of plantation is small. However, the project can go up to 1:4 if the larger areas available. Project could possibly explore plantation area in the degraded upstream catchment of Om Chhu River. This will serve dual purpose – it will lessen erosion and flooding[13]; and in the long term plantation would act as carbon sink.

[13] Omchhu River occassionally cuases flooding of Phuentsholing City.

C. Operational Phase

162. During the operational phase of the Project the PT will maintain the road.

163. The improvement of the hard shoulders on Project road and the improvement of the asphalt surfaced road can be expected to reduce road traffic noise and air pollution from dust. The improvement of the Project roads road will be within the existing corridor keeping vehicles away from sensitive receivers and at this stage it is difficult to see that any residences or commercial premises or schools will still be close enough to the Project road to be affected by noise and dust so as to exceed the assessment criteria.

1. Noise

164. There is no criterion of for road traffic noise in Bhutan but guidelines on ambient noise have been introduced. The Bhutan ambient noise standard is Leq55dB(A) for sensitive area (same as World Bank[3]). Spot measurements of existing measured noise levels along the road are both above and below the Leq55dB(A) criterion. Therefore the criterion of background +3dB(A) should be applied. The main noise source in most areas is traffic noise and in order for the existing background to be exceeded by +3dB(A) the existing traffic would have to be more than doubled. Traffic forecasts indicate that traffic is not expected to double for at least twenty years[2]. Therefore the Project is believed to be sustainable in terms of road traffic noise. No operational mitigation measures are required.

2. Gaseous Emissions

165. Vehicle emissions (gaseous) as indicated concentration of oxides of nitrogen will be the main air pollution sources during operation. There will be few other sources of emissions near the Project road other than from domestic fuel burning. Sensitive receivers are set far enough back from the Project roads road to allow adequate dispersion that there will be no significant impacts at the sensitive receivers.

3. Particulate Emissions

166. Vehicle emissions (particulate contamination) such as dust and fumes will also be air pollution sources during operation however toxic residues from vehicle emissions near the Project roads road are unlikely to accumulate or create significant impacts under the local conditions. Dust from the existing road will be reduced due to the better asphalt surface for the new road. Therefore the Project is believed to be sustainable in terms of gaseous and particulate emissions and no operational mitigation measures are required.

4. Soil Erosion

167. Soil erosion will be prevented by developing a comprehensive suite of engineering controls in the detailed designs to prevent and maintain erosion. A system will be devised and engineered to control erosion and flooding on either side of the embankments in case of heavy rains. Apart from affecting the community lands and resources, this would otherwise cause natural streams and irrigation channels to become silted.

168. Measures will also be taken during the operational phase to ensure that the frequency of maintenance is increased and that storm drains and highway drainage systems are periodically

cleared to maintain clear drainage to allow rapid dispersal of storm water flow. An adequate system of monitoring, reporting and maintenance will be developed.

5. Driving Conditions and Community Safety

169. The rehabilitation and widening of the Project road is likely to increase the vehicle speed on the road. Increases in traffic flow indicate additional future traffic should be moderate and unlikely to create many community safety issues. Overall the condition of the road facilities will be enhanced and driving conditions should improve. Routine safety measures, signage and road markings should be introduced to reduce driving risk further in accident prone areas and provide enhancements to driving conditions.

6. Tree planting

170. Environmental enhancements introduced in the detailed designs may include tree planting, as necessary. The planted specimens should be maintained and monitored for three years after planting to ensure their survival in line with the Tree-cutting and Replanting Plan.

7. Water Resources and Water Quality

171. Complaints about the contractors' works will be resolved in the construction phase. The scale of the works indicates that there are unlikely to be any impacts that continue into the operational phase.

D. Cumulative Environmental Impact

172. More than adverse cumulative impacts, the cumulative beneficial impacts would higher for entire region as well as for Phuentsholing City, if MDP development along with the Phuentsholing Bypass Road (PBR) and Pasakha Access Road (PAR) is carried out. Currently, all heavy transport carriers pass through narrow Phuentsholing City border crossing; and customs and transshipment activities carried out various locations without centralized processes. This result in huge delay which increases the vehicle operating cost and causes congestion within the city. Therefore, development of MDP, and the construction of PBR and PAR would have following cumulative beneficial impacts:

i) Easing of traffic congestion inside Phuentsholing town (currently all vehicles to and from India passes through only border crossing at Phuentsholing through a narrow road);
ii) Reduction of travel distance for heavy trucks (traveling through Jaigaon bypass road)
iii) Reduction of overall transportation cost
iv) Reduction of fuel consumption and thereby lower greenhouse gas emission
v) Reduction of vehicular noise and exhaust pollution within Phuentsholing
vi) Allowing of smooth and faster trading between Bhutan and regional countries; leading to better economic output of the country.

E. Trans-boundary Issues

173. The proposed PBR is to takeoff from second Bhutan-India border crossing and join the Phuentsholing-Thimphu highway. The noise and dust pollution would be the major trans-boundary issues particularly for road section closer to Indian border. Noise and dust during construction and operation will impact neighbouring settlement in India. Noise and dust impacts

during construction will be limited and short term. However, to minimize the impacts; contractor will implement following mitigation measures:

i) Dust will be suppressed by spraying water at least thrice a day during construction period. Water can be sourced from either Om Chhu or AmoChhu River.
ii) Haulage trucks carrying construction material will be covered. Haulage route wherever feasible will avoid traversing through the populated center.
iii) Construction machineries and equipment will be well maintained to minimize the noise generation.
iv) Construction activities will be restricted to a daytime (if possible between 8am to 5.30pm) so that noise will not be during nighttime.

174. Noise and dust impacts during road operation will be sustained one with very limited mitigation choice. Construction of noise and dust barriers along the PBR will be met with opposition from the business setup and public alike. It is viewed as a barrier for their business and free movement. And further, the large barriers constructed within the city center will be unaesthetic. The only measure that could be applied is the checking and restricting of vehicle with high emission and noise through help of Road Safety and Transport Authority (RSTA).

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

175. The objectives of the stakeholder consultation process was to disseminate information on the Project and its expected impact, long-term as well as short-term, among primary and secondary stakeholders and to gather information on relevant issues so that the feedback received could be used to address these issues at early stages of Project design. Another important objective was to determine the extent of the concerns amongst the community, to address these in the Project implementation and to suggest appropriate mitigation measures. The feedback received has been used to address these issues at early stages of Project design.

A. Identification of Stakeholders

176. The stakeholders consulted for the Project included local affected persons residing near the project and other stakeholders including the government agencies. Individuals representing many persons from numerous family groups in the area along the alignment were informed about the Project and invited to comment on their environmental concerns. These stakeholders were considered to be representative of the community living in the area, the road users, the business associated with the road and the locally elected representatives. Subsequently further public consultations have taken place including meetings and discussions with authorities.

177. The stakeholders included local affected persons near the Project road that individuals consulted included persons representing 6 family groups in 6 souses. These were considered to be representative of most of the community living in the area. Consultations took place in between 1st December to 5th December 2012. Dates and locations are presented in Appendix B.

B. Consultation with Stakeholders

178. The results of the public consultations are recorded in Appendix B. The communities along the Project road indicated they would fully support the rehabilitation and improvement project. The main environmental concerns included flooding, erosion control, traffic accidents, protecting water supplies, preventing damage to local electricity cables and other infrastructure and utilities surroundings construction areas. Prompt completion of the works and minimization of land acquisition were also requested by some local stakeholders. Increased traffic noise and controlling project workers and sanitation during construction were not major concerns but this is not surprising as this Project will be the first major project in the area for many years. Compensation for land acquisition was raised by soma as a social issue. No significant operational phase impacts were identified. The affected persons also fully expect that the necessary arrangements to compensate any loss of property are addressed before construction commences. Further information is provided in **Appendix B**.

C. Concerns Addressed

179. Concerns with respect to road alignment and drainage design and the disturbance or destruction of crops and gardens, private property and community disturbance have been brought to the attention of the Project proponent and the relevant parties are well aware of the potential for local disturbance that can result from poorly controlled contractors. The main issues raised are addressed in the environmental management plan, as far as is reasonably practicable at this stage; a resettlement plan has been prepared to compensate for affected persons that can reasonably be predicted at this stage. Unforeseen impacts will also be captured by the requirements to update the environmental management plan and inform ADB in response to any unpredicted impacts that arise periodically as necessary.

D. Information Disclosure and Participation

180. Minor concerns were expressed that the DUDES should disclose the road construction works in advance and complaints monitoring will provide further opportunities for consultation and can assist in public participation. Providing information through local authority offices will provide a conduit for the improvement of the project implementation to better serve the stakeholders. Public consultation can also assist in:

i) harnessing cooperation from informed people to help local authorities reconfirm the extent of local permits and licenses that will be required at a later stage;
ii) obtaining cooperation from informed residents and groups which to avoid cost and time in dealing with complaints;
iii) identifying local infrastructure projects or other local initiatives that will interface with the Project road with assistance from informed local authorities;
iv) The collection of anecdotal information on the current condition of the local environment including aspects of forest and wildlife and conservation.

181. PT will disclose the IEE report to the public through their website to provide public an opportunity to review the project design and engaged in further consultation if necessary. Similarly, ADB will disclose the final IEE on its Website for public dissemination.

VII. GRIEVANCE REDRESS MECHANISM

182. As both components of the project are closely interlinked a unified Project grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

183. Phuentsholing Thromde (PT) shall make the public aware of the GRM through public awareness campaigns. The contact phone number Project Coordination Unit (PCU) will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices and at PT. Information on the project shall be made available at the PT office and a brochure/leaflet will be made available to include information on the GRM and it shall be disseminated to the local government offices, temples, schools and residential associations in Phuentsholing by the environmental safeguards officers in the PT. Grievances can be filed in writing or by phone to any member of the PT as well as the environmental safeguards officer.

184. **First tier of GRM.** The Project Implementation Unit (PIU) under PCU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Project Managers (PM) of PIUs will be designated as the key officer for grievance redress. Resolution of complaints will be done within seven working (7) days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested.

185. A tracking number shall be assigned for each grievance, including the following elements; (i) initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered; (ii) grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); (iii) closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

186. The updated register of grievances and complaints will be available to the public at the PT head office and the PIU office near the Project. Should the grievance remain unresolved it will be escalated to the second tier.

187. **Second Tier of GRM.** The PM of respective PIUs will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the head of the Project Coordination Unit (PCU) in PT who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC shall be established by PT before commencement of site works. The GRC will consist of the following persons: (i) Executive Secretary; (ii) Division Heads of PT; (iii) Environmental Officer (iv) Project Coordinator; (v) representative of the affected person(s); and (vi) representative of the Dzongkhag Environmental Officer (representing NEC) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the

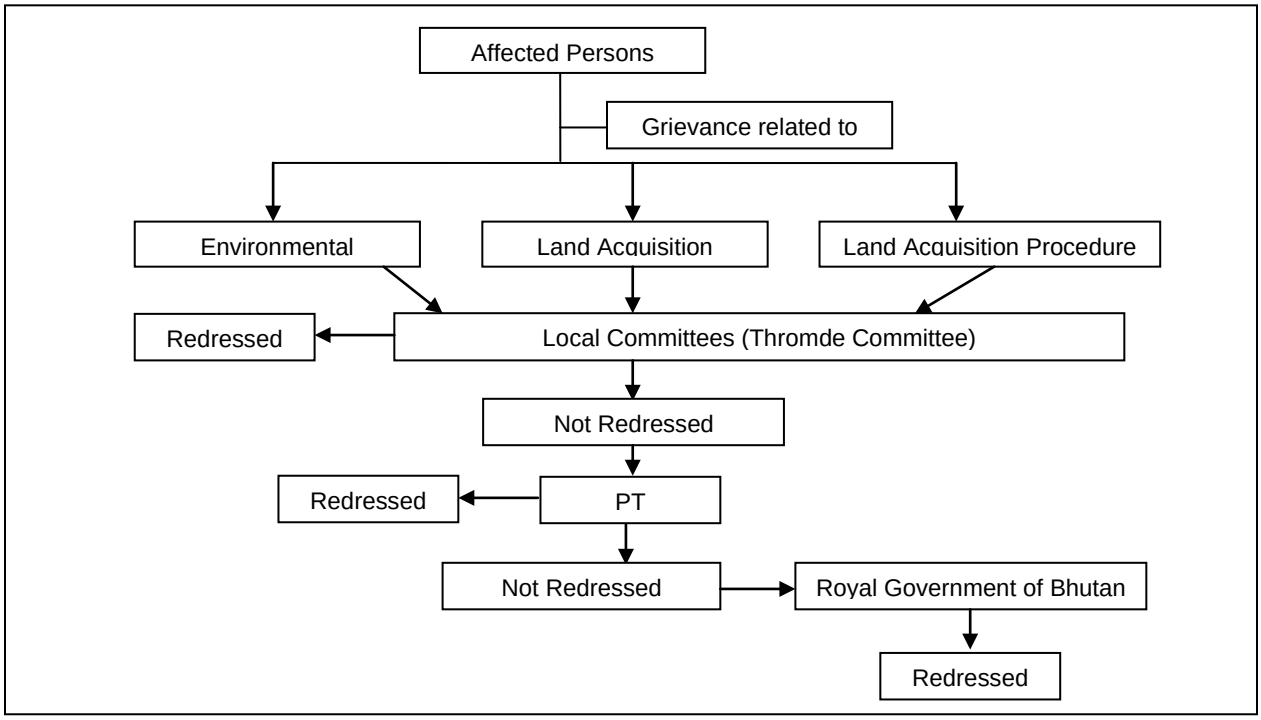
GRC shall not impede the complainant's access to the Government's judicial or administrative remedies.

188. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

189. The Environment officer in PT will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

190. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIU/PCU (first tier) or GRC (PT second tier) the affected person can seek alternative redress through an appropriate court. The GRC will be kept informed by the district, municipal or national authority. The grievance redress mechanism and procedure is depicted in Figure 7.1 for PBR development. The monitoring reports of the EMP implementation shall include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues and status of grievance.

Figure 9: Grievance Redress Mechanism



VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangements

191. The environmental regulations of GOB are derived from the Environmental Assessment Act (2000) and subsequent rules and regulations. The environmental assessment rules are set out in the Environmental Assessment Regulations (2002) For this project the requirement for statutory environmental assessment will be determined by NEC in due course (see Chapter III).

192. Phuentsholing Thromde through Design Consultant will undertake the detailed designs and preparation of Bidding and Contract document. Construction Supervision Consultant (CSC) will be hired separately and will assist the Project Coordination Unit (PCU) and Project Implementation Unit (PIU) in construction supervision and environmental monitoring works. The bidding and contract document will include the Environmental Management Plan (EMP). Environmental Management cost will be included in Bill of Quantity (BOQ) for effective implementation of environmental mitigation measures.

193. Environmental Clearance will be issued by the MOWHS upon submission of IEE forms and related no objection certificates (NOC) from the affected persons/community; BPCL; BTL; DOR and Phuentsholing Thromde.

194. The table 7 below defines the responsibilities for EMP implementation.

Table 7: Responsibilities for EMP Implementation

Agency	Responsibilities
Project Coordination Unit (PCU) of Phuentsholing Thromde (PT)	• Executing agency with overall responsibility for project construction and operation • Ensure that sufficient funds are available to properly implement the EMP • Ensure that Project, regardless of financing source, complies with the provisions of the EMP and ADB Safeguard Policy Statement 2009 (SPS) • Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP. • Project Manager of PIU for will be environmental focal persons. • Ensure that Construction Supervision Consultant (CSS) is recruited. • Environmental Specialist (ES) part of CSC to ensure proper implementation of EMP provisions. Through this specialist, the PT shall: (i) ensure proper and timely implementation of tasks specified in the EMP, (ii) conduct environmental training as specified in the IEE/EMP, (iii) conduct contractors workers' orientation on EMP provisions, (iv) undertake regular monitoring of the contractor's environmental performance, as scheduled in the EMP (v) conduct field measurements for dust and noise as if complaints arise, and (v) prepare environmental baseline report and semi-annual environmental monitoring reports, as specified in the EMP, for submission to ADB • Ensure that Project implementation complies with RGOB/ADB environmental policies and regulations • For project duration ensure that the PT retain an ES to oversee EMP implementation. • Ensure that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs • Establish and implement an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance • In case of change in project components that will result in adverse

Agency	Responsibilities
	environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.). Obtain environmental approvals and certification under RECOP from NEC prior to award of civil works contracts. • Confirm that bidding and contract documents include the EMP. Submit semi-annual monitoring reports on EMP implementation to ADB and identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB.
Project implementation Unit (PIU) of PT	• Liaise with the Environmental Officer in PT to ensure that Project implementation complies with ADB's Safeguards Policy Statement (SPS 2009) principles and requirements; • Ensure that bidding and contract documents include the EMP; • Ensure that the Contractor provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and the contractor(s) identify these sums separately in the bidding documents; • Submit quarterly reports on EMP implementation to PT; • Ensure that EMP provisions are strictly implemented during various project phases (design/pre-construction, construction and operation) to mitigate environmental impacts to acceptable levels; • Check that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs; • Check that necessary environmental clearances and approval(s) from NEC prior to award of civil works contracts; • In case of change in project components that will result in adverse environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.) Assist PT in obtaining environmental approvals and certification under RECOP from NEC prior to award of civil works contracts; • Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance; • Ensure monitoring of the implementation of the EMP (mitigation and monitoring measures); • Prior to bidding ensure that the contractors agree to implement environmental and safety requirements as required in draft contracts to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP; • Conduct environmental management awareness training sessions for Contractor as described in the IEE and EMP.
Construction Supervision Consultant (CSC)	• Attend environmental management and capacity building training sessions on the IEE and EMP; • Ensure implementation of mitigation and monitoring measures for various project phases in the EMP by contractors; • Undertake day to day environmental management and make observations and keep written record of environmental management activities for DOR AND PT as described in the IEE and EMP. • Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance.
Contractor	• Prior to start of bidding agree in writing to implement (if selected) environmental and safety requirements to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP. • Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and identify these sums separately in the bidding documents. • Implement environmental and safety requirements to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP • Attend environmental management awareness training sessions for Contractor as described in the IEE and EMP.

Agency	Responsibilities
	• Implement additional environmental mitigation measures for unexpected impacts, as necessary • Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance.
National Environment Commission	• Review and approve environmental assessment reports required by the Government. • Undertake monitoring of the project's environmental performance based on their mandate
ADB	• Review and approve environmental assessment reports required by ADB. • Undertake monitoring of the project's environmental performance based on above requirements and SPS.

195. To facilitate EMP implementation, during construction the contractors must be prepared during the tendering and pre-construction phase to cooperate with DUDES, PMU, ESM and the local population in the mitigation of impacts. However, experience suggests that contractors may have little impetus or interest in dealing with environmental problems in the absence of performance-related criteria. Therefore, as mentioned in Chapter V, the contractor will be required to agree to the implementation of the EMP updated as necessary by the PMU/ESM during detailed design phase. Clearances for payments will include certification from the PMU/ESM as to the effective implementation of the EMP and all other mitigation measures specified in the EMP. The completion of implementation of mitigation measures will therefore be linked to payment milestones.

B. Environmental Mitigation

196. The anticipated environmental impacts and mitigation measures discussed in the previous section are presented in Table 8. The table also shows responsibilities and timeframe/schedule for implementation of mitigation measures and monitoring.

197. Table 8 shows that most mitigation activities during pre-construction are to be implemented by the PMU (assisted by ESC). During construction mitigation measures shall be primarily implemented by the contractors and monitored by PMU on behalf of DUDES. During operation stage, District DUDES shall undertake environmental mitigation and monitoring requirements specified in the EMP. To ensure implementation of mitigation measures during construction, the EMP shall be included in the tender and contract documents for civil works. Contractors' conformity with environmental contract procedures and specifications shall be regularly monitored by DUDES with assistance from PMU and results shall be reported semi-annually to ADB.

Table 8: Environmental Mitigation and Environmental Performance Monitoring Plan for Phuentsholing Bypass Road.

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
DESIGN & PRE-CONSTRUCTION										
1. Design measures	Incorporate design measures in the project design to minimize environmental impacts. Compliance with Royal GOB statutory environmental assessment process. Establishment of Grievance Redress Mechanism (GRM)	1. Detail design for PBR will incorporate the following measures in the project design: i) Minimize acquisition of private land and property ii) Identify potential solution spaces to ensure sufficient disposal areas for cut surface spoil materials and to avoid fly-tipping. Obtain approval from local authorities and local community for use of land before bidding. iii) Make arrangements to facilitate the timely production and supply of rock and bitumen based materials for construction and to avoid impacts due to unnecessary stockpiling near the Project road. iv) Design extensions and improvements of drainage culverts for the Project road to account for increased rain due to a once in 100 year return storm event and dovetail these designs with design measures incorporated to minimize impacts due to climate change. V) Minimize hydrological and drainage impacts during construction by including in the detailed design early phasing of replacement of culverts and other infrastructure. vi) Disruption to current facilities for water supply will be avoided and facilities will be retained or re-provisioned before construction works commence; provisions will be made to preserve the operation of current facilities for water supply in sufficient quantity in agreement with the local community. vii) Plan and implement reprovisioning of power and water supply lines before construction works commence to avoid disruption of services. Ensure that provisions will be made to preserve the operation of current facilities in sufficient quantity in agreement with the local utility company. viii) Prepare plans to minimize disturbance of vehicular traffic and pedestrians during	PCU	Detailed design phase Preconstruction stage	project office Project site	Cost included in PT, PCU and PIU	Environmental approval for the Project obtained from NEC Response from NEC on permits. Require in PMU contract. Check at detailed design. Complete check of items 1 to 5.	Completion detailed design/prior to start of site works. Once.	PCU/PIU/	PT Budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		construction. Ensure that phasing for construction will retain a passing lane along part of the road during construction in detailed designs programming and avoid community severance. ix) Prepare plans to minimize removal of trees during construction. Ensure that phasing for tree removal will allow sufficient time before construction for consultation with DOF and local leaders to identify, mark, cut and sell timbers included in detailed designs programming and avoid community disruption. x) Aim to provide enhancements in the design based on ADB policy on environmentally responsible procurement and avoid negative impacts due to unnecessary removal of trees.								
4. Environmental capacity development	Develop environmental management capacity PT/PCU/PIU/Contractor	1. Under the current SASEC road connectivity project, Project Coordination Unit (PCU) staff will be provided on the job training on environmental monitoring and reporting. 2. ADB will provide environmental baseline (air and noise) monitoring equipment and the required training on data collection and assessment. 3. PMU shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project EMP and any additional mitigation measures that may be required during construction phase.	ADB PIU/CSC	Initiate during detailed design phase and Pre-construction period	MDP Construction Site	CSC Budget	Check at DD. Complete training and check before and during construction.	Prior to start of site works and throughout construction phase.	PCU/CSC NEC/ District Environment officer	CSC Budget NEC Budget
11. Tree cutting	Minimize tree cutting	Approximately 160 trees will be felled to make way for PBR construction. 1. Tree felling will be done with approval from Department of Forest and Park Services (DOFPS). The application for tree felling process has been initiated and approval will soon be accorded. 2. Upon approval from the DOFPS, PT will carry out tree felling in accordance with procedure set forth in Forest and Nature Conservation Rules (2006). Only the necessary trees that marked by the DOFPS will be felled. 3. The economically valuable timbers will be	Contractor	Pre-construction	Throughout MDP	Contractor Construction Cost	No of trees felled. Tree felling procedures No of trees handed over to NRDCL	Prior to start of site works and throughout construction phase.	PCU/CSC DOFPS	CSC Budget DOFPS budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		handed to the Natural Resource Development Corporation limited (NRDCL). 4. PT in consultation with DOFPS will carry out compensatory plantation. Depending on the availability vacant or barren government land, compensatory ratio of minimum of 1:1 will be followed if area designated is small and for large area a ration 1:4 to be applied.								
4 Baseline Environment data (Air and Noise)	Establishment of baseline data on air and noise	As part of institutionalization and capacity building for environmental compliance monitoring and reporting, ADB will finance the procurement environmental monitoring equipment and provide the necessary training. Baseline data on air quality and noise levels will be collected before commencement of civil works. These data will help in assessing project impacts during implementation.	CSC/PIU	Pre-construction	Construction Site	CSC Cost	Establishment of Baseline data on air and noise	Before construction and monthly check.	PCU/CSC NEC/ District Environment officer	CSC Budget NEC Budget
6. Protect and reprovision irrigation and utilities	Minimize interruption to power, water supply telecoms and irrigation system	1. Identify all power, water supply, telecommunications and irrigation systems likely to be interrupted by the works. 2. Relocation and restoration works to be carried out in consultation with BPCL, BT, local authority and affected community. 3. Temporary water and power supply will be provided during the relocation work.	1: Design Consultant	Detailed design phase Preconstruction stage	Throughout project site	Cost included DC and Contractor fees	Review Contract Document Review DD check items 1 to 3	Once, detailed design phase	PCU/PIU	PT Budget
CONSTRUCTION STAGE										
1. Orientation for Contractors, Workers on environmental and social management.	Contractors & workers trained to implement mitigation measures and better implementation of EMP.	1. PIU along with CSC will conduct training/orientation involving construction workers with regard to implementation of mitigation measures in the EMP (i.e.., those specified in the IEE) 2. Implement any HIV-AIDS education and disease prevention programs in line with social plans, as required.	1: Contractors 2: PIU	1: Before start of site works 2: Upon deployment of workers to project site	Throughout project site	Cost included in contracts for CSC and Contractor	Complete check of implementation of items 1 to 2	1: Before start of site works 2. monthly during construction	ES/CSC/PIU	CSC Budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
2. Drainage and Hydrological Impacts	To minimize hydrological impacts flooding and runoff of river banks.	Om Chhu River fall within the project area and it joins the Amochhhu west of the project area. These rivers will be directly affected by PBR construction activities. Contractor will implement following measures to minimize the impacts: 1. During construction, the contractor will ensure the proper disposal of spoil and other waste. Excavated construction spoil will be used for filling during road widening and embankment construction. 2. Hazardous waste such as oil and lubricants will be properly stored and sent for recycling. 3. Solid municipal waste will be disposed off in a municipal landfill.	Contractor	Throughout construction phase	Construction Site.	Included in project and bid costs	Check implementation of items 1-3	1to 3: Daily by CSC 1 to 3: Monthly by ES	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
3.Flora and Fauna	Minimize impact on flora and fauna	Road construction near Chainage Km1.8 is likely to disturb captive Gharial Crocodiles by construction noise. In order to minimize to noise impact; noise barrier bund or wall of 2m high by 30m long will be constructed.	contractor	Construction phase	Chainage Km1.8 or Crocodile Farm	Included in project and bid costs	Check completion of noise barrier	Once during construction	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
4. Materials exploitation and management of quarry and borrow areas	Minimize impacts from materials extraction, transportation and storage.	1. Stone will be bought from already established government approved quarry. 2. Sand will be imported from neighbouring Indian state of West Bengal as there are no feasible sand quarries within the project area and within Bhutan. 3. However, if some quarry is established within or outside the Project area following measures will be applied: i) Separate application for quarry will be prepared and submitted to the Department of Geology and Mines (DGM) and the NEC for environmental clearance. ii). Quarry operation will be carried out in line with approved environmental condition by NEC/DGM. Principle of balance cut and fill will be applied to minimize the impacts from extraction of aggregates. iii). If the contractors shall operate the	Contractors	Throughout construction phase	Project site, quarry and borrow sites	Cost included in contract	Check implementation of items 1-3	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU District Environmental Officer (DEO); Department of Geology and Mines	PIU and CSC Budgets Dzongkhag budget DGM budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		quarry site, required environmental permits shall be secured prior to operation of quarry/borrow areas. iv). Compensatory plantation of minimum 1:1 will be carried out. Only native plant species will be used for plantation. v). Stockpile topsoil for later use and fence and re-contour borrow pits after use. Topsoil, overburden, and low-quality materials shall be properly removed, stockpiled near the site, and preserved for rehabilitation. vi). Use quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state.								
5. Spoil Disposal	Control spoil and construction waste disposal, oily and hazardous wastes.	1. Total cut and fill of Excavated materials or construction Spoil approach will be applied. Under this project there is a possibility of achieving 100% balance cut and fill. 2. However, if there are any excess spoil from the construction activities; it will be disposed off in a pre-identified site. 3. Disposal site will be determined and approved Phuentsholing Thromde and local communities. 4. Spoil will not be disposed of in rivers and streams or other natural drainage path. 5. Spoil will not be disposed of on fragile slopes, flood ways, wetland, farmland, forest, religious or other culturally sensitive areas or areas where a livelihood is derived. 6. Surplus spoil will be used where practicable for local repair works to fill eroded gullies and depression areas and degraded land in consultation with local community. 7. Disposed spoil will be spread in 15cm layers and compacted to optimum moisture content, covered with topsoil, landscaped and provided with drainage and vegetation to prevent erosion in line with best practice.	Contractors	Throughout construction phase	Project site and spoils disposal sites	Cost included in contracts	Check implementation of items 1-12 Spoils disposal will be monitored by PIU and recorded using a written chain of custody (trip-ticket) system to the designated disposal sites.	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
6. General Construction Waste Disposal	Reduce, reuse and recycle waste and contamination due to poor	Uncontrolled waste disposal operations can cause significant impacts. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable. The contractors will ensure implementation of	Contractor	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-8	Bi-weekly as part of day-to-day project construction	ES/CSC/PIU MOWHS Environmental Officer,	PIU/PMU and CSC Budgets MOWHS

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
	waste disposal practices.	following measures. 1. In principle, the waste generation will be minimized at source. 2. Waste products will be segregated, recycled and reused whenever possible. 3. Recyclable waste will be sold to the scrap dealers. 4. Organic waste such as plant materials will be composted 5. Residual non-hazardous waste will be disposed off in the municipal landfill. 6. Construction/workers' camps will be provided with sufficient refuse bins. 7. Burning of construction and domestic wastes will be prohibited. 8. Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited.						supervision	Dzongkhag Environmental Officer, NEC	Budget Dzongkhag budget NEC budget
7. Use of hazardous substances and hazardous waste disposal	Minimize contamination due to use and storage of hazardous substances	Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Oils and lubricants discharged to woodland can kill the roots and destroy the trees. Mitigation measures will seek to control access to and the use of hazardous substances such as oils and lubricants and control waste disposal. Contractor will carry out following measures to minimize the impacts: 1. Oil and lubricants will be safely stored. Secondary containment around fuel storage area will be ensured. 2. Hydrocarbon, toxic material and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of RGOB to prevent soil and water contamination. 3. Equipment/vehicle maintenance and refuelling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly	Contractor	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-7	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		skimmed of oil and maintained to ensure efficiency. 4. Fuel and other hazardous substances will be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant. 5. Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labelled and safely stored. The spent oil and batteries will be sold to recycling dealers. 6. Hazardous materials will be stored away from water bodies and above flood level. Clean-up operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste 7. All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.								
8. Asphalt plant rock crushers, bitumen usage and soil contamination	Avoid air pollution, nuisances, traffic obstacles and contamination	1. Locate asphalt plant and rock crushers (wherever practical) at least 500m from nearest sensitive receivers (residential areas, schools, hospital, etc.) and rivers and install and maintain dust suppression equipment. 2. Bitumen as well as firewood will not be used as fuel for heating bitumen. Bitumen drums stored in dedicated area not scattered along Project roads and other project facilities. 3. Bitumen will not be allowed to enter drainage system. 4. Bitumen storage and mixing areas shall be protected against spillage. 5. All accidental spills of bitumen or chemicals should be cleaned up immediately with the top 2cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority. 6. Recycle debris generated by dismantling of existing pavement subject to the suitability of the material.	Contractors	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-9 Monthly monitor TSP within the plant site.	1: Before establishment of facilities 2 & 6: Daily by CSC	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
9. Noise and dust nuisances	To minimize air impacts effectively and avoid complaints due to the airborne dust.	Although temporary in nature, construction activities generate noise and dust pollution affecting local communities as well as other establishments. Construction activities at the takeoff point may trigger trans-boundary issue. Noise and dust may affect the communities living across the border. Following mitigation measure will be applied to reduce nuisances: 1. Water sprinkling or spraying using tanker will be done twice a day to reduce dust generation. 2. Water can be sourced from Om Chhu or Amochhu Rivers 3. No work will be carried out within 500m of any settlement during the night (2100 hrs to 0700 hrs). 4. If works have given rise to complaints over dust, the contractor shall investigate the cause, report it in the monthly progress reports and review and propose alternative mitigation measures before works recommence. 5. Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out. 6. Vehicles transporting soil, sand and other construction materials will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PMU. 7. Noise and dust monitoring will be required carried out during the construction.	Contractors CSC/ES	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-7 Monthy Monitor noise (dBA) levels at sensitive areas within 200m from active construction front(s). Ambient TSP levels monthly within 300m from active construction front(s), and materials handling, and storage areas.	Daily during construction	ES/CSC/PIU	PIU and CSC Budgets
10. Blasting (if required)	Perform safe blasting and prevent damage and nuisances from blasting	Conventional blasting using gelatin explosives will be totally prohibited within Phuentsholing urban areas. If blasting is unavoidable, then only non-explosive chemical agent (such as Acconex) will be used.	Contractors	Throughout construction phase	Project site and blasting site	Cost included in contracts	Check implementation of items 1-12	Daily during construction or blasting as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
										budget
11. Erosion control	Protect established works.	Excavation and earthworks during construction will trigger soil erosion and landslides. To minimize the impacts following measure will be implemented: 1. Stockpile topsoil for use in immediate replanting and bioengineering after completion of engineering work. 2. Minimize damage and cutting of surrounding vegetation during slope formation. 3. Protect the cut slope with planted vegetation, bioengineering or conventional civil engineering structures as soon as practicable after cutting. 4. Prevent erosion and protect the cut slope with temporary or permanent drainage as soon as practicable after cutting. 5. Construction material or spoil will not be dumped into the Om Chhu River. 6 River training and flood protection work will be carried out along the road alignment from second till the third bridge.	Contractors	Throughout construction phase	Throughout project site and all vulnerable slopes	Cost included in contracts	Check implementation of items 1-12	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
12. River protection and bridge Construction	Protect rivers and maintain river flow	At bridges and in road stretches within 50m near rivers and streams: 1. Schedule all works for the dry season November till May. 2. Rocks and stones will not be disposed to block rivers and streams. 3. In bridge repair and demolition sites, the bridge structure will not be dropped into the river but alternative means will be used to avoid "dropping the bridge" into rivers/streams. This will be done by "sawing" appropriate sections of the bridge and using cranes to lift these sections away or alternatively by construction of a platform onto which the bridge could be lowered. 4. Cofferdams, silt fences, sediment barriers or other devices will be used as appropriate based on the design to prevent migration of silt during excavation and boring operations within streams. If cofferdams are used, these will be dewatered and cleaned to	Contractors	At all times	All rivers and streams with repair and reconstruction works.	Cost included in contracts	Check implementation of items 1 to 4	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		prevent siltation by pumping from cofferdams to a settling basin or a containment unit. 5. Other erosion control measures above and covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction.								
13. Water quality	Prevent water quality impacts due to negligence and ensure unavoidable impacts managed effectively.	1. Store lubricants, fuels in dedicated enclosures at least 50 m from water bodies. 2. Solid waste from construction activities and workers camps will not be thrown in rivers and other water courses (drainage, irrigation, etc.) 3. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off. 4. Stockpiled materials will be covered to reduce silted run-off. 5. No stockpiling or borrow sites at least 100m of water body. 6. Work in rivers will be scheduled during dry season and work duration shall be as short as possible. 7. Immediate stabilization of bare slopes shall be undertaken. 8. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off. 9. Stockpile areas and storage areas for hazardous substances shall be located away from water bodies. 10. Washing of machinery and vehicles in surface waters shall be prohibited.	Contractors	Throughout construction phase	All Project road stretches and project-related facilities	Cost included in contracts	Check implementation of items 1 to10	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
14. Water resources	Mitigate the impact of using local community water resources.	1. Assess availability of water and evaluate impact on use of local water resources to ensure that water utilization for Project shall not deplete local village supplies. 2. Bring in project water by tanker as necessary. 3. Worker camps will be located at least 500m from the nearest settlement to prevent the contamination of community-owned water resources. 4. Maintain close liaison with local communities to ensure that any potential conflicts related to common resource	Contractors	Throughout construction phase	Throughout project site, construction camps	Cost included in contracts	Check implementation of items 1to11	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		utilization for project purposes are resolved quickly. 5. Establish and implement guidelines to minimize the wastage of water during construction and at campsites. 6. Avoid or minimize use of river bed for construction materials. 7. Confine winning river materials to 20% of river width in any location and keep away from river banks. 8. Reinstate river banks if necessary. 9. Re-provision irrigation channels affected by works two weeks before commencement of works to the satisfaction of local community. 10. All irrigation canals along the alignment shall be clearly marked on the ground to prevent accidental dumping of fill materials into these canals. 11. In case of accidental obstruction or damage, irrigation ditches and ponds shall be cleaned or repaired immediately.								
15. Operation of workers camps	Worker facilities not to cause nuisance or exploit forest of wildlife resources.	1. Worker camp location and facilities located at least away from settlements and agreed with local communities and facilities approved by PMU and managed to minimize impacts. 2. Construction camps will be established in areas with adequate natural drainage channels in order to facilitate flow of the treated effluents. 3. Hire and train as many local workers as possible. 4. Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas. 5. Portable lavatories (or at least pit latrines in remote areas) shall be installed and open defecation shall be prohibited and prevented by cleaning lavatories daily and by keeping lavatory facilities clean at all times. 6. Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers. 7. Wastewater effluents from contractors'	Contractors	1 & 2: During selection of locations for workers camps. 3 to 16: Throughout construction phase	Project site, construction camps	Cost included in contracts.	Check implementation of items 1 to16	1 & 2: Once for each location, prior to establishment of facilities 3 to 16: Bi-weekly 1 to 16: as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		workshops and equipment washing-yards will be passed through gravel/sand beds and all oil/grease contaminants will be removed discharging it into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed Waste Management Plan and consistent with national and local regulations. 8. Predictable wastewater effluent discharges from construction works shall have the necessary permits from NEC and local authorities before the works commence. 9. Borrow pits and natural depressions with pre-laid impervious liners will be used to dispose of scarified/scraped asphalt, and then covered with soil. This will check potential groundwater contamination. 10. Options for completely or partially recycling scraped scarified materials will also be taken into account. 11. As much as possible, food shall be provided from farms nearby and bush meat supplies will be banned to discourage poaching. 12 Ban use of guns and hunting equipment by workers and dismiss workers taking or using green timber or hunting or in possession of wildlife. 13. Camp site will be cleaned up to the satisfaction of and local community after use. 14. Solid and liquid waste will be managed in line with Waste Management Plan. 15. All waste materials shall be removed and disposed to disposal sites approved by local authorities 16. Land used for campsites shall be restored to the original condition as far as practicable and the area shall be planted with appropriate trees / shrubs as soon as practicable after it is vacated and cleaned.								
16. Sanitation and Diseases	Control of infectious diseases.	1. Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes.	Contractors	Throughout construction.	Throughout project site, workers camps	Cost included in contracts.	Check implementation of items 1 to 4	Bi-weekly as part of day-to-day project	ES/CSC/PIU MOWHS Environment	PIU/PMU and CSC Budgets

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		2. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds. 3. Malaria controls ((e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.) and HIV/AIDS education will be implemented in line with social plans for the project. 4. HIV/AIDS awareness and prevention program shall be implemented in line with social plans under the Project						construction supervision	al Officer, Dzongkhag Environmental Officer, NEC	MOWHS Budget Dzongkhag budget NEC budget
17. Safety Precautions for the Workers	Ensure worker safety.	Worker's occupational health and safety will be generally governed Labour and Employment Act of Bhutan 2007. Construction works will generally result in accidents and injuries or even demise of the workers if no health and safety measures are followed. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will be applied for occupation safety. Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows: 1. The contractor will conduct of training (assisted by PIU) for all workers on safety and environmental hygiene at no cost to the employees. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities. 2. The contractors will instruct and induct all workers in health and safety matters (induction course) including construction camp rules and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site will include safety and environmental hygiene. 3. Fencing on all areas of excavation greater than 1m deep and sides of	Contractor	Throughout construction phase	Throughout project site	Cost included in contracts	Check implementation item 1 to 7. Compliance with OHS 2006	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	Cost met by PMU and DUDES project staffing

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		temporary works shall be observed. 4. Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers. 5. Reversing signals (visual and audible) shall be installed on all construction vehicles and plant. 6. Contractor will at all-time keep the first aid kit at the construction sites. 7. Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses								
18. Public safety	Prevent accident with public in local community	1. Install barriers (e.g., temporary fence) at construction areas to deter pedestrian access to the roadway except at designated crossing points. 2. The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation and such sites have a watchman to keep public out. 3. Speed restrictions shall be imposed on Project vehicles and equipment when traveling within 50 m of sensitive receptors (e.g. residential, schools, temples, etc.). 4. Upon completion of construction works, borrow areas will be backfilled (if suitable materials are available, e.g., excavation spoils) or fenced.	Contractor	At all times throughout construction phase	Throughout project road, borrow areas and other areas utilized for the Project	Cost included in contracts	Check implementation of items 1 to 4	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	Cost met by PMU, PMU and DUDES project staffing
19. Traffic Conditions	Minimize disturbance of traffic and traffic congestion	1. Communicate to the public through local officials regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions. 2. In coordination with local traffic authorities, implement appropriate traffic diversion schemes to avoid inconvenience due to project operations to road users, ensure smooth traffic flow and avoid or minimize accidents, traffic hold ups and congestion 3. In coordination with local traffic officials, schedule transport of materials to avoid congestion, set up clear traffic signal boards	Contractor and PIU	Throughout construction. Check and report on same day.	Throughout project site	Cost included in contracts.	Check implementation of items 1-7	1: Before construction 2 & 7: Weekly	ES/CSC/PIU MOWHS Environmental Officer, Road Safety and Transport Authority (RSTA) Royal Bhutan Police (RBP)	PIU/PMU and CSC Budgets MOWHS Budget RSTA and RBP Budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		and traffic advisory signs at the roads going in and out the road and bridge construction sites to minimize traffic build-up. 4. Provide safe vehicle and pedestrian access around construction areas. 5. Install bold diversion signs that would be clearly visible even at night and provide flag persons to warn of dangerous conditions (24 hours, as necessary) 6. Provide sufficient lighting at night within and in the vicinity of construction sites.. 7. Designate traffic officers in construction sites.								
20. Archaeological and cultural artifacts.	Preservation of chance finds of cultural and archaeological relics. identified during construction	There are no known archeological or cultural sites within the project area. However, in the event, it is sited, then following measures will be applied: 1. Should any potential items be located, the PMU and DOR will immediately be contacted and work will be temporarily stopped in that area. 3. If the site supervisor determines that the item is of potential significance, an officer from the MOHCA will be invited to inspect the site and work will be stopped. 4. Until MOHCA has responded to this invitation work will not re-commence in this location until agreement has been reached between MOHCA, PMU and DOR/PT as to any required mitigation measures, which may include excavation.	Contractors	Throughout construction. Check and report on same day.	Throughout project site	Cost included in contracts.	Check implementation of items 1 to 4	Before construction and Bi-weekly checks. as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
21. Compensatory Plantation	Provide environmental enhancement of the project	Project or PIU in consultation with local government; Divisional Forest Office (DFO) and community will locate the government or even community barren for compensatory plantation. Compensatory plant using local or native tree species will be carried out to replace the trees felled during the construction. Ratio for compensation will be 1:1 if the area of plantation is small. However, the project can	Contractors	Throughout construction.	Throughout project site	Cost included in contracts.	Confirmed implementation of required enhancements	Monthly during construction	ES/CSC/PIU MOWHS Environmental Officer, DOFPS	PIU and CSC Budgets MOWHS Budget DOFPS NEC budget

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		go up to 1:4 if the larger areas available. Project could possibly explore plantation area in the degraded upstream catchment of Om Chhu River. This will serve dual purpose – it will lessen erosion and flooding14; and in the long term plantation would act as carbon sink.								
OPERATIONAL STAGE										
1. Soil erosion	To minimize excessive erosion.	1. Ensure that storm drains and highway drainage systems are periodically cleared to maintain clear drainage to allow rapid dispersal of storm water flow. 2. Ensure rapid response in case of landslips and implement thorough maintenance programme along erosion-prone areas. 3. undertake surveillance and re-vegetation for areas prone to erosion and landslips.	Phuentsholing Thromde (PT)	Throughout operation	Slopes with protection measures and new wash out.	Included in operation and maintenance cost	Check implementation of items 1 to 3	Semi-annual	PT	Cost met by for PT staffing
2. Road Safety	Minimize road accidents.	1. undertake road safety awareness campaigns for local residents and other road users of the Project road. 2. Install and maintain road warning signs and markings. 3. Monitor road accidents and implement necessary preventive measures (awareness campaigns, provision of appropriate road furniture to enhance road safety and control traffic).	Phuentsholing Thromde (PT)	Throughout operation	Entire project road	Included in operation and maintenance cost	Check implementation of items 1 to 3	Semi-annual	PT	Cost met by for DUDES staffing
3. Tree survival	Ensure survival of planted trees.	Monitor survival of trees / shrubs and grass in bioengineered slopes (e.g. at landslides, also transplanted / compensatory planting trees) and replant, as necessary.	PT and District DOFPS	During operation.	Throughout project site	Included in operation and maintenance cost	Survival rate of planted vegetation	Semi-annual for 1st 3 years of operation	PT and DOFPS	Cost met by PT and DFO staffing
4. Noise and Dust	Minimize noise and dust pollution impacts	The proposed PBR is to takeoff from second Bhutan-India border crossing and join the Phuentsholing-Thimphu highway. The noise and dust pollution would be the major trans-boundary issues particularly for road section closer to Indian border.	MDP operator	During operation.	Road section near to India border	Included in operation and maintenance cost	Throughout operations and maintenance	Quarterly	DOT	DOT Budget NEC

[14] Omchhu River occassionally cuases flooding of Phuentsholing City.

		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		Noise and dust impacts during road operation will be sustained one with very limited mitigation choice. Construction of noise and dust barriers along the PBR will be met with opposition from the business setup and public alike. It is viewed as a barrier for their business and free movement. And further, the large barriers constructed within the city center will be unaesthetic. The only measure that could be applied is the checking and restricting of vehicles with high emission and noise through help of Road Safety and Transport Authority (RSTA).					Roadside monitoring of SOx, NOx, HC, and TSP annually during dry-season.		NEC RSTA	Budget RSTA Budget

C. Environmental Monitoring

1. Compliance Monitoring

198. Table 8 above also shows the program for monitoring the compliance on various provisions of the EMP during pre-construction, construction and operation phases. Detail design for PBR will incorporate the IEE recommendations. During construction, most of the mitigation measures shall be implemented by the contractors and their environmental performance, in terms of implementation of such measures, shall be monitored by CSC/PIU and relevant agencies. The timing or frequency of monitoring is also specified in Table 8. During operation EMP implementation shall be the responsibility of the PT as operator of facilities.

2. Design Stage

199. PT/PCU will hire Detail design consultant to carry out detailed design study. The detail design will incorporate IEE study recommendations. The EMP will form part of the bidding and contract documents. The environmental mitigation measures will be itemized and inserted into the Bill of Quantity (BOQ). This will ensure the effective implementation of environmental mitigation measures during pre-construction and construction.

3. Pre-construction Stage

200. During pre-construction, PT will need to obtain environment clearance (EC) from the Ministry of Works and Human Settlement (MOWHS) for construction of PBR. PT's compliance with environmental conditions will be monitored. PCU/PIU/CSC will assess the contractor's understanding of Environmental Conditions and EMP that needs to be implemented during pre-construction and construction stages. The orientation program for contractor and labourers will be carried out.

4. Construction Stage

201. The updated EMPs/method statement prepared by the contractors, with assistance from the PMU/ESM, will be reviewed and approved by PMU/ESM before any construction activity is initiated to take account of any subsequent changes and fine tuning of the draft EMP. The PMU/ESM shall undertake regular monitoring of the contractor's implementation of mitigation measures specified in the EMP.

5. Operational Stage

202. The PT assisted by the Environmental Officers will implement the mitigation measures and required monitoring activities during road operation periods. Monitoring activities will be focused on waste management and disposal; health and safety of road workers; drainage management measures; and survival of planted trees etc. Accidents within the PBR jurisdiction will also be monitored as basis for implementation of mitigation measures to improve site safety. (For avoidance of doubt road safety shall remain within the purview of the PT and RBP).

6. Environmental Effects Monitoring

203. PT assisted by the ES/CSC shall implement the EMP mitigation and monitoring requirements during operation such as monitoring of waste management, health and safety plan, drainage management measures, enhancements to traffic management and survival of

retained and planted trees, etc. Accidents within the PAR jurisdiction will also be monitored as basis for implementation of mitigation measures to improve site safety.

D. Reporting

204. PT will submit the following environmental monitoring reports to ADB:

205. **Environmental Monitoring Reports:** Environmental monitoring reports shall cover the status of EMP implementation in terms of required mitigation measures for different project phases, necessary remedial actions to effectively address negative environmental impacts due to project implementation, status of environmental capacity building activities as well as documentation of complaints received and corresponding action/resolution. The environmental monitoring reports will be submitted to ADB semi-annually during the construction period and annually for two years after completion of construction.

206. **Environmental Costs.** Under current SASEC Road Connectivity Project, the environmental cost will be totally integrated into the overall project cost. The environmental mitigation measures will be itemized and will be put into BOQ for budgeting. This will ensure the proper implementation of environmental mitigation measures. The environmental monitoring, supervision and reporting costing will be part of the overall construction supervision consulting cost.

Table 9: Summary of Estimated Costs for EMP Implementation (4 years)*`

Item	*Estimated Total Cost (USD)*	*Costs covered by*
Environmental and safety consultant specialist in PMU and ESE		
National (1 person for 16 months @ USD2,000/month)*	32,000	DUDES/PMU
Environmental management capacity building program/training to be undertaken by ESC	5,000	DUDES/PMU
Mitigation measures (included in project costs)*	Determined during detailed design as part of project design costs	Contractor
Environmental Permitting**	[3000)]***	DUDES/PMU
Tree Planting enhancement.	15.000	DUDES/PMU
Sub-total		
Contingency (10%, approximately)***	5,000	
Total	**60,000**	

* includes design and construction phases.
** In case of complaints
*** Contingency item in case design is modified and permits are required for environmental clearance certificates under ECR not required as yet from NEC.

E. Capacity Assessment

207. In Bhutan, the environmental assessment process is established but environmental awareness and capability for implementation of EMP in infrastructure projects of the executing agency like PT is in the very early stages of development.

208. PT's current approach in tackling environmental issues is only on a project basis. There is no dedicated office which is responsible tackling environmental issues with regard to ongoing

and future projects. Therefore, through this project, there is an opportunity to establish Environmental Unit perhaps under the Engineering Division of PT. Engineering Division is responsible for planning, designing, and execution of various infrastructure projects under PT. Environment unit with trained environmental officer would be able to institutionalize the environmental assessment process; implementation of mitigation measures; and carry out compliance and effect monitoring.

F. Capacity Building

209. Under the current SASEC Road Connectivity Project, PT has agreed to assimilate the environmental assessment and monitoring under the project's institutional setup. At the project coordination level, the project coordinator (of SASEC Project) under PT will assume responsibilities of environmental focal person; who will be answerable to the PT, ADB and other relevant agencies. At the PIU level, the project manager (PM) will act as environmental focal person who will report to their PC. PCU and PIU/PMU will be assisted by Construction Supervision Consultant (CSC) which includes Resident Engineer (RE), Site Inspector (Si) and Environmental Specialist (ES). RE and SI will be the main environmental persons carrying out day to day monitoring and supervision of implementation of environmental management plans. While ES will carry out the intermittent environmental monitoring and reporting. RE, SI and ES will report to the PIU/PMU through their team leader.

210. Further under the current project, ADB has committed to enhance the EMP implementation and monitoring capacity of the project staffs. During the pre-construction stage; all relevant project staffs will be trained in baseline environmental data collection particularly on air and noise. ADB will also train the contractors, project engineers, ES, REs and SIs on EMP implementation, monitoring and reporting.

IX. CONCLUSIONS AND RECOMMENDATIONS

211. This IEE study reveals that the impacts from PBR construction and development are predictable and manageable; impacts can be either avoid, minimized or compensated. The Environmental Management Plan (EMP) covers all aspects PBR construction and development. The detailed design consultant will be hired for detailed study and design of PBR. The current EMP will be further reviewed and updated by ES who will be part of design team; prior to the construction and even during the construction. Institutionalization of environmental compliance monitoring and capacity building of project and related staffs will be carried out.

212. The proposed Phuentsholing Bypass Road (PBR) will enable to diverting trucks traffic from the centre of the city and the main road to a new 2 lanes infrastructure which will get around the centre. In addition, by providing new traffic capacity, the current congestion on the existing road crossing Phuentsholing will be partly avoided. The benefits expected from the PBR include the three following categories and are further dealt in detail:

i) Lowering truck or Vehicle Operating Cost (VOC).
ii) Truck travel time savings through Phuentsholing town
iii) Truck idle time savings from avoided congestion on existing road through the town.
iv) Time savings of Phuentsholing's residents resulting from avoiding congestion on existing road through the town.

213. Over all, the environmental benefits result from lower emission due to lesser requirement of truck movements due to faster customs clearance and efficient transshipment. Benefit also result from lesser waste generation due to minimum spoilage of perishable goods.

214. Therefore, this project is recommended for implementation as its implementation will reduce vehicle operating cost; improve economy and free city center from traffic congestion. Overall there will be reduced vehicular exhaust pollution and greenhouse gas emission due to development of efficient bypass road for Phuentsholing.

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Selected Photographs

Photograph 1
Start PBR bypass near Gurudwara Sahib (Km0.0)

Photograph 4
Approach to Second Bridge Location (Km0.6)

Photograph 2
Border Roads Task Force Compound left (Km0.7)

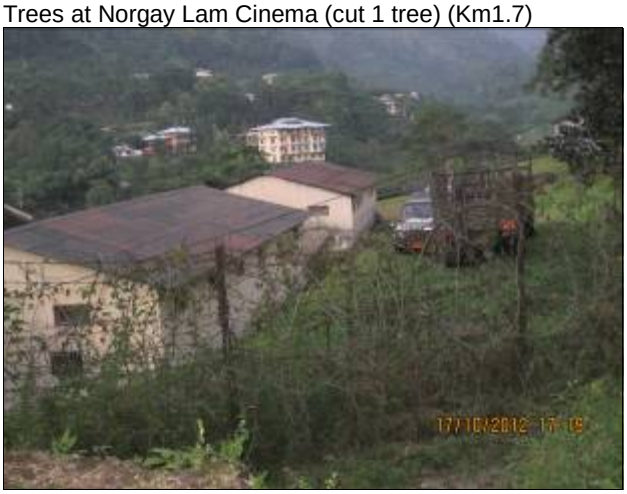
Photograph 5
Check-post (remove) second bridge (Km0.7)

Photograph 3
Petrol Station and Old Weighbridge (Km0.3)

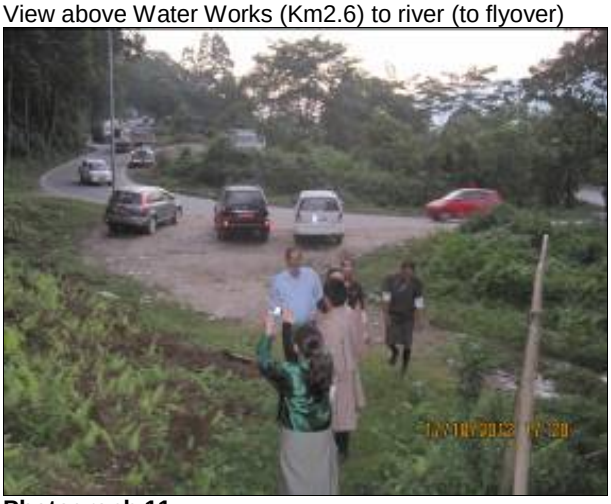
Photograph 6
School admin.building & embankment (Km1.0)

Photograph 7
Trees at Norgay Lam Cinema (cut 1 tree) (Km1.7)

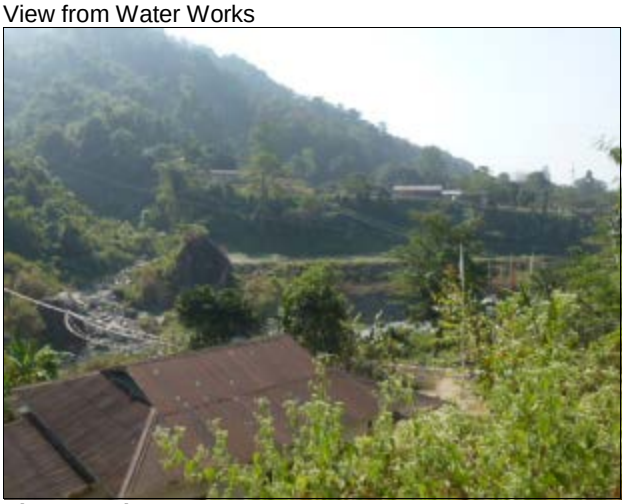
Photograph 10
View above Water Works (Km2.6) to river (to flyover)



Photograph 8
View from Water Works



Photograph 11
Thimphu Road (Km2.6) Bhutan Police camp (right)



Photograph 9
View proposed flyover (Km2.4 Army Camp) from north

Photograph 12
Public Consultation along the proposed PBR

Summary of Information Disclosure, Consultation and Participation with local people

A x B 1 – Introduction to the project (December 2012)

Ref.	Information Provided
1	As consultants for the ADB Project Regional Transport Development in South Asia we are collecting information from interested parties.
2	The main part of the project is the reconstruction of part of the Access Road to Pasakha Industrial Estate near Phuentsholing. Do you know about the proposed the Road Project? Let me clarify
3	The Project will reconstruct parts of the Access Road to Pasakha Industrial Estate near Phuentsholing to facilitate access and relieve traffic congestion on the Access Road to Pasakha Industrial Estate near Phuentsholing. Final Access Road alignment will be designed by consultants by 16 March, 2012
Phuentsholing Bypass Road (PAR): - Construct earthworks, retaining walls, level and seal road with asphalt, construct roadside drainage and lead off drains to outfalls. - Construct junction modifications to road access for connection to nearest roads. - Reconstruct the bridge to facilitate crossing of Pasakha River. - Install street signage.	
4	The Project will construct Phuentsholing Bypass Road consisting of the above facilities so that traffic can move faster from Phuentsholing to Pasakha. The road drains will be constructed and surfaces will be paved. Road signs will be included as necessary.
5	The project will introduce drainage measures.
6	The Project will be near and will cross the Pasakha River and there will be improvements and a new road access and egress leading to the Pasakha border road connections to India.
7	The project will be detailed designed later in 2013 and contractors will be selected in 2013/2014.
8	Construction will be for a two tears and is targeted for completion in late 2016.
9	We would like to ask about your opinions on the Project and if you have any other comments / suggestions or ideas?

QUESTIONAIRE Location No-1: 100 from start of Phuentsholing Bypass Road

***Name*:**	Mr. Chanda Tamang
Province/District/Locality	Allay, Phuentsholing (House at Bhutan/India border, but at Bhutan side)
Workplace / Home	Home
Position / Occupation	Job in Industry at Pasakha
Location - Distance to project boundary (approx.)	100 m from start of proposed Phuentsholing Bypass Road
***Time* / Date**	9:30 AM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market at Pasakha.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 3 Km from India/Bhutan border. Other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road. A major structure shall be provided for smooth flow of water in monsoon, otherwise the road will be dismantled every year and also very important to treat the land slide area before construction of proposed access road.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-2: 100 from start of Phuentsholing Bypass Road

***Name*:**	Mr.Ram Bahadur Groom
Province/District/Locality	Upper Khokala, Jaigoan (House at Bhutan/India border, but at Indian side)
Workplace / Home	Home & Workplace
Position / Occupation	Businnes (Shop)
Location - Distance to project boundary (approx.)	100 m from start of Phuentsholing Bypass Road
***Time* / Date**	10:00 AM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design. However, villagers residing at Upper Khokala have major impact on monsoon due to land slide. They always suffer from flood due to river water and land slide. An embankment is made by India Government, so that during monsoon the water shall not enter into the village. As per villagers suggestion the embankment shall be strengthened and easy flow of hill water shall be allowed, so that there shall ne be any impact to villagers in monsoon period.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha for day to day activities including their job in Pasakha Industry & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Primary school, Srijara Committee about 1 km and other Higher School are at Jaigoan.General hospital at Jaigoan.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road. A major structure shall be provided for smooth flow of water in

Ref.	Questions	Response / Comments
	Better cultural facilities? / Better waste disposal? / better drainage?	monsoon, otherwise the road will be dismantled every year and also very important to treat the land slide area before construction of proposed access road.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-3: 200 from start of Phuentsholing Bypass Road

***Name*:**	Mr. Gyembo & Mr. Budharaj
Province/District/Locality	Allay, Pasakha, Phuentsholing
Workplace / Home	Home
Position / Occupation	Casual labourer to Pasakha Industry
Location - Distance to project boundary (approx.)	200 m from start of Phuentsholing Bypass Road
***Time* / Date**	10:30 AM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.

Ref.	Questions	Response / Comments
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road. A major structure shall be provided for smooth flow of water in monsoon, otherwise the road will be dismantled every year.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-4: 200 from start of Phuentsholing Bypass Road

***Name*:**	Mr. Sonam Duba
Province/District/Locality	Allay, Pasakha, Phuentsholing
Workplace / Home	Home
Position / Occupation	Casual labourer to Pasakha Industry
Location - Distance to project boundary (approx.)	200 m from start of Phuentsholing Bypass Road
***Time* / Date**	11:00 AM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any

Ref.	Questions	Response / Comments
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-5: 350 from start of Phuentsholing Bypass Road

***Name*:**	Mr. Bal Kumar Bishwa
Province/District/Locality	Bawani Jhora, Pasakha, Phuentsholing
Workplace / Home	Home
Position / Occupation	Casual labourer to Pasakha Industry
Location - Distance to project boundary (approx.)	350 m from start of Phuentsholing Bypass Road
***Time* / Date**	11:30 AM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any

Ref.	Questions	Response / Comments
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-6: 400 from start of Phuentsholing Bypass Road

***Name*:**	Mr. Sherub Dorji
Province/District/Locality	BOD, Bawani Jhora, Pasakha, Phuentsholing
Workplace / Home	Work place (Petrol Station)
Position / Occupation	Manager, Petrol Station
Location - Distance to project boundary (approx.)	Next to Phuentsholing Bypass Road
***Time* / Date**	12:15 PM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.

Ref.	Questions	Response / Comments
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-7: 0 m from end of Phuentsholing Bypass Road

***Name*:**	Miss. Sangeeta Sharma
Province/District/Locality	Bhalu Jhora, Pasakha, Phuentsholing
Workplace / Home	Work place
Position / Occupation	Businnes (Shop)
Location - Distance to project boundary (approx.)	End to Phuentsholing Bypass Road
***Time* / Date**	12:45 PM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 1 Km and other Higher Secondary School and General Hospital is at Phuentsholing.

Ref.	Questions	Response / Comments
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-8: 600 m from start of Phuentsholing Bypass Road

***Name*:**	Mr. Kharkha Bahadur Ghale
Province/District/Locality	BOD, Bawani Jhora, Pasakha, Phuentsholing
Workplace / Home	Home
Position / Occupation	Job in Pasakha Industry
Location - Distance to project boundary (approx.)	600 m from start of Phuentsholing Bypass Road
***Time* / Date**	1:15 PM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.

Ref.	Questions	Response / Comments
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

QUESTIONAIRE Location No-9: 600 m from start of Phuentsholing Bypass Road

***Name*:**	Ms.Namgay
Province/District/Locality	BOD, Bawani Jhora, Pasakha, Phuentsholing
Workplace / Home	Home
Position / Occupation	House wife
Location - Distance to project boundary (approx.)	600 m from start of Phuentsholing Bypass Road
***Time* / Date**	1:45 PM 30th Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Phuentsholing Bypass Road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Phuentsholing Bypass Road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Phuentsholing Bypass Road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any

Ref.	Questions	Response / Comments
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

Environmental Criteria and Standards

a) Ambient Air Quality Standards (Maximum Permissible Limits in (µg/m^3)

Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

Parameter	Industrial Area	Mixed Area*	Sensitive Area**
Total Suspended Particulate matter			
24 Hour Average	500	200	100
Yearly Average	360	140	70
Respirable Particulate matter (PM10)			
24 Hour Average	200	100	75
Yearly Average	120	60	50
Sulfur Dioxide			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Nitrogen Oxides			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Carbon Monoxide			
8 Hour Average	5,000	2,000	1,000
1 Hour Average	10,000	4,000	2,000

*** Mixed Area** means where residential, commercial or both activities take place

****Sensitive Area** means where sensitive targets are in place like hospitals, Schools, sensitive ecosystems.

Source: Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

b) Noise Level Limits:

Industrial Area		Mixed Area		Sensitive Area	
Day *	Night **	Day	Night	Day	Night
75 dB (A)	65 dB (A)	65 dB (A)	55 dB (A)	55 dB (A)	45 dB (A)

Note: All the values are maximum values

*Day time is from 0600 hours to 2200 hours (human activities)

**Night time is from 2200 hours to 0600 hours (no human activities)

Source: *Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010*

c) Vehicle Emission Standards:

Fuel Type	Vehicle registered prior to 01st Jan 2005	Vehicle registered after 01st Jan 2005	Type Approval
Petrol (% CO)	4.5	4	Euro II
Diesel (% HSU)	75	70	

Source: *Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010*

d) Ambient Water Quality Criteria for various uses (September, 2010)

Sl. No.	Parameters	A	B	C
1	pH	6.5-8.5	6-9	6-9
2	Colour, Hz Units	5	50	-
3	TSS mg/l	25	100	-
4	Conductivity, µS/cm	800	1000	2000
5	Odour	Unobjectionable	Unobjectionable	-
6	Mineral Oil	No film	No film	-
7	Nitrate, mg/l	10	50	-
8	Flouride, mg/l	1.0	2.0	-
9	Sulphates, mg/l	25	100	-
10	Chloride, mg/l	50	200	-
11	Surfactants, mg/l	0.1	0.2	-
12	Phosphates, mg/l	0.5	<1.0	-
13	DO, mg/l	6	4	-
14	BOD, mg/l	2	5	50
15	TKN, mg/l	0.5	2	
16	Ammonia, mg/l	0.05	0.5	
17	T. Coliform, MPN/100 ml*****	50	5000	10000
18	F. Coliform, MPN/100 ml*****	20	2000	5000
19	F.streptococci, MPN/100 ml*****	20	1000	1000
20	Dissolved Iron, mg/l	0.2	0.5	-
21	Copper, mg/l	0.05	0.1	-
22	Zinc, mg/l	0.2	0.5	
23	Arsenic, mg/l	0.01	0.05	-
24	Cadmium, mg/l	0.003	0.003	-
25	Total-Chromium, mg/l	0.05	0.05	-
26	Lead, mg/l	0.02	0.02	-
27	Selenium, mg/l	0.01	0.01	-
28	Mercury, mg/l	0.0005	0.0005	-
29	Phenol, mg/l	0.001	0.002	-
30	Cyanides	0.05	0.05	-
31	PAH, mg/l	0.0002	0.0002	0.001
32	Total Pesticides, mg/l	0.0005	0.0005	0.001
33	PCB mg/l	0.0002	0.0002	-
34	SAR	-	-	-
35	Boron	-	-	1
36	Floating Materials such as wood, plastic, rubber, excreta, garbage etc.	Absent	Absent	Absent

Source: *Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010*

Note:

A: (Very good) Drinking water source without conventional treatment, but after disinfection whenever necessary.

B: (Good) Drinking water source without conventional treatment.

C: (Moderate) Use for irrigation, industrial cooling etc.

***** *To achieve the drinking quality standards, disinfection/ boiling of the water is recommended. The total coli form may be high due to their contribution from natural sources like soil, litter, etc., which does not relate to pathogen. If MPN of total coli form is noticed to be more than the limit suggested, than regular test should be carried out. The criteria would be satisfied if during a period not more than 5 % sample shows greater than prescribed limit.*