

***Environmental
Assessment Report***
Feasibility, Detailed Design
and Safeguards Impact
Study for Proposed
Pasakha Dry Port and
Inland Clearance Facility

Submitted to

World Bank

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List of Acronyms

SR No	Abbreviation	Full Form
1	ADB	Asian Development Bank
2	CCD	Convention to Combat Desertification
3	CFS	Container Freight Station
4	CIT	Corporate Income Tax
5	EHS	Environmental, Health, and Safety
6	EA	Environmental Assessment
7	EMP	Environment Management Plan
8	EPC	Engineering, Procurement and Construction
9	ESIA	Environmental and social impact assessment
10	FCCC	Framework Convention on Climate Change
11	FGD	Focussed Group Discussions
12	FTWZ	Free Trade warehousing Zone
13	GDP	Gross Domestic Product
14	GIS	Geographic Information Systems
15	ICD	Inland Container Depot
16	ICT	Inland Container Terminal
17	IEC	Important Environmental Components
18	LCL	Less than Container Load
19	MOEA	Ministry of Economic Affairs
20	MVA	Motor vehicle Agreement
21	NEC	National Environmental Contracting
22	OP	Operating Procedure
23	PAF	Project Affected Families
24	PAP	Project Affected People
25	PDP	Pasakha Dry Port
26	PIA	Project Influence Area
27	PPP	Public Private Partnership
28	PRA	Participatory Rapid Appraisal
29	RFP	Request for Proposal
30	RGOB	Royal Government of Bhutan
31	SIA	Social Impact Assessment
32	TEU	Twenty Foot Equivalent Unit
33	ToR	Term of Reference

1. Detailed Environment Assessment

1.1. Introduction

The proposed dry port site is located at Pasakha (largest industrial area in Bhutan), and is within 1 km from the Bhutan-India border. The dry port is envisaged to be developed in an area of 15 acres which is about 20 km from Phuentsholing gate. We have observed that the proposed dry port is in a strategic location to cater to the needs of Pasakha industrial area and also the trade requirements of northern and interior parts of Bhutan. The site is bounded on two sides by seasonal rivers - Bhalu Jhora Chhu and Barsa Chhu (also known as Padsekha Chhu). A 120 m bridge connects the site to the road from Phuentsholing across the Bhalu Jhora Chhu. The diagram of the proposed dry port in the context of Pasakha area in Phuentsholing is shown in Figure below

Figure 1: Map depicting dry port project site



The project site consists of 15 acres of land and is available without any encumbrance. The site is mostly covered with bushes and grass. The location of project site is shown in Figure below.

Figure 2: Location Map of Project Site

1.1.1. Purpose of the study

The major objectives and scope of this Environmental Assessment(EA)report are:

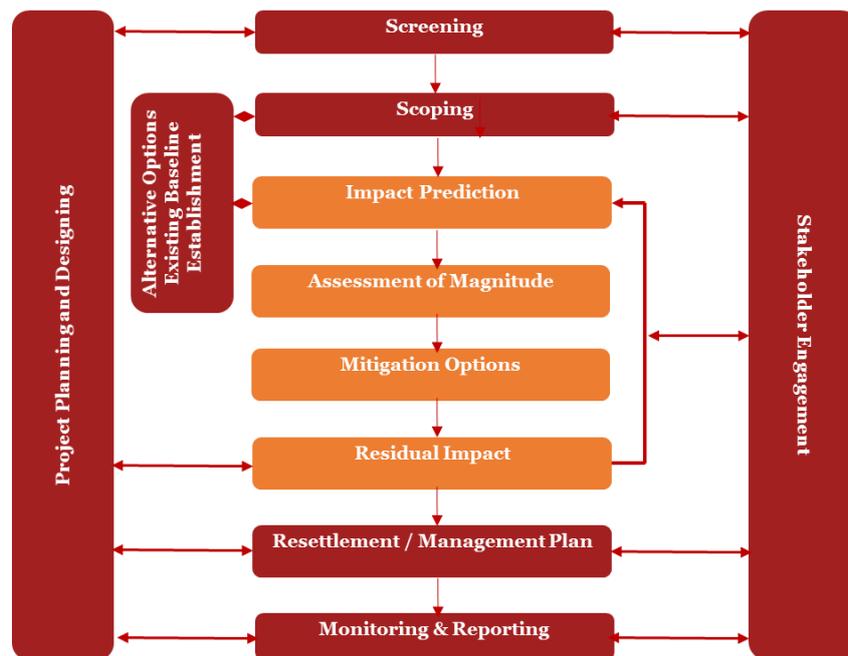
- To assess the existing environmental conditions of the project area;
- To identify potential environmental impacts from the development of Dry Port;
- To evaluate and determine the significance of the impacts;
- To develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities; and
- To carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design.

1.1.2. Methodology

The Environmental assessment (EA) of the dry port in Pasakha is undertaken based on the existing EHS rules and regulations of Bhutan along with the World Bank Environment and Social Operational Policies including Environmental Assessment (OP 4.01), Environmental action plans (OP 4.02), Natural Habitats (OP 4.04), Water Resources Management (OP 4.07), Indigenous people (OP 4.10), Physical Cultural Resources (OP 4.11), Involuntary resettlement (OP 4.12) and Forests (OP 4.36), World Bank Group Environmental, Health, and Safety (EHS) guidelines for Ports, Harbors, and Terminals and NEC Environmental Assessment General Guidelines. The study has been conducted through review of secondary information collected from relevant agencies, and primary information collected from the field survey in January and February 2016. Public consultations and disclosure were carried out to gauge the concerns of Project Affected People (PAP). The relevant 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 are prepared and monitoring plan has been developed. Further, in accordance with the “access to information policy” a work shop in the form of Public consultation meeting has been organized on 17th June, 2016 for presenting the draft EIA to the key stakeholders including key staff of the implementing agencies, agencies of link project, officials of municipality thromde etc. The details of the public consultation meeting along with key concerns and outcomes are reviewed and incorporated in the report. The methodology for undertaking the environmental and social impact assessment study, is depicted in Figure below

Figure 3: Brief snapshot of ESIA study



1.1.3. Description of the Project

The proposed project involves development of Dry port near Pasakha Industrial Estate. The site is surrounded by Barsa Chhu and Bhalu Jhora Chhu, which are seasonal in nature. The site terrain is nearly flat with some undulations in the vicinity. The site is connected to Phuentsholing via AH 48 at its east side. There is another approach road which connects the site to India border. Residential complex of BCCL, BFL and Coca Cola factories adjoin the project site. The proposed site will have the following beneficial impacts:

- Reduction of travel distance for heavy trucks
- Easing of traffic congestion at Phuentsholing gate
- Reduction of overall transportation cost
- Location is near the Indian border, thus facilitating trade between Bhutan and India

Area of 15 acres has been demarcated by the Thromde Municipality for the development of the dry port. The dry port construction activities will include the following activities:

- Construction of access road initiating from the existing bridge to the entry of the Dry Port site
- Construction of several structures such as administrative buildings, service roads and loading and unloading areas. A facility will be created to manage imports and exports with ample warehouse and other operational spaces for inspection loading and unloading.
- Additional special areas will be included for a weighbridge, containers yard, water distribution station, electrical transformer yard and storage of dry bulk and dusty cargo vehicles.

The proposed works will generally be within the boundaries of land designated for the dry port by DoT with some additional adjacent working areas. The built up area and the activity area of the proposed project activity is detailed in Table below.

Table 1: Dry Port Built up Area and the Activity Area

S.no	Particulars	Plot area in sq.mt	Buildup area in sq.mt	Percentage
Processing zone				
1	Container freight station (Import)	4569	4569	7.23%
2	Container freight station (Export)	9138	9138	14.47%
3	Import (Loading & Unloading area)	3319	3319	5.26%
4	Export (Loading & Unloading area)	6401	6401	10.14%
5	Reefer container	1628	1628	2.58%
6	Canteen	223	223	0.35%
7	Empty container yard	2244	2244	3.55%
8	Container yard	1811	1811	2.87%
9	Dry bulk & Dusty cargo vehicles	1199	1199	1.90%
10	Cold storage	2119	600	3.36%
11	Fire station	229	229	0.36%
12	Garage	178	178	0.28%
13	Electrical transformer yard	343	150	0.54%
14	Water distribution station	125	125	0.20%
15	Watch tower	18	18	0.03%
16	Green	7445	7445	11.79%
17	Weigh bridge	210	12	0.33%

S.no	Particulars	Plot area in sq.mt	Buildup area in sq.mt	Percentage
18	Road	10682	10682	16.91%
Subtotal - A		51881	49971	82.15%
Non processing zone				
1	Customs office	520	520	0.82%
2	Administration office(G+1)	336	724	0.53%
3	Clinic	72	72	0.11%
4	Canteen	223	223	0.35%
5	Guest house(G+2)	83	249	0.13%
6	Staff quarter(G+2)	228	684	0.36%
7	2 wheeler & 4 wheeler parking	596	596	0.94%
8	Drivers/Security toilet	50	50	0.08%
9	Drivers dormitory & rest room(G+3)	347	1041	0.55%
10	Security cabin	34	34	0.05%
11	STP	104	104	0.16%
12	Truck temporary parking	1933	1933	3.06%
13	5m wide road	1432	1432	2.27%
14	Foot path	194	194	0.31%
15	12m wide road	2057	2057	3.26%
16	Watch tower	9	9	0.01%
17	Green	3055	3055	4.84%
Subtotal - B		11273	12977	17.85%
Total		63154	62948	100.00%

1.1.4. Construction Approach

The dry port construction will have to be carried out in an environment friendly manner following the principles of balance cut and fill. Excess excavated materials will be disposed off in the pre-identified approved disposal sites. Climate change adaptation (CCA) measures of improved adequate drainage constructions will be carried out.

1.2. Policy and Legal Framework

1.2.1. Environmental Regulatory Compliance

The implementation of the Project will be governed by World Bank Environment and Social Operational Policies including Environmental Assessment (OP 4.01), Environmental action plans (OP 4.02), Natural Habitats (OP 4.04), Water Resources Management (OP 4.07), Indigenous people (OP 4.10), Physical Cultural Resources (OP 4.11), Involuntary resettlement (OP 4.12) and Forests (OP 4.36), World Bank Group Environmental, Health, and Safety (EHS) guidelines and NEC Environmental Assessment General Guidelines.

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). The main requirements of RGOB for environmental management that will apply to the Project are provided below:

Table 2: Main requirements of RGoB for Environmental Management

Statute	Triggered	Explanation
<p>Environmental Assessment Act, 2000</p> <p>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.</p> <p>The Act states that the environmental clearance is required prior to commencement of project.</p>	Yes	<p>It is envisaged that the construction and operation of proposed dry port shall lead to localized environmental impacts during both construction as well as operation phases.</p> <p>As per the Environmental Assessment Act, 2000, the environmental assessment envisaging potential environmental impacts including cumulative effects and suggestive mitigation measures should be conducted for the upcoming projects.</p> <p>As per the above mentioned Act, the environmental clearance should also be taken prior to commencement of project.</p>
<p>Regulation for the Environmental Clearance of Projects, 2002</p> <p>Regulation for Environmental Clearance defines responsibilities and procedures for the implementation of the Environmental Assessment Act, 2000 for issuance and enforcement of environmental clearances.</p>	Yes	<p>Regulation for the Environmental Clearance of projects, 2002 is triggered as Environmental Clearance is required for the project. To obtain an environmental clearance, the steps and procedures stated in Regulation for the Environmental Clearance of projects, 2002 should be followed.</p> <p>This Act ensures that:</p> <ul style="list-style-type: none"> • The project is implemented in line with the sustainable development policy of the Royal Government of Bhutan • Mitigation measures to avoid or mitigate damage to the environment are implemented; and • The concerned people benefit from projects in terms of social facilities

Statute	Triggered	Explanation
<p>National Environment Protection Act, 2007</p> <p>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 manner.</p>	Yes	<p>National Environment Protection Act, 2007 is triggered as it is envisaged that the project shall have potential impacts on the environment. Project Activities will lead to production of both hazardous and non-hazardous waste and other environmental pollutants which in the absence of mitigation plan will impact of Environmental Quality. The above mentioned Act, provides a framework for developing measures and standards to protect Bhutan's environmental quality.</p> <p>Guidance relevant to this project includes:</p> <ul style="list-style-type: none"> • 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 to discharge or emit any pollutants in excess of such standards as may be prescribed. • Environmental Standards for Products: Technologies, and Management Practices • Environmental Emergencies: Environmental emergencies, including any industrial accident or accidental spillage or leakage resulting in a significant release of a hazardous substance into the environment, shall be notified to the nearest government authority which in turn take the necessary measures for damage control including alerting the public affected and inform the Secretariat.
<p>Waste Prevention and Management Act of Bhutan, 2009</p> <p>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.</p>	Yes	<p>Waste Prevention and Management Act of Bhutan, 2009 is triggered as it is envisaged that hazardous and non-hazardous waste shall be produced during both construction and operation phases.</p> <p>Waste management requirements of relevance to the proposed project includes:</p> <p>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.</p> <p>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.</p>

Statute	Triggered	Explanation
<p>General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006</p> <p>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.</p>	Yes	<p>General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006 is triggered as during both construction and operation phase, working men and women will be employed.</p> <p>The requirements of the above mentioned Act relevant for the project are:</p> <p>Management of occupational health and safety system: Health and safety programme including roles and responsibilities of an employer and appointment of health and safety representative.</p> <p>Inspections, Notices and Reports: Inspections by Ministry of Labour and Human Resources, Frequency of Inspections, Improvement of prohibition notice, Prompt compliance and inspection reports.</p> <p>Self-inspections and reporting procedure: It gives description about self-inspections by employers, reporting procedures, correction of unsafe conditions and procedure for refusal of unsafe work.</p> <p>General duties of workers, employers, supervisors and suppliers.</p> <p>Rights of workers to withdraw from dangerous work in unsafe work condition, workers compensation</p> <p>Type and Use of Personal Protective Equipment (PPE) and responsibilities of employer, supervisor and workers regarding use of PPE and clothing to mitigate/ reduce health and safety risks</p> <p>Minimum safety standards for the construction industry outlining personal protective and life-saving equipments, fire protection, hand and power tools, signs, signals and barricades, material handling, storage, use and disposal, scaffolds, excavations, electrical works and sanitation and hygiene.</p>
<p>The Labour and Employment Act of Bhutan, 2007</p> <p>The labour and employment act of Bhutan 2007 provide policies and programs in the areas of employment promotion, labour protection and relations, vocational</p>	Yes	<p>The Labour and Employment Act of Bhutan, 2007 is triggered as the project involves employment of workers in both construction and operation phase.</p> <p>The requirements of the above mentioned Act relevant for the project are:</p> <p>Prohibitions of forced labour, child labour, discrimination of employees and job seekers and sexual harassment</p>

Statute	Triggered	Explanation
education and training, and occupational standards setting and certification.		Employment details including Contracts of employment, compensation and benefits, working hours and leave, wages, minimum age of employment, resolution of labour disputes and employment of foreigners Occupational health and safety including employers duties to both employees and non-employees, employer to bear cost of occupational health and safety, health and safety policy, incident/accident reporting, accident records, duties and rights of employees, appointment of health and safety representative and duties of other people
The Forest Act (1969) The first environmental legislation in Bhutan. It brought all forest resources under government custody to regulate utilization.	No	This act is not triggered as the project site does not come under notified forests/ reserved area.
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.	No	This act is not triggered as the project site does not come under notified forests/ reserved area
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.	No	This act is not triggered as the project site does not come under notified forests/ reserved area
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	Yes	Land Act, 1979 is triggered as the project involves resettlement of residential and residential cum commercial establishments. 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

Statute	Triggered	Explanation
<p>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.</p>		the basis of an evaluation carried out by a qualified engineer appointed by the competent authority.
<p>Bhutan Building Rule 2002 (MoWHS)</p> <p>The Municipal 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.</p>	Yes	The building construction of the Dry port facility should follow Bhutan Building Rule 2002 for construction of ancillary facilities and buildings.

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.

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.

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 should be managed in an environmentally sound and sustainable way.

Based on the interactions with the CEO of NEC, Initial Environmental Examination (IEE) report with all the detailed Project information under general provisions needs to be submitted for obtaining the Environmental Clearance for the project.

1.2.2. World Bank Safeguard Policies

The summary of environmental safeguard Policies of World Bank applicable for the proposed Dry Port project is provided in Table below:

Table 3: Summary of World Bank Safeguard Policies

Safeguard Policies	Triggered?	Explanation
Environmental Assessment OP/BP 4.01	Yes	The project will cause localized environmental impacts during the construction and operation phase
Natural Habitats OP/BP 4.04	No	There are no Natural Habitats in the project area of influence
Forests OP/BP 4.36	No	There are no forests within the project area.
Pest Management OP 4.09	No	The project activities will not lead to use of fertilizers and issues identified in pest management policy
Physical Cultural Resources OP/BP 4.11	No	There are no Physical and Cultural resources in the project area of influence
Indigenous Peoples OP/BP 4.10	No	The Project will not impact Indigenous People
Involuntary Resettlement OP/ BP 4.12	Yes	The project will involve resettlement of households during construction of approach road from existing bridge to the Dry Port road and hence OP 4.12 has been triggered.
Safety of Dams OP/BP 4.37	No	The project doesn't entail construction and operation of dams
Projects on International Waterways OP/BP 7.50	No	The project does not envisage activities in the international ways and also does not impact the quantity and quality of international waterways. It is proposed to construct a RCC retaining wall of 3.5meters height in the periphery of the site boundary in order to prevent the site from inundating during monsoon. The shape of site boundary is also in a curved shape and the site is located along the river flow and not against the river flow and hence the flow of river will not be disturbed at any time. Further, withdrawal of water for the project purpose is not envisaged either during construction or operation stage

Projects in Disputed Areas OP/ BP 7.60	No	Project doesn't envisage activities in disputed areas
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1.2.3. International Conventions

- Protection of biodiversity: The RGoB ratified the UNESCO Convention on 22 October 2001 with 8 sites in the tentative UNESCO list of which 4 are earmarked for the protection of biodiversity, namely: Royal Manas National Park, Bumdeling Wildlife Sanctuary, Sakteng Wildlife Sanctuary, and the Jigme Dorji National Park.
- The RGoB is a party to the Convention on International Trade in Endangered Species since 13.11.2002 and has supported the South Asia Wildlife Enforcement Network to protect the threatened 10 big and small cat species including the color morphs of the Asiatic Golden Cats and the monitoring of illegal killing of elephants. The anticipated impacts from improved access causing resource exploitation and land use changes that affect biodiversity will be considered while establishing the baseline and determining the mitigation measures.
- Bhutan is also 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.

1.2.4. Environmental Roles of Relevant Agencies

1.2.4.1. National Environmental Commission Secretariat (NECS)

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.

1.2.4.2. District Environmental Committee (DEC)

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.

1.3. Project Description

1.3.1. Site Topography

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.

The proposed project site is located in Pasakha which is approximately 20 km from Phuentsholing gate. Pasakha is in Chhukha District situated in the south of Bhutan. The distance from Thimphu is approximately 200 km and the nearest airport is Bagdogra (India), 3hrs drive from Pasakha. 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 (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 (Toorsa River) and the plains to the West lead to India. The road connectivity to the site is available from the existing state highway on the north which at present is a mud road and connecting the site at a distance of approximately 210 meters from the state highway.

Figure 4: View of Project sites before Construction





The site has two operating bore wells within the boundary. As the existing bore wells are the source of water supply to the nearby industries and hence need to be retained while planning the dry port development. As the container freight station warehouses are planned in the area having the bore wells, the position of support columns of the warehouses are planned at the extreme end of walls ensuring that the bore wells are located within the floor area of the warehouse without any disturbance to their operation.

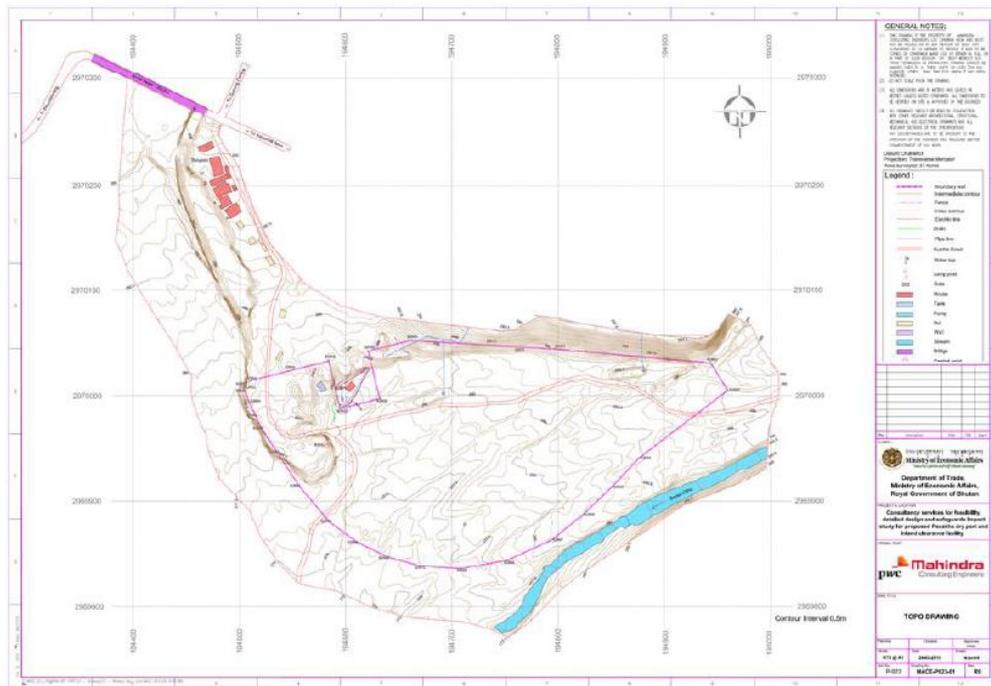
1.3.2. Topographic Survey

Based on a permanent bench mark with respect to MSL at/near the site (within a km) shown by the client during the site visit, the topographical survey was carried out using total electronics surveying station of high precision with computerized method. The findings of the topographic survey have been used to design layout plan of the Dry port site.

Topographic survey was conducted to define the land parcel size, legal boundary, conditions of occupancy and to capture all the existing features such as land levels at site, boundaries of habitation, vegetation cover, creeks, buildings, approach road to site and other structures present in the area, land drainage, all existing service details such as electric lines, fresh water supply, sewerages along with the site control points.

Building lines indicating the type of buildings, right of way for the available roads and boundary are captured in the survey drawing. Special emphasis was laid in identifying all the existing buildings in and around the site within a periphery of 50 m from all the sides. The site is free of vegetation and power lines. Each physical feature on ground true to their position, all the physical objects including existing permanent/ temporary structures, buildings, plots with boundaries, canals with boundaries, cross drainages, electric sub-station/poles, telephone pole, retaining/breast walls, side drains, house drains, roads, paths, gullies, fencing, boundaries walls, gates etc. were marked in their position in the drawing. The topo survey drawing is depicted in figure below.

Figure 5: Topographic survey drawing



The topographic survey findings are:

- The highest point of the site is at a level of 285 m from the MSL in the North-East direction
- The lowest point is at a level of 277.5 m from the MSL in the South-West and North-West directions
- Gradual slope is observed from Northeast to the Southwest
- Mud road for a length of 0.72 km (approximately) is available within the site area
- Barsa is the river along the Southeast direction which is at a distance of 16m from the site boundary, with a RL of 277.5 m from MSL
- A pump house catering to the water demand of the certain residential settlements up hills en route the Malbase sub-station is situated very close to the site

1.3.3. Description of Operations

The Dry port will have customs statutory processing zone. The detailed site plan and traffic flow pattern during operation phase is provided in figures below. The distinct areas in the Dry port will include:

- Container freight station (for both import and export)
- Loading and unloading area (for both import and export)
- Reefer container
- Container yard
- Dry bulk and dusty cargo vehicles area
- Empty container yard
- Cold storage

- Fire station
- Garage
- Electrical transformer yard
- Water distribution station
- Watch tower
- Green belt
- Weigh bridge
- Roads

The ancillary facilities in the Dry port will include:

- Customs office
- Administration office
- Clinic
- Canteen
- Guest house
- Staff quarter
- 2 wheeler and 4 wheeler parking
- Drivers toilet and dormitory and rest room
- Security cabin
- STP
- Truck temporary parking
- 5 & 7 m wide road
- Foot path
- 12 m wide road
- Watch tower
- Green belt

There will be no storage space for dry bulk and dusty cargo within the Dry port facility. Only temporary parking space will be provided. The major type of cargo handled at the Dry port will include:

- Container Cargo
- Break bulk cargo
- Reefer container cargo
- Dry & Dusty cargo

As per the design considerations, the following assumptions has been made:

1. 20% of the existing import cargo volume and 100% of export cargo volume shall be handled
2. Storage space for dry and dusty bulk cargo will not be provided in the facility in view limited space availability. However a temporary holding area will be provided.

The offsite facilities for the dry port shall include:

-
- Construction of approach road of length 283 m from the bridge to the site
 - Construction of Retaining Wall of 4 m height along the periphery of the road.

Figure 6: Detailed site plan



Figure 7: Traffic flow pattern within dry port



It is envisaged that number of vehicles are likely to be increased during construction phase. The project duration is expected to be 16 months (excluding 4 months of monsoon). The total number of trucks per months during construction phase is expected to be 2,348 and number of trucks per day will be 94 (considering 26 days/ month).

There is no manufacturing facility involved in the Dry port and only modern material handling equipments are intended to be used. Storm / rain water drainage system from various levels such as terrace, paved area, lawns and roads drains by means of draining and surface run-off water shall be closed trench along the road/boundary wall.

The main water source is envisaged to be sourced from bore well. The estimated average daily water requirement for operation phase is 0.102 MLD and 0.07 MLD during construction phase.

During construction phase, construction waste is estimated to be generated which will be disposed to local solid waste management (SWM) facility. During operation phase, domestic wastages are envisaged which should be disposed to the local SWM facility. The hazardous wastes generated from port operations such as handling of oil etc will be disposed off through authorized vendors. There will be no processing/ manufacturing activity involved in the port facility. The effluent generated from floor washings and floor runoff will be sent to STP for treatment.

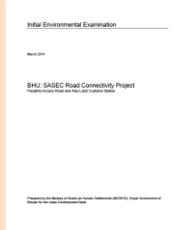
The improvements to logistics, customs procedures, transshipment arrangements, and non-environmental management measures are also under consideration. These improvements will be designed overall to make movement of freight carrying vehicles more efficient. The environmental impacts will also be reduced by undertaking simple measures such as switching of vehicle engines when vehicle are stationary.

1.3.4. Linked Projects

ADB and the Government of Bhutan are working together to bring safer roads and more opportunities to the southern part of the country. The South Asia Sub regional Economic Cooperation Road Connectivity Project (SASEC) will build 68.3 km of the vital Southern East West Highway between the towns of Dewathang and Nganglam, which is one of the main crossing points between Bhutan and India. The project is also building a 1.2 km access road between Bhutan's border with India and the Pasakha industrial estate, reducing travel time by 90 percent from nearly two hours to about 10 minutes. Border crossing stations in Phuentsholing City the town of Alay will also be improved, and a 2.7 km access road to the national highway will be built.

As part of the above mentioned projects, the following activities are being undertaken in close vicinity of the proposed "Pasakha Dry Port project". Since the linked project's activities have an impact on the overall Environmental and Social parameters for Pasakha industrial region as a whole, it is crucial to be cognizant of the progress of the linked project's activities. The current status of these two sets of activities is described in table below:

Table 4 - Linked Project's activities status (SASEC – ADB)

Project Name and Brief Description	Funding Agency	Implementing Agency	Linkage to Dry Port project	Current Status of project
<p>South Asia Subregional Economic Cooperation Road Connectivity Project: Nganglam-Dewathang Highway and Pasakha Access Road</p> <p>Sub Project:</p> <p>The proposed works under this project will require widening and reconstruction of a 1.2km section of the existing access road to Pasakha coming from Phuentsholing; reconstruction of the bridge over the Bhalujhora River (120m) and construction of the multi-cellular culverts over Bhawanijhora landslide debris flow</p>	ADB	SASEC	<p>Direct linkage to Dry port and its associated facility (access road)</p> <p>Pasakha Access road (Bhutan), provides an access to the trucks travelling to the Pasakha Industrial area. The access road being constructed as part of the proposed Dry port is envisaged to be constructed from the new bridge till the entrance of the dry port.</p>	<p>The project is under construction. The IEE, feasibility and resettlement plan is updated and is available on ADB's website for public review. The IEE report along with the EMP of the linked project is in compliance with the WB safeguards. As the EMP has been developed for the linked project, a separate EMP for the linked project has not been detailed in the EA of the dry port. Ensuring the implementation of EMP as detailed in the linked project suffices the requirements.</p> 

1.3.5. Project Area of Influence

As per the World Bank's guidelines OP 4.01 Environmental Assessment – Project's area of influence is defined as the area likely to be affected by the project, including all its ancillary aspects, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, and construction camps, as well as unplanned developments induced by the project (e.g., spontaneous settlement, logging, or shifting agriculture along access roads). The area of influence may include, for example, (a) the watershed within which the project is located; (b) any affected estuary and coastal zone; (c) off-site areas required for resettlement or compensatory tracts; (d) the air shed (e.g., where airborne pollution such as smoke or dust may enter or leave the area of influence; (e) migratory routes of humans, wildlife, or fish, particularly where they relate to public health, economic activities, or environmental conservation; and (f) areas used for livelihood activities (hunting, fishing, grazing, gathering, agriculture, etc.) or religious or ceremonial purposes of a customary nature

Hence the area of influence for the project is the project site and the immediate air-shed including the approach road connecting the existing bridge to the site.

The area of influence is considered to be approx. 150 m on all the sides from the boundary of the proposed site and approx. 50 m on both the sides of the access road.

The map showing area of influence is provided in Figure below.

Figure 8: Project Area of Influence



1.3.6. Screening Categorization

In accordance with WB OP 4.01 environmental screening categorization, the Project falls under “Category B”. The proposed project is classified as Category B as its potential environmental impacts on human population or environmentally important areas such as land, water, forests, grasslands, or natural habitats or human beings are lesser adverse than Category A projects. The potential impacts can be site specific and may be irreversible but can be mitigated by measures more readily than for Category A projects. The major potential limited reversible impacts of the project are:

Potential limited reversible: Environmental and social impacts of the project which can be mitigated by measures encompass the following:

- impact on top soil due to site clearing and Levelling (cutting, stripping, excavation, earth movement, compaction) and other site preparation activities;
- Increase in noise & vibration due to construction activities and traffic movement to be carried out in project area;
- change in air quality during the site preparation and construction activities such as setting of batching plants, labour camps, etc.;

- impact on ambient air quality due to vehicular movement during construction and operation phases;
- temporary changes in water quality in the vicinity of Project site due to construction activities;
- change in water availability in the project area due to usage of water during construction and operational phase;
- Generation of hazardous waste during construction and operation phase;
- occupational health and safety impacts for the workers working in the project area during both construction and operational phase;
- community health and safety impacts during construction phase; and
- influx of workers affects socio-economic condition of the area by impacting public services, demography of the area, housing facilities, employment opportunities and aesthetic quality of the community during both construction and operational phase of the project.

1.4. Baseline environmental establishment

This section establishes the baseline environmental and socio economic status of the proposed dry port and surrounding area to determine the project influence area within which the impacts of the Project are to be assessed.

Establishing baseline helps in understanding the prevailing environmental and socio economic status of the study area. It provides the background environmental and social conditions for prediction of the future environmental characteristics of the area based on the operation of the new/expansion activity of the project during its life cycle. It also helps in environmental and social management planning and strategy to minimize any potential impact due to the Project activities on surrounding environment. Field surveys were conducted at the project site to collect the requisite baseline information through discussions with project proponents, and local people. The baseline information was gathered pertaining to:

- The physical environment (air, water, land, noise, flora, fauna, etc.)
- The socio-economic data of the area in which project site is located
- Disadvantaged or vulnerable groups in the project area of influence
- Presence of any indigenous people in the project area of influence
- Presence of any cultural heritage sites in the project area of influence.

1.4.1. Methodology

The environmental and social baseline has been assessed and a survey of the project area was conducted to identify environmental and social sensitive receptors located within and around the project area.

Environmental and social baseline data was collected through primary surveys as well as secondary sources by literature survey and discussions with the concerned stakeholders.

1.4.1.1. Primary Baseline Data Collection

Physical environment monitoring and consultations were conducted to collect the information related to the environmental conditions in the vicinity of the proposed site. Stakeholder consultations were carried out by us to collect information on socio-economic status of the project area. The primary baseline data was collected for various social and environmental parameters as detailed out in Table below.

Table 5: Primary Baseline Data Collection

S.No	Environmental Attribute	No. of Locations	Frequency	Remarks
1.	Socio- economic Status			
2.	Monitoring of Soil quality	Proposed project site and in its vicinity	Once during study period	Survey was undertaken by third party lab to assess the parameters.
	Monitoring of groundwater and surface water quality			
	Monitoring of ambient air quality			
	Monitoring of ambient noise			

The sampling locations for primary monitoring as shown in Figure below, were chosen strategically to capture the maximum impacts. The sampling locations for air and noise monitoring were selected based on the wind direction and sensitive receptors. As per the available secondary information, the predominant wind direction is from south west to north east. The sampling locations were chosen upstream and downstream to wind direction, near sensitive receptors and at the site location. Soil and groundwater quality monitoring was done at the project site location. Surface water sample was taken from the Barsa Chhu flowing downstream of the site location. The summary of monitoring locations are provided in Table below.

Table 6: Primary Monitoring Location

S.No	Air	Noise	Surfacewater	Groundwater	Soil
1.	Office of the Trade Department	Office of the Trade Department	Barsa Chhu at the back of the site	At the site location	At the site location
2.	B.C.C Colony	B.C.C Colony			
3.	Roof Top of the Santa Restaurant	Roof Top of the Santa Restaurant			
4.	Bhalu Jhora Pump Station	Bhalu Jhora Pump Station			

Figure 9: Primary Monitoring Locations



1.4.1.2. Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting available published material documents. Information’s on various environmental aspects (like soil, geology, hydrogeology, hydrology, drainage pattern, ecology etc.) meteorology, and socio-economic aspects were collected from different government departments, institutions, literatures etc. Type of secondary data and their sources are given in Table below.

Table 7: Secondary Data Collection

S.No	Attribute	Source
1.	Long term meteorological data	• Hydro-met department
2.	Geology, Hydrogeology and hydrology	• Hydro-met department • Department of Geology and Mines
3.	Environment Quality	• National Environment commission
4.	Landuse and Physical Features	• Municipality Thromde
5.	Natural Hazards	• Department of disaster management • Department of Geology and Mines
6.	Traffic Data	• Traffic division, Bhutan Royal Police
7.	Industries Data	• Department of Industries
8.	Socio-Economic	

1.4.2. Physical Environment

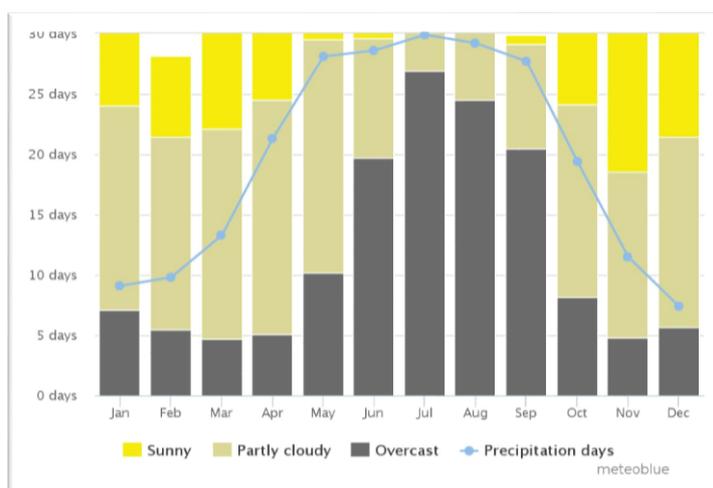
The physical environment includes meteorology, climate, rainfall, humidity and illumination which are described below:

1.4.2.1. Meteorology and Climate

Bhutan experiences four seasons: spring (March-May), monsoon (June-August), autumn (September-November) and winter (October-February). The average cloudy, sunny and precipitation days for Phuentsholing, based on last 30 years data is shown in the Figure below. It has been observed from the data that November to April have sunnier days while June to September has more overcast days.

Annual rainfall is concentrated in the monsoon season from June to September. A summary of average rainfall in Phuentsholing city (2003-2013) is given in the Table and Figure below. The average temperatures and precipitation, based on last 30 years data is shown in the figure below.

Figure 10: Average cloudy, sunny and precipitation days for Phuentsholing

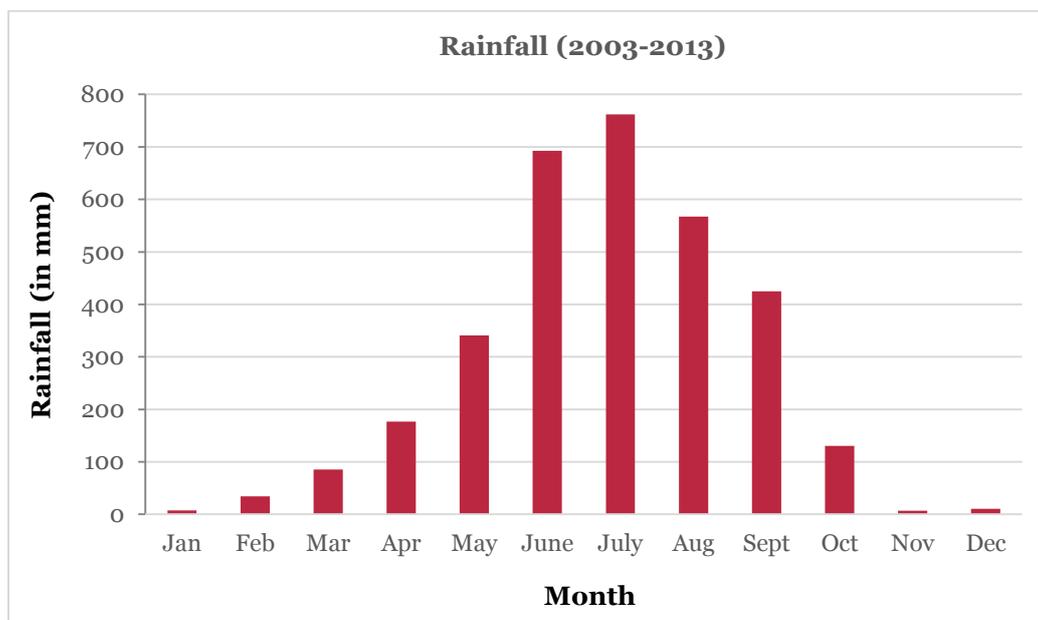


Source: https://www.meteoblue.com/en/weather/forecast/modelclimate/phuntsholing_bhutan_1252484

Table 8: Rainfall data of Phuentsholing (2003-2013)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2003	15	71	341	294	306	1031	916	675	617	293	31	45
2004	30	73	38	280	698	1215	1364	559	408	343	0	27
2005	22	3	59	78	164	126	1141	559	271	174	10	0
2006	0	2	30	55	291	488	276	293	441	101	0	0
2007	2	76	12	100	744	487	659	615	601	79	2	0
2008	14	18	49	45	177	234	410	364	352	18	0	1
2009	0	70	81	222	275	544	708	829	226	201	0	20
2010	0	25	211	423	394	894	926	611	630	68	1	0
2011	0	38	42	209	246	848	706	524	425	0	12	0
2012	0	0	0	125	185	1173	337	-	-	47	-	-
2013	3	3	80	115	270	575	935	641	279	113	15	14

Source: Hydro-met Department, Thimpu

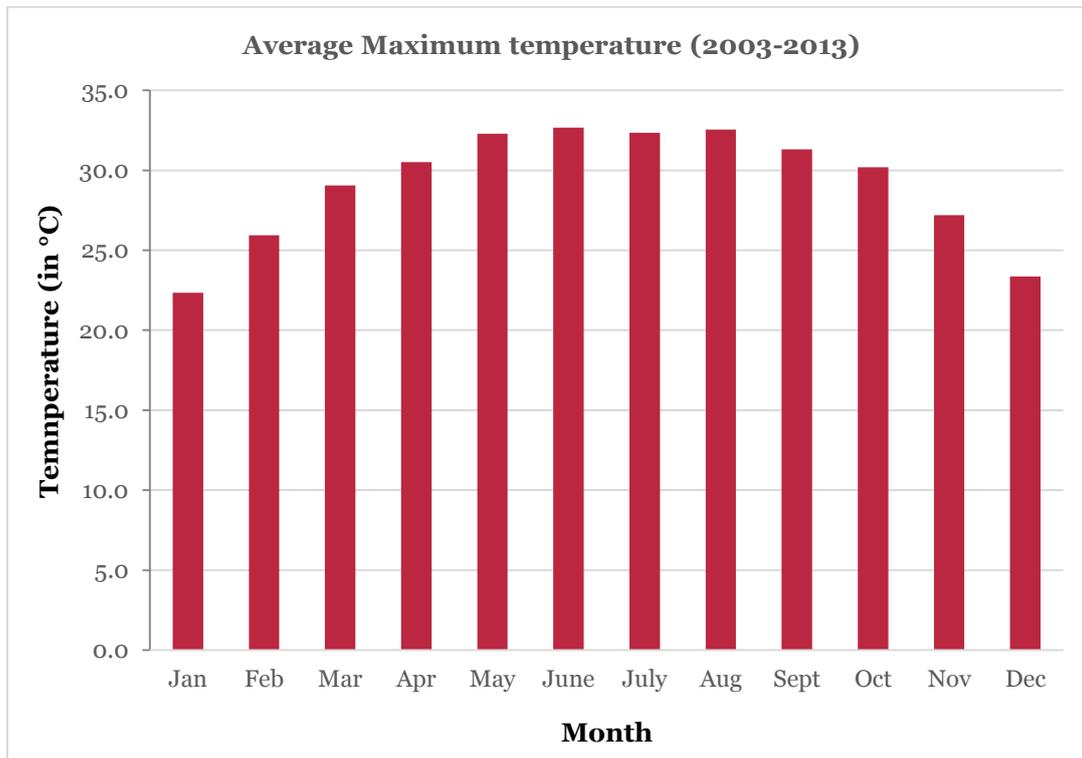
Figure 11: Average Rainfall in Phuentsholing (2003-2013)

The average rainfall varies from 1 mm in the month of November to 1364 mm in the month of July. 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. The average maximum and minimum temperature varies from 17 °C – 35 °C and 10 °C – 25 °C respectively. The average maximum and minimum temperature of Phuentsholing from 2003-2013 are provided in tables and figures below.

Table 9: Maximum Temperature data of Phuentsholing (2003-2013)

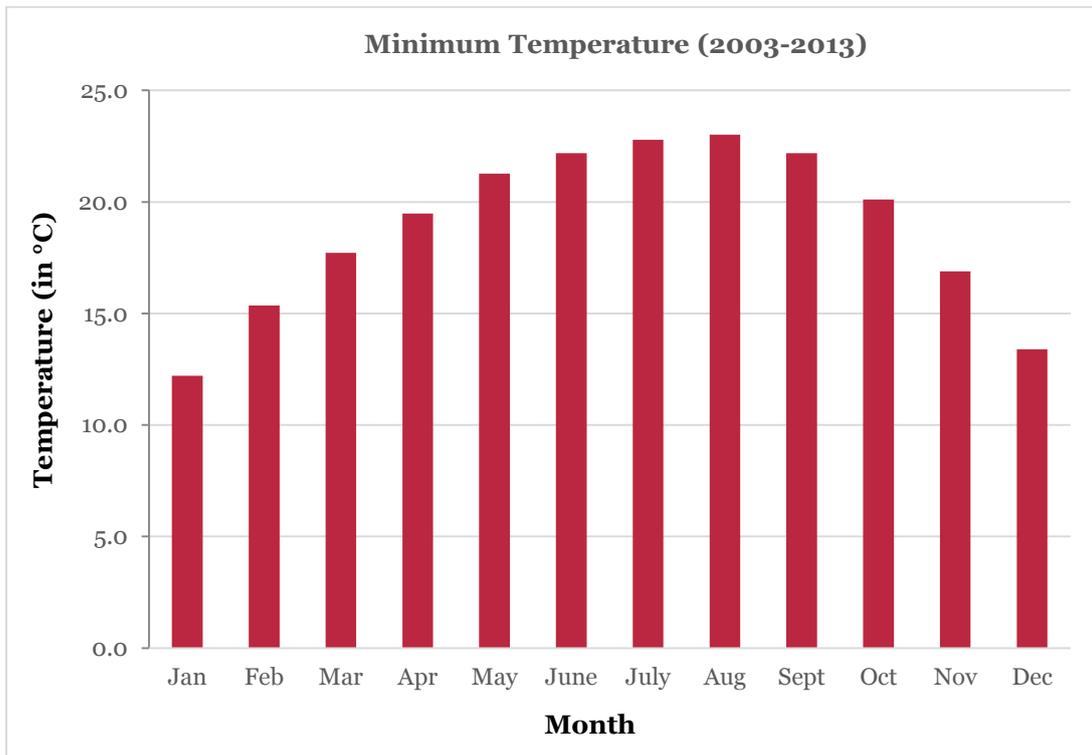
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2003	18	20	24	29	33	33	34	35	32	28	22	20
2004	25	27	31	30	32	32	31	34	32	32	31	27
2005	23	26	29	31	30	33	30	32	30	28	24	19
2006	18	23	24	27	33	34	33	33	28	26	24	20
2007	17	21	25	29	33	34	34	32	30	29	25	22
2008	21	26	30	31	31	30	31	31	31	30	28	26
2009	25	28	31	31	32	32	32	31	33	31	28	25
2010	24	28	31	31	32	30	31	31	32	32	30	26
2011	25	30	30	32	33	33	32	33	33	32	32	24
2012	25	27	32	31	33	33	33	33	29	33	-	-
2013	25	29	33	34	34	34	35	34	35	32	27	25

Source: Hydro-met Department, Thimpu

Figure 12: Maximum Temperature in Phuentsholing (2003-2013)**Table 10: Minimum Temperature data of Phuentsholing (2003-2013)**

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2003	11	12	15	20	22	22	22	23	21	19	14	12
2004	12	15	20	19	22	23	22	24	23	21	18	15
2005	13	15	18	19	21	23	23	23	21	18	15	12
2006	11	15	15	18	21	23	22	22	21	20	17	12
2007	11	12	16	19	23	22	22	23	21	20	17	13
2008	12	15	19	20	21	23	23	22	22	20	16	15
2009	13	16	18	20	21	23	23	23	23	22	18	15
2010	14	14	18	20	20	22	25	24	23	21	19	13
2011	12	20	20	19	21	18	22	24	25	19	19	15
2012	16	19	18	19	21	23	22	22	21	21	-	-
2013	10	15	19	20	22	23	23	23	23	21	16	13

Source: Hydro-met Department, Thimpu

Figure 13 Minimum Temperature in Phuentsholing (2003-2013)

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 2003 to 2013 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. 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 rainfall of 4,400mm.

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 2003 to 2013 across four eco-floristic zones of Bhutan shows annual fluctuations within regions without any detectable trend. Given the rainfall pattern over the region of the Project, it is important that season be considered in planning the implementation of the improvement program. In order to avoid runoff and protect the works earthworks and major construction should be planned for the dry season (November to February).

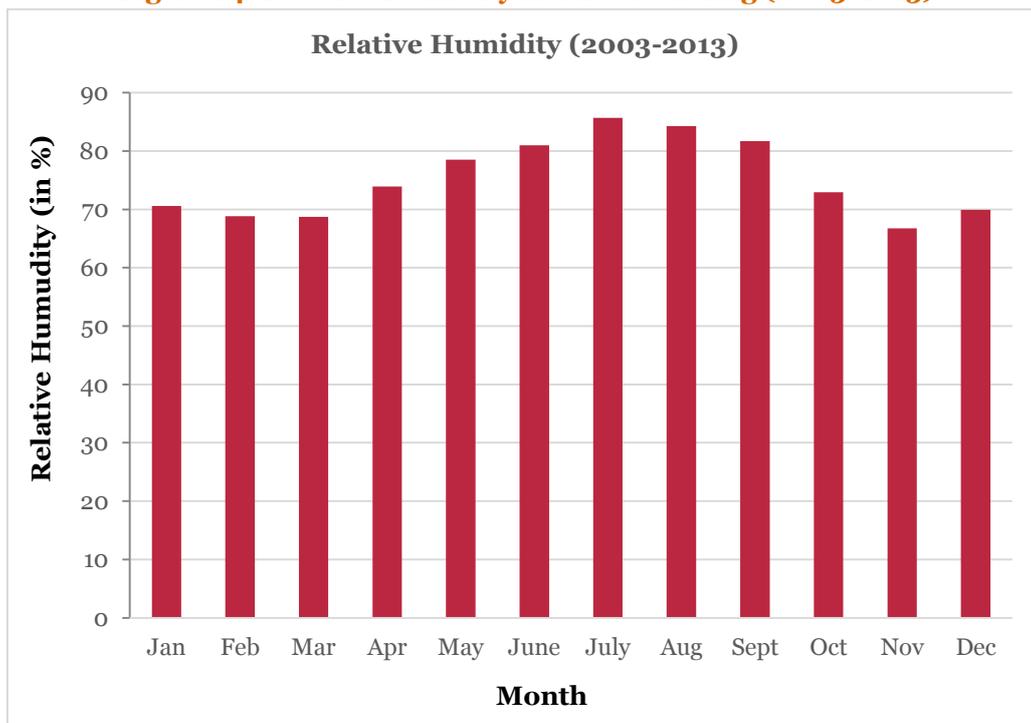
1.4.2.2. *Relative Humidity*

The relative humidity of Phuentsholing varies from 46% to 94 %. Similar to precipitation, the changes in humidity is quite variable and there is no general trend for the same. The relative humidity data for 2003-2013 is provided in the table and figure below.

Table 11: Relative Humidity data of Phuentsholing (2003-2013)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2003	82	63	89	74	88	69	96	71	66	60	92	90
2004	94	90	93	91	92	95	94	94	94	74	58	87
2005	89	86	84	67	77	84	87	90	84	82	72	74
2006	71	75	67	74	81	84	82	79	82	73	70	65
2007	58	65	70	80	79	78	81	89	82	76	67	61
2008	69	64	66	-	-	-	-	90	80	72	60	64
2009	65	58	49	72	72	83	84	88	76	69	63	71
2010	62	56	70	77	80	85	82	82	85	79	66	53
2011	61	72	61	63	68	80	87	79	80	65	62	76
2012	74	74	46	67	72	71	-	82	86	81	-	-
2013	51	54	60	76	77	81	79	-	84	-	59	59

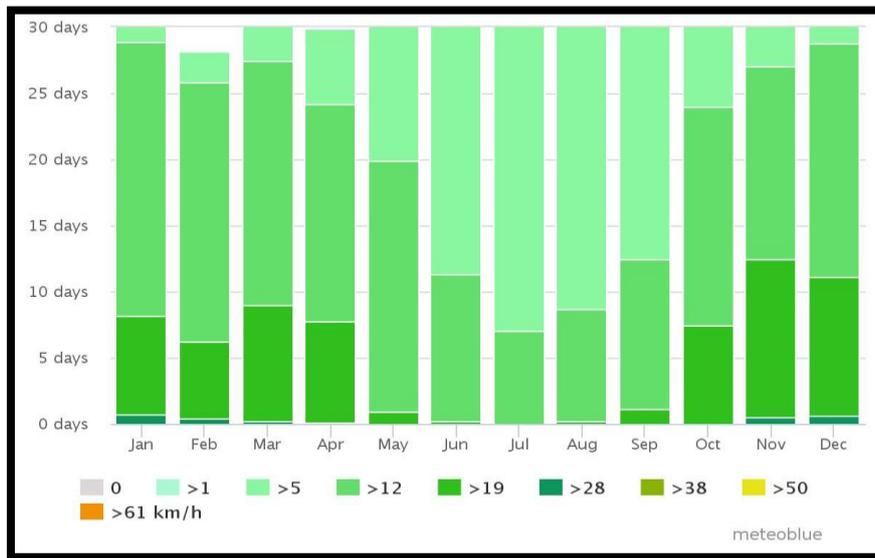
Figure 14: Relative Humidity in Phuentsholing (2003-2013)



1.4.2.3. Wind Speed and Wind Direction

The wind speed in Phuentsholing based on last 30 years data is shown in the Figure below. It has been observed that wind speed is maximum from October to May. The average wind speed is more than 12 km/h from October to May while the average speed is greater than 5 km/h in June to September. As per the secondary data available from Hydro-met Department, the predominant wind direction is from south west to north east.

Figure 15: Wind Speed in Phuentsholing



Source: https://www.meteoblue.com/en/weather/forecast/modelclimate/phuntsholing_bhutan_1252484

1.4.2.4. Air Quality

Based on the wind direction and sensitive receptors, air quality monitoring was undertaken for the Project at four different locations. The analysis results of ambient air quality monitoring are provided in Table below. It has been observed that PM₁₀ at Office of Trade Department and Santa Restaurant exceeds the NEC standards of National Ambient Air Quality for mixed areas by more than 50%. The same is within limits at other two locations. The high PM₁₀ levels indicate presence of the anthropogenic combustion sources, industrial emissions, and fugitive dust emissions from the vehicular movement in the vicinity of the project area. SO₂, NO_x and CO are within prescribed limits of NEC standards for mixed area (mixed area includes residential, commercial or both activities).

The primary field consultations have indicated that emissions from the industrial units located in Pasakha Industrial Estate attributes to the increased particulate matter in the vicinity of the project. Local Stakeholders indicate that dust emissions from the unpaved roads, contribute significantly to the poor air quality in the vicinity of the project area. The dust emissions will be intermittently higher during the construction period resultant of the vehicular movement on the unpaved roads.

Table 12: Ambient air quality analysis

S. No.	Sampling Location	Concentration of Pollutants				
		PM10 ($\mu\text{g}/\text{m}^3$)	PM2.5 ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO ₂ ($\mu\text{g}/\text{m}^3$)	CO (mg/m^3)
1	Office of the Trade Department	159	65	8.8	25.5	0.28
2	B.C.C Colony	58	26	4.6	17.5	0.18
3	Roof Top of the Santa Restaurant	162	78	7.5	21.2	0.25
4	Baljura Boiler Pump Station	68	26	5.5	19.6	0.16
NEC Standards 2010. for Ambient air quality for mixed areas		100	200	80	80	2000

1.4.2.5. Noise

Noise monitoring was done at 4 different locations and the results are provided in Table below along with NEC standards for mixed areas. The monitoring results show that noise levels are within acceptable limits. However, the day time noise levels at three locations except Bhalu Jhora boiler pump station are very close to the NEC standards. There were no complaints about current noise levels from the public during consultation. The criterion for site noise for a mixed area in Bhutan is Leq 65 dB(A) (day) and Leq55dB(A) (night).

Table 13: Noise monitoring results

Location	B.C.C colony	Roof Top of the Santa Restaurant	Office of the Trade Department	Baljura Boiler Pump Station	NEC Standard for mixed areas
Noise Levels in Leq dB(A) Day Time	62.9	65.0	62.9	51.1	65
Noise Levels in Leq dB(A) Night Time	44.6	48.3	45.2	42.6	55

1.4.2.6. Geology, and Soils

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. The analysis of soil sample collected from the site is provided in the Table below. The analysis results show that soil strata is predominated by sand clay.

Table 14: Soil sample analysis results

S No.	Test Parameters	Unit	Result
1.	pH value (1:2.5) at 27°C	---	7.52
2.	Boron (as B)	mg/kg	<0.25
3.	Chloride (as Cl)	mg/kg	39.6
4.	Copper (as Cu)	mg/kg	20.1
5.	Iron (as Fe)	mg/kg	17.0
6.	Magnesium (as Mg)	mg/kg	360
7.	Sulphate (as SO ₄)	mg/kg	273.8
8.	Cadmium (as Cd)	mg/kg	<2.0
9.	Lead (as Pb)	mg/kg	14.4
10.	Nickel (as Ni)	mg/kg	13.5
11.	Arsenic(as As)	mg/kg	<0.25
12.	Total Chromium (as Cr)	mg/kg	7.92
13.	Electrical conductivity	µs/cm	293
14.	Potassium (as K)	mg/kg	20
15.	Sodium Adsorption Ration (as SAR)	---	0.11
16.	Zinc (as Zn)	mg/kg	44.1
17.	Cobalt (as Co)	mg/kg	<4.0
18.	Phosphorus	mg/kg	6.7
19.	Moisture	%	7.5
20.	Particle Size Distribution	%	Loamy Sand (Sand-84.4,Silt-5.4,Clay-10.2)
21.	Nitrogen	mg/kg	91.6
22.	Infiltration rate	mm/Hr	22
23.	Total Sulfur	%	0.028

Intermittent occurrence of heavy rain, slow erosion-deposition, rapid mass washing processes, including rock falls and landslides make the terrain susceptible to erosion and landslides.

1.4.2.7. Seismicity

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.

There is no detailed seismic micro-zonation of the country. However, since the north-eastern parts of India (adjacent to Bhutan) fall under seismic zone V (seismically most active), it can reasonably be assumed that Bhutan can be classified either in seismic zone IV or V. Hence, the project site is vulnerable to earthquake.

1.4.2.8. *Surface Water*

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.

Phuentsholing urban area is divided by the Om Chhu. This river rises in Bhutan, and discharges to the Amo Chhu that crosses the Indian-Bhutanese border. Amo Chhu originates in China and flows through a well-defined valley system. The Bhalu Jhora Chhu near Pasakha rises in Bhutan crosses the Indian-Bhutanese at Pasakha and discharges to the River Amo Chhu about 10km east of Cooch Behar in India.

Pasakha lies on the east bank of the Bhalu Jhora Chhu which emerges from its steep upstream reaches onto the Duar plain and broadens to a width up to 500m near Pasakha. High monsoon flows in the river are eroding the land along the east of Pasakha, and expose the industries to the danger of flooding from the river. The river banks have been protected with limited success. Bhalu Jhora Chhu also has high flow and discharges can reach as high as 500m³/s, and flooding can occur.

River flows are the highest from May to September. When they 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.

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.

The industries in Pasakha are in the bank catchment area of the Bhalu Jhora Chhu and Barsa Chhu. Upstream of Pasakha, the Bhalu Jhora Chhu has good water quality and is used for drinking. Apart from domestic sources, pollution loading from other sources is moderate. Thus water quality in such a setting is expected to be good upstream but more polluted south of Pasakha. The surface water sample was collected from Barsa Chhu and was analysed for parameters as per NEC standards 2010. Bhalu Jhora Chhu was dried up near the project site during primary monitoring. The results of the analysis are provided in the Table below. The surface water analysis results indicate that TSS, turbidity, Iron content exceed the ambient standards.

The higher concentration of iron is attributable to discharge of industrial effluent in surface water.

Table 15: Surface Water Analysis results

S No.	Test Parameters	Unit	Result	NEC standards		
				A*	B*	C*
1.	pH value at 27°C	----	7.47	6.5-8.5	6-9	6-9
2.	Turbidity	N.T.U.	60	-	-	-
3.	Total Dissolved Solids	mg/l	111	-	-	-
4.	Chloride (as Cl)	mg/l	15.8	50	200	-
5.	Copper (as Cu)	mg/l	<0.02	0.05	0.1	-
6.	Fluoride (as F)	mg/l	0.37	1	2	-
7.	Iron (as Fe)	mg/l	29.3	0.2	0.5	-
8.	Nitrate (as NO ₃)	mg/l	1.05	10	50	-
9.	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	0.001	0.002	-
10.	Selenium (as Se)	mg/l	<0.005	0.01	0.01	-
11.	Sulphate (as SO ₄)	mg/l	18.4	25	100	-
12.	Alkalinity (as CaCO ₃)	mg/l	65.5	-	-	-
13.	Cadmium (as Cd)	mg/l	<0.001	0.003	0.003	-
14.	Lead (as Pb)	mg/l	<0.005	0.02	0.02	-
15.	Mercury (as Hg)	mg/l	<0.001	0.0005	0.0005	-
16.	Polychlorinated biphenyls	mg/l	<0.0005	0.0002	0.0002	-
17.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/l	<0.0001	0.0002	0.0002	0.001
18.	Arsenic (as As)	mg/l	<0.01	0.01	0.05	-
19.	Sodium (as Na)	mg/l	03	-	-	-
20.	Potassium (as K)	mg/l	02	-	-	-
21.	Zinc (as Zn)	mg/l	0.05	0.2	0.5	-
22.	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	-	-	-
23.	Total Chromium (as Cr)	mg/l	<0.01	0.05	0.05	-
24.	Total Suspended Solid	mg/l	303	25	100	-
25.	Temperature	°C	19			-
26.	Dissolved Oxygen	mg/l	6.2	6	4	-
27.	Biochemical Oxygen Demand	mg/l	2.9	2	5	50
28.	Chemical Oxygen Demand	mg/l	19.4	-	-	-
29.	TKN	mg/l	<0.3	0.5	2	-
30.	Total Phosphorus	mg/l	<0.05	0.5	<1	-
31.	Magnesium Hardness (as CaCO ₃)	mg/l	20	-	-	-
32.	Faecal coliform /100ml	-	Present	20	2000	5000
33.	Total Coliform Organism in MPN/100ml	-	1600	50	5000	10000

*A – very good (drinking water source without conventional treatment, but after disinfection whenever necessary)

*B – good (drinking water source with conventional treatment)

*C – Moderate (uses for irrigation, industrial cooling etc)

1.4.2.9. Hydrology

The proposed dry port is located in Pasakha, on the southern foot hills of Bhutan bordering India. The total area of the proposed dry port is about 15 acres which is surrounded by Human settlements and Coco-Cola factory on the north, River Bhalujhora on the West, River Barsa on the East and River khaljani (confluence of River Bhalujhora and River Barsa) on the south. The location of the proposed site is provided in figure below.

Figure 16: Location of Proposed site



Past Hydrological Studies in Pasakha Region

At the proposed site which is at the confluence of two rivers there is no much historical hydrology data is available as there exists no discharge gauge stations installed along either of the two rivers. However there are few study reports are available and the publications referred in this report are 'A preliminary study on disaster Mitigation works around BCCL and BFAL factories along the Barsa river basin' by Dr. Daisuke Higaki and Geological survey of Bhutan in December 2000, 'Study on stability of the Barsa river Catchment area' by Department of Geology and Mine in 2002, and 'Pasakha Flood Mitigation Proposal' under NAPA-2 project preparatory Grant by Flood Engineering Management division, Ministry of works and human settlement. Based on the above mentioned studies the following observations were made:

- The Pasakha industrial area falls under the sub-tropical forest zone with pleasant but hot summer and chilly cold winters. The altitude falls under 200m to 2000m above mean sea level category.
- The rainy season begins as early as April and it lasts as late as October.
- The upper catchment areas of the river Barsa is in semi-humid subtropical forest belt.
- The past Flood events in the area were caused by the monsoon river Barsa.
- River Bhalujhora is relatively mild while river Barsa has been causing problems almost every monsoon.
- The preliminary water source in the river Barsa and River Bhalujhora is from monsoon rainfall. However no documented evidence of source of water through glacier melting is available.
- The highest altitude of the catchment area is as high as 2482 meters above mean sea level.
- The catchment area of river Barsa is about 61 square kilometres.
- Maximum monthly mean temperature recorded is 32.5°C in the month of June.
- Minimum monthly mean temperature recorded is 13.3°C in the month of January.
- The highest average monthly rainfall recorded is 950.4mm in the month of July.
- The highest annual rainfall recorded is 8697mm in the year 1998.
- The highest one day rainfall recorded was measured up to 495.3mm on 2nd August 2000.
- The peak discharge for the recorded storm period during August 2000 in river Barsa is 255m³/Sec. (Based on the hydrologic Modelling System software, HEC-HMS).

From the above it is clear that the steep bed profile of the river associated with high intensity rainfall is the chief cause for erosion and deposition along the river course during the monsoon seasons.

Site Specific Hydrological Survey

Inputs from locals

- As the satellite imagery data before 2004 is not available in the public domain, local enquiries were made about the site conditions earlier to 2004 and the following inputs were received.
- The proposed site is prone to frequent flash floods during monsoons every year. Mainly along the river Barsa.
- Prior to the major Flash flood occurred during august 2000, the proposed site was under cultivation.
- After the Flash floods in 2000, a huge deposition of sediments comprising gravels, boulders and sand has taken place. The approximated height of deposition is around 3m from the Natural ground level.
- The River course of Barsa is frequently changing between two streams during monsoon seasons and out of which one stream passes through the eastern side of the proposed site.
- The bridge located across the river Bhalujhora has failed during the 2002 floods due to scouring of foundation soil as show in the figure below.

Historical Variations of Course of rivers based on Satellite Imagery

In order to understand the hydrological changes, historical satellite imagery data between 2004 and 2014 was gathered and presented below.

Figure 17: Imagery Dated December 2004



Figure 18: Imagery Dated March 2006



Figure 19: Imagery Dated November 2010



Figure 20: Imagery Dated March 2012



Figure 21: Imagery Dated April 2013



Figure 22: Imagery Dated November 2013



Figure 23: Imagery Dated February 2014**Figure 24: Imagery Dated December 2014**

Based on the above satellite imagery data the following observation can be made:

In the year 2004 (December),

- Majority of the proposed site is deposited with the sediments from river Barsa. And the course of river Barsa was slightly inside the boundary.
- No vegetation was noticed and no major flow in the river Bhalujhora was noticed.

In the year 2006 (March),

- The river course of Barsa has changed and away from the site boundary.
 - A growth in vegetation around the western side of the site was observed.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2010 (November),
- The river Barsa has changed its course into multiple streams running across the site.
 - Vegetation in the western side remains.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2012 (March),
- The river Barsa has changed its course into single stream running across the site.
 - Vegetation in the western side remains.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2012 (November),
- A huge variation in the course of river Barsa was observed indicating the change of river course during different monsoons.
 - A growth in vegetation around the eastern side of the site was observed.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2013 (April),
- No change in the river course was observed.
 - Vegetation remained same.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2014 (February),
- The river Barsa has changed its course into two streams out of which one stream is running across the site and other is closer to the site in the southern margin.
 - Vegetation remained same.
 - No major flow in the river Bhalujhora was noticed.
- In the year 2014 (December),
- The river Barsa has changed its course into single stream away from the eastern boundary.
 - Vegetation remained same.
 - Erosion along the western boundary along the river Bhalujhora was observed. And a stream is observed flowing close to the western boundary which can be the cause of erosion during monsoons.

Figure 25: Current River Boundary (Blue Line) overlaid on Imagery December 2014

Present Condition of River Boundaries (Field Observation – June 2016)

Based on the field visit in June 2016, the following observation were made,

- River Barsa along the eastern boundary of the site was a trained river using boulders as shown in the Figure 13.0
- The level difference between the site embankment and the bed level of river Barsa is around 1.5 to 2.0 meters. Thus during monsoons and flash floods the river overflows the training boulders and flows inside the site boundary area.
- Training of river Bhalujhora is being carried out under the project “SASEC Road connectivity project – Pasakha access road and Alay land customs station”.
- Erosion in the western boundary cliff along the river Bhalujhora is observed and the same is shown in Figure 14.0
- The level difference between the proposed site and the existing human settlement on the northern boundary is about 5m.
- The river bed of Barsa was found to be bouldery. Where the river bed of Bhalujhora is a mixture of sand and gravel with boulders.
- The flow velocity of river Barsa was found to be high compared with that of river Bhalujhora.
- The width of the river Barsa is about 15m and that of River Bhalujhora is over 100m though the stream width of river Bhalujhora is around 3m with multiple thin streams

Figure 26: Photograph showing the river Barsa Course trained using boulder



Figure 27: Photograph showing the river Bhalujhora Erosion along the West Boundary



1.4.2.10. Ground water and Ground water quality

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/km². 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 good but with expanding settlement along rivers, there are localized pollution problems. In the Project area ground water quality is anticipated to be good. The groundwater sample was collected from water supply station at the project site. As the NEC standards for the ground water are not promulgated, the analysis results have compared with WHO drinking water standards and provided in in the Table below. It has been observed that all the parameters are lower than the WHO standards except for iron and coliform. The concentration of iron was 0.64 mg/l which is higher than WHO standard of <0.1 mg/l. The analysis results shows the presence of coliform which may be due to contamination of groundwater with sewage.

Table 16: Ground Water Analysis results

S No.	Test Parameters	Unit	Result	WHO Standards
1.	pH value at 27°C	----	6.93	-
2.	Turbidity	N.T.U.	<1.0	<1.5
3.	Total Dissolved Solids	mg/l	220	-
4.	Chloride (as Cl)	mg/l	9.90	-
5.	Copper (as Cu)	mg/l	<0.02	2
6.	Fluoride (as F)	mg/l	<0.1	0.5
7.	Iron (as Fe)	mg/l	0.64	<0.1
8.	Nitrate (as NO ₃)	mg/l	<0.5	50
9.	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	-
10.	Selenium (as Se)	mg/l	<0.005	0.01
11.	Sulphate (as SO ₄)	mg/l	11.67	-
12.	Alkalinity (as CaCO ₃)	mg/l	187.2	-
13.	Cadmium (as Cd)	mg/l	<0.001	0.003
14.	Lead (as Pb)	mg/l	<0.005	0.01
15.	Mercury (as Hg)	mg/l	<0.001	0.006
16.	Polychlorinated biphenyls	mg/l	<0.0005	-
17.	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	-
18.	Arsenic(as As)	mg/l	<0.01	0.01
19.	Sodium (as Na)	mg/l	7	-
20.	Potassium (as K)	mg/l	3	-
21.	Zinc (as Zn)	mg/l	0.04	-
22.	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	-
23.	Total Chromium (as Cr)	mg/l	<0.01	0.05
24.	Total Suspended Solid	mg/l	<2.5	-
25.	Temperature	°C	21	-

S No.	Test Parameters	Unit	Result	WHO Standards
26.	Dissolved Oxygen	mg/l	6.4	-
27.	Biochemical Oxygen Demand	mg/l	<2.0	-
28.	Chemical Oxygen Demand	mg/l	<4.0	-
29.	TKN	mg/l	<0.3	-
30.	Total Phosphorus	mg/l	<0.05	-
31.	Magnesium Hardness (as CaCO ₃)	mg/l	64	-
32.	Faecal coliform /100ml		Present	-
33.	Total Coliform Organism in MPN/100ml		1600	Absent

1.4.2.11. Water supply and sanitation

Phuentsholing Thromde (PT) is responsible for providing safe drinking water to the residents within the Thromde. Piped water supply is available to all parts of the main city and some of the sub-urban areas but not the settlements near the PAR. The outermost areas such as Damdara, Pipaldara are served through rural water supply schemes. There is one pumping station at the project site which supply water to the nearby settlements.

1.4.3. Biological Environment

1.4.3.1. Forestry

Bhutan has significant natural forest resources. 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 cover. 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.

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 communities. No forest management units (FMUs) are within the project area of influence. There are only a few mature trees near the vicinity of the project which will also be not affected by the project activity.

The local forests are managed by the Department of Forests and there is a District Forestry Office for Phuentsholing District which has the headquarters in Gedu City. Forests are managed according to the instructions and quotas for cutting and planting received from the Ministry of Agriculture and forests (MOAF). The Department for Forests and Park Services indicated that the Sal forest area and that the mature trees can be removed with permission.

1.4.3.2. *Fauna and Flora*

The Project is located in rural area with industries located in the vicinity of the project site. There are no rare, threatened or endangered species of terrestrial and aquatic flora and fauna in the impact zone. The animals present in the project area are domesticated that can tolerate disturbed conditions.

There are no critical natural habitats, nor any legally protected areas (including natural parks, wildlife sanctuaries, cultural sites) in the vicinity of the project area of influence. Phipsoo Wildlife Sanctuary which is approximately 56 km from the closest point of area of influence. It is the second smallest national park in Bhutan with an area of approximately 268.93 square kilometres (103.83 sq mi). Phipsoo is located in western Sarpang District and southeastern Dagana District along the border with West Bengal. Phipsoo is unique in Bhutan for its chital (*Axis axis*, "spotted deer") and natural sal (*Shorea robusta*) forests. Phipsoo is also inhabited by elephants, bengal tigers, gaur, three species of mahseer, and the rare Ganges River dolphin. There are no human settlements in Phipsoo.

A crocodile Zoo is located in Phuentsholing and is approximately 6 km from the site boundary. It was established during 1976 with two different species mugger crocodile & gharial crocodile.

The nearest national park is the Buxa Tiger Reserve which is located close to 25 km from the project site, with an area of approximately 760-square-kilometre. The Buxa tiger reserve is located inside the Buxa National Park in West Bengal, India, in the Buxa hills of the southern hilly area of Bhutan. Buxa is rich with bio-diversity and has a great collection of rare orchids and medicinal plants. The Generic diversity of mammals is second highest among all the tiger reserves of India. The bio-diversity of animals comprise of a reach avifauna of more than 230 identified species, 67 mammals and 36 species of reptiles. Apart from Bengal Tiger, the other species includes Leopard, Fishing Cat, Leopard Cat, Jungle Cat, Indian Civet, Palm Civet, Wild Dogs, Malayan Gaint Squirrels, Mongooses, Asian Elephant, Gaur, Small Clawless Otter, Chital, Sambar, Barking Deer, Hog Deer, Wild Buffalo, 3 varieties of Pythons, Monitor Lizard and a host of land tortoises. The Avifauna is rich in both endemic as well as migratory species. There are than 300 species of trees, 250 species of shrubs, 400 species of herbs, 9 species of cane, 10 species of bamboo, 150 species of orchids, 100 species of grass and 130 species of aquatic flora including more than 70 sedges (*Cyperaceae*) have been identified so far. There are more than 160 species of other monocotyledons and ferns. Main species include Sal, Champ, Gamar, Simul, Chikrasi etc.

Jaldapara Wildlife Sanctuary in India is approximately 25 km from the site boundary. This sanctuary is rich in biodiversity with Asiatic One-Horned Rhinoceroses, Barking Deers, Pythons, Cobras, Geckos, Indian Bisons, Spotter Deers, Monitor Lizards, Krates and Elephants among others. The sanctuary holds the highest number of rhinos in India after Kaziranga National Park in Assam. About eight species of fresh water turtles live here and birds such as Crested Eagles, Shikras, Jungle Fowls, Palla's Fishing Eagle, Bengal Florican, Partridges, Peafowl and Hornbill are found here. Moreover extensive riverside forests and grasslands with a variety of flora and fauna can be seen. The Cassia Grass which grows on sandy soils along with the Sal trees on the banks of River Malangi can be witnessed here.

Thus based on the baseline assessment, it is envisaged that the project will not entail impacts on the rare, threatened or endangered species of terrestrial and aquatic flora and fauna or natural habitats.

1.4.4. Socio-Economic Data

The socio-economic data for the proposed Dry port site is provided in SIA section.

1.4.5. Cultural Heritage Sites and Schools

During site survey and public consultations, it has been found that there no sacred places or traditional heritage sites in the project area of influence.

The nearest school in Pasakha is approximately 700 m from the proposed site location. The construction and operation of Dry Port may have impacts on the school children and hence adequate mitigations measures should be taken.

There are no hospitals in the project area of Influence and people have to go to Phuentsholing in case of any medical emergency. There is one health centre of BCCL, but it is accessible to BCCL employees.

1.5. Environmental Impacts and Mitigation Measures

This section discusses the potential environmental impacts of the proposed Project and identifies mitigation measures to minimize the impacts in the design, construction and operational phases of the Dry Port.

1.5.1. Project Activities

The lifecycle of the Dry Port project can be further categorized into the following phases:

- Planning phase activities
- Construction phase activities
- Operation and maintenance phase activities

1.5.1.1. Planning phase activities

The activities proposed to be carried out in planning phase are:

- Feasibility Study;
- Topographic Survey;
- Geotechnical investigation;
- Environmental and Social Impact Assessment; and
- NEC approval process.

1.5.1.2. Construction phase activities

The activities in construction phase will include:

- Site preparation and site clearance;
- Construction of the drains and associated earthworks;
- Transportation of construction materials;
- supply and installation of pavement surfacing;
- Pathways and access road construction;
- Construction of warehouses, administration buildings, and other storage facilities;
- Construction of additional facilities such as guest house, canteen, clinic, and staff quarters etc.; and
- Project commissioning.

1.5.1.3. Operation and maintenance phase activities

Operation and maintenance activities are of two types, which includes, scheduled activities and un-scheduled activities:

- loading and unloading of cargo;
- temporary storage of cargo;
- Custom's clearance activities
- Traffic management;
- controlling noise and dust;
- Managing workers and public safety
- Maintenance activities such as repair and re-provisioning drainage; etc.; and
- Waste management and waste disposal.

1.5.2. Environmental Impact Identification

The assessment process is based on available information including the project description, construction activities, operation activities, decommissioning activities, stakeholders engagement and social and environmental baseline data. The assessment considers all relevant social and environmental impact/risks, including issues identified in World Bank Operational Policies 4.01, 4.04 and the concerns expressed by those who will be affected by such risks and impacts.

To address potential project impacts on existing ambient conditions, we considered aspects including, (i) existing ambient conditions; (ii) the finite assimilative capacity of the environment; (iii) existing and future land use; (iv) the project's proximity to areas of importance to biodiversity; and (v) the potential for cumulative impacts with uncertain and/or irreversible consequences.

Table 17: Classification of Social and Environmental Components

Components	Sub-component	Parameters
PHYSICAL		
Water	Surface water Ground water	Hydrology, water quality
Air	Air, noise	Air quality, noise level
Land	Soil	Erosion, soil quality
ECOLOGICAL		
Aquatic	Fisheries/ Aquatic species	Species, diversity, economic value
Terrestrial	Aquatic Biology Forests, vegetation Wildlife	Density, species Species, population Species, population
INFRASTRUCTURE		
Water Supply	Surface/ground water	Frequency, quality
Electricity	—	Generation, Transmission, requirement,
Transport	Highways/Roads	Access, availability, type, utility of each mode
Land use	Rail	—
Drainage	Air Water	— Flooding, drainage
QUALITY OF LIFE		
Socio-economic	Public health	Demographic, amenities, occupational
Cultural	Public safety	pattern, employment opportunities
Aesthetics	Economic and social structure	
	Resettlement	
	Historical	Locations and importance
	Archaeological	—
	Recreation and aesthetics	—

1.5.3. Impact Identification

During the site visit, various environmental sensitive features were identified which may potentially be impacted by the project at various stages. Identified impacts of the project activities on the environment components are given below along with the associated activities.

Table 18: Impact Matrix for development of dry port

S. No.	Activities	Impacts	Negative Impact		Positive Impact		Not Applicable
			Short Term	Long Term	Short Term	Long Term	
A	Pre-Construction Phase						
i	Land Acquisition for access road	<ul style="list-style-type: none"> Displacement of people Change in land use pattern Impact on livelihood 		√			

		• Shifting of Utilities		√			
ii	Site Preparation	Removal of Vegetation. Impact on aesthetic aspects	√				
B Construction Phase							
i	Development of dry port and its ancilliary activities, construction of retaining wall, electrical & water supply system	Loss of Top soil		√			
		Soil contamination due to spillage of material	√				
		Surface water contamination	√				
		Air pollution	√				
		Noise pollution	√				
		Increase in traffic	√				
		Un pleasant view	√				
		Impact on Health & safety	√				
		Social impact	√				√
ii	Construction of access road	Soil contamination due to spillage of material	√				
		Surface water contamination	√				
		Air pollution	√				
		Noise pollution	√				
		Increase in traffic	√				
		Un pleasant view	√				
		Impact on Health & safety	√				
		Social impact	√				√
		Loss of top soil			√		
C Operational Phase							
i	Development of dry port Infrastructure, i.e. retaining wall, access road, water supply system, electrical supply line and administration building	Impact on the ambient Air Quality		√			
		Noise Pollution	√				
		Potential for surface water quality due to surface run off		√			
		Soil Contamination	√				
		Economic Development					√
		Accessibility					√
		Groundwater depletion		√			
		Potential for land contamination		√			
		Improved drainage					√
		Electrification of the area					√
		Improved health and sanitation facilities					√
		Increased Run-off		√			
		Generation of Employment					√
ii	Access Road	Impacts on ambient air		√			

		quality					
		Impact on ambient noise quality		√			
		Soil contamination	√				
iii	Operation activities such as loading and unloading of cargo, custom clearance activities	Impacts on ambient air quality		√			
		Impact on surface water quality due to run-off		√			
		Potential for soil contamination	√				
		Potential for groundwater contamination		√			
		Noise pollution	√				
		Employment generation					√
iv	Green Buffer development around each industrial plot	<ul style="list-style-type: none"> • Improved Ecology • Air Quality Improvement • Aesthetics 				√	√
						√	

1.5.4. Design/ Pre-construction phase

The development of dry port will follow design and built modality. The detailed design will refer and comply with Bhutan Building Rules (BBR) 2002 for structural analysis. BBR requires any proposed building or structure to comply with following IS code

- IS 1893-1894 -Criteria for earthquake resistant design of structures
- IS 875 –1987: Code of practice for Design loads (other than earthquake)
- IS 4326 – Earthquake resistant design & construction of building
- IS 13920 –1993: Ductile detailing of concrete structures subjected to seismic forces
- IS 4326 – Earthquake resistant design & construction of building

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).

1.5.5. Construction phase

Construction of Dry Port

The impacts from the construction phase of Dry port are attributable to the following activities:

- site clearance and site preparation
- landfilling
- construction of buildings
- construction of the internal roads and parking areas;
- construction of perimeter walls and security fencing
- construction of internal road side drainage
- installing landscaping road signage and accessories
- disposal of waste

Construction of Offsite Infrastructure

The offsite activities shall include:

- Construction of approach road to the site
- Construction of Retaining Wall of 4 m height along the periphery of the road.

The construction materials and their source are provided in Table below.

Table 19: Materials and their Source for Construction Phase

Material	Quantity	Source
Sand	Approximately 27,000 cum	Amochu
Aggregates	Approximately 33,225 cum	Kamji in Bhutan, Ethalbari in India
Boulder	Approximately 700 cum	Amochu, Kamji
Bricks	Approximately 23,90,000 number	India
Soil	Approximately 2,21,000 cum	India

The labour camps sand material storage sites during construction phase shall be made at the proposed dry port site location. It is envisaged prior to the commencement of the construction of the dry port, the construction of the access road will be completed. This will aid in vehicular movement during the construction phase of the dry port and will also reduce the impact of the fugitive emissions from the vehicular movements. The plan for vehicular movement during operation phase is provided in the above section. The anticipated impacts for construction phase of dry port are provided below. These impacts are however, temporary in nature and limited for the duration of construction.

1.5.5.1. Impact on Air Quality

The potential sources of air pollution associated with the construction phase of the Project have been identified and are presented in the subsequent sections. The identified pollution sources and impacts have been evaluated and the impact significance was determined considering the nature and magnitude of impacts and sensitivity of receptors.

Construction of access road and retaining wall

The construction of access road and retaining wall shall have the following impacts on the ambient air quality:

- Fugitive dust emissions from clearing, excavation work, cutting and levelling work at the sites, stacking of soils, handling of construction material, transportation of material, emission due to movements of vehicles, plying of heavy construction machinery etc.;
- Vehicular emissions due to traffic movement on site and on the connecting roads;
- Exhaust emissions from construction machineries, other heavy equipment as bull dozers, excavators, compactors;
- Emissions from diesel generator required for emergency power during construction period;

- Emissions from asphalt and bitumen during road construction activities

Mitigation Measures to be implemented are:

The following mitigation measures shall be taken to mitigate the impacts:

- Construction of barricades between the settlements and the site to minimize travel of fugitive emissions towards settlements;
- Tree Plantation on the either side of the access road to mitigate the fugitive dust emissions
- Minimizing stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities;
- 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;
- Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray.
- Proper maintenance of engines and use of vehicles;
- Prevent idling of vehicles and equipment;
- Use eco-friendly materials during road construction.

Construction of Dry port and ancillary facilities

Air quality will be impacted from the following sources during the construction phase:

- Fugitive dust emissions from site clearing, excavation work, cutting and levelling work at sites and access/ internal roads, stacking of soils, handling of construction material, transportation of material, emission due to movements of vehicles, plying of heavy construction machinery etc.;
- Vehicular emissions due to traffic movement on site and on the connecting roads;
- Exhaust emissions from construction machineries, other heavy equipment as bull dozers, excavators, compactors; and

Emissions from diesel generator required for emergency power during construction period.

Gaseous emissions containing Particulates (PM10), CO, HC, NOx, SO2 and lead will be released from the vehicular and construction equipment exhaust. The vehicular movement on the unpaved roads will also result in the fugitive dust emissions. As the predominant wind direction is from south west to north east, the pollutants are expected to disperse to north east directions. Since the construction time emissions are expected to be at ground level, the impacts due to construction equipment and site excavation works are envisaged to be on the settlements located in the north east direction in the project area of influence.

It is estimated that approximately 94 trucks per day will be mobilized for transporting material during construction phase. The movement of trucks carrying construction material to the site will lead to fugitive and exhaust emissions which would impact the people in the project area of influence. The movement of heavy trucks also increase the potential for road accidents.

Apart from the population in the settlements, the construction workers will also be affected due to the emissions during construction activities.

Mitigation Measures to be implemented are:

To mitigate the construction impacts, the dry port authorities should have contract agreements with contractors as well as sub-contractors to implement the measures provided in EMP.

- Construction of barricades between the settlements and the site to minimize travel of fugitive emissions towards settlements;
- Tree Plantation on the either side of the approach road to mitigate the fugitive dust emissions
- Minimizing stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities;
- 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;
- Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray.
- Proper maintenance of engines and use of vehicles; and
- Prevent idling of vehicles and equipment.

1.5.5.2. Impacts on Noise Levels

The heavy equipment, machineries, transportation and earthworks used for the construction activities are the major sources of noise. It is envisaged that there will be an increase in traffic and thereby in traffic noise impacts on the receptors near the access road from the transportation of equipment, construction materials.

As mentioned in Air Quality section, the residents in north east directions and along the access road would be impacted due to the noise emissions.

Mitigation Measures

The following mitigation measures will be implemented to minimize potential noise impacts during the construction phase:

- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components should be conducted;
- Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during idle time;
- Acoustic enclosure will be provided for the DG set;
- Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby sensitive receptors as far as practicable;
- Honking should be avoided; and
- Construction work should be carried out only during day time (from 8.00am to 6 pm).

Bhutan's noise standard permissible for mixed areas are 65dB(A) in the day time and 55dB(A) in the night time. Noise should be monitored within Dry port compound and as well as for sensitive areas (residential and institutional places) during construction. Based on the noise quality monitoring, a

temporary noise barrier (made of high thick ply board or MS sheet) should be erected in all places where the noise is expected to exceed permissible limits.

1.5.5.3. Impact on Water Environment and Hydrology

The proposed site is surrounded by Barsa Chhu and Bhalujhora Chhu, which are seasonal in nature. It is anticipated that there will be an induced impact on the aquatic life, if the storm water carrying silt and other construction waste, domestic waste generated from the proposed labor camps, runoff from the cut and fill operations drains into the river. The physiographical study indicates that the proposed site is prone to flooding during the monsoon from the flow of the Barsa Chhu and Bhalujhora Chhu along the periphery of the proposed site from Northeast to Southwest and Northwest to Southeast directions respectively.

Also, the average natural ground level of the site being only 1.5m above the bed level of the river, increases the propensity of the flood risk especially during the monsoon period.

As per the local inputs,

- The proposed site is prone to frequent flash floods during monsoons every year. Mainly along the river Barsa.
- Prior to the major Flash flood that occurred during august 2000, the proposed site was under cultivation.
- After the Flash floods in 2000, a huge deposition of sediments comprising gravels, boulders and sand has taken place. The approximated height of deposition is around 3m from the Natural ground level.
- The River course of Barsa is frequently changing between two streams during monsoon seasons and out of which one stream passes through the eastern side of the proposed site.

As per the hydrology study conducted during feasibility study, the following conclusions have been made:

- Regular training and maintenance of river Barsa and Bhalujhora is necessary to avoid flooding.
- In order to protect the Pasakha dry port from the flooding it is required to raise the finished floor level of the dry port to 4m above the existing ground level as the maximum depth of water observed in the river Barsa was 3.3m.
- The filled levels of the dry port shall be protected with retaining wall.
- As the retaining wall shall be constructed along the river Barsa and Bhalujhora, it is necessary to estimate the scour depth and the same shall be considered in the design of the retaining wall.
- The foundation of the retaining wall shall be at least 1.5 times greater than the estimated scour depth.
- Below the toe zone of the retaining wall for a minimum width of 10m the bed shall be cement grouted to minimize the seepage pressure and uplift and associated uplift.

Estimation of scour depth

For the design of structures along or across the river flow, it is necessary to consider the scour occurring around the pier, abutments or retaining walls. In the present case it is proposed for the construction of retaining wall along the site boundary, which is along the river. The depth of scour is estimated as per the Hydraulic engineering circular No.23 (HEC-23). The Input data required for estimating the scour depth includes the peak discharge, flow velocity and depth of water flow. In present case the required input data was collected from the literature “Pasakha Flood Mitigation proposal – technical report- NAPA-2 project preparatory Grant prepared by Flood Engineering management division, Ministry of Works and Human settlements”, in which a mathematical model was analysed for the maximum precipitation recorded in August 2000. The minimum depth of retaining wall foundation is 4 m

Mitigation Measures

The following mitigation measures are proposed for minimizing impacts on the water resources of the area:

- In this kind of steep terrain conditions with high water velocities and periodical experience of erosion and deposition the objective of any mitigation solution shall result in reducing the both surface and sub-surface (Seepage) velocity potential. This objective can be achieved by providing multiple cut-off walls at different locations along the river course for a depth of 5m below the bed level extending sufficient distance into the banks to ensure no vertex occurs where the cut-off wall meets the banks and results in bank erosion. In the present case, the cut-off walls are needed on the upstream side of the land to the downstream up to the confluence of two rivers. Apart from providing subsurface cut-off walls it is ideal to carry out pressure grouting in the bed near the retaining walls for a width of 10m to ensure cementation of the boulders for a minimum depth of 3m. The pressure grouting shall be carried out in a lean period. The exact depth of cement grouting shall be based on detailed bed investigation. This pressure grouting of the bed coupled with cut-off walls provides non-scouring, non-erosion environment for the construction of foundations either across the river course or for the river training retaining structures.
- As the site is prone to flooding during monsoon, it is proposed to construct a retaining wall of 4m height along the periphery of the site facing the river bed. Further, it is suggested to raise the site level by filling of earth upto 3.5 meters for the entire site area which would prevent flood waters entering the site and inundating the site area during monsoon and also will contribute in reducing the slope ratio of approaching road to the facility.
- The shape of site boundary is also in a curved shape and the site is located along the river flow and not against the river flow and hence the flow of river will not be disturbed at any time.
- Contractor should ensure the proper disposal of hazardous and other waste. Hazardous waste such as oil and lubricants will be properly stored and sent for recycling. Solid municipal waste should be disposed off in a sanitary landfill.
- Further the following water conservation measures should be adopted:
 - Construction labour should be trained for optimal use of water;
 - Optimum use of water during sprinkling on roads for dust settlement, washing of vehicles, concrete mixing for foundation etc
 - Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers, camp area.

1.5.5.4. *Impacts on Soil Quality and Land Environment*

The impacts on soil due to the project are as follows:

- Dredging and landfilling
- Soil erosion due to vegetation clearance and excavation activities;
- Topsoil degradation
- Generation of waste (hazardous and non-hazardous) from site clearance, excavations, civil works and activities of construction workers (general waste and sewage); and
- Possible contamination of soil due to potential spills of lubricating oil, fuel oil, concrete etc.

Dredging and landfilling

The project site is located in low lying area and landfilling will be done during site development activity. The soil for landfilling shall be obtained from dredging from Amochu. Dredging activity will have two fold impacts - firstly as a result of the dredging process itself and secondly as a result of the landfilling of the dredged material. During the dredging process the activities such as excavation of sediments at the bed, loss material during transport to the surface, overflow from the dredger whilst loading and loss of material from the dredger and/or pipelines during transport may lead to impacts on the land environment. It also leads to the following impacts:

- Pose significant threat to human health and on the land environment if the sediments are contained by the historical deposition and accumulation of hazardous materials, whether due to offsite or onsite activities.
- Short-term increases in the level of suspended sediment can give rise to changes in water quality. It can effect marine flora and fauna, both favourably and unfavourably, such as increased turbidity and the possible release of organic matter, nutrients and or contaminants depending upon the nature of the material in the dredging area.
- Settlement of these suspended sediments can result in the smothering or blanketing of subtidal communities and/or adjacent intertidal communities.

The extent of impacts due to dredging activity is highly varied and site specific, depending upon the following factors:

- Method of dredging and disposal
- Channel size and depth
- The size, density and quality of the material
- Background levels of water and sediment quality, suspended sediment and turbidity
- Current direction and speed
- Rate of mixing
- Seasonal variability and meteorological conditions, affecting wave conditions and freshwater discharges
- Proximity of the marine feature to the dredging or disposal activity

- Presence and sensitivity of animal and plant communities

The soil used for landfilling should be free of any type of contamination and have similar characteristics as that of native soil to avoid impacts on the soil quality.

Soil Erosion

During the pre-construction and construction phase, the site clearance activities including clearing of vegetation, construction of the earth structures, labour camps, storage area, toilets will involve removal of top soil which will result in slope destabilization and the land will be more susceptible to soil erosion.

The soil erosion will result in the run-off of the silt to surface water impacting aquatic ecosystem of receiving water bodies with increased suspended sediment load and associated nutrients.

Soil Compaction

During construction activities, there will be compaction of soil in the project area due to construction of the internal access roads, movement of vehicles/ construction machinery and work force movement. The soil compaction would impact the soil physical properties such as reduction in pore spaces, water infiltration rate and soil strength etc. The extent of soil compaction is primarily limited to the Project foot print area and surroundings within 100 m distance. The impact is restricted to the construction phase of the project.

Waste Generation

The construction waste generated onsite comprises of materials such as excavated soil, rocks, concrete, wooden pallets, steel cuttings/filings, packaging paper or plastic, wood, metals etc. Municipal domestic wastes consisting of food waste, plastic, glass, aluminum cans and waste paper will also be generated by the construction workforce and labor camp site. The waste generated during the construction phase will also include hazardous waste such as used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, solid waste could create impacts not only to land but also to local air quality, water quality, and human health. As per the study conducted by Phuntsho et al. in 2007, MSW generation rates in the urban centres in Bhutan was 0.53 kg per capita per day. Thus the total waste generated by 60-270 workers will be approximately 30-135 kg/d.

It is expected that the generation of the waste oil will be insignificant as the DG sets will be used only during the construction phase and the waste oil will be generated only during the maintenance of DG sets.

Soil Contamination

Soil contamination during the construction phase may result from filling activity, leaks and spills of oil, lubricants, or fuel from heavy equipment and wastewater. Such spills could have a long-term impact on soil quality, but are expected to be localized. The soil at project site is sandy clay. The soil strata has higher permeability, thus allowing contamination at greater depth. Storm water run-off

from the contaminated area can pollute the downstream soil and water quality of receiving water body. Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill.

The soil characteristics of the native soil may also be changed due to import of soil for filling and levelling purpose. Approximately, 2, 21,000 cum of soil will be required for filling activity. The soil will be sourced from Indian quarry, the details will be decided during the project execution. It is envisaged that the filling activity may impact the native soil due to spillages during transportation of soil and run-off during filling and compaction. Mitigation Measures to be implemented are:

Apart from the embedded controls to be included in project design, the following mitigation measures will reduce the negative impacts of construction activities on soil environment:

- Remove contaminated materials to reduce risks to human health and the environment;
- Prior to initiation of dredging activities, materials should be evaluated for their physical, chemical, biological, and engineering properties to inform the evaluation of dredge materials reuse or disposal options
- Excavation and dredging methods should be selected to minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy of the operation, and maintain the density of the dredge material, especially if the dredge material includes contaminated areas.
- There are several dredging methods which are commonly used depending on the depth of the sediments and to minimize sediment suspension and increase dredging accuracy
- Areas sensitive for marine life such as feeding, breeding, calving, and spawning areas should be prohibited for dredging
- Use techniques (e.g. silt curtains), to minimize adverse impacts on aquatic life from the re-suspension of sediments;
- Inspection and monitoring of dredging activities should be conducted to evaluate the effectiveness of impact prevention strategies, and re-adjusted where necessary.
- The dredged material should not be disposal randomly
- The soil used for landfilling should have similar characteristics to the native soil and free of any type of contamination;
- Maintain the extent of the turbidity plumes close to the dredging and disposal areas to minimize impacts on marine fauna habitat;
- Visually inspect for any marine life and terrestrial organisms and stop dredging activity in case of any organism in the vicinity;
- Monitoring should be done continuously during dredging to observe impacts on the marine life and in case of visible impacts, stop the dredging activity;
- Dredging should be carried out during day time to minimize impacts on marine life.
- The excavated material should be used for landfilling at the proposed site location
- Stripping of topsoil should be scheduled as the last mile activity (maintain vegetation cover for as long as possible) in order to prevent the erosion (wind and water) of soil;
- Care should be taken to minimize percolation of soil used for filling to adjacent rivers during filling operations.
- Vegetation should be planned and maintained for slope stabilization and to prevent soil erosion after construction period;

- The disturbed areas and soil stock piles should be maintained moist to avoid wind erosion of soil;
- The routes for movement of heavy machinery should be designated to avoid the soil compaction in other areas; and
- Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages; designate routes for bringing construction material and outside soil.
- Construction contractor should designate the sites to be used for disposal of hazardous wastes including waste oils, solvents, paint and batteries. The Contractor should ensure that no unauthorized dumping of hazardous waste is undertaken from the site;
- Fuel and other hazardous substances should be stored in areas provided with roof, impervious flooring and bund/containment wall

1.5.5.5. *Occupational Health and Safety*

Worker occupational health and safety will be governed using the 'Labour and Employment Act of Bhutan 2007' as guidance document and World Bank Group Environmental, Health, and Safety (EHS) guidelines for Ports, Harbors, and Terminals. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will also be adhered for occupation safety. It is estimated that during construction phase, 60-270 workers will be employed per day based on the requirement. Lack of adequate mitigation measures on the health and safety of the workers will result in accidents and injuries leading to loss of life or property. It is proposed to implement the following mitigation measures to ensure safe work place for the construction labor.

Mitigation measures to be implemented are:

- The project owner should ensure that the contractor (make part of contractors contract) to have an occupational health and safety plan. The contractor should provide for all the workers accidental insurance and medical insurance.
- The contractor should conduct daily tool box meeting for all workers to discuss potential work related hazards and other safety aspects.
- The contractor should conduct training for all workers on safety and environmental hygiene at no cost to the employees.
- The contractor should maintain first aid facilities for the workers and 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.
- Fencing on all areas of excavation greater than 1m deep and sides of temporary works should be observed.
- Workers should be provided with appropriate personal safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers.
- Reversing signals (visual and audible) should be installed on all construction vehicles and plant.
- Contractor should at all-time keep the first aid kit at the construction sites.

- Contractor should be responsible for evacuation injured person to the nearest medical center
- Pertinent H&S trainings should be provided to all the workers with respect to hazards linked to the activities. Additionally, the workers will be informed of precautions to be taken to avoid impacts to the local community;
- Monitoring of the PPE usage can be strengthened, in that, a mechanism can be adopted whereby defaulters receive a warning on non-usage and stringent actions can be taken on subsequent offences;
- Maintain H&S records of occupational H&S incidents, accidents, diseases and dangerous occurrences
- Ensure that PPE is available at all times at site;
- In event of accidents, the contractor will be responsible for immediate evacuation of injured person to the nearest medical center. The contractor should bear medical and other expenses of the injured person.
- Undertake daily tool box talk and proper training of the workers regarding health and safety procedures related to solar projects, PPE usage, and regulatory provisions;
- The contractors should ensure H&S standards of labour camps. The labour camps will be established in the proposed site area. Additionally, the PIU team should conduct random spot checks to determine any issues related to improper waste disposal or the living conditions in these camps (i.e. presence of secure shelter and flooring, number of persons per room, number of toilets for the manpower, water availability etc.);
- Additionally a “Code of Conduct” can be instituted for the operational phase that takes into account (a) health & safety aspects; (b) restrictions on activities – Dos and Don’ts; (c) labour camp regulations; (d) zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting which will be shared with all contractors for induction of their employees/supervisors/workers;
- Training should be provided to all the transport workers on road safety, particularly, the safety precautions to be undertaken while driving through busy village roads; and
- Strong protocols should be built as part of contractual obligations around zero tolerance of child labour or harassment of women workers and even health and safety aspects. These should also be monitored by supervision and monitoring team.

1.5.5.6. **Community Health and Safety**

Public safety, particularly of pedestrians and children can be threatened by the excavation of the trenches for side drain construction. The health and safety (H&S) impacts related to the project can be categorized into two types- occupational health and safety and community health and safety. It is anticipated that the construction (including transport and handling), erection and commissioning and operational activities will have medium risks on both occupational H&S and community H&S aspects.

The mitigation measures that can be adopted are as follows:

- Construction activities should be timed, and provision for safe passage of school children and elderlies should be made.

- Excavated trenches/ditches and freshly cut steep side slopes should be clearly marked and fenced for the safety of passersby and workers alike. Project or construction vehicles should be briefed on speed limit within sensitive areas such as schools, commercial and residential areas.
- The community must be informed of the type of activities being undertaken for the project and the health and safety measures that can be undertaken by them as a precautionary measure. Additionally, the emergency response plan must also be communicated to the villages in the vicinity;
- Linkage of Communication, Disclosure and Grievance Redressal Mechanism should also cover labourers so that any concerns on working conditions and/or contractor mal-practices can be managed.

1.5.5.7. General Construction Waste Management

During construction activities of dry port and access road, general construction waste will be produced which will be approximately 2% of the materials used. The uncontrolled waste disposal can contaminate soil and water bodies, thereby harming the environment. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable.

Mitigation Measures

The contractors should ensure implementation of following measures.

- The waste generation should be minimized at source;
- The waste should be disposed in the bins which should be later collected, segregated and sent to authorized dealers/ landfill;
- Recyclable waste should be sold to the scrap dealers and residual non-hazardous waste should be disposed off in the municipal landfill;
- Construction/workers' camps should be provided with sufficient refuse bins;
- Burning of construction and domestic wastes should be prohibited; and
- 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 should be prohibited.

1.5.5.8. Traffic Management

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 RBP, RSTA and PT); and local communities should 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 should be sought during Pedestrian movement to allow uninterrupted movement; however under the proper guidance by the security personnel.

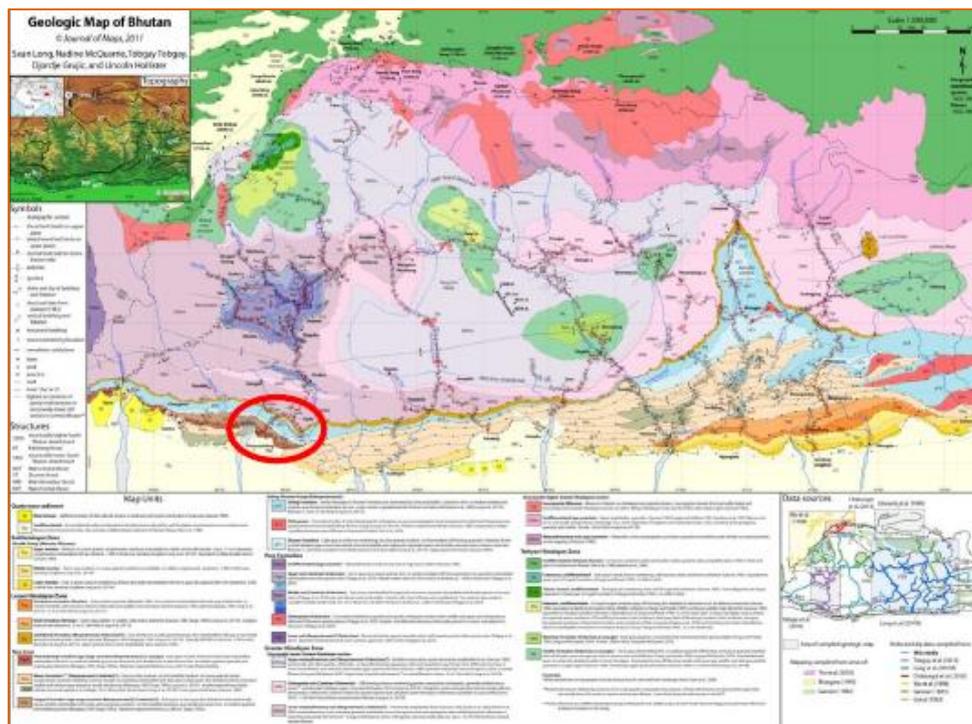
1.5.5.9. Sanitation and Disease Vectors

Potential sanitation and impacts from disease need to be controlled by maintaining hygienic conditions in the Dry port area throughout the operational phase as well during construction by implementing appropriate social and health programs for the Project. Dry port should ensure that improvements are made to site sanitation and should implement the mitigation measure below for all operational activities and also that the contractor ensures that:

- Measures to prevent malaria should be implemented by installation of proper drainage to avoid water stagnation, etc.
- Standing water should not be allowed to accumulate in the drainage facilities or along the warehouse sides to prevent proliferation of mosquitoes.
- Temporary and permanent drainage facilities should be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.
- Malaria controls should be implemented in line with social plans for the Project.
- HIV/AIDS awareness and HIV-AIDS education and prevention program should be implemented in line with social plans under the social development work stream.

1.5.5.10. Climate Change Impacts

The climate in Bhutan varies considerably due to changes in topography. The anticipated impacts due to climate change are mainly landslides and floods. The Geologic Map of Bhutan as shown in figure below indicates that the geology in Phuentsholing area mainly consists of variegated (purple, grey, pink, carbonaceous) phyllite, talcose phyllite with thin bands of grayish white quartzite, limonitic quartzite, dolomite bands and basic rocks. The variegated phyllite rock is highly weathered, fractured and decomposed to residual soil at some places. Phuentsholing is prone to landslides due to high tectonic and neo-tectonic activities. However, as the proposed site is located on flat terrain the impacts due to landslide will be insignificant.



The physiographical study indicates that the proposed site is prone to flooding during the monsoon from the flow of the Barsa Chhu and Bhalujhora Chhu along the periphery of the proposed site from Northeast to Southwest and Northwest to Southeast directions respectively. The project site is located near the confluence of Barsa Chhu and Bhalu Jhora Chhu. Global warming as a consequent of the Climate change will most likely increase the precipitation levels in the region thereby heightening the flood risk from the flow of Barsa Chhu and Bhalujhora Chhu. The past hydrological studies shows that the past flood events in the area were caused by the monsoon river Barsa. The preliminary water source in the river Barsa and River Bhalujhora is from monsoon rainfall. However no documented evidence of source of water through glacier melting is available. After the Flash floods in 2000, a huge deposition of sediments comprising gravels, boulders and sand has taken place. The approximated height of deposition is around 3m from the Natural ground level. The maximum depth of water observed in the river Barsa was 3.3m. Thus, it is estimated the maximum flood level in the river Barsa shall be lower than 4 m.

A warmer atmosphere can hold more moisture, and globally water vapour increases by 7% for every degree centigrade of warming. The impact of these changes on global precipitation has not yet been correlated academically, but the total volume of precipitation is likely to increase by 1-2% per °C of temperature increase. To mitigate the risk of flooding it is proposed to provide retaining wall of 4m along the periphery of the project site.

1.5.5.11. *Construction camps and canteen facilities*

Construction camps will be established at the Dry Port construction zone. Influx of laborer may to some extent increase the pressure on local drinking water supply. Open defecation by laborers may

increase the local health problems. In consultation with the local authority (PT), community supply. Pit latrines should be constructed to prevent laborers from open defecation. Once the construction is over, campsite should be cleaned; and pit latrine should be filled and covered with mud to prevent the spread of germs.

1.5.6. Operational phase

In the operational phase, the major activities will be Customs clearance, loading and unloading of cargo, temporary storage of cargo, vehicular movement and waste management and waste disposal. The entity operating the Dry Port will be responsible for occupational health and safety of the workers and other occupants of the Dry Port. It should also take full responsibility of handling and management of all hazardous materials shipped through the dry port. No hazardous waste should be discharge directly into the local drainage system. All hazardous waste should be collected and stored in a safe place until it is disposed of or recycled. It is estimated that 246 workers will be employed during operational phase.

1.5.6.1. Impact on Air Quality

Analysis of micrometeorological data of Phuentsholing indicates the region experiences low wind speed conditions i.e. upto 1.5 m/s. The maximum wind speed observed in 2013 is 2.75 m/s i.e 9.9 km/h. The predominant wind directions are south west to north east. The maximum wind speeds are experienced during dry season. The calm conditions and very low wind speeds prevail in wet season. This indicates the proposed site experiences relatively low wind speeds. High wind speeds even 10 km/h are very rare. During the low wind speed seasons air pollutants may not be dispersed to longer distances. As the emissions either from vehicles or from handling equipment will take place at ground level or low altitudes, the impacts will be localized to the project site and in the project area of influence.

The terrain of the project area is marked by raising slope towards North, and raising hills towards Northwest, North and Northeast direction, which are also downwind directions. These hills around the dry port would prevent dilution of pollutants released from the dry port, subsequently impacting adjacent settlements.

As detailed earlier, PM₁₀ at Office of Trade Department and Santa Restaurant has exceeded the NEC standards of National Ambient Air Quality at mixed areas by more than 50%. The Trade Department is in Northeast direction to the site, which is one of the downwind directions. Thus, release of pollutants from trucks and other port operating equipment would further impact the air quality situation around the project location.

Loading and unloading activities

The air quality surrounding the proposed dry port is likely to be affected by loading and unloading activities during operation phase.

Loading and unloading at dry port may lead to fugitive emissions in the absence of appropriate housekeeping from the equipments shall be used for loading and unloading operations. The storage and handling of dry bulk cargo shall also contribute to particulate matter emissions. Movement of

vehicles to carry the cargo to and from dry port would also lead to emission of dust and other pollutants.

Further, air quality will also be impacted by linked developmental activities such as urbanization in the region due to the construction of the dry port and the consequent increase in vehicular traffic.

It is proposed that Fork lift, reach tracker and reach truck equipments will be used for handling of cargo in the dry port. The Fork lift and reach truck will be batter/ electricity driven and reach stacker will be diesel operated. DG set will also be installed on-site.

The following equipment as detailed in Table below are proposed to be used for the dry port project.

Table 20: Types of Equipments to be used during operation phase

Equipment	No of Equipments	Possible operating duration per day	Fuel used	Fuel Consumption [l/h or KW/h]
Reach Stacker	2	14	Diesel	18
Fork Lift	2	3	Electrical Power	4
Reach truck	8	4	Electrical Power	3

According to the feasibility study, the area requirement for the identified cargo volume projected up to year 2035 cannot be accommodated in the identified site due to the limited land available for development. The estimated vehicular movement (comprising of diesel trucks) for the proposed dry port in the year 2016 and 2025 will be 1700 and 2906 respectively.

The estimated emissions from the vehicular movement for the year of 2016 and 2025 are depicted in the below table:

Table 21: Emission of various pollutants from vehicular movement

Equipment	CO	HC	NOx	CO2	PM
HCV Diesel Truck: gm/km per truck Applicable Vehicles Models: TECO LPT 2518(5.9lt) , TELCO LPT2515(5.9lt) , Volvo FM9, B7R (9.4lt) , Volvo FM12 (12.3lt) , TECO LPT 2518(5.9lt) , TELCO LPT2515(5.9lt) , etc Assumption: (Assuming truck moves 10 km in the project location with a speed of 10 kmph)	6	0.37	9.30	762.39	1.240
Total Emissions in 2016 (from 1700 trucks) gm/h	10200	629	15810	1296063	2108
Total Emissions in 2025 (from 2906 trucks) gm/h	17436	1075.22	27025.8	2215505.34	3603.44

Source: "Emission Factor development for Indian Vehicles" by ARAI, Pune

The emissions from both diesel and battery operated handling equipments at the Dry Port are provided in tables below.

Table 22: Emissions from diesel operated handling equipment

Equipment	No.	HC	CO	NO _x	PM ₁₀	*CO ₂
Reach Stacker (assumed 274 HP)	1	427.44	328.8	986.4	32.88	74.1
Total Emissions from 2 Reach Stackers (ton/annum)	2	0.312	0.240	0.720	0.024	265.3

Source: US EPA and *IPCC

Table 23: Emissions from battery operated handling equipment

Equipment	No.	Possible operating hours per day	Electricity Consumption (MWh)	Emission factor for Bhutan (tCO ₂ / MWh)	Total CO ₂ equivalent produced (tCO ₂) per annum
Fork lift	2	3	0.012	0.779	6.8
Reach truck	8	4	0.012	0.779	27.3

Source: <http://pub.iges.or.jp/modules/envirolib/view.php?docid=2136>

Reduction in Greenhouse Emissions

It is estimated that the construction of the dry port will result in the reducing the commuting distance for the Pasakha bound cargo by 40 km. Thus the reductions in greenhouse emissions due to development of Dry Port for the years 2016 and 2025 are shown in Table below.

Table 24: Reduction in Greenhouse emissions

Year	Total no of Vehicles	Estimated no of vehicles for Pasakha	Reduction in travel distance (in km)	Emission Factor* (gm CO ₂ /km)	Reduction in CO ₂ Emissions (ton)
2016	1700	1360	54400	870	47.32
2025	2906	2325	92992	870	80.90

*Source: <http://www.ghgprotocol.org/files/ghgp/tools/co2-mobile.pdf>

To mitigate the impacts due to vehicular pollution, vehicular speed should be limited, appropriate maintenance of engines should be undertaken at frequent intervals, prevent idling of vehicles and equipment and spray water at least twice a day to control dust. During winter season, dust pollution which may result from lower dispersion rate can be reduced by having concrete/asphalt surfacing of parking and trucks plying area. The toxic fumes emissions from the trucks entering the Dry Port compound will be checked of emission standards as per the current practice of Road Safety and

Transport Authority of Bhutan (RSTA). Routine checking and penalizing the defaulters should be undertaken to bring level of toxic fume emission to acceptable limits.

Cargo storage and handling activities should be designed to minimize or control dust emissions, including;

- Storing pulverized coal and pet-coke in silos
- Installing dust suppression mechanisms (e.g. water spray or covered storage areas)
- Using telescoping chutes to eliminate the need for slingers
- Using vacuum collectors at dust-generating activities
- Using slurry transport, pneumatic or continuous screw conveyors, and covering other types of conveyors
- Minimizing free fall of materials
- Minimizing dry cargo pile heights and containing piles with perimeter walls
- Removing materials from the bottom of piles to minimize dust re-suspension
- Ensuring hatches are covered when material handling is not being conducted
- Covering transport vehicles
- Regularly sweeping docks and handling areas, truck / rail storage areas, and paved roadway surfaces

Container Yard

The impact on ambient air quality in the container yard shall be due to release of fugitive emissions. In order to mitigate the impacts in the container yard, it is recommended to minimize the pile height. Ensure that cargo is seal tight and there is no leakage or spillage of materials. Ensure that container yard area shall be covered to minimize dispersion of fugitive emissions.

Container freight station

In container freight station, the containers of cargo are packed/unpacked and aggregated / segregation. The ambient air quality shall be impacted due to release of fugitive emissions. To minimize the impacts in the container freight station, minimize the pile height. Ensure that cargo is seal tight and there is no leakage or spillage of materials. Ensure that container freight station shall be covered to minimize dispersion of fugitive emissions. Segregate different types of cargo and place similar cargo together. The workers working in container freight station shall use face masks.

Vehicular movement

The vehicular movement on the internal roads of the dry port shall impact the ambient air quality due to the following factors:

- Fugitive emissions due to vehicular movement; and
- Release of Vehicular emissions. Gaseous emissions containing Particulates (PM₁₀), CO, HC, NO_x, SO₂ and lead will be released from the vehicular movement. The vehicular movement on the unpaved roads will also result in the fugitive dust emissions. As the predominant wind direction is from south west to north east, the pollutants are expected to disperse to north east directions.

Mitigation Measures to be implemented are:

- Allocate green area in the dry port design to mitigate the fugitive dust emissions

- Speed limits of vehicles on unpaved edge areas of the Project road will be established and agreed with the PIU;
- Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray;
- Vehicles should be checked for pollution control certificate;
- Proper maintenance of engines and use of vehicles; and
- Prevent idling of vehicles and equipment.

1.5.6.2. *Noise*

Loading and unloading of cargo

During operation phase, operations such as loading and unloading of cargo and vehicular movement shall cause higher noise levels. Bhutan's noise standard permissible for mixed use areas are Daytime: 65dB(A) and Nighttime: 55dB(A).

Vehicular movement

During operation phase, vehicular movement shall cause higher noise levels. Bhutan's noise standard permissible for mixed use areas are Daytime: 65dB(A) and Nighttime: 55dB(A).

The project activities described above impacting the air quality will also impact the noise levels around the dry port and along the access road. The primary monitoring of noise environment at the project location indicated that day time noise levels are marginally below the NEC standards for mixed use areas. During the operational phase, the ambient noise levels are expected to be even higher. The dry port is surrounded by settlements especially in the downwind directions. Thus, appropriate measures should be undertaken to reduce the noise levels from the mechanized operations generating noise, which would decrease the impact of noise on the settlements in the project area of influence.

High noise levels will also impact dry port workers and the impact on the workers is considered as occupational health hazard.

It is envisaged that the maximum noise levels will be experienced by the receptors on the transport corridors of the dry port especially near the approach road to the site.

Development of greenbelt around the dry port and along transport corridors would reduce the noise levels in the residential areas. Within the dry port area, workers should be provided with ear muffs while working near equipment generating high noise levels.

1.5.6.3. *Impact on Water Environment*

During operation phase, the impact on water environment shall be due to:

- Admin building and additional ancillary facilities

- Loading and unloading and handling of cargo
- Surface run-off

The dry port is surrounded by two seasonal rivers Barsa Chhu and Bhalu Jhora Chhu. Both Barsa Chhu and Bhalu Jhora Chhu are seasonal rivers and hence withdrawal of water for the project purpose is not envisaged either during construction or operation stage.

Admin building and additional ancillary facilities

Dry Port operation will generate sewage from domestic operations and wastegowater from floor washings and other port operations. The discharge of untreated sewage and wastewater from Dry Port in the surface water will impact the water quality of the river bodies.

Approximately 34 cum/ day sewage will be generated in the processing zone and 44 cum/ day sewage will be generated in the non-processing zone.

Sanitary wastewater contains organic matter, which contributes to the BOD of the receiving water body. The high BOD leads to decrease in dissolved oxygen levels at the places where the wastewater is released into the waterbodies. The wastewater would also contain nutrients (N and P), which could lead to algal blooms. In order to avoid impacts of sewage, sewage/effluent treatment plant has been proposed in the dry port facility.

Since the waste water generated from dry port is of domestic nature only, Fluidized aerobic bio reactor based sewage treatment system is recommended as primary and secondary treatment systems in order to optimize land usage. The tertiary treatment system proposed shall consist of filtration with chlorination for disinfection and sludge handling system consists of thickener and centrifuge. The tertiary treated water is proposed to be used as non-potable water and the entire non potable water requirement shall be met from this treated water.

The domestic sewerage system will basically comprises the collection system, pipe network, and sewage treatment plant. The sewage from processing and non-processing area will be collected at the terminal pumping station, where the STP is located and will be treated. The treated effluent will be discharged into a designated point to be located near the STP.

Sewerage treatment plant is designed for domestic effluent system and design peak flow i.e. 2 times of average dry weather flow (DWF). The total sewerage treatment plant scheme consist of pumping station, silting chamber, bar screen, grit chambers, FABR tanks, secondary clarifier, sludge sump, sludge drying bed, and treated water sump. The total design criteria for the above tanks for the treatment plant is based on manual sewerage and sewage treatment prepared as per the acceptable norms.

The effluent standard after the treatment shall meet the standards for discharge into the Inland Surface Water and tolerance limits as stipulated based on local norms.

The average depth of cutting for the sewer laying is anticipated to be in the range of 1.0m to 3.0m.

It is proposed that the STP shall be constructed to cater for a peak flow for dry port area under modular system.

Loading and unloading of cargo

The loading and unloading of cargo shall lead to spillages, which may impact the groundwater as well as surface water quality. Care should be taken that there shall be no spillages during handling of cargo. Appropriate steps as described in section 4.8 should be taken in case of spillage to prevent impact on groundwater quality. Surface run-off should not be directly discharged into surface water Bodies.

1.5.7. Impacts on Land Environment**Admin building and additional ancillary facilities**

Soil quality could be affected by solid and liquid wastes dumped from the dry port. The unauthorized disposal of waste produced from the admin building and other ancillary facilities shall cause soil and groundwater contamination.

Loading and unloading operations

Spills of materials on land during loading and unloading operations and storage in container freight station and during transportation might affect soil quality in the immediate vicinity. These impacts, however, are expected to be minor and localized in nature

The generated solid waste from port operations, staff quarters and drivers restrooms will not be disposed in the nearby areas or water bodies. The waste should be disposed in the bins from which it should be later collected, segregated and sent to authorized dealers/ landfill. Recyclable waste should be sold to the scrap dealers and residual non-hazardous waste should be disposed off in the municipal landfill. Land use pattern of the area could be altered in the area due to dry port development and subsequent urban sprawl.

1.5.8. Impact on Biological Environment

As already mentioned earlier, there are no endangered or threatened species in and immediate vicinity of the dry port area. Thus, the impact on biological environment is expected to be minimal.

1.5.9. Cumulative Environmental Impacts

More than adverse cumulative impacts, the cumulative beneficial impacts would be higher for the entire region as well as for Phuentsholing Mini dry port as the project will also reduce the traffic movement to the Phuentsholing Mini dry port. The establishment of the dry port is expected to minimize processes in Kolkata as the goods destined for Bhutan will use through bills of lading with the dry port serving as the port of destination. The positive and negative impacts of the Dry Port are:

- Speed up the clearance of goods;
- Reduce congestion in Phuentsholing;
- Improve asset utilization especially of the road transport service providers;
- Become a pole of attraction for value added industries and new industrial development;
- Improve land use planning and management in the town of Phuentsholing

- Development of dry port shall lead to reduction in greenhouse emissions due to reduction of travel distance. It is estimated that in 2016 and 2025, the reduction in greenhouse emissions shall be 47.32 ton and 80.90 ton respectively. With the reduction in travel distance, other gaseous emissions and fugitive emissions shall also be reduced.
- The development of dry port shall have some negative impacts on air, water, noise and soil but with mitigation measures the impacts can be minimized. It is estimated that approximately 34 cum/ day sewage will be generated in the processing zone and 44 cum/ day sewage will be generated in the non-processing zone. The untreated disposal of sewage shall impact water quality. Approximately 0.102 cum/day water will be required for dry port operations.

There should be no significant adverse cumulative impacts expected from the Dry port and the other projects that aid in the creation of the dry port. The development of the dry port is expected to contribute to growing traffic, commercial activities, that may indirectly lead to additional pollution. However, it is not possible to model the impacts quantify the same impacts at this stage. Though the statutory provisions in Bhutan cover the pollution control, the institutional capacity was found shortcoming in ensuring that the pollution levels in the region are according to the norms. Thus it is important that institutional strengthening is required and improvements in resources are needed to achieve better enforcement to support strategic management of pollution control and resource exploitation in the long term.

1.5.10. Trans-boundary Impacts

The proposed Dry Port project is located around 100 m from the Bhutan-India border. The confluence of the Barsa Chhu and Bhalu Jhora Chhu rivers is in India. However, the transboundary impacts will be minimal as the Indian boundary is located in the downwind direction. Further the proposed dry port will not impact the flow or quality of the river, thus the transboundary impacts on the surface water will be insignificant. Also, the absence of inhabitants in the vicinity of the Indian boundary also minimize the significance of the impacts.

1.6. Stakeholder Consultations

The stakeholders identified in the project comprise of project displaced / impacted people, project beneficiaries, members of industrial association, executing agency, especially the officials in DoT and Thromde municipality, executing and implementing agency of the linked ADB sub-project “Pasakha Access road” and LCS.

1.6.1. Scope of consultation and issues discussed

The objective of the consultations was to disseminate information about the project and understand their concerns and opinions. The process was aimed at enabling the stakeholders to make informed decisions. A structured census questionnaire was used to collect information on the affected households, and commercial establishments/ properties for understanding the impacts of the project and develop resettlement plan and facilitate the mitigation measures.

Subsequently, public consultations were conducted after the completion of the socio-economic survey to ensure further participation. The public consultation being a two way process was used as

a tool in ensuring peoples' participation in project planning and implementation. All the surveys and consultation meetings were organised with free and prior information to all the stakeholders.

During the consultation process efforts were made by the survey teams to:

- Ascertain the views of all the stakeholders and impacted population with reference to project activities and understand their concerns to facilitate the minimization of the impacts;
- Identify and assess the major socio-economic characteristics of the villages to enable effective planning and implementation;
- Understand the VECs;
- Understand the present water, food, health and sanitation, transport and communication related challenges;
- Examine the opinion of the stakeholders for identification of the overall developmental goals and benefits due to the project's activities

1.6.2. Stakeholder consultations

Stakeholder consultation within the project's area of influence was mainly conducted by organising meetings and face to face interactions with several target groups including a women Focused Group Discussion(FGD) as shown in Figure below. These consultations involved the following groups

- a) Women FGD
- b) Consultation with the owners of all commercial establishment close to the proposed approach road along with participation from residents along the same area
- c) Consultation with the residents on BCCL colony area

In addition to the individual consultation during socio-economic survey, a total of 36 participants (15 females and 21 males) attended the consultation / focused group discussions. A brief summary of the discussions and feedback is included in the Table below.

Table 25: Summary of Focused Group Discussions

Summary of focussed group discussion		
Issue	Discussion or Suggestion	Remark
Information dissemination about the proposed Project		
General understanding of impacts and concerns on the proposed project	<p>The participants were aware of the proposed dry port being envisaged and were enthusiastic of the project.</p> <p>The major query was around extent of land acquisition and their relocation status. It was communicated that the land</p>	The participants overall appreciated the project with the reasoning that such a project will improve the local employment conditions and will boost the economy not only for prospective workers but also for petty shop owners.

Summary of focussed group discussion		
Issue	Discussion or Suggestion	Remark
	<p>acquisition is envisaged only for the construction of the approach road. However, with the proposed design of the approach road, the extent of land acquisition is expected to be minimal.</p> <p>They also had questions around the location of access road to dry port and how their individual access to residential areas will be impacted. It was clarified that no changes in the current access to residential area is envisaged due to the proposed project activity. The access road for the dry port is being planned in such manner so as to provide minimum interference in their residential areas.</p>	They were enthusiastic that such a project is being undertaken in their vicinity since this might lead to an overall development of the neighbourhood.
Understanding current and perceived environmental concerns		
Any existing Air/water/ noise pollution experienced currently. Do you foresee any increase in this regards due to project's activities.	<p>All the participants of the three FGD's unanimously commented that they are currently suffering from a high level of Air and dust pollution due to the ongoing traffic on the nearby road and industries in the vicinity.</p> <p>They also stated that there is scarcity of clean potable water and in general water availability and access for all can be improved.</p>	Reduction in Air, Dust, and noise pollution has to be included within the mitigation measures. Also, further steps need to be taken to increase potable water availability in the project area of influence.
Understanding the existing traffic scenario		
Opinion on existing traffic scenario	The stakeholders informed that the existing traffic scenario on the neighbouring road neither causes restriction in access nor impact the safety of the commuters.	
Understanding concerns around restriction of access due to project		
Will the project result in restriction of access to any public amenity	The stakeholders are concerned on the impact of the project on their access to the bridge which connects the residential area to Phuentsholing Pasakha Highway. Restriction of access to the bridge will result in the	It should be ensured that there will be no restriction of access to their residential area from the bridge.

Summary of focussed group discussion		
Issue	Discussion or Suggestion	Remark
	<p>stakeholders travelling an additional distance to connect with the main highway.</p> <p>It was communicated to the stakeholders that a pedestrian walkway will be provided in the design of the approach road.</p>	
Understanding concerns due possible influx of migrants		
Any perceived challenges due to influx of migrant workers	Majority of the stakeholders didn't perceive the influx of the migrant workers as a substantial threat instead they opined that the influx will result in increase of the business through petty shops. However, the women expressed that the influx of migrants might increase the cost of living in the area and also might affect socio-economic condition of the area by impacting public services, demography of the area, housing facilities, employment opportunities and aesthetic quality of the community during both construction and operational phase of the project	
Perception about labour camps and residential facilities during construction and operational phases	The participants did not express any concern in general against the labour camps for workers however they did mention that adequate planning should be undertaken so that there is no impact on the local tradition and culture.	
Understanding the perception around overall project benefits and expectations		
Will the project benefit community and overall employment	In general, the participants welcomed the project's activities since they are eager to gain better employment opportunities.	
Any more expectation like better cultural facilities, better waste disposal, better drainage and sanitation	The participants expressed that they desire better health facilities, banks, and provision of a local market close to the residential area. However when they were told that the Thromde is looking at all these options including the development of low income housing in this area, they expressed their satisfaction.	

- **Consultations held with Project Officials at Thromde Municipality**

The summary of the consultations with Thromde Municipality is provided in Table below.

Table 26: Summary of Consultation with Thromde Municipality

Name / designation of Stakeholder	Input to project's activities
<ul style="list-style-type: none"> The Mayor – Mr. Utham Kumar Rai, Mr. Tshering Phuntsho (Chief Urban Planner, Thromde Municipality) Regional Director – Dept of Trade, Phuntsholing Mr. Dhimal, (Land records Incharge), Thromde Municipality 	<ul style="list-style-type: none"> Master plan including the proposed approach road and the internal planning of the dry port area was discussed with the Urban Planner and Mayor of Phuentsholing municipality <p>The urban planner opinioned that the alignment of the approach road proposed as part of the feasibility report will significantly impact the land acquisition. Hence the plan needs to be realigned in concurrence with the local area plan as developed by Thromde and also taking into cognizance of minimizing the impacts due to land acquisition. The approach road is recommended to be re-aligned along the periphery of the dry port area.</p> <ul style="list-style-type: none"> Retaining the bore wells in the project site <p>The Urban Planner mentioned that the LAP accounts for the augmenting of the existing municipality water supply unit envisaging the future increased demand. The other two bore wells in the dry port area are being used by the Coco-Cola company and the same should be retained even after the development of dry port.</p>

- Stakeholder consultation held with Consultant responsible for construction supervision and capacity building of Pasakha Access road project under SASEC Road Connectivity – ADB**

Table 27: Stakeholder Consultation with Consultant for Pasakha Access Road Construction

Name / designation of Stakeholder	Input to project's activities
<p>Mr.Niralal Rai (Deputy Team leader/Road Management Specialist)</p> <p>&</p> <p>Mr.Williamor Ramos (Bridge Supervision Engineer),</p> <p>Egis International</p>	<ul style="list-style-type: none"> Re-aligning the approach road alongside the periphery in line with the Local area development plan in Pasakha. <p>Discussion was carried out on the necessity for re-aligning the road along the periphery of the proposed dry port area as per Thromde's requirement. However, the bridge consultant put forth 2 major points which restricted the possibilities of proposing an approach road immediately after the bridge along the periphery of the dry port area.</p> <ol style="list-style-type: none"> As per the general bridge design practice, it is required to have at minimum 100 m of stretch on either sides of the bridge to match the gradient of the bridge with the road gradient. As against the norms of 100 m, at present

	<p>only 40 m of stretch is available to match the gradients of bridge and the existing main road leading to Pasakha industrial estate. Hence the provision of immediately branching away an approach road after the bridge is not recommended.</p> <p>2. As per the traffic engineering and road design practices, it is not recommended to propose a 4 legged intersection immediately after a bridge which justifies the fact that the approach road to the dry port immediately after the bridge is not possible. Also in such a situation, the maneuverability of heavy vehicles bound to the dry port shall be very difficult which may lead to subsequent traffic accumulation on the bridge and downstream the bridge (towards the existing Pasakha industrial estate). Hence it is required that the approach road to the dry port needs to be formed at a distance of 100 m away from the end point of the proposed Bhalu-jhora bridge</p>
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Table 28: Stakeholder Engagement and Public Consultation Meeting

Multiple stakeholder consultations undertaken as part of the project	
Stakeholder consultations being undertaken near BCCL residential area	
Stakeholder consultation and women focussed FGD being undertaken at the approach road area	
Stakeholder consultation held with the officials at Thromde municipality	

<p>Consultation with owners of all commercial establishment close to the proposed approach road</p>	
<p>Socio-economic survey conducted within the project's area of influence</p>	

- **Public Consultation meeting was held on 17th July 2016 at Municipality office. It was attended by members of industrial association, officials from thromde and DoT regional office. The attendance sheet for public consultation meeting is attached in the Appendix.**

Table 29: Public Consultation meeting

Name / designation of Stakeholder	Major Concerns raised by attendees
<p>Members of industrial association, officials from thromde and DoT regional office</p>	<ul style="list-style-type: none"> • Flood risk and adequate mitigation measures • Refer to previous studies for flood risk • Design details should be provided such as container yard, warehouse, loading & unloading, custom clearance, immigration services, temporary & permanent parking arrangement etc. • Air and noise pollution parameters should be provided in detail • Provisions for surface water and ground water quality

- Waste management and waste disposal system should be considered
- All these concerns are addressed in the report.

Figure 28: Newspaper Ad for Public Consultation Meeting

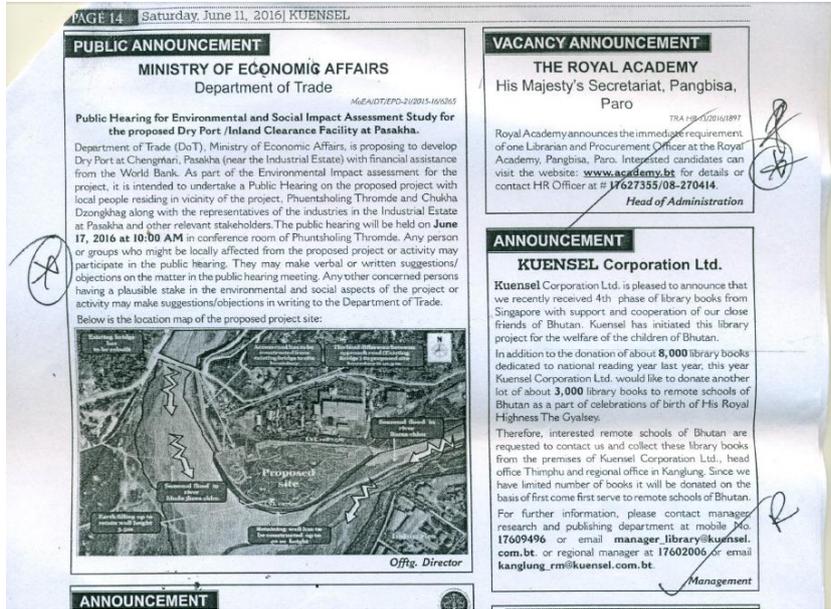


Figure 29: Public Consultation Meeting







Further, the analysis of the key positive impacts, apprehensions and perceived negative impacts and the suggestions/recommendations as documented during stakeholder engagements and public consultation meeting are detailed in Table below.

Table 30: Positive Impacts perceived by the Stakeholders

Positive impacts perceived by the stakeholders
• Increase in direct and indirect employment opportunities for both the genders
• Increase in employment opportunities in neighbouring villages as well
• Possibility of provision of enhanced water supply and medical care facilities
• Improved communication and transportation facilities
• Overall development of the surroundings leading to a cumulative development of living standard and social status

The negative impacts perceived by the stakeholders are provided in Table below.

Table 31: Negative Impacts perceived by the Stakeholders

Negative impacts perceived by the stakeholders
• Increase in environmental pollution levels (Air, Noise, Dust and Water)
• Deterioration in current practice of sanitation and waste disposal
• Possibility of resource crunch specially drinking water and loss of bore well structures
• Possibility of restriction of Access if the project is not planned adequately
• Concerns around the exact employment status for the locals vs Migrants

- *Concerns for flood risk*

The suggestions and measures to enhance benefits and mitigate negative impacts are provided in Table below.

Table 32: Suggestions and Measures to Enhance Benefits and Mitigate Negative Impacts of the Project

Suggestions and measures to enhance Benefits and Mitigate Negative Impacts	
Observation	Suggestion / Recommendation
Employment opportunities for local people	The executing agency shall not only undertake an effective campaign about employment opportunities but also undertake training for skills improvement related to appropriate job profiles than can be created for long term perspective within the port's construction and operation phase.
Control of Environmental Pollution and enhancement in the quality and supply of water	Adequate environmental pollution mitigation measures will be developed to monitor and control Air, Noise, Dust, Water contamination and pollution. The mitigation measures will be part of the contract for construction of the dry port Also, adequate hazardous and non-hazardous waste disposal techniques shall be deployed during the port's construction and operation phase. DoT shall ensure that EMP would be implemented properly.
Enhancement of Waste disposal and Sanitation Facilities	During the planning of environmental mitigation measures, specific focus needs to be provided for enhanced waste disposal and sanitation facilities for both, the locals as well as workers during construction and operational phase
Planning for the provision of Better facilities like Health Centers, Markets, Finance institution (Bank or ATM), communication and transport facilities	This is already being considered by Thromde municipality as part of their LAP for Phuentsholing area. The improved roads and transport would not only help business and trade but also access to education and health care facilities, in addition to improving social relations and network. The current project's area of influence is also a part of the LAP activities.
Adequate compensation for impacted persons	It is essential to compensate not only the title holders for the loss of land and physical displacement, however the Non – title holders have to be adequately compensated for their loss of livelihood and economic displacement due to project's activities. Also, the project's area of influence has 5 WHH, for whom appropriate vulnerability mitigation measures needs to be undertaken as part of resettlement and rehabilitation plan.
Careful project planning to avoid restriction of access	As per the current layout plan, there is no restriction or blockage of any access road being used by the community towards their residence or establishments to for access to schools, markets and other facilities. However, care needs to be exercised during future planning as well so that the access to any facility is not restricted.

<p>Flood risk</p>	<p>As per the hydrology study, in this kind of steep terrain conditions with high water velocities and periodical experience of erosion and deposition the objective of any mitigation solution shall result in reducing the both surface and sub-surface (Seepage) velocity potential. This objective can be achieved by providing multiple cut-off walls at different locations along the river course for a depth of 5m below the bed level extending sufficient distance into the banks to ensure no vertex occurs where the cut-off wall meets the banks and results in bank erosion. In the present case, the cut-off walls are needed on the upstream side of the land to the downstream up to the confluence of two rivers. Apart from providing subsurface cut-off walls it is ideal to carry out pressure grouting in the bed near the retaining walls for a width of 10m to ensure cementation of the boulders for a minimum depth of 3m. The pressure grouting shall be carried out in a lean period. The exact depth of cement grouting shall be based on detailed bed investigation. This pressure grouting of the bed coupled with cut-off walls provides non-scouring, non-erosion environment for the construction of foundations either across the river course or for the river training retaining structures.</p> <p>It is proposed to construct a retaining wall of 4m height along the periphery of the site facing the river bed. Further, it is suggested to raise the site level by filling of earth upto 3.5 meters for the entire site area which would prevent flood waters entering the site and inundating the site area during monsoon and also will contribute in reducing the slope ratio of approaching road to the facility.</p>
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Retaining the existing bore wells

It will be ensured that planning and the design of the dry port will be construed to retain the existing bore wells comprising of 2 bore wells of Coca Cola company and one bore well of the Thromde.

1.7. Grievance Redress Mechanism

A 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.

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

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.

A tracking number should 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.

The updated register of grievances and complaints will be available to the public at the DoT offices and the PIU office near the Project. If the grievance remain unresolved, then it will be escalated to the second tier.

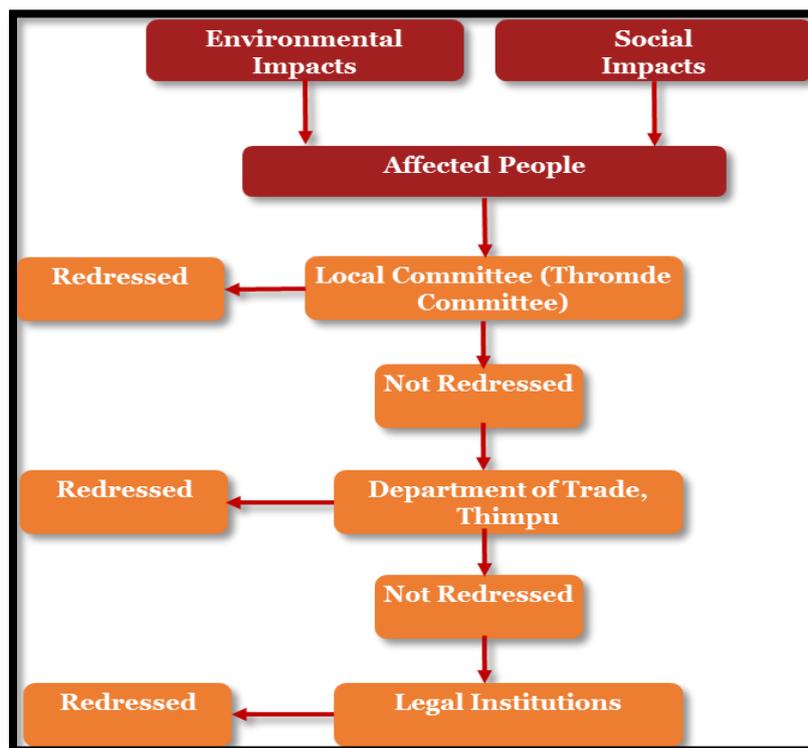
Second Tier of GRM. The PM of respective PIUs will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the head of the Project Coordination Unit (PCU) in DoT which will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC should be established by DoT before commencement of site works. The GRC will consist of the following persons: (i) Senior Trade Officer (ii) Division Heads of DoT and 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 should not impede the complainant's access to the Government's judicial or administrative remedies.

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.

The Environment officer in DoT, Phuentsholing 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.

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 legal institution. The GRC will be kept informed by the district, municipal or national authority. The grievance redress mechanism and procedure is depicted in Figure below for the Dry Port development. The monitoring reports of the EMP implementation should 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 30: Grievance Redress Mechanism



1.8. Emergency Response Plan

Emergency preparedness helps to minimize the human suffering and economic losses that can result from emergencies. In any emergency, actions for safeguarding the health and lives of project personnel and the public, will take priority over any other aspect of the emergency. In the event of any emergency the person who discovers the situation, or the Supervisor(s) of the workers directly involved, will determine if the incident classification is Minor or Major, and ensure appropriate steps are followed in accordance with this plan.

1.8.1. Minor Emergency

An emergency will be deemed "Minor" if: The situation can be controlled, cleaned up, treated or otherwise rectified within 10 minutes and/or with minimum manpower and equipment that is immediately available at the site; or if the incident does not have the potential to materially impact the environment and/or adjacent property/buildings or affect the safety of workers or the public.

For example:

- An injury (first aid) that can be treated by workers or the on-site First Aid Attendant;
- A small fire that can be put out with one fire extinguisher;
- Chemical spill (i.e. fuel, oil) that can be picked up immediately and contained in a suitable manner for later disposal at an approved facility;
- A minor erosion event that does not materially impact waterbodies and is readily contained.

Reporting

Reporting and control of *Minor Emergencies* will be as follows:

Person(s) Who Discovers The Situation

- Notify Supervisor;
- Control and/or assist in the control of the situation, if safe to do so;
- Provide a verbal report to Contractor as soon as possible; and
- Written report of situation given to Supervisor.

Supervisor

- Determine and initiate any further clean-up or control measures as required; and
- Provide report to Contractor's Safety Officer.

Safety Officer

- Report to PIU; and
- Complete Accident/Incident Investigation and Report (as required) and provide report to PIU.

1.8.2. Major Emergency

An emergency will be deemed "Major" if:

The situation is beyond the limitations as stated in "Minor Determination"; the foreman/Supervisor determines that additional resources are needed to achieve control; the incident has the potential to materially impact the environment and/or adjacent property/buildings or affect the safety of workers or the public. For example:

- A small fire that can be put out, but flares up again;
- A serious injury accident or a fatality;
- A large spill (e.g. fuel, oil or chemicals);
- Significant erosion or siltation that materially impacts water bodies;
- Vehicle/equipment accidents or equipment failures that significantly affect worker safety;

- Any situation which must be reported to government Authorities Having Jurisdiction (whether federal, provincial or municipal);
- Damage, or unseen suspected damage to any foreign pipeline or other underground facility; and/or damage to any above ground facilities.

Reporting

Reporting and control of *Major Emergencies* will be as follows:

Person(s) Who Discover the Situation

- Notify Foreman/Supervisor and Contractor immediately;
- Take steps to attempt control and/or remain on scene to provide assistance to other responders, if safe to do so;
- Initiate site evacuation if need be; and
- Secure area to keep others a safe distance away.

Foreman/Supervisor

- Assess the emergency to determine if additional resources are needed to effect situation control and, call for assistance as deemed necessary;

Direct manpower on hand to:

- gather response equipment and materials required to immediately control and contain the situation;
- any other tasks as required that could aid in situation control; and
- initiate and ensure site evacuation if need be, and
- secure area to keep others a safe distance away.

Notify Contractor or his alternate of the situation, giving all the following information:

- nature of emergency; and if emergency involves a spill;
- product name, estimated quantity of product spilled;
- actions taken to minimise the emergency situation effects;
- additional materials, equipment, manpower or other facilities required.
- Continue with immediate control measures until additional help arrives.

Contractor

- Notify PIU and Safety officer of the situation;
- Arrange for additional control measures, equipment and supplies;
- Lead and/or assist with *incident investigation*, following total situation control.

1.8.3. On-Site Notification of an Emergency

The workers and/or Supervisor will sound a vehicle horn and/or use other methods of gaining workers attention, to advise them that an emergency situation exists.

1.8.4. Emergency Information Management

- All supervisory personnel will maintain a written log of activities during the emergency, e.g. date, time & action taken. Each *entry* in log should be initialled.
- Workers are not to release any information to media, they should direct media to the Safety officer.
- Press releases will be issued, as determined, by PIU.

1.8.5. Post Emergency Procedure

When the Emergency situation has been controlled and is no longer a danger to people, material, equipment or the environment; the Safety officer will conduct an investigation, independent of, but in cooperation with all other investigative bodies, for the purpose of determining cause and preventing recurrence of similar incidents.

1.8.6. Emergency Communications

- Supervisor will be assigned a vehicle with two-way radio, mobile phones which permits contact with safety officer, contractor and PIU

1.8.7. Emergency Transportation

- In an emergency, any vehicle may be used to transport men, equipment or materials.
- The ambulance units will be fully dedicated for the transportation of injured persons.
- The Senior First Aid Attendant at the scene will determine if there is need for "Air Medi-Vac" of injured persons and make arrangements accordingly.

1.8.8. Accidents – First Aid & Emergency Medical Response

Assess the Scene

- Assess the scene for hazards; e.g. downed power lines; unstable vehicles or equipment, etc. and ensure the scene is made safe before attempting to provide assistance;
- It may be necessary to wait for qualified persons to make the scene safe, e.g., utility workers to shut off electricity to downed power lines.

To Access First Aid & Emergency Medical Services

- Call for Industrial First Aid Attendants using two-way radio (Channels to be identified prior to start of work) or telephone and provide the following information:
- Your name;
- Your location;
- Brief description of accident;
- Number of injured persons and type of injuries;
- Is the area accessible by vehicle, and
- **stay on the radio/phone for further instructions or information.**

Emergency Guidelines

- Have a first aider provide immediate treatment to their level of capability;
- Dispatch someone to guide Emergency Response Personnel to scene;
- Do not move the injured person(s) or disturb scene unless:
- there is danger of further injury;
- incident is minor and adequate initial treatment has been rendered by a qualified person;

In the event of a serious injury or fatality:

- all work will cease immediately;
- do not disturb scene, pending investigation by PIU;
- secure the scene and keep unauthorised persons out of area;
- photograph scene if possible and get names of witnesses;
- record any details, conversations and observations in writing.

1.8.9. Environmental and Spill Response

First Response to Incidents or Spills Involving Hazardous Products

- **Approach Cautiously From Upwind.** Resist urge to rush in until situation is assessed. Others cannot be helped if first responders put themselves at risk.
- **Secure the Scene.** Without entering hazard area, isolate the area and keep people outside the safety perimeter.
- **Identify the Hazards.** Placards, labels, shipping documents and persons on scene can provide information about the materials involved. Refer to *MSDS* sheets, for information about appropriate response.
- **Assess the Scene.** Consider the following: fire, spill or leak; weather conditions; property or the environment at risk; what actions are necessary, i.e. evacuation, diking; resources at hand and what can be done immediately to control or minimize the impacts of the incident.
- **Obtain Help.** From outside agencies as required, i.e. Municipality, etc.
- **Decide on Site Entry.** Enter site only when safe; use appropriate PPE.
- **Respond.** In appropriate manner, establish site command if needed, rescue, evacuate, continually reassess and modify as needed. First priority is safety of people in the immediate area.
- **Above All.** Avoid inhaling fumes, vapors, smoke and do not touch or walk through products.

Subject to approval by Manager, the following material shall be supplied by the Contractor and shall be available at locations convenient to the work:

- swamp mats
- T-bar posts
- geotextile (Terrafix 270R, Nicocan or equivalent)
- straw bales
- plastic snow fence
- sand and sandbags
- miscellaneous pumping equipment
- spill response material

Fuel trucks and service trucks shall carry the following as spill contingency equipment:

- minimum 10 kg of suitable absorbent material,
- thirty square metres (30 in²) of 6 mil polyethylene,
- a shovel, and
- one empty fuel barrel (180 litre minimum).

1.8.10. Drowning

In the event that someone has fallen in the river water near the site boundary, there are several safety related items to remember. Please follow these instructions if you are the first person on the scene of a potential drowning incident:

REMEMBER THE FOLLOWING LETTERS: D.R.A.B.C.

D: DANGER:

- Assess the situation and ensure safety of yourself, the casualty and others. Be especially careful of potential electrical current.
- Drag Casualty from water

R: RESPONSE

Check the casualty's response: SHAKE AND SHOUT

A: AIRWAY

- Turn casualty on side and clear airway
- Caution if suspected spinal injury

B: BREATHING

- Open mouth, tilt head back, extend jaw and listen for breathing.
- If not breathing: commence mouth-to-mouth
- 5 breaths in 10 seconds

C: CIRCULATION

- Check for pulse at neck or wrist
- If no pulse: commence cardiac massage
- 30 compressions each 10 seconds
- Then 2 breaths in 5 seconds
- Repeat compressions
- Repeat breaths

Note: If only one person is responding they should do compressions only.

ONCE RECOVERED, PLACE ON LEFT SIDE AND CALL the emergency number

1.9. Environmental Management Plan (EMP)

This section outlines the mitigation measures, post project monitoring and management responsibilities during the construction and operational phases of the project. The purpose of EMP is to:

- List all suggested mitigation measures and control technologies, safeguards identified for the anticipated impacts;
- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in EIA designed to mitigate potentially adverse impacts, are implemented;
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

The environmental regulations of RGOB are derived from the Environmental Assessment Act (2000). The environmental assessment rules are set out in the Regulation for Environmental Clearance of Projects (2002). Dry port development will follow the principle of design and built modality. DoT will hire construction contractor who will be responsible for design as well as carry out the subsequent construction. Environmental Clearance will be issued by the NEC upon submission of IEE forms.

1.9.1. Construction Phase

Pre-construction Operations

As observed during the site visit, the project site is completely barren land with wild shrubs and weeds, and three borewells.

Cut and fill operations: Due to undulation terrain of the project site, it is envisaged that landfilling will be done with material sourced from outside the project boundary. To minimize the impacts due to the use of material sourced from outside the project boundary, the following general measures should be adopted:

- The soil supplying contractor should be insisted to stabilise the excavated site;
- Shortest possible routes should be selected for transporting the material and settlements may be bypassed as far as practicable;
- If the material is dusty the trucks should be covered; and
- To avoid fugitive dust, water may be sprayed at the places where vehicles are moving.

The exposed soil after cut and fill operation in the site will increase the chances of soil erosion. As mentioned earlier, the run off through exposed soil may increase suspended solid levels in adjacent rivers. The cut surface which is not covered with construction is expected to be naturally stabilised over time. However, to reduce short term impacts, hard grass may be grown on the cut surfaces.

The cut soil should be disposed off outside the project area, and care should be taken to avoid blockage of streams and pollution of groundwater by careful planning for spoils disposal. The cut soil may also be used for road construction at the nearby roads.

Construction Operations

The major activities during construction will include:

- Development of dry port, including storage and handling facilities;
- Construction of roads and other paved areas;
- Construction of access roads
- Construction of rest rooms for drivers; and
- Construction of ancillary facilities including canteen.

The major sources of air and noise pollution are already mentioned in Impact Assessment Section. The above mentioned activities along with vehicles transporting men and materials to and from construction sites, and movement of construction equipment will cause gaseous emissions which include CO, HC, and NO_x.

To mitigate these impact, the project owner should ensure through construction contractors, as well as sub-contractors, to execute construction activities in accordance with environmental and social management plan. Implementation of ESMP during the project construction and being supervised by project owner / contractor personnel, will minimise the emissions.

The fugitive dust emission can be minimised by spraying water. The project owner should insist the construction contractor to use standard equipment which meet exhaust and noise standards; generator (DG set) exhaust and noise standards; and other construction equipment standards such as NEC standards, US Federal Highway Administration Standards.

The potential for noise impact during construction phase will vary by location and land use. As the project site is surrounded by residential establishments and considering the baseline noise levels marginally lower to NEC standards, the noise from the construction operations will impact the residential settlements especially during the night time. Thus, noise generating operations should be planned only during day time. Continuous exposure to high noise levels lead to adverse health conditions.

To deal with noise exposure by construction workers, the following guidelines as per the OSHA pocket guide are recommended to be followed by the contractor:

Reduce It: Reduce the noise by using the quietest equipment available. For example, choose a smaller, quieter generator.

Move It: Move the equipment farther away with the use of extension cords, additional welding leads, and air hoses. Noise levels go down as with the increase of the distance from the noise generating source. Move the generator (example) farther away or face it in a direction that is away from where most people are working. If you are not required to be in a high noise area, move to a quieter area.

Block It: Block the noise by building temporary barriers of plywood or other on-site materials to keep the noise from reaching workers. Place a five-sided, oversized wooden box over the generator. Add fire-resistant acoustical absorbing material (foam) inside the box. If the generator sits on soil or sand, that will help absorb some of the noise.

The following are the further measures to reduce noise exposure. Proper maintenance of equipment and tools results in lower noise levels. Changing seals, lubricating parts, using sharp blades and bits, installing mufflers, and replacing faulty or worn equipment or parts can reduce the noise levels significantly at the project site.

At individual worker level, the construction contractor should be insisted to provide earmuffs to the workers exposed to high noise levels.

During construction period, the construction contractor should construct labour colony along with proper sanitation facilities solid waste management facilities.

1.9.2. Operation Phase

Air Environment

The loading and unloading at dry port may lead to fugitive emissions. For this purpose water spraying is recommended during loading and unloading operations especially in the routes where vehicular movement is envisaged. As it is envisaged that dusty cargo will be transported by trucks to the project area, it is recommended to cover trucks and wagons with tarpaulins while transportation. The contractor should ensure that there should be regular maintenance and engine tuning of the vehicles and equipments used at the dry port site. The drivers should be instructed to show maintenance card at the entry gate.

Noise Pollution

Mufflers should be provided to the workers wherever possible to reduce noise levels from mechanical operations and workers in noisy areas should be provided with ear muffs to prevent hearing loss.

To mitigate the noise impact due to port operations i.e. due to operation of handling equipment and vehicle movement in dry port, a physical barrier should be provided between the dry port and the residential areas. This can be achieved by planting trees on the boundary of dry port. Two to three rows of trees along with bush plantation in between will result in reasonable attenuation of noise. Even the landowners in the neighbourhood may be encouraged by project owner to develop their own greenbelt in their lands.

Water Environment

Scrupulous housekeeping should be practised during loading and unloading at dry port to minimise leaks and spills. It is recommended that the STP proposed to be installed at the dry port will have the following operations:

- Oil-water separation
- Equalization and neutralization
- Sediment removal
- Biological treatment

- Chlorination

The STP should be designed in such a way that the treated effluent will meet standards for discharge into inland surface waters. A part of the treated effluent could be used for greenbelt development in the dry port. The remaining treated effluent could be discharged into the adjacent rivers.

Land Environment

The disposal of excavated soil outside the premises would impact the soil at the dumping location if there is difference in soil quality between excavated site and dumping site. The detailed analysis for soil at project location showed that it did not contain appreciable quantities of heavy metals. However, a thorough soil analysis including textural class is necessary before dumping of removed soil, so that selection of dumping sites can be made based on similar soil characteristics.

The maintenance of loading and unloading equipment may deal with replacements of some equipment parts and lubricants, and results in creation of used spare parts and used lube oil. The quantity of lube oil to be generated in a month may not be very high. The used lube oil may be sent to ETP for possible oil recovery or landfilling.

The used spare parts may be given for recycling if such provision is available or send to land fill.

Solid waste collection and disposal: Solid wastes may contain wet wastes and dry wastes. Wet wastes are envisaged to be generated from canteen and other domestic operations. Dry wastes contains recyclable wastes like glass bottles, tins, etc. The disposable wet and dry wastes should be segregated and collected in separate bins. Suitable bins with collection bags for wet waste collection should be provided at canteen areas. Bins for dry waste collection should be placed on the side of roads, in front of office premises, etc. It is required to keep separate bins for disposable wastes and recyclable wastes.

The collected wet waste and disposable dry waste should be handed over to municipal solid waste collection system. The recyclable dry waste should be sent to authorized recyclers.

Greenbelt/ Tree Plantation Plan

Development of a greenbelt/tree plantation along the boundary and internal roads will be beneficial.

The tree plantation will have the following objectives:

- Restoration/ preservation of genetic diversity
- attenuation of noise pollution from the dry port to surroundings
- creation of aesthetic environment

At least three rows of trees may be retained along the boundary. New trees can be planted to make up the gaps devoid of trees.

The selection of trees and plants for greenbelt/tree plantation should be those which could grow in the existing agro climatic conditions. They should be able to survive in the local soil conditions.

Some of the commonly planted trees in Chhukha district are *Phoenix rupicola*, *Leucosceptrum canum*, and *Acer thomsonii*.

Based on the above considerations and also due to loss of trees on the site, the plant species should be native (especially those which are cut from the site and for road widening) in nature. The selected plant species would need minimum level of maintenance including fertilisation and other soil amelioration.

Apart from trees, the shrubs removed from the site, and other herbaceous species may also be planted in between the trees along the boundary wall. This will act as green cover, prevent soil erosion by increasing the binding capacity of the soil, and importantly act as noise barrier together with trees.

Community development plan

The local community should be involved during the project development. The project owner/its contractors may recruit local work force to the extent possible during both construction and operational phases. The project owner should identify technically qualified unemployed youth around the project location and other nearby areas, and employ as far as practical. The project owner should encourage training for the local people to develop skilled manpower required if sufficient skilled manpower is not available to carry out technical work in the proposed project during operational phase.

The project owner should organise a community advisory group involving local representatives, and representatives from other industries; that would help them in finding ways to participate with its neighbours in addressing socio-economic concerns. With the advice of its community advisory panel, local officials, and other key individuals and groups, the project owner may sponsor appropriate programs and projects to benefit its community as a whole.

Some specific community development programs that could be considered by the project owner in coordination with other industries in the locality are suggested here:

- Conducting awareness programs in surrounding villages on health impacts due to environmental pollution (air, noise, water, solid waste, etc), and precautions to be taken to minimize health impacts;
- Conducting periodic health check-ups to the dry port staff and in the surrounding villages to identify pollution related diseases;
- Encouragement to residents in the nearby localities for self-employment ventures, such as by assisting them in arranging micro finances to develop them as artisans/ skilled personnel;
- Periodic training programs on health and sanitary education, women and child development, and income generation schemes;
- Participation in improving the existing medical and educational facilities of the area - for this purpose, it is suggested that the project owner provide funds for facilities improvement (providing toilets, furniture, additional space creation, any other needed) to the local hospitals and schools;

- Development of greenbelt/greenery or tree plantation in the nearby vacant government lands to build a green and clean environment in the surrounding areas and to reduce pollution impacts to some extent;
- Sponsoring fellowships to students in surrounding villages to encourage them to go for higher education;
- Construction of a hospital in Pasakha in collaboration with other industries to improve health status.

1.9.3. Post Project Monitoring Plan

To monitor the extent of environmental impact of the proposed project, it is advisable to periodically monitor the ambient environmental quality around the project location. This section describes the environmental quality monitoring detailing number and location of sampling stations, parameters to be monitored, frequency of sampling, etc. The project owner has to submit all the monitoring results to NEC, Bhutan.

Micrometeorology

The nearest meteorological station is located at Phuentsholing, around 15 km away from the proposed project site. Even though, the nearest meteorological station is located in close proximity, considering the hilly terrain of the region it is necessary to monitor the alteration of meteorological conditions in the area around project location. Thus, it is recommended to install a weather station for monitoring wind speed and direction, temperature, rainfall, and relative humidity within the dry port premises.

Air Quality

Air quality monitoring includes ambient air quality monitoring and truck exhaust emission monitoring. Four ambient air quality monitoring stations are recommended to be established at and around the dry port site depending on the predominant wind directions to assess the change in ambient air quality over the time. Out of these, one sampling place will be dry port location and rest three will be decided based on predominant wind direction. The project owner will also interact with NEC while deciding the exact monitoring locations.

The parameters to be monitored are SPM, PM₁₀, PM_{2.5}, SO₂, NO_x, and CO. The frequency of sampling is two days in a week of consecutive days, with 24 hours sampling. The project owner is also advised to carry out monitoring of truck exhaust emissions of SPM, SO₂, NO_x, and CO in regular intervals.

Noise Quality

It is proposed to measure noise at 10 locations day and night. Noise monitoring could be done once in 4 weeks. Portable noise meters could be used for the purpose.

Water Quality

Regular monitoring of the quality of raw and treated effluent should be carried out at the sewage treatment plant. This would indicate the efficiency of the STP in treating the wastewater and whether the treated effluent meets effluent discharge standards.

Water quality should be monitored once a month at upstream and downstream locations to the dry port in both the rivers.

Methods of analysis and parameters to be analysed would be according to standard methods. The following water quality parameters should be monitored:

- Temperature
- pH
- Turbidity
- Colour
- Odour
- BOD
- COD
- NH₃-N
- TKN
- Oil and grease
- Nitrates
- Acidity
- Phosphates
- Alkalinity
- Sulphates
- Heavy metals (Hg, Pb, Cd, As, Ni, Zn, Cu)

The parameters can be altered based on NEC Standards for surface waters. The parameters, which could be analyzed in the dry port laboratories should be analyzed there and the samples should be sent to other laboratories like NEC laboratory or any Research Laboratory for analyzing remaining parameters.

Parameters such as oil and grease, TSS, COD, BOD should be measured manually as per Standard Methods, whereas pH, residual chlorine, and temperature should be monitored with appropriate meters. The results of the monitoring should be sent to NEC regularly.

Flora and Fauna

During the primary ambient environmental quality monitoring around the project location, flora and fauna on the site and surrounding the project site has not been monitored to assess the flora and fauna before construction of the project. Thus, it is recommended to carry out a onetime assessment

of baseline flora and fauna surrounding the project location before completion of the project. There after terrestrial and aquatic flora and fauna should be monitored to observe any alteration in their species composition and replacement. This could be done in association with local universities and research institutions which carry out such studies frequently. Such monitoring would help in taking necessary steps at the appropriate stage to prevent further deterioration of the surrounding ecology and protect the flora-fauna. The frequency of sampling could be once in a year during post monsoon season (Oct to Dec).

In addition, the ESMC should collect studies on flora-fauna conducted by local universities and research institutions in the nearby areas.

1.9.4. EMP Cost Estimation

The cost of EMP implementation is provided in table below. The cost does not include the building required for setting up the laboratory. The costs are approximate and need calibration at the time of detailed BOQ preparation.

Table 33: Summary of cost estimation for implementing EMP

S. No	Activity/ Equipment	Cost (Ng)
1	Weather Station	65,000
2	Ear Muffs (100 Nos)	40,000
3	ETP construction	25,00,000
4	Solid waste bins (100 Nos)	10,000
5	Greenbelt along the boundary and plantation along the roads	10,00,000
6	High Volume Air Samplers (2 Nos)	3,00,000
7	Digital Sound Level meter	8,000
8	First time flora and fauna study	2,00,000
9	Analytical Laboratory (equipment for water quality and air quality analysis)	10,00,000
10	Manpower cost: This is recurring cost. <ul style="list-style-type: none"> • Assistant Director – Environment and Social, • Environmental scientist/ engineer, • Social Analyst, • part time occupational health specialist and a safety specialist, • One ETP Incharge • One Chemist • Three Plant Operators (one per shift) • Laboratory/Field Assistants • Air quality sampling assistants 	42,60,000 per year
	TOTAL EMP COST (Capital Expenditure + 1 year manpower) excluding building cost	93,83,000

	Funds to be proposed for community development activities	50,00,000
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In the above costs the laboratory building, office space for environmental and social cell and staff costs are not included.

1.10. Roles and Responsibilities

It is recommended that the DoT should set up a Project Implementation Unit (PIU) to implement and manage the project and to address environmental and social management concerns.

The Project Implementation Unit (PIU) of DoT should be responsible for the following major activities:

- Executing agency with overall responsibility for project construction and operation
- Ensure that sufficient funds are available to adequately implement the EMP
- Ensure that Project, regardless of financing source, complies with the provisions of the EMP and *WB Op's and EHS guidelines*
- Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP.
- Ensure that contractor follows EHS requirements and EMP
- Ensure that Project implementation complies with RGOB/WB environmental policies and regulations
- 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 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.
- Ensure that bidding and contract documents include the EMP. Submit semi-annual monitoring reports on EMP implementation to WB and identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to WB.
- 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 DoT;
- Ensure that EMP provisions are strictly implemented during various project phases (design/pre-construction, construction and operation) to mitigate environmental impacts to acceptable levels;
- Ensure that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs;

- Ensure that necessary environmental clearances and approval(s) from NEC prior to award of civil works contracts;
- Ensure that the Resettlement Plan is implemented prior to the start of the construction work
- Ensure monitoring of the implementation of the EMP (mitigation and monitoring measures);

DoT should be responsible for overall development and operation of the project. It should ensure that EMP is implemented during port construction and operations phases.

1.11. Environmental and Social Cell

It is recommended that the DoT should set up an ESMC (Environmental and Social Management Cell) to address environmental and social management concerns. The cell should be constituted by qualified persons who will be responsible for regular environmental quality monitoring, proper functioning of ETP, implementation of community development plan, and liaison with regulatory bodies such as NEC.

The ESMC will be responsible for the following:

- to implement the EHS policy of dry port
- to ensure that ETP function properly and meet effluent discharge standards
- to maintain environmental quality analysis laboratory and analyze air, noise, and water samples on a regular basis
- to implement community development plan
- to regularly check workers health and safety and take appropriate steps
- to monitor safety conditions at various work environments and take necessary steps to maintain high safety standards.
- to deal with emergency situations.
- to liaison with regulatory bodies
- to ensure systematic and routine housekeeping of the dry port
- to maintain the proposed greenbelt along the boundary
- to carry out outreach programs in the surrounding villages to create awareness of health impacts of environmental pollution and noise

Laboratory and Equipment:

One analytical laboratory will be set up to carry out the monitoring and analysis as mentioned above. In addition to the instruments required for collection of samples, the laboratory will be equipped with the following:

- Single pan balance
- pH meter
- Conductivity meter
- Dissolved oxygen meter
- Incubator
- Flame photometer

- UV/Visible spectrophotometer
- Atomic absorption spectrophotometer
- Any other necessary equipment

For air and noise sampling, two air quality samplers, one noise meter to be acquired. A grab sample is required to take bottom water sample from the River whenever required.

The ESMC may be headed by an Assistant Director – Environment and Social, who should be a senior person, should have an overall knowledge of ETP and its maintenance, environmental laws and standards, and should be able to independently manage the Cell. The ESMC in-charge may be supported by Environmental scientist/ engineer and a Social Analyst. The scientist will be responsible for environmental quality analysis and should be capable of preparing reports and data sheets. He/she should have sufficient knowledge in sampling and analysis of environmental parameters. The social analyst should have knowledge of community programs and should be able to plan and implement community programs. In addition a part time occupational health specialist and a safety specialist can be appointed.

In addition the following staff at laboratory are required:

- One ETP/Laboratory In-charge
- One Chemist
- Three Plant Operators (one per shift)
- Laboratory/Field Assistants
- Air quality sampling assistants (two consecutive days each day 24 hours at each location, 4 locations)

In order to minimize adverse impacts during different phases of project lifecycle, the summary of mitigation measures, monitoring plan and responsibilities for its implementation are given in Table below.

Table 34: Environmental Management & Monitoring Plan for Dry port

Impacts/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Reporting Requirements
Design of Dry Port	Pre-construction	<ul style="list-style-type: none"> Dry Port development should follow design and built modality. Detail design should refer and comply with Bhutan Building Rules (BBR) 2002 for structural analysis. BBR requires any proposed building or structure to comply with following IS code: <ol style="list-style-type: none"> IS 1893-1894 -Criteria for earthquake resistant design of structures IS 875 –1987: Code of practice for Design loads (other than earthquake) IS 4326 – Earthquake resistant design & construction of building IS 13920 –1993: Ductile detailing of concrete structures subjected to seismic forces IS 4326 – Earthquake resistant design & construction of building EMP should be made integral part of the bidding and contract document. Environmental Mitigation measures should be itemized and put in the Bill of Quantities (BOQ). Grievance Redress Committee should be formed prior to the start of civil works 	Contractor/ PIU	Check detailed design and implementation of mitigation measures	Check detailed design, GRM,BOQ and contractual documents	PIU	-
Contamination of the dredged soil	Pre-construction	<ul style="list-style-type: none"> Prior to initiation of dredging activities, soil should be evaluated for the physical, chemical, biological, and engineering properties In case the dredging is carried out at river bed, excavation and dredging methods should be selected to minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy 	Contractor	Prior to the commencement of dredging the contractor should test the soil on the following parameters:	Before the start of dredging and every month till the end of dredging period	Contractor	Test results/ progress reports

		<p>of the operation, and maintain the density of the dredge material,</p> <ul style="list-style-type: none"> • Areas sensitive for marine life such as feeding, breeding, calving, and spawning areas should be prohibited for dredging • Use techniques (e.g. silt curtains), to minimize adverse impacts on aquatic life from the re-suspension of sediments; • Inspection and monitoring of dredging activities should be conducted to evaluate the effectiveness of impact prevention strategies, and re-adjusted where necessary. • The dredged material should not be disposal randomly • The soil used for landfilling should have similar characteristics to the native soil and free of any type of contamination; • Maintain the extent of the turbidity plumes close to the dredging and disposal areas to minimize impacts on marine fauna habitat; • Visually inspect for any marine life and terrestrial organisms and stop dredging activity in case of any organism in the vicinity; • Monitoring should be done continuously during dredging to observe impacts on the marine life and in case of visible impacts, stop the dredging activity; • Dredging should be carried out during day time to minimize impacts on marine life. 		<ol style="list-style-type: none"> 1. Volatile Organic Compounds (USEPA 8260) 2. Semi-Volatile Organic Compounds (USEPA 8270) 3. 13 priority heavy metals; 4. Total Petroleum Hydrocarbons (C6-C36); 5. Poly Aromatic Hydrocarbons (PAH) <p>The analytical reports shall be compared with Canadian Soil Standards-2014 or Dutch Intervention Values-2009 or USEPA Regional 9 standards for Industrial Soil. All the tested parameters should comply within the respective standards to be declared as free from contamination.</p>			
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<ul style="list-style-type: none"> • Soil erosion and contamination issues • Soil Compaction 	Construction	<ul style="list-style-type: none"> • Stripping of topsoil should be scheduled as the last mile activity (maintain vegetation cover for as long as possible) in order to prevent the erosion (wind and water) of soil. Care should be taken to minimize percolation of soil used for filling to adjacent rivers during filling operations. • Vegetation should be planned and maintained for slope stabilization and to prevent soil erosion after construction period; • The disturbed areas and soil stock piles should be maintained moist to avoid wind erosion of soil; • The routes for movement of heavy machinery should be designated to avoid the soil compaction in other areas; and • Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages; designate routes for bringing construction material and outside soil. • Construction contractor should designate the sites to be used for disposal of hazardous wastes including waste oils, solvents, paint and batteries. The Contractor should ensure that no unauthorized dumping of hazardous waste is undertaken from the site; Fuel and other hazardous substances should be stored in areas provided with roof, impervious flooring and bund/containment wall 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping • Training records; 	At the start of construction and Monthly till the end of construction period	PIU	Monthly Progress Report
<ul style="list-style-type: none"> • Generation of solid and hazardous waste • Generation of construction debris and domestic waste 	Construction / Operation /	<ul style="list-style-type: none"> • Prohibit and apply zero-tolerance towards leaks, spills and seeps (of fuel, oil, lubricants, grease, bitumen and other hazardous materials) from various sources such as: vehicles, heavy equipment, at break-down maintenance site along roadside, at parking bays, storage and handling sites etc. Adopt appropriate mitigation strategies. • Contaminated sites should be immediately attended and cleaned off by scraping off entire contaminated soil layer and disposing it off with hazardous waste generated from site; 	Contractor	<ul style="list-style-type: none"> • Site Inspection; • Record Keeping • Training records; • Visual Assessment 	Monthly	PIU	Monthly Progress Report

		<ul style="list-style-type: none"> • Construction site should be maintained free of wastes, excavation debris, concrete waste, wood, litter, plastics and metal scraps by periodically collecting, segregating, storing, transporting and disposing them appropriately; • All non-hazardous wastes (such as excavation debris, concrete waste, wood, litter, plastics and metal scraps) should be segregated at source, recycled and reused to the extent possible; • Hazardous wastes (such as used fuel oil/paint/chemical containers, waste oil, lubricants, oil rags, contaminated soil, used batteries etc) should be segregated at source and stored in secure and leak proof containers with secondary containment before transporting and disposing them through authorized waste management agencies as per the Hazardous Rules of RGoB to prevent soil and water contamination; • Monitor and inspect waste management procedures adopted through the entire waste chain from source to disposal point for both hazardous and non-hazardous waste categories at least once in a week; • Undertake training on waste management procedures and related regulations during inception of construction phase to contractor staff • Burning of construction and domestic wastes should be prohibited. • 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 should be prohibited; • STP should be installed for sewage treatment 					
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<p>Impact in water Environment and Hydrology</p>	<p>Construction / operation/</p>	<ul style="list-style-type: none"> • In this kind of steep terrain conditions with high water velocities and periodical experience of erosion and deposition the objective of any mitigation solution shall result in reducing the both surface and sub-surface (Seepage) velocity potential. This objective can be achieved by providing multiple cut-off walls at different locations along the river course for a depth of 5m below the bed level extending sufficient distance into the banks to ensure no vertex occurs where the cut-off wall meets the banks and results in bank erosion. In the present case, the cut-off walls are needed on the upstream side of the land to the downstream up to the confluence of two rivers. Apart from providing subsurface cut-off walls it is ideal to carry out pressure grouting in the bed near the retaining walls for a width of 10m to ensure cementation of the boulders for a minimum depth of 3m. The pressure grouting shall be carried out in a lean period. The exact depth of cement grouting shall be based on detailed bed investigation. This pressure grouting of the bed coupled with cut-off walls provides non-scouring, non-erosion environment for the construction of foundations either across the river course or for the river training retaining structures. • As the site is prone to flooding during monsoon, it is proposed to construct a retaining wall of 4m height along the periphery of the site facing the river bed. Further, it is suggested to raise the site level by filling of earth upto 3.5 meters for the entire site area which would prevent flood waters entering the site and inundating the site area during monsoon and also will contribute in reducing the slope ratio of approaching road to the facility. 	<p>Contactor</p>	<ul style="list-style-type: none"> • Site Inspection; • Record Keeping; • Visual Assessment 	<p>Monthly</p>	<p>PIU</p>	<p>Monthly Progress Report</p>
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		<ul style="list-style-type: none"> • Contractor should ensure the proper disposal of hazardous and other waste. Hazardous waste such as oil and lubricants should be properly stored and sent for recycling. Solid municipal waste should be disposed off in a sanitary landfill. • Optimum use of water during sprinkling on roads for dust settlement, washing of vehicles, concrete mixing for foundation etc. • Adequate provision of safe drinking water for the construction workers at camps and project site with a provision of monthly monitoring of water quality; • Provision of septic tanks and with soak pits for collection of sanitary wastewater at all labour camps; • Installation of STP during operation phase; • Avoid land preparation activities during monsoon season as far as possible to avoid surface runoff of loosely bound soil. • Ensure proper cover of loose construction material at construction site to prevent surface runoff and contamination of receiving water body, the drainage present close to the site; • Further the following water conservation measures should also be adopted by the project activity: <ul style="list-style-type: none"> ○ Construction labour should be trained for optimal use of water; ○ Optimum use of water during sprinkling on roads for dust settlement, washing of vehicles, concrete mixing for foundation etc ○ Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers, camp area. 					
Impact on air quality	Construction / operation/	<ul style="list-style-type: none"> • Construction of barricades between the settlements and the site to minimize travel of fugitive emissions towards settlements; 	Contractor	<ul style="list-style-type: none"> • Site Inspection; • Record Keeping; 	Monthly	PIU	Monthly Progress Report

		<ul style="list-style-type: none"> • Tree Plantation on the either side of the approach road to mitigate the fugitive dust emissions • Minimizing stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities; • Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road should be established and agreed with the PIU; • Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray. • Proper maintenance of engines and use of vehicles; and • Prevent idling of vehicles and equipment. 		<ul style="list-style-type: none"> • Visual Assessment 			
Impact on Noise	Construction/operation/	<ul style="list-style-type: none"> • PIU should make sure that contractor employs vehicles and equipment which meet the noise standards as prescribed by NEC. Before deploying the equipment, noise levels should be measured and recorded; • Construction of barricades between the settlements and the site to minimize travel of fugitive emissions towards settlements; • Tree Plantation on the either side of the approach road to mitigate the fugitive dust emissions • Minimizing stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities; • Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road should be established and agreed with the PIU; • Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray; • Proper maintenance of engines and use of vehicles; and • Prevent idling of vehicles and equipment. 	Contractor, and sub-contractors	<ul style="list-style-type: none"> • Site Inspection; • Record Keeping • Training records; • Visual Assessment • Monitoring 	Monthly	PIU	Quarterly Progress Report
Setting up of construction camps/ labour camps	Construction	<ul style="list-style-type: none"> • The construction camps should be at least 500 m distance from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. 	Contractor, and sub-contractors	<ul style="list-style-type: none"> • Site Inspection; 	Monthly	PIU	Quarterly Progress Report

		<ul style="list-style-type: none"> • Location for stockyards for construction materials will be identified at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer • All sites used for camps will be adequately drained. There should not be any risk of periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water • The camps will be located such that the drainage from and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis. • The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. • Clean potable drinking water facility should be provided at the site and the water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed • First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2 % alcoholic solution of iodine, bottle containing volatile, snakebite lancet, 		<ul style="list-style-type: none"> • Record Keeping • Training records; • Visual Assessment • Monitoring 			
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		<p>bottle of potassium permanganate crystals, scissors, Ointment for burns & surgical antiseptic solution</p> <ul style="list-style-type: none"> • 1 first aid box should be available for every 50 labour • A person trained in first-aid treatment should be made in charge who will always be readily available during emergency • A suitable motor transport shall be kept readily available to carry injured or ill person to the nearest hospital. 					
Occupational Health and Safety Impacts	Construction	<ul style="list-style-type: none"> • The project owner should ensure that the contractor (make part of contractors contract) to have and occupational health and safety plan. The contractor should provide for all the workers accidental insurance and medical insurance. • The contractor should conduct daily tool box meeting for all workers to discuss potential work related hazards and other safety aspects. • The contractor should conduct training for all workers on safety and environmental hygiene at no cost to the employees. • The contractor should maintain first aid facilities for the workers and should instruct and induct all workers in health and safety matters (induction course) including construction camp rules and site agents/foremen should follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site should include safety and environmental hygiene. • Fencing on all areas of excavation greater than 1m deep and sides of temporary works should be observed. • Workers should 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. 	PIU/ Contractor	<ul style="list-style-type: none"> • Site Inspection; • Training records; • Minutes of community meetings; • Visual Assessment 	Monthly	PIU	Monthly Progress Report

		<ul style="list-style-type: none"> • Reversing signals (visual and audible) should be installed on all construction vehicles and plant. • Contractor should at all-time keep the first aid kit at the construction sites. • Contractor should be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses • Pertinent H&S trainings should be provided to all the workers with respect to hazards linked to the activities. Additionally, the workers should be informed of precautions to be taken to avoid nuisance to the local community; • Monitoring of the PPE usage can be strengthened, in that, a mechanism can be adopted whereby defaulters receive a warning on non-usage and stringent actions can be taken on subsequent offences; • Maintain H&S records of occupational H&S incidents, accidents, diseases and dangerous occurrences • Ensure that PPE is available at all times at site; • In event of accidents, the contractor should be responsible for immediate evacuation of injured person to the nearest medical center. The contractor should bear medical and other expenses of the injured person. • Undertake daily tool box talk and proper training of the workers regarding health and safety procedures related to solar projects, PPE usage, and regulatory provisions; • While engaging with contractors in the future, H&S standards of labour camps and disposal of waste should be considered. Additionally, the team can conduct random spot checks to determine any issues related to improper waste disposal or the living conditions in these camps (i.e. presence of secure shelter and flooring, number of persons per room, number of toilets for the manpower, water availability etc.); • Additionally a “Code of Conduct” can be instituted for the operational phase that takes into account (a) health & safety aspects; (b) restrictions on activities – 					
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		<p>Dos and Don'ts; (c) labour camp regulations; (d) zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting which should be shared with all contractors for induction of their employees/supervisors/workers;</p> <ul style="list-style-type: none"> • Training should be provided to all the transport workers on road safety, particularly, the safety precautions to be undertaken while driving through busy village roads; • strong protocols should be built as part of contractual obligations around zero tolerance of child labour or harassment of women workers and even health and safety aspects. These should also be monitored by supervision and monitoring team. 					
<ul style="list-style-type: none"> • Community Health and Safety and Sanitation and Vectors 	Construction	<ul style="list-style-type: none"> • Construction activities should be timed, and provision for safe passage of school children and elderly should be made. • Excavated trenches/ditches and freshly cut steep side slopes should be clearly marked and fenced for the safety of passersby and workers alike. Project or construction vehicles should be briefed on speed limit within sensitive areas such as schools, commercial and residential areas. • The community must be informed of the type of activities being undertaken for the project and the health and safety measures that can be undertaken by them as a precautionary measure. Additionally, the emergency response plan must also be communicated to the villages in the vicinity; • Linkage of Communication, Disclosure and Grievance Redressal Mechanism should also cover labourers so that any concerns on working conditions and/or contractor mal-practices can be managed. • A screening of workers as well as health awareness training can be conducted to prevent unsanitary 	Contractor	<ul style="list-style-type: none"> • Site Inspection; • Necessary Certificates for Licenses; • Training records; • Visual Assessment 	Monthly	PIU	Monthly Progress Report

		<p>conditions and spread of communicable diseases and a follow-up can also be carried out;</p> <ul style="list-style-type: none"> • Monitor contractors for compliance on labour laws as well as PS2 • Linkage of Communication, Disclosure and Grievance Redressal Mechanism to also cover labourers so that any concerns on working conditions and/or contractor mal-practices can be managed; • Provide an induction to the workforce to sensitize them towards the cultural norms of the local community; • Provide recreational activities can also be provided to the workers on their days off to limit their interaction with the local community; • Standing water should not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes. • 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 should be implemented in line with social plans for the project. • HIV/AIDS awareness and prevention program should be implemented in line with social plans under the Project • Refer to the IFC Handbook on Accommodation and Labour Camps as Guidance; • All key contractors should have '<i>certificate of registration in place</i>' for the engagement of migrant workers through sub-contractors. 					
Public Safety	Construction	<ul style="list-style-type: none"> • Informed the community about the type of activities being undertaken for the project and the health and safety measures that can be undertaken by them as a precautionary measure. Additionally, the emergency 	Contractor	<ul style="list-style-type: none"> • Visual Assessment • Record Keeping 	Weekly	PIU	Monthly Report

		<p>response plan must also be communicated to the villages in the vicinity;</p> <ul style="list-style-type: none"> • Install barriers (e.g., temporary fence) at construction areas to deter pedestrian access to the roadway except at designated crossing points. • The general public/local residents should 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. • Speed restrictions should be imposed on Project vehicles and equipment when traveling within 50 m of sensitive receptors (e.g. residential, schools, temples, etc.). • Upon completion of construction works, borrow areas should be backfilled (if suitable materials are available, e.g., excavation spoils) or fenced. • Linkage of Communication, Disclosure and Grievance Redressal Mechanism should also cover labourers so that any concerns on working conditions and/or contractor mal-practices can be managed. 					
Direct and induced employment opportunities	Operation	<ul style="list-style-type: none"> • Providing additional preference to the local labour, sub-contractors or suppliers to pass on maximum economic benefit locally; • Providing preference to those households that may have sold their land for the project or the vulnerable population in the project area; • Encouraging sub-contractors to employ unskilled labour locally 	Contractors	Employee records	Quarterly	PIU	Records of local employees
Handling of cargo	Operation	<p>Cargo storage and handling activities should be designed to minimize impacts:</p> <ul style="list-style-type: none"> • Storing pulverized coal and pet-coke in silos • Installing dust suppression mechanisms (e.g. water spray or covered storage areas) • Using telescoping chutes to eliminate the need for slingers 	Contractor	Site inspection, visual assessment	Quarterly	PIU	-

		<ul style="list-style-type: none"> • Using vacuum collectors at dust-generating activities • Using slurry transport, pneumatic or continuous screw conveyors, and covering other types of conveyors • Minimizing free fall of materials • Minimizing dry cargo pile heights and containing piles with perimeter walls • Removing materials from the bottom of piles to minimize dust re-suspension • Ensuring hatches are covered when material handling is not being conducted • Covering transport vehicles • Regularly sweeping docks and handling areas, truck / rail storage areas, and paved roadway surfaces • Do not dispose unauthorized waste into the surface water bodies • Always provide secondary containment during cargo and other hazardous material storage • Limit the stack pile height to minimize fugitive emissions, leakages and spillages • Workers handling cargo should use appropriate PPEs • In case of spillages/ leakages follow appropriate measures as provided in section 4.8 					
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Table 35: Environmental Management & Monitoring Plan for construction of Access Road and Retaining wall

Impacts/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Reporting Requirements
EMP for offsite Structures (Approach Road and construction of retaining wall)							
Removal of vegetation	Construction	<ul style="list-style-type: none"> When clearing the site for the construction of boundary wall, care shall be taken to keep vegetation clearing at a minimum and only from the RoW Removal of as little vegetation as possible during the development and re-vegetation of bare areas after the project. 	Contractor	Visual assessment	-	-	-
Resettlement & Rehabilitation	Pre-construction	<ul style="list-style-type: none"> Affected HHs identified as per SIA should be given compensation and should be relocated as per RAP prior commencement of construction activity 	DoT	-	-	-	-
<ul style="list-style-type: none"> Soil erosion and contamination issues Soil Compaction 	Construction	<ul style="list-style-type: none"> Stripping of topsoil should be scheduled as the last mile activity; Vegetation should be planned and maintained for slope stabilization and to prevent soil erosion after construction period; The disturbed areas and soil stock piles should be maintained moist to avoid wind erosion of soil; The routes for movement of heavy machinery should be designated to avoid the soil compaction in other areas; Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages; designate routes for bringing construction material and outside soil; Fuel and other hazardous substances should be stored in areas provided with roof, impervious flooring and bund/ containment wall to protect these 	Contractor	<ul style="list-style-type: none"> Record Keeping; Site inspection; Visual Assessment 	Bi-monthly	PIU	Monthly Report

<ul style="list-style-type: none"> • Generation of solid and hazardous waste • Generation of construction debris and domestic waste 	<p>Construction</p>	<p>from the elements and to readily contain spilled fuel/lubricant.</p> <ul style="list-style-type: none"> • Prohibit and apply zero-tolerance towards leaks, spills and seeps (of fuel, oil, lubricants, grease, bitumen and other hazardous materials) from various sources such as: vehicles, heavy equipment, at break-down maintenance site along roadside etc. Adopt appropriate mitigation strategies; • Contaminated sites should be immediately attended and cleaned off by scraping off entire contaminated soil layer and disposing it off with hazardous waste generated from site; • Access road and retaining wall site should be maintained free of wastes, excavation debris, concrete waste, and metal scraps by periodically collecting, segregating, storing, transporting and disposing them appropriately; • All non-hazardous wastes (such as excavation debris, concrete waste, and metal scraps) should be segregated at source, recycled and reused to the extent possible; • Hazardous wastes (such as used fuel oil/paint/chemical containers, waste oil, lubricants, oil rags, contaminated soil, used batteries etc) should be segregated at source and stored in secure and leak proof containers with secondary containment before transporting and disposing them through authorized waste management agencies as per the Hazardous Rules of RGoB to prevent soil and water contamination; • Monitor and inspect waste management procedures adopted through the entire waste chain from source to disposal point for both hazardous and non-hazardous waste categories at least once in a week; 	<p>Contractor</p>	<ul style="list-style-type: none"> • Site Inspection; • Record Keeping; • Training records; Visual Assessment 	<p>Bi-monthly</p>	<p>PIU</p>	<p>Monthly Report</p>
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		<ul style="list-style-type: none"> Undertake training on waste management procedures and related regulations during inception of construction phase to contractor staff Burning of construction wastes should be prohibited. 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 should be prohibited; STP should be installed for sewage treatment 					
Dust Generation	Construction	<ul style="list-style-type: none"> Vehicles delivering materials should be covered with tarpaulin to reduce spills and dust blowing off the load. Compaction of prepared site to re-strain the fugitive emissions. Water should be sprayed in the cement and earth mixing sites as well as after compaction. In high dust areas, workers should be provided and encouraged to use masks. Regular maintenance, servicing of the vehicles and periodic emission check for equipment and machinery should be carried out. Water will be sprayed on the haul road. All the vehicles entering the project site will be checked for Pollution-Under-Control Certificates. Air quality monitoring to be carried out during construction phase to check the pollutants level in the air 	Contractor	<ul style="list-style-type: none"> Visual inspection 	Daily	PIU	Monthly Report
Procurement & Setting up of Crushers, Hot-mix plants, other Vehicles, Equipment and Machinery	Construction	<ul style="list-style-type: none"> Specifications of crushers, hot mix plants and batching plants, other Construction Vehicles, Equipment and Machinery to be procured should comply to the NEC Standards/ norms Hot mix plants, crushers and batching plants shall be located at distance of approx 1 km from nearest 	Contractor	<ul style="list-style-type: none"> Record Keeping; Site inspection; Visual Assessment 	Bi-monthly	PIU	Monthly Report

		<p>habitation, archaeological site, sensitive areas, forests etc.</p> <ul style="list-style-type: none"> • Adequate stack height and emission control devices such as bag house filters, cyclone separators, water scrubbers etc., should be attached • Impervious platform for storage of bituminous and other liquid hazardous chemical • Pollution control measures for Diesel Generator (DG) set i.e. stack height (calculated by $H = h + 0.2 * \sqrt{kVA}$ where h = height of building where generator set is installed and kVA is total generator capacity), acoustic enclosure etc. should be ensured • Proper lighting arrangement shall be made around plant site if the plants are operated during dark hours. • Provision of readily available first aid kit, fire-fighting equipments at the plant site at appropriate location to respond in case of accident. • Periodical monitoring of air quality and noise levels as per conditions stipulated under the statutory clearance from NEC. Whenever the emission exceeds the permissible level the plants should be stopped and necessary repairing works of faults should be done to bring down the emission levels 					
Loss of water bodies/ surface / ground	Construction	<p>During retaining wall construction, no excavation from the bund of the water bodies.</p> <ul style="list-style-type: none"> • No earth will be excavated for development of any off-site facility • No debris disposal near any water body. • Construction labours to be restricted from polluting the source or misusing the source. • Labour camps will be located away from water bodies. 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping 	Bi-monthly	PIU	-
Drainage and runoff	Construction	<ul style="list-style-type: none"> • The Contractor will always clear all the cross drainage structures and natural drainage before onset of monsoon in order to keep all drainage unblocked 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; 	Bi-monthly	PIU	-

		<p>Earth, stones, wastes and spoils will be properly disposed off, to avoid blockage of any drainage channel.</p> <ul style="list-style-type: none"> • All necessary precautions will be taken to construct temporary or permanent devices to prevent inundation • 		<ul style="list-style-type: none"> • Visual Assessment 			
Accidents	Construction	<ul style="list-style-type: none"> • Safety officer should be appointed at site to ensure all the safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented. • Barricade should be done during construction work to avoid accidents 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping 	Bi-monthly	PIU	Monthly Report
Clearing of Construction of Camps & Restoration	Construction	<ul style="list-style-type: none"> • Contractors shall prepare site restoration plans. The plans shall be implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy. 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping • Training records; 	Bi-monthly	PIU	-
Occupational Health & Safety Plan	Construction	<ul style="list-style-type: none"> • All construction worker should wear PPEs including safety jacket, helmet, gloves, gum boots, ear plugs, mask while working at the site • Workers should be made aware about the health issues related with open defecation • Training to workers should be provided for handling the construction equipment and machinery • Training to the workers should be provided to handle the emergency situations like fire, floods etc. 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping • Training records; 	Bi-monthly	PIU	Monthly Report

		<ul style="list-style-type: none"> • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp • Cautionary signage and notice should be during construction works. A security guard should be deputed in these areas and entry should be restricted 					
Impact on Noise	Construction	<ul style="list-style-type: none"> • PIU should make sure that contractor employs vehicles and equipment which meet the noise standards as prescribed by NEC. Before deploying the equipment, noise levels should be measured and recorded; • Construction of barricades between the settlements and the site to minimize travel of fugitive emissions towards settlements; • Tree Plantation on the either side of the approach road to mitigate the fugitive dust emissions • Minimizing stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities; • Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road should be established and agreed with the PIU; • Cease or phase-down work if excess fugitive dust is observed, investigate source and take suppression measures such as water spray; • Proper maintenance of engines and use of vehicles; and • Prevent idling of vehicles and equipment. 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping 	Bi-monthly	PIU	Monthly Report
Disaster Management	Construction	<ul style="list-style-type: none"> • Provision of first aid kit at the site all the time • Tie-ups with local hospital should be made to handle emergency case, if any • Availability of safety officers and supervisors at all the time on the site • Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone • Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, 	Contractor	<ul style="list-style-type: none"> • Record Keeping; • Site inspection; • Visual Assessment and Record Keeping 	Monthly	PIU	Monthly Report

		heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures					
		<ul style="list-style-type: none"> Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room 					

Table 36:Environmental Management & Monitoring Plan for Electrical supply system

Impact	Mitigation Measures	Location	Implementation of Mitigation Measures	Monitoring & Supervision
Fixing the alignment	<ul style="list-style-type: none"> Alignment should not pass through residential areas Transmission line should not disrupt any aquatic habitat Riparian vegetation should not removed for construction of the tower, alignment should be shifted, if required 	RoW	Contractor	PIU/ DoT
Soil Erosion and Sedimentation control	<ul style="list-style-type: none"> Contractor should plan the activities so that no naked / loose earth surface is left out before the onset of monsoon. Soil excavated for construction of tower should be filled back to same To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. 	Throughout Project Corridor, Service roads and equipment storage sites, etc.	Contractor	PIU/ DoT
Material sources	<ul style="list-style-type: none"> Adequate safety precautions shall be ensured during transportation of quarry material from quarries to the construction site. Vehicles transporting the material shall be covered to prevent spillage. 	Nearest Source Station	Contractor	PIU/ DoT
Disposal of Debris	<ul style="list-style-type: none"> Waste from construction camp should be segregated at site and disposed to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area Dustbins should be provided at the site and construction camps to prevent littering of waste 	Identified debris disposal location during preconstruction phase	Contractor	PIU/ DoT

	<ul style="list-style-type: none"> • Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold through authorized dealers and reject waste should be sent to the identified debris disposal site • All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. 			
Dust Generation	<ul style="list-style-type: none"> • Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. • Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of NEC • The Contractor will submit PUC certificates for all vehicles/ equipment/ machinery used for the project. Monitoring results will also be submitted to PMC/PIU through the 'Engineer'. • Air quality monitoring to be carried out during construction phase to check the pollutants level in the air 	Throughout Project Corridor, all access roads, temporarily acquired sites.	Contractor	PIU/ DoT
Contamination of water	<ul style="list-style-type: none"> • Construction close to water bodies shall be avoided • Car washing / workshops near water bodies will be avoided. 	Throughout Project Corridor and at all locations of water bodies	Contractor	PIU/ DoT

Noise from Vehicles, Plants and Equipment	<ul style="list-style-type: none"> All vehicles and equipment used in construction will be fitted with exhaust silencers. Noise standard at processing sites, should be strictly monitored to prevent exceeding of noise standards. Workers in vicinity of loud noise, shall wear earplugs and working time should be limited as a safety measure. Job rotations should also be carried out to prevent continuous exposure Construction activities to be taken up during day time only Servicing of all construction vehicles and machinery should be done for exhaust silences and should be checked and if found defective should be replaced. No noisy construction activities should be permitted around educational institutions/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. Monitoring shall be carried out at the construction sites Environmental Expert will be required to inspect regularly to ensure the compliance of EMP. 	Throughout Project Corridor and at all construction sites, hot mix plant etc.	Contractor	PIU/ DoT
Compaction of vegetation	<ul style="list-style-type: none"> Construction vehicles, machinery and equipment will move or be stationed in the designated area only (RoW or CoI, as applicable), to prevent compaction of vegetation outside the RoW. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses will be avoided. 	Throughout Project Corridor	Contractor	PIU/ DoT
Loss, damage or disruption to fauna	<ul style="list-style-type: none"> Construction workers will be directed not to disrupt or damage the fauna. Construction vehicles will run along specified access to avoid accidents to cattle. 	Throughout Project Corridor	Contractor	PIU/ DoT

<p>Accidents</p>	<ul style="list-style-type: none"> • Safety officer should be appointed at site to ensure all the safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented. 		<p>Contractor</p>	<p>PIU/ DoT</p>
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1.11.1. Reporting

The environmental monitoring reports should 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 should be submitted to WB semi-annually during the construction period and annually for two years after completion of construction.

1.12. Conclusions and Recommendations

The screening and scoping report highlights the impacts from the Dry port construction and operation phases. Overall the impacts from both construction and operation phase have limited adverse social and/or environmental impacts, and it can be readily addressed through mitigation measures as provided in EMP. The current EMP will be reviewed by contractor of Dry port prior to construction and by DoT, prior to operational phase. The major activities carried out at the Dry port will be customs clearance, loading and unloading of cargo, temporary storage of cargo. Additional facilities will also be provided such as driver's restroom, toilets, staff quarters, canteen etc.

The establishment of the dry port is expected to minimize processes in Kolkata as the goods destined for Bhutan will use through bills of lading with the dry port serving as the port of destination. The Dry Port is expected to:

- Speed up the clearance of goods;
- Reduce congestion in Phuentsholing;
- Reduce negative environmental and social impacts;
- Improve asset utilization especially of the road transport service providers;
- Become a pole of attraction for value added industries and new industrial development;
- Improve land use planning and management in the town of Phuentsholing.

It is anticipated that majority of the impacts are only during the construction phases of the Project, and during operation phase of the Project, there will be limited environment, health & safety and social impact. The cumulative beneficial impacts are higher for the entire region.