PROJECT NAME : PREPARATION OF DETAILED PROJECT REPORT (DPR) FOR ROADS IN (MEGHALAYA WEST) UNDER MEGHALAYA INTEGRATED TRANSPORT PROJECT(MITP)

ROAD NAME : PARALLEL ROAD TO EXISTING DALU BAGHMARA ROAD

ENVIRONMENTAL ASSESMENT REPORT

ALL PURPOSE STRUCTURES

Consultant :

APS CORPORATIONS PVT. LTD.

House No. 2, Kamalakanta Bhattachargee Path

Hatigaon Chariali, Guwahati - 781038

PUBLIC WORKS DEPARTMENT
GOVERNMENT OF MEGHALAYA

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DRAFT ENVIRONMETAL REPORT

Date of Release: 06.01.2020
Prepared: BK
Checked:BK/CB
Approved:BPS

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LIST OF ABBREVIATIONS

CPCB	-	Central Pollution Control Board
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Monitoring Plan
ESZ	-	Eco-Sensitive Zone
GoI	-	Government of India
IFC	-	International Finance Corporation
IRC	-	Indian Road Congress
MDR	-	Major District Road
MoEF&CC	-	Ministry of Environment and Forests & Climate Change
MoRT&H	-	Ministry of Road Transport and Highways
MPWD	-	Meghalaya Public Works Department
NBWL	-	National Board for Wildlife
NGO	-	Non-government Organization
NH	-	National Highway
OP	-	Operational Policy
PAF	-	Project Affected Person
PMGSY	-	Pardhan Mantri Gram Sadak Yojana
RF	-	Reserve Forest
ROW	-	Right of Way
SPCB	-	State Pollution Control Board
TOR	-	Terms of Reference

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EXECUTIVE SUMMARY

1. The Government of India thus, on behalf of Government of Meghalaya has applied for financing an amount of US$ 82 Million equivalent from the World Bank for *MEGHALAYA Integrated transport project*, **MITP Phase - I Roads**. Up-gradation of 266.82 km road length will be carried out in Phase-I. The Department of Economic Affairs (DEA) and The World Bank (WB) has accorded in principle approval of Tranche-I of MITP for US$ 110 million (loan assistance of US$ 82 million and State Share of US$ 28 million), under which State Road Network roads measuring 128 km length will be upgraded along with certain other institutional development activities. There are total 10 road sections selected under Phase-I, 5 road sections in East Meghalaya and 5 road sections in West Meghalaya. The Government of India thus, on behalf of Government of Meghalaya has applied for financing an amount of US$ 110 Million equivalent from the World Bank for MEGHALAYA Integrated transport project,.

2. The Meghalaya PWD is in the process of preparing DPR (Detailed Project Road) for about 140 km (Stage -1) in West Meghalaya as part of whole MITP (see table below). The main objective of the proposed consultancy assignment is to carry out the DPR for Construction of major district roads in West Meghalaya State under Phase-I of MITP. The Consultancy service for preparation of Detailed Project Report have been entrusted to M/s APS Corporation Pvt. Ltd., Meghalaya, for total design length of 139.668 km of major road sections listed in below Table.

Sl. No	Name of Road	Total Length in Km
1	Bajengdoba Resu Mendipathar Damra Road	35.860
2	Agia Medhipara Phulbari Tura (AMPT) Road (1st to 32nd kms)	31.955
3	Rongram Rongrenggre Darugre (RRD) Road	40.400
4	Parallel Road to existing Dalu Baghmara Road	20.853
5	Rongjeng Mangsang Adokgre (44th to 55th km) Ildek A'kong to A'dokgre	10.600
	Total	139.668km

3. The proposed road iis situated in the undivided district of West Garo Hills and South garohills lies the latitudes 90° 30' and 89° 40' E, and the longitudes of 26° and 25° 20' N. The West Garo Hills district being relatively lower in altitude to the rest of Meghalaya, experiences a fairly high temperature for most part of the year.

4. Project road is under Meghalaya PWD NH Works. The proposed Project road under study will start at Paulpara, Dalu and ends at Phakirkona. The Project Road traverses from West to East direction. The location of the Project Road lies between Latitude: 250 54'11.14" N to 250 55'56.94" N, Longitude: 90031'35.86" E to 900 46'21.016".

5. The entire project road passes through the plain area. Land used along the road is either cultivable land, grazing land, private, submerged area or government land. The Project Road traverses from West to East. The average ground level of area varies between 28.00 m to 58.00 m from the Mean Sea Level. The proposed road will be constructed in Intermediate Lane standard, with paved shoulders. There are about 45 Nos. of Minor Junctions out of which 36 Nos are T Junctions and 9 Nos are Y Junctions. There are 7 No. of Major Bridge, 4 No. of Minor bridges, 8 Nos of Slab Culverts and 65 nos. of HP culvert are found along the existing road.

6. At present most of the length of project road is single lane carriageway throughout the length. The project road is having poor to fair pavement condition in general, with few stretches having very poor pavement condition. The proposed formation width is 6.00 m to 9.000 m.

7. This Environmental Impact Assessment Report is prepared for Parallel Road to existing Dalu Baghmara section in order to identify all relevant direct, indirect and cumulative environmental and social risks and impacts for construction and operational phase. For environmental studies and subsequently the assessment the Corridor of Impact is considered of 500m on either side of the proposed road and project influence zone is taken 10km on either side (Arial distance) from boundary of road.

8. The environmental assessment study was prepared between the months of October-December 2019 as part of detailed project report. This is draft Environmental Impact

Assessment (EIA) report prepared to fulfil requirements of the Operational Policy 4.01 for World Bank funded Project.

9. The baseline environment parameter within the Corridor of Impact, was conducted by the consultants during November-December 2019. Primary data for ambient air quality, ambient noise status, water quality (Ground and surface) and soil quality was collected and analysed through an NABL accredited laboratory. The monitoring results are found within the prescribed limits for air and noise level at the monitored locations in the project area.

10. Climate of Meghalaya plateau is influenced by elevation and distribution of physical relief. On the basis of weather condition, the Meghalaya plateau has 4 distinct seasons. The project road is within the West Garo Hills District of Meghalaya state. The general topography of West Garo Hills district is hilly with plain area on the north. The proposed Parallel Road to existing Dalu Baghmara Road is located in Sothern of West Garo Hills District & South Garohills District.

11. The proposed project road falls under the Seismic Zone V, which is susceptible to major earthquakes as per the seismic zone map of India (IS 1893 - Part I: 2002). Considering high hazard seismic zone of the project road section area, design standards for structures stipulated in the clause under IRC: 6-2014 has been taken into account.

12. Land use pattern abutting the project road section is mainly community forest (vegetation) and built up areas along the road alignment.

13. The road alignment is passing through two reserved forest areas vz. Gobrakura R.F., Angratoli R.F. The Gobrakura R.F. extended from chainage 13/600 to 14/800 Km and Angratoli R.F. from chainage 15/800 to 16/300 Km. From the end of the road alignment the Balpakram National Park situated at a distance of 11 Km (Approx.) and the Baghmara Pitcher Plant Sanctuary situated at a distance of 20 Km. (Approx.) and the proposed road alignment has been out of the ecosensitive zone of these two protected area. This project road as per the amendment (dt. 1st December, 2009) on Environmental Notification (September 14, 2006) of MoEF, Government of India, the

current project requires no environmental clearance as it is not under the category 'A' or "B" for road projects.

14. As there is no National Park, Wild Life Sanctuaries within 10 km of the site the project is not coming under the ecosensitive zone but has some faunal diversity of birds, small mammals, butterflies, herpetofauna etc. However, during construction chances of small animal stray into the construction area and fall into the excavation pits. To prevent such accidents from happening temporary woven wire mesh guards of about 2.4 m (8 ft.) high will be put around the excavated areas. Further, if any stray animal falls in an excavation. No harm would be done to the trapped animal. The contractor in association with PMU and Forest. Department would ensure safe release of the animal.

15. In the project stretch of Parallel Road to existing Dalu Baghmara Road estimated 53 trees need to be felled for this project. All cut trees will be compensated at the rate of 1:10 with preference to fast growing local species that are more efficient in absorbing emissions.

16. Approximately 7620.86 cum of excavated soil from hill cutting material will be scarified from existing carriageway are expected to be generated form scarified bitumen, dismantling and excavation of existing culvert. The excavated material will used in backfilling in the project and balanced quantity will be disposed of at approved designated site.

17. In addition, to the above specific measures to mitigate construction related impact the Environmental Management Plan has also suggested mitigation measures and action plans which would be implemented during the construction and operation stage of the project. A management system has also been developed to ensure that these measures are effectively implemented.

18. The Environment Management Plan for the project road section has been prepared to detail out the mitigation measures which has been identified during the impact assessment in the EIA Study. It furthers detail out the mitigation measures discussed earlier during the Pre-Construction, Construction and Operation Phases of the project. This will ensure that environmental issues are properly addressed during road

upgradation. This Environment Management Plan would be included as part of the Bidding Document and shall at a later date used by the Contractor for developing the Contractor's EMP.

19. The institutional arrangement for the implementation of the EMP in the project road section has been mentioned to identify the role and responsibility of each parties involved in the project implementation. PMU for overall project is headed by the Chief Engineer, PWD who will be responsible for the successful implementation of the Project. The Chief Engineer would be assisted by an Environmental Officer. The team at the PMU would be assisted by the Environmental Officer of Project Management Consultant (PMC).The actual responsibility of implementation of the EMP would be with the Contractor.

20. The Contractor's Environmental Engineer and Health Safety Officer would be responsible for the implementation of the environmental safeguards. The roles and responsibilities of each of these officials have also been detailed out in the EMP. Training and capacity building would be required especially for the PMU staff associated with the project as the Environmental Safeguards would be a relatively new areas which staff are required to handle. The training and capacity building would not only be project specific but would target and developing long term capacities in PWD.

21. An Environmental Monitoring Program has been drawn up to essentially monitor the day to day activities in order to ensure that the environmental quality is not adversely affected during the implementation. The monitoring programme consists of Performance Indicators and Process Indicators. The performance indicators would identify the components which have to be monitored and reported on a continuous basis during the stage of the implementation. These would help identify the level of environmental performance of the project. In addition, there would be Process Indicators which would help in assessing the effectiveness of the system which has been instituted for the program.

22. For the purpose of reporting of environmental performance, a reporting framework has been defined. This include:

- Daily Monitoring Report: by the contractor to the PMC on the environmental actions which has been implemented.
- Fortnightly and Monthly Monitoring Report: by the PMC to PMU.
- Quarterly Auditing by the PMU to the Management.
- Annual Audit by an External Agency of the entire process of EMP Implementation and reporting to the PMU for onward reporting to the World Bank

1 Introduction

1.1 Background

Meghalaya has been one of the most tourist friendly state of the eight states of the north eastern region and also serves to provide regional interconnectivity between Barak valley and the Brahmaputra valley. The West Meghalaya has been one of the beautiful hill areas in Meghalaya which has the capacity to be developed as tourist hub and horticulture productivity hub in recent future.

The Road transport is the backbone of the state's socio-economic development. More than 80 percentage of freight and almost cent percentage of passenger movement within the state depend on roads. Yet, about half of the habitations lack all-weather road access. Further, many semi-permanent timber bridges are in dilapidated condition, limiting maximum allowable axle load on them. The problem is further compounded by difficult terrain and extreme climatic condition, leading to high maintenance cost of the roads.

Similarly, rapid urbanisation has created a huge gap between demand and supply of urban services and infrastructure. It has been assessed that other than Shillong, urban mobility at other cities and towns of the state are less than satisfactory1. In most of the towns due to narrow roads, lack of parking facilities and yearly growth of vehicles, traffic congestion is often evident. Further, in most cases the major highway passes through the city center as a result of which regional traffic comes in conflict with the local traffic.

To overcome the abovementioned challenges in a holistic and all-inclusive manner, the Government of Meghalaya, with financing and technical support from the World Bank, is preparing a project titled "Meghalaya Integrated Transport Project". The objective of the project is to "provide a well-connected efficient, good quality and safe transport network on long-term basis in a cost-effective manner maximizing economic and social outcomes". This will involve taking a whole-of-the-state approach of the entire transport sector and introduce innovations, efficiency, and new ways of doing business at various stages of service delivery, ensuring value for money.

This will involve:

- Integrating transport and development agenda thus resulting in more job-creation, better incomes, and realization of the SDGs;

- Integrating various modes of transport – such as roads, ropeways, waterways, and urban transport to operate as part of one system for optimal performance;
- Integrating climate resilience, green growth, asset management, and safety in the transport sector thus making the sector more resource efficient, reducing carbon footprint, minimizing GHG and contributing to health outcomes.

The Government of India thus, on behalf of Government of Meghalaya has applied for financing an amount of US$ 82 Million equivalent from the World Bank for *MEGHALAYA Integrated transport project*, **MITP Phase - I Roads**. Up-gradation of 266.82 km road length will be carried out in Phase-I. The Department of Economic Affairs (DEA) and The World Bank (WB) has accorded in principle approval of Tranche-I of MITP for US$ 110 million (loan assistance of US$ 82 million and State Share of US$ 28 million), under which State Road Network roads measuring 128 km length will be upgraded along with certain other institutional development activities. There are total 10 road sections selected under Phase-I, 5 road sections in East Meghalaya and 5 road sections in West Meghalaya. The Government of India thus, on behalf of Government of Meghalaya has applied for financing an amount of US$ 110 Million equivalent from the World Bank for MEGHALAYA Integrated transport project,. The Meghalaya PWD is in the process of preparing DPR (Detailed Project Road) for about 140 km (Stage -1) in West Meghalaya as part of whole MITP (Table 1-1).

Table 1-1: MITP Phase - I Roads (West Meghalaya)

Sl. No	Name of Road	Total Length in Km
1	BajengdobaResuMendipatharDamra Road	35.860
2	AgiaMedhiparaPhulbari Tura (AMPT) Road (1st to 32nd kms)	31.955
3	RongramRongrenggreDarugre (RRD) Road	40.400
4	Parallel Road to existing Dalu Baghmara Road	20.853
5	RongjengMangsangAdokgre (44th to 55th km) IldekA'kong to A'dokgre	10.600
	Total	139.668km

The Chief engineer of MPWD serves as a project proponent for the above roads and the contact details is given in Table 1-2.

Table 1-2: PIU / Project Proponent Contact Details

Sl. No	PIU/ Project Proponent Contact Details	
1	Name of the applicant/ Proponent	The Chief Engineer, PWD
2	Registered Address	PWD, Shillong, Meghalaya
3	Address for correspondence: Name Designation(Owner/Partner/CEO) Address Pin Code E-mail Telephone no Fax No	The Chief Engineer Office of the Chief Engineer PWD, Government of Meghalaya Shillong Shillong, Meghalaya cea.apwd@nic.in +91- +91-

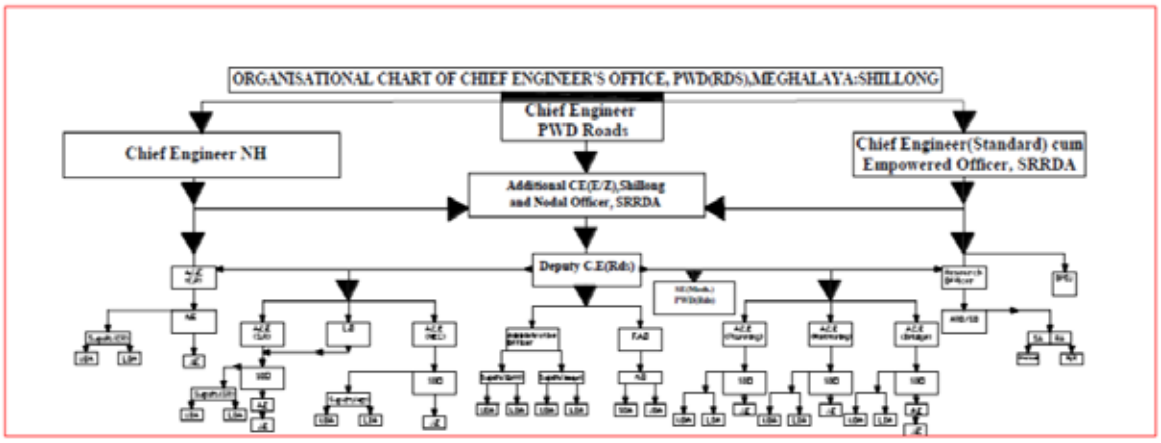


Figure 1-1: MPWD Organisation Structure

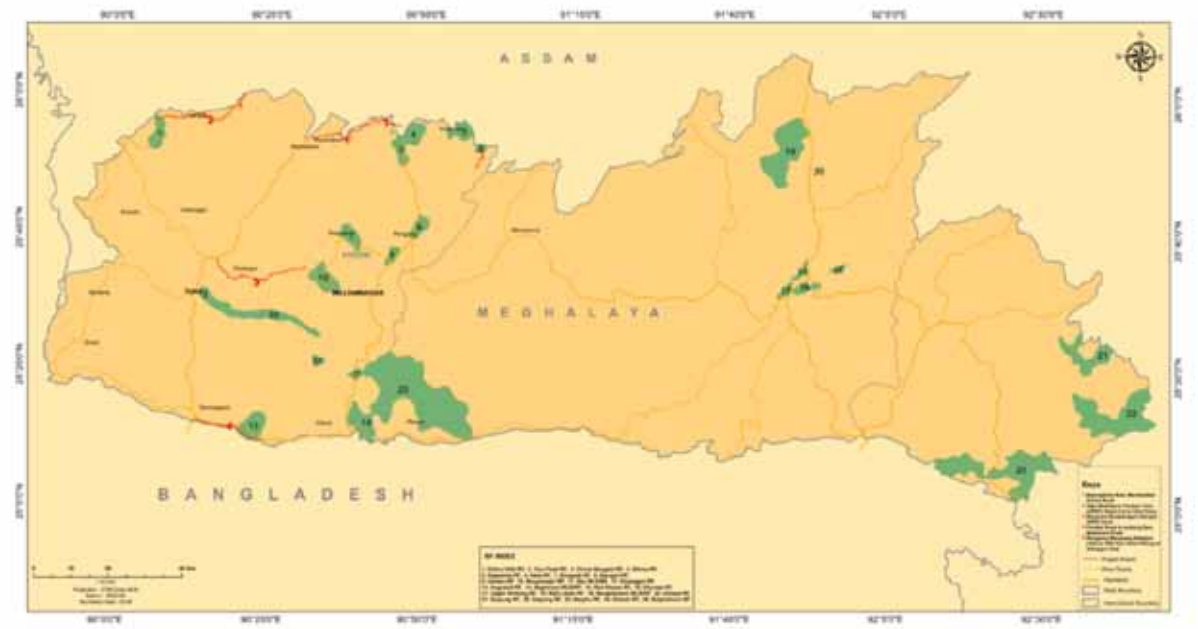
The project roads prioritized for design shall be subjected to Environmental Assessment (EA) /Social Assessment (SA) as per the requirements of Government of India (MoEF) and the World Bank. It is also decided that SA/EA projects and project surveys will be undertaken by appointing external consultants. The task of Environmental and Social Assessment of above roads is entrusted to M/s APS Corporation Pvt. Ltd., Meghalaya.

1.2 Brief Description of the Project Road

The Government of Meghalaya (GoM) plans to improve the state road network under Improved Transport Connectivity Rehabilitation of Roads under Phase-I in West Meghalaya Programme i.e. MEGHALAYA Integrated transport project (MITP) with the help of World Bank funding. This project comprises of two components namely Improved Transport Connectivity Rehabilitation of Roads. Under this programme the following roads has been taken:

Sl.no.	Division	Name of Road	Category	Length to be taken
1	Resu Belpara	Bajengdoba Resu Mendipathar Damra Road	MDR	35.860km
2	NEC	Agia Medhipara Phulbari Tura (AMPT) Road (1st to 32nd kms)	SH	31.955 km
3	Williamnagar / NH Tura	Rongram Rongrenggre Darugre (RRD) Road	MDR	40.400 km
4	Barengapara	Parallel Road to existing Dalu Baghmara Road	MDR	20.853 km
5	Resu Belpara	Agia Medhipara Phulbari Tura (AMPT) Road (1st to 32nd kms)	MDR	10.600 km
			Total	139.668km

MITP Roads in West Meghalaya



At present all project routes are single lane except AMPT. The planned Rehabilitation includes one state highway. The improvements have been planned by carrying out economic viability of each project route. The MITP project will provide faster traffic movement and project benefits in terms of reduction in vehicle operation costs (VOC) and travel time. The planned up-gradation may result into some adverse environmental impacts.

This road section Parallel Road to existing Dalu Baghmara Road in fact, alternate road to reach the Baghmara from Dalu (as per project ToR).

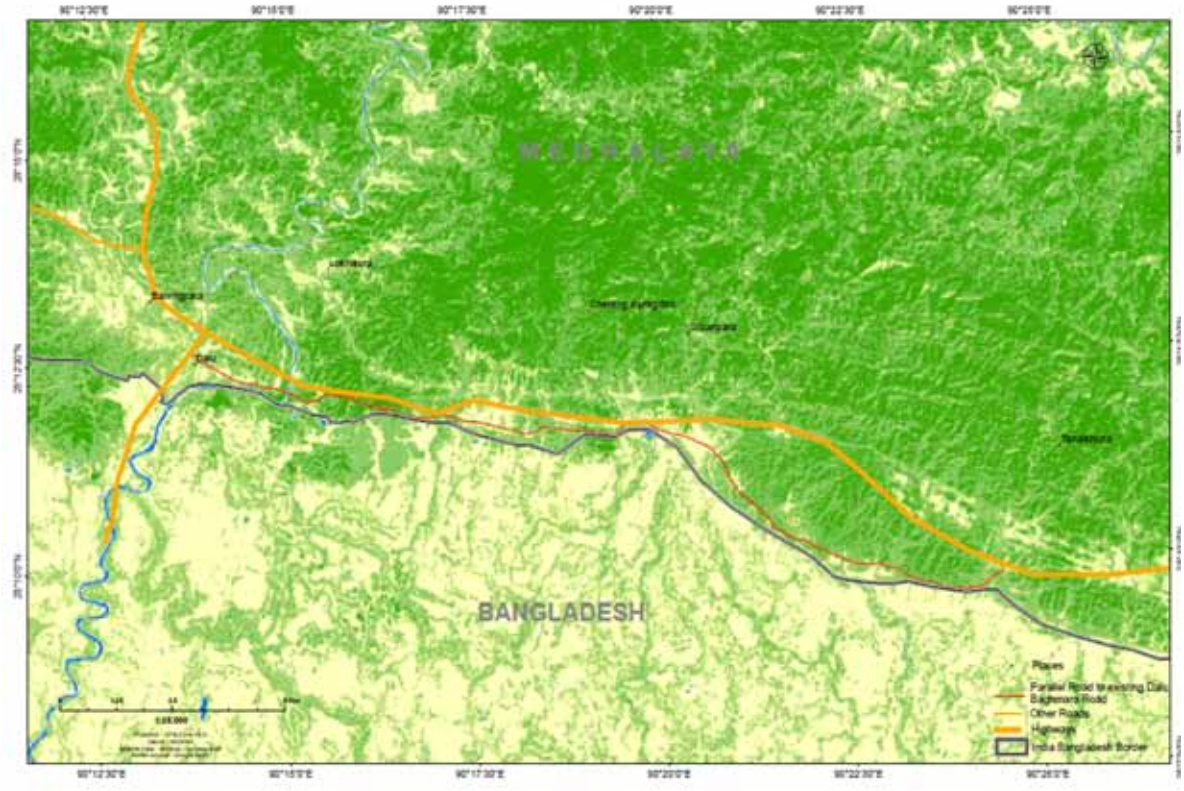


Figure 1-2 **Parallel Road to existing Dalu Baghmara Road Corridor Map**

1.3 Purpose of ESIA Report

This Environmental Impact Assessment Report has been prepared for Parallel Road to existing Dalu Baghmara Road in order to identify all relevant direct, indirect and cumulative environmental and social risks and impacts for construction and operational phase. Preparation Environment and Social Management Plan for each road section to mitigate the potential impacts on the physical, biological and socio-economic parameters.

The environmental assessment study was done between the months of October-December 2019 as part of detailed project report. This is draft Environmental Impact Assessment (EIA) report prepared to fulfill requirements of the Operational Policy 4.01 for World Bank funded Project.

Objective and Scope of the EIA Study

The objective of the present, EIA study is to identify potential environmental impacts of the proposed Parallel Road to existing Dalu Baghmara Road improvement measures and formulate strategies to avoid / mitigate the same. The scope of work to accomplish the above objective, comprise the following.

- Collecting primary and secondary environmental baseline data within the project boundary and surrounding areas; Assessing potential adverse environmental impacts that might arise during operation of the Project after reviewing Project information and using the environmental baseline study conducted during the feasibility study;
- Suggesting appropriate mitigation measures to effectively manage potential adverse impacts; and
- Analyse the alternatives in terms of alternative alignment, technology, design and operation, including the “with project” and "without project" situation were carried out to analyse the feasibility
- Consultation with the Public/Stakeholders and incorporate their concerns into the project design;
- Developing an Environmental Management Plan (EMP) to implement suggested mitigation measures and management plans to minimise adverse impacts through effective management systems including formulation of monitoring and reporting requirements;
- Conducting additional studies for the enhancement of the benefit to the local Community and the road users;

The environmental studies have been confined to the situation around the deemed areas of direct influence caused by constructional and operational facilities along Parallel Road to existing Dalu Baghmara Road, the proposed major district road section in the state of Meghalaya. The following sections of the report, discusses the methodology adopted by the consultant in conducting the study and presents the results of the same.

1.4 Approach and Methodology Adopted for EIA Study

The Environmental Impact Assessment has been carried out, in accordance with the requirements of the World Bank’s Operational Policy 4.01. The Government of India

guidelines for Rail/Road/Highway project; EIA notification 2006 and its amendment of MoEFCC and Highway Sector EIA guidance manual 2010 has also been followed in the process of this environmental assessment. The study methodology has been adopted in such a manner to ensure that environmental concerns are given adequate weightage in the selection of alignment and design of proposed road improvements. The study in the road section project employ an iterative approach in which potential environmental issues have been examined at successive levels in detail and specificity, at each step in the process.

The Environmental impact assessment is based on the information collected from secondary as well as primary sources on various environmental attributes. Monitoring of air, water, noise and soil quality was also carried out along the road section alignment and significant issues were examined during field surveys to determine the magnitude of significant environmental impacts.

The major steps in the EIA process for the project were as follows:

(i) Screening of Project Road

As a part of the project feasibility study, Environmental Screening is undertaken in parallel

With the Preliminary Economic and Engineering studies to determine any significant social Or environmental issues which could require further analysis (including the analysis of alternative alignments, improvement of junctions etc.) to resolve such issues.

The environmental screening typically identifies the natural habitats (e.g. national parks, wildlife reserves, sanctuaries, sacred groves, protected areas, forests, water bodies etc.), major rivers and waterways, notified cultural heritage sites and any other potentially sensitive areas. The information available from secondary sources along with the inputs from the site visits and consultation with local people are used to identify these issues and sensitive receptors which might be located along the corridor. The results of this analysis are communicated to the design team to resolve them (including recommendation for exclusion, analysis of alternative alignment and/or mitigation) as a precursor to preliminary engineering design and undertaking the required for environmental assessment studies.

(ii) Delineation of Project Impact Zone

For carrying out further environmental studies and subsequently the assessment it was required to delineate the project influence zone. Depending on the severity of impact the Project influence zone has been classified as:

Corridor of Impact (CoI): The area of 500 m on either side of the proposed road centerline is considered as the corridor of impact. The proposed formation width i.e. 7.2 m is thus included within the CoI. This area is more vulnerable to the project's direct impacts.

Project Influence Area (PIA): In accordance with MoEF &CC' S EIA Guideline Manual for Highways and as per guidelines of EIA Notification-2006, the Project Influence Area has been defined as 10 km on either side (Arial distance) from boundary of road for collection of secondary data, including impacts due to ancillary sites like borrow areas, quarry, material storage, disposal areas, etc.

(iii) Preliminary Engineering Surveys

With the information available from the screening the design team took the preliminary surveys of the project site to assess the engineering aspects of the road including the likely environmental issues associated with the project. The survey carried out as part of the detailed design data collection also provided valuable information regarding area adjacent to the proposed project corridor.

(iv) Collection of Secondary Environmental Data

Secondary data was collected from various verifiable sources about different components e.g. Climate, Physiography, Soil type, Ecology, etc. The source from which information is gathered is presented in Table 1-2.

Table 1-2: Source of information collected on environment features in the project area

S.No.	Aspects	Parameters	Source of Information
1	Climatic Conditions in the Project Influence Area	Climate, Temperature, Rainfall	Indian Metrological Department
2	Soil & Geology	Soil type and its stability, Fertility of the soil potentiality for soil erosion	Geological Survey of India, State Mining Department
3	Slopes	Direction of slope, Percentage of slope	Contour Survey, satellite image and Survey of India topographic sheets
4	Drainage/ Flooding	Existing drainage map and flooding level including its	Satellite Imagery/ Topo-sheet/Hydrology study /

		extent of water spread. Identification of drainage channel and its catchments area around the Project stretch	State Water Resource Department.
5	Water Bodies and Water Quality	Identification of water bodies /canal / drainage channels where the run off surface water will flow/due to erosion and also due to spillage oil and other hazardous materials. Status of surface water and ground water quality	Topography sheets /field study. Hydrological data from the CGWB Reports
6	Forest within Proposed ROW Legal Status – Protected Areas, Endangered Plant and Animal, Ecological Sensitive Area, Migratory Corridor / Route etc.	Status of the forests, Conservation of forest area, & endangered plant and animal and any other species	Department of Forest, Govt. of Meghalaya, DFOs, Discussion with local community and local DFO officers
7	Trees and Vegetation Cover	Identification of existing tree species in the project influence area	Forest Department, Research Institution, Field Survey.
8	Settlements along the PROW	Settlements & its population along the corridor. Its location & numbers	Population/ District Census report 2011. Topographic survey
9	Cultural / Heritage and Ancient Structures	Conservation areas if any, Protected structures, monuments and heritage structures.	Archaeological Survey of India, State Archaeological Department

(v) Collection of Primary Baseline Information

For gathering the baseline environmental condition along the project corridor baselines studies were conducted. These baseline studies carried out included:

• Baseline environmental surveys for assessing the ambient air, water and noise quality;

• Enumeration of trees to identify the Location, number, types spread, girth etc. Local name, no. of the trees within the proposed RoW;

• Ecological surveys to identify the habitats and the flora and fauna;

• Structure enumeration to identify the one likely to be impacted;
• Socio-economic surveys to identify the condition of the impacted persons.

In addition to the above survey interactions are carried out with the populations along the project corridor to gather local level information on the following:

• Local practices and traditions with respect to conservation and use of natural resources;
• Farming practices and Cropping pattern;
• Perception of the people about the project
• Traffic surveys were used to estimate the present and future traffic
• Preliminary engineering surveys to identify the topographical features

This information was used to develop the baseline environmental condition in the project area and identify the environmental sensitivities which might still get affected by the proposed alignment.

(vi) Public consultation

At the beginning of the EIA process, a preliminary identification of probable stakeholders was carried out. An inventory of actual / potential stakeholders, including local groups and individuals, local institutions like the village councils which may be directly or indirectly affected by the project or with interest in the development activities in the region was made at a preliminary stage. This inventory was arrived through discussions with local PWD official and also in consultation with members of the local community.

Consultations with the community were a continual process that was carried out during the EIA study and would also be continued during the construction and operation phases of the project. Issues like disturbance during the construction, severance and increased congestion, noise and air pollution, employment opportunities, need for development of basic infrastructure, safe drinking water, sanitation facilities in the villages adjoining to the corridor were discussed during the consultations so that they can be adequately addressed through the environment management plans. The consultations with community and local institution like village councils also helped in developing preliminary understanding of the requirement of people in the area and identification of the enhancement proposals.

(vii) Impact Identification and Evaluation

Potential significant impacts were identified on the basis of: analytical review of baseline data; review of environmental conditions at site; analytical review of the underlying physical, biological and socio-economic conditions within the project influence area.

(viii) Environmental Management and Monitoring

The final stage in the EIA Process is definition of the management and monitoring measures that are needed to ensure: a) impacts and their associated Project components remain in conformance with applicable regulations and standards; and b) mitigation measures are effectively implemented to reduce the effects to the extent predicted.

An Environmental Management Plan, which is a summary of all actions which the Project has committed to execute with respect to environmental/social/health performance for the Project, is also included as part of the Bidding Documents. The Environmental Management Plan includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

1.5 Limitation of EIA Study

This report is based on the preliminary designs which were prepared. The final design would be developed by the Contractor before the initiation of construction. Even though no major changes are expected in the design the EIA report needs to be verified against the final engineering design. Further, the report has been developed on certain information available at this point of time, scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available data and information.

The Report only deals with the environment health and safety aspects (both community safety and occupational health and safety) associated with the project during the construction and operations. The social impact and the resettlement and rehabilitation requirement of private and community property have been detailed in the Social Impact Assessment and Resettlement and Rehabilitation Plan. In case of common property structures the report only considers those structures where relocation is required and only enhancement is required either for the aesthetics or safety purpose.

1.6 Generic Structure of EIA Document

This EIA report has been presented as per requirements of the World Bank's Operational Policy 4.01. The report is organised into following ten chapters, a brief of each chapter is described below:

- ***Chapter 1 - Introduction***: This section described the background information about the project and EIA study.
- ***Chapter 2 - Project Description***: This section presents the key features and components of the proposed project.
- ***Chapter 3 - Policy, Legal, and Administrative Frameworks***: this section summarizing the national and local legal and institutional frameworks that guided the conduct of the assessment.
- ***Chapter 4 - Environmental Baseline Status***: This section discussing the relevant physical, biological, and socioeconomic features that may be affected by the proposed project.
- ***Chapter 5- Analysis of Alternatives***: This section covers analysis of various alternatives considered to minimise the overall impacts of proposed development and suggest most appropriate alternatives based of detailed analysis of impact and risk associated with each alternative.
- ***Chapter 6– Impact Assessment and Mitigation***: This section presents the environmental assessment of likely positive and adverse impacts attributed to the proposed project and concomitant mitigation measures.
- ***Chapter 7– Public Consultation and Discussion***: This section describing the consultation process undertaken during the environmental examination and its results, their consideration in the project design, and manner of compliance to the ADB's Publication Policy and related national laws.
- ***Chapter 8 - Environmental Management Plan***: This section discussing the lessons from the impact assessment and translated into action plans to avoid, reduce, mitigate or compensate adverse impacts and reinforces beneficial impacts. This plan is divided into three sub-sections; mitigation, monitoring, and implementation arrangements.

- ***Chapter 9–Implementation Arrangements***: This section brief the institutional set up in the executing & implementation agency and contract for the execution of the project along wirh responsibilities on environmental management.

- ***Chapter 10- Conclusion and Recommendation***: *The document summaries the environmental sensitivities in the project. The environmental safeguards, monitoring etc. which need to be implemented is also summarised in the Chapter.*

2.1 Project Description

The Chief Engineer PWD (N.H. Works), Meghalaya will be the employer and executing agency for the consultancy services for design of the proposed road: Parallel Road to existing Dalu Baghmara Road in Meghalaya West and the standards of output required from the appointed consultants are of international level both in terms of quality and adherence to the agreed terms & conditions and time schedule.

The instant proposal is to carryout Detailed Project Report (DPR) of the above-mentioned road project.

2.2 **Objective of the Project:** To improve transport connectivity and efficiency and modernization of transport institutions in Meghalaya. The project will focus "to provide a well-connected efficient, good quality and safe transport network on long-term basis in a cost-effective manner maximizing economic and social outcomes". This will involve:

(i) Integrating transport infrastructure with transport services to reduce overall transport costs thereby increasing the competitiveness of agricultural, industries, and businesses;

(ii) Integrating climate resilience, green growth, asset management, and safety in the transport sector thus making the sector more resource efficient, reducing carbon footprint, minimizing GHG and contributing to health outcomes.

2.3 **Project Scope:** The project will emphasize leveraging of annual sector investments using the two-pronged approach:

(i) introducing an improved delivery framework for transport infrastructure using a rational criterion for investment decision; innovative, climate resilient, green, cost-effective designs; and improved contracting practices through direct funding of critical transport infrastructure gaps; and

(ii) expand this improved delivery framework to the entire transport sector.

As part of the development policies, Government of Meghalaya is implementing various programs for development of tourism, agriculture, handicrafts, rural livelihood, employment generation, and women empowerment. It is perceived that adequate transport infrastructure and efficient transport services (focus of the proposed project) are essential for successful implementation of these programs.

The existing road network of 13,000 km has been developed in bits and pieces rather than according to a well-designed plan: consequently, it is non-coherent and has many deficiencies like missing links, bridges, drainage and protection structures, and road safety engineering measures; and inadequate pavements and poor riding quality. Large part of the network has failed due to poor quality of initial construction, lack of maintenance, and extreme climate events (high rainfall). There are about 800 semi-permanent timber bridges in failed condition – posing a serious safety issue and need immediate replacement. Particularly, the road network towards Bangladesh Border is relatively underdeveloped and the population living in that part is deprived of even the basic facilities like access to health and education. About half of the 5,362 habitations lack all-weather road access, out of these 1,700 not covered under PMGSY[1] as their population (of individual habitation) is below 250. Due to hilly and difficult terrain conditions, road construction is not always possible in many areas. In such situations, alternate solutions such as ropeways, foot bridges and foot paths are to be considered.

The absence of last mile connectivity and transport services impact the transport costs which are about 25 percent higher compared to other places in India reducing the competitiveness of agriculture and businesses.

Due to limited road space, traffic management and parking issues, Shillong and other urbanized locations experience long traffic congestions, especially during peak working hours. The reasons for the under-developed transport network are

inadequate funds, their inefficient utilization, and low institutional capacities and knowledge base of the transport agencies

2.4 Project Location

The project road is located in the undivided district of West Garo Hills and South garohills in the State of Meghalaya.

Table 2.1 .The location plan of project road is shown below:

Sl. No.	Name	District	Length	Cetegory
1	Parallel Road to existing Dalu Baghmara road	West Garo Hills and South Garohills	20.826	MDR

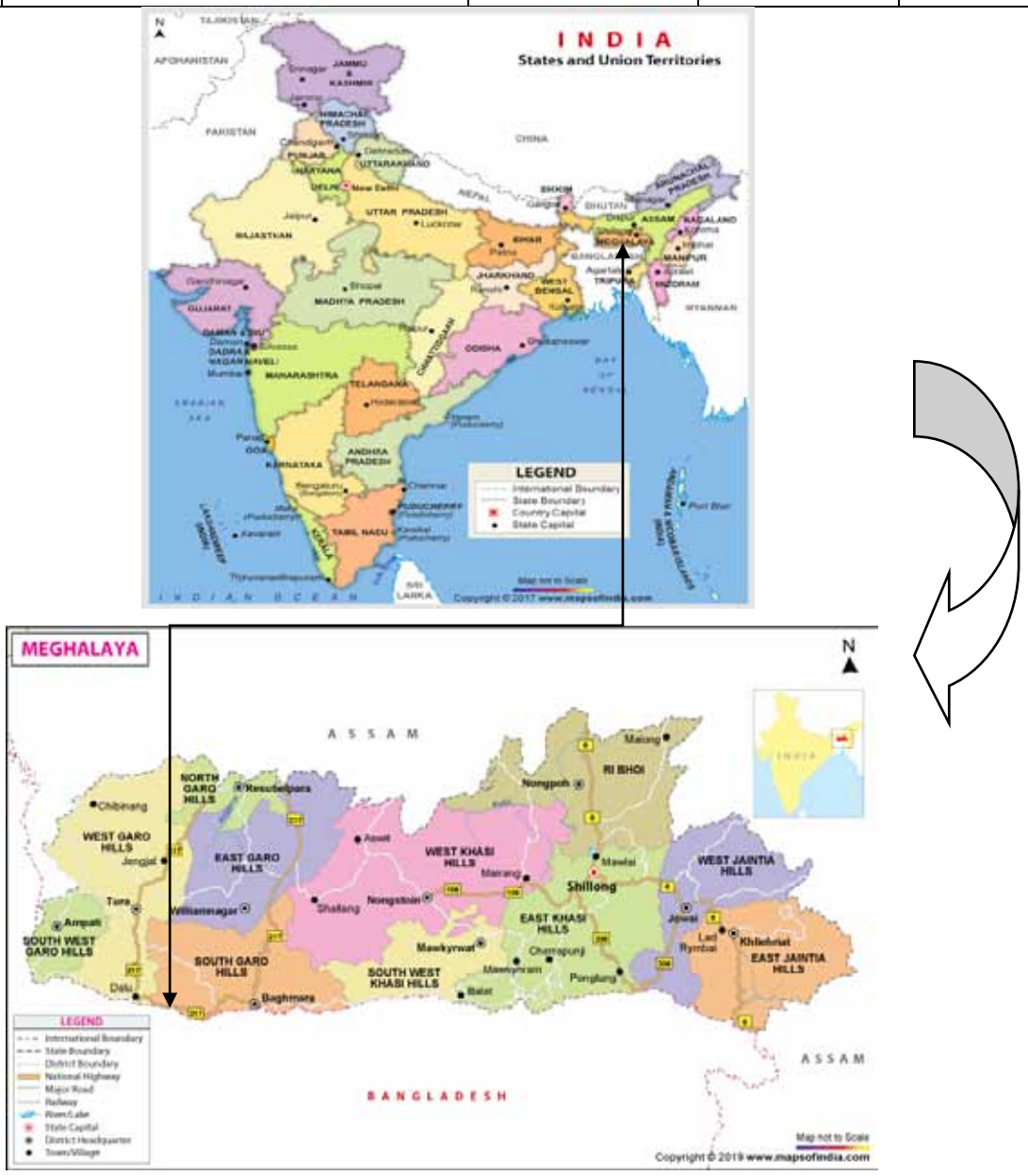


Figure. 2.1. Location Plan

2.4.1 **Parallel Road to existing Dalu Baghmara road:**

The proposed road is situated in the district of undivided district of West Garo Hills and South Garohills Hills and lies between Latitude: 25^0 54'11.14" N to 25^0 55'56.94" N, Longitude: $90^0$31'35.86" E to 90^0 46'21.016" E. The Project Road traverses from West to East direction. The alignment of the project road is shown in Fig : 2.2

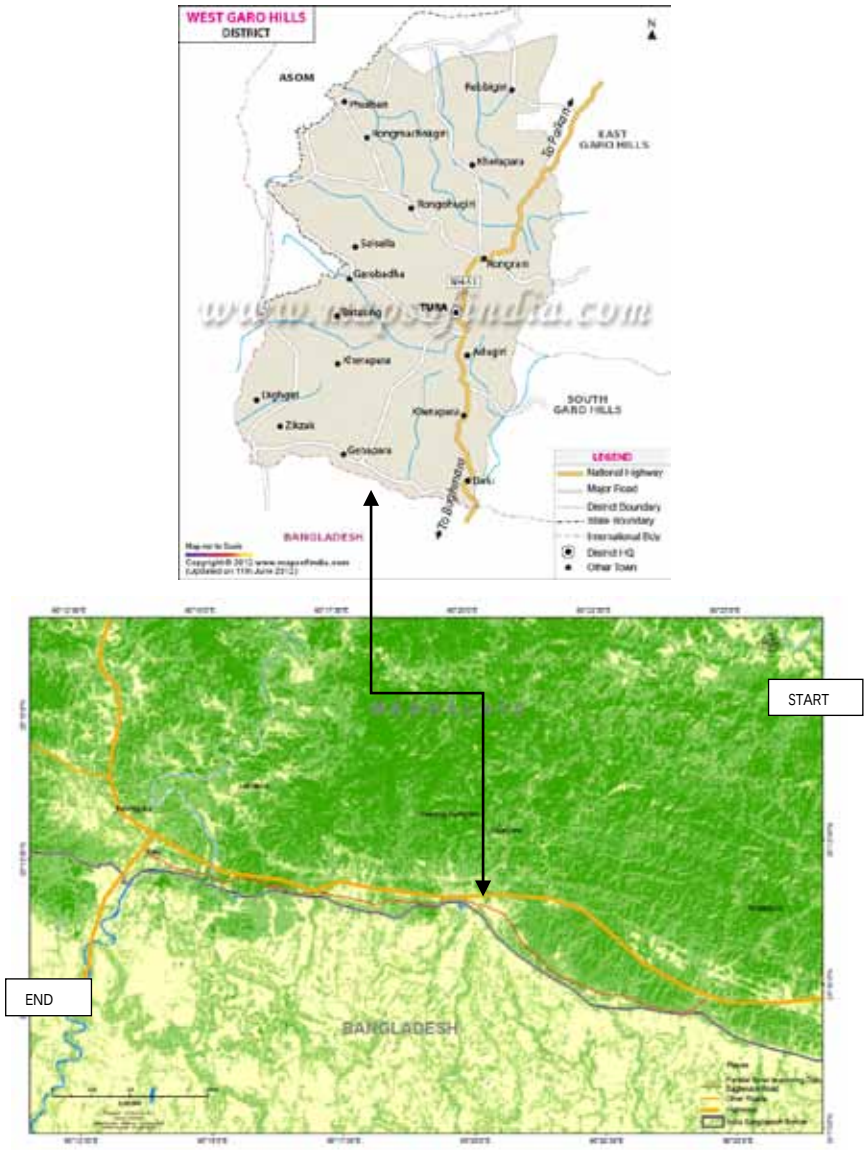


Fig. 2.2: Alignment Plan Parallel Road to existing Dalu Baghmara Road

2.4.2 **State of** the project **at a glance:**

The State of Meghalaya is situated on the north east of India. It extends for about 300 kilometers in length and about 100 kilometers in breadth. It is bounded on the north by Goalpara, Kamrup and Nowgong districts, on the east by Karbi Anglong and North Cachar Hills districts, all of Assam, and on the south and west by Bangladesh. Tucked away in the hills of eastern sub-Himalayas is Meghalaya, one of the most beautiful State in the country. Nature has blessed her with abundant rainfall, sun-shine, virgin forests, high plateaus, tumbling waterfalls, crystal clear rivers, meandering streamlets and above all with sturdy, intelligent and hospitable people. Shillong, the capital of Meghalaya is located at an altitude of 1496 metres above sea level. Shillong, which was made Assam's capital in 1874, remained so till January 1972, following the formation of Meghalaya. The capital city derives its name from the manifestation of the creator called Shillong.

The main tribes in Meghalaya are the Khasis, the Garos, and the Jaintias. Each tribe has its own culture, traditions, dress, and language. The majority of the population and the major tribal groups in Meghalaya follow a matrilineal system where lineage and inheritance are traced through women. All the three major ethnic tribal groups, namely, the Khasis, Jaintias and the Garos also have their own traditional political institutions that have existed for hundreds of years. These political institutions were fairly well developed and functioned at various tiers, such as the village level, clan level, and state level. Dance is central to the culture of Khasi life, and a part of the rites of passage. Dances are performed in Shnong (village), a Raid (group of villages), and a Hima (conglomeration of Raids). Some festivals include Ka Shad Suk Mynsiem, Ka Pom-Blang Nongkrem, Ka-Shad Shyngwiang-Thangiap, Ka-Shad-Kynjoh Khaskain, Ka Bam Khana Shnong, Umsan Nongkharai, Shad BehSier.

Fig 2.3: Physical Map of Meghalaya

2.4.3 Climate

The state of Meghalaya is directly influenced by the south west monsoon and the northeast winter winds. The four seasons of Meghalaya are: Spring - March and April, Summer (Monsoon) - May to September, Autumn - October and November and Winter - December to February. During March and April, the atmosphere gradually warms up with the advent of Spring. From the middle of April, the temperature starts rising to the maximum in the month of June and then decreases gradually. This period may be termed as the Summer (Monsoon) Season. The maximum temperature recorded is 34 Celsius at Tura and West Garo Hills District and 28 Celsius at Shillong.

October and November are the two months when the climate is cool and temperate. After November, the winter season sets and continues up to the end of February. During these months the temperature comes down to as low as 2 Celsius in the Khasi Hills. Rainfall starts by the third week of May and

continues right up to the end of September and sometimes well into middle of October. The maximum rainfall occurs over the southern slopes of the Khasi hills, i.e. over Cherrapunjee and Mawsynram platform which receives the heaviest rainfall in the world. The average rainfall in the State is 12,000 mm.

2.4.4 **The** D**district of West Garo Hills at a Glance**

The initial part of the proposed project road passes through the undivided West garo hills District. The West Garo Hills District covers an area of 3677 sq. kms. and has a population of 5,15,813. Tura which is its Head Quarters has a population of 58,391. There are two Civil Sub-Divisions, namely, Ampati and Dadenggre besides 7 C D Blocks, namely, Betasing, Dalu, Selsella, Dadenggre, Tikrikilla, Rongram and Zikzak. West Garo Hills District is predominantly inhabited by Garos, which happens to be one of the main tribes of Meghalaya. The District shares its borders with Goalpara and Dhubri districts of Assam in the North and an International Border with Bangladesh on the West and South. The major area of the District is mostly hilly terrain. The northern, western and southern parts of the District are mostly plains. There are four major rivers in the District, namely, Rongai, Jinjiram, Ganol and Bugai. Tura, the District Head Quarters lies at the foot of the towering and majestic Tura peak range.

2.4.5 **Geography and Climate**

The West Garo Hills District of Meghalaya is situated approximately between the latitudes 90° 30' and 89° 40' E, and the longitudes of 26° and 25° 20' N. The West Garo Hills district being relatively lower in altitude to the rest of Meghalaya, experiences a fairly high temperature for most part of the year. The average rainfall is 330 cms. of which more than two-thirds occur during the monsoon, winter being practically dry.

2.4.6 Population

A'chik is the general title used for the various groups of people after the division of the race. The title is used to denote different groups such as the Ambeng, Atong, Akawe (or Awe), Matchi, Chibok, Chisak Megam or Lyngngam, Ruga, Gara-Ganching who inhabit the greater portion of the present Garo Hills District. But the name applies also to the groups of Garos scattered at the neighbouring places in Assam, Tripura, Nagaland and Mymensing in Bangladesh.Though the main feature of their traditional political setup, social institutions, marriage systems, inheritance of properties, religion and beliefs are common, it is observed that as these units were isolated from one another, they have developed their own separate patterns. They also speak different dialects. Also their traditional songs, dances, music differ from each other. The song, dances and music are mostly associated with traditional religious functions and ceremonies.

2.4.7 Economy

The economy of the West Garo Hills district is basically agrarian and rural based. Agriculture is the mainstay of about 90% of the population of West Garo Hills and most earn their living directly or indirectly from agriculture. Rice is the most important food crop that is grown in the district, both in the plains and the hills. Other food crops that are widely grown in the district are tapioca, yam, maize, millet and pulses Due to widespread practice of shifting cultivation and deforestation, the production of food crops is decreasing and Government has intervened to provide alternative measures of farming practices like terracing, contour farming etc. to the people. Horticulture is one of the flourishing sector in the region and much needed attention has been given by the Government to develop this sector. The important fruit crops of the district are oranges, pineapple, litchi, banana, jackfruit and other citrus fruits.

2.4.8 Flora & Fauna

The flora and fauna of the region has a very diverse distribution. The region also boast of thick natural vegetation mostly comprising of bamboo, teak and sal forests and many other species of plants having varied uses. This diverse spread of vegetation favours the undergrowth of many shrubs and herbs and hence the biomass reserves rich in fertility are well preserved.

2.4.9 The District of East Garo Hills at a Glance

East Garo Hills District was upgraded from a sub-division to a full-fledged district in 1976, after the erstwhile Garo Hills District was reorganised with a view to bring the administration closer to the people. In 2012 East Garo Hills District was further reorganised to form a new district, the North Garo Hills District, out of the erstwhile Resubelpara Civil Sub-Division.

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2.4.10 Topography & Demography

As is evident from the name, the district of East Garo Hils is a hilly terrain. The hills are highly dissected and one major formation is the Arbella Range, which is cuts through the south-central part of the district. The range consists of peaks with an average height of 700 metres above sea level. Another important physiographic feature is the Simsang Valley which runs through the southern part of the district. The River Simsang is the longest river in Garo Hills, which originates in West Garo Hills and flows through East Garo Hills and thence to South Garo Hills. The population of East Garo Hills district consists of two major groups - tribal & non-tribal. The tribal population of the district amounts to 96.54 % of the total population. The majority of the tribal population are the Garos, while the other indigenous inhabitants are the Hajongs, Rabhas, Koches, Rajbansis, Kacharis and Dalus. The small non-tribal population, including the Scheduled Castes is mostly concentrated in the urban settlements of Williamnagar and semi-urban habitations like Rongjeng, Songsak & Rongsak. The distribution of population in the district is uneven and is mostly governed by topography.

2.4.11 People & Culture

The Garos constitute the majority in the East Garo Hills district as is evident from the name of the district. The district also is home for a sizeable population of Rabhas, Hajongs, Koches, Dalus, Banais and Boros.

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2.4.12 Natural Resources

Bamboos are tall arborescent grasses belonging to the family Graminaceae. They have an extremely wide range of distribution and are found as an understorey in many types of forests occurring in the state. They form rich belts of vegetation in well-drained parts of tropical and subtropical habitats and rise up to the highest point in Meghalaya. Bamboos are perennial grasses, with woody and pointed stems. Stems or culms are mostly hollows from inside with few exceptions. Thickness or thinness of the culm determine utility..

2.4.13 Climate

The district enjoys confortable temperature throughout the year; not very hot in summer and not very cold in winter. Over-all the climatic condition of the district is healthy and tropical. The whole district is under the influence of the monsoons characterised by hot and humid rainy seasons during the summer, and cool and dry seasons during the winter. Temperature ranges from minimum of 5°C to maximum of 36°C. The district gets rainfall from the South-West monsoon. With high average annual rainfall, Meghalaya as a whole including the East Garo Hills district, is the wettest place on earth. The average annual rainfall data for the years 2001-2014 are given below.

2.5 Project Features

The features of the exiting road and the proposed road is presented in the following section.

2.5.1 Right of Way

The carriageway width in the road section varies from 3.0m to 3.75m with unpaved shoulders of 0.5 to 1.0 m width on each side and right of way as was observed varies from 6.0m to 9.0m.

2.5.2 Existing Road

Carriageway: The detailed inventory on existing carriageway reveals that the project road stretch comprises of mainly single lane carriageway with 0.5 m to 1.0m earthen shoulder configuration. The existing pavement is flexible throughout the road section.

Pavement Conditions: The existing pavement of project road is bituminous surface with earthen shoulders of width 0.5 m to 1.0 m exist predominantly on both sides throughout the project stretch. The pavement is flexible type having earthen/gravel shoulders. Pavement condition is fair except few locations where it has been badly damaged. The pavement is showing signs of distress at some locations. The defects noticed include Cracking (alligator, transverse, longitudinal, edge cracks), Rutting and edge breaking. The shoulders are earthen/gravel with fair to poor condition. The road surface is black topped with Bituminous Macadam (BM); Semi Dense

2.5.3 About the Project road stretch

Project road is under Meghalaya PWD NH Works. The proposed Project road under study will start at Parallel Road and ends at Dalu Baghmara.

The Project Road traverses from west to east direction. The location of the Project Road lies between Latitude: 25^0 49'55.61" N to 25^0 09'47.62" N Longitude: 90^0 58'26.54" E to 90^0 24'30.29" E.

The entire project road passes through the plain area. Land used along the road is either cultivable land, grazing land, private, submerged area or government land. The Project Road traverses from West to East. The average ground level of area varies between 28.00 m to 58.00 m from the Mean Sea Level. The proposed road will be constructed in Intermediate Lane standard, with paved shoulders. There are about 45 Nos. of Minor Junctions out of which 36 Nos are T Junctions and 9 Nos are Y Junctions. There are 7 No. of Major Bridge, 4 No. of Minor bridges, 8 Nos of Slab Culverts and 65 nos. of HP culvert are found along the existing road.

2.5.4 Topography

The entire project road passes through the Hilly area. Land used along the road is either cultivable land, grazing land, private, submerged area or government land .

2.5.5 Main Carriageway and Shoulders

The average existing road details are shown in table below:

Table 2.2: Summary of existing carriageway

Sr. No.	Chainage		Carriageway		Shoulder-Roadway		Remarks
	From (km)	To (km)	Width	Surface	Shoulder Surface	Roadway width	
1	0.0	20.826	3.0 to 7.0	BT-ER	ER	7.0 to 10.0	Details are shown in road inventory Vol.II

2.5.6 Pavement Surface Condition

Pavement condition survey has been carried out and seen as below.

2.5.7 Right of Way Design

The R**o**W for the proposed road will be provided as per table 6.4. of IRC:SP:48 Hill Road Manual as shown below and will be adopted as MDR exceptional category.

Table 2.3 : Desirable Road Land Widths (Meters)

SL. NO.	Road Classification	Open areas		Built Up Areas	
		Normal	Exceptional	Normal	Exceptional
1	National and State Highways	24	18	20	18
2	Major District Roads	18	15	15	12
3	Other District Roads	15	12	12	9

2.5.8Junctions

There are about 45 Nos. of Minor Junctions out of which 36 Nos are T Junctions and 9 Nos are Y Junctions.

2.5.8 Culverts Major Bridges and Minor Bridges (Proposed)

There has been altogether 95 culvert, hume pipes and bridges are present in the entire road alignment.

2.5.9 ROB, RUB & Railway Crossings

There is no existing manned railway crossing (LC), ROB & RUB along the proposed project road stretch.

2.5.10 Existing Bypass

There is No bypass in the proposed project road stretch.

2.5.11 Forest Land

The entire project road passes through one reserved forest which is under the Meghalaya Forest Department. However no extra land will be required for the construction of the road through this forest area. The Gobrakura R.F. extended from chainage 13/600 to 14/800 Km and Angratoli R.F. from chainage 15/800 to 16/300 Km. From the end of the road alignment the Balpakram National Park situated at a distance of 11 Km (Approx.) and the Baghmara Pitcher Plant Sanctuary situated at a distance of 20 Km. (Approx.) and the proposed road alignment has been out of the ecosensitive zone of these two protected area.

2.5.12 Utilities

The major utilities along the corridor are:

a) Electric Poles are laid throughout Project Corridor.

2.5.13 Wayside Amenities

Wayside amenities are there along Project Corridor. Detailed study will be conducted for various amenities required and new location for Bus Stops , Village Haat/market platform, Toilet Blocks, villagers meeting platform , view point etc. will proposed accordingly in addition to the existing facilities.

2.5.14 Homogeneous Section [HS]

The 40.400 km long project road will have one homogeneous section [HS]. The start & end km, length of HS is as below.

Sr.	Section		

No.	At km. From Rongram	Samandra	Homogenous Section	Remark
1	0.0	20.826	HS 1	Gasuapara point

2.5.15 Trees Cutting

The preliminary engineering surveys conform that felling of 53 is required for the improvement of road section. Total trees to be cut will be 53. The species of the trees to be cut has been listed below.

Sl. No.	Scientific Name
1	*Albizia lebbek*
2	*Ficus benjamina*
3	*Dysoxylum binecteriferum*
4	*Bischofia javanica*
5	*Ailanthus altissima*
6	*Litsea monopetala*
7	*Bauhinia purpurea*
8	*Lannea coromondolica*
9	*Garcina sps.*
10	*Calicarpa arborea*
11	*Eucalyptus globulus*
12	*Erythrina indica*
13	*Cryptomeria japonica*
14	*Stereospermum tetragonam*
15	*Tectona grandis*
16	*Lagerstroemia parviflora*
17	*Mangifera indica*
18	*Sterculia villosa*
19	*Shorea robusta*

2.5.16 Improvement Proposals

As part of the road improvement for the road section the existing single-lane road would be improved with single lane corridor of 3.750m width, with 0.525 m wide paved shoulder

on either side, V-type Drain / Crash Barrier Hill / Valley side with 0.6m on each side. The total width required will be 6.0m minimum in rural areas and maximum 7.050m in both side built-up with footpath over both side drains. In addition, provisions the following provision for improvement have been made:

- Geometric Improvements
- Pavement – strengthening and reconstruction
- Cross-Drainage Structures
- Safety and
- Road Appurtenances

The draft *design* standards proposed for this project road are based on IRC: SP:73 2007, Manual of Standards & Specifications for intermediate lane. The design standards are presented below:

(i) Design Life

Geometry: The geometry of a highway is difficult to improve at frequent intervals because of inherent difficulties in availability of land and inconvenience and hazards to running traffic during improvement works. Thus, a design life of pavement has been taken for 15 years.

Structures: Structure, like bridges are costly. It is difficult and uneconomical to augment/ widen these structures later. These structures have therefore to be designed for longer life, that is, 75-100 years. Culverts are designed for a design life of 25 years.

(ii) Design Speed

It was proposed that the design speeds tabulated in Table be adopted, in general, for the Project Road as recommended by IRC. Wherever it becomes necessary to impose short sections of geometry over which operating speeds will have to be lower than 30 km/h, (R<35 m), these will be

(i) adequately marked with appropriate warning road signs.

Road Classification	Design Speed (km/h)	
	Mountainous	Terrain Steep Terrain

	Ruling	Min.	Ruling	Min.
National/State Highway	50	40	40	30
Major District Roads	**40**	**30**	**30**	**20**

2.5.17 **Traffic Projections:**The traffic projections are based on IRC guidelines and the assumed growth rate is 7.5%.

2.5.18 **Terrainand Topography:**This is determined by the general ground slope, and categorised as below:

Ground Slopes for Different Terrain

Terrain	Percent cross slope of the country
Plain	0-10
Rolling	10-25
Hilly	25-60
Mountainous	Greater than 60

2.5.19 **Sight Distance:** As per IRC recommendations, the minimum sight distance (Stopping sight distance) is absolutely minimum from safety angle and must be ensured regardless of any other considerations. It would be good practice if this value can be exceeded and visibility corresponding to intermediate sight distance in as much length of road as possible.The following stopping and intermediate sight distance for various design speeds are adopted:

Design Speed (kmph)	Sight Distance (m)	
	Stopping	Intermediate
20	20	40
25	25	50
30	30	60
35	40	80
40	45	90
50	60	120
60	80	160
65	90	180
80	120	240
100	180	360

2.5.20 **Soil Characteristics:** The soil characteristics along the alignment are determined in terms of CBR, both under soaked and un-soaked conditions. The design of pavement is based on the traffic load and on the soil characteristics available.

2.5.21 **Earth Work Slopes:** The recommended earthwork side slopes are tabulated in Table as shown-

Material	Cut	Fill	Slope from shoulder break point to side ditch
Soil	0.5:1	2:1	2:1
Rock	0.25:1	Not Applicable	

For 'rock' cuttings of height > 6.0 m in occurrences of friable material the consultants have considered the practical issue of inserting horizontal benches into the side slopes to reduce the load on the lower section of the cutting and to intercept occasional falls of soil, rocks fragments, and other debris.

2.5.22 Design Elements

Various design elements, which govern functioning of the project road, are broadly grouped under the following-

- Geometric Design
- Pavement Design
- Cross Drainage structure

Geometric Design: Geometric design features include individual components like Cross sectional Elements, Sight Distances, Horizontal Alignment and Vertical Alignment. These elements are geometrically combined to generate an efficient road layout.

2.5.23 Cross Sectional Elements for Parallel Road to existing Dalu Baghmara Road

Existing single lane is improved to single lane with paved shoulders.

Road Structure	Width
Carriageway width	3.750m
Paved shoulder	0.525m (each side)
V-type Drain / Crash Barrier [Hill / Valley side]	0.6m (each side)
Total width	6.000m in rural areas 7.050m in both side built up

Super elevation has been retained to maximum of 7.0%. Curve widening has been done on inner side wherever applicable. The surface cross fall of 2.5% is provided on main carriageway.

2.5.24 **Components *of Horizontal Alignment:*** Horizontal alignment has several components, all inter-dependent on each other. They are super-elevation, side Friction, radius of curvature, length of spiral, and attainment of super elevation. All the above elements are functions of design speed.

2.5.25 ***Horizontal Curves*:** The tangent sections, circular curve and transition curve elements are the major component of Horizontal alignment. A balanced control on the above elements is required to provide safe and continuous flow of vehicles under the general traffic conditions.

***Transition* curves** in the form of spiral between the tangent sections and circular curve element are designed to satisfy the requirements of allowable rate of change in experiencing centrifugal acceleration by the user and attaining super-elevation on carriageway for the circular curve. The minimum transition lengths suggested in the IRC guideline are indicated in the following sections. However, in unavoidable cases, where transition curves cannot be provided, super-elevation should be achieved by two-third being attained on the straight section before start of circular curve and one-third on the curve. The radii for horizontal curves corresponding to ruling minimum and absolute minimum design speed and the minimum transition lengths suggested in the IRC guideline are indicated in the below Tables.

Minimum Radii of Horizontal Curves for Various Classes of Hill Roads

S. No.	Road Classification	Mountainous Terrain	
		Ruling Min.	Absolute Min.
1	National and State Highways	80	50
2	Major District Roads	50	30
3	Other District Roads	30	20
4	Village Roads	20	14

Minimum Transition Length for Different Speeds & Curve Radii for Mountainous Terrain

Curve Radius (m)	Design Speed (kmph)				
	50	40	30	25	20
15				NA	30
20				35	20
25			NA	25	20
30			30	25	15
40		NA	25	20	15
50		40	20	15	15
55		40	20	15	15
70	NA	30	15	15	15
80	55	25	15	15	NR
90	45	25	15	15	
100	45	20	15	15	
125	35	15	15	NR	
150	30	15	15		
170	25	15	NR		
200	20	15			
300	15	NR			
400	15				
500	NR				

Horizontal Transition Curves: Transition curves have not been used due to geometry in this terrain generally does not find sufficient straight lengths in between curves to accommodate spiral lengths for transition.

Broken Back Curves: It is recommended to adopt a minimum 15-20 m minimum length of straight between curves of the same turning direction within the flat and rolling terrain sections; and in the hilly and mountainous terrain sections make every attempt to avoid the incorporation of short straight elements. In these latter sections each situation is considered individually and, if deemed appropriate, suitable warning signage will be installed.

Curve Widening: Recommended curve widening for single lane road as per IRC: SP: 48-1998 are indicated in Table below:

Radius (m)	**Widening (m)**
< 20	0.9
20-60	0.6
>60	No Widening Required

2.5.26 ***Components of Vertical Profile:*** Various components of vertical profile are longitudinal gradient and vertical curves. These elements are functions of design speed.

Longitudinal Gradient

Maximum Gradient:

The maximum grades allowed in steep terrain up to 3000 m above MSL are

Ruling gradient – 6.0% (1 in 16.7)

Limiting gradient – 7.0% (1 in 14.3)

Exceptional gradient – 8.0% (1 in 12.5)

However, in *view* of the existing steep hills and necessary economy in the project it has been proposed to limit the gradient to 7%.

Vertical Curve: The vertical curves are classified into two categories: Summit or Crest Curves and Valley or Sag Curves. Crest curves are designed to provide visibility corresponding to safe stopping sight distance (SSD). Length of sag curves is based on headlight sight distance and comfort criteria.

The "K" value, the ratio of length of curve and the algebraic difference between the intersection *tangent* grades, adopted for different speeds are given below.

"K" Values for Vertical Curve

Design Speed (kmph) **V**	**Rate of Vertical Curvature "K"** **(length (m) per % of grade difference)**	
	Crest Curve	***Sag Curve***
30	2	3.5
50	9	8

65	19	16

Below mentioned Typical Pavement Cross sections are proposed for the road section, these are given in Figure-,2.4,2.5,2.6, 2.7, 2.8, 2-9, 2-10, 2-11.

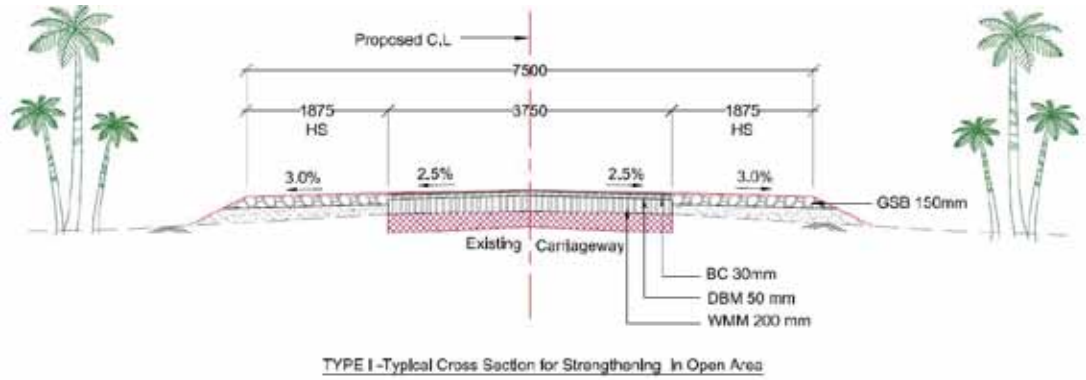

Figure-2-4 Typical Cross Section Type I

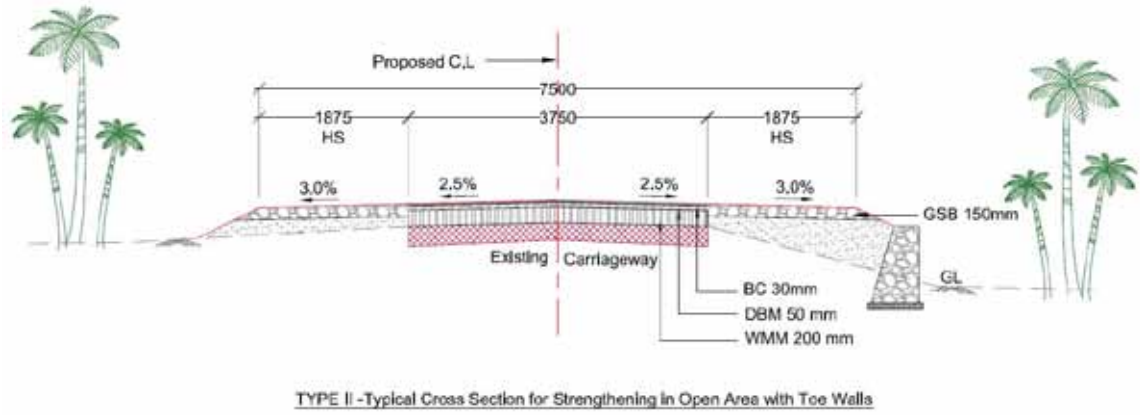

Figure-2-5 Typical Cross Section Type II

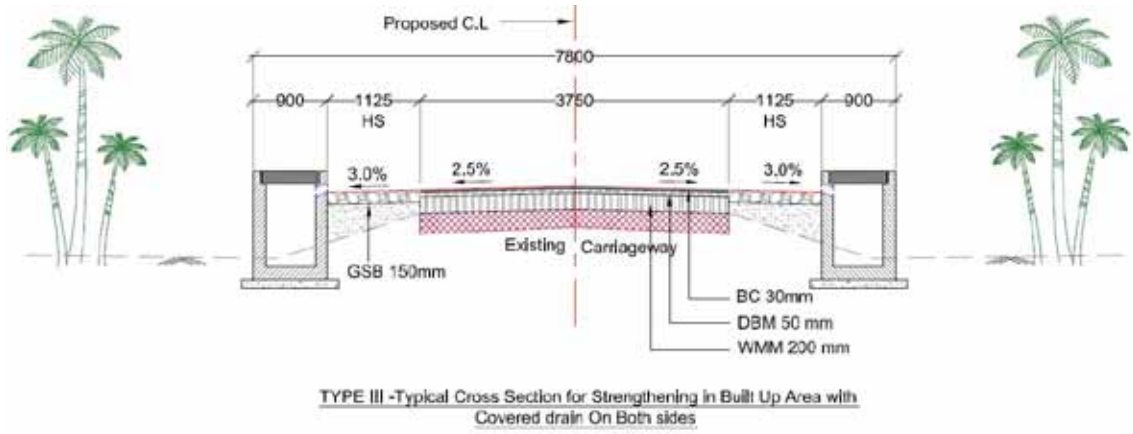

Figure-2-6 Typical Cross Section Type III

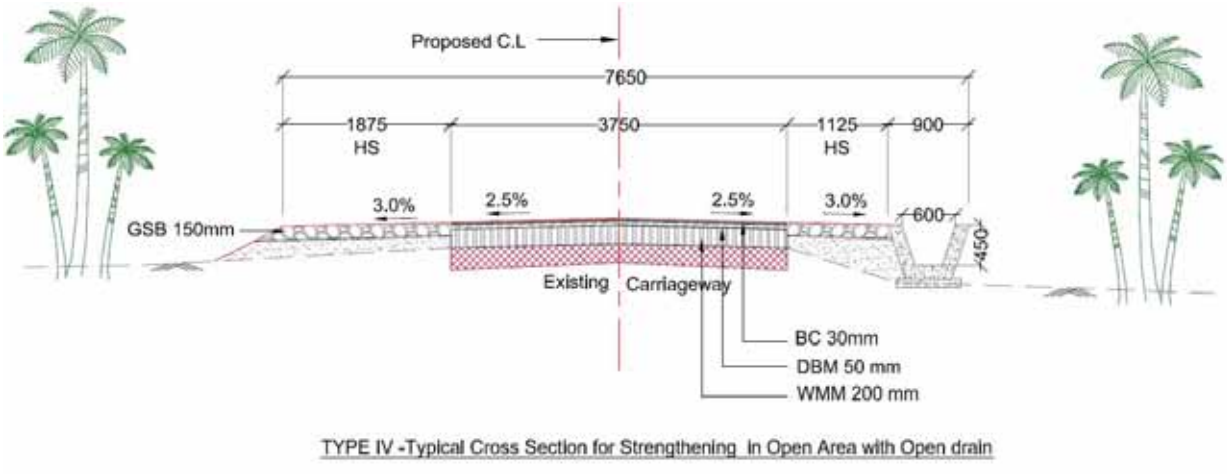

Figure-2-7 Typical Cross Section Type IV

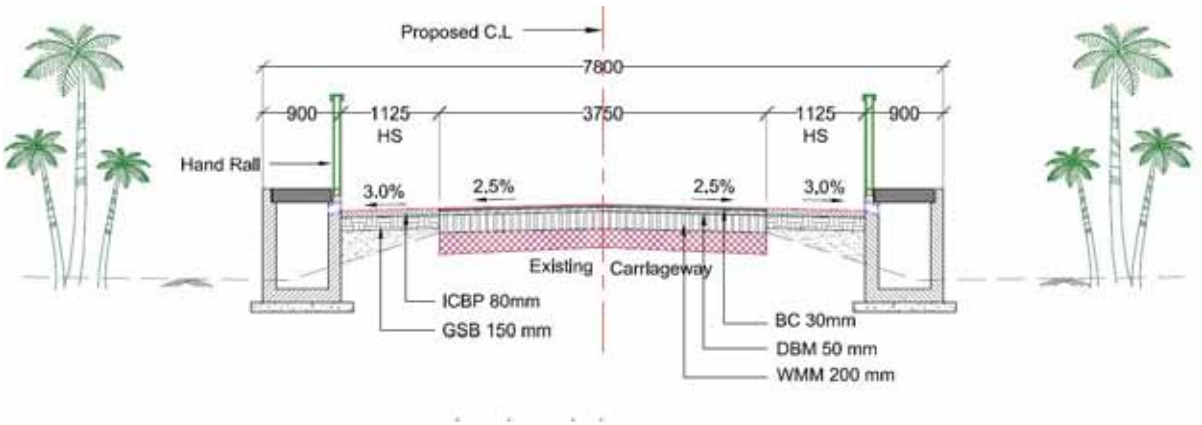

Figure-2-8 Typical Cross Section Type V

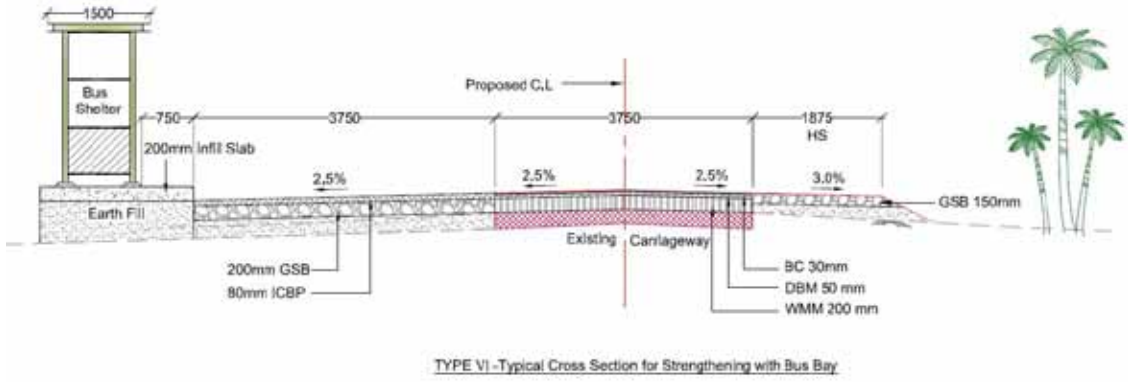

Figure-2-9 Typical Cross Section Type VI

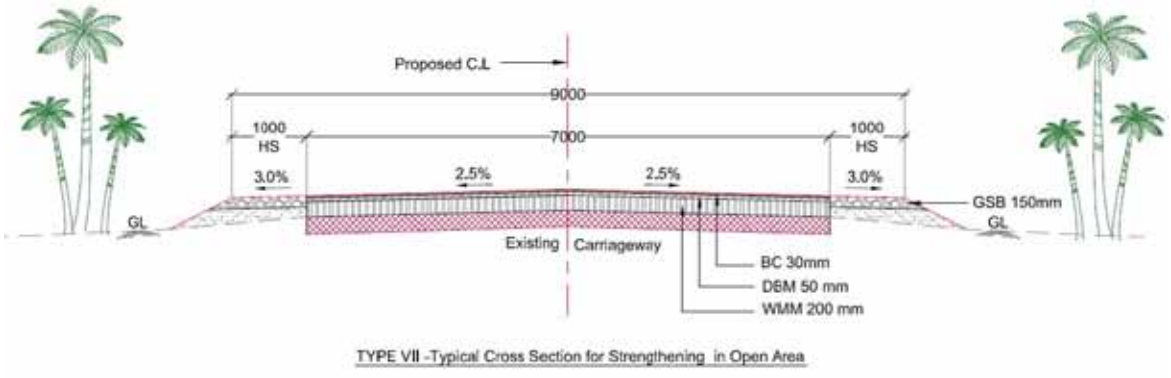

Figure-2-10 Typical Cross Section Type VII

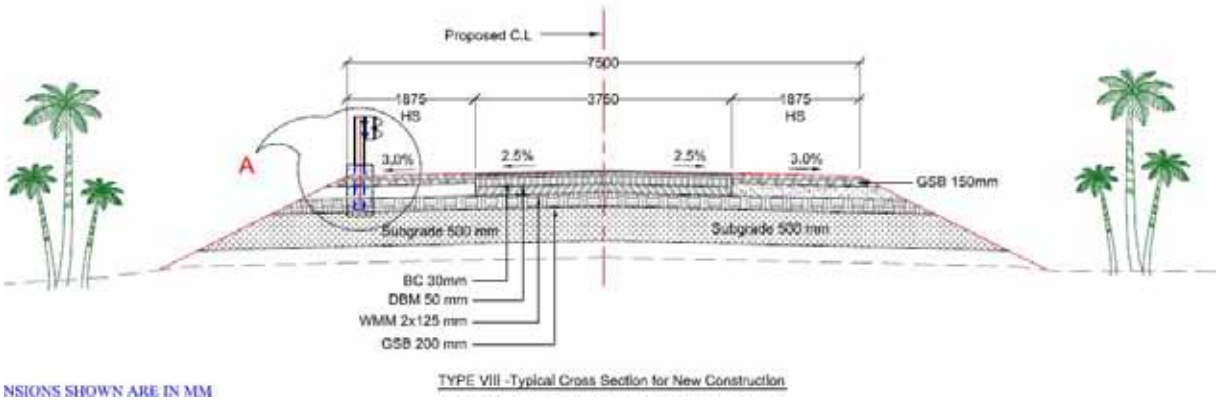

Figure-2-11 Typical Cross Section Type VII

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

3.1 Introduction

To address environmental risks of the project and its associated components and to protect and conserve the environment from any adverse impacts, the regulations, policy and guidelines enacted by the Government of India and Government of Meghalaya which must be followed are presented in the sections below. In addition, The World Bank have their own set of requirements i.e. the Operational Policy to which any project funded by them must also ensure compliance.

. This Section focuses on the administrative framework under the purview of which the Project will fall and the EIA study will be governed, namely:

• The national and local, legal and institutional framework;

• World Bank Policies and framework; and

• International Safeguard Requirements.

3.2 Government (India) Environmental Legal Framework

. The national legal framework of India consists of several acts, notifications, rules and regulations to protect environment and wildlife. In 1976, the 42nd Constitutional Amendment created Article 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment.

The environmental impact assessment requirement in India is based on the Environment (Protection) Act, 1986, the Environmental Impact Assessment Notification, 2006 (amended 2009), all its related circulars, MOEF&CC's Environmental Impact Assessment Guidance Manual for Highways 2010 and IRC Guidelines for Environmental Impacts Assessment (IRC:104-1988) of highway projects. In addition to road widening and rehabilitation including establishment of temporary workshops, construction camps, hot mix plants, and opening of quarries for road construction work require to comply with provisions of The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003): The Wildlife (Protection) Act, 1972 (Amended 1993); The Water (Prevention and Control of Pollution) Act 1972 (Amended 1988) and Rules 1974; The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982; The Noise Pollution (Regulation and Control) Rules, 2000 (Amended 2002) and Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008 (Amended 2009).

3.3 Environmental Clearance Procedure

The Proposed Parallel Road to existing Dalu Baghmara road improvement project is classified under 'Category B'[2] type project as per the latest EIA amendment, 2009. The project road doesn't attract any of the General Conditions (GC's) specified under the highways project activities. Since the project is classified under the Category B, it requires

[2] All state highways projects and state highways expansion projects in hilly terrain (above 1000m AMSL) and or ecologically sensitive area

Environmental Clearance (EC) from the state Environmental Impact Assessment Authority (SEIAA). In the absence of the state committee, the project shall be treated as Category A and will demand EC from MoEF. The process for the Environmental Clearance is depicted in Figure 3-1.

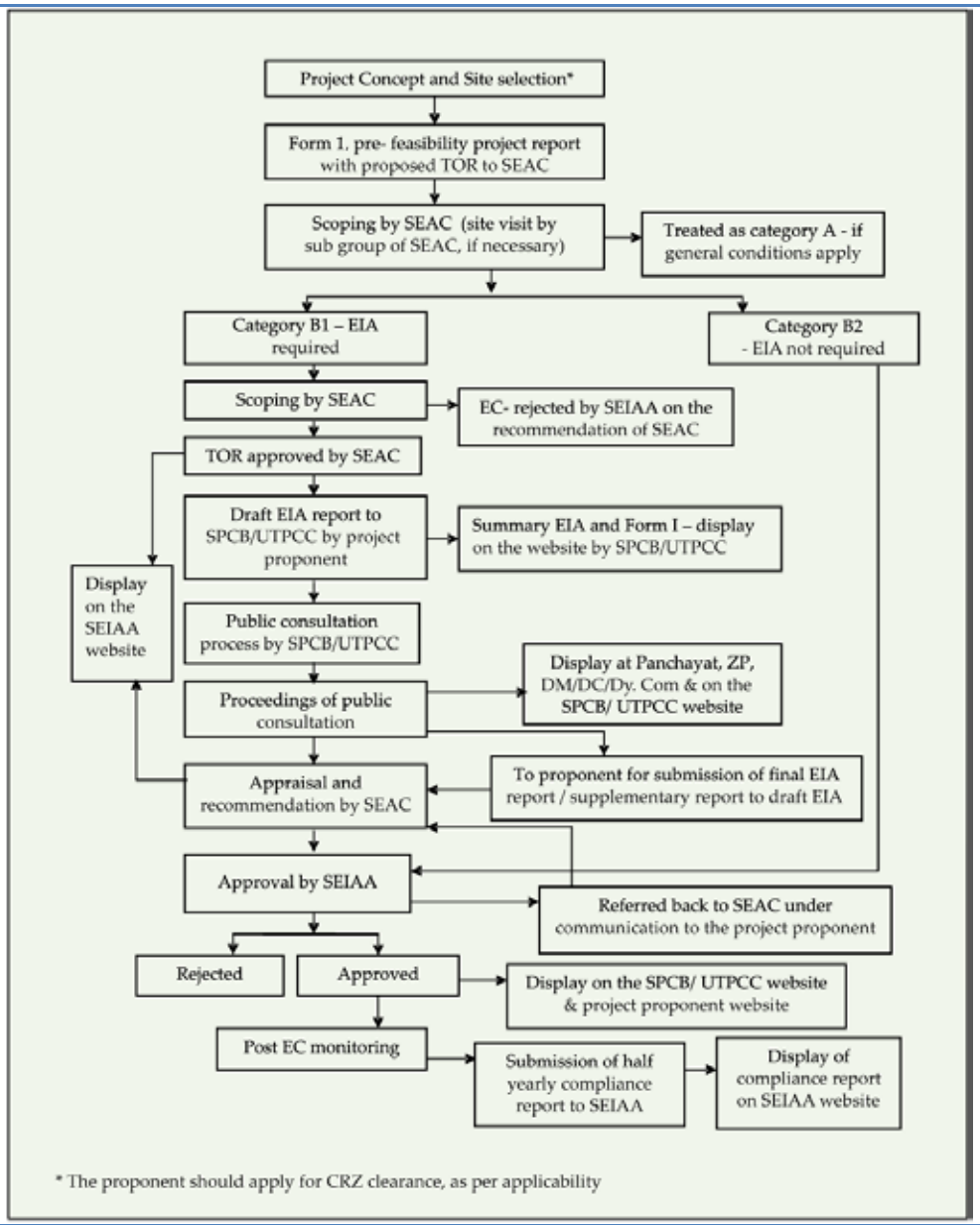

Figure 3-1: Environmental Clearance Process for 'Category B' Type Projects

The project shall also require obtaining consent from competent authorities such as the PCB, Meghalaya for 'Consent to Establish' by submitting a Common Application (as per Schedule-I), under Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981) and authorisation under Hazardous Wastes (Management and Handling) Rules, 1989, as amended.

3.4Environmental Standards and Code of Practices

In order to understand the extent of the environmental and social assessment for the proposed improvement works, applicable laws, legislation and policies were reviewed and presented in the following sections. A summary of applicable rules and regulation is furnished in Table 1-3.

Table 3-1: Summary of Environmental Legislation Applicable for Proposed Project

National Act	Year	Objective	Responsible Institution
Environment (Protection) Act.	1986	To protect and improve the overall environment	MoEF, CPCB
Notification on Environment Impact Assessment of Development projects (and amendments) (referred to as the Notification on Environmental Clearance)	2006 2009	To provide environmental clearance to new development activities following environmental impact assessment.	MoEF, CPCB
Wildlife Protection Act	1972	To protect wild animals and birds through the creation of National Parks and Sanctuaries	MoEF
Forest (Conservation) Act	1980	To protect and manage forests	MoEF
Water (Prevention and Control of Pollution) Act (and subsequent amendments)	1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	CPCB
Air (Prevention and Control of Pollution) Act (and subsequent amendments)	1981	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB and PWD
The Land Acquisition Act	1894 1984	Set out procedures for acquisition of land by government	Revenue and disaster management department, Meghalaya
Central Motor Vehicle Act Central Motor Vehicle Rules	1988 1989	To control vehicular air and noise pollution. To regulate development of the transport sector, check and control vehicular air and noise pollution.	Transport Department, Meghalaya
National Resettlement and Rehabilitation Policy	2007	Addressing impacts on affected persons due to all development projects	MoRD and respective state institutions undertaking the development projects
Meghalaya Government's Guidelines for Compensatory Afforestation	2000	Focus on mitigating environmental impact associated with any infrastructure development projects in the state	Department of Environment and Forest, Meghalaya
Draft National Policy on Tribal's	2004	The main objective is to facilitate overall development	Department of Social Welfare

National Act	Year	Objective	Responsible Institution
		and welfare of the tribal people	
Ancient Monuments and Archaeological sites and Remains Act	1958	Conservation of Cultural and historical remains found in India.	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).

Source: GoI, MoEF & GoM

3.4.1 Legal Framework

Ministry of Environment and Forests (MoEF)

The primary responsibility for administration and implementation of the GoI policy with respect to environmental management, conservation, ecologically sustainable development and pollution control rests with the MoEF Established in 1985; the MoEF is the agency primarily responsible for review and approval of EIAs pursuant to GoI legislation. The MoEF has set up regional offices responsible for collecting and furnishing information relating to EIA of projects, pollution control measures, enforcement of legislations and environmental protection in special conservation areas such as wetlands, mangroves and biological reserves.

Pollution Control Board, Meghalaya

The objective of PCB, Meghalaya is to control, prevent and abate pollution in the State to protect the environment from any degradation by effective monitoring and implementation of state pollution control legislations and also involved in Implementation, supervision and monitoring activities pertaining to Central Pollution Control Acts and Rules vests with the Central Pollution Control Board (CPCB), Government of India.

3.4.2 Key Environmental Laws and Regulations

The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements existing environmental regulations. Empowered by the EP Act, the Ministry of Environment & Forests (MoEF), Government of India has issued the following notifications regulating siting of industry and operations, procuring clearance to establish industries and development of projects with appropriate EIA studies, coastal zone regulations and other aspects of environment are:

- Empowers the Government of India (*section 6*) to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other environmental pollutants
- Prohibits operations that emit pollutants in excess of standards (*section 7*)
- Regulates handling of hazardous substances and identifies persons responsible for discharges and pollution prevention (*section 9*)
- *Section 17* deals with offences committed by Government Departments
- Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6, 8 and 25 of EP Act
- The act has been supplemented with EIA notification 2006

Environmental Impact Assessment Notification, 2006

EIA notification of the MoEF dated the 14th September 2006 provides for the following:

- All projects and activities are broadly categorized into two categories - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources.
- All projects or activities included as *Category 'A'* in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes of this notification;
- All projects or activities included as *Category 'B'* in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC) as to be constituted for in this notification.

Environmental Impact Assessment Notification - 2006, amendment 2009

EIA notification 2006 amendment 2009 explicates 'All state Highways and State expansion projects in hilly terrain (above 1,000m AMSL) and or ecologically sensitive areas' will be categorized as 'B' type project and demands for Environmental Clearance from SEIAA.

Water (Prevention and Control of Pollution) Act 1974, amended in 1988

Water Act is the first environmental regulation that brought at the state and centre levels, pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 88, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

Vests regulatory authority on the State Pollution Control Boards and empowers them to enforce effluent discharge standards to prevent water pollution (both for industries and local authorities)

- *Section 24* of the act prohibits use of stream or well or on land disposal for polluting substances that violate disposal standards laid down by the board
- *Section 25* of the act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer on land
- *Sections 41* and *44* provide for penalties for not complying with the various provisions or directives of the board
- *Section 48* deals with offences committed by Government Departments
- *Section 55* asserts that all local authorities shall render help & assistance and furnish information to the board as required for discharge of functions, and shall make available to the board, for inspection and examination, such records, maps, plans and other documents as may be necessary
- The act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilise and augment resources for the Pollution Control Boards. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated.

Air (Prevention and Control of Pollution) Act 1981

Similar to Water Act, the Air Act vests regulatory authority on the State Pollution Control Boards and empowers them to enforce air quality standards to prevent air pollution in the country. *Section 21* of the act requires an application to be made to the state board to establish or operate any industrial operation.

Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

These rules aim at controlling the generation, storage and import of hazardous chemicals. According to these rules, the user of hazardous chemicals has to perform the following and dispose hazardous waste as mentioned in the rules:

- Identify the potential hazards of the chemicals and take adequate steps to prevent and control such hazards
- Develop or provide information about the chemical in the form of safety data sheets
- Label the specified information on the container of the hazardous chemical

Forest (Conservation) Act, 1980, (as Amended In 1988)

As per Section 26 of Indian Forest Act, 1927 a number of activities are prohibited in forest areas and prior approval is required from the Central government to use forest land for non-forest purposes.

The Forest (Conservation) Act, 1980 prohibits large-scale diversion of forestland for non-forest use. As amended in 1988, no State Government or authority shall make such diversions except with the prior approval of the Central Government. Salient features of the act are summarised below.

- The Indian Forest Act, 1927: *Section 5* states that after declaring a particular land as reserved forest, no fresh clearings for any purpose shall be made, except in accordance with such rules as made by the state government
- *Section 26* states the acts prohibited in such forests, in addition to *section 5*
- *Sections 30, 32* furnish power to the State government to regulate certain acts (clearing for cultivation, building or any other purpose) in such forests as specified in the section
- *Section 35* furnishes power to the State government to prohibit certain acts (clearing of vegetation etc) in lands not being the property of the government

- The Forest (Conservation) Act, 1980: *Section 2* of the Act restricts the state government on the de-reservation of forests or use of forestland for non-forest purposes
- The Forest (Conservation) Rules, 1981: *Rule 4* states that the procedure for state governments to make a proposal seeking prior approval to de-reserve a forest for non-forest purposes (section 2 of Forest Act, 1980), provided all proposals involving clearing of naturally grown trees in forest land or portion thereof, for the purpose of using it for afforestation, shall be sent in the form of a working plan / management plan

Wildlife Protection Act, 1972

This act is promulgated to provide for the protection of wild animals, birds and plants and for matters connected therewith. The provisions under this act are as below:

- *Section 9* of the Act mentions that no person shall hunt any wild animal specified in Schedule-I
- The act prohibits picking, uprooting, damaging, destroying, acquiring any specified plant from any forestland
- It bans the use of injurious substances, chemicals, explosives that may cause injury or endanger wildlife in a sanctuary
- No alteration of the boundaries of a National Park shall be made except on a resolution passed by the Legislature of State
- Destruction or damage of wildlife property in a National Park is prohibited

Biological Diversity Act 2002

The Biological Diversity Act 2002 is a law meant to achieve three main objectives:

- The conservation of biodiversity;
- The sustainable use of biological resources;
- Equity in sharing benefits from such use of resources

Its key provisions aimed at achieving the above are:

- Measures to conserve and sustainably use biological resources, including habitat and species protection, environmental impact assessments (EIAs) of projects, integration of biodiversity into the plans, programmes, and policies of various departments/sectors;

- Prohibition on transfer of Indian genetic material outside the country, without specific approval of the Indian Government;
- Measures for sharing of benefits from the use of biodiversity, including transfer of technology, monetary returns, joint Research & Development, joint IPR ownership, etc.;
- Protection of indigenous or traditional knowledge, through appropriate laws or other measures such as registration of such knowledge;
- Regulation of the use of genetically modified organisms;
- Setting up of National, State, and Local Biodiversity Funds, to be used to support conservation and benefit-sharing;
- Setting up of Biodiversity Management Committees (BMC) at local village level, State Biodiversity Boards (SBB) at state level, and a National Biodiversity Authority (NBA).

3.4.3 Environmental Requirements of the State

3.4.4 Other Legislation Applicable to Road Construction Projects

National Policy on Resettlement and Rehabilitation-Project Affected Families- 2003, GoI, 2004

The National Policy is in the form of broad guidelines and executive instructions for guidance of all concerned and is applicable to Projects displacing 500 families or more in plain areas and 250 families in hilly areas, Desert Development Programme (DDP) blocks, areas mentioned in Schedule V and Schedule VI of the Constitution of India.

The Policy sets stress on the need to handle R&R of Project Affected Families with utmost care and forethought particularly in cases of tribal's, small and marginal farmers, those below poverty line and women. The policy recognizes the following as vulnerable: BPL, Small and Marginal farmers, SC, ST and Women. As a result, the Policy provides for additional assistance particularly to BPL (in Section 6.3), Marginal farmers (in Section 6.12), SC (in Section 6.20) and ST (in Section 6.21).

- Article 243 D: Reservation of seats for SC, ST and women

Draft National Policy on Tribal's

This National Policy recognises that a majority of Scheduled Tribes continue to live below the poverty line, have poor literacy rates, suffer from malnutrition and diseases and are

vulnerable to displacement and the policy aims at addressing each of these problems in a concrete way. It also lists out measures to be taken to preserve and promote tribals cultural heritage.

The main objective is to facilitate the overall development and welfare of the tribal people through empowering them educationally, socially, economically and politically while recognizing their special identity - culturally, habitationally, traditionally and in terms of their age old rights and privileges.

Ancient Monuments and Archaeological sites and Remains Act, 1958

An Act formulated for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects.

3.4.5 World Bank Environmental Requirements

A review of all applicable operational policies / directives of The World Bank and environmental laws / regulations in India, was carried out in this task. This included review of the following operational policies of The World Bank.

- OP 4.01 - Environmental Assessment
- OP 4.04 – Natural Habitats
- OP 4.11 – Cultural Properties
- OP 4.36 – Forestry

OP 4.01 - Environmental Assessment

Operational Policy 4.01 (OP 4.01) is one of the ten safeguard policies of the World Bank, which provides the Environmental Assessment (EA) guidance for the lending operations. The OP 4.01 requires the borrower to screen projects upstream in the project cycle for potential impacts. Thereafter, an appropriate EA approach to assess, minimize / enhance and mitigate potentially adverse impacts is selected depending on nature and scale of project. The EA needs to be integrated in the project development process such that timely measures can be applied to address identified impacts. The policy requires consultation with affected groups and NGOs to recognize community concerns and the need to address the same as part of EA.

OP 4.04 – Natural Habitats

OP 4.04 sets out the World Bank's policy on supporting and emphasizing the precautionary approach to natural resource management and ensuring opportunities for environmentally sustainable development. As per this policy, the Bank does not support projects that involve significant conversion or degradation of critical natural habitats. As per this policy, the Bank does not support projects that involve significant conversion or degradation of critical natural habitats. Projects involving non critical habitats are supported if no alternatives are available and if acceptable mitigation measures are in place.

OP 4.11 – Cultural Properties

Guided by Operational Policy Note 11.03, this OP sets out the Bank's policy to assist in preservation and avoiding elimination of cultural properties with archaeological (prehistoric), paleontological, historical, religious and other unique natural values. Projects that could significantly damage non-replicable cultural properties are declined for funding and the Bank will in turn assist protection and enhancement of cultural properties encountered in the project rather than leave that protection to chance.

OP 4.36 – Forestry

This policy of the bank aims to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively for sustainable economic development and protect vital local and global environmental services and values of forests. According to this policy, the bank does not finance projects involving significant conversion or degradation of critical forest areas or critical natural habitats. The potential impacts on forests resources are addressed as per OP/BP 4.01 and projects are financed only after incorporating appropriate mitigation measures.

3.4.6 MORTH & IRC SPECIFICATIONS

Specifications for Road and Bridge Works, Fourth Revision, MoRTH, Published by IRC, 2001

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, Annexure A and the contractor is to satisfy the provisions. Apart from the Annexure A to clause 501, there are provisions for control of erosion, drainage, dust suppression,

borrow area and haul road management under relevant sections. Provisions of clause 501 Annexure A, cover the environmental aspects as:

General	·	The contractor shall take all necessary measures and precautions to carry out the work in conformity with the statutory and regulatory environmental requirements
	·	The contractor shall take all measures and precautions to avoid nuisance or disturbance from the work. It shall be precautionary measures than abatement measures taken after generation of nuisance
	·	In the event of any spoil, debris, waste or any deleterious material from site being deposited on adjacent land, the same shall be removed and affected area shall be restored to its original state
Water	·	The contractor shall prevent any interference with supply/abstraction of water resources
	·	Water used for dust suppression shall be reused after settlement of material in collected water
	·	Liquid waste products to be disposed off such that it does not cause pollution
	·	No debris is to be deposited or disposed into/adjacent to water courses
Air	·	The contractor to devise and arrange methods to control dust, gaseous or other airborne emissions in such a way that adverse impacts on air quality is minimized
	·	Dust shall be minimized from stored material and stockpiles by spraying water
	·	Covering of material likely to rise dust during transport is to be covered with tarpaulin
	·	Spraying of water on haul roads if found necessary
Noise	·	The contractor shall use all necessary measures to reduce noise from construction equipment and maintain all silencing equipment in good condition
Control of wastes	·	No uncontrolled disposal of wastes shall be permitted. The contractor shall make specific provisions for disposal of all forms of fuel and engine oil, all types of bitumen, cement, surplus aggregate, gravels, bituminous mixtures etc. conforming to local regulations and acceptance of the engineer
Emergency Response	·	The contractor shall plan and provide for remedial measures in case of occurrence of emergencies as spillages of oil, bitumen or chemicals

In addition to the above conditions, avoidance measures and control of activities having potential for generation of environmental impacts are devised. These include:

Section 111	·	Precautions for safeguarding the environment
Clause 201.2	·	Preservation of Property/Amenities during clearing and grubbing
Clause 301.3.2	·	Stripping and storing of topsoil for reuse during excavation for roadway and drains
Clause 302.4	·	Restriction on timings for blasting operations
Clause 304.3.6	·	Public safety near towns and villages where excavation is carried out
Clause 305.2.2.2	·	Locations of borrowing and relevant regulations
Clause 305.3.3	·	Stripping and storing of topsoil at borrow locations
Section 306	·	Soil erosion and sedimentation control
Clause 407.4.2	·	Provisions for turfing on median and islands
Section 517	·	Recycling of bituminous pavement and excavated material
Clause 701.2.1	·	Use of geotextiles for control of soil erosion
Section 810	·	Use of Metal beam crash barriers for safety, relevant regulations and specifications
Clause 1010	·	Quality of water for curing and construction
Clause 2501	·	Precaution during river training works

Guidelines for Environmental Impact Assessment, IRC: 104-1988

The guidelines endorse application of Environmental Protection Act, 1986 for highway projects. It recommends that the methods of measuring air pollution should be in conformance with IS: 5182-1977 and in case of noise pollution: IS: 3028-1980, Measurement of noise emitted by moving road vehicles; IS: 4758-1968, Method of measurement of noise emitted by machines; IS: 10399-1982, Method of measurement of noise emitted by stationary road vehicles are to be followed. As regards Highway aesthetics, use of provisions made in IRC: SP: 21-1979, Manual on Landscaping of roads are to be followed.

Other Applicable Laws

Environmental issues during road construction stage generally involve equity, safety and public health issues. The road construction agencies require complying with laws of the land, which include inter alia, the following:

Workmen's Compensation Act 1923: The Act provides for compensation in case of injury by accident arising out of and during the course of employment;

Contract Labour (Regulation and Abolition) Act, 1970: The Act provides for certain welfare measures to be provided by the contractor to contract labour;

Minimum Wages Act, 1948: The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act;

Payment of Wages Act, 1936: It lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers;

Equal Remuneration Act, 1979: The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees;

Child Labour (Prohibition and Regulation) A; 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry;

Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979: The inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.;

The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996: All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.;

The Factories Act, 1948: The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities;

Hazardous Wastes (Management and Handling) Rules, 1989: Occupiers generating hazardous wastes given in the list shall take all practical steps to ensure that such wastes are properly handled, i.e. collection, reception, treatment, storage, and disposed of without any adverse effects to human health and environment (Rule 4 Such occupier shall apply for authorization in prescribed format to the State Pollution Control Board).

Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996: The Rules provide for mandatory preparation of On-Site Emergency Plans by the industry and Off-Site Plans by the district collector and the constitution of four tier crisis groups at the centre, district, and local levels for the management of chemical disaster.

4 ENVIRONMENTAL BASELINE STATUS

4.1 Introduction

This section describes the existing environmental and social baseline of the study area around the Project Road. It includes relevant components of physical, biological and socio-economic environment.

The purposes of describing the environmental settings of the study area are:

- To understand the project needs and environmental characteristics of the area; and
- To assess the quality of the existing environment, as well as the environmental impacts of the future developments being studied.

The baseline environment for the EIA was studied through primary survey, information collected from secondary sources and discussion with local stakeholders.

4.2 Methodology

Study Area

Entire stretch of proposed strengthening & improvement corridor (Parallel Road to existing Dalu Baghmara Road) falls in the district of undivided East Garohills district and in West Garo Hils district. District of West Garohills is situated on North of Meghalaya bordering with the state of Assam. The West Garo Hills District of Meghalaya is situated approximately between the latitudes 90° 30' and 89° 40' E, and the longitudes of 26° and 25° 20' N. The West Garo Hills district being relatively lower in altitude to the rest of Meghalaya, experiences a fairly high temperature for most part of the year. . The district covers an area of 1,831 Km2 and is bounded by West and East Garo Hill districts of Meghalaya on the South and Kamrup District on the East, Dhubri District on the West River Brahmaputra all along the North.

As discussed in section -1. the study area has been defined as follows:

Corridor of Impact (CoI): The area of 500 m on either side of the proposed road centerline is considered as the corridor of impact. The proposed RoW i.e. 10 m is thus included within the CoI. This area is more vulnerable to the project's direct impacts.

Project Influence Area (PIA): In accordance with MoEF&CC's EIA Guideline Manual for Highways and as per guidelines of EIA Notification-2006, the Project Influence Area has Been defined as 10 km on either side (Arial distance) from boundary of road. Collection of Secondary data, including likely impacts due to ancillary sites like borrow areas, quarry, material storage, disposal areas, etc. are done within this influence area.

4.3 Environmental Surveys and Studies

Collection of baseline information on bio-physical, socio-economic aspects of the project area is the most important reference for environmental assessment studies. The description of environmental settings includes the characteristic of area in which the activity of project road section would occur, and cover area affected by all environmental impacts. Thus, for conducting EIA, existing environmental conditions along the project road have been obtained by primary data collection, monitoring, sampling and secondary data collection from published source and various government agencies. The primary studies are focused on the Corridor of influence but the sensitivities in the project influence area have been collected through secondary literature review.

To assess the baseline environmental status of the Corridor of Impact, monitoring of various environmental attributes was conducted by the consultants during November-December 2019. Primary data for ambient air quality, ambient noise status, water quality (Ground and surface) and soil quality was collected and analysed through an NABL accredited laboratory. The detailed results of baseline monitoring and photographs are given in Appendix-1.

Information of various physical parameters was collected from the Guwahati Centre of Indian Meteorological Department, Statistical Department, Gazetteer of Meghalaya, Forest Department, Department of Environment and other concern Government Departments and discussions with the officials from these agencies.

4.4 Land Environment

4.4.1 Topography

The topography of undivided West Garohills is generally characterized by undulating terrain and flat plain mostly covered with low forested Hills that break the monotony of the terrain. The elevations of these hills ranging from 100 to 1500 mos. physiographically,

the area is occupied by both the hills and plains. The hills are veneered by lateritic mantle and are deeply forested with evergreen mixed open jungles.

4.4.2 Soil

The plain areas bordering Brahmaputra River and in between the inselbergs are occupied by alluvial sediments belonging to quaternary ages. Based on such criteria such as sedimentation, soil characteristics and geomorphic features, the quaternary sediments can be grouped into two subdivisions, viz.

- Older Alluvium, and
- Younger alluvium

The Older alluvium by virtue of its relative maturity is composed of somewhat oxidized sediments comprising yellow and reddish brown colour sand, silt and clay in contrast to the light colour, less compact Younger alluvial sediment. The Older alluvium always occupies the higher grounds than the adjacent Younger alluvium but takes the proper stratigraphical position underlying the Younger alluvium sediments in the plain areas.

4.4.3 Geology

Geologically, the district may be divided into two broad groups, viz (i) Pre-Cambrian crystallines occupying in the hills and the Inselbergs and (ii) Quaternary sediments constituting the river valleys and the plain areas in between the Inselbergs.

- Pre-Cambrian crystallines consist of green schist to amphibolites facies (minor granulites) metamorphic rocks intruded by granitic plutons.
- Quaternary sediments are commonly recognized in the field by their lack of consolidation into rock and by association with landforms representing processes of deposition (river terraces, shorelines, moraines and drumlins. Quaternary sediments are most easily distinguished in temperate latitudes where glacial or periglacial processes held sway.

4.4.4 Seismicity

Based on the distribution of epicentres, fault plane solutions and geotectonic features, northeastern region is divided into five seismotectonic zones. These are (i) Eastern Himalayan collision zone (ii)Indo-Myanmar subduction zone (iii) Syntaxis zone of Himalayan arc and Burmese arc (Mishmi Hills) (iv) Plate boundary zone of the Shillong Plateau and Assam Valley and (v)Bengal Basin and Plate Boundary Zone of Tripura Mizoram fold belt.

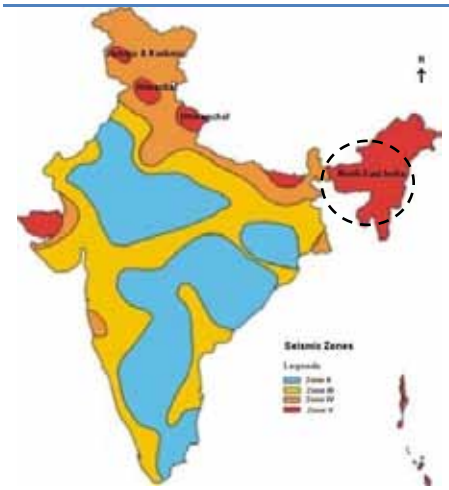

Figure 4-1: Seismic zone map of India

The proposed project corridor attracts under zone-4 (Plate boundary zone of the Shillong Plateau and Assam Valley). Seismicity in this zone is considered as the plate-boundary zone activity. Seismic activity is quite high in this zone. It was the seat of great Shillong earthquake of 1897. Besides, three large earthquakes of M>7 occurred in this zone. In the Shillong plateau, the focal depth is mostly within 60 km. The prominent structural discontinuities in the plateau are Dudhnai, Kulsi, Samin, Dauki and Dhubri faults and Dapsi and Barapani thrusts.

4.4.5 Flood plains

The project district i.e. West Garohills which has no serious impacts of the monsoon flood. In the project road alignment only one area has been coming under the risk of annual flood. This stretches in the project corridor has been prone to flood during the monsoon seasons. Details of the stretches are given in the Table 4-1.

Table 4-1: Flood prone stretch of Parallel Road to existing Dalu Baghmara Road

Sl.No.	Chainage		Length	Depth of submergence (cm)	Remarks
	From	To			
1	12/900	13/100	100	10 to 15	Local depression

Source: Primary Analysis

4.5 Water Environment

4.5.1 Hydrogeology

Hydrogeologically, the entire district has been grouped into two main units, viz. (i) Unconsolidated formation, and (ii) Consolidated formation. Further subdivisions like Older and Younger alluvium have been made on the basis of (a) geomorphology including land use (b) Lithology and soil characteristics (c) Hydrogeological properties like yield characteristics etc. The aerial distributions of the unconsolidated formations are rather discontinuous occurring in between the inselbergs, but are broadly bordering the Brahmaputra River valley.

Consolidated formations including the isolated inselbergs cover approximately 250 sq. km, which are mainly occupied by forest and barren lands.

4.5.2 Rivers

The project alignment passes through two major rivers viz. Bakali river and Bhogai river other than the seasonal and perennial streams.

Table 4-2: Rivers/ Streams Crossing Across Project Road

Sl. No	Rivers	Chainage (Km)	Type
1	Bakali River	0/990	Perennial
2	Bhogai River	2/350	Perennial

Source: Primary Analysis

STREAMS

Sl.No.	Chainage	Spring/Stream
1	4+535	Stream
2	8+900	Stream
3	14+310	Stream
4	15+916	Stream
5	17+470	Stream
6	19+100	Stream
7	19+800	Stream
8	19+043	Stream

Figure 4-2: Map View of Bakali River

Figure 4-3: Map View of Bhogai

4.5.3 Ponds / Lakes

There are few ponds and a big fishery (9/300, 16/600, 17/100/18100) identified along the project stretch, all are found to be monsoon dependent. However, at the time of observation the ponds seem to be perennial in nature. The available water source is utilized for irrigation and aquaculture purpose.

4.5.4 Ground water aquifer

The hydrogeological framework of the district is essentially controlled by geological setting, distribution of rainfall and movement of ground water through inter-connect weak planes due to joints, fissures and faults, primary and secondary porosities of the Geological formation. Hydrogeologically, the district can be divided into three units, namely consolidated, semi consolidated and unconsolidated formations.

4.5.5 Recharge zones

In the deeper aquifer of older alluvium, medium/heavy duty tube wells range in depth from 82 to 93 m and tap 18–36 m of granular zone yielding 55 – 110 m^3 per hour for draw down ranging up to 9 m. In the Younger alluvial areas, there is no deep tube well. However, the low duty small diameter (8 cm) shallow tube wells constructed in the similar younger alluvium range in depth from 25 to 30 m tapping 8 – 10 m granular zones and yield about 25 – 40 m^3 per hour for a draw down up to 8 m.

4.5.6 Surface water quality

The assessment of water quality in the study area was done by comparing with the standards prescribed in the IS: 2296. After studying the drainage pattern of the study area,

3 samples of surface waters were collected; one is from Paulpara, the second is from the river near Gasuaspara and the third from Jatrakona (pond).

The analytical results of surface water samples show that the Calcium and Magnesium content indicates water to be soft and suitable for drinking as well as for construction activities. The dissolved oxygen value for all the samples ranging from 4.2 to 5.4 indicates the sustainability of aquatic life. Thus almost all physico-chemical parameters are well within the prescribed limits as per IS: 10500:1991 standards. Calcium and magnesium represents the hardness is low in the surface water.

Figure 4-4: Surface Water Sampling Locations

Table 4-3: Surface Water Quality

Sl. No	Parameters	Paulpara	Gasuaspara	Jatrakona	Units
1	pH	7.2	7.1	6.8	
2	EC	0.215	0.208	0.211	millimhos/cm
3	Acidity	12.8	15.3	14.2	mg/l as $CaC0_3$
4	Alkalinity	79	63	71	mg/l as $CaC0_3$
5	Nitrate	0.78	0.85	0.78	mg/l
6	Calcium	6.5	6.42	6.18	mg/l
7	Magnesium	3.2	3.1	2.84	mg/l

Sl. No	Parameters	Paulpara	Gasuaspara	Jatrakona	Units
8	Chloride	12	11	10	mg/l
9	Sulfate	5.2	6.58	6.12	mg/l
10	DO	4.2	4.2	5.4	mg/l
11	Sodium	21.36	24.56	18.63	mg/l
12	Total Suspended Solids	176	168	182	mg/l
13	Dissolved solids	45	42	54	mg/l
14	Iron	0.66	0.76	0.75	mg/l
15	Potassium	3.8	4.4	4.9	mg/l
16	Lead	BDL	BDL	BDL	mg/l
17	Cadmium	BDL	BDL	BDL	mg/l
18	Copper	0.04	0.02	0.03	mg/l
19	Chromium	0.08	0.5	0.07	mg/l
20	Zinc	0.23	0.29	0.36	mg/l
21	Nickel	BDL	BDL	BDL	mg/l

Source: Primary Analysis

4.5.7 Ground water quality

Understanding the water quality of the project area is an integral part of Environmental Impact Assessment to identify critical issues with a view to suggest appropriate mitigation measures for implementation. Water samples were collected from the project area to represent the baseline condition. Even though impact on ground water is not envisaged in the proposed road improvement works, three groundwater samples were collected from one is from Paulpara, the second is from Gasuaspara and the third from Jatrakona (Figure 4-7) were analysed for its chemical parameters. The following Table 4-4 furnishes the various physico-chemical property of the groundwater.

Table 4-4: Groundwater Quality

Sl. No	Parameters	Paulpara	Gasuaspara	Jatrakona	Units
1	pH	7.1	6.9	6.9	
2	EC	0.21	0.26	0.21	mmhos/c
3	Nitrate	0.35	0.27	0.34	mg/l
4	Total Hardness	86	52	91	mg/l
5	Chloride	6.6	5.8	5.87	mg/l
6	Sulphate	5.21	7.26	6.8	mg/l
7	Fluoride	0.51	0.55	0.49	mg/l
8	TSS	179	171	169	mg/l
9	Dissolved solids	139	132	145	mg/l
10	Iron	0.9	0.7	0.6	mg/l
11	Potassium	3.4	3.7	3.1	mg/l
12	Magnesium	7.2	8.5	7.9	mg/l
13	Calcium	21.36	22.31	19.36	mg/l
14	Lead	BDL	BDL	BDL	mg/l
15	Cadmium	BDL	BDL	BDL	mg/l
16	Copper	0.02	0.03	0.01	mg/l
17	Chromium	BDL	BDL	BDL	mg/l
18	Zinc	0.17	0..18	0.24	mg/l
19	Nickel	BDL	BDL	BDL	mg/l

Source: Primary Analysis

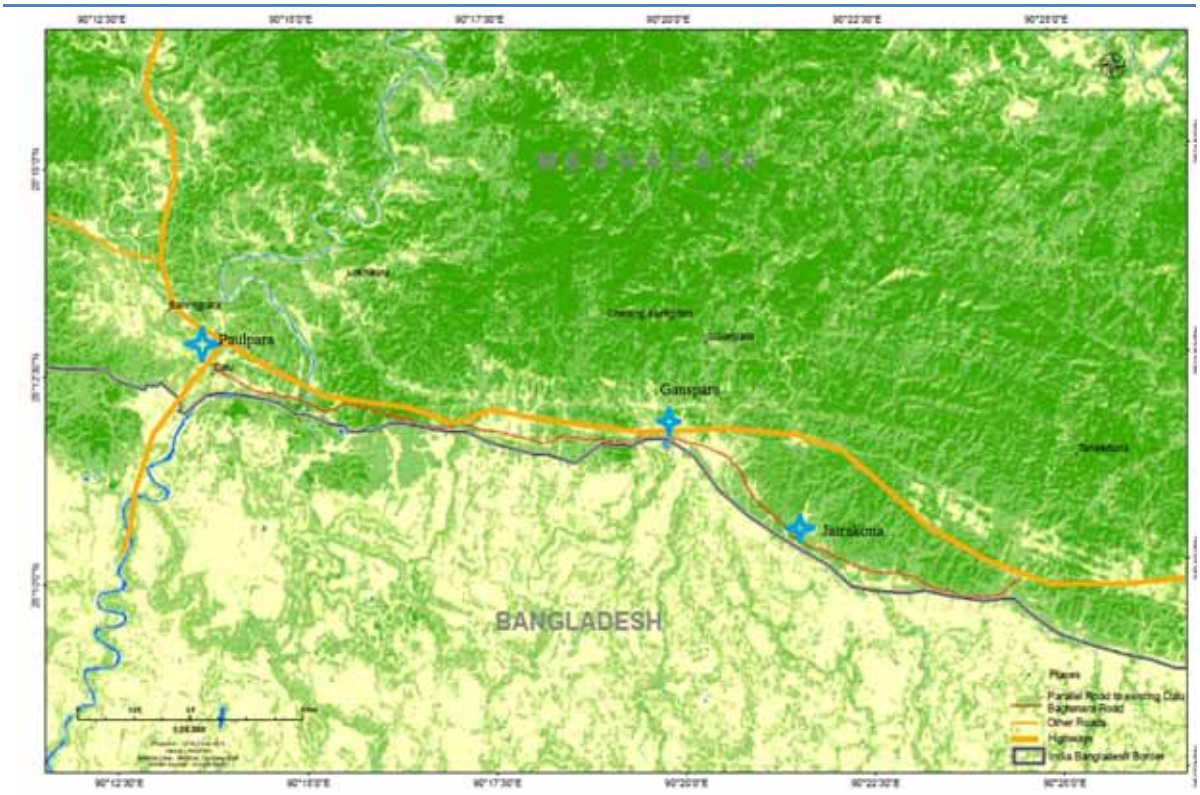

Figure 4-5 Ground Water Sampling Locations

The water quality with respect to almost all the essential parameters was observed to be good and acceptable quality except for the concentration of iron which was found to be very high. Sulfate was found to be higher at one of the sites (Gasuapara) in groundwater compared to surface water. There was no significant difference in total hardness in the different locations and also in the fluoride concentration. Similarly, no significant differences were observed in the levels of inorganic pollutants with the location.

4.6 Air Environment

4.6.1 Climate & Meteorology

The meteorology data were obtained from the Regional Meteorology Centre (RMC), which is located at Airport, Borjhar. The meteorological parameters include, wind speed, wind directions and other information, viz. humidity, rainfall, temperature. The study area is low lying and surrounded by hills and is subjected to a wet weather. The area experiences a lot of rainfall every year. The pre-monsoon months, March-April, have winds from North East. During monsoons, the predominant wind corridors are North East, North, and also South. The post monsoon period, from October-November is a period

mixed with calm conditions and winds mainly from North. The winter months, November to February, experience frequent calm conditions. The maximum number of calm periods observed is in the month of December and January. The climate is tropical. The temperature varies from 33 degree centigrade during summer to 4 degree centigrade during winter. The annual average temperature observed of maximum mean daily is 29.5°C and that of minimum mean daily temperature is 19.7°C. August is the hottest and January is the coldest month of the year. The rainy season in the district starts from the month of May to August with moderate rainfall during the month of March, April and September, October every year. In the four other months, November to February, there is altogether no rain in the district and is also the only really cold months in the year. Though the heavy rainfall in summer months keeps down the temperature, it renders the atmosphere exceedingly steamy and oppressive. The average rainfall during May to September is about 81% of the total contribution. The highest rainfall occurs in the month of July followed by June. The annual average mean relative humidity is 82% in the morning and 70% in the evening. The climatic condition (Table 4-5) in the area is thus humid and tropical.

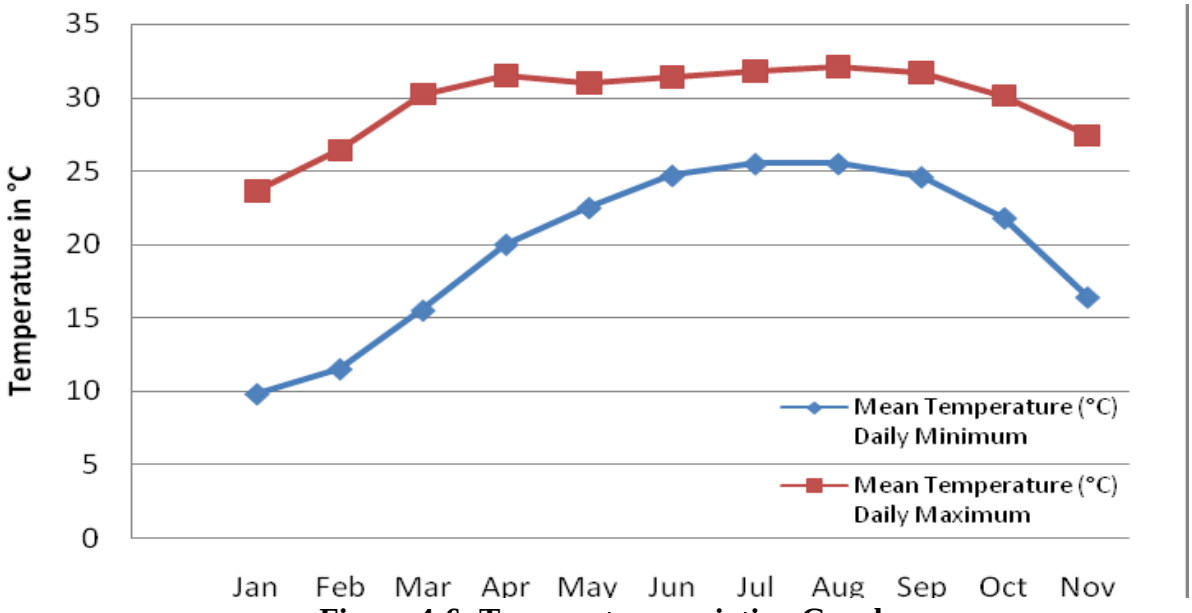

Figure 4-6: Temperature variation Graph

WINDROSE DIAGRAN FOR SHILLONG

The below figure wind-rose diagram indicates the distribution of wind direction and its speed over the montoring period at Shillong. From the diagram it is shown that around 17% wind direction is from South-East with a wind speed of 0.1 to 1.5 m/s. Similarly, around 14% wind direction has been observed from North/North-West with 2-0-2.5 m/s wind speed. From the diagram the resultant vector has been obtained at 80 degree. The predominant wind direction was observed to be from East-North-East with an average wind speed value of 1.08 m/s. The highest wind speed frequency was generally observed in the range of 0.5-1.5 m/s with calm frequency being recorded at 2.70%.

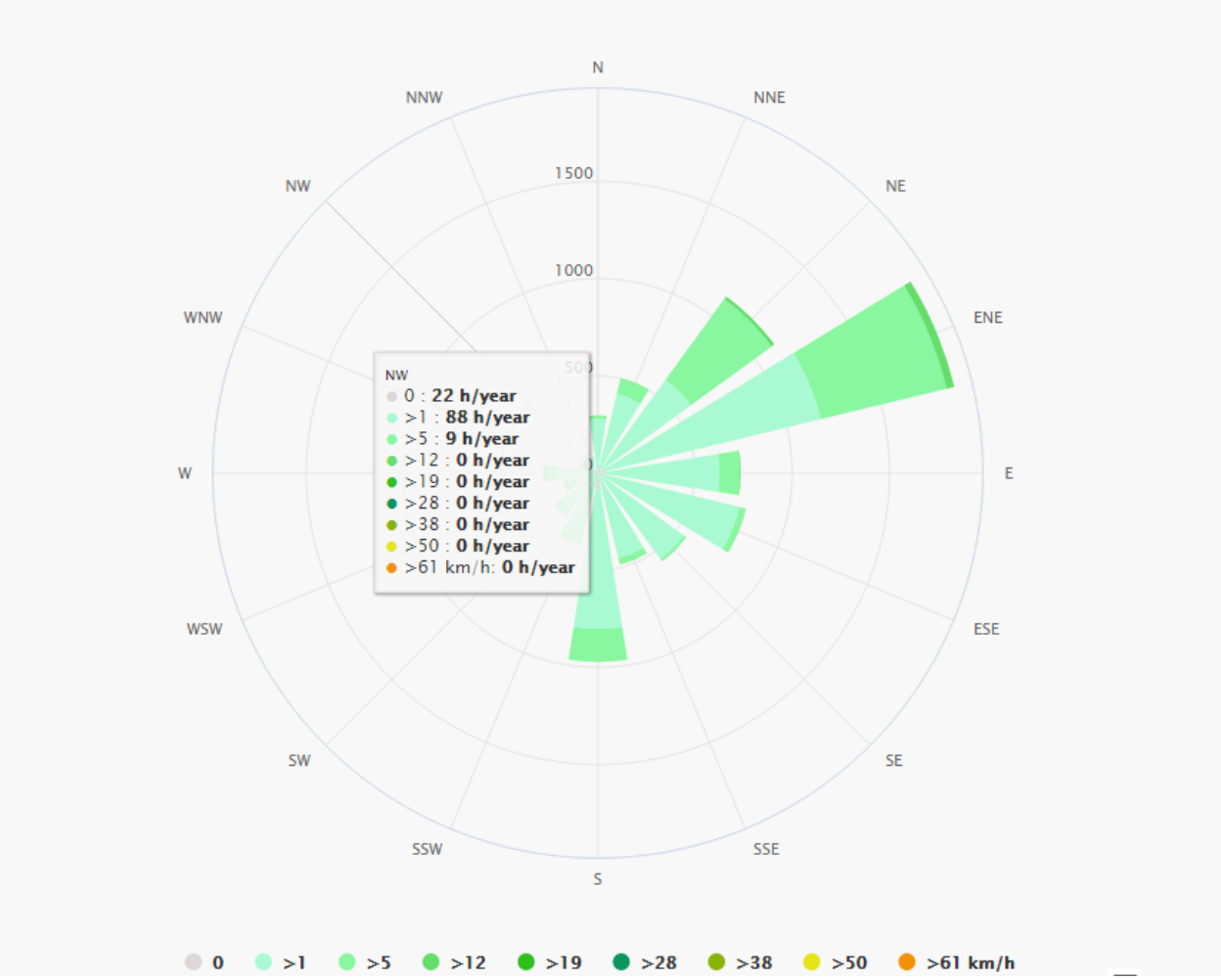

Table 4-5: Climatology Table (Nearest Station at Tura)

Month	Mean Temperature (°C) Daily Minimum	Daily Maximum	Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with Hail	Thunder	Fog	Squall
Jan	11.8	23.4	10.5	1	0	0.8	12.2	0
Feb	14.1	26.1	11.5	1.5	0.2	2.4	1.4	0.2
Mar	17.9	29.8	58.36	4.7	0.2	4.5	0.1	0.8
Apr	21.4	31.6	156.25	9.5	0.8	14.56	0.1	2.4
May	22.7	30.4	348.5	15..1	0.2	16.5	0	2.6
Jun	23.3	29.5	352.4	17.1	0	15.2	0	0.4
Jul	24.1	29.5	356.2	17.6	0	13.2	0	0.1
Aug	24.2	29.8	272.5	12.5	0	17.5	0	0.1
Sep	23.6	29.8	167.5	12.4	0	14.1	0.5	0.1
Oct	21.3	29.1	81.2	4.8	0	5.7	2.0	0
Nov	17.1	26.7	21.6	1.2	0	2.0	11.23	0

Source: Regional Meteorology Division – Guwahati (2018-2019)

4.6.2 Ambient Air Quality

Air pollution can cause significant effects on the environment, and subsequently on humans, animals, vegetation and materials. It primarily affects the respiratory (e.g. by fine dust), circulatory (e.g. by carbon monoxide) and olfactory (e.g. by odors) systems in humans. In most of the cases, air pollution aggravates pre-existing diseases or degrades health status, making people more susceptible to other infections or the development of chronic respiratory and cardiovascular diseases. Environmental impacts from air pollution can include acidic deposition and reduction in visibility. Following the reconnaissance survey of the study area and taking into account the predominant environmental factors such as winds, topography and details of existing residential, commercial activities in the region, Ambient air quality was monitored at three stations (Figure 4-9) viz.. one at Paulpara, the second at Gasuaspara and the third at Jatrakona. Selection of Air quality monitoring station was done as per MoEF guidelines for conducting EIA study. High volume samplers were used to collect/measure the air pollutant concentration data at 24 hours averaging periods for all stations. The recorded observations are given in the Table 4-6.

Table 4-6: Ambient Air Quality Monitoring Analysis

Sl. No	Parameter	Paulpara	Gasuaspara	Jatrakona	CPCB
1	SO_2	10	17	11	80
2	NO_x	19	21	25	80
3	RPM	40	56	42	100
4	SPM	49	61	52	200

Source: Primary analysis

The pollutant concentration data was analyzed to evaluate the air quality in the study region. The pollutant concentration levels of NO_x, SO_2, and RPM were measured at all the stations (Figure 4-9). The pollutant concentrations were compared with the National Ambient Air Quality Standards (NAAQS) as notified by CPCB.

It was observed that pollutant concentration levels of NO_x and SO_2 at all the stations were very low in concentrations and complies with the NAAQS. The recorded RPM ranges from 40-56 mg/m^3. Recorded SPM concentration also exceed the CPCB air quality standards for residential area at almost all the stations and it is in the range of 49-61 mg/m^3. The higher values are attributed to the re-suspended dust from the unpaved / damaged roads in the area used by trucks for carrying soils and other materials.

Figure 4-7: Ambient Air Quality - Sampling Location Map

4.7 Noise Environment

Noise is considered to be one of the dimensions of pollution, which also leads to the gradual degradation of environment and also poses health and communication hazards. The impact of noise pollution on humans and animals including birds is already exemplified in various studies. For measuring ambient noise levels, ***SLM100*** **sound** level meter was used at the site (Noise monitoring locations) as shown in Figure 4-8. Noise

monitoring has been undertaken for 24 hours at each location to capture the day-time and night-time noise levels and the noise equivalent (Leq) was calculated using the formula given below (equation -1). The monitored noise level data are furnished in Table 4-7.

$$L_{eq} = 10\ log\left[\sum_{i=1}^{n} fi10^{Li/10}\right] dB(A) \text{ - - - - - - - - - - } (1)$$

Table 4-7: Noise Monitoring Observations

Sl. No.	Location	Average Noise Level in dB	
		Day Time	Night Time
1	Paulpara	55	36
2	Gasuaspara	57	34
3	Jatrakona	47	33

Source: Primary analysis

The Leq was found to be in the range of 47-57 dB (A) in daytime and 33-36 dB (A) in nighttime. Though the observed values are near to the specified noise standard, but still it is within the limits set by the CPCB (Table 4-8). Minimum noise level recorded in one is from one at Paulpara, the second at Gasuaspara and the third at Jatrakona. Maximum noise level recorded Samandra area due to the presence of commercial and residential activities.

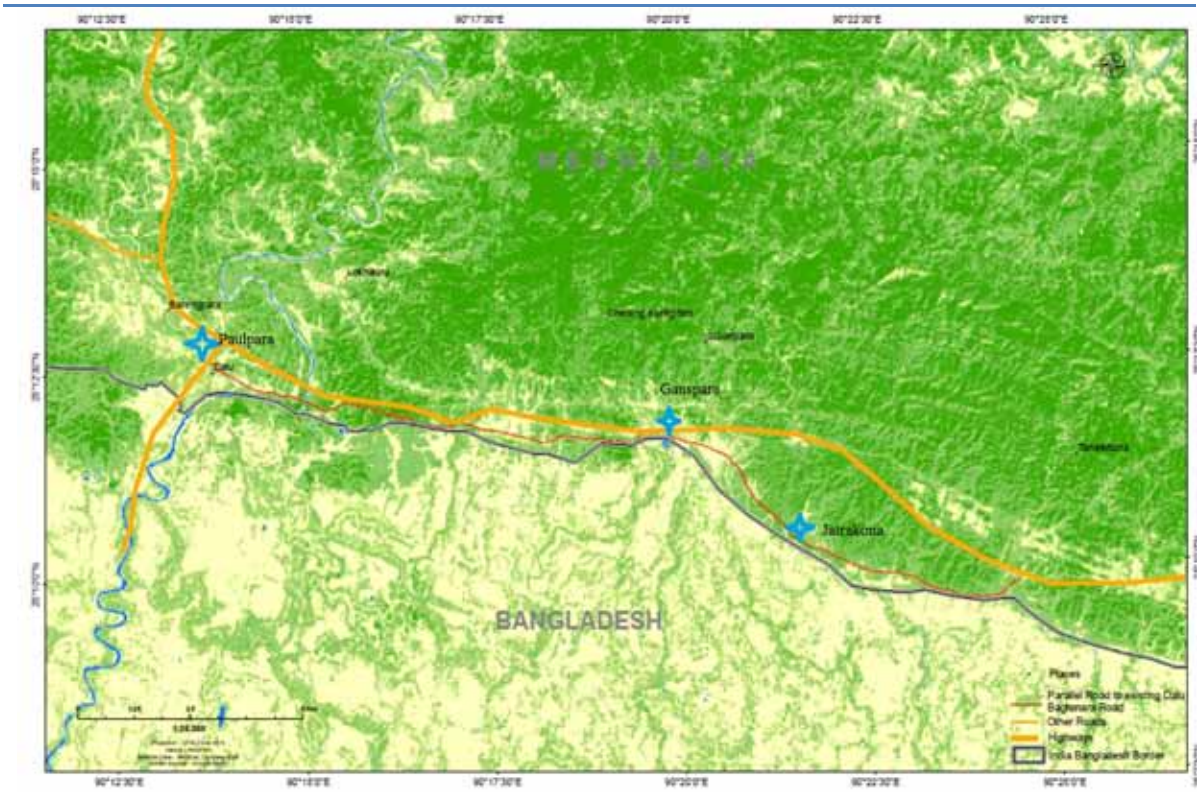

Figure 4-8: Ambient Noise Quality – Sampling Location Map

Table 4-8: CPCB Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A)	
		Day Time	Night-Time
(A)	Industrial area	75	70
(B)	Commercial area (C)	65	55
(C)	Residential area (R)	55	45
(D)	Silence zone	50	40

Source: CPCB

4.8 Biological Environment

4.8.1 Flora

The entire project area passes through eight villages and has seconadary forest mostly due to anthropogenic pressure. Predominant tree species found in project area are Rain Tree (*Caesalpinea sp.*), Sal tree(*Sorea robusta*), Shegun (*Tectona grandis*), Fig Trees (*Ficus religiosa*, *Ficus benghalensis & Ficus* raecemosa), *Cassia sp.*, Jamun (*Syzigium cumini*), Elephant apple (*Dilenea indica*), Tamarind (*Terminalia indica*), Simul tree (*Bombax ceiba*), Sonaru (*Cassia pistula*), Gulmohar Tree (*Dilonix regia*), Poma, Lali(*Walsura robusta*), Mango (*Mangifera indica*), Jackfruit (*Atrocarpus sp.*), Ghora Neem (*Azadirachta sp.*), Gamari (*Gmelia arborea*) Sotiona (*Alstonia scholaris*), Indian jujube (*Zhizyphus zuzuphus*). (Figure 4-9 and Figure 4-10).

Figure 4-9: View of avenue trees

Figure 4-104: View of Betelnut Orchards

Forest map collected from MoEF reveals that, project corridor is free from reserved/ protected forest with no environmental sensitive area (Figure 4-11 and Figure 4-12).

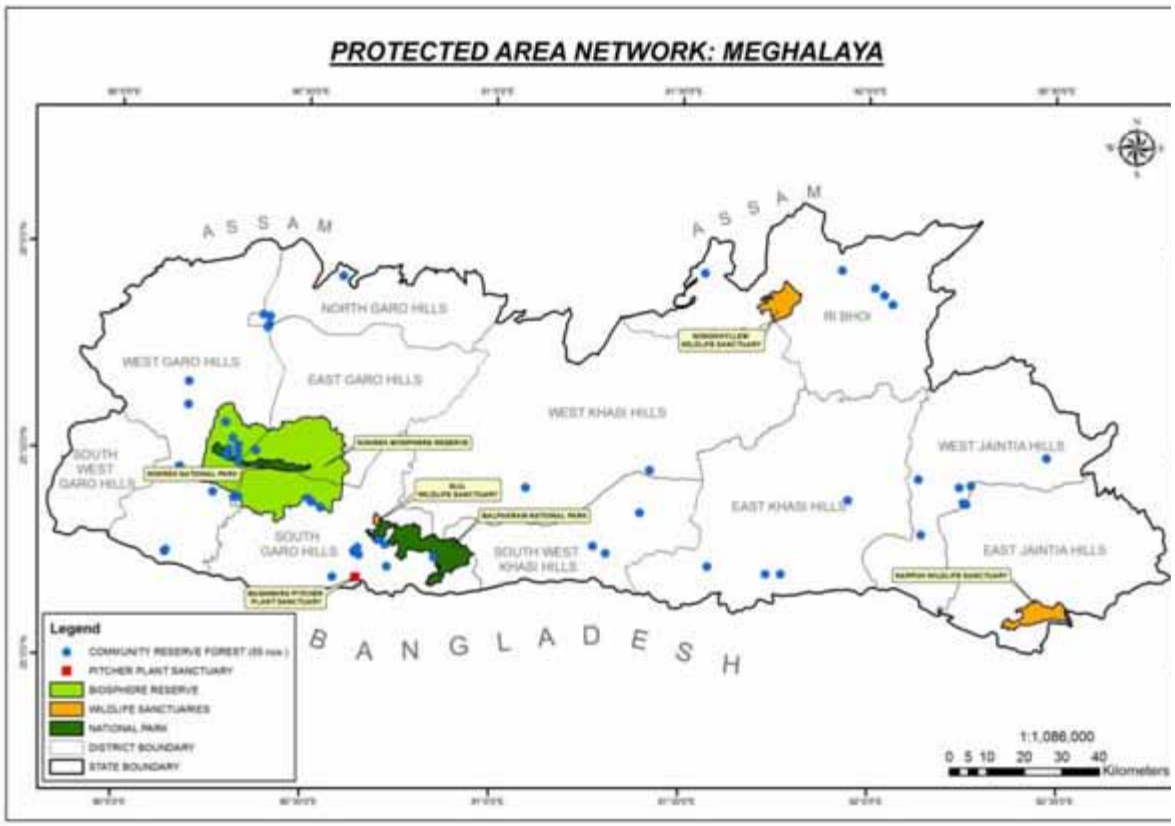

Figure 4-11: Forest Map of Project Site, Govt of Meghalaya.

Source: Meghalaya Forest Department

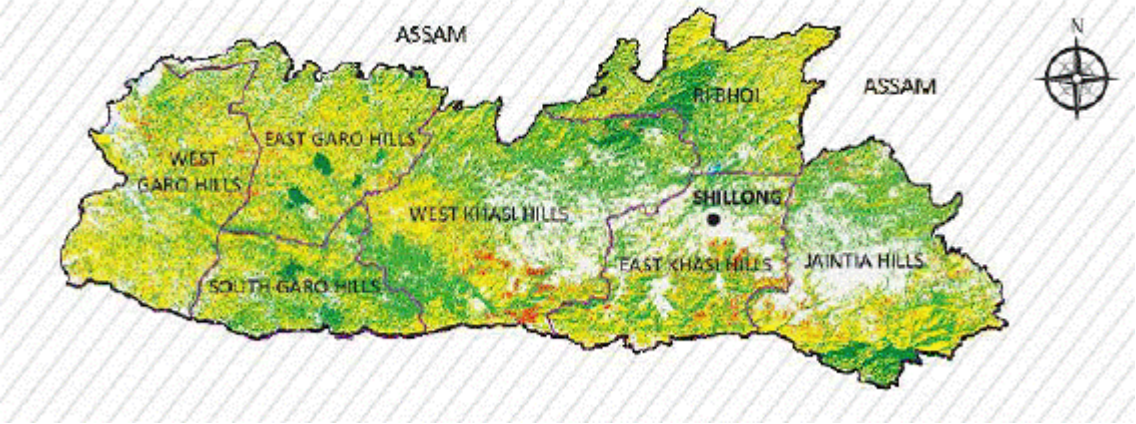

Figure 4-12: Forest Type Map of Project District

Source: Meghalaya Forest Department

4.8.2 Fauna

Bio rich rivers and forest areas attracts more migratory and local birds and it is also known as bird watching season. Some of the species recorded around the Project stretch in East Garo hills and West Garo Hills districts are listed below.

Asian pied Starling (*Gracupica contra*), Black drongo (*Dicrurus macrocercus*), Black kite (*Milvus migrans*), Blue throated barbet (*Psilopogon Asiaticus*), Chestnut throated bee eater (*Merops leschenaulti*), Common kingfisher (*Alcedo atthis*), Common myna (*Acridotheristristis*), Coppersmith barbet (*Psilopogon haemacephalus*), Crimson sunbird (*Aethopyga siparaja*), Grey back shrike (*Lanius tephronotus*), House sparrow (*Passer domesticus*), Indian pond heron (*Ardeola grayii*), Jungle myna (*Acridothers fuscus*), Large billed crow (*Corvus macrorhynchos*), Red Jungle Fowl (*Gallus gallus*), Red vented bulbul (*Pycnonotus cafer*), Scaly breasted munia (*Lonchura puntulata*), Oriental white eye (*Zosterops palpebrosus*), Common Hill myna (*Gracula relogiosa*), Hair crested drongo (*Dicrurus hottentottus*), Rufous treepie (*Dendrocita vagabunda*), White wagtail (*Motacilla alba*), Lineated barbet (*Megalaima Liniata*), Common stonechat (*Saxicola torquatus*), Jungle babbler (*Turdoides striata*), Dusky warblar (*Phylloscopus fuscatus*), Black Hooded Oriole (*Oriolus xanthornus*), Shikra (*Accipiter badius*), Ashy wood swallow(*Aratamus fuscus*), Bronzed Drongo (*Dicrurus aeneus*), Red Jungle Fowl (*Gallus gallus*), Lesser racket tailed drongo (*Dicrurus remifer*), Rufous woodpecker (*Micropternus brachyurus*), large cuckoo shrike (*Coracina dobsoni*), Large Hawk cuckoo (*Hierococcyx sparverioides*), Jungle owlet (*Glaucidium radiatum*), Scarlet minivet

(*Pericrocotus flammeus*), Common Iora (*Aegithina tiphia*), Chestnut tailed starling (*Sturnia malabarica*), White rumped Sama (*Copsychus saularis*), Blue eared Barbet (*Psilopogon cyanotis*), Golden Throated Barbet (*Psilopogon franklinii*), Rose Ringed Parakeet (*Psitaculla krameri*), Red Breasted Parakeet (*Psitaculla alexandri*), Common Hawk Cuckoo (*Hierococcyx varius*), Black headed munia (*Lonchura malacca*), Yellow Legged green pigeon (*Treron phoenicopterus*), Fulvous breasted woodpecker (*Dendropus macei*), Common Hoopoe (*Upupa epos*), Barn Swallow (*Hirundo rustica*), Asian Koel (*Eudynamys scolopeceus*), Indian roller (*Coracias benghalensis*), Oriental Magpie Robin (*Copsychus saularis*), Green billed malkoha (*Phaenicophaeus tristis*),
Eurassian tree sparrow (*Passer montanus*), Great barbet (*Psilopogon virens*), Asian Palm Swift (*Cypsiurus balasiensis*).

The project alignment roadside forest area has a low density distribution of mammals. These mammals are- Rhesus macaque (*Macaca mulatta*), House Rat (*Rattus rattus*), Greater Bandicoot Rat (*Bandicota indica*), Hoary bellied squirell (*Callosciurus pygerythus*), Jungle cat (*Felis chaus*), Barking deer (*Muntiacus muntjak*), Civet Cat (*Vierricula indica*) and Indian Mongoose (*Herpestes javanicus*).

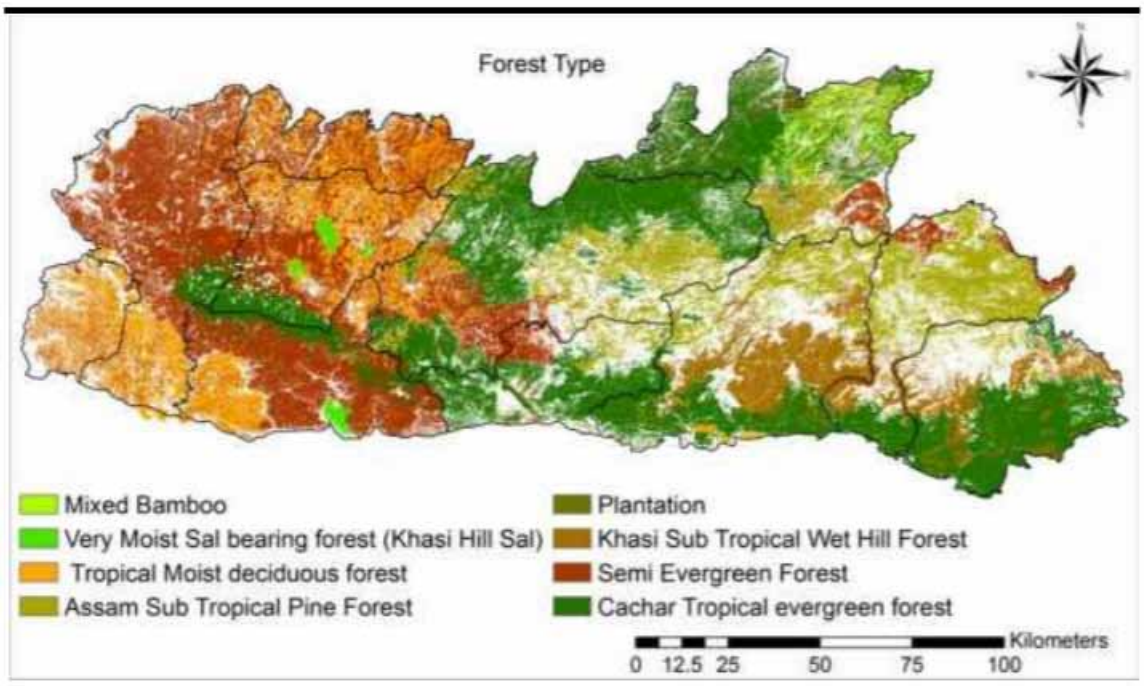

Figure 4-13: Wild life and Forest Type Map of Project District

Source: NESAC, 2017

Some of the butterfly species found in the area are listed as follows: Common Palmfly (*Elymnias hypermnestra*), Common lime butterfly (*Papilio demoleus*), Common crow (*Euploea core*), Peacock Pansy (*Junonia almana*), Lemon Pansy (*Junonia lemonias*), Grey Pansy (*Junonia atlites*), Common Mormon (*Papilio polytes*), Red base jejebel (*Delias pasithoe*), Common pierrot (*Castalius rosimon*), Three spotted grass yellow (*Eurema blanda*), Common Grass yellow (*Eurema hecabe*), Common jejebel (*Delias eucharis*), Common Sailor (*Neptis hylas*), Common Indian Palm Bob (*Suastus gremius*), Common Lascar (*Pantoporia hordonia*), Great Mormon (*Papilio memnon*), Red spot jejebel (*Delias aganippe*), Plum judy (*Abisara echerius*), Punchinello (*Zemoros flegyas*), Common evening brown (*Melantis leda*), Common Blue bottle (*Graphium sarpedon*), Common bush brown (*Mycalesis janardana*), Plain tiger (*Danaus chrysippus*), Common sergeant (*Athyma perius*), Common grass blue (*Zizina labradus*), Complete paint brush swift (*Baoris farri*), Tailed Jay (*Graphium agamemnon*), Plain tiger (*Danaus chrysippus*), Common birdwing (*Troides helena*), Common five ring (*Ypthima baldus*).

The reptiles and amphibian species found in the project area are as follows: Common garden lizard (*Calotes versicolar*), Forest Garden Lizard (*Calotes jerdoni*), Checkered keelback (*Xenochropis piscatar*), Common Tree Frog (*Polypepdates leucomystax*), Common Indian Toad (*Duttaphrynus melanostictus*), Red Necked keelbak (*Rhabdophis subminiatus*), Common Skink (*Lampropholis guichenoti*), Bronze skink (*Eutropis macularia*), Spotted forest skink (*Sphenomorphus maculates*) and White spotted suppled skink (*Lygosoma albapunctata*).

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4.8.3 Sensitive Ecological Areas

The Simsang river has been moving along the proposed road sections from starting point of this road section is the only river which may be impacted during the construction of the road. Figure 4-15.

Figure 4-14: Map View of Bakali River

Figure 4-15: Map View of Bhogai

Aquatic ecosystems

The project corridor crosses Simang river . The rivers and nalas in the project corridor act as storm water drain and don't have a unique aquatic ecosystem.. The presences of fishes are listed in Table 4-9.

Table 4-9: Fishes in Bakali River

Sl. No	Species Name	Order
1	Gudusia chapra (Hain.)	Clupeiformes
2	Oxygaster bacaifa (Ham.)	Clupeiformes
3	Barilius barila Ham.	Clupeiformes
4	Barilius barna (Ham.)	Clupeiformes
5	Barilius bandelisis (Haul.)	Clupeiformes
6	Barilius bola (Ham.)	Clupeiformes
7	Danio aequipinnatus	Clupeiformes
8	Danio dangila (Ham.)	Clupeiformes
9	Crossocheilus latius la/ius (Ham.)	Clupeiformes
10	Ghagunius chagullio (Ham.)	Clupeiformes
11	Labeo boga (Hanl.)	Clupeiformes
12	Labeo gonius (Hanl.)	Clupeiformes
13	Lobeo pangllsia (Ham.)	Clupeiformes
14	Puntius ticto (Ham.)	Clupeiformes
15	Tor tor (Ham.)	Clupeiformes
16	Botia dario (Ham.)	Clupeiformes
17	Glyptothorax cavia (Ham.)	Siluriformes
18	Rara hara (HaITI.)	Siluriformes
19	Heteropneustes fossilis (Bloch)	Siluriformes

20	Clarias batrachus (Lin.)	Siluriformes
21	Channa punctata (Bloch)	Atheriniformes
22	Ambassis baculis (Ham.)	Perciformes
23	Ambassis nama (Ham.)	Perciformes
24	Badis badis (Ham.)	Perciformes
25	Anabas testudineus (Bloch)	Perciformes

Source: Primary survey

4.9 Socio-economic Environment West Garo Hills District

4.9.1 Demography

The project corridor viz. Agia Medhipara Phulbari Tura (AMPT) Road (1st to 32nd kms), Rongram Rongrenggre Darugre (RRD) Road and Parallel Road to existing Dalu Baghmara Road traverses through this district. Total population of undivided West Garo Hills district recorded a total number of found to be 6, 43,291 out of which the male population comprises of 3,24,159 and the female population of 3,76,. Scheduled tribe population in the rural areas of the different C.D. blocks. Dadenggiri C.D. block has recorded the highest percentage of scheduled tribe population 97.01 percent, trailed by Gambegre C.D. block with 96.83 percent while Selsella has the least percentage of scheduled tribe population with 44.93 percent. In terms of number, Selsella C.D. block has the highest number of scheduled tribe population with 78712, followed by Betasing C.D block at 65776. The percentage of schedule caste population is the highest in Zikzak C.D Block with 2.28 percent, trailed by Selsella C.D. block with 1.74 percent. The highest number of scheduled caste population is witnessed at Selsella C.D. block with 3046, followed by Zikzak C.D. block with 1703.

4.9.2 Urbanisation

The Tura has been the most developed town in the Tikrikilla. Tura, the only big town after Shillong of the district, has recorded a decadal variation of 26.9 percent which is slightly higher than the total decadal variation of rural. The percentage of urban population in Rongram C.D. Block is at 56.0. percent while that of the district is at 11.6 percent only. Except these two towns, all other villages are considered as rural villages.

4.9.3 Gender Ratio

The gender ratio in the district is higher than state level at 984 females per 1000 males. The district registered Sex Ratio of 981 females per 1000 males is marginally less than the State's Rural Sex Ratio of 986.Dadenggiri C.D. Block has the highest Sex Ratio of 996

amongst the C.D. Blocks, while Zikzak and Gambegre C.D. Blocks have the lowest Sex Ratio of 970 each.

4.9.4 Literacy Rate

The literacy level in the state is 67.58 %; it is comparatively more than national average of 65.38%. In comparison to the state level the district and the project corridors are low. The literacy level among the female (62.7%) is less than male (72.49%).

4.9.5 Vulnerable population

The district has mostly the Schedule Tribe (ST) population as reported in the district census report 2011. The number of villages and scheduled tribe population are the highest in the percentage range of scheduled tribe population of 76 and above. The percentage of village is 88.33 while the percentage of ST population in this range is 96.56.

4.9.6 Economic Base

Wet cultivation is practiced in the plain areas while in the hills, the population practice Jhum or shifting cultivation..

4.10 SOUTH GARO HILLS (Presently South Garo Hills and South-West Garo Hills District)

4.10.1 Demography

The project corridor Parallel Road to existing Dalu Baghmara Road traverses through this district. Total population of undivided West Garo Hills district recorded a total number of found to be 6, 43,291 out of which the male population comprises of 3,24,159 and the female population of 3,76,. It is observed that the total population for the state in 2001 is recorded to be 1, 10,244 persons (1,01,601 persons in rural and 8,643 persons in urban) and by 2011, it has increased to 1, 42,334 persons (1, 29,203 persons in rural and 13,131 persons in the urban). The percentage of decadal variation from 2001 to 2011 has been recorded to be 29.1 where in case of rural, it has increased by 27.2 % which is found to be comparatively lower than that of the urban (51.9 %). The percentage of urban population increases to 9.2 % in 2011 as compared to that of the 2001 (7.8 %). Amongst all the C&RD Blocks, Baghmara has recorded to have the highest population in both 2001 and 2011and it has also recorded to have the maximum percentage of decadal variation (32.1 %).

4.10.2 Urbanisation

The only Town in the district has been the Baghmara Town. The town comprises of a total number of 9,787 literates (5,123 males and 4,664 females) and 3,344 illiterates (1,577 males and 1,767 females). The overall literacy rate of the town is 89.79 % (91.65 % males and 87.83 % females) and the gap in the male-female literacy rate is 3.82 %.

4.10.3 Gender Ratio

The gender ratio in the district is higher than state level at 984 females per 1000 males. The district registered Sex Ratio of 981 females per 1000 males is marginally less than the State's Rural Sex Ratio of 986.Dadenggiri C.D. Block has the highest Sex Ratio of 996 amongst the C.D. Blocks, while Zikzak and Gambegre C.D. Blocks have the lowest Sex Ratio of 970 each.

4.10.4 Literacy Rate

The literacy level in the state is 71.72 %; it is comparatively more than national average of 65.38%. In comparison to the state level the district and the project corridors are low. The literacy level among the female (76.23%) is higher than male (66.9%).

It is noticed from the table that the total number of literates and illiterates for the overall sub-districts is recorded to be respectively 82,062 persons (72,275 persons rural against 9,787 persons urban) and 60,272 persons (56,928 persons rural against 3344 persons urban). Among the total literates, 45,003 are males (39,880 rural against 5,123 urban) and 37,059 are females (32,395 rural against 4,664 urban) whereas among the total illiterates, 28,167 are males (26,590 rural against 1,577 urban) and 32,105 persons are females (30,338 rural against 1,767 urban). The overall literacy rate of the district is 71.72 % and it is noticed to be higher in the urban (89.79 %) than the rural (69.81 %). Moreover, males (76.23 %) are found to have higher literacy rate than the females (66.9 %) and the same is true for the rural (74.62 % males' against 64.69 % females) as well as for the urban (91.65 % males against 87.83 % females). The gap in the male female literacy rate is also recorded to be 9.33 % and it is higher in the rural (9.93%) as compare to that of the urban (3.82%). Again, among the sub-districts, Baghmara has recorded the highest literacy percentage (74.17 %) and again in case of the rural the highest literacy rate is observed in the Rongara sub-district (71.69 %) and in case of urban, it is noticed in Baghmara sub-district (89.79 %) having the only town in the district.

4.10.5 Vulnerable population

The district has mostly the Schedule Tribe (ST) population as reported in the district census report 2011. From the census report it was that the district has a total schedule tribe population of 1, 23,068 persons inhabited in 731 villages. Again, it is also observed that out of the total villages, 713 villages (97.54%) having a population of 1, 20,737 (98.11 %) are observed to occupy 76 and above percentage range of scheduled tribes population to total population. 20 percentage range of scheduled tribes population to total population.

4.10.6 Economic Base

Wet cultivation is practiced in the plain areas while in the hills, the population practice Jhum or shifting cultivation.

5 Analysis of Alternatives

This chapter presents a comparative analysis of various alternatives considered to avoid or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. Cross-sections adopted for the up-gradation component as presented in Chapter -2 (project description) are flexible in design to avoid most of the impacts within RoW. Along the project road sections there are number of habitation/settlements. Of them, mostly villages appear not so congested as mostly temporary roadside establishment spilling along the project road sections. An analysis of various alternatives is attempted to arrive at the technically and environmentally best-fit alternative.

Based on the secondary traffic data and traffic during site visit, upgradation of existing road section as two lanes may be adequate and that can be accommodated within existing right of way the road or with no additional land acquisition along the existing road section alignment. Under the present circumstance, No Bypass option is therefore proposed for the project road section. The requirement of bypass proposal is not anticipated on project road section and widening & improvement work will follow existing alignment only.

The project road section has number of geometric deficient locations and afforts has been made to improve these locations by providing alignment improvement where it is feasible and workable.

5.1 With or Without Project Scenario

5.1.1 With Project' Scenario

The 'with project' scenario includes the widening of single lane road section to two lane carriageway configurations of the existing major district road section in Meghalaya. The 'with project' scenario has been assessed to be economically viable and will alleviate the existing conditions. It would thereby, contribute to the development goals envisaged by the Government of Meghalaya, and enhance the growth potential of the regional and the state.

To avoid the large-scale acquisition of land and properties, the project envisages the widening of single lane road to two lanes along the existing alignment to minimize the loss of properties and livelihood of the PAPs.

5.1.2 Without Project' Scenario

In the case of 'without project' scenario the existing road secton with narrow carriageway width will be considered as it is. Considering the present traffic volume and potential for growth in near future, the capacity of the present road sections is insufficient for handling expected traffic volume and calls in for immediate improvements.

The existing road section has poor riding condition with landslide zones, poor drainage conditions and poor geometry. Poor drainage is seriously impacting and deteriorating the road surface. This is further compounded by the landslides and disrupting the traffic for long hours particularly in monsoon season. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to failure to initiate any further improvements and impede economic development. Keeping in view the site conditions and the scope of development of the area, the 'With' and 'Without' project scenarios have been compared as shown in Table 5.1 .

By looking at the table it can be concluded that "With" project scenario with positive/beneficial impacts will vastly improve the environment and enhance social and economic development of the region compared to the "Without" project scenario, which will further deteriorate the present environmental setup and quality of life. Hence the "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be definitely advantageous to achieve the all – round development of the economy and progress of the State.

Table 5.1: Comparison of 'With' and 'Without' project scenarios as alternative analysis

With Project		Without Project	
IMPACTS		IMPACTS	
Positive	Negative	Positive	Negative
· With the improvement of road surface and slope protection measures, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced. · Tourism will flourish. · Better access to other part of the region as the project road sections are as a lifeline of interior region. · Providing better level of service in terms of improved riding quality and	· Minor change in topography is expected due to construction of embankments. · Minor changes in land use pattern. · Loss to properties and livelihood.	Nil	· Increase in travel time. · Increase case of landslide and soil erosion. · Increase in fuel consumptions. · Increase in dust pollution and vehicular emission. · Increase in accident rate. · Overall economy of the State will be affected.
· All weather access reliability.	· Removal of vegetative cover along the road sections at selected locations and loss of trees. · Impacts of flora and fauna. · Removal of trees along the road sections.	Nil	· Increase in accidents.
· Reduced transportation costs.	· Increase in air pollution due to vehicular traffic. · Short term increase in dust due to earth work during construction at micro-level.	Nil	· Project road will further deteriorate.

· Increased access to markets.	· Increase in noise pollution due to vehicular traffic during construction work.	Nil	· Increased vehicle operation cost.
· Access to new employment centers.	Nil	Nil	Reduced employment/ economic opportunities.
· Employment to local workers during the execution of the project.	Nil	Nil	· Arrest of possible significant enhancement and economic development of the region.
· Better access to health care centres and other social services. · Improved quality of life.	Nil	Nil	· Land degradation, dust pollution and damage to pastureland, contamination in water bodies due to vehicles travelling along multiple tracks on the open ground. · Deep impact to human health in case of emergency.
· Reduction in travel time and development of the important places of in the district of North Garo hills, West Garo Hills, East Garo Hills in Meghalaya State.	· Increase in speed may lead to accidents in congested areas.	Nil	· In absence of the project, it is extremely difficult to generate funds for such a massive improvement of the road infrastructure from its own resources.
· Reduction in erosion and landslides from multi tracking and stone pitching of elevated embankments.	Nil	Nil	· Increase in dust pollution and creation of sedimentation problems in water bodies.
· The widened and paved road will reduce impacts due to multiple tracking on soil and vegetation along the road.	Nil	Nil	Increased adverse impacts on soil and vegetation.

5.2 Consideration of Alternative Alignment

There are no alternative alignment has been proposed in this project section of road..

6. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 Impact Assessment and Mitigation Measures

The impacts due to proposed project activities across different phases have been identified and predicted. The proposed project activities will impact the environment in two distinct phases:

(i) Construction phase

(ii) Operational phase

Impacts are identified and predicted based on the analysis of the information collected from

the following:

- Project information (as outlined in Chapter 2);
- Baseline information (as outlined in Chapter 4).

The identification of likely impacts during construction and operational phases of the proposed project has been carried out based on likely activities having their impact on environmental parameters.

6.2 Potential Impact on Land Use

6.2.1 Impact Assessment

Since the road strengthening would follow the existing alignment of the road the change in land use would be limited only to areas widening is proposed, or improvement of geometrics is required, or widening within the existing RoW is undertaken. In this project no realignment or Bypass is proposed. Most of the land along the corridor is single cropped agricultural land or community forest. Impact on the agriculture land or the structure would have significant impact. As per preliminary design few of the structure are likely to be impacted in road section.

Construction work of the project road section will be virtually through hilly terrain with steep and unstable slopes at few locations. Much of areas in this section is geologically young, resulting in soft/fragile substrates. Another complicating factor is the high monsoon rainfall throughout most parts of the project road section. These factors mean that project area conditions are amongst the most difficult in the region for road construction. Landslides frequently caused by inappropriate construction techniques, slope instability, and inadequate drainage are major problems and are associated with all types

of road construction. It should be noted that a significant number of landslides that occur in the vicinity of road are caused by factors/features only indirectly linked to the road itself – frequently, irrigation channels, logging, quarrying and cultivation practices.

Some temporary changes in land use might occur due to setting up of construction camp, material storage yards and plant and machinery. These would be fallow land or waste land and would be for a period of 2-3 years and the impacts would be low. With the development of the road there is a likelihood of induced ribbon development along the project road section. The agricultural or other land use would change to commercial and or residential use over time.

6.2.2 Mitigation Measures

To prevent any adverse impacts on land-use the following measures need to be adopted:

• The measures to be adopted for the control of soil erosion at identified landslide locations along the project road section:

– The existing vegetation on slopes outside the immediate area of construction must remain undisturbed during construction and/or upgrading.

– Bioengineering techniques will be used to prevent barren slopes and to stop soil erosion and to protect the animals from grazing animals.

– Support structures will be installed where slope failures are anticipated or may have occurred previously.

– Slope failures should be monitored and remedial actions initiated at the earliest possible time.

– logging immediately above road should be restricted to reduce erosion/landslide potential;

– quarrying along road ROW should be restricted;

– excavated material should be properly disposed of and not simply dumped downhill; – adequate reclamation (e.g. fertilisation and reseeding) along denuded ROW should be implemented;

– particular care should be given to providing adequate drainage; and

– to the largest extent possible, care should be taken to avoid sacred and religious sites.

• No agricultural land, fallow land (current or temporary), grazing land should be used for setting up of construction camps, material storage or staging of plant and machinery.

The following parameters would be considered while selecting site for construction camp:

• Sites /land types to be avoided:

– Lands close to habitations

– Irrigated agricultural lands

– Lands belonging to small farmers

– Lands under village forests

– Lands within 100m of community water bodies and water sources as rivers

– Lands supporting dense vegetation and Forest with/without conservations status

– Low lying lands within 100m of watercourses

– Grazing lands and lands with or without tenure rights

– Lands where there is no willingness of the landowner to permit its use

– 2km from towns 500m from any villages

– Community land (Church, community forest) which is traditionally used as conservation areas

• Land Types Preferred

– Waste lands.

– Waste Lands belonging to owners who look upon the temporary use as a source of income.

– Community lands or government land not used for beneficial purposes.

– Private non-irrigated lands where the owner is willing.

– Lands with an existing access road.

6.3 Potential Impact on Soil

6.3.1 Impact Assessment

• The impacts on the soil are expected along the alignment especially in case of expansion of Carriage way as well as in the borrow areas and construction camp. The impact on the soil is primarily due to the:

– Loss of topsoil. The topsoil on the land parcels which is ether used for short term (e.g. borrow areas, construction camps etc) or permanent use (expansion of the road alignment) would be lost unless the same has been preserved.

– Soil Erosion: The alignment passes through areas which have sandy loam or sandy clayey loam. These soils are light textured and are thus prone to erosion by winds and during rain, gravity erosion.

The soil erosion prone areas were-

Sl. No.	ANTICIPATED IMPACT					
	L.H.S OF ALIGNMENT			R.H.S OF ALIGNMENT		
	FROM	TO	IMPACT	FROM	TO	IMPACT
1	850	890	RR Masonary Wall	650	700	RR Masonary Wall
2	2150	2230	RR Masonary Wall	1886	1911	RR Masonary Wall
3	2250	2334	RR Masonary Wall	2200	2320	RR Masonary Wall
4	3150	3200	RR Masonary Wall	2500	2535	RR Masonary Wall
5	6150	6230	RR Masonary Wall	2752	2770	RR Masonary Wall
6	6255	6300	RR Masonary Wall	3150	3200	RR Masonary Wall
7	9500	9560	RR Masonary Wall	6150	6230	RR Masonary Wall
8	9585	9600	RR Masonary Wall	6255	6300	RR Masonary Wall
9	-	-	-	9500	9560	RR Masonary Wall
10	-	-	-	9585	9600	RR Masonary Wall
11	-	-	-	11133	11200	RR Masonary Wall

– Compaction: The movement of vehicle over land next to existing road and to access the construction site would also cause compactions of soil and affect soil fertility.

• It is estimated that approximately 7620.86 cum of material would be excavated during construction and will be scarified from existing carrriage. This would be primarily from hill side cutting and the construction of minor bridge or culvert, demolition and waste generated during the dismantling of the existing cross drainage structure and bituminous waste generated during dismantling of pavement.

In addition, waste from off-spec hot-mix as wells as from the regular operations of the machinery e.g. layers and bitumen sprayers during the surfacing of the roads. The concrete wastes from the batching plant and transit mixer wash water would also be generated.

• The labour camps would be setup for construction would generate municipal solid waste and hazardouswaste (waste oil from the maintenance and operation of machinery). These wastes have potential to contaminate the soil around the site if it is not properly stored, handles and disposed. If these excess excavated material, construction and demolition wastes are disposed on agricultural land it may result in loss of productivity of land.

6.3.2 Mitigation Measures

Mitigation measures which would be considered to reduce impacts on soil during road and bridge construction are given below:

• The borrow areas should be developed as per the guideline presented in Appendix2 to minimize impacts.

• Excess excavated material should not be dumped by the contractor on any adjoining property. The excess excavated material to be stored at a specified location so that it can be reused where ever possible or used for strengthening of shoulders of village roads;

• All demolition debris especially from cross drainage structures and pavement should be utilised in the backfilling where ever possible. No virgin material shall be utilised unless the demolition debris are certified by the Engineer as "not fit for use". All construction debris which cannot be reused should be disposed at pre-designated sites. The Contractor should identify site for temporary storage of the construction debris during the preconstruction.

• Vehicular movement should be restricted over the open fields or agricultural land.

The following structures to be constructed in various chainage-

Sl. No.	SCHEDULE OF TOE WALL					
	L.H.S OF ALIGNMENT			R.H.S OF ALIGNMENT		
	FROM	TO	TYPE	FROM	TO	TYPE
1	850	890	RR Masonary Wall	650	700	RR Masonary Wall
2	2150	2230	RR Masonary Wall	1886	1911	RR Masonary Wall
3	2250	2334	RR Masonary Wall	2200	2320	RR Masonary Wall
4	3150	3200	RR Masonary Wall	2500	2535	RR Masonary Wall
5	6150	6230	RR Masonary Wall	2752	2770	RR Masonary Wall
6	6255	6300	RR Masonary Wall	3150	3200	RR Masonary Wall
7	9500	9560	RR Masonary Wall	6150	6230	RR Masonary Wall
8	9585	9600	RR Masonary Wall	6255	6300	RR Masonary Wall
9	-	-	-	9500	9560	RR Masonary Wall
10	-	-	-	9585	9600	RR Masonary Wall
11	-	-	-	11133	11200	RR Masonary Wall

6.3.3 Bio Engineering – Use of Vetiver for Slope Protection

The rivers and streams of the road section has been facing bank erosion problem during monsoon. The river regularly overflow the bank during flood and hit the riverside approach of the bridge. Hence needs protection of the slopes, which wil be done through bioengineering approaches.

6.3.4 Bio engineering methods adopted for slope Protection

An environment friendly bio engineering tool, the *Vetiver System*- is proposed to be applied for this work. The vetiver system has proved its efficacy throughout the world including Meghalaya in preventing river bank erosion. The basis of this technique is plantation of Vetiver plants of approved variety specifically designed according to the soil and site conditions. For controlling the underwater erosion, a flexible mattress is proposed to be used. This mattress made of waste/recycled items like empty cement bags which will remain intact for long under water has been found effective in controlling underwater erosion elsewhere in Meghalaya. The stretches along the river bank will also have a reed bed which will absorb the flow energy before the water current hits the bank.

Slope Protection design

Slope Protection @ the River bank: Plantation of the vetiver system will need to be in grid pattern. The rows parallel to the flow of river will arrest land slip where as the rows normal to the flow will reduce the energy and initiate sedimentation. The anti-erosion mattress, pegging with bamboo stakes, reed etc. are shown in Figure 6-2.

Slope Protection @ Bridge approach (Upstream side): This face of the approach will have grid pattern of the vetiver plantation. This is suggested as there will be flow of flood water parallel to the approach when water

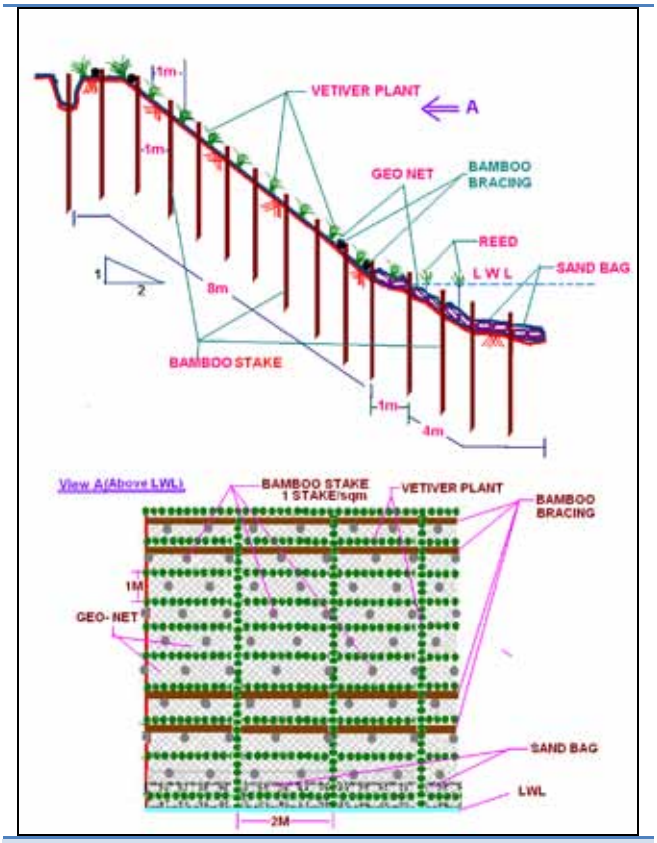

Figure 6-1: Slope Protection @ River Bank

hits the embankment (Figure 6-3).

Slope Protection @ Bridge approach (Downstream side): The plantation is proposed to be only in parallel rows as shown in Figure 3-3.

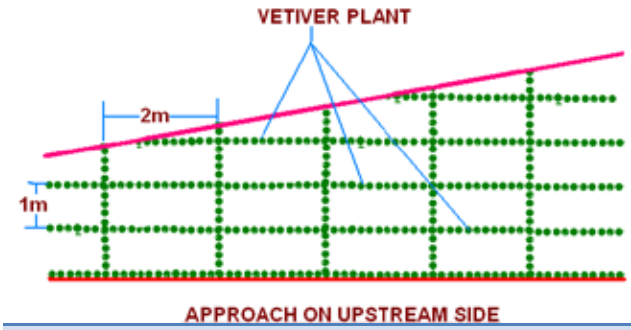

Figure 6-2 Slope Protection @ Bridge approach (Upstream side)

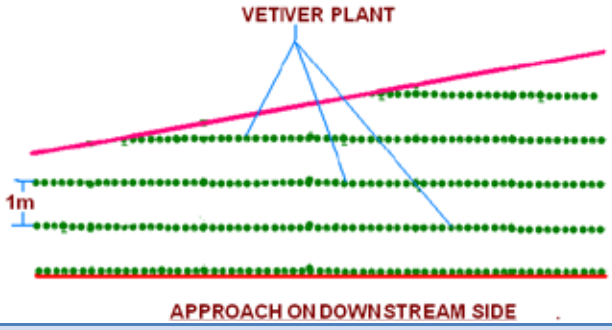

Figure 6-3: Slope Protection @ Bridge approach (Downstream side)

Based on the topography and the project design, the bio engineering for slope protection measures has been suggested for the following location as illustrated in Table 6-1.

Table 6-1: Slope Protection Measures Parallel Road to existing Dalu Baghmara Road -

Sl. No	Location	Start Chainage	End Chainage	Type of Protection
1	Bakali River	0/990	1/050	Slope Project Measures
2	Bhogai River	2/350	2/450	Slope Project Measures

6.4 Potential Impact on Surface Water Resources

6.4.1 Impacts Due to Construction

There is no major river crossing on the project road section. There are only a few small season streams crosses the road alignments. The surface water will be used for construction activity. The construction activities e.g. earthwork, concreting of structure and labour camps, would require 100 KLD of water and may result in conflicting situations with local communities. In addition, the construction activities would also witness influx of skilled labour who would be housed in the construction camps. It is estimated that approximately an average of 250-300 KLD of water would be required during the peak construction period for construction purpose and 45 KLD for domestic purpose in the road section. Water would also

be required for domestic requirement and the stream water in the state meet the required standards of IS 10500: 2012.

- Like surface water and ground water are scarce. In project construction area withdrawal of water for any purpose other than for drinking will be taken with permission from CGWB. Using groundwater especially freshwater for domestic and construction activities would have serious impacts on the availability of the resource for local population.

6.4.2 Mitigation Measures

- The drainage and the contour maps indicate that the alignment passes through hilly topography so the contractor can identify channel along the corridor and create check dam, if required to store water for construction purpose. The entire exercise would be conducted in consultation with the local community. These check dams would be handed over to the community for use and maintenance after the completion of construction.
- Dust suppressant /dust binders shall be used to reduce water consumptions. The acceptable dust suppressants include: Acrylic polymers, Solid recycled asphalt, Chloride compounds (calcium chloride and magnesium chloride), Lignin compounds (lignin sulphate and lignin sulfonate powders), Natural oil resins (soybean oil) and Organic resin emulsions.
- The Contractor should notify the executing agency for its source for procurement of water. It should provide monthly reports of water consumed and its source. The water consumption for concrete mixing can be reduced by use of plasticizers/ super plasticizers as mentioned in IRC 015:2011.

6.5 Potential Impact on Surface Water Quality

6.5.1 Impacts Due to Construction

In addition to competition over the scarce resource, the construction camp and the construction activities would generate waste water. These would include domestic wastewater from the construction camp and the wash water from the machinery e.g. batching plant concrete transit mixers would cause deterioration of the water quality These liquid wastes have potential to contaminate the water bodies around the site if it is not properly handled.

6.5.2 Mitigation Measures

- No wastewater should be discharged from construction camps. Runoff from the camp shall be passed through an oil-water separator.
- Construction water would not be procured from any unauthorised wells or existing wells. The permission of CGWB would be obtained in case new wells are sunk;
- The Contractor shall make arrangement for bottle drinking water which conforms to IS 14543 (2004). In case the contractor uses groundwater for drinking purpose he shall install adequate treatment technologies e.g. reverse osmosis and fluoride removal filters.
- Water usage for construction work would be reduced by adopting following best practices:

  – Use buckets etc. to wash tools instead of using running water;

  – Use of auto shut off taps (without sensors) in labour accommodation;

  – Install water metres with main supply pipes/water tanks/bore well to assess quantity of consumed water and – Use of plasticizers/super plasticizers in the concrete production to reduce water consumption.

  The construction camps facilities are presented in Appendix4.

6.6 Potential Impact on Ambient Air Quality

The impact on the air environment is likely both during the construction as well as the operations phases.

6.6.1 Impacts Due to Construction

In the construction phases the activities related to the earthwork is likely to generate large quantities of particulates. The possible sources of generation of such particulates are borrow area operations, transport of material, storage of construction material, carrying out of earthwork, movement of vehicles on unpaved road. Vehicular movement due to the project would also add to PM 2.5 and SOx and NOx emissions. In case of the project road both PM 10 and PM 2.5 are identified as a major source of pollutant.

The operations of the Hot-mix plant, handling of cement in batching plants is also likely to generate the air pollutant. The generation of PM 2.5 due to the construction activities would add on the already stressed air environment.

6.6.2 Mitigation Measures During Construction

To prevent the generation of dust during the construction activity the following measures may be considered:

- The speed limit of project vehicle movement over unpaved surface should be limited to 15 kmph;
- All vehicles carrying construction material should be covered;
- The construction material should be stored against wind breaks so that they are not carried away by wind. The length of the windbreak wall shall be twice the height for it to effectively work. The stockpiling of material should be carried out considering the prevailing wind direction;
- Water sprinkling should be restricted due to the scarcity of water. Dust suppressant should be applied on the surface of the unpaved earthwork to reduce the consumption of water;
- Vehicular movement on the unpaved pavement should be strictly restricted. The access roads within the construction camp should be paved using the waste concrete or batching plant and concrete mixer wash;
- All project related vehicles and equipment should have valid Pollution Control Certificates.
- The pollution control equipment in the Hot-mix plant shall be kept in working condition at all times. The plant shall not be operated if the pollution control equipment is not functional;
- Requisite permits shall be obtained from the MSPCB for operation of the Hot Mix Plant and Quarry (in case of new Quarry);
- The grievance redressal mechanism for the project would also be used for reporting any matter related to air pollution

6.6.3 Impacts during Operation

The strengthening of the carriageway would improve vehicular movement, congestion is likely to get reduced and speed to vehicles is likely to improve. Even though there would be a decrease in vehicular emission due to the reduction in congestion the increased vehicular traffic on the MDR would increase the pollution load.

6.6.4 Mitigation during the Operations

To mitigate the impacts of vehicular pollution during operations phase, green belt shall be developed along the corridors. Local species which can arrest both gaseous and particulates shall be planted.

6.7 Potential Impact on Noise Quality

6.7.1 Impact due to Construction

The principal source of noise during construction of highway would be from operation of equipment, machinery and vehicles. Earth moving machineries e.g. excavators, graders and vibratory rollers has potential to generate high noise levels. These machineries produce noise level of more than 70 dB (A). This can cause disturbance to the settlement, adjacent to the carriageway or at 500 m from the worksite. The vibration produced by rollers can be transmitted along the ground. This may cause damage to kutcha structure located along the alignment. The extent of damage would be dependent on the type of soil, the age and construction of the structure.

The noise generated during the construction would cause inconvenience to the population adjoining the road especially within 500 m of the alignment after which it would be attenuated to acceptable levels Since, the settlement along the road alignment is sparse the severity of the impact would below. The impact on the workers however would be dealt with in separate section.

6.7.2 Mitigation Measures

- The DG sets used in the project road section should conform to the CPCB stimulated standards for installation and operation.
- Regular maintenance of the machinery, equipment and vehicle would be carried out to prevent excessive noise. A maintenance schedule would be prepared and maintained by the contractor.
- Night time construction activity would be prohibited in case settlement/habitation is located within 500 m of the construction site. Consider the use of traffic calming measures7 in the final design to reduce the speed of the vehicle.

6.7.3 Impact during Operation

The development of the road is expected to increase the traffic volume but at the same time reduce the congestion in the settlements. The noise levels are still expected to increase with the increase in traffic. As pointed out in section 4.4.3 the noise measured in front of the sensitive receptors e.g. schools are within the standards prescribed for sensitive receptors.

The increase in traffic would further aggravate the problem and would cause inconvenience especially at educational institution. As pointed out earlier in some case due to the proximity of the classroom to the exiting highway student have complained

about noise. The operations of the highways and the increased traffic would further aggravate the noise levels.

6.7.4 Mitigation Measures

In cases where land is available three-layer plantations would be carried out with local species to act as a vegetative barrier for noise.

6.8 Potential Impact on Physiography and Drainage

6.8.1 Impact Identification

The alignment follows the existing topography except for the location of the cross-drainage

structure. At these locations the vertical profile has been changed and the height of the finished level has been increased by approximately 0.25 to 0.5m. There is no existing Major Bridge on the Project road section only one Minor Bridge exist, and No additional bridges are proposed to be constructed. There are existing199 pipe culverts and 37 slab culverts. Thus, any change in the drainage is also not envisaged.

6.8.2 Mitigation Measures

- At all locations where the preliminary design has indicated in raise in the level of the embankment the final design should review the feasibility of the same and if possible, reduce the embankment height.
- At all location where the vertical profile has increase by 0.25 To 0.50 m or more protections of embankment is required.

6.9 Potential Impact on Biological Environment

6.9.1 Impact on Flora

It is estimated that 53 trees would be felled for the proposed road improvement project. Even though no major change in habitat is envisaged being agriculture and built up area along the road section, the felling of trees would have an impact on the flora. The impact would also not be significant as the alignment would not affect any forest area within the reserved forest areas.

6.9.2 Mitigation Measures

Plantation would be taken along the corridor to compensate for the tree felled. At least 10 trees would be planted for every tree felled or as mentioned in the permission for tree felling provided by the Department of Forest, Government of Meghalaya

- Only tree species which are less water consuming should be used for plantation.

- In the section of the rseserved forest not to be cut at any cost. During the construction only existing RoW should be used for road construction. These forest will enhance the aesthetic beauty of the road. Using the Existing RoW will not invite forest clearance procedures and will be helpful in maintaining the biodiversity of the region.

6.9.3 Impact on Fauna during construction

The proposed project road section does not passes through Ecological sensitive Zone of protected areas in the State of Meghalaya. The alignment would not encroach into the natural habitats so there would be no impact on ecological resources.

During the construction hunting of wild animals by workers and, excavation has to be carried out for developing the foundation culverts. There is a small population of wildlife e.g. snake, rabbits etc. is the project area. The risk to wildlife is primarily due to falling of the animal into the excavation carried out for foundation.

6.9.4 Mitigation Measures during Construction

During the detailed design further investigations has been undertaken to identify the areas with known road kills and wildlife movement. Identified location after consultation with the forest department and the local community where the movement is happening. Sign boards and speed limits caution board will be used for identification of the wildlife movement. Since the alignment follows the exiting topography and the numbers of cross drainage structure are limited it may not be possible to develop animal underpass. Alternately, at such location alternatively the following measures would be undertaken:

- Traffic calming measures would be undertaken
- Reflectors should be installed along the road in these areas to prevent wildlife from approaching the road.
- Display boards (as per IRC 30 - 1968 - Numerals of Different Height for Use on Road Signs and IRC 67 - 2012: Code practice for Road Signs) should be placed ahead of the stretch to warn drives of the approaching wildlife crossing areas.
- During the construction areas which have proven wildlife movement or presence temporary woven wire mesh guards of about 2.4 m (8 ft.) high will be put around

the excavated areas to prevent small wild animal from falling. No harm would be done to the animal if they are trapped in the excavated area. The contractor in association with Executing Agency and Forest Department would ensure safe release of the animal.

6.9.5 Impact on Fauna during Operation

There is no concentrated population of wild animal and also no reported location of road kills. However, during the operations if road kills are reported specific measures would need to be undertaken.

6.9.6 Mitigation Measures during Operation

• A survey of the vulnerable stretches of the road especially with respect to road kill would be

carried out. The measures discussed above would be under taken.

6.10 Potential Impact on Socio-economic Environment

The socio-economic impacts have been detailed in the Social Impact Assessment and Resettlement and Rehabilitation study carried out under the project.

6.11 Community Health and Safety Issues

6.11.1 Impacts during Construction

The construction activities would be carried out without hampering the existing traffic since

there is no alternate corridor for diversions of traffic. The construction activities would also remove the additional spaces i.e. shoulder to accommodate the construction of the additional carriageway or strengthening of the carriageway and shoulders. Since the local slow-moving traffic including pedestrians and the through highway traffic would be using a reduced road space the congestions on the road section would increase during construction. This situation would be further aggravated by the additional vehicle used in the construction activity using the road for haulage of construction material.

The local slow-moving traffic and pedestrians are thus prone to collision with the through road traffic and the construction vehicle. Also, at times the excavations are carried out close to a village access road or settlement. These work sites may also cause potential injuries to the public unless they are protected.

6.11.2 Mitigation measures

All worksites should be barricaded, and the integrity of the workspace segregation from

the traffic maintained at all times;

- In settlement area the workplace should be segregated by the erecting barriers. Separate walkway should be identified in the settlement areas for use by pedestrians and slow moving traffic Crossover points should be provided at the worksite locations in settlement areas so that people can easily crossover without coming is in close proximity with the construction work or equipment.
- At the point of entry or exit from the work site flagman should be provided. The entry and exit vehicle shall be regulated by the flagman to prevent collision;
- All worksite shall be provided with reflective stickers so that it can be easily identified during night;
- Precautionary signages should be put-up well in advance to warn drivers of impending construction works;
- Flashers should be provided near excavation to warn the traffic of the excavations;
- The worksite within the settlement shall be properly illuminated as a safety precaution;
- The construction debris should not be placed on the road as it would further constrict the space available for the public.

6.11.3 Impacts during Operations

During the operations phase of the highway the traffic volumes and vehicular speeds are both

likely to increase. This can potentially be risky both for pedestrian as well as slow - moving traffic. In case of sensitive receptors mentioned above in addition, as traffic speeds increase the chances of vehicular collisions are also expected to increase.

6.11.4 Mitigation Measures

During the design activity a traffic hotspot study carried out to identify the location of accident or areas of conflicting traffic. Design interventions given for these locations

• During the operations of the road traffic hotspot studies should be carried out every year as per the MoRTHs Circular. The traffic safety expenditure should be included in the annual budget.

6.12 Occupational Health and Safety Issues

6.12.1 Impact Identification

Road workers are at risk of injury from i.) passing traffic vehicles, ii) Construction equipment

operating within the work zone and in ancillary areas which support the work zone e.g. batching plant, hot-mix plants iii) construction vehicles entering and leaving the work zone.

Similarly, there are occupational risks during operation of the road is from traffic. Accidents primarily occur due to collisions with passing vehicle. The project districts experience extreme weather conditions especially during winter and rainy season. This can cause accidents and cold climate.

6.12.2 Mitigation Measures

The following mitigation measures need to be adopted to protect the workers:

- Temporary traffic control devices such as signages, warning devices, concrete barriers can be used to segregate the highway traffic from the work zone. These control devices should be setup at a distance ahead of the work zone to control traffic. Cover or remove the precautionary signages when the workers are not present;
- Flaggers/Flagmen should be placed with high reflective jackets and other devices so that they can slow down the traffic;
- No equipment or vehicle should enter the work zone without the flagmen being present to guide the equipment/vehicle;
- All vehicle should be fitted with reverse siren. Rotating equipment should also be fitted with siren which should come on when the equipment rotates to the reverse;
- In case of extreme temperatures, the working hours may be regulated. Night time working can be considered especially in areas outside settlement with the permission of the Executing Agency.
- These measures as discussed above would also be made part of the Standard bidding document of Contractors involved in project road section.

6.12.3 Key Impacts in the Project

Considering the sensitivity of the receiving environment along the project road section and the project intervention the following key impacts have been identified:

- In absence of any approved water source and the also community arranged supply of water for domestic and agricultural purpose sourcing of water for construction

would cause stress on the surface water resource. Hence, sourcing of water from stream is prohibited. Prior permission from local community and authority should be processed before start of work.

- Approximately 7620.86 cum of excavated soil from hill cutting. The debris especially from cross drainage structures and pavement should be utilized in the backfilling where ever possible. No virgin material shall be utilised unless the demolition debris are certified by the Engineer as “not fit for use”. All construction debris which cannot be reused should be disposed at pre-designated sites. The Contractor should identify site for temporary storage of the construction debris during the pre-construction.
- All hill/soil cutting areas should be revegetated as soon as construction activities are completed. At more vulnerable landslide locations, selected bioengineering techniques should be adopted - a combination of bioengineering techniques and engineering solutions such as rock bolting and the provision of bank drains may be required. Solutions will, however, need to be individually tailored by the geo-technical/ environmental experts of contractor or authority engineer.
- The road alignment is passing through two reserved forest areas viz. Gobrakura R.F., Angratoli R.F. The Gobrakura R.F. extended from chainage 13/600 to 14/800 Km and Angratoli R.F. from chainage 15/800 to 16/300 Km. However the road will be constructed within the existing RoW without encroaching the forest land areas while passing through these two forests.

7 PUBLIC CONSULTATION AND DISCLOSURE

7.1 Stakeholders Consultation

7.1.1 Introduction

The objective of this stakeholder consultation is to get different views on the project activity, to take into account concerns and recommendations. From the project inception stage itself, the consultation procedure has been continued as part of the environmental screening, environmental assessment and environmental management plan preparation at various stages of technical proceedings of the project.

Stakeholder consultation involving local communities in the project planning is basis of the participatory planning. Because, often suggestion and option given by the people improves technical and economic efficiency of the project and suggested improvements proposals (if adopted by the project) of the people also generates sense of ownership within communities, thus eases implementation process.

Following section highlights level of consultative procedure adopted at various stages, strategies to participatory and continued consultation and specific inputs from the stakeholder's consultation in project planning.

7.1.2 Identification of Stakeholders

Consultations are conducted with both primary and secondary stakeholders in the project area. The primary stakeholders consulted are usually (i) Roadside community having their temporary or permanent residences (PAP's) (ii) Road side shop owners/vendors and (iii) Road users (iv) Community Leaders and Forest Department. While the secondary stakeholders are mostly the project officials (PWD), Village representatives, NGO's, few academicians and other consultants (if any) working on road projects in the area.

1	Primary Stakeholders (Main stakeholders)	· Potential PAPs, Forest Department and Community Leaders
2	Secondary Stakeholders (Other stakeholders)	· Groups of affected persons; · Village representatives like Nokma and members, PRIs, Village level health workers · Tribal groups · Local voluntary organizations like CBOs and NGOs; · Field level Engineers (Asst Engineers, Junior Engineers), PWD, Government of Meghalaya, · Other project stakeholders such as official of line Department

7.1.3 Consultations with Primary Stakeholders

Preliminary consultations with the primary stakeholders provided some insight into the felt need of the community, their suggestions on design of the road, likely environmental & social impacts, mitigation measures in case of likely adverse environmental & social impacts. The consultations were held with the people inhabiting along PARALLEL ROAD TO EXISTING DALU BAGHMARA ROAD, who are likely to be affected.

Figure 7-1: Consultation @ Shops

Figure 7-2: Consultation @ Residence

Figure 7-3: Consultation with Primary Stakeholders

Figure 7-4: Consultation with Primary Stakeholders

The summary of the issues that were identified during the consultations are presented below

Acquisition of land and assets: The people wanted to know about the land and property that will be acquired as a result of the road construction. They also wanted to know about the trees and plantation they would lose as a result of the project.

Compensation: The people fear of non-compensation. They wanted to know

- Whether the compensation would be paid before or after the acquisition
- The Compensation for non patta land. They wanted to know whether the compensation for non patta land would be equal or less than the patta land
- The Compensation of land at junction points. They are of the view that land located at the junction points fetches more value
- Compensation of Trees
- Compensation of shops
- The people during the public consultation has been raising question about the compensation for the land coming under the impact during the construction of road. They wanted to know if they would be compensated for that land also. However the

Addl. Chief Engineer, MPWD, West Meghalaya informed them that on major areas has been coming under the impact zone, hence there has not been any provision of compensation payment during this road project implementation.

Social and Economic issue: The people spoke at length about their sufferings and loss because of the poor road condition that exists now. They believe that the socio economic problems that they have been facing will no longer be there with the construction of the road. They foresee a lot of opportunities

- **Parallel Road to existing Dalu Baghmara Road** is the alternate route to connect William Nagar With Tura town. So they want the road to be constructed as soon as possible as it would lead to better and faster connectivity with Tura and other parts of the state
- Prices of all essential commodities have gone high because of the poor road condition. So the construction of the road would lead to reasonable pricing
- Transportation has become a big issue as even the few vehicles that ply through the existing road. The building of the road thus would lead to more buses and other carriers and lead to quick and faster access to other places
- Bad roads have led to the disinvestment of many agro-based industries in the thus losing a lot of employment opportunities and in turn hampering economic growth. Thus this project would trigger investment and in turn employment opportunities and economic growth.
- Bad and uneven roads have also led to a lot of accidents over the years specially in Gasuapara area. So the construction of the new road would reduce accidents
- As regards to the places of worship and other social property the people were of the view that they would discuss among themselves and let the authorities know about it. However any kind of opposition was not witnessed in this regard
- Bad road have led to other social issues also. So they believe that the new road would bring an end to this
- Petrol and diesel consumption in vehicles is more due to the bad roads and with the increasing prices of crude oil it has become an economic issue
- With the construction of the road fire brigades would reach in time and the emergency ambulance service which refuses to come now would come

Environment Issues: People were concerned about the felling of trees and wanted the initiative of the forest officials to guide them on endangered species and also on environmentally and economically viable trees.

General Suggestions on Road Design and construction:

- The local residents suggested that the MPWD proposed width of the road should be marked by boundary pillars as soon as possible
- The people suggested that the road should be aligned properly to reduce the impact on the community infrastructures, households, horticulture estates.
- The people are concerned about the open bath area by women in the roadside streams and river. They suggest that the covered bathing sheds near the streams to be constructed and should be included as part of the project
- The People suggested siltation near the paddy field to be minimized during the construction phase. They suggest that construction no to be done during the paddy season.
- They suggested to have less cutting on hill side to save the betel nut orchards.

Mitigation Measures

- Resettlement Action Plan adequately addresses the benefits to be extended to the Project Affected Persons (PAPs) and has an inbuilt clause that compensation disbursement and benefits are to be disbursed to the PAPs before commencement of civil works
- PAP's were explained that the compensation for the affected structures are arrived at as per entitlement framework formulated for MPWD.
- PAP's were explained that the necessary provisions are already made in the project for shifting the utilities such as electrical lines, telephone OFC lines and water pipelines.
- Assurance was given that all eligible PAPs will be suitably compensated for trees in their horticulture gardens as no household is coming under the impact zone in this area.
- Assurance was also given by the PWD that drains would be constructed along the roadside and silt traps will be installed during constructions.
- Assurance was given that the marking of the proposed road width has already started and should be completed for the entire corridor soon. They said it is being done with assistance from the revenue department. They also confirmed that the proposed ROW for rural areas is 9m-14 (as available without impacting any households) and for urban areas it is 9m.
- The PWD officials informed that a joint verification is being made with the Forest and Revenue Department on acquisition and the result would be out soon

- Assurance was given that prior notice would be given to all the PAPs (Only horticulture gardens came under impact zone) with all the details of acquisition
- Assurance was given by the PWD that all safety measures would be taken into consideration while constructing the road

7.1.4 Consultations with Secondary Stakeholders

Consultation with the MPWD officials at Head Quarter and field offices have resulted in getting idea about the plan for improvement by PWD, understanding field situation, likely negative environmental & social impacts, probable mitigation measures etc. Since the road design is done in-house, the necessary details for the proposed design like proposed RoW, proposed bridges, bus bays, proposed alternative alignments, proposed drains and utility shifting etc… is shared with the consultants for better environmental and social assessment.

Consultation with the District Officials and other key persons (Deputy Commissioner) are organized. Issues discussed in the meeting are regulatory clearances such as Permission of tree cutting, Land acquisition, Entitlement Framework, Utility shifting, etc.

7.2 Environmental Management Framework (EMF)

The primary objective of the EMF is to develop a model / structure to cover the overall existing environmental baseline (for better understanding of project area) and to identify the magnitude of environmental issues associated with the project implementation with alternatives, planning and design. It also highlights the importance of the environmental screening and scoping exercises with procedure to be followed for better understanding of the project impact to the environment at the initial stage of the project itself. The EMF also helps to categorise the sub - project based on the environmental severity.

For the identified environmental impacts and issues arising during planning, design, construction and operation phase, a generic environmental management plan is also developed. The EMF will be used to establish criteria to identify the level of EA required (detailed or limited EA) for the project and the processes involved, their sequence to conduct the EA studies for various components/phases of road projects including their legal requirements and implication.

The EMF will also suggest suitable mechanisms to operationalize / Implement EMP, appropriate institutional mechanisms and specific training / capacity building needs and environmental guidelines to prepare a work plan.

7.3 Social Management Plan

The project road requires widening almost all through the corridor. The proposed improvements involve land acquisition. The extent of the impact varies from minor to major impacts the extent of land acquisition varies from 1.0 m to 5.0 m. There are only two cases of partial impact due to the project. The project corridor passes through scheduled tribal populated villages. The vulnerable population belongs to below poverty level and physically challenged persons and women headed households are commonly observed in the corridor. The population affected by HIV has not been recorded in the project indirect influence area. The Government of Meghalaya has Resettlement and Rehabilitation policy for the road sector projects. The policy clearly insists for the preparation of the Social Management Plan for the project affected population. The primary objectives of the National R&R policy have also taken into account over and above the state R&R policy. The management plan would address the extent of impacts due to land acquisition, socio-economic base line of the project affected persons, Resettlement and Rehabilitation plan for the project affected persons, consultation process in the project preparation, Action plan for the addressal of road safety issues and HIV/AIDs and Livelihood support plan for the vulnerable and tribes.

7.4 Road Safety Management System

7.4.1 Potential Accident Prone Areas

The basic aim for road safety review is to identify areas of major concern, including black spots and accident-prone stretches on project road and to propose measures to be taken for improving the engineering design with respect to road safety aspects. Consultants have carried out a detailed reconnaissance survey along the project road and identified areas of major concern, including black spots and accident-prone stretches on each project road.

The construction and operation phase of the project could also cause hindrance to public, especially to the road users. This is mainly attributed due to the obstruction of the roads and the diversions in the traffic. This is a temporary impact and it is time dependent. But at present the road doesn't have safety measures like road markings, direction marking, road studs and zebra crossing. During the reconnaissance survey some of the critical areas prone to accident are identified and depicted in Table 7-1.

Table 7-1: Identified Accident Prone Areas in Parallel Road to existing Dalu Baghmara Road.

Sl. No.	Chainage (km)		Location/ Village	Landuse category
	From	To		
1	0/00	0/200	**Paulpara**	Market/Bypass
2	12/850	13/950	Gasuapara	Curve/Commercial/ Institutional area

Source: Primary analysis

Figure 7-5: Accident Prone area @ 0/100

Figure 7-6: Accident Prone area @12/850

The project road is designed for a travel speed of 40 to 60km/hr. However, at the identified accident zones, the speed limit shall be limited to 20 to 30km/hr. Apart from the speed restrictions, the road furniture's as suggested as per IRC will be provided. Some of the mitigation measures to avoid accidents are discussed in detail below.

MITIGATION MEASURES

Road Markings

The ordinary paint for markings takes a long time to dry and has a short life (3/6 months). Thermoplastic paint mixed with retro-reflective beads has long life, night visibility and its drying period is very short. In view of these advantages, retro-reflective thermoplastic paint is proposed for this project. The specifications and standards for road markings are as per IRC: 35: 1997.

Lane markings, with retro reflective thermo plastic paint are provided along the carriageway edges where built-up areas, junctions and curves are there and for centerline also the same has to be provided. Centerline markings are in the form of 1.5m strips with 3m longitudinal gap. Edge markings are continuous strip of painting with breaks at the junctions. Other markings, viz. island marking, warning lines, chevron markings and directional arrows, etc. are provided at suitable locations.

Road Signs

For the same reasons as mentioned in the road marking section, the recommended material for road signs will be retro-reflectorized plastic flexible sheet. The major advantage of this

type of material is its excellent night visibility. Various traffic signs proposed for the project road fall in to Cautionary Signs, Regulatory signs and Informatory Signs. The specifications and standards for traffic signs are as per IRC: 67-2001.

Cautionary /Warning signs

These signs are used to warn the road users of the existence of certain hazardous condition either on or adjacent of the roadway, so those motorists are cautious and take the desired action. These signs shall be located at about 90m before the point of hazard. Distance may be modified to suite the site conditions.

- Curve Ahead sign
- Junction Ahead sign
- Pedestrian crossings sign
- Regulatory /mandatory signs

These are to provide to inform certain laws and traffic regulation for the safety and free flow of traffic. The regulatory signs are proposed under the following types,

- Stop signs on Access Roads, which has direct entry into project road.
- Give Way Signs at minor intersections
- Speed limit signs
- Informatory signs

These signs are informatory in nature and will make the travel easier safe and pleasant. The informatory signs are recommended in the project stretch, which comprise of the following.

- Advance direction sign at Major Junctions
- Place identification signs
- Facility information signs and Bus stop signs

Cats Eyes

Road delineators in the form of Cats Eyes are proposed at pedestrian crossings, curves and rumble strip locations.

Pedestrian safety measures

With respect to the R&R issues, the pedestrian safety is taken care of by providing 1.5 m wide foot path at all built-up locations. Apart from this pedestrian crossing are provided at all schools, Built-up area and other sensitive locations as per IRC guidelines. The width of side-walks depends upon the expected pedestrian flows and could be fixed with the help of guidelines given in IRC 103-1988, subject to a minimum width of 1.5 m.

8. Environmental Management Plan

8.1 Introduction

Environmental Management Plan (EMP) deals with the implementation procedure of the guidelines and measures recommended to avoid, minimize and mitigate environmental impacts of the project. It also includes management of measures suggested for enhancement of the environmental quality along the **Parallel Road to existing Dalu Baghmara Road**. The institutional arrangement made under project will look into the implementation of project as well as EMP and the various legal settings applicable to the project are briefly stated in Chapter 1.

The avoidance, mitigation & enhancement measures for protection of the environment along **Parallel Road to existing Dalu Baghmara Road** have been discussed in detail in previous chapter. Although the social environmental impacts, its mitigation and management is an essential component of the EMP, this section excludes it for the purpose of clarity and procedural requirements. Social environmental elements have been separately dealt in separate volume namely, Resettlement and Rehabilitation Action Plan (RAP).

8.2 Objective of EMP

The EMP is a plan of action for mitigation / management / avoidance of the negative impacts of the project and enhancement of the project corridor. For each measure to be taken, its location, implementation and overseeing / supervision responsibilities are listed. A description of the various management measures during various stages of the project is provided in the Table 8-1.

8.3 Environmental Monitoring Program

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections.

8.4 Performance Indicators

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed

The Performance Indicators and monitoring plans prepared for Project Implementation are presented in Table 8-1.

Table 8-1: Performance Indicators for Project Implementation

Sl. No.	Indicator	Details	Stage	Responsibility
A	Environmental Condition Indicators and Monitoring Plan			
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 6-5)	Construction	
			Operation	PIU through approved monitoring agency
			Pre Construction	PIU through approved monitoring agency
2	Noise Levels		Construction	
			Operation	PIU through approved monitoring agency
			Pre Construction	PIU through approved monitoring agency
3	Water Quality		Construction	
			Operation	PIU through approved monitoring agency
			Pre Construction	PIU through approved monitoring agency
4	Soil Quality		Construction	
			Operation	PIU through approved monitoring agency
B	Environmental Management Indicators and Monitoring Plan			
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of	Pre-construction	PIU

Sl. No.	Indicator	Details	Stage	Responsibility
		environment in the area has to be reported		
2	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported.	Pre-construction	PIU
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Forest Department to PIU
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Department
C	Management & Operational Performance Indicators			
1	Survival Rate of Trees	The number of trees surviving during each visit will be compared with the number of saplings planted	Operation	Forest Department/ PIU
2	Status Regarding Rehabilitation of Borrow Areas	The PU will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Operation	The PIU will be responsible for a period of three years.
3	Soil Erosion	Visual monitoring and operation inspection of embankments will be carried out once in three months.	Operation	The PIUwill be responsible for a period of three years.

8.5 Monitoring Parameters and Standards

The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

8.6 Ambient Air Quality Monitoring (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO2), Oxides of Nitrogen (NOX), Carbon Monoxide (CO), Hydro-Carbons (HC), Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM) , Ammonia (NH3), Ozone (O3), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in Table 8-2. The duration and the pollution parameters to be monitored and the responsible

institutional arrangements are detailed out in the Environmental Monitoring Plan Table 8-5.

Table 8-2: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	
1	Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravemetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravemetric -TOEM -Beta attenuation
5	Ozone (o_2) µg/m^3	8 hours* 1 hours**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m^3	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m^3	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR)spectroscopy
8	Ammonia (NH_3) µg/m^3	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C_6H_6) µg/m^3	Annual*	05	05	-Gas chromatography based continuous analyser -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, µg/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) µg/m^3	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) µg/m^3	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

**Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals*

***24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

8.7 Noise Quality Monitoring

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in Table 8-3. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 8-5.

Table 8-3: National Ambient Noise Quality Standards

Area Code	Category of Zones	Limits of Leq in dB(A) Day*	Night*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone **	50	40

** Daytime shall mean from 6.00am to 10.00 pm and Night shall mean from 10.00 pm to 6.00 am*

*** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicles horns, loud speakers and bursting of cracking are banned in these zones.*

8.8 Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications, presented in Table 8-4. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 8-5.

Table 8-4: National Standard of Water

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27ºC)	3.0	DO-Azide modification of Wrinkler's method
3	Temperature (ºC)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Wrinkler's method
5	Color (Hazen)	300	Visual Comparison method
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO_4)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthrolin method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr^{6+})	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method

18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified; Brackets ([ ]) indicates extended limits. All the values in mg/l if otherwise mentioned

8.9 Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in Table 8-5. Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 8-5: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO_2, NO_x, RPM, SPM, O_3,Pb, CO, NH_3, C_6H_6, BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Two seasons in a year for three years		Along the road	Contractor / PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor / PIU
	Operation				Four seasons for three years			Contractor / PIU
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night	Along the road Hot mix / batching	Contractor / PIU

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
			distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement			time	plant	
	Operation				Three seasons per year for three years.		Along the road	Contractor / PIU
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Four seasons per year	Grab Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Four seasons for three years		Along the road	Contractor / PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Tree plantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Contractor / PIU

8.10 Reporting System

Reporting system for the suggested monitoring program operates at two levels as:

- Reporting for environmental condition indicators and environmental management indicators (except tree cutting indicator)
- Reporting for operational performance indicators at the PIU level

Contractor and Engineer operate the reporting system for environmental condition and environmental management indicators (except tree cutting). The Environmental Cell of PIU will operate the reporting system for environmental management tree cutting indicator and operation performance indicators. The PIU will set the targets for each activity envisaged in the EMP beforehand and all reports will be against these targets.

Contractor will report to the Engineer on the progress of the implementation of environmental conditions and management measures as per the monitoring plans. The Engineer will in turn report to the PIU on a quarterly basis which will be reviewed. Along with these reports, Environmental Cell of the PIU shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. The PIU will also send compliance report to the MoEF every six months as per the conditions of clearance granted for the project after receiving the report from the contractor and duly verified by the Engineer. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer and/or the Environmental Cell as required and presented as Annexure 2.

Table 8-6: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (SC) / Concessionaire		Project Implementation Unit (PIU)
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM 1	Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
EM 2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
EM 3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
EM 4	Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly
EM 5	Tree Plantation	Construction	-	Monthly	-	-	Quarterly
EM 6	Top Soil Monitoring	Construction	Quarterly		Continuous	Quarterly	Quarterly
EC1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
EC2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
OP1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

8.11 Pre-Construction Stage

Pre-Construction Activities by PIU

Prior to the contractor mobilization, the PIU will ensure that an encumbrance free CoI is handed over to enable the start of construction. The RoW clearance involves the following activities:

- Clearance of the RoW including removal of trees, and
- Relocation of common property resources impacted, including cultural properties as temples and community assets as hand pumps and other utilities

Pre-Construction Activities by Contractor/Engineer

The pre-construction stage involves mobilisation of the contractor, the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:

- Joint field verification of EMP by the Engineer and Contractor
- Modification (if any) of the contract documents by the Engineer
- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery
- Identification and selection of material sources (quarry and borrow material, water, sand etc)
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc
- Planning traffic diversions and detours, including arrangements for temporary land acquisition

8.12 Construction Stage

Construction stage activities by the contractor

Construction stage activities require careful management to avoid environmental impacts. Activities that trigger the need for environmental measures to be followed include:

- Imbibing environmental principles at all stages of construction as good engineering practices
- Implementation of site-specific mitigation/management measures suggested

- Monitoring the quality of environment along the construction sites (as air, noise, water and soil)

There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs. They include improvement of roadside drainage, provision of additional cross drainage structures or rising of road height in flood prone stretches, provision of cattle crossings and reconstruction and improvement of bunds of the affected water bodies.

Construction Stage Activities by the PIU

The construction stage involves the following activities by PIU:

- Tree plantation along the project corridor and landscaping along junctions by the PIU.
- Monitoring of environmental conditions through approved monitoring agency

8.13 Operation Stage

Operation stage actives are to be carried out by the Environmental Cell includes mostly environmental monitoring of operational performance of the various mitigation/enhancement measures carried out as a part of MITP.

Other Activities

- Orientation of Implementation agency staff towards project specific issues of EMP implementation
- Conducting additional studies for issues identified during any stage of project preparation/ implementation

Table 8-7: Summary Matrix of Environmental Management Plan

Sl. No	Activities	Management Measure	Location	Reference[3]
1.0	PRE-CONSTRUCTION STAGE			
1.1	Pre-construction activities by PIU			
1.1.1	Tree Cutting	Trees will be removed from the Corridor of Impact and construction sites before commencement of construction with prior intimation to the Forest Department. Prior Permission will be obtained from the Forest Settlement Officer. As part of the project 3,155 trees will be removed. The trees cut will be disposed off through auction (inclusive of tree stumps). This disposal will be done immediately to ensure that the traffic movement is not disrupted. Progress	Corridor of Impact.	Design MoRTH 201.6

[3] MoRTH Clause 111.1 with modifications mentioned in Appendix 3.15 shall be applicable for all the EMP Clauses

Sl. No	Activities	Management Measure	Location	Reference[3]
		of tree cutting shall be reported to the PIU.		
1.1.2	Utility Relocation	All utilities lost due to the project will be relocated with prior approval of the concerned agencies before construction starts, on any sub-section of the project road.	Corridor of Impact.	Design MoRTH 110.7
1.1.3	Relocation of Cultural Properties	All cultural properties within the CoI, whose structure is getting affected, will be relocated at suitable locations, as desired by the community before construction starts.	Corridor of Impact.	Design
1.1.4	Replacement of Common Property Resources	All common property resources such as community sources of water will be replaced. The relocation site identification will be in accordance with the choice of the community. The replacement will be complete before construction starts.	Corridor of Impact.	Design
1.2	Pre-construction activities by the Contractor/Engineer of SC			
1.2.1	Joint Field Verification	The Engineer and the Contractor will carry out joint field verification of the EMP. The efficacy of the mitigation/enhancement measures suggested in the EMP will be checked. Design changes recommended as part of the independent review shall be included in the designs by the Engineer.	Project Corridor	EMP
1.2.2	Modification of the Contract Documents	If required, the Engineer will modify the EMP and Contract document.	Project Corridor	EMP
1.2.3	Procurement of Machinery			
1.2.3.1	Crushers, Hot-mix Plants & Batching Plants	Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations.		Contract, MoRTH: 111.1, GoI Air & Noise Standards, OSHA Standards
1.2.3.2	Other Construction Vehicles, Equipment and Machinery	The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. All vehicles, equipment and machinery to be procured for construction will conform to the relevant Bureau of Indian Standard (BIS) norms. Noise limits for construction equipments to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one metre from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.		Contract, Environment Protection Act, 1986 & MoRTH: 111.1
1.2.4	Identification & Selection of Material Sources			
1.2.4.1	Borrow Areas	Arrangement for locating the source of supply of material for embankment and	Ecologically sensitive area	MoRTH: 305.2.2.2

Sl. No	Activities	Management Measure	Location	Reference[3]
		sub-grade as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. The environmental personnel will be required to inspect every borrow area location prior to approval. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads should be routed to avoid agricultural areas.		
1.2.4.2	Quarries	The Contractor will identify materials from existing licensed quarries with the suitable materials for construction. Apart from approval of the quality of the quarry materials, the Engineer's representative will verify the legal status of the quarry operation, as to whether approval from Meghalaya State Government is obtained.	All quarries recommended to be used in the project	MoRTH: 111.3
1.2.4.3	Water	The contractor will source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project area. The contractor will be allowed to pump only from the surface Water bodies. Boring of any tube wells will be prohibited. To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations. The contractor shall consult the local people before finalizing the locations. Only at locations where surface water sources are not available, the contractor can contemplate extraction of ground water. Consent from the Engineer that no surface water resource is available in the immediate area for the project is a pre-requisite prior to extraction of ground water. The contractor will need to comply with the requirements of Department of Irrigation, Meghalaya and seek their approval for doing so.	All rivers / surface water bodies that can be used in the project	Contract
1.2.4.4	Sand	The contractor will identify sand quarries with requisite approvals for the extraction of sand under The Land Acquisition Act, 1894 for use in the project	All riverbeds recommended for sand extraction for the project.	
1.2.5	Labour Requirements	The contractor will use unskilled labour drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply, etc.)	Along project corridor at construction sites	Contract
1.2.6	Setting up construction sites			
1.2.6.1	Construction Camp Locations – Selection, Design & Layout	Construction camps will not be proposed: (i) Within 1000m of Ecologically sensitive areas (ii) Within 1000m from the nearest	All Construction Workers Camps	Contract Annexure

Sl. No	Activities	Management Measure	Location	Reference[3]
		habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. Layout of construction camps will be as per the conceptual design presented in Annexure 1 Locations for stockyards for construction materials will be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odour is generated. Unless otherwise arranged by the local sanitary authority, arrangements for disposal of excreta suitably approved by the local medical health or municipal authorities or as directed by Engineer will need to be provided by the contractor.	including areas in immediate vicinity.	
1.2.6.2	Hot Mix Plants & Batching Plant Location	Hot mix plants and batching plants will be sited sufficiently away from habitation, agricultural operations or industrial establishments. Such plants will be located at least 1000m away from the nearest habitation, preferably in the downwind direction.		Contract Appendix 3.15, Sub clause 111.5
1.2.6.3	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules will carry out negotiations with the land owners for obtaining their consent for temporary use of lands for construction sites/ hot mix plants /traffic detours /borrow areas etc. The Engineer will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.	Areas temporarily acquired for construction sites / hot mix plants / borrow areas / diversions / detours	
2.0	CONSTRUCTION STAGE			
2.1	Construction Stage Activities by Contractor			
2.1.1	Site Clearance			
2.1.1.1	Clearing and Grubbing	Vegetation will be removed from the CoI before the commencement of Construction. All works will be carried out such that the damage or disruption to flora is minimised. Only ground cover / shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Engineer. The contractor, under any circumstances will not damage trees (in addition to those already felled with prior permission from the forest department).	Corridor of Impact	Design MoRTH 201
2.1.1.2	Dismantling of Bridgework / Culverts	All necessary measures will be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage	At locations were bridge works and culverts are proposed.	MoRTH 202.2

Sl. No	Activities	Management Measure	Location	Reference[3]
		systems.		
2.1.1.3	Generation & disposal of Debris	Generated debris material shall be suitably disposed off by the contractor either through filling up of borrow areas created for the project or at pre-designated disposal locations, subject to the approval of the Engineer. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. Disposal sites shall be: · Located in the downwind side of residential areas · Located at least 100m away from Ecological sensitive areas · Not contaminate any water sources, rivers etc, and should have adequate capacity equal to the amount of debris generated. · Finalised taking in to account the Public perception about the location · Obtain permission from the Village Panchayat · Avoid productive lands · Give preference to available waste lands	Throughout Project Corridor	MoRTH 202.5 MoRTH 517
2.1.1.4	Non-bituminous construction wastes disposal	Location of disposal sites will be finalized prior to completion of the earthworks on any particular section of the road. The Engineer shall approve these disposal sites conforming to the following (a) These are not located within designated forest area (b) The dumping does not impact natural drainage courses (c) No endangered/rare flora is impacted by such dumping. (d) Settlements are located at least 1.0km away from the site.	Disposal site locations	Contract MoRTH: 201.4 & 202.5 Section 2.1.1.3
2.1.1.5	Bituminous wastes disposal	The disposal of residual bituminous wastes will be done by the contractor at secure land fill sites, with the requisite approvals for the same from the concerned government agencies.	Throughout Project Corridor	Contract MoRTH: 201.4
2.1.2	Procurement of Construction Materials			
2.1.2.1	Borrow Areas	No borrow area will be opened without permission of the Engineer Borrow pits will not be dug continuously in a stretch. The location, shape and size of the designated borrow areas will be as approved by the Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the guidelines for siting	All along the project corridor, all access roads, sites temporarily acquired & all borrow areas	MoRTH: IRC 10 1961

Sl. No	Activities	Management Measure	Location	Reference[3]
		and operation of borrow areas The unpaved surfaces used for the haulage of borrow materials will be maintained dust free by the contractor. Since dust rising is the only impact along the haul roads sprinkling of water will be carried out twice a day along such roads during their period of use.		
2.1.2.2	Stripping, stocking and preservation of top soil	The topsoil from borrow areas, areas of cutting and areas to be permanently covered will be stripped to a specified depth of 150mm and stored in stockpiles. At least 10% of the temporarily acquired area will be earmarked for storing topsoil. The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is to be restricted to 2m. Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes.	Throughout Project Corridor, where productive land is acquired.	MoRTH: 301.3.2 & MoRTH: 305.3.3 MoRTH: 301.7 & MoRTH: 305.3.9
2.1.2.3	Quarries	The quarry operations will be undertaken within the rules and regulations in force.	All along the project corridor and all haul roads	Forest department as per Meghalaya Government Regulation
2.1.2.4	Blasting	Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor will comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land as applicable. The Contractor will at all times take every possible precaution and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The contractor will at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer. The Contractor will at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations.	All blasting and Pre-splitting Sites.	MoRTH: 302.4

Sl. No	Activities	Management Measure	Location	Reference[3]
		Blasting will be carried out only with permission of the Engineer. All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives will be strictly followed. Blasting will be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing should be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions.		
2.1.2.5	Transporting Construction Materials	All vehicles delivering materials to the site will be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the contractor, or any of his sub -contractor or suppliers of materials and similarly roads which are part of the works will be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles The unloading of materials at construction sites close to settlements will be restricted to daytime only.	All along the Project corridor and all haul roads	MoRTH: 111.9
2.1.2.6	Water Extraction	Procurement of water is to be carried out as per Section 1.2.4.3. The contractor will minimize wastage of water during construction.	All water bodies recommended to be used in the project	Section 1.2.4.3
2.1.3	Infrastructure provisions at construction camps	The contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the resident Engineer. There shall be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each for these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water-flushed latrines connected with a water borne sewage system, all latrines shall be provided with dry-earth system (receptacles) which shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year. If women are employed, separate latrines and urinals, screened from those for men (and marked in the vernacular) shall be provided. There shall be adequate supply of water, close to latrines and urinals.	Construction camps	Contract

Sl. No	Activities	Management Measure	Location	Reference[3]
		All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and shall be regularly emptied and the garbage disposed off in a hygienic manner. Construction camps are to be sited at least 1000m away from the nearest habitation and adequate health care is to be provided for the work force. Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta by putting a layer of night soils at the bottom of a permanent tank prepared for the purpose shall be taken up by the contractor. It should be covered with 15 cm layer of waste or refuse and then with a layer of earth for a fortnight (by then it will turn into manure).		
2.1.4	Operation of construction equipments and vehicles	All vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked and if found to be defective will be replaced. Noise limits for construction equipment used in this project (measured at one metre from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986 Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of noise emission. The contractor will ensure that the AAQ concentrations at these construction sites are within the acceptable limits of industrial uses in case of hot mix plants and crushers and residential uses around construction camps. Dust screening vegetation will be planted on the edge of the RoW for screening dust crusher. Monitoring of the exhaust gases and noise levels will be carried out by the agency identified for Environmental Monitoring for the project.	All construction equipments and vehicles	Environment (Protection) Rules, 1986 Monitoring Plan Table 8-2

Sl. No	Activities	Management Measure	Location	Reference[3]
2.1.5	Material Handling at Site	All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Workers engaged in stone breaking activities will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals. The use of any herbicide or other toxic chemical will be strictly in accordance with the manufacturer's instructions. The Engineer will be given at least 6 working days notice of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site will be kept and maintained up to date by the Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product. No man below the age of 14 years and no woman will be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.	All construction sites	MoRTH: 111.6 MoRTH: 105
2.1.6	Precautionary/Safety Measures During Construction	All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to. Adequate safety measures for workers during handling of materials at site will be taken up. The contractor has to comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.	All construction sites	Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 MoRTH 105
2.1.7	Protection of Religious Structures and Shrines	All necessary and adequate care shall be taken to minimize impact on cultural properties (which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important structures as identified during design and all properties/sites/remains	All construction sites	

Sl. No	Activities	Management Measure	Location	Reference[3]
		notified under the Ancient Sites and Remains Act). No work shall spillover to these properties, premises and precincts. Access to such properties from the road shall be maintained clear and clean.		
2.1.8	Chance found Archaeological property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped. The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.	All construction sites	
2.1.9	Earthworks			
2.1.9.1	Excavations	All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand. The excavations shall conform to the lines, grades, side slopes and levels shown in the drawings or as directed by the engineer. While planning or executing excavation the contractor shall take all adequate precautions against soil erosion, water pollution etc (clause 306) and take appropriate drainage measures to keep the site free of water (clause 311), through use of mulches, grasses, slope drains and other devices. The contractor shall take adequate protective measures to see that excavation operations do not affect or damage adjoining structures and water bodies. For safety precautions guidance may be taken from IS:3764	All along the project corridor	MoRTH 301.3.3 MoRTH 304.3.6 IS:3764
	Earth fill	Embankment and other fill areas, unless otherwise permitted by the Engineer, be constructed evenly over their full width and the contractor will control and direct movement of construction vehicles and machinery over them	Along earth fill areas	MoRTH 305.3.5.3
2.1.9.2	Stripping, stocking and preservation of top soil	Stock piling of top soil as per Section 2.1.2.2 The stockpiles will be located at least 100m from watercourses.	All along the project corridor	Section 2.1.2.2
2.1.9.3	Slope protection	While planning or executing excavations		MoRTH 306

Sl. No	Activities	Management Measure	Location	Reference[3]
	and control of erosion	the contractor will take all adequate precautions against soil erosion as per MoRTH 306. Dry stone pitching for apron and revetment will be provided for bridges and cross drainage structures.		MoRTH 307 & MoRTH 308
2.1.9.4	Drainage requirements at construction sites	In addition to the design requirements, the contractor will take all desired measures as directed by the Engineer such measures to prevent temporary or permanent flooding of the site or any adjacent area.	All along the project corridor	
2.1.9.5	Dust	All earthwork will be protected in a manner acceptable to the Engineer to minimise generation of dust. The contractor will take every precaution to reduce the level of dust along construction sites involving earthworks, by frequent application of water.	All along the project corridor	MoRTH 111.8
2.1.9.6	Contamination of soil	Vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptor will be provided for vehicle parking, wash down and refueling areas within the construction camps as per the Figure 8-2. Fuel storage will be in proper bunded areas. All spills and collected petroleum products will be disposed off in accordance with MoEF and PCB, Meghalaya guidelines. Fuel storage and refilling areas will be located at least 1000m from rivers and irrigation ponds or as directed by the Engineer. In all fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the topsoil will be stripped, stockpiled and returned after cessation of such storage and refueling activities.	All along the project corridor	MoRTH 306 & MoRTH 311 Drawing 3.1
2.1.9.7	Compaction of soil	To minimize soil compaction construction vehicle, machinery and equipment will move or be stationed in designated area (RoW or CoI, haul roads as applicable) only. The haul roads for construction materials should be routed to avoid agricultural areas	All along the project corridor	Annexure 'A' to MoRTH 501
2.1.9.8	Silting, Contamination of Water bodies	Silt fencing will be provided around stockpiles at the construction sites close to water bodies. The fencing needs to be provided prior to commencement of earthworks and continue till the stabilization of the Construction materials containing fine particles will be stored in an enclosure such that sediment-laden water does not drain into nearby watercourses. All discharge standards promulgated under	Water bodies close to the project corridor	Environmental Protection Act, 1986

Sl. No	Activities	Management Measure	Location	Reference[3]
		Environmental Protection Act, 1986, will be adhered to. All liquid wastes generated from the site will be disposed off as acceptable to the Engineer.		
2.1.9.9	Cutting/Filling of Surface water bodies	Earth works shall be undertaken such that the existing embankments of water bodies are not disturbed. In case of cutting of embankments, the same shall be reconstructed with appropriate slope protection measures and adequate erosion control measures. Filling of surface water bodies will be compensated by digging an equal volume of soil for water storage. Such dug-up soil will be used for spreading as topsoil. Wherever digging is undertaken, the banks will be protected as designed or as approved by the Engineer. The excavation will be carried out in a manner so that the side slopes are no steeper than 1 vertical to 4 horizontal, otherwise slope protection work, as approved by the Engineer will be provided. As far as practicable, and as approved by the Engineer, excavation for replacement of water bodies will be at the closest possible place/location, with respect to the original water body or part thereof consumed by filling.	Surface Water bodies whose water storage capacity is affected by the project and whose embankments are being cut	Contract
2.1.10	Sub-Base & Base	The contractor will take all necessary measures/ precautions to ensure that the execution of works and all associated operations are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in Annexure A to MoRTH 501. The contractor will plan and provide for remedial measures to be implemented in event of occurrence of emergencies such as spillage of oil or bitumen or chemicals. The contractor will provide the Engineer with a statement of measures that he intends to implement in event of such an emergency, which will include a statement of how he intends to adequately train personnel to implement such measures. Adequate safety measures for workers during handling of materials at site will be taken up. The contractor will take every precaution to reduce the level of dust along construction sites by frequent application of water. Noise levels from all vehicles and equipment used for construction will conform to standards as specified in Section 1.2.3. Construction activities involving	All along the project corridor	Annexure A to MoRTH 501 Section 2.1.5 Section 1.2.3 Section 2.1.2.5. Section 2.1.3.5 Section 2.1.6

Sl. No	Activities	Management Measure	Location	Reference[3]
		equipments with high noise levels will be restricted to the daytime. Transport of materials for construction will be as per Section 2.1.2.5 The contractor will provide for all safety measures during construction as per Section 2.1.6		
2.1.11	Surfacing	The contractor will take all necessary means to ensure that works and all associated operations are carried out in conformity with Annexure A to MoRTH 501. All workers employed on mixing asphaltic material etc. will be provided with protective footwear as specified in Section 2.1.5. Noise levels from all vehicles and equipment used for surfacing will conform to standards as specified in Section 1.2.3. Construction activities involving equipments with high noise levels will be restricted to the daytime. Transport of materials for construction will be as per Section 2.1.2.5 The contractor will provide for all safety measures during construction as per Section 2.1.6	All along the project corridor	Annexure A to MoRTH 501 Section 2.1.5 Section 1.2.3 Section 2.1.2.5 Section 2.1.6
2.1.12	Bridge Works & Culverts	While working across or close to the rivers, the Contractor will not disrupt the flow of water. If for any bridgework, etc., closure of flow is required, the Contractor apart from obtaining the requisite clearances from the PWD (Irrigation Department) will seek approval of the Engineer. The Engineer will have the right to ask the Contractor to serve notice on the downstream users of water sufficiently in advance. Construction over and close to the non-perennial streams will be undertaken in the dry season. Construction work expected to disrupt users and impacting community water bodies will be taken up after serving notice on the local community. Dry stone pitching for apron and revetment will be provided for bridges and cross drainage structures.	At locations were bridge works and culverts are proposed.	MoRTH 2500
2.1.13	Road Furniture	Road furniture including footpaths, railings, storm water drains, crash barrier, traffic signs, speed zone signs, pavement markers and any other such items will be provided as per design	All along the project corridor	MoRTH 801

Sl. No	Activities	Management Measure	Location	Reference[3]
2.1.14	Monitoring Environmental Conditions	The contractor will undertake seasonal monitoring of air, water, and noise through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 8-1, Table 8-2 and Table 8-4).		Environmental Monitoring Plan Table 8-8
2.2	Contractor Demobilization			
2.2.1	Clearing of Construction of Camps & Restoration	Contractor to prepare site restoration plans for approval by the Engineer. The plan is to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. Residual topsoil will be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75mm - 150mm.	All Construction Workers' Camps	
2.2.2	Redevelopment of Borrow Areas	Redevelopment of borrow areas will be taken up in accordance with the plans approved by the Engineer.	At all borrow area locations suggested for the project.	
2.2.3	Tree Plantation	Tree plantation Trees felled will be replaced in accordance with the Forest (Conservation) Act, 1980. Four trees will be planted for every tree lost. 9,000 trees will be planted.	At locations of tree plantation carried out by the PIU	Forest (Conservation) Act, 1980
3.0	OPERATION STAGE ACTIVITIES BY PIU-ENVIRONMENTAL CELL			
3.1	Monitoring Operational Performance	The PIU will monitor the operational performance of the various mitigation measures carried out. The indicators selected for monitoring include the environmental parameters for air and noise, survival rate of trees, and status of rehabilitation of borrow areas.	Table 8-8	Table 8-8
4.0	OTHER ACTIVITIES			
4.1	Orientation of implementing agency and contractors	The PIU shall organize orientation sessions during all stages of the project. The orientation session shall involve all staff of Environmental Cell, field level implementation staff of PIU, Engineer and Contractor.		

8.14 Summary Matrix for Environmental Monitoring

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising

responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in Table 8-8. Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 8-8: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation	
Air	Construction	SO_2, NO_x, RPM, SPM, O_3,Pb, CO, NH_3, C_6H_6, BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant	Contractor / PIU	
	Operation				Two seasons in a year for three years		Along the road	Contractor / PIU	
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor PIU	/
	Operation				Four seasons for three years			Contractor PIU	/
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant	Contractor PIU	/
	Operation				Three seasons per year for three years.		Along the road	Contractor PIU	/
Soil	Construction	Monitoring of Pb, SAR and Oil &	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant	Four seasons per year	Grab Sampling	Along the road Hot mix /	Contractor PIU	/

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
		Grease		set by IRIS database of USEPA until national standards are promulgated			batching plant	
	Operation				Four seasons for three years		Along the road	Contractor / PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor
Tree plantation	Operation stage	As per Rehabilitation Plan			Quarterly	-	Areas where plantation is being done	Contractor / PIU

9 IMPLEMENTATION ARRANGEMENT

9.1 Project Implementation Arrangement

The Environmental Management Plan, EMP process does not stop once a project (planning and design) got approval for implementation. During implementation of project MPWD (MITP), Construction Supervision Consultant, CSC (if any) and Contractor will be responsible for ensuring that the environmental commitments made to regulatory agencies, lending agencies and other stakeholders during the EIA process are met. To execute EMP is a cumulative responsibility of all three parties involved, indicative responsibility mechanism has been presented in Table 9-3, as developed for upgradation projects.

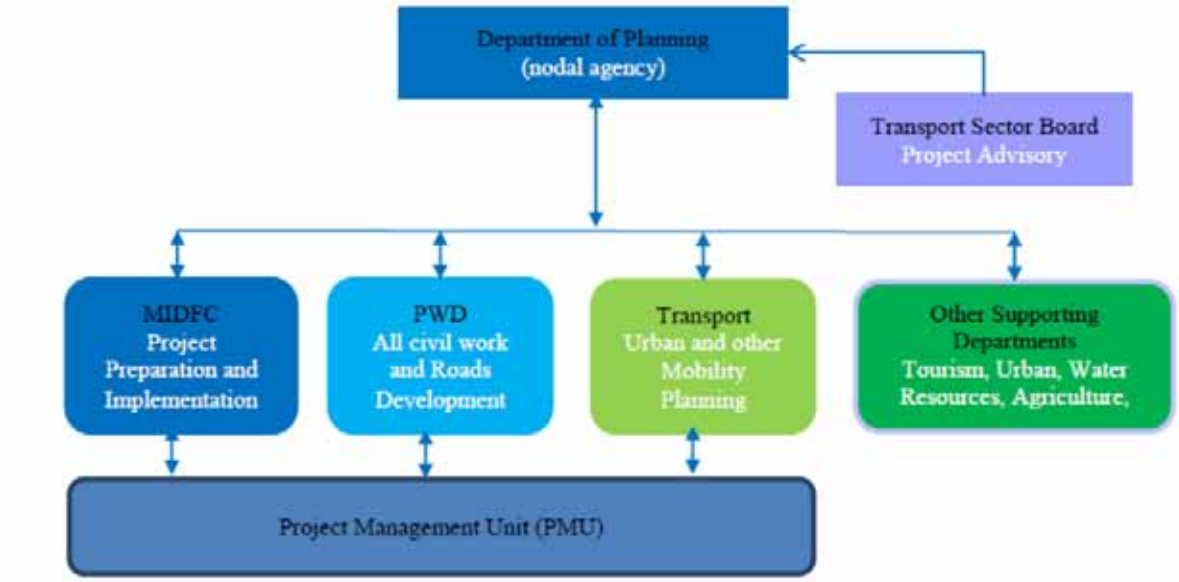

Figure 9-1: Organisation Setup for EMP Implementation

Table 9-1: Institutional Responsibilities

System	Designation	Responsibilities
Coordinating/Facilitating Agency	Chief Engineer MPWD	· Overview of the project implementation · Ensure timely budget for the EMP · Coordination with different state level committee, to obtain Regulatory Clearances · Participate in state level meetings · Monthly review of the progress.
	Chief Engineer MPWD (NH)	· Overall responsible for EMP implementation · Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation · Coordination with PIU Staff (Environmental officer). · Responsible for obtaining Regulatory Clearances

System	Designation	Responsibilities
		· Review of the progress made by contractors · Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.
	Environmental Officer (PMU)	· Recommend for approval to PMU all document and ensure that design and documents include all relevant EHS Safeguards · Recommend for approval to PMU the Contractor's Environmental Management Plan after approval of the Environmental Engineer of the PMC; · Review the environmental performance of the project through Monthly Reports and Monthly · Environmental Audits reports submitted by the Project Management Consultants and report to the Management; · Carry out quarterly environmental audits and report back to the management · Review Corrective Action Plan for closure of the Environmental Audit Findings · Overall coordination and management through PIU supported by PMC and Authority Engineer for implementation of Environment Safeguards. · Review and action on all grievance related to environment through the Grievance Redress Mechanism. · Prepare the Annual Safeguards Monitoring &closure Reports to the Management for review and onwards submission to the Bank and its closure; · Review of all the finding in the monitoring and auditing report and ensuring corrective action are implemented so that it does not reoccur; · Updating of the EMP if any new or unanticipated environmental impacts occur during project implementation due to design change or other reasons · Organise training for Capacity building of the PMU and the PIU for effective implementation of safeguard requirements
	Environmental Engineer (PMC)	· Ensure that Contractor is in compliance with all the statutory requirement and the Safeguard requirement mentioned in the EMP. · Review and approve the Contractor's EMP Implementation Plan; · Ensure that the weekly environmental reports are compiled by Contractor, reviewed and submitted to PMC; · Carry out any specialized designs which would be required for the environmental safeguards; · Facilitating the Contractor to obtain necessary permissions/ approvals and its submission to PMC

System	Designation	Responsibilities
		· Directly interact with aggrieved persons and record their views and grievances in the Grievance Management System. · Work with the contractor to ensure grievances if any at field level is resolved · Review and approve the package specific EMP's and make necessary modifications if required. · Ensure that all mitigation measures as given in the EMP are implemented properly by the Contractor during the study. · Conduct weekly environmental monitoring of all project during preconstruction, construction and operation phases. · Ensure monthly, quarterly and annual environmental monitoring reports are prepared and submitted to PMC · Work with the Contractor and PMC for preparation of the environmental corrective actions on audit observations.
	Environmental Engineer (Contractor)	· Responsible for integration of the mitigation measures proposed in the Environmental Management Plans (EMP) associated with the construction activities into the construction processes. · Responsible for daily monitoring of the environmental compliance and submission of the information to the Authority Engineer. · Preparation of Contract Specific management and submission of the same to the Authority Engineer for approval. · Ensure that adequate budget provisions are made for implementing · all mitigation measures specified in the Contract specific EMP. · Participate in induction training on EMP provisions and requirements delivered by the PMU and carry out the same for all contract staff. · Carry out liasoning with the regulatory agencies for necessary environmental license(s), permissions. · Assist the PIU with support required for obtaining necessary environmental permits · Participate in resolving issues as a member of the Grievance Redressal Cell.

System	Designation	Responsibilities
		· •Respond promptly to grievances raised by the local community or and implement corrective actions.
	Health and Safety Office (Contractor)	· Responsible for ensuring integration of the health and safety aspects in the work processes associated with the construction activities. · • Responsible for day -to day monitoring of the occupational health and safety performance and submission of the information to the Authority Engineer. · • Preparation of a Safety Plan and submission of the same to the · Authority Engineer for approval. · • Participate in induction training on EMP provisions and · requirements delivered by the PMU and carry out the same for all contract staff. · • Carry out Construction safety Audits and report it to the Team Leader of the Contractor. · • Assist the PMC with the health safety performance of the project · • Respond promptly to grievances raised by the local community for the safety and implement corrective actions.

9.2 Training and Capacity Building

Training and capacity building would be required especially for the PMU staff associated with the project as the Environmental Safeguards would be a relatively new area which the staff are required to handle. The training and capacity building would not only be project specific but would also target and develop long term capacities in the PWD Division. The training program would include:

- Sensitisation Training: primarily aimed at introducing the EHS safeguards to the officers and also make them aware of the responsibilities.
- Orientation Training: Introducing the Environmental safeguards to the PMU staff and making them aware of the key principles of environmental safeguards

- Detailed Training: aimed at the PMU staff to make them aware of the detailed activities which needs to be implemented and enforced during the EMP Implementations
- Refresher Training: this would be a need-based training organised to rectify the shortcomings identified during the Monitoring.

9.3 Monitoring Plan

Reporting system for the suggested monitoring plan, operating at two levels are as follows:

- Reporting for environmental management (EM) indicators to assess the progress of the EMP Implementations
- Review of the Environmental management implementation to assess the effectiveness of the implementation. The monitoring responsibilities and their reporting authority over the period of one year is presented in Table-9.2 . This cycle would be replicated over the tenure of the project.

Table 9.2 : Reporting requirement details of the project

Reports	Responsibility	Reporting authority
Daily	Contractor-Summery of all environmental issues and activities	Authority Engineer-review of reports and corrective action
Monthly	PMC- Monitoring of all projects and compilation nd review of all corrective actions	PMU- review the action taken repeat and develop new strategies
Quarterly	PMU- review of project progress and auditing of the process of implementation	Management- review of progress and process of implementation, Approve of the Corrective Action Plan
Annual External	Audit External Agency- review of progress EMP of implementation	Management/World Bank- Review of findings and approve of the corrective Action Plan; Report to the World Bank

9.3.1 Monitoring

.Periodic Monitoring of the EMP is required for assessing the progress of the implementation of the EMP. The monitoring would include regular activities related to the

activities proposed in the EMP.The following Monitoring reports would be submitted as per the protocol described earlier:

- Daily Monitoring Report: by the Contractor to the PMC on the environmental actions which has been implemented on site on a daily basis. The complains received from the community, observations at site for EHS issues, daily site audit, unsafe acts etc. would also record;
- Monthly Monitoring: by the PMC for reporting to the PMU, would include a monitoring of all the packages and report the observations. The Completed Action would also be assessed for its effectiveness and sustainability.
- Quarterly Monitoring: by the PMU for reporting to the World Bank, would include a monitoring of all observations and Completed Action would also be assessed for its effectiveness and sustainability.

9.3.2 Periodic Evaluation

An external evaluation of the safeguard implementation prepared for sub projects will also be undertaken twice during the implementation of the project – midterm and at the end of the implementation. During implementation, meetings will be organized by PMU inviting all PIUs for providing information on the progress of the project work.

Mid-term Assessment Study – this would be undertaken mid-way through the project to ascertain the progress achieved and any mid-course corrections which need to be introduced. It would include indicators to measure progress towards log frame goals and objectives.

End-Term Assessment Study – this will be undertaken at the end of the project period (around the time of project completion) and will assess the achievement of the project during the tenure.

All monitoring and evaluation records would be transmitted and maintained electronically. No hardcopies of the documents would be used for circulation. Each of the documents would be uniquely numbered by the Package, Project Corridor Nomenclature of the Report and Date. The records of the project would be stored in a Central repository at the PMU.

9.3.3 Review and Corrective Action

. An annual review shall be conducted by Project Advisory Committee at the time of the Project Review meeting and after the completion of the Quarterly and Annual audit. The Project Directors and the Assistant Engineer of the respective projects shall deliberate on the findings and recommendation of Environment Audit and agree on a Corrective Action Plan including budgetary support if required. The Corrective Action Plan shall be implemented in a time bound manner and reported back to the PMU. The PMU would prepare a closure report which would form a part of the Annual Report submitted to the Bank.

9.4 Environment Management Budget

The budget for implementing the Environmental management Plan for the road section is Presented in Table-9.3. This budget would not be part of the Contract and would be used by the PMU to implement the Environmental Safeguards. The budget should not form a part of the Bid Document.

9.5 Cost Estimates for Environmental Management

Mitigation measures proposed in the EMP will be implemented by the Contractor. The works to be undertaken by the Contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, noise barriers, road safety features, and shrub plantation.

Provisional quantities have also been included for additional measures that may be identified during construction and for silt fencing which will depend on the Contractors work methods and site locations. Items and quantities have also been included for enhancement measures.

More general environmental management measures to be followed by the contractor have been included in the specifications and this EMP. These cannot be quantified and are to be included in the contract rates. A total of Rs. 1.77 crores has been allocated for the environmental management for the Project road.

Table 9. 3 EMP budget estimation for the project road section

S.No.	Measure	Description	Unit	Quantity	Rate	Amount (Rs.)
1	Dust Suppression	Water Sprinkling a day in all construction sites and dust suppressant in Habitation area	Month	36	100000	3600000
2	Development of water source	Concrete drain and Check dams structures	Lump sum	3	300000	900000
		Lump sum	Lump sum	3	40000	120000
3	Flora	Compensatory plantation against tree cut	nos.	53	1250	662500
4		Soil Erosion protection Vegetated bamboo crib wall during construction	rm	3150	1000	3150000
		Turfing with sods on slope protection	sq.m.	3241	119	385679
		Bio-engineering measures	sq.m.	3451	150	517650
5	Training and capacity building		Lump sum		650000	
6	Landslide	Disposal of material from location	cum	2951	118	348218

	zone management measures	up to 1000m distance				
		Disposal of material from location more than 1km to 6km distance	cum	3146	158	497068
		Cement Treated Crushed Rock	CUM	1576	4021	6337096
7	Monitoring Expenses	Monitoring expenditure for PMU Monitoring Expenses for PMU (travel Expenses +Incidental Expenses)	Months for the pkg	3057	158	483006
		Digital camera and potable sound meter	One Set		85000	85000
8	Ambient environment parameter monitoring	Air, Water and Noise Quality Monitoring (once every quarter depending on need)	Lump sum			
9	Road Safety Measures		Covered under Civil Works BOQ			
10	External Auditing	Annual External Auditing (involving auditing both at the PIU and the site)	Lump sum	4	157400	629600
						17715817

10 Summary & Conclusions

10.1 Background

Government of Meghalaya has planned to improve the State road network by providing better quality and safer roads to the users in sustainable manner with loan assistance from World Bank. Improved quality of roads, better institutional operation and management system of PWD, Meghalaya and safe roads are important features of the project component. In this connection Govt. of Meghalaya has selected few corridors (cumulative length of 240.00 km) of important roads to be developed.

10.2 Objectives of the Assignment

The main objective would be to alleviate the current unsafe and congested conditions of the road network connecting the villages and towns by providing better quality and safe roads to the users in a sustainable and environment friendly manner. Government of India, GoI through Ministry of Environment and Forest (MoEF) enforces Environment (Protection) Rules, 1986 for environmental protection because of intervention of new projects or activities, or on expansion and modernization of existing projects or activity based on their environmental impacts.

10.3 Scope of Environmental Assessment (EA)

The environmental assessment scope includes screening and scoping, environmental assessment and environmental management plans for the individual project roads as required. The EA process also envisages to develop a comprehensive environmental management frame work for the entire project which will adopted as part of the corporate environmental policy for Meghalaya State Road Project.

10.4 Description of Project Road

Project road Parallel Road to existing Dalu Baghmara, is a MDR road, which connects A'dokgre with Rongjeng Mangsang. It is a single lane throughout with flexible pavement and badly damaged with ruts, pot holes and in some of the stretches, pavement have been completely worn off leaving behind only earthen tracks resulting in very slow and low / poor movement of traffic. It has one wooden bridges, which is in damaged condition and inadequate / not passable for through commercial vehicles. Due to connectivity between sections being affected, there is very low through traffic in such sections.

10.5 Key Environmental Laws and Regulations

In the below Table 10-1 presents the environmental regulations and legislations relevant to Meghalaya state road project (MITP).

Table 10-1: Environmental Regulations and Legislations

Sl. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
1.	Environment Protection Act-1986	To protect and improve overall environment	Yes	As all environmental notifications, rules and schedules are issued under this act.	MoEF. Gol; DoE, State Gov. CPCB; PCB, Meghalaya
2.	The Land Acquisition Act 1894 & 1989	Set out rule for acquisition. of land by government	Yes	This act will be applicable to as there will be acquisition of land for widening, geometric improvements and realignments.	Revenue Department State Government.
3.	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by & Transport controlling emission of air pollutants as per the prescribed standards.	Yes	This act will be applicable during construction; for obtaining NOC for establishment of hot mix plant, workers' camp, construction camp, etc.	PCB, Meghalaya
4.	Water Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, construction camp, workers' camp, etc.	PCB, Meghalaya
5.	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	PCB, Meghalaya
6.	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	PCB, Meghalaya
7.	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	For transporting and storing diesel, bitumen etc.	Chief Controller of Explosives
8.	Minor Mineral and concession Rules	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	Govt of Meghalaya
9.	Central Motor Vehicle Act	To check vehicular air and noise	Yes	This rule will be applicable to road users and	Motor Vehicle

Sl. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
	1988 and Central Motor Vehicle Rules 1989	pollution.		construction Machinery.	Department
10.	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregates. These will be procured through mining from riverbeds and quarries	Forest Department,

As per the amendment (dt. 1st December, 2009) on Environmental Notification (September 14, 2006) of MoEF, Government of India, the current project requires no environmental clearance as it is not under the category 'A' or "B" for road projects.

The project shall also require obtaining consent from competent authorities such as the PCB, Meghalaya for 'Consent to Establish' by submitting a Common Application (as per Schedule-I), under Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981) and authorisation under Hazardous Wastes (Management and Handling) Rules, 1989, as amended.

10.6 Base Line Environment

Data was collected from secondary sources for the macro-environmental setting like climate, physiography (Geology and slope), biological and socio-economic environment within Project Influence Area. First hand information has been collected to record the micro-environmental features within Corridor of Impact, CoI. Collection of first hand (Primary) information includes preparation of base maps, extrapolating environmental features on proposed road design, tree enumeration, location and measurement of socio-cultural features abutting project road.

A. Physical Environment

(i) Climate & Meteorology

The study area is low lying and surrounded by hills and is subjected to a wet weather. The pre-monsoon months, March-April, have winds from North East. During monsoons, the predominant wind corridors are North East, North, and also South. The annual average temperature observed daily is 29.5 °C and that of minimum mean daily temperature is 19.7 °C. The annual average mean relative humidity is 82% in the morning and 70% in the evening. The climatic condition in the area is thus humid and tropical. The average rainfall during May to September is about 81% of the total contribution.

(ii) Ambient Air Quality

Ambient air quality is monitored at three stations viz. Paulpara, Gasuaspara and Jatrakona. Selections of Air quality monitoring stations are done as per MoEF guidelines for conducting EIA study. From the observation the NO_x and SO_2 concentrations are well within the NAAQS. Whereas, RPM and SPM are relatively high with CPCB standards. The higher values are attributed to the re-suspended dust from the unpaved / damaged roads in the area used by trucks for carrying soils and other materials.

(iii) Ambient Noise Quality

To observe the noise level of the project area, noise monitoring are performed at the AAQM stations. The observed noise equivalent (Leq) was in the range of 40 – 44 dB (A) in daytime and 32 – 36 dB (A) in nighttime. The observed values are within the CPCB noise quality standards.

(iv) Surface water quality

The physico–chemical property of surface water samples indicates that the presence of Calcium and Magnesium are low signifying that the water is soft and suitable for drinking as well as for construction activities. The Dissolved Oxygen values are in the range 4.6to 5.4 indicating sustainability of aquatic life. From the analysis almost all physico-chemical parameters are well within the prescribed limits as per IS: 10500:1991 standards indicating less pollution level in surface water.

(v) Ground water quality

The groundwater water qualities with respect to almost all the essential parameters are observed to be good and of acceptable quality except for the concentration of iron which are found to be high. All other parameters are well within the standards (IS: 10500:1991).

B. Biological Environment

(i) Flora

From the reconnaissance survey it is evident that the project corridor is dominated by commercial / residential and institutional activities, hence the flora populace is significantly less. Predominant tree species found in project area are Rain Tree (*Caesalpinea sp.*), Sal tree(*Sorea robusta*), Shegun (*Tectona grandis*), Fig Trees (*Ficus religiosa, Ficus benghalensis & Ficus* raecemosa), *Cassia sp.*, Jamun (*Syzigium cumini*), Elephant apple (*Dilenea indica*), Tamarind (*Terminalia indica*), Simul tree (*Bombax ceiba*), Sonaru (*Cassia pistula*), Gulmohar Tree (*Dilonix regia*), Poma, Lali(*Walsura robusta*), Mango (*Mangifera indica*), Jackfruit (*Atrocarpus sp.*), Ghora Neem (*Azadirachta sp.*), Gamari (*Gmelia arborea*) Sotiona (*Alstonia scholaris*), Indian jujube (*Zhizyphus zuzuphus*)..

(ii) Fauna

As a district, West Grohills and East Garo Hills is very rich in bio diversity with variety of faunal populace. As a part of northeast, this area is also known as home of biodiversity.

During the winter season, Bio rich rivers and forest areas attracts more migratory and local birds and it is also known as bird watching season. Some of the species recorded around the West Garo hills district are - Asian pied Starling (*Gracupica contra*), Black drongo (*Dicrurus macrocercus*), Black kite (*Milvus migrans*), Blue throated barbet (*Psilopogon Asiaticus*), Chestnut throated bee eater (*Merops leschenaulti*), Common kingfisher (*Alcedo atthis*), Common myna (*Acridotheristristis*), Coppersmith barbet (*Psilopogon haemacephalus*), Crimson sunbird (*Aethopyga siparaja*), Grey back shrike (*Lanius tephronotus*), House sparrow (*Passer domesticus*), Indian pond heron (*Ardeola grayii*), Jungle myna (*Acridothers fuscus*), Large billed crow (*Corvus macrorhynchos*), Red Jungle Fowl (*Gallus gallus*), Red vented bulbul (*Pycnonotus cafer*), Scaly breasted munia (*Lonchura puntulata*), Oriental white eye (*Zosterops palpebrosus*), Common Hill myna (*Gracula relogiosa*), Hair crested drongo (*Dicrurus hottentottus*), Rufous treepie (*Dendrocita vagabunda*), White wagtail (*Motacilla alba*), Lineated barbet (*Megalaima Liniata*), Common stonechat (*Saxicola torquatus*), Jungle babbler (*Turdoides striata*), Dusky warblar (*Phylloscopus fuscatus*), Black Hooded Oriole (*Oriolus xanthornus*), Shikra (*Accipiter badius*), Ashy wood swallow(*Aratamus fuscus*), Bronzed Drongo (*Dicrurus aeneus*), Red Jungle Fowl (*Gallus gallus*), Lesser racket tailed drongo (*Dicrurus remifer*), Rufous woodpecker (*Micropternus brachyurus*), large cuckoo shrike (*Coracina dobsoni*), Large Hawk cuckoo (*Hierococcyx sparverioides*), Jungle owlet (*Glaucidium radiatum*), Scarlet minivet (*Pericrocotus flammeus*), Common Iora (*Aegithina tiphia*), Chestnut tailed starling (*Sturnia malabarica*), White rumped Sama (*Copsychus saularis*), Blue eared Barbet (*Psilopogon cyanotis*), Golden Throated Barbet (*Psilopogon franklinii*), Rose Ringed Parakeet (*Psitaculla krameri*), Red Breasted Parakeet (*Psitaculla alexandri*), Common Hawk Cuckoo (*Hierococcyx varius*), Black headed munia (*Lonchura malacca*), Yellow Legged green pigeon (*Treron phoenicopterus*), Fulvous breasted woodpecker (*Dendropus macei*), Common Hoopoe (*Upupa epos*), Barn Swallow (*Hirundo rustica*), Asian Koel (*Eudynamys scolopeceus*), Indian roller (*Coracias benghalensis*), Oriental Magpie Robin (*Copsychus saularis*), Green billed malkoha (*Phaenicophaeus tristis*),

Eurassian tree sparrow (*Passer montanus*), Great barbet (*Psilopogon virens*), Asian Palm Swift (*Cypsiurus balasiensis*).

Some of the identified animal's species are Rhesus macaque (*Macaca mulatta*), House Rat (*Rattus rattus*), Greater Bandicoot Rat (*Bandicota indica*), Hoary bellied squirell (*Callosciurus pygerythus*), Jungle cat (*Felis chaus*), Barking deer (*Muntiacus muntjak*), Civet Cat (*Vierricula indica*) and Indian Mongoose (*Herpestes javanicus*).

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10.7 Stakeholder Consultation

From the project inception stage itself, the consultation procedure has been continued as part of the environmental screening, environmental assessment and environmental management plan preparation at various stages of technical proceedings of the project. Considering the fact that involving local communities in the project planning is basis of the participatory planning, often suggestion and option given by the people improves technical and economic efficiency of the project and suggested improvements proposals (if adopted by the project) of the people also generates sense of ownership within communities thus eases implementation process.

10.8 Potential Impact

Table 10-2 below presents the general environmental impacts expected due to the proposed upgradation of the project road. Impacts have been assessed based on the first hand information collected from the screening & scoping of environmental attributes. The quanta of all the impacts on Natural Environment are analyzed in detail.

Table 10-2: **General Impacts on Natural Environment**

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation	Indirect effects of operation or Induced development
Env. component Affected	Land acquisition	Removal of Structures	Removal of trees and vegetation	Earth works including quarrying	Laying of pavement	Vehicle & Machine operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)	Vehicle operation	
Air		Dust generation during dismantling	Reduced buffering of air and noise pollution, Hotter, drier microclimate	Dust generation	Asphalt odour	Noise, dust, pollution	Noise, soot, odour, dust, pollution	Odour / smoke	Noise, dust, pollution	other pollution
Land	Loss of productive Land	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil		Contamination by fuel and lubricants Compaction	Contamination Compaction of soil	Contamination from wastes	Spill from accidents Deposition of lead	Change in cropping pattern
Water	Loss of water sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage Break in continuity of ditches Siltation, Stagnant	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contamination from wastes Overuse	Spill Contamination by fuel, lubricants and washing of	Increased contamination of ground water

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase			Road Operation	Indirect effects of operation or Induced development
			water pools in quarries.				vehicles	
Noise		Noise Pollution	Noise Pollution due to machinery	Noise Pollution	Noise pollution	Noise Pollution		Noise Pollution	Noise pollution
Flora		Loss of Biomass		Lowered productivity Loss of ground for vegetation	Removal of vegetation	Lower productivity Use as fuel wood	Felling trees for fuel	Impact of pollution on vegetation Lowered productivity Toxicity of vegetation.	
Fauna			Disturbance Habitat loss	Disturbance	Disturbance	Disturbance	Poaching	Collision with traffic	Distorted habitat

10.9 Environmental Management Plan

Environmental Management Plan (EMP) deals with the implementation procedure of the guidelines and measures recommended to avoid, minimize and mitigate environmental impacts of the project. It also includes management of measures suggested for enhancement of the environmental quality along the highways. The institutional arrangement made under project will look into the implementation of project as well as EMP and the various legal settings applicable to the project.

The avoidance, mitigation & enhancement measures for protection of the environment along highways have been discussed in detail in Chapter 9. Although the social environmental impacts, its mitigation and management is an essential component of the EMP, this chapter excludes it for the purpose of clarity and procedural requirements. Social environmental elements have been separately dealt in separate volume namely, Resettlement and Rehabilitation Action Plan (RAP).

10.10 Environmental Monitoring Plan

The environmental monitoring plan for the project for the individual infrastructure components is presented in Chapter 6. The proposed monitoring of all relevant environmental parameters, with a description of the sampling stations, frequency of monitoring, applicable standards and responsible agencies are presented.

10.11 Cost Estimates for Environmental Management

Mitigation measures proposed in the EMP will be implemented by the Contractor. The works to be undertaken by the Contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, noise barriers, road safety features, and shrub plantation. Provisional quantities have also been included for additional measures that may be identified during construction and for silt fencing which will depend on the contractors work methods and site locations. Items and quantities have also been included for enhancement measures. More general environmental management measures to be followed by the contractor have been included in the specifications and this EMP. These cannot be quantified and are to be included in the contract rates. A total of Rs. 1.77 cr. has been allocated for the environmental management for the project road.

APPENDICES

APPENDIX- I

BASELINE DATA COLLECTION IN FIELD

CHECKLIST OF BIRDS

SI No.	Common Name	Scientific Name	IUCN Status	WPA1972 Schedule
1	Asian pied Starling	*Gracupica contra*	Least concern	Schedule IV
2	Black drongo	*Dicrurus macrocercus*	Least concern	Schedule IV
3	Black kite	*Milvus migrans*	Least concern	Schedule IV
4	Blue throated barbet	*Psilopogon Asiaticus*	Least concern	Schedule IV
5	Chestnut throated bee eater	*Merops leschenaulti*	Least concern	Schedule IV
6	Common kingfisher	*Alcedo atthis*	Least concern	Schedule IV
7	Common myna	*Acridotheristristis*	Least concern	Schedule IV
8	Coppersmith barbet	*Psilopogon haemacephalus*	Least concern	Schedule IV
9	Crimson sunbird	*Aethopyga siparaja*	Least concern	Schedule IV
10	Grey back shrike	*Lanius tephronotus*	Least concern	Schedule IV
11	House sparrow	*Passer domesticus*	Least concern	Schedule IV
12	Indian pond heron	*Ardeola grayii*	Least concern	Schedule IV
13	Jungle myna	*Acridothers fuscus*	Least concern	Schedule IV
14	Large billed crow	*Corvus macrorhynchos*	Least concern	Schedule IV
15	Red Jungle Fowl	*Gallus gallus*	Least concern	Schedule IV
16	Red vented bulbul	*Pycnonotus cafer*	Least concern	Schedule IV
17	Scaly breasted munia	*Lonchura puntulata*	Least concern	Schedule IV
18	Oriental white eye	*Zosterops palpebrosus*	Least concern	Schedule IV
19	Common Hill myna	*Gracula relogiosa*	Least concern	Schedule I
20	Hair crested drongo	*Dicrurus hottentottus*	Least concern	Schedule IV
21	Rufous treepie	*Dendrocita vagabunda*	Least concern	Schedule IV
22	White wagtail	*Motacilla alba*	Least concern	Schedule IV
23	Lineated barbet	*Megalaima Liniata*	Least concern	Schedule IV
24	Common stonechat	*Saxicola torquatus*	Least concern	Schedule IV
25	Jungle babbler	*Turdoides striata*	Least concern	Schedule IV
26	Dusky warblar	*Phylloscopus fuscatus*	Least concern	Schedule IV
27	Black Hooded Oriole	*Oriolus xanthornus*	Least concern	Schedule IV
28	Shikra	*Accipiter badius*	Least concern	Schedule IV
29	Ashy woodswallow	*Aratamus fuscus*	Least concern	Schedule IV
30	Bronzed Drongo	*Dicrurus aeneus*	Least concern	Schedule IV
31	Red Jungle Fowl	*Gallus gallus*	Least concern	Schedule IV
32	Lesser racket tailed drongo	*Dicrurus remifer*	Least concern	Schedule IV
33	Rufous woodpecker	*Micropternus brachyurus*	Least concern	Schedule IV
34	large cuckooshrike	*Coracina dobsoni*	Least concern	Schedule IV

35	Large Hawk cuckoo	*Hierococcyx sparverioides*	Least concern	Schedule IV
36	Jungle owlet	*Glaucidium radiatum*	Least concern	Schedule IV
37	Scarlet minivet	*Pericrocotus flammeus*	Least concern	Schedule IV
38	Common Iora	*Aegithina tiphia*	Least concern	Schedule IV
39	Chestnut tailed starling	*Sturnia malabarica*	Least concern	Schedule IV
40	White rumped Sama	*Copsychus saularis*	Least concern	Schedule IV
41	Blue eared Barbet	*Psilopogon cyanotis*	Least concern	Schedule IV
42	Golden Throated Barbet	*Psilopogon franklinii*	Least concern	Schedule IV
43	Rose Ringed Parakeet	*Psitaculla krameri*	Least concern	Schedule IV
44	Red Breasted Parakeet	*Psitaculla alexandri*	Least concern	Schedule IV
45	Common Hawk Cuckoo	*Hierococcyx varius*	Least concern	Schedule IV
46	Black headed munia	*Lonchura malacca*	Least concern	Schedule IV
47	Yellow Legged green pigeon	*Treron phoenicopterus*	Least concern	Schedule IV
48	Fulvous breasted woodpecker	*Dendropus macei*	Least concern	Schedule IV
49	Common Hoopoe	*Upupa epos*	Least concern	Schedule IV
50	Barn Swallow	*Hirundo rustica*	Least concern	Schedule IV
51	Asian Koel	*Eudynamys scolopeceus*	Least concern	Schedule IV
52	Indian roller	*Coracias benghalensis*	Least concern	Schedule IV
53	Oriental Magpie Robin	*Copsychus saularis*	Least concern	Schedule IV
54	Green billed malkoha	*Phaenicophaeus tristis*	Least concern	Schedule IV
55	Eurassian tree sparrow	*Passer montanus*	Least concern	Schedule IV
56	Great barbet	*Psilopogon virens*	Least concern	Schedule IV
57	Asian Palm Swift	*Cypsiurus balasiensis*	Least concern	Schedule IV

CHECKLIST OF BUTTERFLIES

SI No.	**Common Name**	**Scientific Name**	**IUCN Status**	**WPA1972 Schedule**
1	Common Palmfly	*Elymnias hypermnestra*	Not evaluated	Schedule IV
2	Common lime butterfly	*Papilio demoleus*	Not evaluated	Schedule IV
3	Common crow	*Euploea core*	Not evaluated	Schedule IV
4	Peacock Pansy	*Junonia almana*	Least Concern	Schedule IV
5	Lemon Pansy	*Junonia lemonias*	Least Concern	Schedule IV
6	Grey Pansy	*Junonia atlites*	Least Concern	Schedule IV
7	Common mormon	*Papilio polytes*	Not evaluated	Schedule IV
8	Red base jejebel	*Delias pasithoe*	Not evaluated	Schedule IV
9	Common pierrot	*Castalius rosimon*	Not Evaluated	Schedule IV
10	Three spotted grass yellow	*Eurema blanda*	Not Evaluated	Schedule IV
11	Common Grass yellow	*Eurema hecabe*	Not evaluated	Schedule IV
12	Common jejebel	*Delias eucharis*	Not evaluated	Schedule IV

13	Common Sailor	*Neptis hylas*	Not evaluated	Schedule IV
14	Common Indian Palm Bob	*Suastus gremius*	Not evaluated	Schedule IV
15	Common Lascar	*Pantoporia hordonia*	Not evaluated	Schedule IV
16	Great mormon	*Papilio memnon*	Not evaluated	Schedule IV
17	Red spot jejebel	*Delias aganippe*	Not evaluated	Schedule IV
18	Plum judy	*Abisara echerius*	Not evaluated	Schedule IV
19	Punchinello	*Zemoros flegyas*	Not Evaluated	Schedule IV
20	Common evening brown	*Melantis leda*	Least Concern	Schedule IV
21	Common Blue bottle	*Graphium sarpedon*	Not evaluated	Schedule IV
22	Common bush brown	*Mycalesis janardana*	Least Concern	Schedule IV
23	Plain tiger	*Danaus chrysippus*	Not evaluated	Schedule IV
24	Common sergeant	*Athyma perius*	Not evaluated	Schedule IV
25	Common grass blue	*Zizina labradus*	Not evaluated	Schedule IV
26	Complete paint brush swift	*Baoris farri*	Not evaluated	Schedule IV
27	Tailed Jay	*Graphium agamemnon*	Not evaluated	Schedule IV
28	Plain tiger	*Danaus chrysippus*	Not evaluated	Schedule IV
29	Common birdwing	*Troides helena*	Not evaluated	Schedule IV
30	Common five ring	*Ypthima baldus*	Not evaluated	Schedule IV

CHECKLIST OF MAMMALS

SI No.	**Common Name**	**Scientific Name**	**IUCN Status**	**WPA1972 Schedule**
1	Rhesus macaque	*Macaca mulatta*	Least Concern	Schedule II
2	House Rat	*Rattus rattus*	Least Concern	Schedule V
3	Greater Bandicoot Rat	*Bandicota indica*	Least Concern	Schedule V
4	Hoary bellied squirell	*Callosciurus pygerythus*	Least Concern	Schedule II
5	Jungle cat	*Felis chaus*	Least Concern	Schedule II
6	Barking deer	*Muntiacus muntjak*	Least Concern	Schedule III
7	Civet Cat	*Vierricula indica*	Least Concern	ScheduleII
8	Indian Mongoose	*Herpestes javanicus*	Least Concern	Schedule II

CHECKLIST OF HERPETOFAUNA

SI No.	**Common Name**	**Scientific Name**	**IUCN Status**	**WPA1972 Schedule**
1	Common garden lizard	*Calotes versicolar*	Not Evaluated	Non Schedule
2	Forest Garden Lizard	*Calotes jerdoni*	Not Evaluated	Non Schedule
3	Checkered keelback	*Xenochropis piscatar*	Least Concern	Schedule III
4	Common Tree Frog	*Polypepdates leucomystax*	Least Concern	Non Schedule

5	Common Indian Toad	*Duttaphrynus melanostictus*	Least Concern	Non Schedule
6	Red Necked keelbak	*Rhabdophis subminiatus*	Least Concern	Schedule IV
7	Common Skink	*Lampropholis guichenoti*	Not Evaluated	Non Schedule
8	Bronze skink	*Eutropis macularia*	Not Evaluated	Non Schedule
9	Spotted forest skink	*Sphenomorphus maculates*	Not Evaluated	Non Schedule
10	White spotted suppled skink	*Lygosoma albapunctata*	Not Evaluated	Non Schedule

GPS LOCATION OF TREES TO BE FELLED

SL.No.	Latitude (North)	Longitude (East)
1	25.211	90.23035
2	25.207449	90.235359
3	25.20627	90.24196667
4	25.20438	90.24196667
5	25.20338	90.24661667
6	25.20143	90.25878333
7	25.19698	90.27756667
8	25.20327	90.24838333
9	25.20030	90.29531667
10	25.20030	90.29531667
11	25.19497	90.2953
12	25.19417	90.30645
13	25.18780	90.34533333
14	25.18422	90.3478
15	25.19615	90.33028333
16	25.18158	90.34901667
17	25.16572	90.37433333
18	25.16518	90.37945
19	25.16222	90.38776667

Appendix-2: Borrow area management guidelines

Borrow Area Management

Preconstruction Stage

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The contractor shall submit an application to the District Level Environmental Assessment Committee for Environmental Clearance with the required details. The Environmental clearance shall be submitted to the Employer before the borrowing operations can begin.

Borrowing are to be avoided in the following areas:

- Lands close to toe line of the existing or proposed road.
- Irrigated agricultural lands shall be avoided. (In case of necessity for borrowing from agricultural land, the topsoil shall be preserved in stockpiles. The subsequent

  Guidelines detail the conservation of topsoil.
- Grazing land or any community property e.g. Orans, Gochars etc.
- Lands within 0.8km of settlements.
- Environmental sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands. distance of 1000 m should be maintained from such areas.
- Eco-sensitive areas around Mount Abu and Eco-Sensitive Zones of the Wild Life Sanctuaries
- Unstable side-hills.
- Water-bodies.
- Streams and seepage areas.
- Areas supporting rare plant/ animal species;

The Employer/Authority Engineer will have the right to stop work at any borrow location even after the required environmental clearance is received if it violates any of the above. The Contractor shall ensure soft rock is not prominent within the proposed depth of excavation as it will render rehabilitation difficult. The compliance to with MoRTH, clause 305.2.2.2 for redevelopment of Borrow area must be considered. The rehabilitation measures for the borrow areas shall be dependent on the following factors:

• Land use objectives and agreed post-borrowing activities with the owner of the land as per the agreement;

– Physical aspects (landform stability, erosion, re-establishment of drainage, geological profile);

– Biological aspects (species richness, plant density,) for areas of native re vegetation;

– Water quality and soil standards; and

– Public safety issues.

The method statement which can be adopted for different options is presented below in as Options for Rehabilitation of Borrow areas to the Guidance Notes Operation of the Borrow Areas during the Construction Period.

The Contractor will work out statutory requirement for borrowing with the land from the Department of Mining and Geology, Govt. of Meghalaya. The Contractor must also obtain the necessary environmental clearance as per the EIA Notification 2006.

The Contractor shall also work out an agreement for the borrowing of soil with the concerned land owner. The arrangements will include:

– Commitment not to use the topsoil;

– Redevelopment after completion of borrowing;

– Commercial terms and conditions as may be agreed between the two parties;

The contractor shall submit to the Employer/Engineer the following before beginning work on the borrow areas.

– Environmental Clearance Certificate of the borrow area

– Written No-objection certificate of the owner;

– Estimate extent of earth requires;

– Extent of land required and duration of the agreement;

– Photograph of the site in original condition; and

– Site redevelopment plan after completion.

The arrangements (except for the commercial terms and conditions) will be verified by the Employer/Engineer to enable redressal of grievances at a later stage of the project. The Employer/Engineer shall approve the borrow area with or without inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The

contractor shall commence borrowing soil only after the approval by the Employer/Engineer.

The depth of excavation should be decided based on natural ground level of the land and its surroundings, as well as based on the rehabilitation plan. In case of highland larger depths may be allowed but the final level of the borrowed land shall in no case be lower than the adjoining plots so that it gets water logged. In case higher depth of excavation is agreed by backfilling using unsuitable excavated soil (from roadway), in those cases filling should be adequately compacted except for topsoil, which must be spread on the top most layer (for at least 20m thick).

In case the borrow pit is on agricultural land, the depth of borrow pits shall not exceed 45 cm and may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside. In case of stripping and stockpiling of topsoil, provisions of Topsoil Salvage, Storage and Replacement need to be followed.

The guidelines for location, depth, size and shape of the borrow areas are available in the following:

– Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;

– Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989: IRC: 104-1988);

– IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;

– Highways Sector EIA manual of MoEFCC, 2010 (http://envfor.nic.in/sites/default/files/highways-10_may_0.pdf);

During the excavation the contractor must ensure that following database must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

– Chainage along with offset distance;

– Area of the plot (Sq.);

– Geo-tagged Photograph of the borrow pit from all sides;

– Type of access/width/kutcha/pucca etc from the carriageway;

– Soil type;

– Slope/drainage characteristics;

– Water table of the area or identify from the nearest well, etc;

– Existing landuse, for example barren/agricultural/grazing land;

– Location/name/population of the nearest settlement from borrow area;

– Present usage of borrow area; and

– Community facility near borrow pit.

Appendix-3: GUIDELINES FOR STORAGE, HANDLING AND DISPOSAL OF HAZARDOUS WASTE, MUNICIPAL SOLID WASTE AND CONSTRUCTION AND DEMOLITION WASTE

Hazardous Waste

• For storing of hazardous waste (Used oil and waste oil, Empty barrels/containers of oil, lubricant and grease, Contaminated cotton rags or other cleaning materials), the Contractor shall follow the guidelines while planning and designing the hazardous waste storage areas:

– The storage area should be provided with concrete floor;

– The storage area floor should be provided with secondary containment;

– Proper slopes as well as collection pit to be provided in the storage area to collect wash water and the leakages/spills etc.;

– Storage area should be provided with the flameproof electrical fittings;

– Automatic smoke, heat detection system should be provided in the sheds;

– Adequate fire fighting systems (ABC type fire extinguisher) should be provided for the storage area; and

– The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.

Municipal Solid Waste

• The Contractor shall segregate and store bio-degradable and non-biodegradable municipal solid waste in two separate bins (primary collection point). The storage area should be provided with concrete floor;

• The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.

• The storage area shall be enclosed, or the storage containers shall be covered to prevent vermis and scavengers from littering.

Construction and Demolition Waste

• The Contractor shall keep the construction and demolition waste within the premise or at a designated place for the collection of the C&D waste. The designated place shall be decided in consultation with the local body. The agreement with the local body shall essentially mention the end-use of the designated location. The designated site shall be away from:

– Located at least 1000 m away from sensitive locations;

– do not contaminate any water sources, rivers etc; and

– Lotal site has adequate capacity equal to the amount of debris generated;

– Public perception about the location of debris disposal site has to be obtained before

– finalizing the location;

– Productive lands are avoided; and available waste lands shall be given preference;

– Forest land shall be avoided.

• During the site clearance and disposal of debris, the contractor will take full care to ensure that the public or private properties are not damaged/affected and that the traffic is not interrupted.

• In the event of any spoil or debris from the sites being deposited on any adjacent land, the contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Authority Engineer.

• The contractor will at all times ensure that the existing water bodies and drains within and adjacent to the site are kept safe and free from any debris.

• In case the dumping operations are carried out in dry and windy condition Contractor will regulate the dumping operations so that the dust generation is minimised, or preferably carry out the operations in early morning when the environment is moist. The contractor may utilize effective water sprays during the delivery and handling of materials.

• Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.

• Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Authority Engineer.

• During the debris disposal, contractor will take care of surrounding features and avoid any damage to it.

• While disposing debris / waste material, the contractor will take into account the wind direction and location of settlements to ensure against any dust problems. The contractor can also consider the use of dust screens to prevent dust pollution.

EMERGENCY SPILL CONTROL PROCEDURE

Should a spill occur, either though spillage or equipment failure, the applicable emergency spill procedure outlined below must followed.

Spill Procedure: In the case of a spill, overflow or release fluid into the stream waterway (whether water is flowing during the spill or not), any actions that is practical and safely possible to control the situation, shall be implemented.

• Stop the flow
  – Stop the release into the stream waterway
  – Shutdown equipment
  – Close valves and pumps
  – Plug hoses
• Remove Ignition Sources
  – Shut off vehicles and other engines
• Do not allow torches, mobile phone, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible).
• Contact the environmental Officer and initiate Emergency Response
• Notify the site supervisor and the Contractor's Environmental Engineer and Health and Safety Officer as soon as possible
• The Environmental Engineer of the Contractor will review the situation and decide if Emergency Services like Fire Brigade are required
• Appropriate parties to be notified of the spill are The contractor's Project Manager, The
• Authority Engineer through his designated Environmental Officer, The PIU, Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.

Clean up and Disposal

• Identify nature and type of chemical/fuel spilled through information available onsite or from first responder.

• Refer to the MSDS for any special instruction

• Wear personal protective equipment (PPEs) viz. chemical resistant gloves, safety boots ,safety glasses etc. Reach for the spill kit placed at the Contractor Camp.

• In case of spill on land create a dyke on the spill and use readily available sand, saw dust to contain the spill. Use absorbent pads, to clean up the spill. In case of spill in a water channel which is dry use the above method.

• In case the spill occurs within a water body stop any agitation to the water body and place absorbent material to remove the spill.

• Recover the spill contaminated absorbent materials and use pads and store the same in "Hazardous Waste" containers and store it in the waste storage area for disposal.

• For spill on unpaved areas such as soil, remove the upper layer of soil in the contaminated area with a shovel and transfer it to the hazardous waste containers using a bucket.

• If any of your PPEs have been exposed to spill material dispose it off safely in hazardous waste containers

Reporting

• The Contractor's Environmental Officer will document the event and submit reports to the Authority Engineer. The Authority Engineer would send a report of the incident immediately with its observations to the PIU, PMC and Environmental Officer at the PMU.

• If required the Client would direct the Contractor to imitate the process of reporting to the regulatory agencies. like the Pollution Control Board.

Procedure Review

• The Environmental Office will review the report, determine if changes are required to procedures and recommend implementation of all required changes. He would also intimate the management of such incident.

GUIDANCE NOTE ON SITE CLEARANCE

Vegetation Clearance

• Vegetation clearance shall comprise uprooting of vegetation, grass, brushwood, shrubs, stumps, trees and saplings of girth up to 30 cm. measured at a height of one meter above the ground level. Where only clearance of grass is involved it shall be measured and paid for separately. The procedure/ steps involved for uprooting, skating and felling trees are described below.

Uprooting of Vegetation

• The roots of trees and saplings shall be removed to a depth of 60 cm. below ground level or 30 cm. below formation level or 15 cm below sub grade level, whichever is lower.

• All holes or hollows formed due to removal of roots shall be filled up with earth rammed and levelled.

• Trees, shrubs, poles, fences, signs, monuments, pipe lines, cables etc. within or adjacent to the area, which are not required to be disturbed during vegetation clearance shall be properly protected by the contractor at his own cost.

Staking and Disposal

• All useful materials obtained from clearing and grubbing operation shall be staked in the manner as directed by the Consultant.

• Trunks and branches of trees shall be cleared of limbs and tops stacked properly at the places indicated by the Consultant. These materials shall be the property of the Government.

• All unserviceable materials are disposed off in such a manner that there is no livelihood of getting mixed up with the materials meant for construction.

Felling Trees

• Marking of tress: Trees, above 30 cm girth (measured at a height of one meter above ground level) to be cut, shall be approved by the Consultant and then marked at the site.

• Felling of trees: Felling of trees shall include taking out roots up to 60 cm. below ground level or 30 cm. below formation level or 15 cm. below sub-grade level, whichever is lower.

• Filling: All excavations below general ground level arising out of removal of trees, stumps etc. shall be filled with suitable material in 20 cm. layers and compacted thoroughly so that the surface at these points conform to the surrounding area.

• Sizing: The trunks and branches of trees shall be cleared of limbs and tops and cut into suitable pieces as directed by the Consultant.

• Staking: The serviceable materials shall be staked in the manner as directed by the Environmental specialist of Supervision Consultant.

Disposal: The material, which cannot be used or auctioned shall be removed from the area and disposed off as per the directions of the Consultant. Unsuitable waste materials should not get mixed with construction material during disposal.

Appendix-4: Construction Camp Management

1. Campsite of a contractor represents the single potentially most polluting location during implementation of any road project. Air pollution may be caused by emissions from Crushers, Hot-Mix, and Concrete Batching Plants. Water pollution may be caused by discharge of sediment, oil & grease, and organics laden run-off from these plants and their ancillary facilities as well as workshops, residential quarters for the labor. Land may be polluted due to indiscriminate disposal of domestic waste or (accidental) release of hazardous solids from storage areas.

2. While the installation and operation of Crushers and Hot-Mix Plants are regulated by the respective Pollution Control Boards, the other sources described above usually do not appear to be causes of significant concern. Items to be considered for labor camps are mentioned briefly in Clause 105.2 (as part of 105: Scope of Work) of the Ministry of Road Transport and Highways (MoRTH) publication: Specifications for Road and Bridge Works. Some specific requirements for labor accommodation and facilities are to be met by the Contractor in line with Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. Currently, there is no one-point guidance regarding the environmental management aspects of the Contractor's campsite. This guideline on Campsites is designed to fill this gap.

A. Scope

3. This guideline covers the Contractors' camp sites – whether used by in-house crew or by any sub-contractors' crew. It covers siting, operation, maintenance, repair and dismantling procedures for facilities for labor employed on project (and ancillary) activities as well as equipment and vehicles.

1. Siting, Establishing, Operation and Closure of Construction Camp

a. Potential Environmental Impacts

4. Construction camps require large areas for siting facilities like major plants, storage areas for material, residential accommodation for construction labor and supervisors, and offices. Removal of topsoil and vegetation from the land to be utilized for camps is the first direct impact of any such establishment. In addition, local drainage may be impaired

if proper drainage is not effected by grading. Other impacts may include damage to ecologically important flora and fauna, if campsites are located close to such areas. Water pollution because of discharge of sediment, fuel and chemicals is also a possibility. Pollution of land due to indiscriminate disposal of construction wastes including scarified pavement, concrete and even substantial quantities of domestic wastes from residential areas can also be potentially disastrous, especially if the site is reverted to its original use after the project (mostly agriculture).

b. Mitigation Measures

2. Siting of Construction Camps

5. The following guidelines will assist the Contractor to avoid any environmental issues while siting construction camps:

- Maintain a distance of at least 1 km from boundaries of designated Reserved Forests, Sanctuary or National Park area for locating any temporary or permanent camps.
- Maintain a distance of 500m from river, stream, lake and ponds
- Maintain a distance of 200 m from the boundary of state and national highways.
- Locate facilities in areas not affected by flooding and clear of any natural or storm water courses.
- Locate campsites in the (most prevalent) downwind direction of nearestvillage(s). The boundary of the campsite should be at least 500 m from the nearest habitation so that the incoming labor does not stress the existing local civic facilities.
- The ground should have gentle slope to allow free drainage of the site.
- Recorded consultations should be held with residents of the nearest settlement and/or their representatives to understand and incorporate where possible, what they would like to see within their locality.

3. Establishment, Operation, and Closure of Camps

- The facilities within the camp site should be laid out so that the separation distances suggested in other guidelines are maintained. A notional lay-out of the facilities except the major plants is included in this guideline.

- Topsoil from the area of the plant shall be stored separately for the duration of the operation of the camp and protected from being washed away, unless agreed otherwise in writing with the owner. If stored, it will be returned on to its original location at the time of closure of the site.
- The Contractor shall prepare, make widely available (specially to staff responsible for water and material management), and implement a Storm water Management Plan (SWMP) for (all) the site(s) following approval of the same by the Engineer.
- The Contractor shall prepare an Emergency and Spill Response Plan as per the requirements of Appendix 1 to Clause 501 of Specifications for Road and Bridge Works to cover the spillage of bitumen and/or chemicals like retarders, curing compounds, etc.
- The Contractor shall prepare a Waste Management Plan describing the types and quantities that are likely to be generated from within the camp site, with the period and duration during the construction schedule; methods to be adopted to minimize these; methods of removal, treatment and (on-site or off-site) disposal for each type; as well as location of final disposal site, if any.
- The Contractor shall provide safe ingress and egress for vehicles from the site and public roads and shall not impact existing through traffic.
- Water tankers with sprayers must be available at the camp site at all times to prevent dust generation.
- In case of stockpiles of stored material rising higher than wind-breaking perimeter fencing provided, sprinklers shall be available on site to prevent dusting from the piles during windy days.
- On completion of works, the Contractor shall restore the site to the condition it was in before the establishment of the campsite, unless agreed otherwise in writing with the owner(s) of the site(s). If such a written agreement has been made, the Contractor shall hand over the site to the owner(s) in accordance with such an agreement.
- Construction waste disposal should be disposed only at landfill facilities which are selected, designed, constructed and operated to ensure environmentally safe disposal, and these facilities have to be approved by the regulators.

4. Equipment and Vehicle-related issues

a. Potential Environmental Impacts

6. The maintenance and repair of equipment and vehicles in Contractor's camp are activities that can have significant adverse impacts if not carried out properly. The concern mainly arises from discharge of wash water contaminated with oil and grease, whether from washing of vehicles or degreasing of equipment and vehicle parts. Vehicle washing, especially dirt from tires, also gives rise to sediment-laden run-off. No such discharges should be directly allowed into surface water bodies since they can be harmful to aquatic species.

b. Mitigation Measures

i. Vehicles

- All vehicles used by the Contractor must have copies of currently valid Pollution Under Control Certificates displayed as per the requirement of the Motor Vehicles Department for the duration of the Contract.
- All vehicles and equipment will be fitted with silencers and/or mufflers which will be serviced regularly to maintain them in good working condition and conforming to the standard of 75dB (A) at 1m from surface of enclosure.

ii. Workshop and Maintenance areas

- These areas must have impervious flooring to prevent seepage of any leaked oil & grease into the ground. The area should be covered with a roof to prevent the entry of rainwater.
- The flooring shall be sloped to from both directions to one corner where an oil-and-grease trap with sufficient capacity should be installed. All discharges from the workshop area must pass through the trap to remove the floating oil and grease before entering the drainage system of the site. The trap should be designed to provide a hydraulic residence time of about 20 minutes for the peak hourly discharge anticipated from the area (as per following figure).
- Alternatively, degreasing can also be carried out using mechanical spray type degreaser, with complete recycle using an enclosure with nozzles and two sieves, coarse above and fine below, may be used as shown in the

adjacent photograph. This arrangement will require some initial investment and running cost for the pump, but the payback period, in terms of the use of diesel, under Indian conditions, has been reported to be less than 1 year.

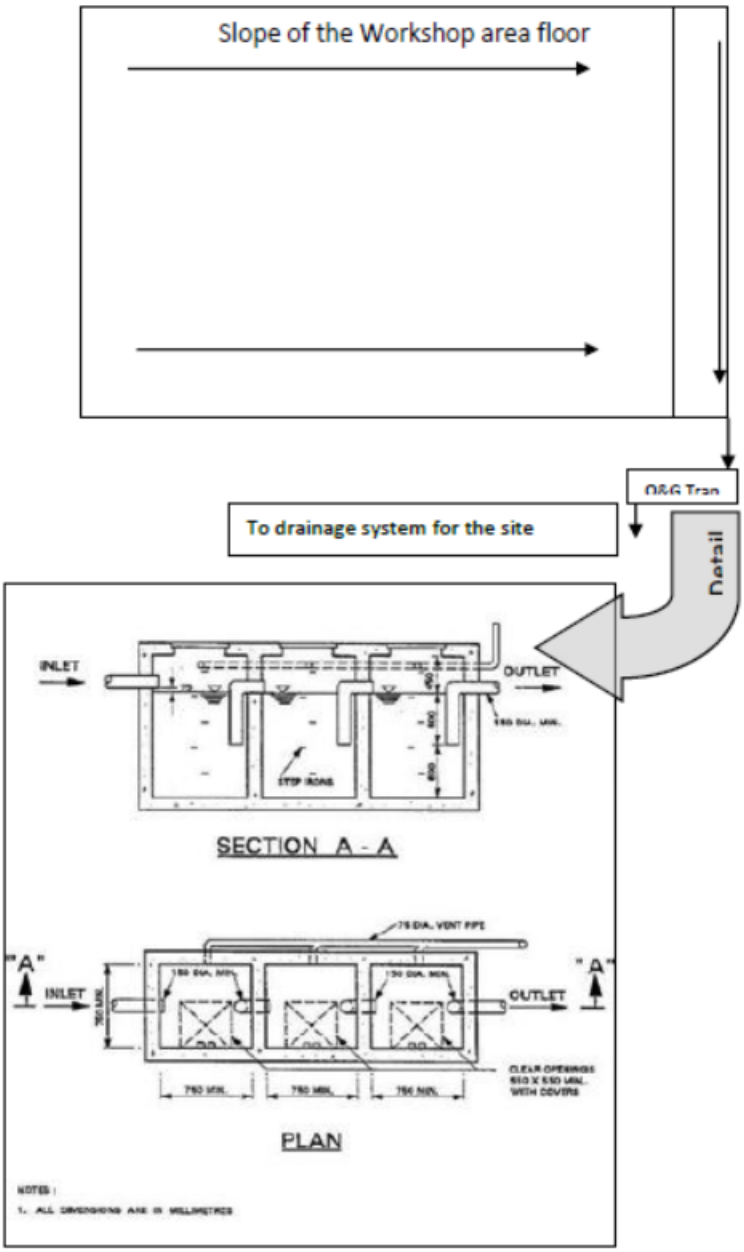


Figure 1: Workshop Area Pollution Control

- All the waste oil collected, from skimming of the oil trap as well as from the drip pans, or the mechanical degreaser shall be stored in accordance with Slope of the Workshop area floor O&G Trap Details To drainage system for the site the Environment Protection (Storage and Disposal of Hazardous Wastes) Rules, 1989. For this purpose, metallic drums should be used. These should be stored separately in sheds, preferably bunded. The advantage of this arrangement is that it allows for accurate accounting in case the waste material is sold to oil waste recyclers or other users like brick-kiln owners who can burn such inferior fuel.
- A separate vehicle washing ramp shall be constructed adjacent to the workshop for washing vehicles, including truck mounted concrete mixers, if any, after each day's construction is over, or as required. This ramp should have an impervious bottom and it should be sloped so that it drains into a separate chamber to remove the sediment from the wash water before discharge. The chamber should allow for a hydraulic residence time of about 10 minutes for discharge associated with the washing ofeach truck. Following figure 2 shows an outline sketch for a sedimentation chamber.

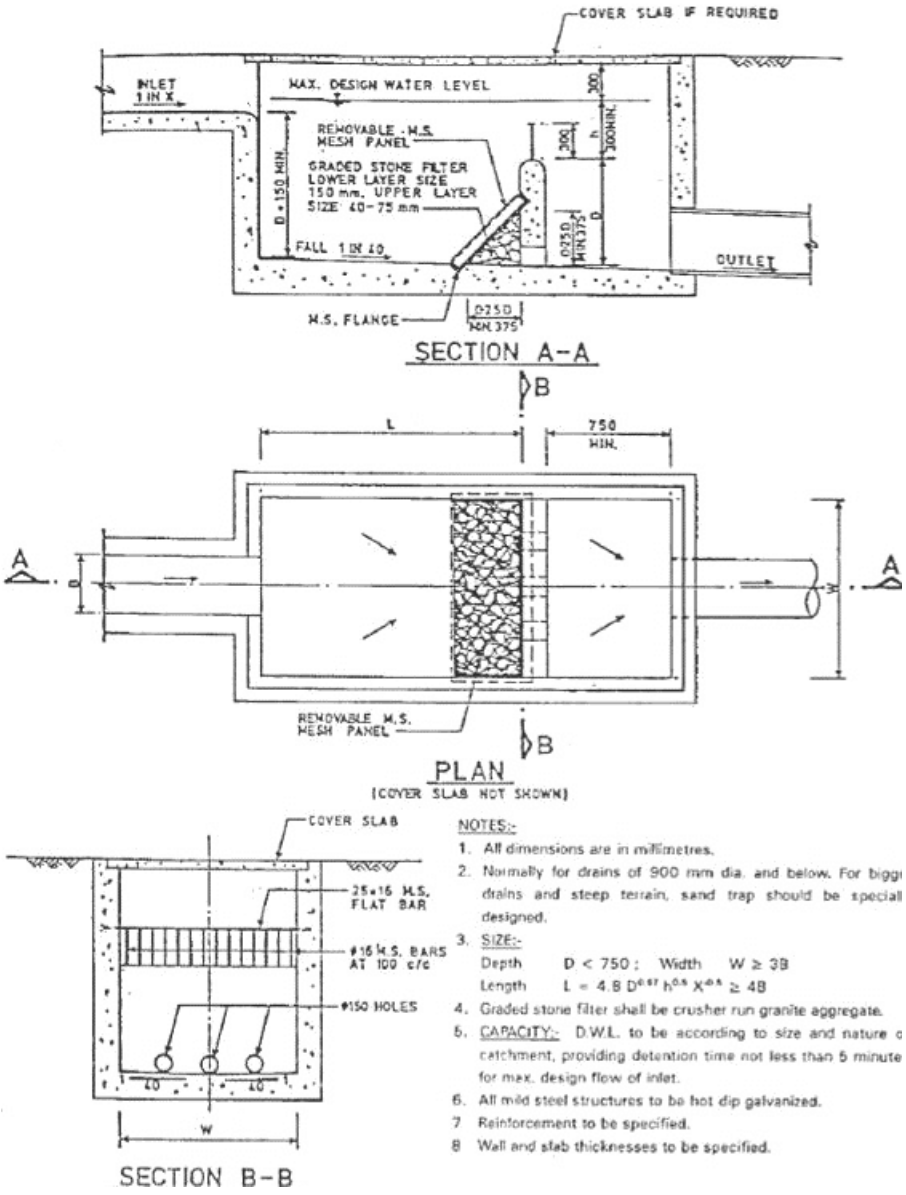


Figure 2: Sedimentation Chamber for vehicle washing ramp discharge

5. Facilities for Labour

a. Potential Environmental Impacts

7. The sudden arrival and relatively longer duration of stay of construction crew can cause substantial strain on the existing infrastructure facilities like water supply, sanitation and medical care, especially in rural areas. Pollution from domestic wastes can affect local sources of water supply and may harm the crew themselves as well as local residents. Improper sanitation and inadequate health care also potential bottlenecks that the Contractor can eliminate with relatively little effort.

b. Mitigation Measures

8. It should be emphasized that the Indian Law requires that the Contractor provide several facilities to for the workers as per Building and Other Construction Workers (Regulation of

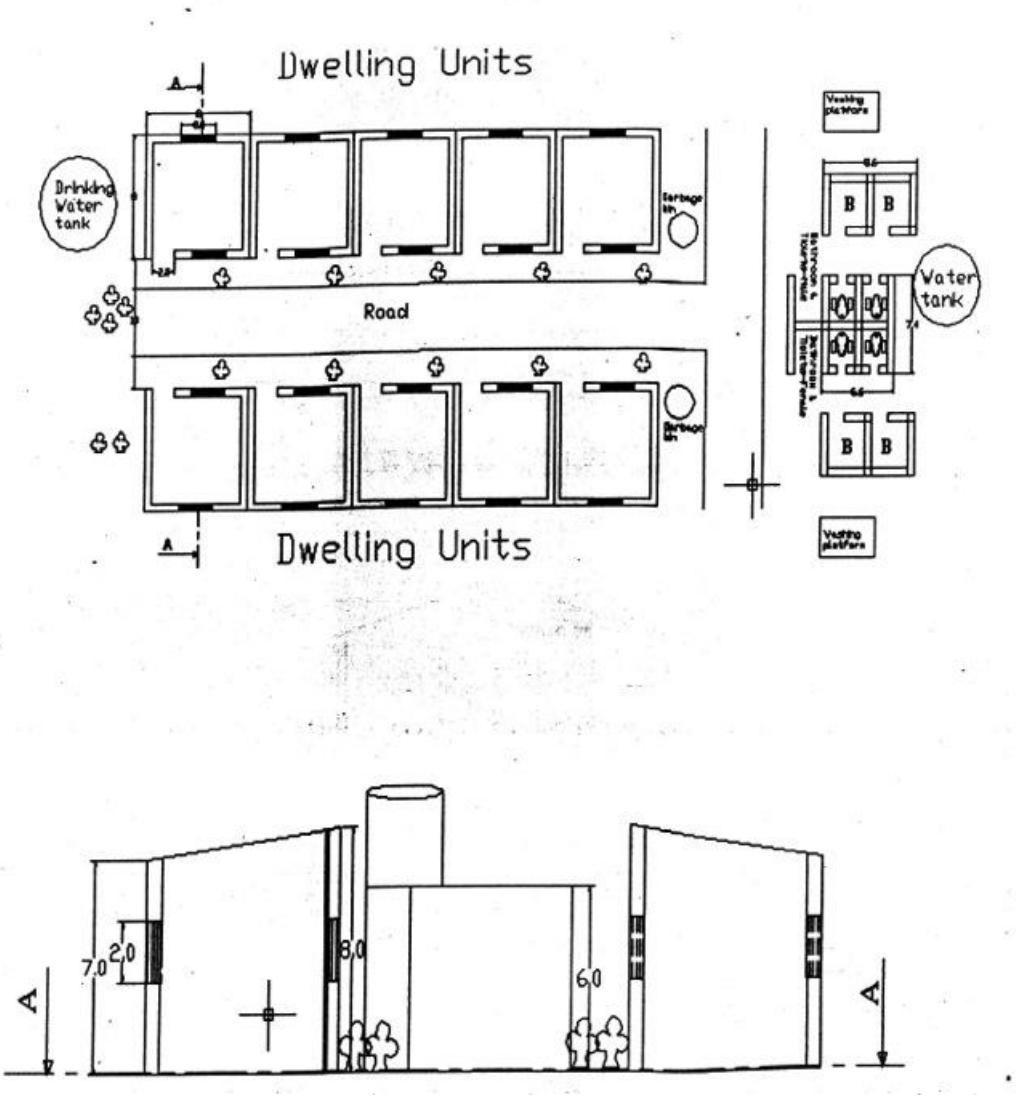
Employment and Conditions of Service) Act, 1996. Some of the provisions described herein are more stringent to act as benchmark for improved environmental performance of road projects:

- The contractor shall provide free-of-charge temporary accommodation to all the labour employed for the project. The accommodation includes separate cooking place, bathing, washing and lavatory facilities. At least, one toilet will be provided for every 35 people and one urinal will be provided for every 20 persons. More toilets and/or urinals may have to be provided if the Engineer decides that these numbers are insufficient. In case female labourers are employed, separate toilet and urinals will be provided in locations clearly marked “Ladies Toilets” in a language understood by most labourers.
- The contractor shall ensure the supply of wholesome water for all the labour, including those employed by any other agency working for the contractor. These locations will be marked “Drinking Water” in the language most commonly understood among the labour. In hot season, the contractor shall make efforts to ensure supply of cool water. No water point shall be located within 15 m of any washing place, urinal, or latrine.
- The contractor shall ensure that adequate cooking fuel, preferably kerosene or LPG, is available on-site. The contractor will ensure that wood/ coal are not used as fuel on the

site. Workers need to be made aware of this restriction. In cases where more than 250 labours are employed, canteen facility should be provided by the Contractor.

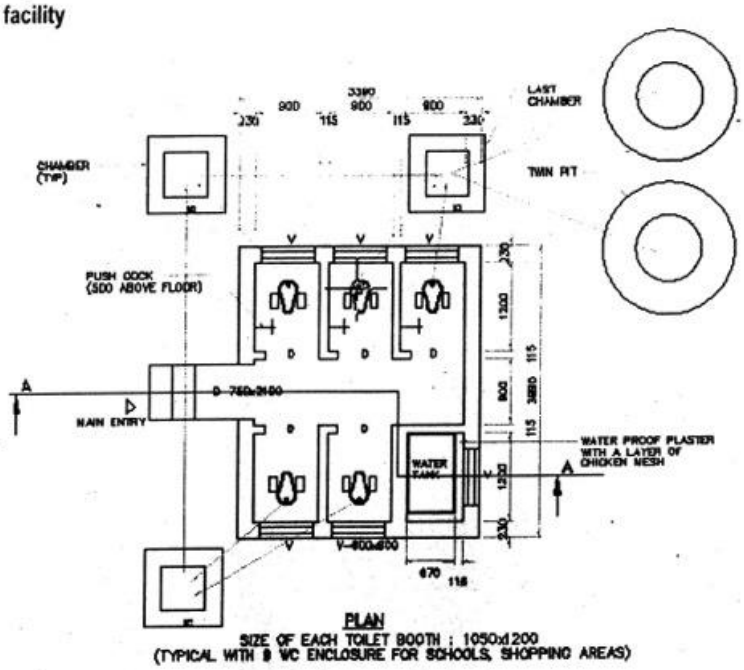
- A crèche must be provided in each campsite where more than 50 female labourers are employed, whether directly or indirectly, for the project or its ancillary activities.
- Contractor must provide adequate facilities for first-aid treatment at the campsite. A doctor ambulance should be available on call for the duration of project implementation.
- The contractor shall obtain the approval of the Engineer for these facilities within 30 days of mobilization.

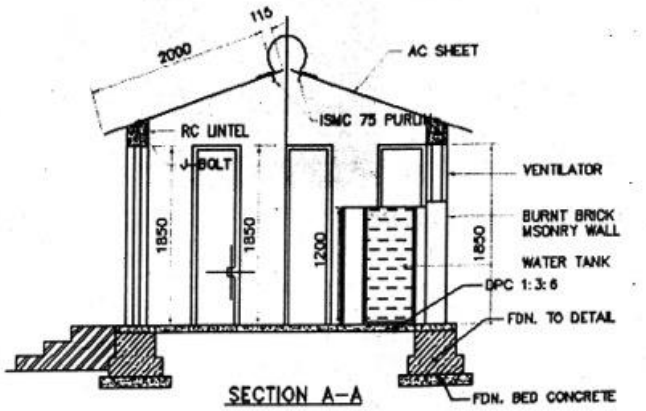
TYPICAL DRAWING OF WORKERS' CAMP SANITARY FACILITY



TYPICAL DRAWING OF WORKERS' CAMP SANITARY FACILITY

Sanitary facility

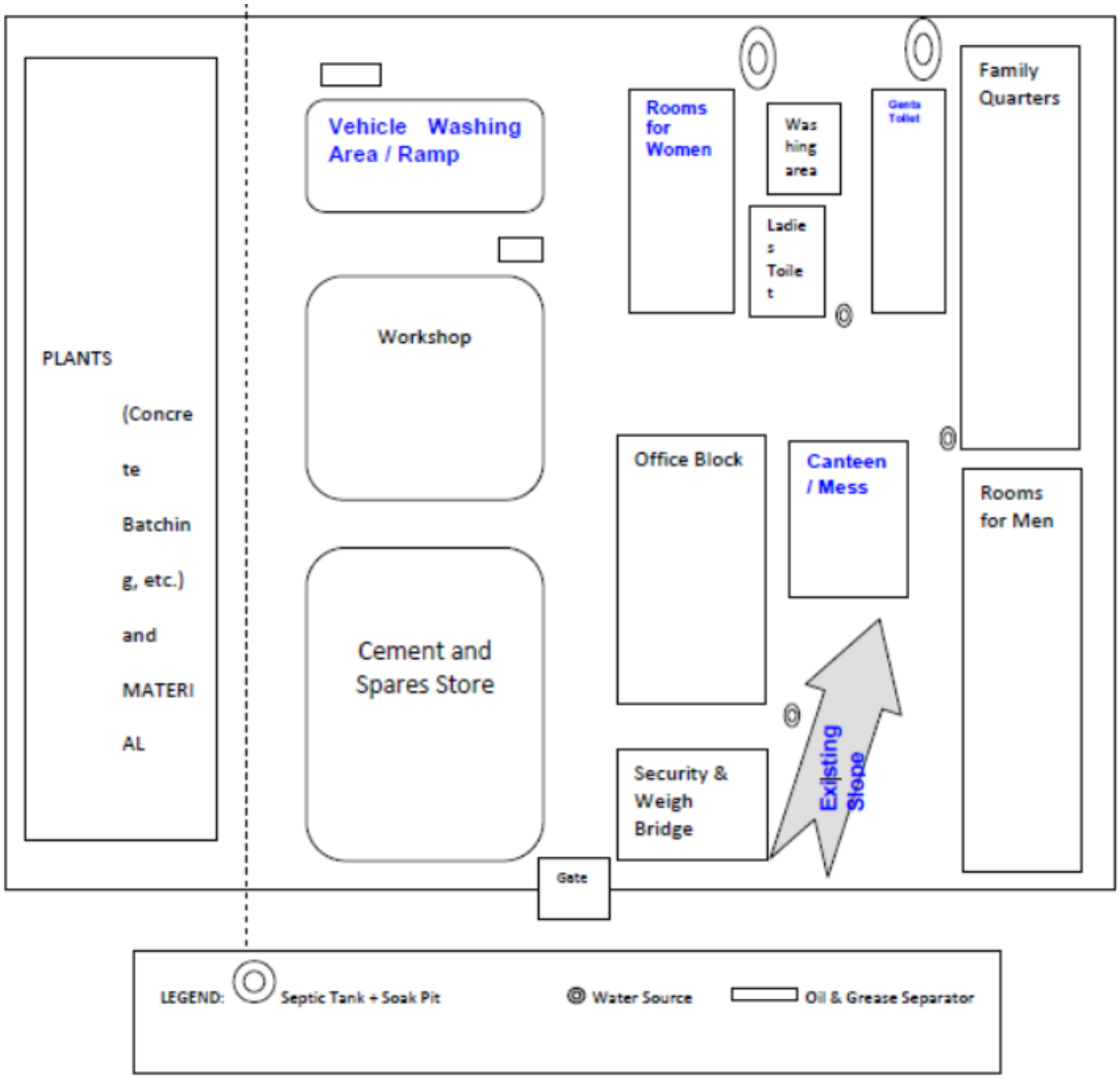




NOTES:

1. INSPECTION CHAMBER (IC) 600x600x600 DEEP WITH AIRTIGHT MH COVER
2. SEPTIC TANK & SOAK PIT AS PER SITE CONDITIONS

Layout of a Construction camp



Appendix-5: Attendance Sheet of public consultations

ATTENDANCE

MEGHALAYA INTEGRATED TRANSPORT PROJECT (MITP) STAKEHOLDERS CONSULTATION PROGRAMME

Venue - B.A.D.O. Conference Hall, Dalu

Date-23-10-19

Sl No.	Name	Designation/Address	Phone Number	Signature
1	C.N. Sangma	S.E., PWD (R) Tura Circle	9436112302	
2	O. K. Marak	EE, PWD(R) Baringapara	9436144158	
3	T. M. G. Momin, MCS	BDO, Dalu C&RD Dalu	7005650873	
4	C.K. Sangma	AEE, PWD(R) Border Roads Sub-Division	94361-61155	23-10-19
5	H. G. Momin	AE, PWD(R) Nodal officer, ESMF		
6	Dr. P. Gautam	Env. & Wild Life Management Specialist World Bank	9818928248	P. Gautam
7	Kanthiram Borai	Xilla Para		K. Borai
8	Pohonath Marak	Baburam bil		P. Mk
9	Ramkash Marak	Baburam bil		R. Marak
10	Pengston Marak	Baburambil	8787358898	
11	Borun Sangma	Baburambil		BSg.
12	Rakesh Sangma	Asiragre	8787609039	
13	Sujit Rishi	Chaipani		S Rishi
14	Credit T Sangma	Babugri	7005811131	
15	Nilu Debnath	Secy. VEC Paulpara	8787597722	
16	Kishore Herong	Paul Para	8132837380	
17	Fulbrill Mohonta	Paul Para	8974933422	
18	Sibilla D Marak	Paulpara	7005948188	S. Mk
19	Sibani D. Marak	Paulpara	9366449298	SMK
20	Ranika Sangma	Paulpara	9612501616	K Sg.
21	Latu Rishi	Paulpara		L. Rishi
22	Rinna Rishi	Paul para		R. Rishi
23	Binna Biswas	Paulpara		B. Biswas
24	Ketish Marak			
25	Josan Sangma			

ATTENDANCE

MEGHALAYA INTEGRATED TRANSPORT PROJECT (MITP) STAKEHOLDERS CONSULTATION PROGRAMME

Venue -

Date-23+-10-19

Sl No.	Name	Designation/Address	Phone Number	Signature
26	Subhash [illegible]	Camboog Killapara	7378171475	[illegible]
27	Emush Marak	Vill Bengapara	9862042150	[illegible]
28	Rajani Hajong			
29	Pillip Sangma			
30	Nopal Sukhan			
31	Mithun Saha	Barengapara	7005691172	[illegible]
32	Napami N Sangma	Barengapara		
33	Monjulla Banai	Barengapara		
34	Dudmini Risi	Barengapara	7005567932	[illegible]
35	prakash marak			
36	Nakill sangma			
37	Nasser R. Marak	Barangapara	9366279990	[illegible]
38	Arjan N. Sangma	JE PWD(R) Barengapara	8114349583	[illegible]
39	[illegible]			
40	Brenes A. Sangma	JE PWD(R) Barengapara Div.	7005643216	[illegible]
41	R.C. Chowdhury	JE. PWD(R) Barengapara Div	7005895366	[illegible]
42	Britiroy Kharu	Consultant (STA)	[illegible]	B. Kharu
43	Jyotish Daimary	Consultant (STP)	8876361720	Jyotish Daimary
44	Dipika Hajong		8787561565	[illegible]
45	Gilbn Koy			G. [illegible] Koy
46	Pushitha Banai			
47	Ryomring ch. Sangma	M/ Rugapara		[illegible]
48	Salwiang D Marak	Rugapara(GS)	9366560584	[illegible]
49	Meumeun M. Sangma	Megua Sangma(AHAM)		[illegible]
50	Matgrek Marak	AHAM Dalu	7005205934	[illegible]

ATTENDANCE

MEGHALAYA INTEGRATED TRANSPORT PROJECT (MITP) STAKEHOLDERS CONSULTATION PROGRAMME

Venue -

Date-23+-10-19

Sl No.	Name	Designation/Address	Phone Number	Signature
51	Mimtu Rizbi	Paul Para	9366011951	M. R
52	Shyamal Biswas	Paul Para	9306398252	[signature]
53	Rayo Hajong			R. Hajong
54	Maxfield Arengh	S.A. PWD Baughpur	7005713416	[signature] 23/10
55	Ratan Kr. Paul	Babupara	8837478779	[signature]
56	Suresh Barel	Rol Prona		
57	[illegible]	Paul para. Uaipani		
58	S. R. Mondal	Paulpara.		S. D M
59	Ripok Marak	AE, PMGSY	9089834312	[signature]
60	Deep Mazumder	Durgabari	7005704300	[signature]
61	Hari. Barman	N. Para	88372471359	
62	Bebeati ch Marak	Rozugri	9383019629	[signature]
63	Alokesh Koch	Durgabari	8787656638	[signature]
64	Nayni R. Sangma	Tura.	9436524063	[signature]
65	Zister R. Marak	Lower Darengri	9089741625	[signature]
66	Bandi G. Momin	SA, Tura	7005631741	[signature]
67	Perline N. Sangma.	Dalu.	7005188316	[signature]
68	R. Lyngdoh.	Ampati	8837083632	R. Lyngdoh
69	P. Manphriang	Ampati	9862151699	P. Manphriang
70	Ajay Pratap Singh	Director APS Corporations NT LTD	9654720595	[signature]
71	Prafulla H. Lee	SIA	—	[signature]
72	DR. B. P. Sai	CIA	9435767064	[signature]
73				
74				
75				

Appendix-6: Environment Management Plan

Sl.No.	Environmental Issue/Component	Management Measures	Institutional Responsibility	
			Planning	Supervision
Pre- construction activities by Project Implementation Unit				
1	Land Acquisition	· The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement framework for the project. PIU has to ascertain that any additional environmental impacts resulting from acquisition of land shall be addressed and integrated into the EMP and other relevant documents. · No land acquisition is involved in this road section.	PIU, Revenue Dept., NGOs, Collaborating Agencies	PIU
2	Preservation of Trees	· All efforts will be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. Specific attention will be given for protecting giant trees and locally important trees (religiously important etc.). · Tree cutting (approx. 54 nos.) is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept./DoEF/MoEF are completed and subsequently a written order is issued to the Contractor. · Particular species declared as 'protected' by the State's Forest Dept. in the private land will be felled only after due clearance from the Forest Dept. is obtained. In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms. Systematic corridor level documentation for the trees cut and those saved will be maintained by the	PIU, Forest Dept., Contractor	Authority Engineer and PIU

		PIU.		
3	Relocation of Community Utilities and Common Property Resources	· All community utilities and properties i.e., water supply lines, sewer lines, bank buildings, health centers, schools, health clinics and veterinary hospitals will be relocated before construction starts, on any section of the project corridor. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. The schools and health centres will be constructed as per the relevant state norms. · All other community property resources within the corridor of impact such as hand pumps, ponds, grazing lands etc. will be relocated. The relocation sites for these schools will be identified in accordance with the choice of the community. · Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community utilities and resources.	PIU, Concerned Agencies, Contractor	PIU
4	Relocation of affected Cultural and Religious Properties	· All religious property resources such as shrines, temples and mosques within the project zone will be relocated. Sites for the relocation of these religious structures will be identified in accordance with the choice of the community. · The NGO and PIU in consultation with local people will finalize design of these temples. As far as possible, the architectural elements of the structure should be conserved/reflected/translated into the design of new structures. · The entire process (i.e. selection of relocation sites and designs) will be under supervision of Environmental	PIU, NGOs, Contractor	PIU

		Expert of the Authority Engineer. The relocation will be completed before the construction starts in these sites.		
Pre-construction activities by the Contractor/Environmental Expert of Authority Engineer				
5. Field Verification and Suggested Changes in Design				
5.1	Joint Field Verification	· The Environmental Expert of the Authority Engineer and the Contractor will carry out joint field verification to ascertain the possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Contractor/ Environmental Expert of the Authority Engineer	PIU
5.2	Assessment of Impacts due to Changes/Additions in the Project	· The Environmental Expert of the Authority Engineer will assess impacts and revise/modify the EMP and other required sections of the project document/s in the event of changes/revisions (including addition or deletion) in the project's scope of work.	Contractor/ Environmental Expert of the Authority Engineer	PIU
5.3	Crushers, hot-mix plants and Batching Plants Location	· Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1000 m away from the nearest village/settlement preferably in the downwind direction. · The Contractor shall submit a detailed lay-out plan for all such shall be necessary prior to their establishment. · Arrangements to control dust pollution through provision of wind screens, sprinklers, dust encapsulation will have to	Contractor/ Environmental Expert of the Authority Engineer	PIU

		be provided at all such sites. · Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the SC and PIU. · The Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted		
5.4	Other Construction Vehicles, Equipment and Machinery	· All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Bureau of India Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. · Noise limits for construction equipment to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. · The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period.	Contractor/ Environmental Expert of the Authority Engineer	PIU
6	**Identification and Selection of Material Sources**			
6.1	Borrow Areas	· Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. The Contractor will not start borrowing earth from select borrow area until the formal agreement is signed between land owner and contractor and a copy is submitted to the SC and the PIU.	Contractor/ Environmental Expert of the Authority Engineer	PIU

		· Locations finalized by the contractor shall be reported to the Environmental Expert of the Authority Engineer and who will in turn report to PIU. Format for reporting will be as per the Reporting Format for Borrow Area and will include a reference map. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Contractor will rehabilitate it as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available. · In addition to testing for the quality of borrow materials by the SC, the environmental personnel of the SC will be required to inspect every borrow area location prior to approval (follow criteria for evaluation of borrow areas).		
6.2	Quarry	· Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements In case the contractor decides to use quarries other than recommended by DPR consultant, then will be selected based on the suitability of the materials. · The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the PIU and Environmental Expert of the SC. · Contractor will also work out haul road network and report to Environmental Expert of the Authority Engineer and SC	Contractor	Environmental Expert of the Authority Engineer and PIU

		will inspect and in turn report to PIU before approval.		
6.3	Arrangement for Construction Water	· To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of the Authority Engineer before finalizing the locations. · The Contractor will provide a list of locations and type of sources from where water for construction will be used. · The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. · The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to SC and PIU.	Contractor	Environmental Expert of the Authority Engineer and PIU
6.4	Labour Requirements	· The contractor preferably will use unskilled labor drawn from local communities to give the maximum benefit to the local community.	Contractor	Environmental Expert of the Authority Engineer and PIU
6.5	Construction Camp Locations – Selection, Design and Lay-out	· Siting of the construction camps will be as per the guidelines below. Locations identified by the contractor will report as per format given. · Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. · Location for stockyards for construction materials will be identified at least 1000 m from water courses. · The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is	Contractor	Environmental Expert of the Authority Engineer and PIU

		generated. Unless otherwise arranged by the local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of the Authority Engineer will have to be provided by the contractor.		
6.6	Arrangements for Temporary Land Requirement	· The contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc. · The Environmental Expert of the Authority Engineer will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.	Contractor	Environmental Expert of the Authority Engineer and PIU
6.7	Orientation of Implementing Agency and Contractors	· The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a subproject). These sessions shall involve all staff of Environmental Cells, field level implementation staff of PIU, Environmental Experts of SCs and Contractors.	PMU/PIU	PIU
Construction Stage (Activities to be carried out by the Contractor)				
7 Site Clearance				
7.1	Clearing and Grubbing	· Vegetation will be removed from the construction zone before commencement of civil works. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is avoided or minimal. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works	Contractor	Contractor

		will be removed with prior approval from the Environmental Expert of the Authority Engineer. · The contractor, under any circumstances will not cut or damage trees. Trees identified under the project will be cut only after receiving clearance from the Forest Dept./MoEF/concerned authority (as applicable) and after the receipt of PIU's written permission in this regard. Vegetation with girth of over 30 cm only will be considered as trees and shall be compensated, in the event of PIU's instruction to undertake tree cutting.		
7.2	Stripping, stocking and preservation of top soil	· The top soil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre identified in consultation and with approval of Environmental Expert of the Authority Engineer. The following precautionary measures will be taken to preserve them till they are used: a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, the edges of the pile will be protected by silt fencing. b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation.	Contractor	Contractor

		c) It will be ensured by the contractor that the top soil will not be unnecessarily trafficked either before stripping or when in stockpiles. · Such stockpiled topsoil will be utilized for - – covering all disturbed areas including borrow areas (not those in barren areas) top dressing of the road embankment and fill slopes – filling up of tree pits, in the median and in the agricultural fields of farmers, acquired temporarily. · Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway. Construction on the cleared soils shall begin as soon as possible to avoid soil erosion. · Top soil shall not be unnecessarily trafficked either before stocking or when in stockpiles. Slope stabilization shall be done by turfing and planting bush grass. Stockpiled top soil shall be returned to cover the disturbed area & cut slopes. Residual top soil shall be used for redevelopment of borrow areas, landscaping along slopes, medians etc.		
7.3	Compaction of Soil	· Heavy, wide and slow-moving vehicles should be kept away from the sensitive routes such as agricultural land. Use of heavy machinery on productive land is to be minimized. · Limitation on the axle load shall be identified such that topsoil is protected from compaction.	Contractor	Contractor
7.4	Generation of Muck, Debris from hill cutting and dismantling	· Debris generated due to the dismantling of the existing structures or scarification of the road will be suitably reused in the proposed construction, subject to the suitability of the materials and approval of the Authority · Engineer (Resident Engineer and Environmental Expert)	Contractor	Contractor

	structures and road surface	as follows: – The sub grade of the existing pavement shall be used as embankment fill material. – The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads – The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc. · The contractor will suitably dispose off unutilized debris materials either through filling up pre-designated disposal locations, subject to the approval of the Environmental Expert of the Authority Engineer. · At locations identified for disposal of residual bituminous wastes, the disposal will be carried out over a 60-mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water. The contractor will ensure that the surface area of such disposal pits is covered with a layer of soil. · All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as approved and directed by the Environmental Expert of the Authority Engineer. · The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of the Authority Engineer. · Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into		

		the surface water bodies or form mud puddles in the area. · The contractor shall identify dumping sites. The identified locations will be reported to the Environmental Expert of the Authority Engineer. These locations will be checked on site and accordingly approved by Environmental Expert of the Authority Engineer prior to any disposal of waste materials.		
7.5	Other Construction Wastes Disposal including balance quantity of muck	· The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of the Authority Engineer. Location of disposal sites will be finalized prior to completion of the earthworks on any particular section of the road. · The Environmental Expert of the Authority Engineer will approve these disposal sites after conducting a joint inspection on the site with the Contractor. · Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (is so desired by the owner/community). · No muck will be disposed in any disposal site. Contractor will take care of residual muck, if any that remains after construction work. Either this will be returned to the source or used in construction of embankment elsewhere with proper protection measures. Authority Engineer will	Contractor	Contractor

		keep strict vigil on this aspect. · Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Expert of the Authority Engineer. · All waste materials will be completely disposed, and the site will be fully cleaned and certified by Environmental Expert of the Authority Engineer before handing over. · The contractor at its cost shall resolve any claim, arising out of waste disposal or any noncompliance that may arise on account of lack of action on his part.		
8	**Procurement of Construction Material**			
8.1	Earth from Borrow Areas for Construction	· No borrow area will be opened without permission of the Environmental Expert of the Authority Engineer. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of the Authority Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the guidelines for siting and operation of borrow areas. · The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the contractor. Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. · During dry seasons (winter and summer) frequency of	Contractor	Contractor

		water sprinkling will be increased in the settlement areas and Environmental Expert of the Authority Engineer will decide the numbers of sprinkling depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Guidelines for Redevelopment of Borrow Areas or as suggested by Environmental Expert of the Authority Engineer.		
8.2	Quarry Operations	· The contractor shall obtain materials from quarries that are the licensed one. If new quarries are to be opened, the contractor shall obtain permission from Department of Mining & Geology of the respective state as well as from Environmental Clearance from SEIAA/MOEF&CC and consents from State Pollution Control Board. The quarry operations will be undertaken within the rules and regulations in force.	Contractor	Contractor
8.3	Construction Water	· Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. · The Contractor will submit a list of source/s from where water will be used for the project to Authority Engineer and PIU. · The contractor will source the requirement of water preferentially from ground water but with prior permission from the Ground Water Board. A copy of the permission will be submitted to Authority Engineer and PIU prior to initiation of construction. · The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Contractor	Contractor
8.4	Transporting	· Contractor will maintain all roads (existing or built for	Contractor	Contractor

	Construction Materials and Haul Road Management	the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials. · All existing highways and roads used by vehicles of the contractor or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. · Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces. The unloading of materials at construction sites in/close to settlements will be restricted to daytime only.		
9	**Safety During Construction**			
9.1	Increased Accident Risks in Work Zones - Planning for Traffic Diversions and Detours	· Detailed Traffic Management Plans prepared prior to commencement of works on any section of road shall be executed fully. Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of the Authority Engineer. · Detailed Traffic Control Plans will be prepared and submitted to the Environmental Expert of the Authority Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures undertaken for transport of hazardous materials and arrangement of flagmen.	Contractor	Contractor

		· The Contractor will provide specific measures for safety of pedestrians and workers at night as a part of traffic control plans. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. · The contractor will also inform local community of changes to traffic routes, pedestrian access arrangements with assistance from Authority Engineer and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic). · The contractor shall make sure that adequate traffic measures are available especially near sensitive receptors. · The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the highway shall be drawn up. · One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway		

		inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. · For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/lights Temporary diversion shall be constructed with the approval of the Engineer. · The Contractor shall ensure that the running surface is always properly maintained, particularly during the monsoon so that no disruption to the traffic flow occurs. · The Contractor shall take all necessary measures for the safety of traffic during construction. Care shall be taken to ensure that the working conditions for the workers in stone quarries are up to the required standards. · Construction related activity resulting in direct release of criteria pollutants (CO, NO2, SO2, PM2.5, PM10) to be avoided at busy locations at night during winters.		
9.2	Traffic and Safety	· The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert of the Authority Engineer for the information and protection of traffic approaching or passing through the section of any existing cross roads. · The contractor will ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic	Contractor	Contractor

		Control Plan will be devised and implemented to the satisfaction of the Environmental Expert of the Authority Engineer.		
9.3	Loss of Accessibility and Unsafe Access	· The construction works shall not interfere with the convenience of the public or the access to use and occupation of public or private roads, railways and any other access footpaths to or of properties, whether public or private. · Temporary access shall be built at the interchange of the project road and other roads. · The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. · The contractor will also ensure that the existing accesses will not be undertaken without providing adequate provisions and to the prior satisfaction of the Authority Engineer. · The contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.	Contractor	Contractor
9.4	Personal Safety Measures for Labour	· Contractor will provide: – Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. – Welder's protective eye-shields to workers who are	Contractor	Contractor

		engaged in welding works – Protective goggles and clothing to workers engaged in Factories Act, 1948 stone breaking activities and workers will be seated at sufficiently safe intervals – Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. – Adequate safety measures for workers during handling of materials at site are taken up. – The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. · The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. · The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. · The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. · The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste		

		or readymade paint. · Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped. · The Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non - compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by Authority Engineer and PIU.		
9.5	First Aid	· The contractor will arrange for - – a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone – availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital equipment and trained nursing staff at construction camp.	Contractor	Contractor
9.6	Risk from Electrical Equipment(s)	· The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - – No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. – All necessary fencing and lights will be provided to protect the public in construction zones. · All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as	Contractor	Contractor

		per IS provision and to the satisfaction of the Environmental Expert of the Authority Engineer.		
9.7	Risk Force Measure	· The contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. · The contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	Contractor	Contractor
9.8	Informatory Signs and Hoardings	· The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, as required in line with IRC:55 or as suggested by the Environmental Expert of the Authority Engineer.	Contractor	Contractor
10	**Management of Water**			
10.1	Loss of Community Water Resources	· Water reservoir enhancement measures shall be provided for community water sources/pond getting impacted to slight degree and falling within the right of way as per the design provided in annexure of specific EMP. · The enhancement measures shall include provision for stepped access to the edge of water, providing flat boulders for washing, stone pitching for slope stabilization etc. · Roadside water reservoir/streams shall also be enhanced as per the design general EMP.	Contractor	Contractor
10.2	Drainage and Flood Control	· Contractor will ensure that no construction materials like earth, stone, ash or appendage disposed off so as not to block the flow of water of any water course and cross	Contractor	Contractor

		drainage channels. · Contractor will take all necessary measures to prevent the blockage of water flow. In addition to the design requirements, the contractor will take all required measures as directed by the Environmental Expert of the Authority Engineer to prevent temporary or permanent flooding of the site or any adjacent area.		
10.3	Water logging	· Adequate water-harvesting structures shall be made part of the project design, all along the storm water drains, at appropriate intervals. · The contractor shall provide RCC covered drains in urban locations in areas with high water table for storm water runoff management. The drains shall be connected to proximal culverts.	Contractor	Contractor
10.4	River Training and Disruption to Other Users of Water	· While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water. · Construction over and close to the non-perennial streams shall be undertaken in the dry season. If construction work is expected to disrupt users of community water bodies, notice shall be served well in advance to the affected community. · The contractor will serve notice to the downstream users well in advance to divert the flow of water of any surface water body. Wherever excavation for diverting water flow will take place, contractor will ensure that the slopes are not steeper than 1:2 (vertical: horizontal) otherwise proper slope protection measures will be taken as approved by the Environmental Expert of the	Contractor	Contractor

		Authority Engineer. · The contractor will take prior approval of the River Authority or Irrigation Department or Authority Engineer for any such activity. The PIU will ensure that contractor has served the notice to the downstream users of water stream in advance.		
10.5	Disruption to other users	· While working across or close to the Rivers, the contractor shall not prevent the flow of water. If for any bridgework, etc., closure of flow is required, the contractor shall seek approval of the Engineer. · The engineer shall have the right to ask the contractor to serve notice on the downstream users of water sufficiently in advance. · Construction work expected to disrupt users and impacting community water bodies shall be taken up after serving notice on the local community.	Contractor	Contractor
11	**Pollution**			
a	**Water Pollution**			
11.1	Water Pollution from Construction Wastes	· The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor will avoid construction works close to the streams or water bodies during monsoon. · All waste arising from the project is to be disposed off in the manner that is acceptable to the State Pollution Control Board or as directed by Environmental Expert of the Authority Engineer. · The Environmental Expert of the Authority Engineer will certify that all liquid wastes disposed off from the sites	Contractor	Contractor

		meet the discharge standards.		
11.2	Siltation of Water Bodies and Degradation of Water Quality	· The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. · Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including stream) adjacent to the RoW and around the stockpiles at the construction sites close to water bodies, specially from km 40+520 to 41+519. · The contractor will also put up sedimentation cum grease traps at the outer mouth of the drains located in road sections which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. · Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby water course.	Contractor	Contractor
11.3	Slope Protection and Control of Soil Erosion	· Slope protection shall be provided on embankments abutting water bodies by providing stone pitching for slopes b/w 1:4 (V:H) to 1:2 (V:H). Retaining walls shall be provided at high embankments. · In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. · The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of the Authority Engineer to control soil erosion and	Contractor	Contractor

		sedimentation through use of dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. · All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. · Contractor will ensure the following aspects: – During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. – Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. – In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontals, from the edge of the final section of the bank. – Along sections abutting water bodies, stone pitching as per design specification will protect slopes. Soil shall be monitored for erosion at select locations as per the monitoring plan mentioned in General EMP.		
11.4	Water Pollution from Fuel and	· The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling	Contractor	Contractor

	Lubricants	sites will be located at least 500 m from rivers and irrigation canal/ponds. · All location and lay-out plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the Environmental Expert of the Authority Engineer and PIU. · Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. · In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. · Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Authority Engineer and PIU) and approved by the Environmental Expert of the Authority Engineer. · All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines. · Environmental Expert of the Authority Engineer will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.		
11.5	Contamination of Water Resources	· Silt fencing shall be provided along ponds within the direct impact zone intercepting highway to prevent	Contractor	Contractor

		siltation in water body. Such ponds shall not be getting impacted during construction. · Temporary drains shall be prepared to dispose off the eroded sediments and to prevent them from entering the surface water bodies. · To prevent contamination of water resources due to contaminants from construction camps, adequate sewage disposal measures shall be taken care of at construction camps. · Contaminated discharges containing oil/grease contributed by vehicle parking/repair areas and workshops and construction sites shall be collected and treated using oil interceptors. · Construction work close to water bodies shall be avoided during monsoon. The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites shall be located at least 1000 m from rivers and stream/reservoir/tanks or as directed by the Engineer. · Both ground and surface water quality shall be monitored as per the monitoring plan at select locations		
b	**Air Pollution**			
11.6	Dust Pollution	· The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. · All the plants will be sited at least 1 km in the	Contractor	Contractor

		downwind direction from the nearest human settlement. · The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. · The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m3. The pollution monitoring is to be conducted as per the monitoring plan. · Alternatively, only crushers licensed by the PCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case. · Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units. · All crushers identified to be used in construction shall conform to relevant dust emission control legislation of the respective SPCB. · Clearance for siting shall be obtained from the respective SPCB. Alternatively, only those crushers hat are already licensed by the SPCB shall be used. · All Hot mix plants shall be fitted with dust extraction systems SPM value at a distance of 40 m from a unit located in a cluster should be less than 600 microgram/m3. The monitoring is to be conducted as per the monitoring plan. · Excavation and transport of earth shall be done during the daytime only to minimize risks of the spills etc. from the earthwork on the community. · Transport of the soil/earth shall be done by covering		

		the haulage vehicles with tarpaulin or any other good quality material. · Dust suppression measures in the form of water sprinkling on the lime / cement and earth mixing sites, asphalt mixing site and temporary service and access roads. · Traffic detours shall not be located on areas with loose soils. Temporary pavement shall be made by using dismantled pavement material from existing roads. · All construction workers shall be provided with pollution masks to mitigate the effect of dust generation on the health of workers. · Muck shall be transported in covered dump trucks to the project site and shall be directly dumped on the disposal sites. This shall not be stock piled at the project site.		
11.7	Emission from Construction Vehicles, Equipment and Machineries (Generation of Exhaust Gases)	· All vehicles, plants and machinery used during construction shall conform to the emission standards promulgated under the Environment (Protection) Act, 1986. 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 PCB. · The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to Authority Engineer and PIU as per the monitoring plan. · Traffic detours and diversions shall be designed such as	Contractor	Contractor

		to minimize bottlenecks and ensure smooth traffic. · Air pollution monitoring shall be carried out at specified locations as described in the monitoring plan to verify that air pollution norms are being followed by the contractor and the air quality at the construction site does not exceed the prescribed limits. 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 PCB.		
c	**Noise Pollution**			
11.8	Noise Pollution: Noise from Vehicles, Plants and Equipment	· The Contractor will confirm the following: – All plants and equipment used in construction (including the and PIU, MPWD aggregate crushing plant) shall strictly conform to the MoEF/CPCB noise standards. – All vehicles and equipment used in construction will be fitted with exhaust silencers. – Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. – Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986.	Contractor	Contractor

		– Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Environmental Expert of the Authority Engineer to keep noise levels at the minimum. – At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am. – No noisy construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 5.00 pm. – Contractor will provide noise barriers to the suggested locations of select schools (at km 4+600, 4+900, 6+275, 10+400, 10+480, 11+570, 13+100 and 36+000) / health centers. – Workers in the vicinity of high noise levels must wear ear plugs, helmets and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90 dB(A). – Blasting operations, if required shall be undertaken so as to produce minimum vibrations in sensitive areas. – Traffic management plans prepared during construction mobilization period shall also be implemented during construction stage. Effective traffic management shall especially be taken care of in sensitive locations, major built-up areas and along important highway junctions.		

		– Asphalt mixing sites and the batching plants should be at a distance of at least 200 m from sensitive receptor locations. – Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to Authority Engineer and PIU. Environmental Expert of the Authority Engineer will be required to inspect regularly to ensure the compliance of EMP.		
12	**Land/Soil Pollution**			
12.1	Contamination of Soil	· Fuel shall be stored in proper bounded and covered areas. · All spills and collected petroleum products shall be disposed off in accordance with the guidelines framed by Ministry of Environment, Forests &, Climate Change and State Pollution Control Board. · Maintenance and refuelling of vehicles, machinery and other construction equipment shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. · An “Oil Interceptor” shall be provided for wash down and refuelling areas. · Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction, subject to the suitability of the materials and approval of the Engineer as follows: – The sub-grade of the existing pavement shall be used as embankment fill materials	Contractor	Contractor

		– The existing base and sub- base material shall be recycled as sub-base of the haul road or access roads – The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites, temporary traffic diversions, haulage routes etc. – The contractor shall suitably dispose off un-utilized debris materials including spoils of material unsuitable for embankment; either through filling up of borrow area located in wasteland or at pre-designated dump locations, subject to the approval of the Engineer. – At locations identified for dumping of residual bituminous wastes, the dumping shall be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water. – The contractor shall ensure that the surface area of such dumping pits is covered with a layer of preserved topsoil. – All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary shall be considered incidental to the work and shall be planned and implemented by the contractor as approved and directed by the Engineer. – The pre-designed dump locations shall be a part of comprehensive solid waste management plan to be prepared by Contractor in consultation with Engineer. – Debris generated from pile driving or other construction		

		activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. The contractor shall identify dumping sites. The identified locations shall be reported to the Engineer. Location of dump sites shall be finalised prior to earth works on any particular section of the road. – No fly ash shall be disposed in any disposal site. Care shall be taken to return the remaining fly ash after construction work to the source or to use it in construction of embankment elsewhere with proper construction measures. IE shall keep strict vigil on this aspect. – Non-bituminous wastes other than fly ash may be dumped in borrow areas covered with a layer of the conserved topsoil. No new disposal sites shall be created as part of the project, except with prior approval of the Engineer. – All waste materials shall be completely disposed and the site shall be fully cleaned before handing over. – Soil shall be monitored for contamination as per the monitoring plan at locations to be identified by the Engineer. The Engineer shall certify the site after approval. – The contractor at his cost shall resolve any claim arising out of waste disposal.		
13	**Flora and Fauna: Plantation/Preservation/Conservation Measures**			
13.1	Road side Plantation	· The contractor will do the plantation at median and/or turfing at embankment slopes as per the tree plantation	Contractor	Contractor

	Strategy	strategy prepared for the project. · Minimum 80 percent survival rate of the saplings will be acceptable otherwise the contractor will replace dead plants at his own cost. The contractor will maintain the plantation till they handover the project site to Project Authority. · The Environmental Expert of the Authority Engineer will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.		
13.2	Flora and Chance found Fauna	· The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Environmental Expert of the Authority Engineer and carry out the Authority Engineer's instructions for dealing with the same. IE shall be responsible to intimate the wildlife protection authorities in the area. · The Environmental Expert of the Authority Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Contractor	Contractor
14	**Archaeological Resources and Cultural Properties**			
14.1	Chance Found Archaeological Property	· All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be	Contractor	Contractor

		the property of the Government and shall be dealt with as per provisions of the relevant legislation. · The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the · Environmental Expert of the Authority Engineer of such discovery and carry out the Authority Engineer's instructions for dealing with the same, waiting which all work shall be stopped. · The Authority Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.		
14.2	Impact/s on Cultural/Religious Properties	· All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including temples and shrines, etc., graveyards, monuments and any other important structures as identified during design. All conservation and protection measures shall be taken up as per design. Access to such properties from the road shall be maintained clear and clean.	Contractor	Contractor
15	**Labor Camp Management**			
15.1	Accommodation	· Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. · The location, layout and basic facility provision of each	Contractor	Contractor

		labour camp will be submitted to Authority Engineer and PIU prior to their construction. · The construction will commence only upon the written approval of the Environmental Expert of the Authority Engineer. · The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Authority Engineer.		
15.2	Potable Water	· The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. · The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. · The contractor will also guarantee the following: a) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. b) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1mt. from the surrounding ground level. c) If water is drawn from any existing stream/reservoir/well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the water	Contractor	Contractor

		from source will be disinfected before water is used for drinking. d) All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof. e) A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. f) Testing of water will be done every month as per parameters prescribed in IS 10500:1991. g) Environmental Expert of the Authority Engineer will be required to inspect the labour camp once in a week to ensure the compliance of the EMP.		
15.3	Sanitation and Sewage System	· The contractor will ensure that - – the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take places – separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women – adequate water supply is to be provided in all toilets and urinals – all toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and in a strict sanitary condition – night soil is to be disposed off by putting layer of it at	Contractor	Contractor

		the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight.		
15.4	Waste Disposal	· The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of the Authority Engineer. · Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of the Authority Engineer will have to be provided by the contractor.	Contractor	Contractor
15.5	Health and Hygiene Impacts on Construction Camps	· The contractor shall provide erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour up to living standards and scales approved by the IE at the locations identified for such facilities in pre-construction phase. · The contractor shall also guarantee the following: – Supply of sufficient quantity of potable water (as per IS) in every work place/labour campsite at suitable and easily accessible places and regular maintenance of such facilities. – If any water storage tank is provided it shall be kept at a distance of not less than 15m from any latrine drain or other sources of pollution.	Contractor	Contractor

		– If water is drawn from any existing reservoir which is within close proximity of any latrine, drain or other source of pollution the well shall be disinfected before water is used for drinking. – All such reservoir shall be entirely covered and provided with a trap door, which shall be dust proof and waterproof. – A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month. – Testing of water shall be done every month as per parameters prescribed in IS 10500:1991. – Engineer shall be required to inspect the labour camp once in a week to ensure the compliance of the EMP. – Contractor shall be responsible for proper functioning and management of sanitation and sewage system as per applicable national and state regulations. – All latrines shall be provided with dry-earth system (receptacles), which shall be cleaned at least four times daily, and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year. – Adequate health care is to be provided for the work force. On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and		

		effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.		
15.6	Deterioration of indoor air quality and risk of water borne diseases	· It shall be the responsibility of the contractor to make adequate provisions for workers at labour camps under the Factories Act, 1948. Dwelling units shall be supplied with clean fuel for domestic purpose. Generation of carbon monoxide under any circumstance shall not be allowed. · Contractor shall make sure that no water stagnation happens in the vicinity of construction camp as well as anywhere along the project stretch to prevent spread of malaria & other water borne diseases	Contractor	Contractor
16	**Contractor's Demobilization**			
16.1	Clean-up Operations, Restoration and Rehabilitation	· Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of the Authority Engineer. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. The contractor will clear all temporary structures; dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by Authority Engineer. · All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed on adjoining/ proximate barren land or areas identified by Environmental Expert of the Authority Engineer in a layer of thickness of 75 mm-l50 mm. · All construction zones including river-beds, culverts,	Contractor	Contractor

		road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Environmental Expert of the Authority Engineer		