অসম চৰকাৰ

GOVERNMENT OF ASSAM

ASOM MALA PROGRAM

Government of Assam

Public Works Roads Department (PWRD)

Project Title: Improvement and Upgradation of A07 Sarthebari Rampur Pathsala Road under Asom Mala [From Ch. 0+000 to Ch. 17+653]

Detailed Project Report

(Environment Impact Assessment and Environmental & Social Management Plan)

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Abbreviations

AADT	Average Annual Daily Traffic
AAQ	Ambient Air Quality
AIIB	Asian Infrastructure Investment Bank
ADT	Average Daily Traffic
AE	Assistant Engineer/Authority Engineer
AEE	Assistant Executive Engineer
agl	Average Ground Level
AIDS	Acquired Immune Deficiency Syndrome
AM	Ante Meridiem
AP	Affected Persons
APHA	American Public Health Association
ASI	Archaeological Survey of India
AWWA	American Water Works Association
BA	Borrow area
BC	Bitumen Concrete
BDL	Below Detection Limit
BHS	Both Hand Side
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantity
BSI	British Standards Institution
BT	Bituminous
BTPS	Bongaigaon Thermal Power Station
C/L	Centre line
C/S	Cross Section
CA	Crusher area
CAL3QHCR	EPA Recommended Intersection Dispersion Model
CALINE	California Intersection Model
CBR	California Bearing Ratio
CD	Cross Drainage
CE	Chief Engineer
CER	Corporate Environmental Responsibility
CF	Conservator of Forest
CFL	Compact Fluorescent Lamp
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
cm	Centimetre
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CoI	Corridor of Impact
CoRTN	Calculation of Road Traffic Noise
COVID	Coronavirus Disease
CPCB	Central Pollution Control Board
Cr.	Crore
CRRI	Central Road Research Institute
CSIR	Council of Scientific and Industrial Research
CTE	Consent to Establishment
CTO	Consent to Operate
CWC	Community Welfare Committee
dB (A)	Decibels
DBM	Dense Bituminous Macadam
DC	District Collector
DFO	Divisional Forest Officer
DG	Diesel Generator
DGRC	District Grievance Redress Committee
DO	Dissolved Oxygen
DPR	Detailed Project Report
EA	Executing Agency
EA	Environmental Assessment
EAP	Externally Aided Project
EE	Executive Engineer
EFRC	Environmentally Friendly Road Construction
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
ESMP	Environmental & Social Management Plan
EMPIU	Environmental Management Plan Implementation Unit
EN	Endangered
EO	Environmental Officer
ES	Environmental Specialist
ESZ	Eco-sensitive Zone

ESMPF	Environment & Social Management Planning framework
FGD	Focus Group Discussions
FRA	Forest Rights Act
FSI	Forest Survey of India
FV	Forest Village
FWD	Falling Weight Deflectometer
GA	Geographical Area
GEC	Ground Water Estimation Committee
GHG	Greenhouse Gases
GO	Government Order
GoA	Government of Assam
GoI	Government of India
GRM	Grievance Redress Mechanism
GSB	Granular Sub-base
GW	Ground Water
ha	Hectare
HC	Hydrocarbon
HFL	High Flood Level
HIV	Human Immunodeficiency Virus
hr	Hour
HS	High School
HT	High-tension
IBAT	Integrated Biodiversity Assessment Tool
ICB	International Competitive Bidding
EIA	Environmental Impact Assessment
IMD	India Meteorological Department
INR	Indian Rupee
IRC	Indian Road Congress
IRS	Indian Remote Sensing
IS	Indian Standard
ISFR	India State of Forest Report
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
IVI	Importance Value Index
Jn	Junction
Jr.	Junior
kg	Kilogram
Km	Kilometre
LA	Land Acquisition
LAP	Land Acquisition Plan
LAQ	Land Acquisition Officer
LC	Least Concern
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
Leq	Equivalent Continuous Noise Level
LHS	Left Hand Side
LISS	Linear Imaging Self-Scanning System
LMV	Light Motor Vehicle
LP	Lower Primary
LPG	Liquid Petroleum Gas
lpm	litres per minute
LT	Low-Tension
m	Meter
m^3	Cubic Meter
MAV	Multi Axle Vehicle
MC	Monitoring Consultant
MDB	Multilateral Development Banks
MDF	Moderately Dense Forest
MDR	Major District Road
mg	Milligram
MI	Monitoring Indicators
MJB	Major Bridge
ml	Millilitre
mm	Millimetre
MNB	Minor Bridge
MO	Medical Officer
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoRT&H	Ministry of Road Transport & Highways
MPN	Most Probable Number
MSA	Million Standard Axles
MSL	Mean Sea Level
MT	Metric Ton
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NBWL	National Board of Wildlife

NE	Not Evaluated
NGO	Non-Governmental Organisations
NO_2	Nitrogen Dioxide
NOC	No-objection Certificate
NOx	Oxide of Nitrogen
NP	National Park
NRC	Noise Reduction Coefficient
NRSC	National Remote Sensing Centre
NSSO	National Sample Survey Organization
NT	Near Threatened
NTFP	Non-Timber Forest Products
°C	Degree Celsius
OF	Open Forest
OFC	Optical Fibre Cables
OHT	Over Head Tank
PAF	Project Affected Family
PAH	Project Affected Household
PAP	Project Affected Persons
PCB	Pollution Control Board
PCM	Public Consultation Meeting
PCU	Passenger Car Unit
PD	Project Director
pH	potential hydrogen
PIU	Project Implementation Unit
PM	Particulate Matter
PM	Post Meridiem
PMU	Project Management Unit
POL	Petroleum, Oil & Lubricant
PPP	Public Private Partnership
PSC	Precast Prestressed Concrete
PT	Performance Target
PUC	Pollution Under Control
Pvt.	Private
PWD	Public Works and Road Department
R&R	Resettlement and Rehabilitation
R/F	Rain Fall
RAP	Resettlement Action Plan
RCC	Reinforced Cement Concrete
REA	Rapid Environmental Assessment
RF	Reserved Forest
RFCTLARR	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act
RHS	Right Hand Side
ROW	Right of Way
RP	Resettlement Plan
RTI	Right to Information
SAIL	Steel Authority of India Limited
SBWL	State Board of Wildlife
SC	Scheduled Caste/ Supervision Consultant
SDO	Sub-divisional Officer
SEAC	State Expert Appraisal Committee
SEIAA	State Environment Impact Assessment Authority
SH	State Highways
SO	Safety Officer
SO_2	Sulphur Dioxide
SOx	Oxide of Sulphur
SP	Special Publication
SPCB	State Pollution Control Board
SPL	Sound Pressure Level
SPS	Safeguard Policy Statement
SPT	Standard Penetration Test
SQ	Soil Quality
sq. m.	Square meter
ST	Scheduled Tribe
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
SW	Surface Water
TDS	Total Dissolved Solid
TEEMP	Transport Emissions Evaluation Model for Projects
TL	Team Leader
TOR	Terms of Reference
TSS	Total Suspended Solid
UK	United Kingdom
USEPA	United States Environmental Protection Agency
VDF	Very Dense Forest
VEC	Valued Environment Components
VG	Viscosity Grade
VU	Vulnerable

WEF	World Economic Forum	WPA	Wildlife Protection Act
WL	Wildlife	ZSI	Zoological Survey of India
WLS	Wildlife Sanctuary	µg	Microgram
WMM	Wet Mix Macadam		

0. EXECUTIVE SUMMARY

A. Introduction

This report summarizes the findings and results of the Environmental Impact Assessment (EIA) study carried out for the **A07 Sarthebari Rampur Pathsala** road under Improvement of SH's and MDR's under Axom Mala. The report describes the existing environmental conditions in the project area, anticipated environmental and social impacts and corresponding mitigation measures, the public consultation process, the environmental and social management plan (ESMP), and its monitoring plan.

The program is envisaged to improve the SH & MDR network in the next 15 years for fuelling economic growth and bringing the state road infrastructure at par with Southeast Asian countries; provide quality inter-linkage roads between the National Highways and the rural roads network as well as facilitate seamless multi-modal transportation; interconnect economic growth centers with quality developing quality transportation corridors and improve inter-state connectivity. The proposed project is designed to improve transport connectivity in Assam by rehabilitating and upgrading 1268 Km of State Highways and Major District Roads, out of which 8 project road corridors of length of 245.7 Km is proposed under ASRIP for AIIB financing. The project road is proposed for improvement and upgradation of 17.653 Km (approx.) in Barpeta and Bajali district which is being implemented under Asom Mala program by Government of Assam (GoA).

This EIA report has been prepared to meet the requirements of the Asian Infrastructure Investment Bank (AIIB) for financing the project road and in compliance with AIIB's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS).

B. Description of the Sub-Project

The project road starts at Sarthebari (26°22'6.47"N, 91°13'27.88"E), at Y-intersection of SH-9 and SH-9A and ends at Pathsala NH-27 Nr Raipur village (26°30'15.05"N, 91°12'23.68"E) of the project road. The project road passes through the Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Raipur and Dharmatala settlements. The carriageway width of the road varying from single lane (3.75m) to Intermediate Lane (5.5m) with earthen shoulder of approx. 1.0m to 2.4m. The entire stretch of the project road is in plain terrain and having very poor condition. The land cover of the Project area is mainly agriculture followed by build-up area/ roads, the soils are mostly fertile in terms of productivity.

C. Categorization of Project

The Project is categorized as Category "B," in accordance with the Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS). it is likely to have a limited number of potentially adverse E&S impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the project area; and can be successfully managed using good practices. As per AIIB ESP for Category "B" project an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) is required. However, in this case an Environmental Impact Assessment (EIA) Report and Environmental and Social Management Plan (ESMP) has been prepared since a separate Social Impact Assessment (SIA) is prepared. The EIA report will examine the Project's potentially negative and positive environmental impacts and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental performance of the Project.

D. Potential Environmental and Social Impacts & Mitigation Measures

The proposed project will generate socioeconomic benefits due to the improved condition of the road A07. The primary economic benefits of the investment program are cost savings from vehicle

operation, reduction in travel time, and lower transaction costs related to transportation. This will lead to sustainable development, economic growth, integrity and national security, as well as improvement of living standards and livelihoods of local population. The project will also generate employment opportunities particularly during its construction phase.

The potentially negative impacts of the proposed project include acquisition of land or the project and felling of trees. The potential impacts of the project's construction phase include soil erosion caused by excavation and vehicular traffic on unpaved areas; soil and water contamination caused by release of waste effluents from construction sites, accidental leakage of fuels and chemicals, and waste effluents from camps and offices; noise and air emissions generated by construction machinery and vehicles; blockage of canals and drainage channels during the construction of bridges and culverts; impacts associated with borrow areas required to obtain fill material; generation of solid waste, blockage of and damage to local roads and infrastructure; health and safety risks for local community particularly children and construction workers; and impacts associated with influx of construction workers.

Enumeration of properties reveals an impact on total of 254 properties (Private, Religious, Community and Government) in project roads due to the implement of project section. The total number of private properties to be affected due to the project is estimated to be 193 in number. Out of these private properties, 68 are commercial, 53 are residential, 8 are res-cum-commercial and 64 are other properties. The total number of families to be affected by this project is 228. There are 22 government, 3 community and 36 religious properties to be affected. Nearly 69% of the structures are fully impacted. Out of total structures, most of the structures that have been enumerated during social survey within proposed ROW are Permanent (29%) followed by Temporary 25%, Semi-permanent 13% and 33% other structures such as boundary wall and shed. The total private land to be acquired or transferred for this project road is approximately 20.65 Ha.

The project will affect 18 villages, fall under the jurisdiction of Barpeta and Bajali districts which are not coming under as schedule VIth tribal area/district. No indigenous people will be impacted involving direct or indirect impacts to the dignity, human rights, livelihood systems or territories or natural or cultural resources that are used, owned, occupied or claimed by indigenous peoples as their ancestral domain or asset, is anticipated. The assessed impacts to scheduled tribe populations (2 affected families) are involuntary resettlement impacts. The project area does not fall in a scheduled area or ITDP area, nor has recorded presence of particularly vulnerable tribal groups. Hence, the need for an Indigenous Peoples Plan is not assessed for this project.

The potential impacts associated with the operation and maintenance (O&M) of the project road include noise and air quality deterioration caused by the vehicular traffic, safety risks for the local population as well as for the O&M workers. Appropriate mitigation measures have been identified to address the identified potential impacts of the proposed project.

E. Public Consultation and Information Disclosures

Considering the fact that involving local communities in the project planning is basis of the participatory planning, stakeholder consultations at various levels were conducted during different stages of the project. Suggestions and options given by the people improves technical and economic efficiency of the project and suggested improvement proposals of the people (if adopted by the project) also generates sense of ownership within communities thus eases implementation process. Stakeholder consultations were conducted for the project comprised one-to-one interviews, focus group discussions and structured public consultation meeting. The stakeholder consultations were conducted before project design and after project design. The suggestions obtained during pre-design consultation were considered in the project design. The designs were further modified based on the suggestions obtained during post-design consultations. Public/Stakeholders Consultation were conducted at 13 locations namely- Sarthebari, Khudragomura, Perkuchipam, Bongaon, Bugan,

Tapattari, Malipara, Dubi, Raipur, Bamunkushi and Dharmatala, Total No. of participant was 110 out of which 90 were male and 20 were female in the project Road in the month of June, October and November 2020. Major issue was tree cutting and their compensation, dust emission control, safety issue and road improvement proposal details of Public Consultations are given in Chapter 8 and **Annex-17.**

Major Issue discussed as mentioned above

Natural hazards (Flood/earthquake/drought), dust generation due to poor condition of road, tree felling issue, air/water/noise pollution, road accident and improvement of road safety, wild kills, present of forest/wildlife along the road and present of ancient monuments.

Information Dissemination

- The consultant has conducted information dissemination by one-to-one campaigning about proposed improvement.
- Potential project affected families were consulted to inform them about proposed road improvement program and possible environmental and social conflict such as tree cutting, relocation of utilities.
- Structured consultation was conducted at hot spots along the project corridors for information dissemination and collecting the opinion / suggestion from the public.
- Pictorial Methods were adopted to explain proposed improvement and possible environmental and social impacts in the concerned villages.

F. Institutional Arrangement

The Government of Assam's Public Works Roads Department (PWRD) will be the executing agency. The Chief Engineer (EAP) will be the Project Director (PD) of state level Project Management Unit (PMU). CE (EAP) will be assisted by an Executive Engineer as Nodal Officer of Asom Mala Program.

The PMU will oversee overall execution and technical supervision and monitoring of the project. The EE will be supported by AE/JE and/or program Coordination and Management Consultant (PCMC)/CSC/AE. The Institutional Arrangement and capacity Building are given in Chapter 9, Section G. To enable PWRD officials to implement Environmental and Social Safeguard requirements effectively a training program will be conducted for the PWRD Environmental and Social Safeguard Experts to improve the environmental and Social awareness, construction practices, legislative compliance requirement, ESMP requirements and its roles and responsibilities.

G. Environmental & Social Management Plan

Environmental & Social Management Plan (ESMP) 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 measures suggested for enhancement of the environmental quality along the highway. The institutional arrangement made under project will look into the implementation of project as well as ESMP and the various legal settings applicable to the project are briefly stated in Chapter 10 of this report.

The avoidance, mitigation & enhancement measures for protection of the environment along the highway have been discussed. Although the social environmental impacts, its mitigation and management are essential component of the ESMP, this report excludes it for the purpose of clarity and procedural requirements. Social environmental elements have been separately dealt in separate volume namely, Resettlement Action Plan (RAP).

a. Environmental & Social Management plan (ESMP) Budget

Mitigation measures proposed in the ESMP 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 tree 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.

The cost for environmental management for the project road is INR **1.02** Cr. and details of the same is presented in Table 9.5 & 9.6.

b. Organizational Framework

The ESMP for the project road will be implemented by PWD (EAP) through its Project Monitoring Unit (PMU). The PMU comprises of officers from PWRD, GoA, and other Environmental Engineers. The PMU will be coordinating with the field level implementing agencies such as PCMC/CSE/AE and Contractor. Role and responsibilities of important officials are detailed in Chapter 10.G of this report.

H. Conclusion and Recommendations

Comprehensive contractual, design, and budgetary provisions are made for avoidance, minimization, management or enhancement of various environmental components likely to be impacted due to the construction of project road. A working effective systematic supervision and monitoring mechanism will be developed as a part of environmental and social management to ensure compliance of the designed environmental and social protection plans, adoption of corrective measures when and wherever required to make the measures environmentally and socially sustainable. Construction of the proposed road will reduce the travel time, fuel consumption per vehicle, and exhaust emissions.

1. INTRODUCTION

A. Project Background

The Gateway to the North East, the state of Assam has seen rapid progress in road infrastructure development since 2014. The length of National Highways (NH) in the State has reached 3,909 km and the road network of State Highways (SH) and Major District Roads (MDR) is about 7,547 km and 36,544 km of Rural Roads. The majority of the roads are being maintained and managed by the Public Works Roads Department (PWRD), Government of Assam (GOA). The road network of Assam caters to other six north-eastern states of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura and also provides regional interconnectivity to the nations of Bangladesh, Bhutan, Myanmar and India.

PWRD, GOA in 2015-16 developed a Road Asset Management System for Assam (ARAMS) to rationalize decision-making for prioritizing and planning of road rehabilitation and maintenance activities. ARAMS also estimates long-term funding requirement for preserving the road assets at an acceptable service level. With a linkage to ARAMS, the GoA has initiated a flagship program, named Asom Mala as a long-term programme for fuelling economic growth as well as improving the road infrastructure towards Sustainable Development Goals and achieving Assam Vision 2030. The Asom Mala program is planned to have a) Planning and Construction of project roads, b) Road sector strengthening and institutional development and c) Road safety improvement.

Asom Mala program would be a large and prestigious long-term road infrastructure development program which in addition to State funded works, would also include several Externally Aided Projects (EAP) under its umbrella like the Asian Development Bank (ADB) aided Assam Road Network Improvement Project (ARNIP), Asian Infrastructure Investment Bank (AIIB) aided Assam Secondary Road Network Improvement Project (ASRIP), etc., and may also include Public Private Partnerships (PPP) projects.

B. Project Description

The proposed Project Road from Sarthebari to Pathsala section of SH-9 A, is one of the sub-projects among seven (07) roads of about 250 km which are identified to be rehabilitated in Assam Secondary Road Network Improvement Project (ASRIP) under Asom Mala program. The improvement project would further implement road safety measures along 38 roads of about 750km of SH and of MDR. The ASRIP will be aided by AIIB and will also support modernization of the PWRD's asset management system, enhance IT environment, and other capacity building activities. The details of proposed sub- project roads of ASRIP are summarized in **Table 1.1**.

Table 1-1: Details of Sub-projects of ASRIP

Sr. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
1	A31	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Lakhimpur & Majuli	19.2
2	A15	Dhodar Ali (Kamargaon to Kamarbandha)	Golaghat	42.1
3	A07	Sarthebari Rampur Pathsala Raipur Road	Barpeta & Bajali	17.7
4	A22	Dhakuakhana Butikur Tiniali Telijan	Lakhimpur & Dhemaji	32.7
5	A30_1	Moran Naharkatia Road (Moran to Deesang Kinar Bangali)	Dibrugarh	46.6
6	A30_2	Moran Naharkatia Road (Deesang Kinar Bangali to Kathalguri)	Dibrugarh	24.0

Sr. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
7	A20_1	Sivasagar to Chumoni	Sivasagar	18.4
8	A20_2	Balighat Tiniali to Nakachari	Sivasagar & Jorhat	45.0
Total (km)				**245.7**

Source: PWRD, GOA, March 2021

The construction of sub-project road works will include geometric improvement in terms of horizontal and vertical alignment improvement, as well as widening to two lanes with or without paved shoulders depending on the necessity and feasibility. Roads are to be improved mainly following the existing alignment, with realignments or new alignments at some stretches. New Reinforced Concrete Construction (RCC) bridges would be constructed wherever required and existing structurally weak bridges in poor condition would be rehabilitated. Present ESIA study discussed about A07 Sarthebari Pathsala Rampur Road (17.653km) section of SH-9A in Barpeta and Bajali Districts in the state of Assam.

C. Project Location

The proposed project road **"Sarthebari – Rampur - Pathsala"** is a widening/rehabilitation of the existing SH-9A. The proposed project road starts at Sarthebari, at Y-intersection of SH-9 and SH-9A and ends at Pathsala town. The entire stretch of 17.653 km of the project road is in plain terrain. Location map of the project road is given in **Figure 1.1**.

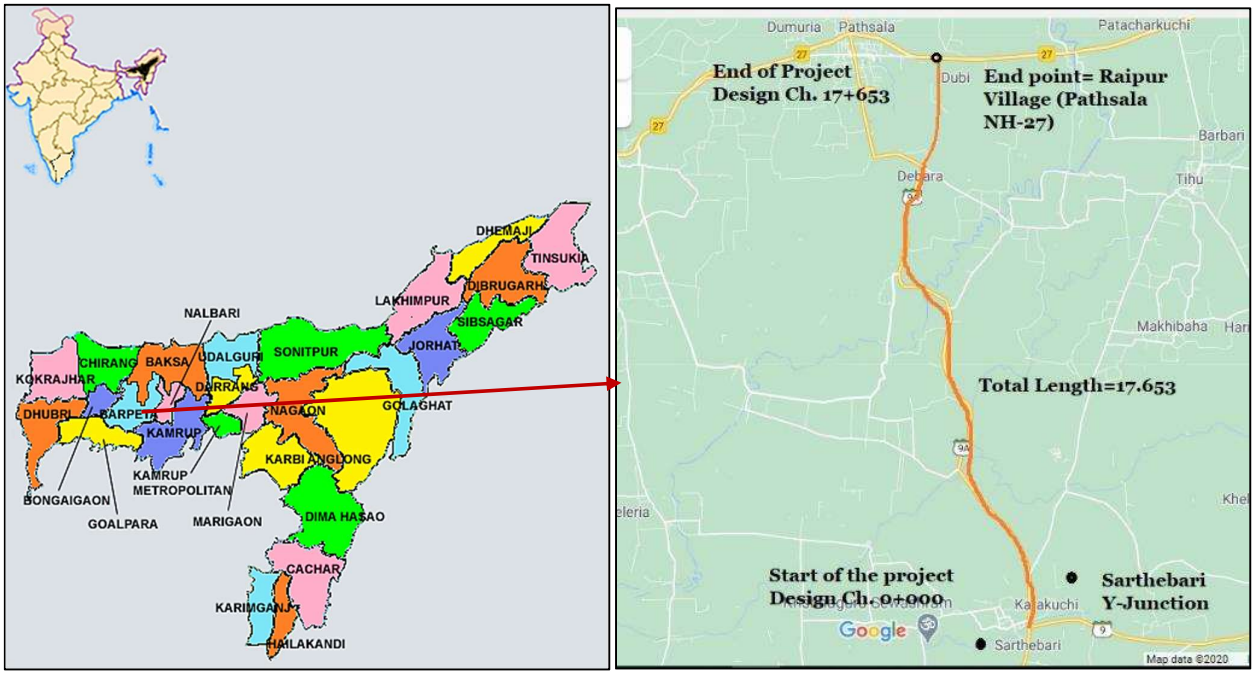


Figure 1.1: Project Road Alignment

The Project Road passes through the Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Pathsala villages/towns. The carriageway width of the road varying from Single Lane (3.75m) to Intermediate Lane (5.5m) with earthen shoulder of approx. 1.0m to 2.4m. Construction of one new Major bridge is proposed at Km.

4.745 for enhancing connectivity between Sarthebari, Gomura, Batiya, and Parkuchipam, Rampur, Bugan, Tappatari, Maipara villages in project corridor A 07.

The Sarthebari town is the hub of Bell Metal industry. The Pathsala town is the local hub of educational institutes, having Colleges and Technical educational institutes. Therefore, most of the road realignment is proposed over existing road to minimize the land acquisition. Realignment is proposed from Km. 4.400 to Km. 5.930 to improve the existing geometry of the road and avoid sharp horizontal curve at approach of Major bridge at Km 4+700. A bypass is also proposed from Km. 14.750 to Km. 17.653 to bypass the congested areas of Pathsala town.



Start point of the Project Road



End Point of the Project Road





Existing Road Condition

Figure 1.2: Photographs of the existing road

D. Objectives of The Study

The Environment Impact assessment (EIA) Study has been undertaken against the following reference frameworks:

- Applicable National, State, and Local regulatory requirements
- Nation road safety policy and guidelines
- AIIB Environment and Social Framework (ESF)

As per the requirement of the AIIB's ESF, the EIA has been prepared with the following objectives:

- To determine the category of the project depending on the length, extent of land acquisition, location, environmental sensitivity, nature and magnitude of its potential environmental impacts, i.e., screening as per Government of India's regulations and AIIB's Safeguard Policy.
- To determine the appropriate extent and type of Environmental Assessment (EA) required, i.e. scoping.

- To determine whether the project requires environment clearance, forest clearance, wildlife clearance, NOCs for Archaeological Monuments if any, Consents to Establish and Consents to Operate etc. depending on its type of development.
- To establish present environmental conditions of the study area through available data/information supported by field studies, wherever necessary.
- To predict the potential impacts on relevant environmental attributes due to the proposed project and to recommend adequate mitigation measures to minimize/reduce adverse impacts.
- To prepare an EIA report including ESMP.

The sections below detail out the methodology adopted for the assessment of environment for the Project.

E. Methodology Adopted for EIA Study

The study methodology for the EIA employs a simplistic approach and analyses the environmental issues identified. The sections below detail out the methodology adopted for the environment assessment of the Project and a flow of process is presented as below in **Figure 1-3**.

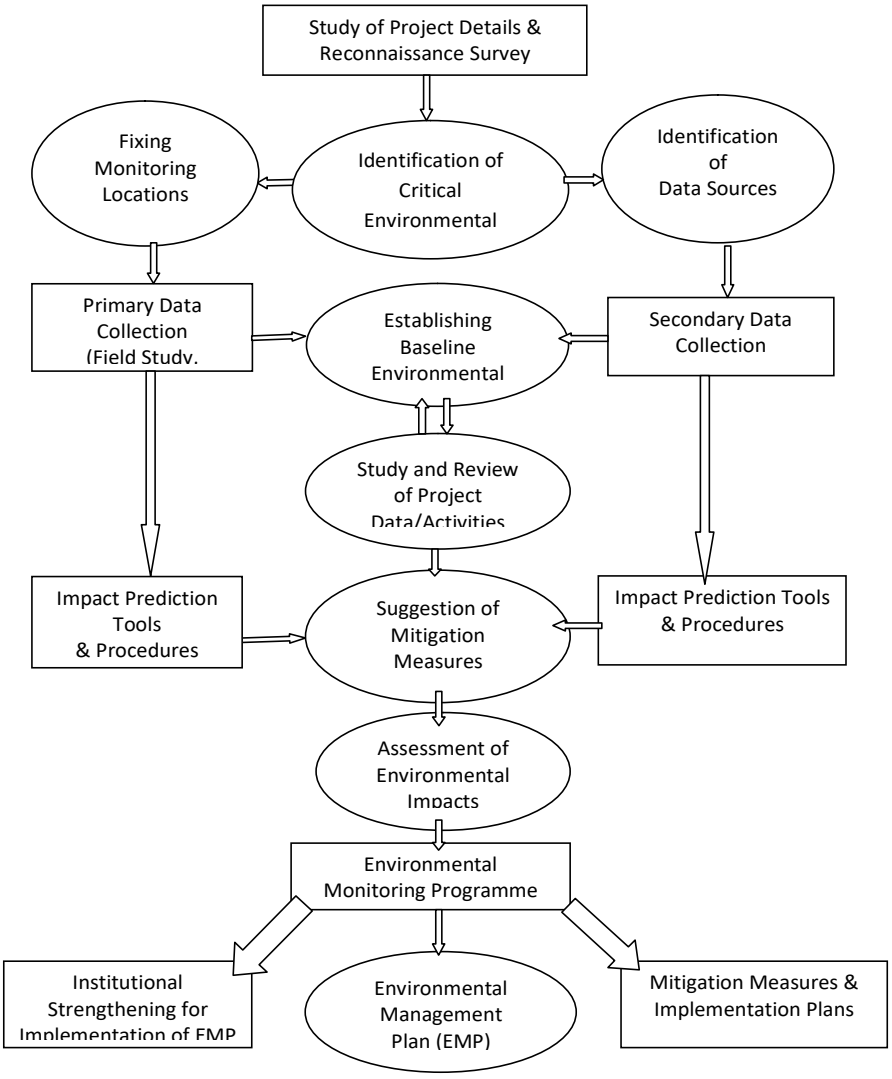


Figure 1.3: Methodology of EIA

- **Project Study Area:**
  A study area of 10 km radius from the project road was considered for **Secondary Data Collection**. **Primary Data** has been collected within 500 meters on both sides of the proposed alignment.
- **Project Influence Zone/ Study Area:**
  Most of the environment and socio-economic impacts of the project are expected to be localized. Therefore, to study the impacts of the Project, the study area delineated for the Project is separated into two major zones as:
    - **Direct Impact Zone (DIZ):** This consists of a strip of land on both sides of the centre line of the proposed alignment. 50 m width on either side of the centre line has adopted for detailed inventory of environmental features.
    - **Indirect Impact Zone (IIZ):** This consists of a strip of land of 500 m width on both side of the proposed carriageway. Here, the existence of sensitive features has been identified based on secondary information and possible impacts on them due to the project corridor development will be assessed.
- **Review of Applicable Environmental Regulations:** Applicability of various environmental regulations and guidelines were reviewed for the Project and its allied activities. Review analysis in respect to Government of India guidelines and regulatory environment framework is presented in Chapter 02.
- **Reconnaissance Survey:** A reconnaissance survey has been made for identification of Valued Environmental Components (VECs) on proposed project road. Location of environmentally protected areas (National Parks, Wildlife Sanctuaries, Biosphere Reserves, Reserved/Protected Forest, Important Bird Areas, World Heritage Sites, Archaeological Monuments etc.); surface water bodies; environmentally sensitive receptors (educational institutions, religious structures, medical facilities etc.) along the alignment has been identified during the survey. The Consultant conducted preliminary analysis of the nature, scale and magnitude of the impacts that the project is likely to cause on the environment, especially on the identified VECs.
- **Data Collection & Review:** Project information from available reports and documents were reviewed to understand the Project objectives, its main components, its boundary etc. After having the background information about the Project, the Project specific data pertaining to all facets of environment which include physical, ecological, and socioeconomic environment were collected from both through primary and secondary sources.
- **Environmental Screening & Scoping:** Screening has been conducted with specific consideration such as location of the sub-projects with respect to environmentally sensitive areas and critical issues to be studied in detail as well as provide important feedback to the design/technical team. It helped to modify the designs at locations to avoid impacts and to incorporate mitigation measures wherever the impacts were unavoidable due to other constraints. Based on the screening, scope of the study of the assignment i.e., scoping has been done.
- **Baseline Environmental Monitoring:** To establish the baseline environmental status primary monitoring was carried out for various environmental parameters such as Physical (meteorology, ambient air quality, ambient noise level, ground & surface water quality and soil quality), Biological and Social aspects along the proposed alignment. The monitoring locations were identified to determine baseline pollution levels, vicinity of habitation and identified sensitive receptors, land use, accessibility, etc. The collection and analysis of data for each component were carried out National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratory as per Ministry of Environment, Forest and Climate

Change (MoEF&CC) and Central Pollution Control Board (CPCB) prescribed guidelines. The results of the monitoring were compared with the relevant national standards.

- **Stakeholder Consultation:** Consultations on environmental issues have been carried out with relevant stakeholders like Forest, Wildlife, Local Villagers. Details of Public Consultations and discussion are given in Chapter 07.
- **Analysis of Alternatives:** With and without project scenarios have been assessed. The environmental analysis of alternatives mainly focuses on bypasses (if any), cross-sections, sources of materials from an environmental management perspective, selection of alignment, etc.
- **Prediction of Impacts & Mitigation Measures:** Assessment of potential impacts has been carried out based on the Project design and baseline environment data as collected from primary and secondary sources. Assessment of the environmental and social impacts were assessed to ascertain the direct and indirect impacts likely to be induced due to proposed development on land environment, air environment, noise environment, water environment and biological environment for both construction and operation phase. For each impact predicted, feasible and cost-effective mitigation measures have been suggested to reduce potentially significant adverse environmental and social impacts to acceptable levels.
- **Environment & Social Management Plan:** ESMP has been prepared as per the requirements of AIIB as required under ESS 1 (Environment and Social Standard-1) under ESF. ESMP includes management and redevelopment of borrow areas, quarries, construction camp; rainwater harvesting, storm water management practices; enhancement plan for water bodies; requirement of noise barrier, capacity building & training; environmental supervision, monitoring and auditing requirements, bill of quantities etc.

F. Structure of the Report

This Environmental Impact Assessment and Environment & Social Management Plan is a part of the Detailed Project Report of the "Sarthebari to Pathsala via Rampur" Project Road under the corridor A07.

EIA Report has been structured based on AIIB's ESF. The structure of the EIA Report is as follows:

- Executive Summary
- Chapter-1: Introduction
- Chapter-2: Legislative frameworks
- Chapter-3: Project Description
- Chapter-4: Baseline Environment
- Chapter-5: Analysis of Potential Environmental and Social Impacts & Mitigation Measure
- Chapter-6: Climate Change Impacts and Risks
- Chapter-7: Consultation Participation and Information Disclosure
- Chapter-8: Grievance Redress Mechanism
- Chapter-9: Environmental & Social Management Plan
- Chapter-10: Conclusion and Recommendations
- Annexures

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

An outline review of policies, regulations, and administrative framework at the National and State levels within which the Project is to be implemented are presented in this section. Regulations concerning procedures and requirements that may directly concern the project, the capacity of the concerned institutions and their ability to successfully implement the Environmental Management Measures have been addressed.

The Indian constitution makes environmental protection an explicit duty for every citizen by the statement, "It shall be duty of every citizen of India to protect and improve the environment including forests, lakes, rivers, wildlife, and to have compassion for living creatures". In addition, Govt. of India has laid out various policy guidelines, acts and regulations pertaining to sustenance of environment, and these have been presented in the following sections.

The laws, regulations, policies, and guidelines applicable to this project based on the location, design, construction and operation are summarized in the subsequent sections in the following order.

- National Environmental Legislation and Legal Administrative Framework,
- State Level Environmental Regulatory Framework,
- Social Regulatory Requirements of India and State,
- Summary of international treaties and other Environment Standards applicable to the Project, and,
- AIIB Environment and Social Framework and Standard.

A. National (India) Environmental Policies and Regulatory Framework

The national environmental policies that are relevant to PWD, Assam have been identified and highlighted below.

- National Environment Policy, 2006
- National Conservation Strategy and Policy Statement on Environment and Development, June 1992
- Policy Statement for Abatement of Pollution, 1992
- National Forest Policy, 1988
- Wildlife Conservation Strategy, 2002
- National Water Policy, 2002

The list of the environmental, health, safety and labour related legislations are given below. This list is indicative and not exhaustive. As the regulations are subject to change in the future, the Contractor shall be advised by PWD (EAP) to undertake a thorough review of regulations applicable on the project as part of the Environmental and Social Management process recommended in the Contract.

I. Environment (Protection) Act, 1986

To protect and improve overall environment, this umbrella act imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts.

It is a comprehensive act covering overall objective to improve environment by prevention and control of air, water, soil pollution etc. The Act is Effective since 1986.

II. EIA Notification, 2006

The EIA notification, 2006 imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts as indicated in the schedule to the notification, being undertaken in any part of India, unless prior environmental clearance has been accorded in accordance with the objectives of National Environment Policy and the procedure specified in the notification, by the Central Government or the State or Union territory Level Environment Impact Assessment Authority (SEIAA).

The notification has listed out the Projects or activities requiring prior environmental clearance under Category "A" and "B" based on the spatial extent of potential impacts, and the intensity of those impacts on human health and natural and manmade resources. Category "A" projects require prior environmental clearance from MoEF&CC on the recommendations of an Expert Appraisal Committee (EAC) and Category "B" projects require prior environmental clearance from State or Union territory Level Environment Impact Assessment Authority (SEIAA) on the recommendations of a State or Union Territory Level Expert Appraisal Committee (SEAC). In the absence of a duly constituted SEIAA or SEAC, a **Category "B"** project shall also be treated as a **Category "B"** project at Central Level.

List of projects requiring Prior Environmental Clearance is given in the "Schedule" of EIA Notification 2006 and its subsequent amendments. As per the Schedule, categorization of the highway project is as follow:

Project Activity	Category 'A'	Category 'B'	Conditions if any
Highways 7(f)	i) New National Highways; and ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40m on existing alignments and 60m on re-alignments or by-passes	i) All New State Highway Projects ii) **State Highway Expansion projects in Hilly terrain (above 1,000 m MSL) and or Ecologically Sensitive Areas.**	General Condition shall apply. Note: Highways include expressways

General Condition of the EIA Notification:

Any project or activity specified in Category 'B' will be appraised at the Central level as Category 'A', if located in whole or in part within 5 km from the boundary of:

(i) Protected Areas notified under the Wildlife (Protection) Act, 1972 (53 of 1972),

(ii) Critically Polluted areas as identified by the Central Pollution Control Board constituted under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974) from time to time,

(iii) Eco-sensitive areas as notified under sub-section (2) section 3 of the Environment (Protection) Act, 1986, and

(iv) Inter-State boundaries and international boundaries.

Proposed project is improvement and upgradation of existing State Highway. Project road is passing through plain terrain and is not passing through any ecologically sensitive area. ***Therefore, Environmental Clearance is not required for this project.***

Note: Environmental Clearance for Borrow area is not applicable for Road project as per EIA Notification no. S.O. 2224 (E) Dated 28th March 2020.

III. The Forest (Conservation) Act, 1980

The Forest (Conservation) Act, 1980 prohibits 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. Section 2 of the Act restricts the State Government on the de-reservation of forests or use of forestland for non-forest purpose. Section 3 of the Act empowers the Central Government to constitute an Advisory Committee (to advice the Government on the proposals received by it for the use of forest land for non-forest purposes).

The project road is not passing through any forest area. Therefore, the Forest Conservation Act shall not be applicable for this road.

IV. The 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 Wildlife Protection Act has allowed the government to establish several National Parks and Sanctuaries to protect and conserve the flora and fauna of the state. The provisions under this Act are as followed:

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. Further, the Wildlife (Protection) Amendment Act, 2002 proposed the setting up of National Board for Wildlife to promote the conservation and development of wildlife and forests. This is a statutory body with the prime minister as Chairperson. The Act also proposed the setting up of State Boards for Wildlife with the Chief Minister as the Chairperson. The Act specifies that no alteration of the boundaries of a National Park by the State Government shall be made except on a recommendation of the National Board for Wildlife.

The proposed alignment is not falling within 10 km radius of any eco-sensitive / protected area. Hence, Wildlife Clearance shall not be applicable for A07 road.

V. The Water (Prevention & Control of Pollution) Act, 1974

This act provides for the prevention and control of water pollution and the maintaining and restoring of the wholesomeness of water. The Act resulted in the establishment of the Central and State level Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities. The ***Contractor must obtain consent to establish & operate (CTE & CTO) for construction camps/plant site from the Assam State Pollution Control Board*** as per the Water (Prevention and Control of Pollution) Act of 1974, since it involves discharge of wastewater from construction camps.

VI. The Air (Prevention & Control of Pollution) Act, 1981

This act provides for prevention, control, and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant' which means any solid, liquid, or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. The SPCB is empowered to set air quality standards and monitor and prosecute offenders under The Air (Prevention and Control of Pollution) Act, 1981. The ***Contractor must obtain consent to establish & operate for construction plants from the Assam State Pollution Control Board*** as per the Air (Prevention and Control of Pollution) Act of 1981, since it involves operation of Hot Mix Plants and Diesel Generator Sets.

VII. Noise Pollution (Regulation and Control) Rules, 2000

The ambient noise quality standards in respect of noise for different areas/zones are specified in the Schedule of these rules. The State Government may categorize the areas into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards for different areas. As per these rules "an area comprising not less than 100m around hospitals, educational institutions and courts may be declared as silence area/zone". The noise levels in any area/zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule. The State Pollution Control Board is responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise. The proposed project in its construction and operation phases may attract the provisions of these rules if the noise level from the construction machinery and the vehicles are above the standards.

VIII. The Ancient Monuments and Archaeological Sites and Remains Act, 1958

This Act provides for the preservation of ancient and historical monuments and archaeological sites and remains of national importance and for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects. According to this Act, areas within the radii of 100m from the "Protected Monument" are designated as "Prohibited Areas" and from and from 200m is designated as "Controlled / Regulated Areas" (Figure 2.1).

No development activity (including building, mining, excavating, blasting) is permitted in the "prohibited areas". Development activities likely to damage the protected monument are not permitted in the "controlled/regulated areas" without prior permission from the Archaeological Survey of India (ASI) if the site/remains/ monuments are protected by ASI or the State Directorate of Archaeology. No archaeological monument/site found along the proposed alignment. Hence the provisions of this Act will not be applicable for this road.

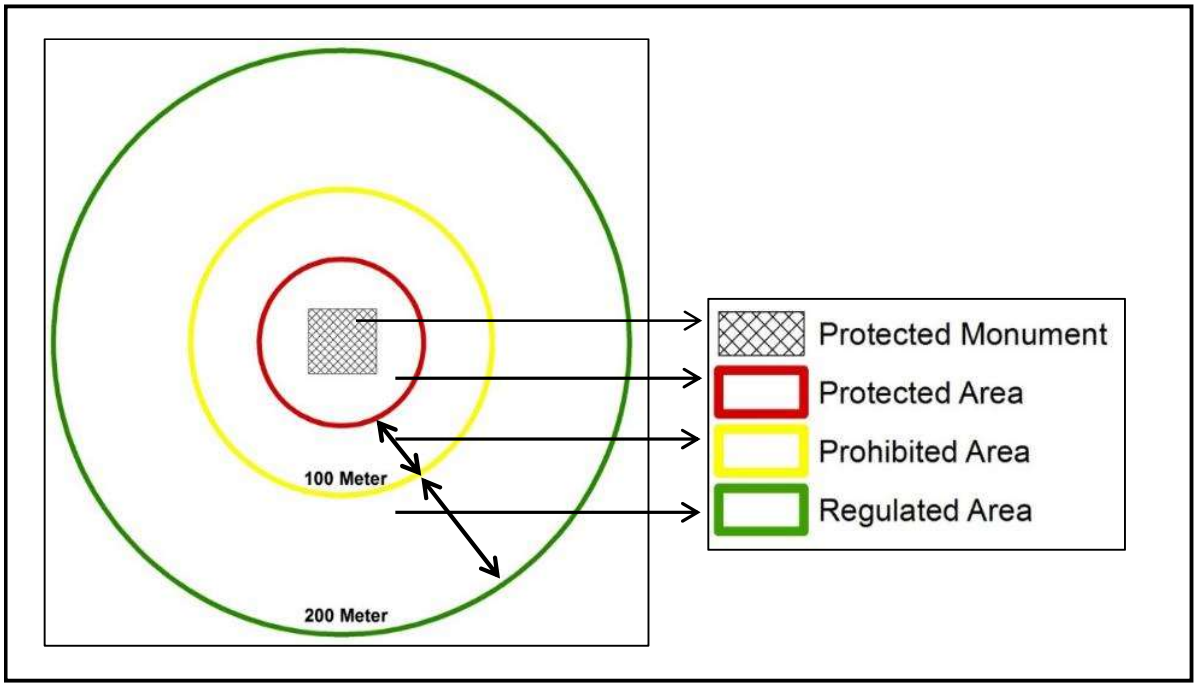


Figure 2.1 : Depiction of Protected Area Criteria for a Monument

IX. Disposal of Fly Ash Notification 2009 and amended on 25th January 2016

The main objective of the Fly Ash Notification is to conserve the topsoil, protect the environment and prevent the dumping and disposal of fly ash discharged from coal-based power plants. The fly

ash notification makes essential the use of fly ash in road construction activities. As per the amendment of the Notification dated 25th January 2016, "No agency, person or organization shall, within a radius of 300 km of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments with topsoil; The guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001 as amended from time to time regarding use of fly ash shall be followed and any deviation from this direction can only be agreed to on technical reasons if the same is approved by Chief Engineer (Design) or Engineer-in-Chief of the concerned agency or organization or on production of a certificate of 'fly ash not available' from the Thermal Power Plant(s)".

The amendment further states "The cost of transportation of ash for road construction projects within a radius of 100 km from a coal or lignite based thermal power plant shall be borne by the thermal power plant and the cost of transportation beyond the radius of 100 km and up to 300 km shall be shared equally between the user and the thermal power plant". The time period to comply with the provisions of the amendment by all concerned authorities was 31st December 2017.

Bongaigaon Thermal Power Station (NTPS) is approx. 114 km from the project road in West direction from the project road in East direction from the project road A-07. Hence, the provisions of the said notification are applicable for the project as per MoEF&CC Notification No. 225, 25th Jan 2016.

X. Other Legislations

The other legislations relevant to the project include The Motor Vehicles Act, 1988, Workmen Compensation Act, 1923, The Public Liability Insurance Act, 1991, The Explosives Act (& Rules), 1884 (revised in 1983), Contract Labour (Regulation & Abolition) Act, 1970, Minimum Wages Act, 1948, Payment of Wages Act, 1936, Equal Remuneration Act, 1979, Child Labour (Prohibition & Regulation) Act, 1986, The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and Hazardous and Other Wastes (Management, and Transboundary Movement) Rules, 2016.

B. State Level Environmental Regulatory Framework

I. Assam Ancient Monuments and Records Act, 1959

Provide provisions for the preservation and protection of ancient and historical monuments and records in Assam. No archaeological monument/site found along the proposed alignment. Hence the provisions of this Act will not be applicable for this road.

II. Forest related Acts and Rules

- Assam Forest Protection Force Act, 1986
- Assam Compensatory Afforestation Fund Rules, 1994; and GOA Guidelines for Compensatory Afforestation, 2000
- Assam Forest Regulation, 1891 including Assam Forest Regulation (Amendment) Act, 1995
- The Assam Forest (Removal and Storage of Forest Produce) Regulation Act, 2000
- Assam Revolving Fund (Forest Department) Rules, 2000
- The Assam Forest (Forum of Appeal) Rules, 2001
- Assam Forest (Rewards) Rules, 2002
- Assam (Control of Felling and Removal of Trees from Non-Forest Lands) Rules, 2002 (Amendment) Rules, 2019
- Assam Forest Policy, 2004
- The Assam Joint Forest Management Rules, 2004

- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA 2006)
- Forest Rights Act, 2006

Under the Assam Forest Regulation, 1891 including Assam Forest Regulation (Amendment) Act, 1995, forests may exist in at least four categories: Reserved Forests, Village Forests, Un-classed State Forests and those forests and wasteland which are not the property of the government. The term "unsettled tracts" has also been used in the Regulation and the State government has been empowered to reserve trees in such unsettled tracts.

Rules under Assam (Control of Felling and Removal of Trees from Non-Forest Lands) Rules, 2002 prescribe how tree plantations raised in nonrecorded forest areas by individuals or institutions are to be governed.

Assam Forest Policy has the following objectives: (i) maintain environmental stability, (ii) conserve the natural heritage of the state, (iii) provide livelihood support and alternatives to forest fringe dwellers, (iv) increase the tree cover of the State, (v) meet the livelihood needs of rural poor and tribes in fuel wood and NTFP, (vi) demarcate all forest lands, irrespective of ownership, (vi) promote research on forest related topics and (vii) encourage the conservation of the genetic diversity and the traditional ecological knowledge of Assam. Policy advocates community participation.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA 2006) offers guidelines to protect wildlife, forest, and biodiversity, prevent destructive practices affecting their cultural and natural heritage and regulate access to community forest resources.

III. Assam Biodiversity Rules, 2010

- Prescribes tasks for the Assam State Biodiversity Board with regards to the Biodiversity Act 2002.
- Assam National Park Act, 1968
- It is expedient to provide by law for the constitution and management of National Parks, the preservation of fauna and flora therein and other incidental matters.
- Wildlife Protection Rules, 1980

Table 2-1: Applicability Review of the Regulatory Environment Framework

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
1	The Environmental (Protection) Act. 1986 (various amendments)	The Environmental (Protection) Act, 1986 is the umbrella legislation providing for the protection of environment in the country. This Act provided for the Environment (Protection) Rules, which were formulated in 1986 and various other successive notifications.	**Yes**	Applicable as the Project construction will lead to environment pollution due to air and noise emission, generation of waste and other impacts.
2	The EIA Notification 2006, and subsequent amendments	Identifies all new national highways, expansion of national highways projects greater than 100 km involving additional RoW or land acquisition greater than 40m on existing alignments and 60m on re-alignments or by-passes (item 7 (f) of schedule) as one of the Projects requiring prior clearance. Opening of new Quarry Area (including excavation of Riverbed)	**No**	Proposed project is improvement and upgradation of existing State Highway. Project road is passing through plain terrain and is not passing through any ecologically sensitive area. Therefore, Environmental Clearance is not required for this project. ***Note:*** *Environmental Clearance for Borrow area is not applicable for Road project as per EIA Notification no. S.O. 2224 (E) Dated 28th March 2020.*
3	Forest (Conservation) Act, 1980 Forest Conservation Rules, 2003 and its Amendments Assam Forest Protection Force Act, 1986	The Forest Conservation Acts and Rules enforced at Centre and State level mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests.	**No**	The Project Road is not passing through any forest area. Therefore, the Forest Conservation Act shall not be applicable for this road.
4	Wildlife Protection Act, 1972 and Wildlife (Protection) Amendment Act of 2002	All projects/activities being conceptualized, developed, implemented and/or funded within wildlife sanctuaries or national parks should take cognizance and comply with the provisions of these rules and obtain required clearances from the National Board for Wildlife /Chief Wildlife Warden. These rules deal in licencing and permitting for hunting and	**No**	The proposed alignment is not falling within 10 km radius of any eco-sensitive / protected area. Therefore, Wildlife Clearance shall not be applicable for A07 road.

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
	Assam Wildlife Protection Rules, 1980	management of protected areas in State.		
5	Wetlands (Conservation and Management) Rules, 2017	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	**No**	The Project and Associated Facilities will not affect any Wildlife Sanctuaries, National Parks, designated Ramsar site and/or Important Bird Area (IBA).
6	The Air (Prevention and Control of Pollution) Act. 1981	Empowers SPCB to set and monitor air quality standards and to prosecute offenders, excluding vehicular air and noise emission.	**Yes**	Applicable since air emission is expected from project activity during construction phase. The contractor engaged for the Project shall obtain the permission in form of consent to establish & operate (CTE & CTO) from Assam State Pollution Control Board for, since the Project activities may involve operation of Hot Mix Plants and Diesel Generator Sets.
7	Noise Pollution (Regulation and Control) Act, 1990 Guidelines for Noise and Vibrations, Sept. 2019	The Rules stipulate ambient noise limits during daytime and night time for industrial, commercial, residential, and ecologically sensitive areas. The rules apply both during the construction and operation of the Project. Violation of the standards for assessing the noise quality due to the Project will lead to penalty as under the EP Act 1986. the Project. Violation of the standards for assessing the noise quality due to the Project will lead to penalty as under the EP Act 1986.	**Yes**	Applicable since noise emission is expected from project activity during construction phase. Construction machineries and vehicles to conform to the standards for construction
8	The Water (Prevention and Control of Pollution) Act, 1974	Central and State Pollution Control Board to establish / enforce water quality and effluent standards, monitor water quality, prosecute offenders, and issue licenses for	**Yes**	Applicable since water pollution is expected from project activity during construction phase.

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
		construction / operation of certain facilities.		The contractor engaged for the Project shall obtain the permission in form of consent to establish & operate (CTE & CTO) from Assam State Pollution Control Board for construction camps/plant site before commencement of the construction period.
9	Ancient Monuments and Archaeological sites and Remain Act 1958	To protect and conserve cultural and historical remains, the act designate area within the radius of 100 m and 300 m from the "protected property" as "protected area" and "controlled area" respectively. No development activity (including building, mining, excavating, blasting) is permitted in the "protected area" and development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI) if the site / remains / monuments are protected by ASI or the State Directorate of Archaeology if these are protected by the State.		The Project and Associated Facilities do not affect any areas subject applicable to the act however, in chance of any archaeological remains found during excavation. Project Proponent will notify the incident to the nearest branch of Archaeological Survey of India.
	Assam Ancient Monuments and Records Act, 1959	Provide provisions for the preservation and protection of ancient and historical monuments and records in Assam.		
	Antiquities and Art Treasures Act (No. 52),1972	Control of moveable cultural property consists of antiquities and art treasures. Regulate the export and trade of antiquities and art.		
10	Hazardous and Other Wastes (Management, and Transboundary Movement) Rules, 2016 and its amendments.	These Rules outline the responsibilities of the generator, transporter, and recycler of the hazardous wastes for handling and management in a manner that is safe and environmentally sound. Project proponent is required to	**Yes**	The Project activities will result in generation of hazardous waste therefore, contractor/s engaged for the Project need to obtain the

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
		obtain consent from State Pollution Control Board for generation and storage of hazardous waste like transformer oil, etc. irrespective of quantity of waste. As per the law the occupier and the operator of the facility should be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.		prior permission/s from competent authority before installation.
11	Disposal of Fly Ash Notification 2009 and amended thereof	MoEFCC has issued various notifications for fly-ash utilization. As per the latest notification of MoEFCC, it is mandatory to use fly-ash in construction of roads or flyover embankments within a radius of 300 km of thermal power plants.	**Yes**	Bongaigaon Thermal Power Station (NTPS) is approx. 114 km from the project road in West direction from the project road in East direction from the project road A-07. Hence, the provisions of the said notification are applicable for the Project.
12	Construction and Demolition Waste Management Rules, 2016 and Solid Waste Management Rules 2016	Safe disposal of construction waste and municipal solid waste	**Yes**	Construction waste shall be generated during construction phase, which will be utilize for base camp area and haul road. Municipal waste shall be generated from labour camp area, which shall be dispose to the Govt. designated dumping site or handed over to the municipal collection facility in the Project area.
13	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) BOCW Act, 1996	This Act provides for safety, health and welfare measures of buildings and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare	**Yes**	Project proponent to ensure through its Contractors that basic amenities are provided to the labours and all vendors employed have valid labour license.

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
		amenities like drinking water, latrines, urinals, crèches, first aid, canteens, and temporary living quarters within or near the work site. This Act also requires application of the following: Building or other construction workers' (regulation and Employment Conditions of Service) Central Rules 1998 & Workman's compensation Act, 1923 to buildings and other construction workers. These will be followed by contractor & developer during construction and operation phase.		
14	The Explosives Act (& Rules) 1884 (1983) its subsequent amendments.	Sets out the regulations as to regards the use of explosives and precautionary measures while blasting and quarrying.	**Yes**	Use of blasting materials if required for project and storing of Diesel / Petrol at project site. Contractor engaged need to obtain the permission before installation.
15	The Motor Vehicle Act. 1988 and its amendments (2019).	Empowers State Transport Authority to enforce standards for vehicular pollution. From August 1997 the "Pollution Under Control Certificate is issued to reduce vehicular emissions.	**Yes**	All vehicles used for construction will need to comply with the provisions of this act. Contractor engaged for the Project need to obtain Pollution Under Control Certificate for vehicles to be used for project before commencement of the construction.
16	Public Liability and Insurance Act, 1991	Protection to the general public from accidents due to hazardous materials.	**Yes**	The Project will involve storage of hazardous materials like Bitumen, blasting and/or other hazardous activities.
17	The Child Labour (Prohibition and Regulation) Act, 1986	A child is defined as a person who has not completed 14years of age. The Act prohibits employment of children in certain occupation and processes (part II, Section 3). The Act also specifies conditions of work for children, if	**Yes**	The project proponent is required to ensure compliance of the act conditions by ensuring that no child labour, bonded

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
	The Bonded Labour System (Abolition) Act 1976	permitted to work under section 7 and 11. The Bonded Labour System (Abolition) Act 1976: States that all forms of bonded Labour stand abolished, and every bonded Labour stands freed and discharged from any obligations to render any bonded labour.		labour/forced labour will be engaged at site for construction or operation works either directly or by the contractors/sub-contractors. Include a clause in the subcontractor agreements prohibiting employment of child labour.
18	Minimum Wages Act, 1948	Minimum Wages Act, 1948 requires the Government to fix minimum rates of wages and reviews this at an interval of not more than five (05) years. The minimum wage as prescribed for the industry by the government is required to be paid by the employers to the staff.	**Yes**	The project proponent is required to ensure that all the contract workers are provided with condition of services, rate of wages, holidays, hours of work as stipulated in the rules as per applicability and tenure of service, by the deputed contractor.
19	The Workmen's Compensation Act, 1923	The Workmen's Compensation Act, 1923 requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act.	**Yes**	The project proponent is required to ensure through its contractors in case of any accident/ injury/ loss of life the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the Project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
				of compensation and wages.
20	The Contract Labour (Regulation and Abolition) Act, 1970 and Rules	As per the contract Labour act, every principal employer is required to get the establishment registered before employing any contract Labour. The contractors are also required to provide at minimum amenities like canteen, urinals, restrooms or alternate accommodation (if night halting Labour), first aid, safe drinking water, etc. in case of contractor's failure to provide these amenities, the principal employer is liable to provide such amenities at its cost.	**Yes**	All vendors will be employed including contractors should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Master roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty. Failure to comply results in financial penalty. Project proponent through its contractors should also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.
21	ESI Act, 1948 (Employees State Insurance Act, 1948)	The ESI Act provides for certain benefits to employees in case of sickness, maternity, and employment injury. Applicable to employees with less than or equal to a maximum of basic salary of INR 15000 per month.	**Yes**	Contractors to ensure compliance as per the applicability.
22	Interstate Migrant workmen (Regulation of employment and condition of service) Act, 1979	This act helps the government to keep a track about the number of workers employed by the establishments and provide a legal basis for improving the conditions of the	**Yes**	The Project may employ migrant labour therefore, contractors to ensure compliance as per the

S. N.	Act / Regulation	Relevance	Applicability (Yes / No)	Reason for Applicability
		migrant workers. As per this law, the contractors deploying the migrant workers must provide terms and conditions of the recruitment to the workers mainly related to the remuneration payable, hours of work, fixation of wages and other essential amenities. This law is applicable to all the establishments employing five or more migrant workmen from other states. In addition to this, this law is also applicable to contractors who have employed five or more inter-State workmen.		applicability of the Act and specifically guidelines imposed by the State and Center Government during COVID 19 Pandemic.
23	Equal remuneration act, 1976	Act provides for payment of equal wages for work of same and similar nature to male and female workers and for not making discrimination against female employees in the matters of transfers, training and promotion etc.	**Yes**	Compensation to all workers (own and vendors) shall be paid equally as specified by Government of India. No discrimination on payments to the workers should be made due to gender, religion, race, age, etc.
24	Sexual harassment of women at workplace act, 2013	An Act to provide protection against sexual harassment of women at workplace and for the prevention and redressal of complaints of sexual harassment and for matters connected therewith or incidental thereto.	**Yes**	Project proponent is required to sterically enforce the provision of the Act for the protection of women workforce in the Project.

Various permissions related to environment are required for the Project during Pre-construction, Construction and Operation phases of the Project. The key permissions required for the Project are listed in **Table 2.2**.

Table 2-2: Key permissions required for the Project

Permission/Clearance /Permit	Acts/Rules	Concerned Agency	Stage
Consent to establish and Consent to Operate permission for the Project.	The Water (Prevention and Control of Pollution) Act, 1974, amended 1988 and The Air (Prevention and Control of Pollution) Act 1981, amended 1987	Assam Pollution Control Boards	Pre-Construction
Generation, handling, storage, and transportation of hazardous waste	Hazardous and other wastes (management and trans boundary movement) rules, 2016	Assam Pollution Control Boards	Construction and Operation
Permission for extraction of ground water.	Environment (Protection) Act, 1986	DJB/NDMC/CGWA	Pre-construction (as the case may be) / and for operation.
Permission for felling trees	Tree Preservation Act	Forest Department	Pre-construction
Construction and Demolition Waste Management Plan	Construction and Demolition Waste Management rules, 2016	Local Authority	Pre-construction

C. International Treaties and Relevance to the Project

1. India has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the RAMSAR Convention, the Rio de Janeiro Convention on Biodiversity Diversity, and the Kyoto Protocol on Climate Change. There are 20 major global Multilateral Environmental Agreements (MEAs) to which India is a signatory. There are three MEA related to Nature Conservation that are applicable to the project as listed in the Table 2-3.

Table 2-3: Applicable MEAs Related to Nature Conservation for the Asom Mala Project

Sl. No	Nature Conservation	Relevancy to Project
1	Ramsar Convention on Wetlands	Yes, Protection of significant wetland and prevention of draining or filling during construction
2	CBD (Convention on Biological Diversity)	Yes, Conservation of biological diversity (or biodiversity) and sustainable use of its components.
3	IUCN (International Union for Conservation of Nature)	Yes

I. Ramsar Convention on Wetlands

This convention was signed by India in 1981 and ratified in February 1982. The convention requires protection of identified wetlands of international importance as identified under Ramsar convention. Assam has a freshwater lake (**Dipor Beel**), designated as a wetland under the Ramsar Convention (November 2002).

Ramsar notified lake in Assam is situated south-west of Guwahati city in Kamrup District, and is not affected by or falls in close proximity to the Project or Associated Facilities

II. Convention on International Trade in Endangered Species of Wild Flora and Fauna

This convention was signed by India in 1976. The Convention aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

III. Convention on Biological Diversity

According to Convention on Biological Diversity, States, in accordance with the Charter of the United Nations and the principles of international law, have the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

India is a party to the Cartagena Protocol on Bio safety to Convention on Biological Diversity, which aims to ensure the safe handling, transport and use of living modified organisms resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health.

IV. Convention on Migratory Species

Convention on Migratory Species, also known as the Bonn Convention, aims to conserve terrestrial, aquatic, and avian migratory species whilst recognizing that States must be the protectors of species living within or pass through their corresponding national jurisdictions. Hence, the Parties to the Convention adhere to strictly protecting such species, conserving or restoring the places where they live.

India is contracting party to the convention on conservation of migratory species of wild animals and migratory species.

V. International Union for Conservation of Nature and Natural Resources (IUCN)

Some animals and plant species found in Assam are included in the IUCN Red List and Category II category. The Projects will not affect these sensitive areas. The Project is not expected to alter bird migration or affect any species on the IUCN list.

VI. Convention Concerning the Protection of the World Cultural and Natural Heritage

The Convention concerning the Protection of World Cultural and Natural Heritage was adopted by the General Conference of UNESCO on 16 November 1972. The same General Conference adopted on 16 November 1972 the Recommendation concerning the Protection, at National Level, of the Cultural and Natural Heritage.

Kaziranga, Assam located in the flood plains of the Brahmaputra River's south bank, was declared a World Heritage Site by UNESCO in 1985 for its unique natural environment, is not affected by or falls in close proximity to the Project or Associated Facilities

D. Social Regulatory Requirements of India and State

- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013, Govt. of India.
- RFCTLARR (Removal of Difficulties) Order, 2015.
- The Assam Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015.
- The Constitution (73rd Amendment) Act, Part IX of the Constitution of India, 1992.
- Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002.
- The Constitution (Eighty-Ninth Amendment) Act, 2003.
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
- National Tribal Policy, 2006.

These acts are discussed and detailed out in Social Impact assessment prepared for the Project.

E. AIIB Environment and Social Framework and Standard

AIIB recognizes that environmental and social sustainability is a fundamental aspect of achieving development outcomes consistent with its mandate to support infrastructure development and interconnectivity.

- AIIB screens and categorizes each project based on environmental and social impacts anticipated due to project,
- Identifies mitigation measures to avoid, minimize, mitigate and/or offset impacts,
- Includes provisions for disclosure of information and public consultation, and
- Ensure that Grievance Redress Mechanism (GRM) is in place for every project and is accessible to the general public/ community.

The AIIB Environmental and Social Framework (ESF), 2016 and its amendment 2019, includes an Environmental and Social Policy (ESP) and Environmental and Social Standards (ESSs).

The objective of ESF is to facilitate achievement of these development outcomes, through a system that integrates sound ESF for each project. The key objectives of the ESF are:

- Ensure the environmental and social soundness and sustainability of each project,
- Support integration of environmental and social aspects of projects into the decision-making process by all parties,
- The Environment and Social Framework applies to all projects.

The EIA study is carried out as per the requirement of AIIB's ESP which sets forth mandatory environmental and social requirements for each Project and ESSs which set out more detailed mandatory environmental and social requirements relating to the following:

a) ESS 1: Environmental and Social Assessment and Management,

b) ESS 2: Involuntary Resettlement and

c) ESS 3: Indigenous Peoples

Table 2-4: Environmental and Social Standards of AIIB

Environmental and Social Standards (AIIB)	Objective & Brief Description
ESS 1: Environmental and Social Assessment and Management	Aims to ensure the environmental and social soundness and sustainability of projects and to support the integration of environmental and social considerations into the project decision-making process and implementation. This is applicable if the project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. It defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.
ESS 2: Prevent/ Minimize Involuntary Resettlement	It is applicable if the project's screening process reveals that the project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and

Environmental and Social Standards (AIIB)	Objective & Brief Description
	natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. It defines the detailed requirements of resettlement planning of the projects involving involuntary resettlement. No involuntary resettlement is proposed for the project. Hence, ESS-2 is not applicable for the proposed project road.
ESS 3: Protection of vulnerable/ Indigenous Peoples	This is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the project, and are likely to be affected by the project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others. (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories. (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. It defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project.

AIIB's Environmental and Social Exclusion List: AIIB decided not to finance Projects that it determines do not comply with the ESP and ESSs. The Bank will not knowingly finance a Project that: (a) either involves or results in forced evictions; or (b) involves activities or items specified in the list set forth in the Environmental and Social Exclusion List of AIIB's Environmental and Social Framework, February 2016 (amended 2019).

The AIIB classifies all its projects into four categories-

- The project is categorized as Category A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented and requires the client to conduct an Environmental Impact Assessment (EIA) with Environmental and Social Management Plan (ESMP).
- A project is categorized as Category B when: it has a limited potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are site-specific; and can be successfully managed using good practice in an operational setting and requires clients to conduct an initial review of the environmental and social implications of the Project.
- A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts and the client is required to prepare a review of the environmental and social aspects of the Project.

- A Project is categorized FI if the financing structure involves the provision of funds to a financial intermediary (FI) for the Project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed subprojects. The Bank requires the FI to develop and apply an appropriate ESMS that is proportional to the environmental and social risks associated with the Bank-supported portfolio, is consistent with this ESP, excludes from Bank support activities covered in the ESEL and incorporates applicable provisions of the ESSs.

Based on Environmental and Social Assessment Study proposed project is tentatively assigned as Category "**B**". To minimize Environmental and Social impacts, widening of the proposed road is proposed following the exiting alignment except realignment/bypass at 2 locations (Ch. 4+800 to 5+700 & Ch. 14+650 to 17+653) and curve improvements.

F. Applicable Environment Standards

The Central Pollution Control Board (CPCB) has stipulated different environmental standards with respect to Ambient Air Quality, Noise level, Water and Wastewater for the country under Environment (Protection) Act, 1986. The World Bank, Environment, Health and Safety (EHS) guidelines shall also be applicable for best international practices. Some of these standards shall only be applicable either during construction phase or in operation phase of the Project. The applicable environmental standards for the proposed project have been discussed in following sections.

I. Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given in **Table 2.4** below. Detail standard with methodology is provided as **Annex-2**.

Table 2-5: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
Sulfur Dioxide (SO_2), µg/m³	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2), µg/m³	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM10, µg/m³	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or PM2.5, µg/m³	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m³	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m³	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO), mg/m³	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m³	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m³	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m³	Annual*	1	1

Pollutant	Time Weighted Average	Concentration in Ambient Air	
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

** Annual arithmetic means of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval.*

*** 24 hourly or 8 hourly or 01 hourly values as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.*

II. Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table 2.5** and **Table 2.6** as below and detail standard with methodology is provided as **Annex- 3**.

Table 2-6: Primary Water Quality Criteria for Designated-Best-Use-Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliform Organism MPN/100ml shall be 50 or less. pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days at 20 °C 2mg/l or less
Outdoor bathing (Organized)	B	Total Coliform Organism MPN/100ml shall be 500 or less. pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20 °C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliform Organism MPN/100ml shall be 5000 or less. pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20 °C 3mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25 °C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

Table 2-7: Drinking Water Standard (IS 10500: 2012)

S. N.	Parameters	Unit	IS 10500:2012	
1	pH	--	6.5-8.5	No Relaxation
2	Turbidity	NTU	1	5
3	EC	µMho/cm	Not Specified	Not Specified

S. N.	Parameters	Unit	IS 10500:2012	
4	TSS	mg/l	Not Specified	Not Specified
5	TDS	mg/l	500	2000
6	Total Alkalinity as $CaCO_3$	mg/l	200	600
7	Chlorides as Cl^-	mg/l	250	1000
8	Sulfates as SO_4^-	mg/l	200	400
9	Nitrates as NO_3	mg/l	45	No Relaxation
10	Phosphates as PO_4	mg/l	Not Specified	Not Specified
11	Total Hardness as $CaCO_3$	mg/l	200	600
12	Calcium as Ca	mg/l	75	200
13	Magnesium as Mg	mg/l	30	100
14	Sodium as Na	mg/l	Not Specified	Not Specified
15	Potassium as K	mg/l	Not Specified	Not Specified
16	Fluoride as F^-	mg/l	1.0	1.5
17	Iron as Fe	mg/l	0.3	No Relaxation
18	Phenolic Compounds	mg/l	0.001	0.002
19	Cyanide as CN-	mg/l	0.05	No Relaxation
20	Residual Chlorine as Cl^-	mg/l	0.2	1.0
21	Cadmium as Cd	mg/l	0.003	No Relaxation
22	Total Chromium as Cr	mg/l	0.05	No Relaxation
23	Lead as Pb	mg/l	0.01	No Relaxation
24	Zinc as Zn	mg/l	5	15
25	Manganese as Mn	mg/l	0.1	0.3
26	Copper as Cu	mg/l	0.05	1.5
27	Nickel as Ni	mg/l	0.02	No Relaxation
28	Color	Hazen	5	15
29	Taste	-	Agreeable	Agreeable
30	Odor	-	Agreeable	Agreeable
31	Boron	mg/l	0.5	1.0
32	Anionic Detergents	mg/l	0.2	1.0
33	Mineral Oil	mg/l	0.5	No Relaxation
34	Aluminum as Al	mg/l	0.03	0.2
35	Mercury as Hg	mg/l	0.001	No Relaxation

Source: Indian Standard Drinking Water-Specification (Second Revision), May 2012

III. Ambient Noise Standards

Noise standards notified by the MoEF&CC vide gazette notification dated 14th February 2000 based on the A- weighted equivalent noise levels (L_{eq}) are presented in **Table 2.7** as below whaile detail standard with methodology is provided as **Annex-4**.

Table 2-8: Ambient Noise Standards

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

*Note: * Day time is from 6 am to 10 pm, Nighttime is 10 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 vehicle horns, loudspeakers and bursting of crackers are banned in these zones.*

3. PROJECT DESCRIPTION

A. The Project

The project road corridor is approx. 17.653 km in length, and it is situated in Barpeta and Bajali districts which starts at Sarthebari, at Y-intersection of SH-9 and SH-9A and ends at Pathsala town. The project stretches passes through the Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Pathsala villages/towns. The carriageway width of the road varying from Single Lane (3.75m) to Intermediate Lane (5.5m) with earthen shoulder of approx. 1.0m to 2.4m. The entire stretch of the project road is passing through plain terrain.

B. Location and Features of the Project Road

The project road starts at Sarthebari (26°22'6.47"N26°22'6"N, 91°13'27.88"E79°13'28"E), at Y-intersection of SH-9 and SH-9A and ends at Pathsala NH-27 Nr Raipur village (26°30'15.05"N26°30'19"N, 91°12'23.68"E79°10'40"E) of the project road. The coordinates start at 26°22'6"N, 79°13'28"E and end at 26°30'19"N, 79°10'40"E of the project road.

a) Right of Way (RoW)

As per the revenue village maps collected the existing RoW varies from 10m to 20m.

b) Carriageway

The carriageway width of the road is predominantly single lane with earthen shoulder of approx. 0.5m to 2.0m and at some location it is Intermediate Lane.

c) Pavement Condition

The existing pavement of the road is flexible type and condition of the road varies from poor to Fair.

Figure 3.1 : Photographs of the pavement condition of the Project Road A-07







d) Existing Bridges

There are 02 Major bridges, and 06 minor bridges present in this project corridor A07 i.e. from Sartebari to Pathshala town Road. A list of major and minor bridges indicating locations and type is given as below Table 3.1.

Table 3-1: List of Existing Bridges

Sl No	Existing Chainage (Km)	Total length (m)	Span arrangement	Structure Type	Bridge Type Minor/ Major	Existing Carriageway Width (m)	Remarks
1	0+700	31.2	1x31.2	PSC I Girder	MNB	7.5	Good Condition
2	0+843	22.7	1x22.7	RCC I Girder	MNB	7.5	Good Condition
3	2+220	45	1x45.0	PSC I Girder	MNB	7.5	Good Condition
4	2+987	34	2x17.0	RCC I Girder	MNB	7.5	Good Condition
5	4+700	123.5	1x20.5 + 1x22.4 + 1x23.2 + 1x32.8 + 1x22.9	Balance Cantilever + RCC Girder + PSC girder	MJB	3.75	Very Poor Condition
6	10+300	63.0	2x31.5	PSC I Girder	MJB	7.5	Good Condition
7	12+428	22.2	1x22.2	RCC I Girder	MNB	7.5	Good Condition
8	15+725	21.6	1x21.6	RCC I Girder	MNB	7.5	Good Condition

e) Terrain

The terrain along the project stretch is predominantly plain. The existing road geometry has few curves with inadequate sight distances with sharp radii which require geometric improvements. The existing road embankment is of approx. 0.30m to 1.62m. Terrain of project road is varying from 40m to 54m avg terrain is 46m (Figure 3.2).

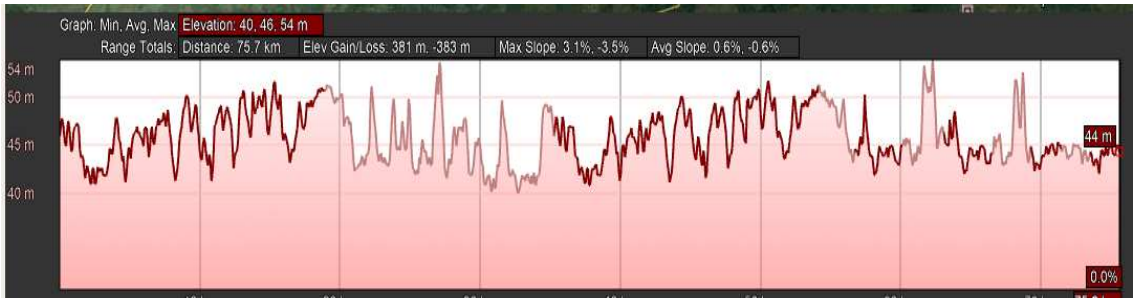


Figure 3.2 : Terrain of the Project Road A-07

f) Roadside Development – Villages / Towns

The alignment of project road passes through few built up sections. These urban/village stretches act as bottlenecks to the free flow of traffic due to mixed local and through traffic, presence of ribbon development on either side and uncontrolled access from side road/crossroads, lack of traffic segregation and pedestrian facilities. The list of built-up towns, villages and their locations are shown in Table 3.2.

Table 3-2: List of Settlements

Sl. No.	Existing Chainage (km)		Settlements
	From	To	
1	0.000	1.000	Sarthebari
2	1.000	1.600	Gomura
3	3.700	4.300	Batiya
4	5.000	6.000	Lankeparakuchi
5	6.000	6.500	Parakuchi
6	6.800	8.150	Rampur
7	8.800	10.100	Bongaon
8	11.100	12.600	Bugan
9	13.000	14.000	Tapattari
10	14.100	15.100	Malipara
11	15.100	15.700	Dubi
12	15.700	16.300	Dubi Chowk
13	16.900	17.653	Raipur/Dharmatala

Figure 3.3 : Photographs along the Project Road and bypass section



Railway Line Crossing Ch. 16+100



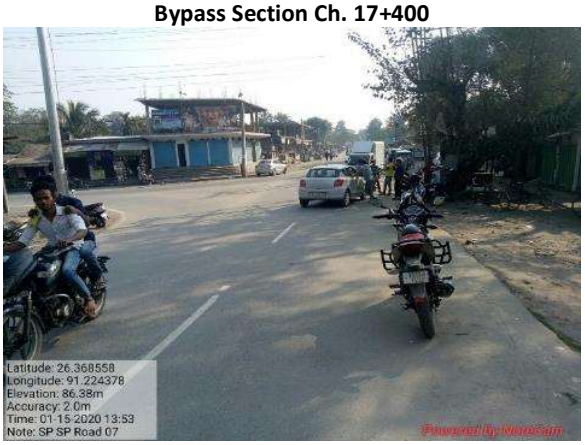
Bypass Staring Point 14+600



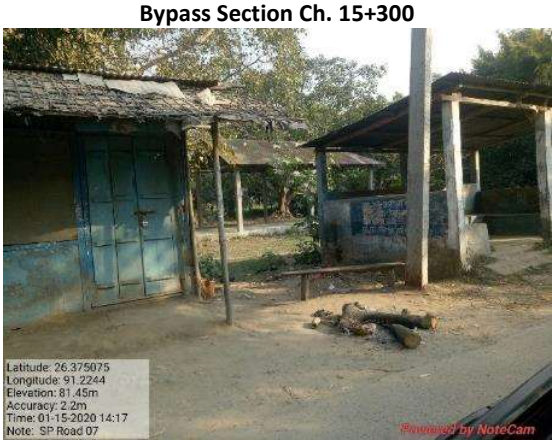
Bypass Section Ch. 17+400



Bypass Section Ch. 15+300



Starting Point Ch. 0+000



Settlement Ch. 0+700

g) Existing Traffic

At the beginning of the study, a detailed reconnaissance survey has been carried out to identify traffic homogeneous sections so that each homogeneous section will have similar traffic volume and composition. Based on the above, the length of total project road has been considered as one homogeneous section. The details of the homogeneous sections are discussed below in the Table 3.3.

Table 3-3: Homogeneous Traffic Section

Section No	Starting		Ending		Length (km)
	Existing Chainage	Place	Existing Chainage	Place	
I	Ch. 0.000	Sarthebari (SH 9 Jn)	Ch. 17.653	Pathsala (Near Rly station)	17.653

The average daily traffic (ADT) has been converted to average annual daily traffic (AADT) using seasonal correction factors. The AADT is the input for various analyses like traffic forecast, capacity augmentation, pavement design, economic and financial analysis etc. Table 3.4 below gives the ADT and AADT plying on the project road.

Table 3-4: Summary of ADT & AADT at Count Locations

Sl No.	Location	ADT		AADT	
		Nos.	PCUs	Nos.	PCUs
1	Km 8.700	1694	1080	1694	1080

h) Drainage

Unlined Drains are present at few locations. Cover Drains/ Lined Drains are present at few built up locations and the details are given in below in Table 3-5.

Table 3-5: Covered Drains Locations

Sl. No.	Drains Location		Covered/Lined Drain
	From (km)	To (km)	
1	0.100	0.300	Covered

i) Submergence Locations

Overtopping is observed at Two bridges at chainage 3.100 and Ch 3.680 respectively, where bridge approaches overtop.

j) Major and Minor Intersections

There are 19 minor junctions and 6 major junctions are present along the existing road and the details are given in design report.

C. Trees & Vegetation

Request to the District Forest Officer (DFO) has been submitted for joint inspection. Tree enumeration details will be submitted post joint inspection. Approx. 999 Nos of trees found along the project road RoW.

Figure 3.4: Tree along the project Road



D. Water Bodies

Kaldia and Buradiya/Tihu river is crossing the project road. There is presence of some water bodies in the forms of ponds and nallahs/seasonal streams over which hydrological structures shall be provided/rehabilitated based on project requirement.

Figure 3.5: Water body along the project road



Buradiya/Tihu River (Ch. 4+700)



Kaldia River (Ch. 10+400)


Pond (Ch. 0+300, RHS)



Pond (Ch. 0+900, RHS)


Pond (Ch. 6+800 RHS)



Pond (Ch. 9+500 LHS)



Pond (Ch. 12+500 LHS)

E. Engineering Surveys and Investigations

A detailed reconnaissance survey has been conducted on the total section of the project road and an assessment of possible alignment change at places, if required, has also been made. Detailed features such as land-use, habitation, water routes, canals, intersecting roads, railway lines, Structure details (Major/Minor Bridge and Culverts details), utilities such as OFC Cables, electrical lines (HT/LT), etc. have also been recorded. This has enabled the Consultants to visualize the possible problems likely to be encountered in surveys and investigations, design, and execution of the project. The detailed ground reconnaissance of project influence area has been utilized for planning and programming the detailed surveys and investigations. Topographic survey maps of the project area and other relevant information collected. Surveys has been carried out at 100m intervals along the project road to collect details of all the features of the existing road and pavement. The following aspects have essentially been covered:

- Terrain
- Land use (built-up/agricultural/forest/industrial/barren)
- Village/Town
- Baseline Environmental Survey
- Social Survey
- Formation width
- Carriageway width – (type/width/condition)
- Shoulder (type/width/condition)
- Embankment height
- Submergence history, if any
- Details and configuration of major junctions.
- Details of crossroads
- Location of sharp curves
- List of important structures like temples, petrol pumps, weigh bridges, schools/colleges, passenger shelters, dhabas, major buildings, industrial areas etc.
- Location of water bodies (lakes & reservoir etc.)
- Right of way
- Culverts, bridges and other structures (type, size & span arrangement)
- Roadside arboriculture
- Existing tree plantations
- Existing utility services on either side within ROW
- General drainage condition

This data has been taken into consideration for preliminary design (duly augmented by topographical survey).

F. Projected Daily Traffic

A detailed reconnaissance survey has been carried out to identify traffic homogeneous sections so that each homogeneous section will have similar traffic volume and composition. Based on the above, the length of total project road has been considered as one homogeneous section and the ADT & AADT has been described in Table 3.4

a) Projected Traffic Growth

Once the project road is upgraded, additional traffic will be generated from developments around the project road and diverted traffic from nearby roads to the project road. However, it is nearly impossible to quantify these volumes in the absence of clear-cut plans and roadmap. Hence, 20% of AADT are assumed as additional traffic based on existing traffic volume along the project corridor. This additional traffic will be considered from the year 2022-23 which is supposed to be the opening year of the upgraded facility up to 2023-24 but not beyond that. There after the traffic may considered to grow normally.

G. Proposed Improvement

The project stretches runs through plain terrain. There is an appreciable deficiency in the horizontal geometry at some locations of the project stretch with respect to design standards. Thus, proper geometric design would play a pivotal role to ensure the proper functioning of the proposed facility.

a) Selection of Widening Scheme

The existing project stretch under study has multidimensional facets in terms of geometry, pavement condition, existing utilities, religious structures, etc. and considering all these aspects the section-wise policy adopted for widening based on the initial investigations. The detail of widening scheme are given in DPR.

b) Design Speed

Design speed is the basic parameter, which determines geometric features of the road. As most of the roads falls under the Plain terrain (cross slope up to 10%) the recommended design speed is 80 Kmph (ruling) and 65 Kmph (minimum) and where the widening is not possible like at the built up stretches speed is restricted to 40km/hr. Whereas, Hilly/Mountainous roads design speed recommended to 50Kmph (ruling) and 40 Kmph (minimum).

c) Typical Cross-sections of road, bridges, ROB, RUB and Culvert

The basic principle followed in the design is to develop a cross section based on guidelines for preparation of Detailed Project Reports under Asom Mala Program vide Lr. No. CE/ASOMMALA/12/2019/41 dated 06.02.2020. The design of the proposed cross sections is given and details are presented in Table 3.6 & 3.7. details of TCS are given in **Annexure-1**.

Table 3-6: List of Typical Cross Sections

Sl. No.	Description	Type of TCS	Length
1	Two Lane with Paved Shoulders Reconstruction (Open Country -	TCS1	2.640
2	Two Lane with Paved Shoulders Reconstruction (Built-up Area - Plain	TCS2	6.563
3	Two Lane Without Paved Shoulders Reconstruction (Built-	TCS3	2.610
4	Two Lane with Paved Shoulders in Realignment	TCS4	5.770
5	Major Bridge	--	0.070
Total Length (km)			**17.653**

Table 3-7: Details of Proposed Cross Sections

Element	Width (m)	Total Width (m)
Rural Cross Section-2 Lane with Paved Shoulder (C/S Type 1B and 9)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Earthen Shoulders	2 X 1.00	2
Utility Corridor	2 X 0.75	1.5
Space left for future widening and Unlined Drain	Varies	
Right of Way	20m	
Built up Cross Section-2 Lane (C/S Type 10)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Footpath cum Drain	2 X 1.50	3
Utility Corridor	2 X 1	2
Right of Way	15 m	
Built up Cross Section-2 Lane (C/S Type 11)		
Main Carriageway	1 X 7.50	7.5
Footpath cum drain	2 X 1.50	3
Utility Corridor	2 X 1.00	2
Right of Way	12.5m	
Realignment Cross Section-2 Lane (C/S Type 17)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Element	Width (m)	T
Earthen Shoulders	2 X 1.00	2
Utility Corridor	2 X 0.75	1.
Space left for future widening and Unlined Drain	Varies	
Right of Way	20m	

d) Proposed New Pavement Design

Conventional flexible pavement of 550 mm thickness is proposed for New / Widening / Reconstruction sections of the project road.

e) Overlay Design for Existing Pavement

The falling weight deflectometer survey (FWD) has been carried out to calculate the remaining life of the existing flexible pavement in accordance with the IRC: 115-2014 “Guidelines for structural evaluation and strengthening of flexible road pavements using Falling Weight Deflectometer (FWD) technique”.

Since the entire Project Road Stretch has been proposed for Re-construction, the Profile corrective course is not required.

f) Road Rehabilitation Proposals

From the FWD assessment of remaining life, it is revealed that the remaining life of the existing pavement is very less (i.e., less than 2MSA), which is far less than the design MSA of 20. Further, the existing crust composition is also very less in accordance with the IRC: 37-2018. Therefore, the existing flexible pavement is recommended for reconstruction by scarifying the existing bituminous

layers and new pavement to be constructed from GSB onwards considering the existing granular layers is the sub-grade top.

g) Intersection / Junction Improvement Proposals

There are no grade separator proposals on the project highway. There are 6 major junctions and 19 minor junctions to be improved at grade along the project Road.

h) Improvement Proposals for Existing Horizontal Curves

There are number of horizontal curves on the existing alignment of the project road. Some of the curves are deficient in radius. As per guidelines of relevant IRC standards & codes, major curve improvement is proposed about 4 locations to the extent possible in the form of increasing the radius of curvature or realignment of road at these locations, keeping in view the terrain type & site constraints.

i) Proposal for Service Roads and Slip Roads

There is no major built-up section along the project road and due to very low local traffic in settlement area, provision of service roads has not been made.

j) Bypass and Realignment Proposals

There are no bypass proposals in the project stretch. The most of stretch is following the existing road to minimize the land acquisition. Realignments/Bypasses are proposed to improve the existing geometry at one location. The details are presented in given Table 3.8.

Table 3-8: Realignment/Bypass Proposals

S.N.	Design Chainage(km)		Design Length (m)	TCS No.	Description
	From	To			
1	2+550	2+880	330	4	New Construction
2	3+060	3+360	300	4	New Construction
3	4+400	5+930	1530	4	New Construction
4	8+050	8+210	160	4	New Construction
5	10+210	10+415	205	4	New Construction
6	10+485	11+180	695	4	New Construction
7	14+610	17+653	3043	2,4	New Construction

k) Roadside drains

The following provisions have been considered to develop a sound drainage network:

- Covered CC lined drain in Built-up area.
- Unlined drain is provided at rural areas at the edge of toe of embankment.
- Side Drain and Catch water drain.

l) Proposal for New Bridges

No existing bridge proposed for improvement, there are six (06) Minor bridges which will be retained and repaired. There is one (01) major existing bridge on Buradiya River, which will be abandoned after construction of new bridge. Details of the proposal for the new bridges are given in **Table 3.9**.

Table 3-9: New Construction of Bridges

Existing Chainage (Km)	Design Chainage (Km)	Bridge Type	Existing Carriageway Width (m)	Proposed span	Total outer width of bridge (m)	Remarks
4+700	4+745	Balance	3.75	3x45	4.55	New Construction Nearer

Existing Chainage (Km)	Design Chainage (Km)	Bridge Type	Existing Carriageway Width (m)	Proposed span	Total outer width of bridge (m)	Remarks
		Cantilever+ RCC Girder+ PSC girder				to Existing Bridge and Existing Bridge will be abandoned after construction of New Bridge

m) Proposal for New Culverts

There are 13 nos. of existing culverts observed on the project road. Out of which 09 nos. are pipe/choked culverts and 04 no. box culvert. Out of 13 nos. existing culverts, 10 nos. existing culverts will be re-constructed, 02 nos. will be widened, and 01 no. of culvert will be eliminated from scope due to proposed realignment. Construction of 20 new culverts are proposed as balancing culverts due to re-alignment.
The details of new culvert are given in **Table 3.10**.

Table 3-10: New Culverts Proposed

Sl. No.	Design Chainage (Km)	Type	Span (LxH) m	TCS Type	Total Width of Culvert (m)
1	1+698	Single Cell Box Culvert	1x2.0x1.5	1	12
2	2+697	Single Cell Box Culvert	1x2.0x1.5	4	12
3	3+512	Single Cell Box Culvert	1x2.0x1.5	1	12
4	4+011	Single Cell Box Culvert	1x2.0x1.5	2	12
5	4+511	Single Cell Box Culvert	1x2.0x1.5	4	12
6	5+055	Single Cell Box Culvert	1x2.0x1.5	4	12
7	5+668	Single Cell Box Culvert	1x2.0x1.5	4	12
8	6+169	Single Cell Box Culvert	1x2.0x1.5	1	12
9	7+546	Single Cell Box Culvert	1x2.0x1.5	2	12
10	8+145	Single Cell Box Culvert	1x2.0x1.5	4	12
11	12+118	Single Cell Box Culvert	1x2.0x1.5	2	12
12	13+405	Single Cell Box Culvert	1x2.0x1.5	3	12
13	13+905	Single Cell Box Culvert	1x2.0x1.5	2	12
14	14+300	Single Cell Box Culvert	1x2.0x1.5	3	12
15	14+950	Single Cell Box Culvert	1x2.0x1.5	4	12
16	15+350	Single Cell Box Culvert	1x2.0x1.5	4	12
17	15+760	Single Cell Box Culvert	1x2.0x1.5	4	12
18	16+360	Single Cell Box Culvert	1x2.0x1.5	4	12
19	16+970	Single Cell Box Culvert	1x2.0x1.5	4	12
20	17+410	Single Cell Box Culvert	1x2.0x1.5	2	12

n) Proposal for Bus Bays & Truck Lay Byes

16 Bus Shelters are proposed, and no Truck Lay Bye are proposed for this project road.

o) Proposal for Vehicular Underpass

No vehicular underpass is proposed along the project stretch.

p) Proposal for Pedestrian and Cattle Crossing

There are no pedestrian and cattle crossing facilities along the project highway.

q) Wayside Amenities

There are no rest areas / way side amenity proposals along the project highway.

r) Landscaping and Arboriculture

The landscaping shall be carried out within RoW as per IRC SP 21.

s) Road Furniture and Safety Measures

Road safety aspects have been well studied and several safety features like road marking, signage, safety barriers, boundary stones, kilometre stones and hectometre stones, pavement marking, and lighting has been proposed as discussed below. The engineering design of the road has also considered IRC provisions related to road safety such as:

- IRC: SP: 32-1988 Road Safety for Children
- IRC: SP: 44-1994 Highway Safety Code
- IRC: SP: 55-2001 Guidelines for Safety in Construction Zones
- IRC: 119:2015 Guidelines for Traffic Safety Barriers

Road Markings

- Road Markings shall comprise of carriageway markings such as longitudinal markings and object markings such as raised pavement markers (Cat's Eyes or Road Studs).
- All markings shall conform to IRC:35-2015 and Raised pavement markers shall be provided as per IRC: SP:73-2015.

Road Signs

- Three types of Road signs shall generally be provided (such as Mandatory/Regulatory, Cautionary/Warnings, and information signs.
- Locations of Signs shall conform to IRC:67-2012 and Section 800 of MoRT&H Specifications.

Roadside Safety Barriers

The following types of Road Safety Barriers shall be provided on the Project Road Sections:

- Semi-rigid type/rigid type/flexible type safety barriers shall be provided on the high Embankment Section (where the height of embankment is more than 3.0 m) and along all curves having radii up to 450m for complete length of curves including transitions and 20m further before and after the curve.
- Rigid Type such as Concrete Crash Barriers shall be provided on the bridges, isolated structures and its approaches.

Boundary Stone, Km Stone and Hectometre Stone

- Road boundary stones have been proposed all along the project highway to discourage future encroachment into the right of way. Km stone and hectometre stones have been proposed all along the **project road as per IRC Code provisions.**

Pavement Marking and Lighting

Pavement markings will be done for traffic lane line, edge lines and hatching. The marking will be with hot applied thermoplastics materials. The pavement markings will be reinforced with raised RR pavement markers and will be provided for median and shoulder edge longitudinal lines and hatch markings.

Highway lightings including high masts will be provided at intersections in order to improve the night-time visibility. All the built-up locations as well Underpasses has been proposed lighting arrangements.

t) Raw Material for Construction

Soil and material investigation for a road project is very essential to assess the availability of suitable construction material in the vicinity of the project road. This includes investigation of suitable borrow area for borrowing earth and quarries for stone/aggregate material and for the other construction materials like cement, steel, bitumen etc. are recommended to be procured directly from reputed manufacturers spread at different locations in the vicinity of the Project.

Material investigations have been carried out to explore the availability of suitable construction material and likely extent of usage in embankment and different pavement courses.

- For improvement work as well as for new carriageway / bypass the list of materials includes the following: Granular material for lower sub-base works.
- Crushed stone aggregates for upper sub-base, base, surfacing and cement works.
- Sand for filter material and cement, concrete works, sub-base and filling material.
- Borrow material for embankment, sub grade and retaining wall back filling.
- Manufactured materials like cement, steel, bitumen, primer coat, tack coat, fly Ash etc. for other related works.

Potential sources of soil for construction of embankment and sub grade (for reconstruction / new carriageway) were identified on either side of project stretch. Aggregate quarries located in the vicinity of project area were inspected and the details on numbers of crushers in operation, area spread etc. were gathered.

The estimated raw materials requirement during construction stage is given in Table 3.11.

Table 3-11: Raw Material Required during Construction

S. No.	Item & Unit	Quantity	Mode of transport	Source
1.	Blue metal (m^3)	36063	Truck	Existing licensed quarries
2.	Sand (m^3)	9085	Truck	Existing licensed quarries
3.	Cement (MT)	7604	Truck	Local traders
4.	Bitumen (MT)	2278	Truck	Refinery
5.	Steel (MT)	1853	Truck	Local traders
6.	Earth (m^3)*	430964	Truck	Identified Borrow areas

u) Borrow Area

Approximately 4,30,964 cubic meters of borrow materials will be used for the Project Road. The summary of identified borrow areas indicating their Location with respect to project chainages, approximate distance from the source of nearest point on the project and owner ship details are given in Table 3.12 as below.

A location plan showing investigated borrow source with respect to project road is shown in Figure-3.6.

Table 3-12: Details of Borrow Areas

S.N.	Sample No.	Chainage (km)	Left/ Right	Location/Name of Village	Lead (Km)	Remarks
1	BA 01	5+000	Left	Naligaon	0.1	Private Land
2	BA 02	10+000	Left	Bongaon	1.50	Private Land
3	BA 03	13+000	Right	Bagana	0.500	Private Land

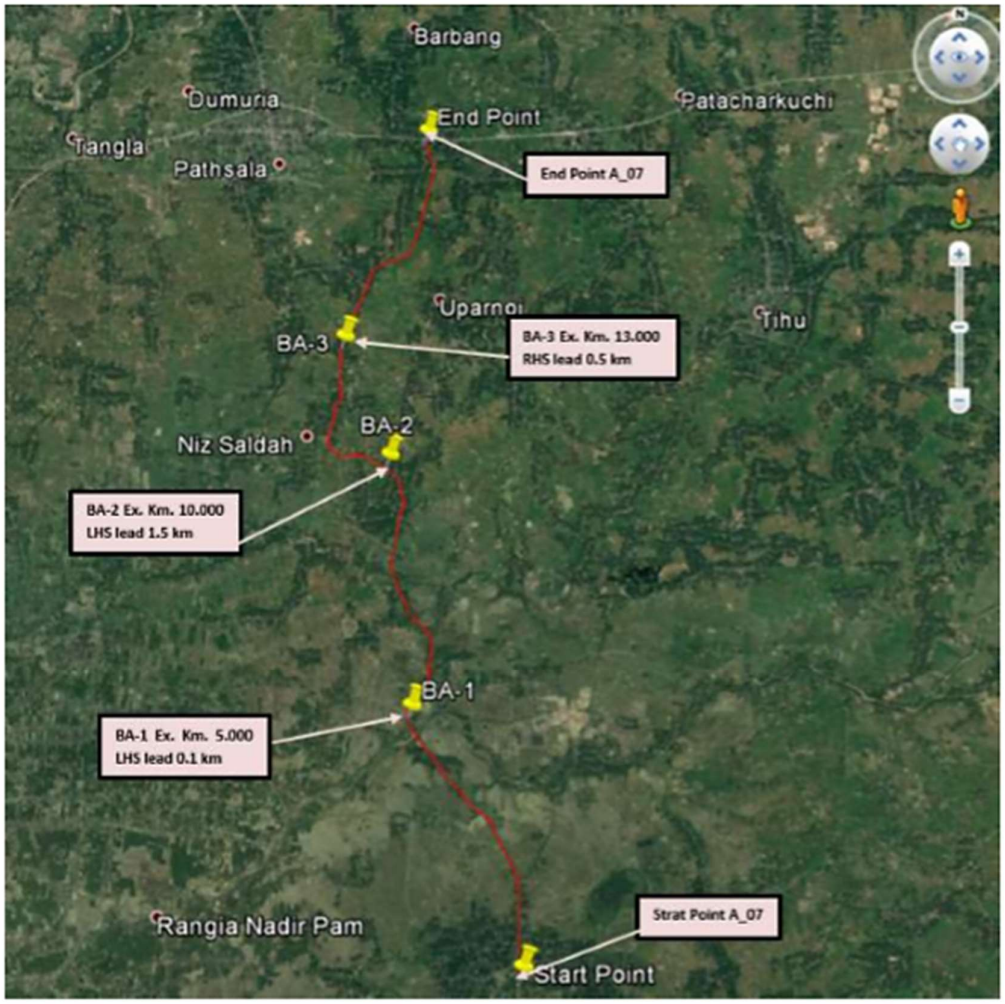


Figure 3.6: Location of Borrow Areas

Coarse Aggregate

The objective is to identify, inspect and evaluate the aggregate sources, which would supply for the pavement and concrete, quality aggregate for the road construction. During the site visit, aggregate quarries are observed along the project road. Existing and known quarries/crushing plants and other potential extraction sources of quarry areas in the project vicinity have been inspected. The summary of estimated available quantities of aggregates and ownership details are given in Table 3.13. A location plan showing investigated coarse and fine aggregate source with respect to project road is shown in Figure 3.7.

Table 3-13: Details of Coarse Aggregate Crusher Location

S.N.	Sample No.	Chainage (km)	Left/ Right	Location/Name of Village	Lead (Km)	Remarks
1	CA 01	0+000	Right	Moduki	88	Private Land
2	CA 02	0+000	Right	Rani	83	Private Land

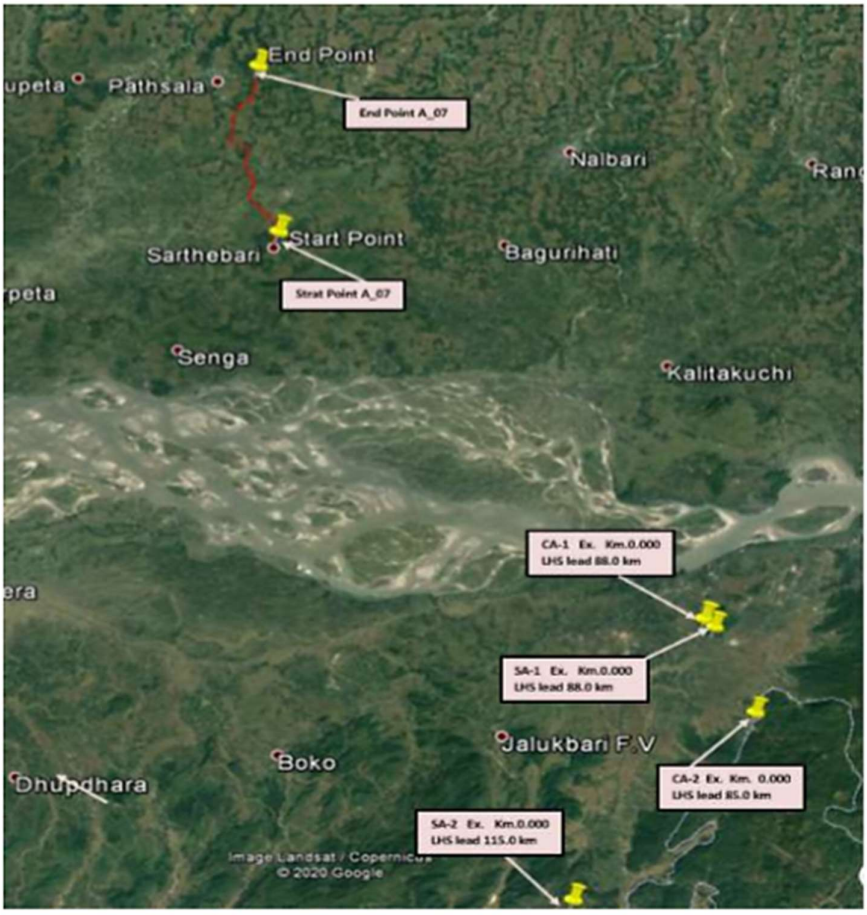


Figure 3.7: Location of Course and Fine aggregates

Fine Aggregate

During the site reconnaissance, two sand sources have been identified nearer to the project vicinity. Silt content of both the sources has been found within limit. Thus, identified sources of sand can be considered suitable for use in concrete works after proper screening and processing. The details of the identified sand details are given in Table 3.14.

Table 3-14: Details of Fine Aggregate Quarry Location

S.N.	Sample No.	Chainage (km)	Left/ Right	Location of River & Source (km)	Lead (Km)	Remarks
1	SA 01	0+000	Left	Mirza & Vinayaka Stone Crusher	88	Private Land
2	CA 02	0+000	Right	Moduki & Batha River	115	Private Land

Fly Ash Sample

Fly Ash / Pond Ash: The availability of Fly Ash Manufacturing Industries was explored in Assam through INAMPRO+ website, the letter of correspondence was also made to Thermal Power Plants. But so far there is no reply or consent regarding availability of Fly Ash / Pond Ash is received from the following Thermal Power Plants. The Fly Ash / Pond Ash producing Thermal Power Plant is listed below.

S.N.	Sample No.	Chainage (km)	Source Name	Lead (Km)	Ownership Details
1	Fly Ash-1	0+000	Bogaingaon Thermal Power Plant, Salakati, BTAD, Kokrijhar District	99	Thermal Power Plant, Kokrajhar, Assam

The Thermal Power Plant Authorities has not given their consent regarding Fly Ash / Pons Ash availability in their plants; hence the use of Fly Ash / Pond Ash is not proposed in this project.

Cement

The availability of Cement Manufacturing Industries was explored in Assam through INAMPRO+ website. In total 7604 metric ton cement will be required for the Project, which will be sourced from Star Cement India ltd., a renowned manufacturer of Ordinary Portland cement (OPC 53 Grade) and Portland Pozzolana cement (PPC) products. The availability of Cement Manufacturing Industry is shown below in Table below.

Table 3-15: Summary of Cement Manufacturing Industries

S.N.	Sample No.	Chainage (km)	Source Name	Lead (Km)	Ownership Details
1	Cement-1	0+000	Bogaingaon Thermal Power Plant, Salakati, BTAD, Kokrijhar District	105	Star Cement Limited Gopinath Bordoloi Road, Vill- Chamatapathar, Dist – KamrupM, Guwahat

Bitumen

Approximately 2278 metric ton of Bitumen will be required for the Project. There are three (03) Bitumen Refineries and Petrochemicals are in Assam. The details are tabulated in below. The Specification of Bitumen must comply with relevant IS/IRC codes.

Table 3-16: Summary of Bitumen Refineries and Petrochemicals

S.N.	Sample No.	Chainage (km)	Left/ Right	Village	Lead (Km)	Remarks
1	Bitumen-1	0.000	Left	Guwahati	78.000	Guwahati Refineries and Petrochemicals Limited, Guwahati
2	Bitumen-2	0.000	Left	Bongaigaon	94.000	Bongaigaon Refineries and Petrochemicals Limited, Bongaigaon
3	Bitumen-3	0.000	Left	Guwahati	80.000	Numaligarh Refineries and Petrochemicals Limited, Guwahati
4	Bitumen-4 (Alternative)	0.000	Right	Hladia	1037.00	Haldia Refineries and Petrochemicals Limited, Haldia

Steel

Structural steel, reinforcement steel (HYSD, TMT), HT strand, etc. are manufactured indigenously in India by reputed companies and can be procured directly from manufacturers or from their local authorized agents at Guwahati. Approximately 1853 metric ton of steel will be required for the Project.

S.N.	Sample No.	Chainage (km)	Village	Lead (Km)	Type of Road
1	Steel-1	0.000	Guwahati	80	Surface

H. Land Requirement

During construction period water is required for compaction of embankment, dust suppression, concrete making and domestic use in construction camp. The estimated tentative water requirement during construction stage is given in Table 3.17.

Table 3-17: Breakup of Fresh Water Requirement during Construction

Sl. No.	Purpose	Quantity (KL)
1.	For road construction: a) Construction related to earthwork b) Construction of GSB c) Construction of WMM d) Bridges, culverts, retaining walls & other structures	77,979

I. Land Requirement

Total land requirement for the Project is 30.17 hectare out of which 10.84 (35.93%) hectare land is available (Existing RoW) and 19.32 hectare of land will be acquired which includes 16.74 (55.49%) hectare of private and remaining 2.58 (8.55%) hectare of government land.

J. Project Cost

The total civil cost of the project is estimated about INR 138.19Cr.

K. Implementation Schedule

Implementation/Construction schedule is 30 months as construction of Major bridge involve. Construction schedule with details of project activity is presented as **Annex- 5**.

L. Manpower Requirement

About 120 manpower comprising skilled, semi-skilled and unskilled labours will be required during Construction period.

M. Contract Package and Type of Contract

Proposed road is a single package and type of contract is (EPC/ item rate)

N. Project Benefits

- Employment opportunities due to recruitment of local labourers.
- Trading opportunities due to procurement of some construction materials locally.
- Clean up operations, landscaping, and plantations.
- Increase in road traffic & transportation activities due to faster accessibility.
- Time saving due to faster movement of traffic.
- Fuel saving due to faster movement of traffic.
- Reduction of air pollution
- Reduction of number of accidents
- Reduction of vehicle operating cost
- Better facilities to road users e.g., bus bay etc.

O. Analysis of Alternatives of the Project

1. Introduction

The chapter tries to compare feasible alternative to the proposed project with respect to site, technology, design etc. The alternatives examined take into account all possible and feasible options and includes both with and without project scenarios in terms of the potential environmental impacts for the justification of the project. The chapter discusses how environmental parameters were assigned due importance and were carefully considered in the analysis of alternatives.

2. With and Without project Alternatives

a) Without Project Scenario

The existing project road section is mostly intermediate / two lane highway with varying pavement width. With present and projected traffic volumes, the capacity of the present highway is insufficient for handling the high volume of traffic and calls in for improvements to a 4-lane carriageway with paved shoulder. The road has many roadside settlements, and the traffic flow is seriously impacted by severe conflicts between the local and through traffic. This is further compounded by the various land use conflicts, in terms of horizontal and vertical curves along the highway. The existing unsafe conditions along the highway would continue to worsen in the absence of the proposed improvements. Moreover, if it is decided not to proceed with the project, then the attendant reduced socio-economic development of this relatively poorly connected area cannot be justified. 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 of the region.

b) With Project Scenario

The 'with project scenario' is found to have a positive impact in the long run on social, environmental, economic and financial issues. This scenario includes the widening to 2/4 lanes with paved shoulder of the existing two lanes / intermediate stretch as envisaged in the project objectives. It, would thereby, contribute to the development goals envisaged by the Governments of Assam and Tripura as well as Govt. of India, and enhance the growth potential of the area.

To minimise the acquisition of land and properties, the project envisages the development within the existing ROW as much as possible. However, need for land acquisition has also been envisaged for Bypass and realignment sections.

In spite of the various development benefits likely to accrue due to the project, as is the case of every road development project, the project would be accompanied by certain impacts on the natural, social and environmental components. The potential impacts on the various environmental components can be avoided through good environmental practices. Wherever avoidance of negative impact has not been possible, appropriate mitigation and enhancement actions shall be worked out to effectively offset the environmental damages inflicted due to the project. A detailed Resettlement and Rehabilitation (R&R) Action Plan has been worked out to improve the well-being and livelihood of the people to be impacted. Comparative assessments of the "with and without" project scenarios are presented in the following Table.

Table 3-18: "With and Without" Project Scenarios – A Comparative Assessment

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometrics	2 lane carriageways with paved shoulder with geometric improvements	Existing single lane carriageway with poor geometrics
Design Speed	80 kmph	• In Built up area: - 20 and 30 km/h. • In open Area: - 30 and 40 km/h
Congestion in Settlements	Free flow of traffic due to widened carriageway with paved shoulders	Congestion In urban areas
Felling of roadside trees	Felling of both old and young trees. Old and weak trees near the road edge shall be a road hazard and shall be felled. Ten times the number of new young and healthy trees to be planted in compensation.	No felling of trees. The old trees may become a safety hazard to the road users with passage of time.

Component	"With" Project Scenario	'Without" Project Scenario
Pedestrian safety	Along the settlement stretches with significant pedestrian traffic pedestrian (zebra) crossings and footpath has been provided in urban sections.	Pedestrian safety an issue of major concern especially along the settlements and congested sections.
Road Safety Measures	Provision of proper road markings, zebra crossings, Speed breaker on village road and improvement of geometry to reduce accidents.	Accident incidents shall rise with an increased traffic volume.
Environmental Quality	Provision of lined drain in urban settlements improves environmental and quality. Low Emission level as proper movement of traffic due to no congestion.	Poor due to congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to Increase in traffic volumes and further congestion.
Drainage	Shall be improved due to further widening of culverts / bridges with adequate hydraulics.	These issues remain unaddressed without the project
Roadside Amenities	Appropriate roadside amenities to be provided at various locations along the corridor.	Not adequate.
Development	Higher potential for development due to improvement in access and consequent increase in connectivity.	Development activities shall be greatly hampered by the gross inadequacy of infrastructure.

By looking at the table it can be concluded that "with" Project Scenario, with positive/beneficial impacts will greatly enhance social and economic development of the region and improve the environment, when compared to the "without" project scenario.

"With" project scenario with some reversible impacts is an acceptable option rather than the "Without" project scenario. The implementation of the Project therefore will be advantageous to improve the environmental quality of the region besides to achieve an all-round development of the economy and progress of the region.

3. Greenfield option vs Existing Highway Widening

The major difficulty with following an entirely new alignment is the magnitude of land acquisition and social disruption likely, lack of funds, and lack of viability for private financing. Therefore, as an alternative, the project proponent has adopted the policy of widening of highways to 2 lanes with paved shoulder on existing alignments, with selective provision of realignment and bypasses.

The project, therefore, involves mostly concentric/eccentric widening of the existing alignment to fully utilise the available ROW. The project road shall be flexible pavement throughout the stretch.

4. Criteria for Fixing Alignment

- The section of the road between two terminal stations should be short and straight as far as possible, but due to engineering, social and environmental considerations some deviations may be required.
- The Project should be constructible and easy to maintain; the improvement project should reduce the vehicle operation cost with respect to the already available existing option.
- It should be safe at all stages i.e., during design, construction, and operation stages. Safety audits at each stage should confirm the same.

- The Project initial cost, maintenance cost, and operating cost should be optimum to be considered economical with respect to its options.
- The alignment should be finalised giving due consideration to siting/location of major structures including Major/Minor Bridges, Interchanges and ROBs. The space requirement of interchanges to be kept into consideration to avoid major resettlement.
- The location of spurs for connecting the important towns to be decided while fixing the alignment Options.
- The alignment should follow the unused / barren land to the extent possible to reduce the cost of land acquisition.

5. Analysis of Alternative

An assessment of alternatives was carried out by considering three alternative routes for the proposed alignment. The alternatives were selected through professional experience and consultation with project stakeholders, screening criteria considering potential environmental effects and social acceptability, engineering feasibility and cost. The different parameters considered for each alternative is presented **Table 3.19** and shown in **Figure 3.8**.

Table 3-19: Alternative analysis of A07 Pathsala Bypass

Sl. No	Description	Option-1	Option-2	Option-3
1	Route Alignment	RHS of SH-9A	Along SH-9A	LHS of SH-9A
2	Take off Chainage	14+350	14+350	14+350
3	End Chainage	17+650	17+500	19+630
4	Road Length	3.3 Km	3.15 Km	5.28 Km
5	Right of way (ROW)	12.5-20m	12.5-20m	12.5-20m
6	Land Acquisition in ha.	6.16	5.20	9.82
7	Design speed Adopted	80-100 Kmph	20-100 Kmph	80-100 Kmph
8	No. Of Curves	3	14	8
9	Major at grade junction	1	0	1
10	Minor at grade junction	2	7	7
11	Railway Crossing	1	0	1
12	Connectivity with NH-31	Yes	No	Yes
Merits		• Smooth geometry and higher design speed with shortest length for connectivity with NH-31 • Number of curves and grade junction proposed are less than option 2 and 3. • land to be Acquired is less than option 3. • Least Pollution Envisaged.	• Geometry is poor and less possibility to improve since passing through built-up section. • Connectivity with NH-31 is only possible if ROB is constructed over Pathsala station and thereafter alignment needs to pass through densely built-up area for an approximate length of	• Smooth geometry and higher design speed with longer route for connectivity with NH-31. • Provision of ROB will make the junction development critical. • Number of curves are less than option 2.

Sl. No	Description	Option-1	Option-2	Option-3
		• Least number of Sensitive Features	1.5km • Maximum number of curves. • land to be Acquired is less than both options.	
Recommendation		Recommendations:	Recommendations:	Recommendations:

Based on the analysis of all three alternatives, proposed alignment Option 1 is best suitable for the Project.

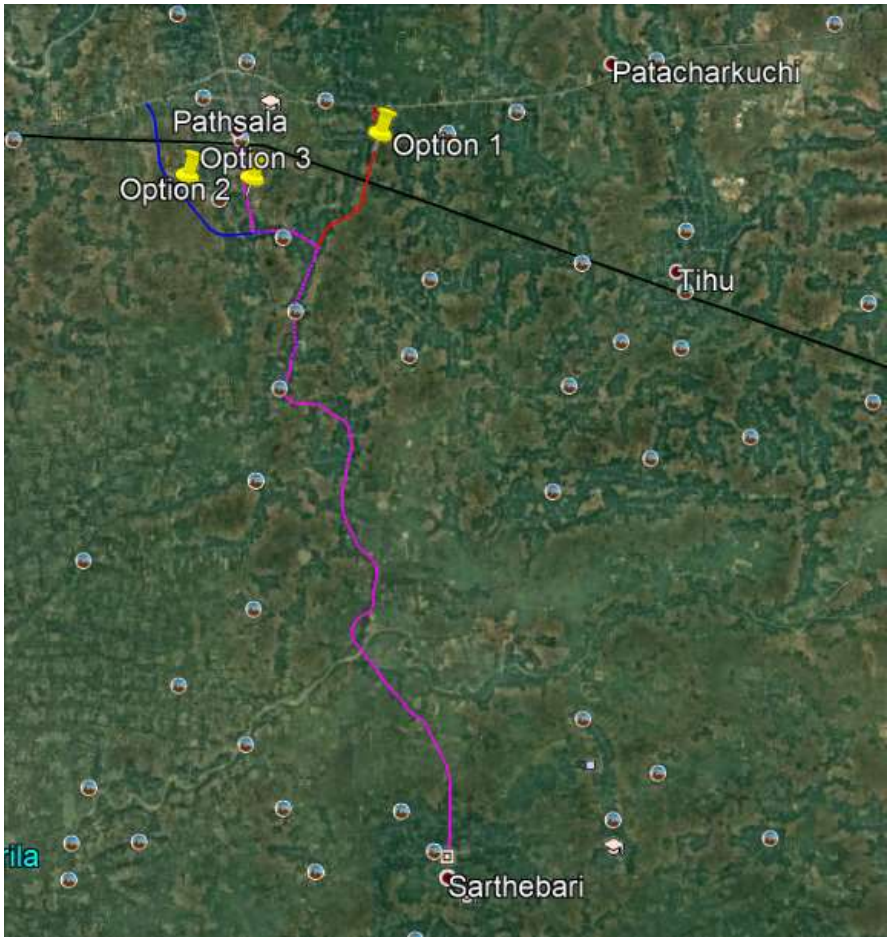


Figure 3.8: Map Showing all the Alternatives.

6. Rigid Pavement and Flexible Pavement

Comparative analysis of Rigid and Flexible pavement options is given in Table below.

Table 3-20: Comparative Analysis of Rigid and Flexible Pavement

Flexible Pavement	Rigid Pavement
Deformation in the sub grade is transferred to the upper layers	Deformation in the subgrade is not transferred to subsequent layers
Design is based on load distributing characteristics of the component layers	Design is based on flexural strength or slab action

Flexible Pavement	Rigid Pavement
Low flexural strength	High flexural strength
Load is transferred by grain-to-grain contact	No such phenomenon of grain-to-grain load transfer exists
Low completion cost, high repair cost	Low repair cost, high completion cost
Short service life (High Maintenance Cost)	Longer service life (Low Maintenance Cost)
Surfacing cannot be laid directly on the sub grade, but a sub base is needed	Surfacing can be directly laid on the sub grade
No thermal stresses are induced as the pavement have the ability to contract and expand freely	Thermal stresses are more vulnerable to be induced as the ability to contract and expand is very less in concrete
Strength of the road is highly dependent on the strength of the sub grade	Strength of the road is less dependent on the strength of the sub grade
Force of friction is low.	Force of friction is high

Flexible pavement is proposed for the project.

7. Environmental Considerations

The various mitigation measures for minimizing the extent of environmental impacts and avoiding of sensitive environmental features have been worked out. The table below provides the measures that have been adopted for offsetting the impacts. A description of the measures has been presented in the following Table 3.19.

Table 3-21: Minimization of Environmental Impacts

Criteria	Means
Maintenance of Design Speed for through traffic	Geometrics as per standard IRC codes
Improvement of Road Safety	Intersection as per IRC safety codes; Geometric improvements at curves
Adequate drainage	Provision of cross drains
Reduction of Air and Noise Pollution	Intersection improvements. Aggressive tree plantations; good ESMP implementation practices
Displacement of Local Population	Limiting of development within available ROW to the extent possible, SIA & RAP
Minimisation of Direct Impact on Sensitive Receptors, cultural and religious properties	Alignment option analysis, Public consultations, Good ESMP measures
Loss of Water body	Wise design
Avoidance of contamination due to Siltation / spillage	Silt Fencing, Oil Interceptor
Minimisation of Tree Loss	Maximum effort shall be given to avoid avoidable tree felling
Minimisation of Loss of Utility Lines	Utility shifting after concurrence of regulatory authority and stakeholders
Stabilisation of Slope	Turfing / Pitching
Accidental Road Kill of Fauna	Proper Signage, Speed Control

a) Improvement of air and noise quality

- By improving intersections
- By removing traffic bottlenecks
- Provision of Noise barrier

b) Avoidance of Impact of Sensitive, Cultural and Community Properties

- By lateral shifting of the alignment
- By providing zebra crossing for smooth and safe travel of local populace
- Providing noise attenuation measures mainly along schools and hospitals
- Avoiding direct impact on sensitive receptors

4. BASELINE ENVIRONMENT

A. Introduction

As a precursor for the prediction of various types of environmental impacts likely to arise due to implementation of the project, it is essential to establish the baseline environmental status in project study area. Details of baseline environment parameters are required for decision making for the project.

The project road corridor is 56 approx. 17.653 km in length and it is situated in Barpeta and Bajali districts which starts at Sarthebari, at Y-intersection of SH-9 and SH-9A and ends at Pathsala town. The project stretch passes through the Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Pathsala villages/towns.

B. Data Collection and Study area

A study area of 10 km radius from the project road was considered for secondary data collection. Primary data has been collected within 500 meters on both sides of the proposed alignment. Secondary data were collected from published reports, research papers, working plans, consultations and discussions with govt. officials. Primary baseline environment monitoring was carried out for the period of one season from December 2019 to February 2020. Baseline data collection location is given in Figure 4.1.

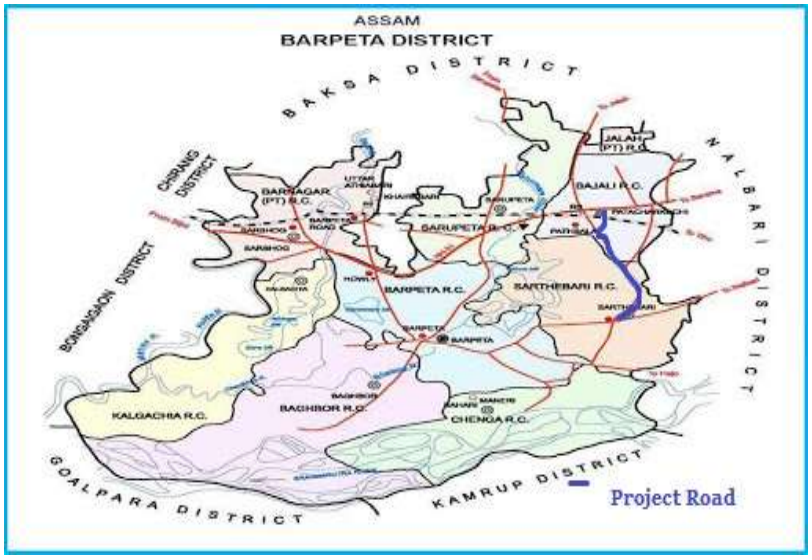


Figure 4.1: Project Road alignment on district Map

**Project road is passes through Barpeta and Bajali (Bajali is bifurcated from Barpeta district on 10th Aug 2020), Map of Bajali district is not available.*

C. Physical Environment

Physical environmental components along the project road are described below.

a) Physiography & Topography

The State can be broadly divided into 3 physiographic domains: Brahmaputra valley, Central Assam Hills (Mikir Hills in Karbi Anglong and Dima Hasao districts) and Barak valley. Majority of the areas in Assam State are floodplains of the Brahmaputra and Barak Rivers and the altitude of the plain areas vary from as low as 25 m to as high as 600 m. The eastern plains have an altitude of about 600 m. Cachar plains in the southern part of the state have an altitude of about 25 m. Central and south-

central part of the state, comprising Dima Hasao and Rengma Hills, have an altitude ranging from 300 m to 150 m. The western part of the state, comprising North and South Brahmaputra Hills, have similar altitude range.

The district Barpeta lies approximately between 90º39'30" E and 91º23'00" E longitude and between 26º05'30" N to 26º48'30"N latitude. It lies elongating in south-north direction extending from the Brahmaputra in the south to Baska District in the north. The district is bounded by Nalbari district in the east, by Baska District in the north, by Bongaigaon and Chirang District in the west and by Goalpara and Kamrup District in the south. The river Brahmaputra lies in southern boundary of the district which runs along the southern bank of the river. Bajali district is a newly formed district of Assam State, bifurcated from Barpeta district. The Assam Govt. approved the full-fledged district on 10 August 2020.

The present physiographic configuration of Assam has taken its shape only during the recent geological time. The geologic and tectonic base of the state has given rise to a variety of land forms under varying climatic conditions and geomorphic processes. The low hill ranges with hot and humid climate and heavy rainfall concentrated to a few months of the year, experience of sheet erosion and landslides. On the other hand, significantly dominant on the valley bottoms and plains where alluvial deposition takes place due to erosion of the higher surfaces by rivers and flooding in the valley. The erosional and depositional processes conspicuously intensified by copious rainfall and frequent seismic movement play dominant role in shaping various physiographic unit of the district. Physiography may be described, in terms of the physiographic elements like plain, floodplain and river valleys. The flood plains of the Brahmaputra including the charlands inside the river lies between north ·and south bank plains. The flood plains are irregular in its transverse extension due to the occurrence of occasional hillocks and incipient leaves on both the bank of the Brahmaputra. On the north bank the floodplain contains numerous swamps and beets and is fairly wide in Barpeta district.

The relatively high but narrow northernmost part of the region, which is the continuation of the lesser Himalayas, runs in east-west direction. The average ·elevation of this range varies from 150m to 1000 m. The elevation generally decreases from north to south. There are three Pre-Cambrian hillocks named Baghbar, Phulara and Chatala in the south-western part of the Barpeta Region. These are geologically detached parts of the Meghalaya plateau. The remaining areas of the region are covered by extensive plains and active floodplains of the Brahmaputra and its tributaries generally sloping from north to south. The alignment entirely passes predominantly through plain terrain. Elevation varies from about 40 m to 55 m above MSL with an average elevation of 46 m.

b) Climate and Meteorology

With the 'Tropical Monsoon Rainforest Climate', Assam is a temperate region and experiences heavy rainfall and humidity. The climate of Assam is humid, with a sub-tropical nature, having warm humid summers and cool dry winters. Due to its unique geographical location, along with the presence of varied physiography, Assam has an array of climatic conditions. Assam is situated in the high rainfall zone.

The climate of the districts Barpeta and Bajali is characterized by excessive humidity during summer and moderately cold and foggy winters. Generally, the weather goes dry and moisture less from February to April. From May to September sufficient rainfall sweeps over the district with heavy moisture in the atmosphere. During the months of October and November, the weather becomes pleasant, and the atmosphere gets foggy. Fogginess remains in the atmosphere till the end of January. Winter starts in the month of November and continues for about four months. The climate is somewhat dry and dusty during the months of February and March (Table 4.1).

Table 4-1: Meteorological Data of Nearest IMD Station Rangia (1981-2010)

Month	Temperature °C (Max)	Humidity (%)	Wind Speed (KMPH)	Wind Direction (D)	Rain fall (mm)
January	21.9	78	3.4	E	10.6
February	24.5	70	4.2	E	25
March	27.5	66	5.3	E	69.3
April	28.4	74	6.2	E	241.1
May	30.6	79	5.8	E	277.6
June	31.4	82	5.1	E	328.8
July	31.6	83	4.5	E	319.2
August	31.6	83	4.1	E	253.5
September	31.4	81	3.4	E	177.8
October	30	79	1.9	E	101.1
November	26.8	73	2.1	E	6.8
December	23.7	76	2.3	E	12.5

Source: Climatological Normal (1981-2010), India Meteorological Dept., Govt. of India

c) Rainfall

the 5 years rainfall data from year 2014 to 2018 is given in Table 4.2.

Table 4-2: Rainfall Details

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2014	1.7	37.5	34.6	42.6	384.9	360.5	290.6	355.6	343.9	13.0	0	0
2015	11.8	13.2	30.1	170.3	553.1	694.2	333.4	622.6	204.8	31.2	9.4	6.7
2016	32.1	2.8	89.8	422.8	292.7	372	513.3	149.7	233.1	52.5	0	1.4
2017	4.6	31.5	65.9	308.4	218.6	392.8	306	255.3	342.0	131.4	14.0	0
2018	0	17.4	70.6	140.5	250.8	387.1	259.2	215.0	341.8	33.3	28.8	21.2

Source: http://hydro.imd.gov.in/hydrometweb/(S(ew1psxijp124pyrqrtho1cam))/DistrictRaifall.aspx

d) Geology

The land characteristics of the districts Barpeta and Bajali is not deviated from that of the neighbouring districts. These districts are characterized by a plentiful of marshes and low lands, the soil of which contain a large percentage of organic matter. These districts have a large number of big and small rivers. The Brahmaputra, Manas and Beki are the main rivers of the district. The Chaulkhoa, Bhelengi, Pahumara, Mora Manas, Nakhanda, Kaldia, Palla, Moranadi etc though are the small rivers flowing through the district can cause devastating flood and severe soil erosion in their nearby areas. Unlike the northern part, the southern part of the district depicts a contrasting physical character where lot of low-lying areas are scattered throughout the region.

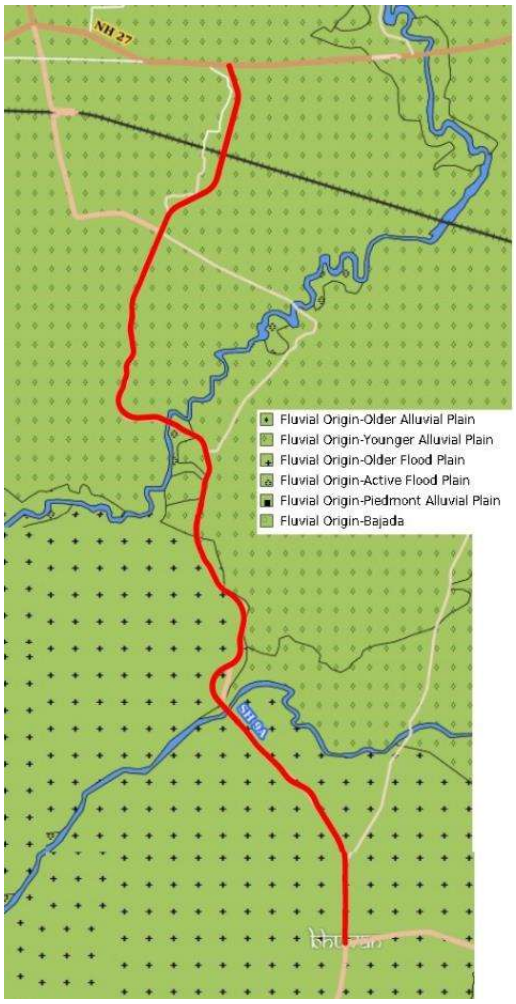
The solid geology of the district which mostly lies under the board level plain is covered by alluvium. The older alluvium composed of light terrace gravel stretches from the Bhutan border. The soil is composed of sand and clay in varying proportion ranging from pure sand near the rivers to a stiff clay. The new alluvium soils are mostly found in the narrow flood-prone tracts bordering southern part of the Brahmaputra. They vary in texture, mostly from clay to sandy loams. The soils are less acidic. The percentage of Nitrogen and organic matters are suitably proportioned for agricultural purpose. The soils in the districts are mostly fertile due to annual deposit of silt carried by the rivers.

The geologic formation of Assam belongs to the Archaean, Precambrian, Tertiary and Quaternary period. As revealed by its geologic history, the formation may be broadly classified into five divisions. These include:

- The Archaean group of rocks , The upper Tertiary sediments, The lower Tertiary sediments, Quaternary alluvial sediments, The pre-Cambrian rocks

The Archaean rocks composed the metamorphic rock type of gneisses and schists which are intruded by younger acidic and basic intrusive. These rocks are found in the northern and central parts of the Karbi plateau along the Assam-Meghalaya border. The isolated monadnocks like remains consisting of genisses and granites scattered along the north and south bank of the Brahmaputra in Goalpara, Barpeta, Nalbari, Kamrup, Darrang, Sonitpur and Nagaon districts also belong to the Archaean group of rocks. The geological formation of Barpeta and Bajali districts are almost similar to that of other parts of Brahmaputra valley.

It consists of (i) Recent and sub-recent alluvial deposits and (ii) A thin strip of upper tertiary sandstone belonging to the Siwalik group associated with clay alternations, which occur all along the Bhutan foothills. The sand stones are light grey to whitish grey, medium grained mica with pebbles at the top. Recent and sub-recent deposits can be divided into older alluvium and newer alluvium. The older or high-level alluvium deposited during or at the end of the Pleistocene period consists of reddish to brownish impure sands and irregularly distributed pockets of unasserted rocks pebbles covering a considerable area in the northern part of the district. The newer alluvium consists of sands, silts and clays, covering the alluvial plains along the Brahmaputra valley (Figure 4.3).

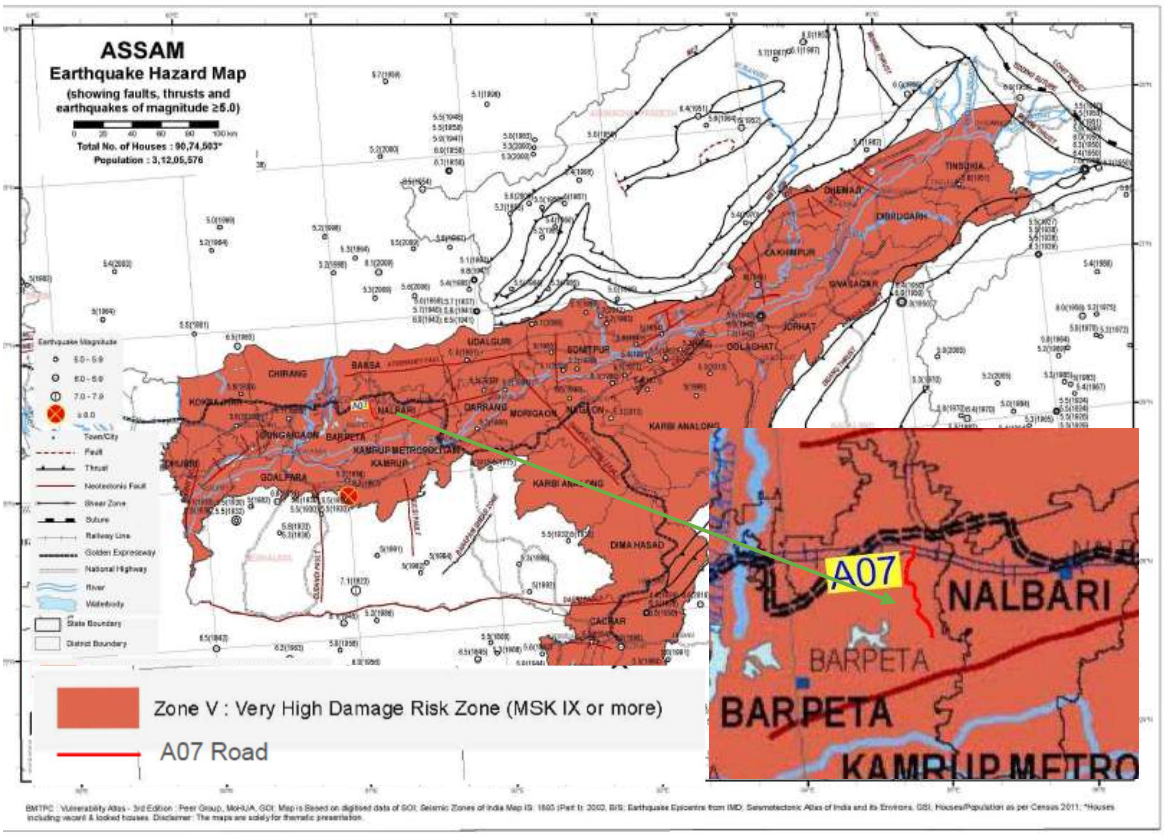


Source: Bhuvan NRSC

Figure 4.2: Geomorphology Map of the Study Area

e) Seismology

The entire Assam state has been placed under seismic Zone V and therefore the project is located in Zone V that has highest potential for occurrence of severe earthquake and liable to seismic intensity MM-IX[1] and above. This is the most severe seismic zone and is referred to as Very High Damage Risk Zone. Like other district of Assam, Barpeta and Bajali are a seismic area where earthquakes are by no means a rare phenomenon (Figure 4.4). These districts have been affected by several major earthquakes in the past. The earthquake that occurred in 1869 had caused great damage to life and property. There were damages also in the earthquakes of 1897, 1950 and 1957.



Source: Building Material & Technology Promotion Council (BMTPC) Assam

Figure 4.3: Seismology Map of Assam

f) Land Use Land Cover

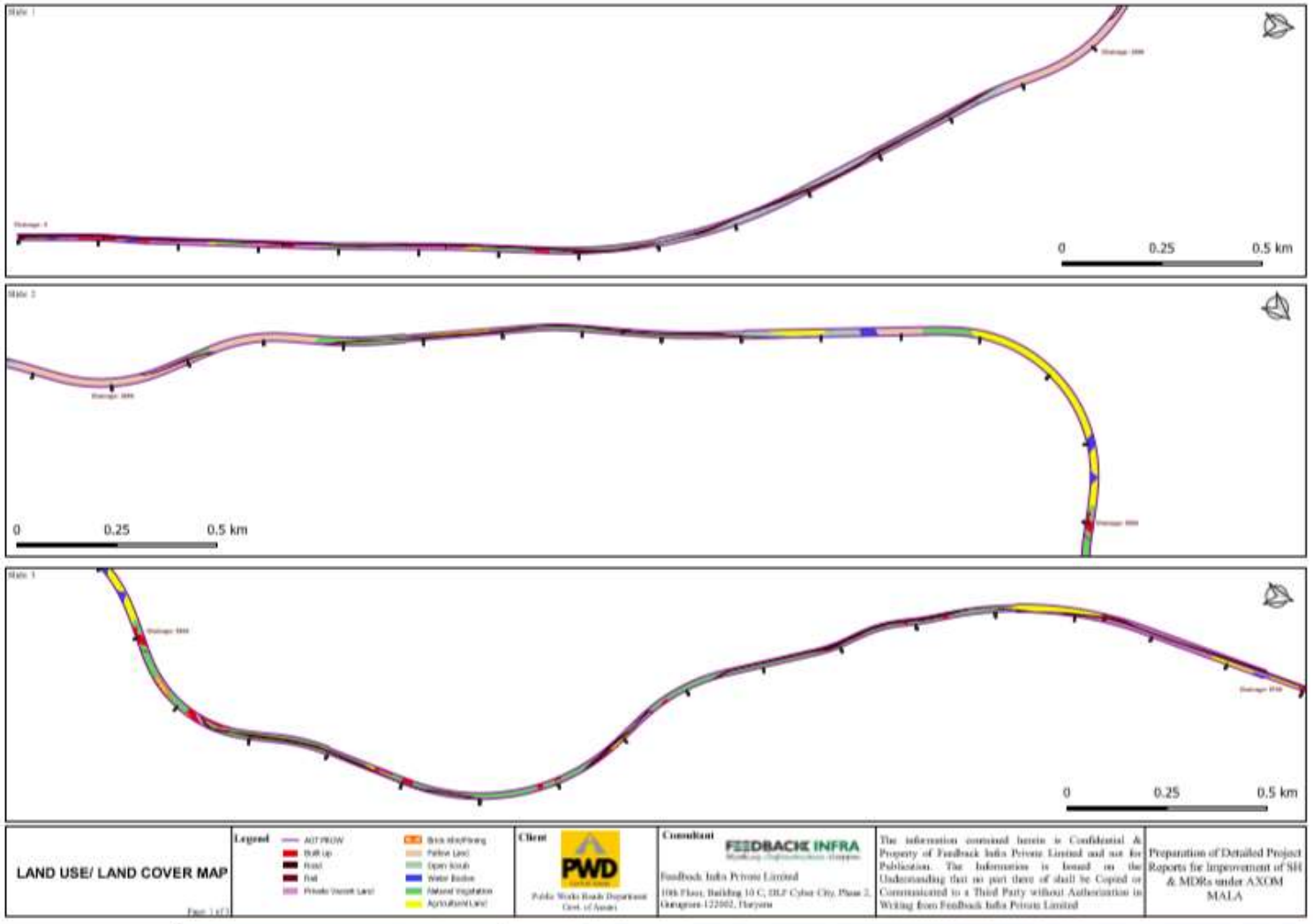
Agriculture is the pre-dominant occupation of the project districts Barpeta and Bajali. The cultivation area is spread over a vast area in the districts. The land cover in the project districts are Agriculture, tea garden, forest, uncultivated and fallow land. There were large areas of the government waste land which have got converted to cultivable lands. Forest area has also been taken up for habitation off late by the influx of immigrants into the districts over the years.

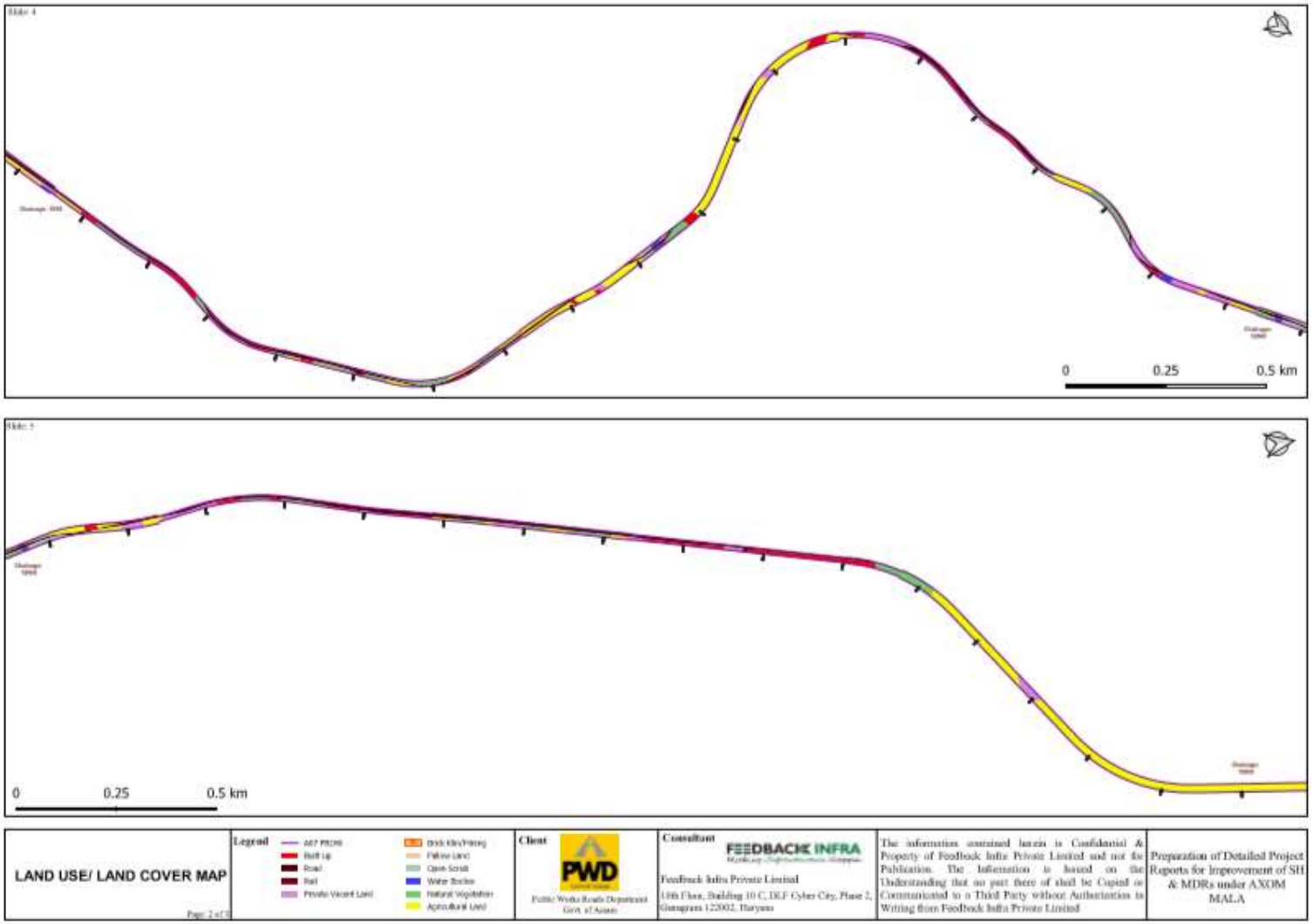
[1] Modified Mercalli Intensity Scale

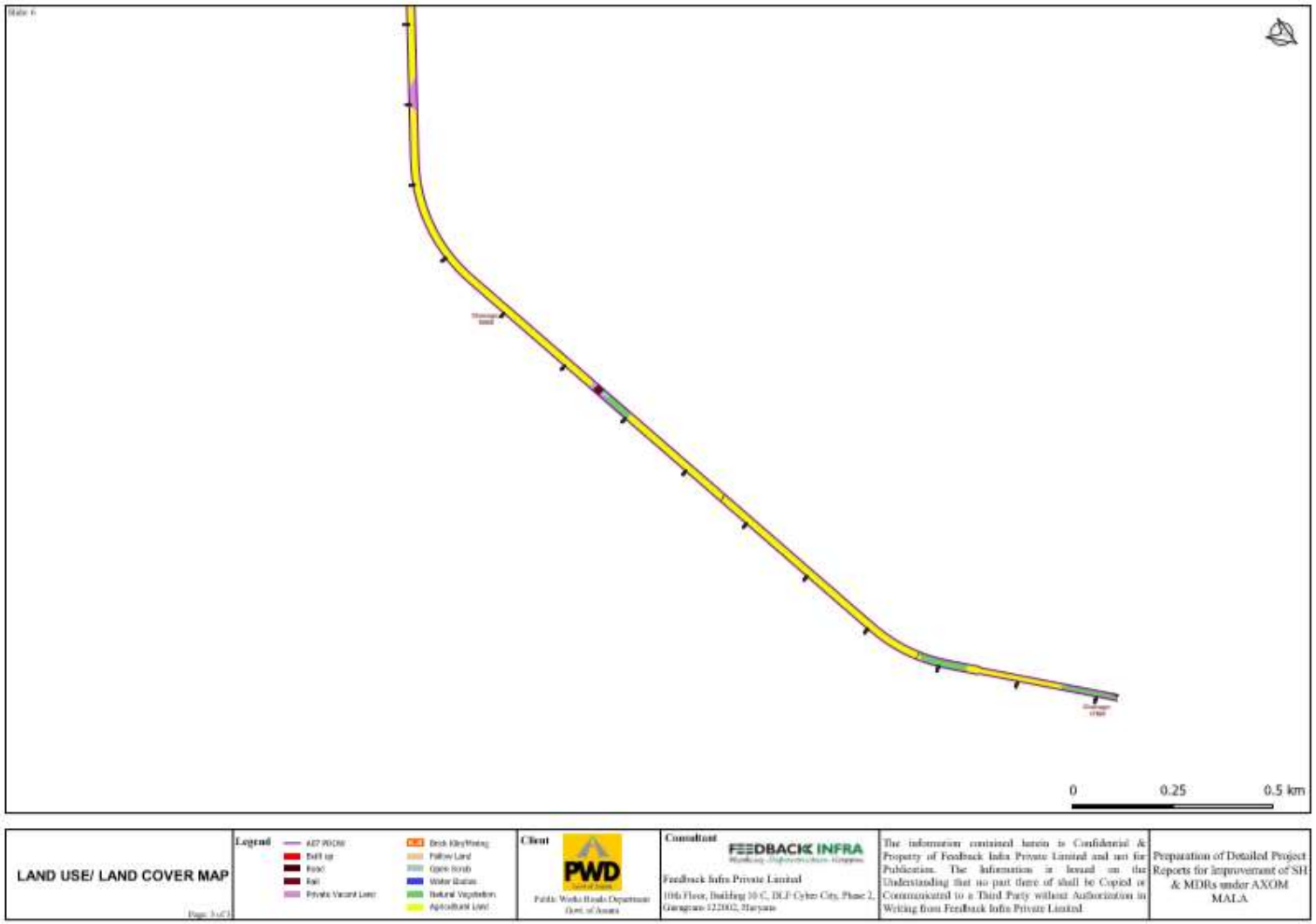
The major classes of land use as identified by the Assam Remote Sensing Application Centre are built-up land, agricultural land, forest land, wasteland, water bodies and others. Agriculture is the dominant land use category and accounts for about 54.11 per cent of the total geographical area of the state. As per the land use data, the total area under different types of forest is about 21.9 per cent of the total area of the state. Among the most potential sector of land uses for development is the wasteland & account for about 13.5 per cent of the geographical area of Assam.

The area of the government wasteland was very large in the past but with the inflow of immigrants, large char areas of the virgin soil has been upturned. At the same time, large areas of wasteland such as forest area has been taken up for habitation.

Figure 4.4: Land Use Pattern of the PRoW




0
0.25
0.5 km
0
0.25
0.5 km
LAND USE/ LAND COVER MAP
Legend
Client
PWD
Public Works Roads Department
Govt. of Assam
Consultant
FEEDBACK INFRA
Feedback Infra Private Limited
10th Floor, Building 10 C, DLF Cyber City, Phase 2, Gurugram 122002, Haryana
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Preparation of Detailed Project Reports for Improvement of SH & MDRs under AXOM MALA


0
0.25
0.5 km
LAND USE/ LAND COVER MAP
Legend
Client
PWD
Public Works Roads Department
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Preparation of Detailed Project Reports for Improvement of SH & MDRs under AXOM MALA

Details of Land Use/Land Cover observed in 500 m indirect impact zone and 10 km study area of the Project stretch are given in **Tables 4.3** and percentage classification is presented in **Figure 4.5** as below.

Table 4-3: Land Use/Land Cover Map of 500 m Buffer Zone of the Project Stretch

S.N.	LU/LC Class (500m Buffer)	Area in Ha.
1	Built up	1.83
2	Road	7.55
3	Rail	0.04
4	Brick Klin/Mining	0.08
5	Private Vacent Land	1.82
6	Fallow Land	1.6
7	Natural Vegetation	6.03
8	Open Scrub	2.08
9	Water Bodies	0.39
10	Agricultural Land	8.69
Total		**30.11**

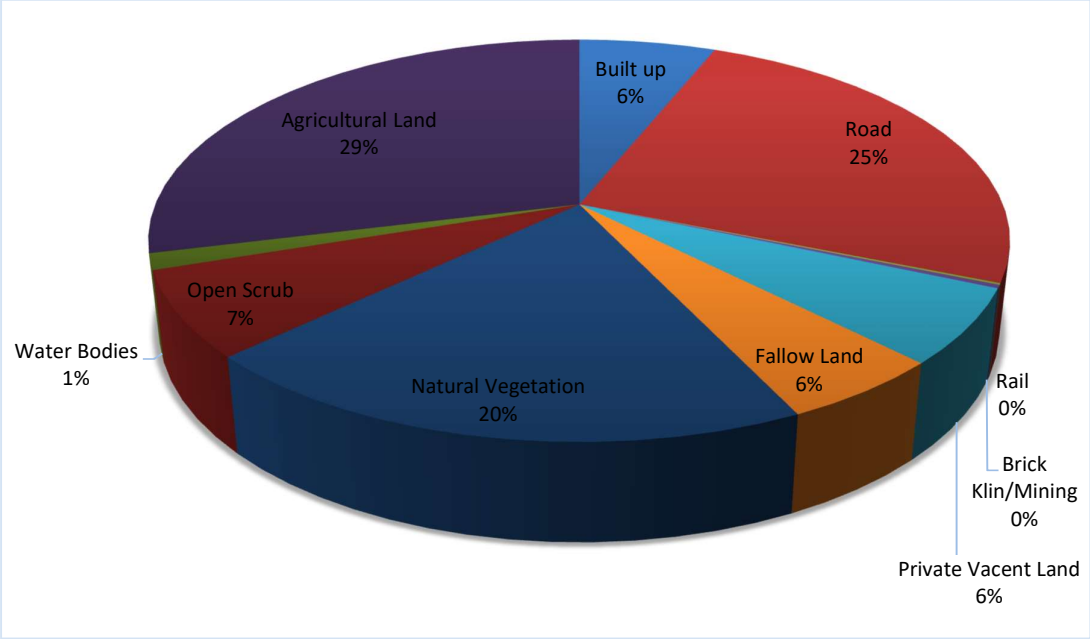


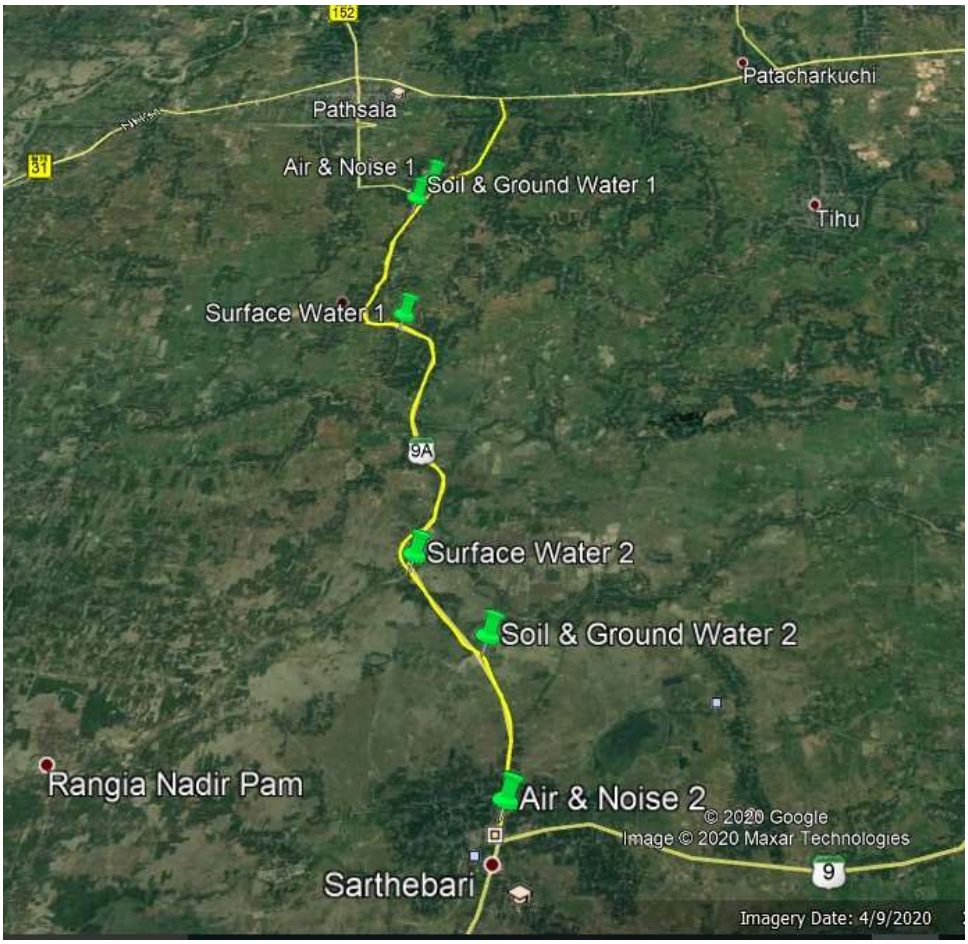
Figure 4.5: Land Use classification of PRoW of the Project stretch

The above data indicates that with 29% most of the land use in PRoW of the Project is covered by agriculture land followed by existing road with 25 % and natural vegetation having 20% of land cover.

D. Baseline data Collection Physical Environment

Sampling locations for primary data generation w.r.t to soil, air, noise and water parameters is presented in Figure 4.6.

Figure 4.6: Baseline data collection locations



a) Soil

The soil of Barpeta and Bajali districts are not much different from those of the other district of Assam. These districts are characterized by an abundance of marshes and low lands, the soils of which contain a large percentage of organic matter. In winter the soil becomes excellent for growing crops like pulses and oil seeds. The soils in Barpeta and Bajali districts are generally fertile due to annual deposing of silt. A major portion of total sown area of these districts is under agricultural crops and vegetables.

To study the soil quality of the region, sampling locations were selected to assess the existing soil conditions in and around the Project area representing various land use conditions. The physical and chemical concentrations were determined.

Soil samples were collected at two locations. The sampling locations were identified with the following objectives:

- To determine the baseline soil characteristics of the study area and
- To determine the impact of proposed project on soil characteristics

The samples were analyzed for physical and chemical characteristics. The samples have been analyzed as per the established scientific methods for physio-chemical parameters. Soil sampling locations are given in Table 4.4.

Table 4-4: Soil Sampling Locations

S. No.	Monitoring Station Code	Location	Distance from Road edge (m)	GPS Coordinates	Date of Sampling
1.	S1	Debara	25	26°28'28.02"N 91°11'38.64"E	25/12/2019
2.	S2	Bamun Paka	15	26°23'32.39"N 91°13'7.45"E	25/12/2019

Figure 4.7: Photos of Soil Sampling



Debara Ch. 13+870



Bamun Paka Ch. 2+800

The important physical characteristics of soil are bulk density, porosity and texture. Ph of soil in the proposed study area were found in the range of 7.02 to 7.24, the soil samples are, therefore, moderately alkaline. Conductivity of soil in the proposed study area is found to be in the range of 196 to 224 Mhos/cm. Available phosphorous of soil samples along the proposed study area ranges from 50.2 to 62.10 mg/kg. Potassium content as K in soil samples along the proposed study area is found in the range of 154.3 to220.4 mg/kg. Total organic matter in soil samples along the proposed study area is found in the range of 0.56 – 0.62 %, therefore the soil is fertile in terms of productivity (Table 4.5).

Table 4-5: Results of the Soil Analysis

Sl. No	Parameter	Locations		Unit	Standards
		S8	S9		
1.	Ph(1:5 suspension)	7.02	7.24	-	IS:2720(Part-26)
2.	Electrical Conductivity at $25^{O}C$ (1:5suspension.)	224	196	µS/cm	IS:2720(Part-21)
3.	Infiltration Rate	264	178	mm/hr	STP/SOIL
4.	Organic Matter	0.62	0.56	% by mass	IS:2720(Part-22)
5.	Sulphate	52.24	71.2	mg/kg	STP/SOIL
6.	Potassium (as K)	220.4	154.3	mg/kg	STP/SOIL
7.	Moisture Retention Capacity	94	64	% by mass	STP/SOIL
8.	Porosity	96	43.1	% by mass	STP/SOIL
9.	Sand	52.4	55.20	% by mass	STP/SOIL
10.	Clay	34.8	32.2	% by mass	STP/SOIL

Sl. No	Parameter	Locations		Unit	Standards
		S8	S9		
11.	Silt	12.8	12.60	% by mass	STP/SOIL
12.	Texture	Sandy Clay	Sandy Clay Loam	-	STP/SOIL
13.	Sodium Sulphate	0.053	0.056	% by mass	STP/SOIL
14.	Nitrogen	432	362	mg/kg	STP/SOIL
15.	Phosphorus	62.10	50.2	mg/kg	STP/SOIL
16.	Bulk Density	1.19	1.30	gm/cc	STP/SOIL

Source: Primary Survey by Noida Testing Laboratories

b) Ambient Air Quality (AAQ)

Total two ambient air-sampling locations has been selected for assessment of the existing status of air environment within the study zone. The selection of monitoring locations has been distributed throughout the study area to get representative baseline of any variation in land use as well as road geometrics and traffic conditions across the proposed alignment including the baseline at sensitive receptors along the project. The heights of the sampling locations were kept between 3.0 to 5.0 m in all the locations. The baseline data of air environment was generated for the parameters namely Particulate Matter size less than 10 µm (PM10), Particulate Matter size less than 2.5 µm (PM2.5), Sulphur dioxide (SO2), Nitrogen dioxide (NO2) and Carbon Monoxide (CO). The sampling locations of ambient air monitoring stations are presented in Table 4.6 ad Figure 4.8.

Table 4-6: Location of Ambient Air Quality Monitoring Station

Sl. No.	Monitoring Station Code	Location	Latitude / Longitude	Area Categorization	Distance from Road edge (m)	Height from Ground Level (m)
1	AQ 1	Raipur	26°28'43.27"N 91°11'45.64"E	Residential	5	3
2	AQ2	Sarthebari	26°22'12.38"N 91°13'26.73"E	Residential	20	5

Figure 4.8: Photos of Ambient Air Monitoring



Pathsala (Raipur) Ch. 13+900



Sarthebari Ch. 0+200

The monitoring of the Ambient Air Quality (AAQ) at each selected location was carried out as per guidelines of Central Pollution Control Board (CPCB) and requirements of MoEF&CC. The summary of the ambient air quality results is presented in Table 4.7.

Table 4-7: Consolidated 98th Percentile Values (µg/m³ except CO in mg/m³)

S. No.	Station Name	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO
1	AAQ1	72.20	36.66	10.75	15.88	0.65
2	AAQ2	72.52	36.78	10.62	15.94	0.61
NAAQS Limit		**100**	**60**	**80**	**80**	**02**

Source: Primary Monitoring and Analysis undertaken by Noida Testing Laboratory, Noida

Arithmetic mean of the 24-hourly average values of PM_{10} varies between 67.64 and 67.76 µg/m³. The 24-hourly average 98-percentile values of PM_{10} were observed between 72.20 and 72.52µg/m³, which is within the stipulated limit of 100 µg/m³ for Industrial, Residential, Rural & other areas as per National Ambient Air Quality Standards (NAAQS) 2009 and higher than WHO AAQ Std i.e, 50 µg/m³.

Arithmetic mean of the 24-hourly average values of $PM_{2.5}$ varies between 29.75 and 29.33 µg/m³. The 24-hourly average 98-percentile values of $PM_{2.5}$ is 38.82 and 36.78 µg/m³ at two locations which is within the stipulated limit of 60 µg/m³ for Industrial, Residential, Rural & other areas as per National Ambient Air Quality Standards (NAAQS), 2009 and higher than WHO AAQ Std i.e, 25 µg/m³.

Arithmetic mean of the 24-hourly average values of SO_2 for all stations is found between 9.07 and 9.81 µg/m³. The 24-hourly average 98-percentile values of SO_2 is 10.75 and 10.62 µg/m³ at two locations which is within the stipulated limit of 80µg/m³ for Industrial, Residential, Rural & other areas as stipulated in the National Ambient Air Quality Standards (NAAQS), 2009 as well as lower than WHO AAQ Std i.e 20 µg/m³.

Arithmetic mean of the 24-hourly average values of NO_2 for all the stations is found to be 12.70 to 13.69 µg/m³. The 24-hourly average 98-percentile values of NO_2 is 15.88µg/m³ and 15.94µg/m³ at two locations were observed within the limit of 80 µg/m³ for Industrial, Residential, Rural & other areas as stipulated in the National Ambient Air Quality Standards (NAAQS) as well as lower than WHO AAQ Std i.e 40 µg/m³.

Arithmetic mean of the 8-hourly average values of CO varied station-wise between 0.49-0.54 mg/m³ The 8-hourly average 98-percentile values of CO (0.61 to 0.65 mg/m³) at all locations were observed to be within the limit of 2 mg/m³ for Industrial, Residential, Rural & other areas as stipulated in the National Ambient Air Quality Standards, 2009.

Concentration of Criteria pollutants was found within prescribed National Ambient Air Quality standards (NAAQS).

c) Ambient Noise Level

Noise is an important environmental attribute in all road projects because vehicular traffic is a major source of noise pollution. Two ambient noise-sampling locations were identified for noise monitoring to characterize the baseline noise levels in the project area. Locations for noise monitoring along the corridor are identified to cover the various land use present along the corridor. Noise monitoring stations are detailed in Table 4.8.

Table 4-8: Noise Monitoring Location

Monitoring Station Code	Location	Date of Sampling	GPS Coordinates	Area Category	Distance from Road edge (m)
N 1	Pathsala (Raipur)	25/12/2019	26°28'43.27"N 91°11'45.64"E	Residential	7 (m)
N 2	Sarthebari	25/12/2019	26°22'13.49"N 91°13'27.52"E	Silence	28 (m)

**Note: There is no industrial and Commercial area in the vicinity of project corridor.*

Source: Primary Surveys

Figure 4.9: Photos of Noise Monitoring



Raipur (Residential) Ch. 13+980



Sarthebari (School) Ch. 0+240

The main objective of noise monitoring in the study area is to establish the baseline noise levels, which was used to assess the impact of total noise generated by the proposed project activities. Noise level monitoring was carried out continuously for 24 – hours with one-hour interval at each location using Sound level meter (HTC made in Taiwan Model No. SL-1350) capable of measuring the Sound Pressure Level (SPL) in Db (A). Hourly Leq values were computed by the noise integrating sound level meter and statistical analysis was done for measured noise levels in the study area.

Leq day and Leq night calculated for various locations in the area are presented below which are compared with the standards prescribed by CPCB for various zones. The Noise quality result presented in below table, show Leq Day time is 45.8 to 54.9 Db(A) and Leq Night time varies from 37.4 to 43.4 Db(A) as shown in Table 4.9.

Table 4-9: Results of Primary Noise Monitoring

Monitoring Station Code	Observed Noise Levels in Db (A)								Noise Quality Standards in Db (A)	
	L10	L50	L90	L_{eq} Day	L_{eq} Night	Leq	Min Value	Max Value	L_{eq} Day	L_{eq} Night
N1	51.2	48.3	46.4	54.9	43.4	49.1	58.6	40.1	55	45
N2	43.8	40.7	38.0	45.8	37.4	41.6	49.2	34.2	50	40

Source: Primary Survey by Noida Testing Laboratories

d) Water Resources and Water quality

Assam is endowed with enormous water resources. The large perennial rivers like Brahmaputra and other water bodies with the rich aquifer speak about vastness of its water resource. Surface water is available in the forms of river, stream, lake, swamps, pond etc. The ground water is available at low to moderate depth almost in entire state. Although there is seasonal and regional variation in the availability of water resources, the annual availability of water resource remains almost same. In the last few decades, the use of water has been growing at a fast rate, which is more than twice the rate of the increase of human population. The consumption of water has increased due to the increase of human population as well as the diversification of human activities. With the increase of per capita consumption of water in domestic, agricultural and industrial sectors, cause the reduction of potential per capita availability of water. Moreover, it may cause the deterioration of water quality to a great extent. The status of the ground water quality and surface water quality in the project area has been given hereafter.

Samples for ground water quality assessment were collected from two GW locations and analysed for assessment of water quality. Location of ground & Surface water sampling are provided in below Table 4.10.

Table 4-10: Ground water sampling locations

Sl. No	Monitoring Station Code	Location	Distance from Road edge (m)	Latitude	Longitude	Date of Monitoring
1	GW 1	Debara	28	26°28’29.10”N	91°11’38.99”E	25/12/2019
2	GW 2	BamunPaka	5	26°23’32.39”N	91°13’7.45”E	25/12/2019

Source: Primary Survey by Noida Testing Laboratory

Figure 4.10: Photos of Ground Water Sampling



Debara (Ch 13+900)



Bamun Paka (Ch. 2+800)

Surface water quality of the entire project stretch has been monitored as per the parameters laid down by Central Pollution Control Board for surface water quality criteria at two SW locations along the proposed alignment. Sampling location and photos are given in **Table 4.11** and **Figure 4.11**.

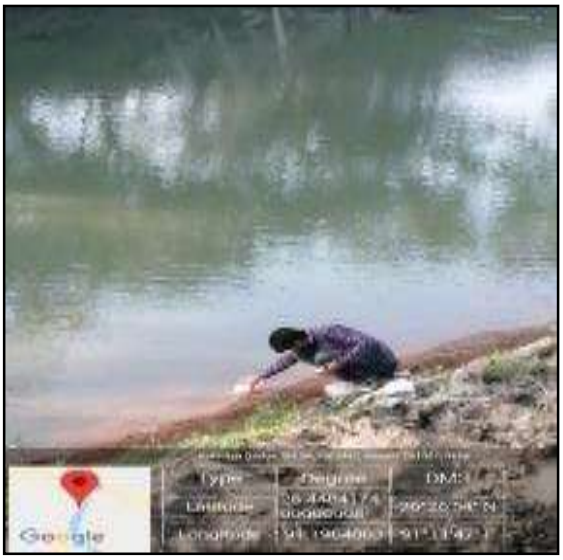
Table 4-11: Surface water sampling locations

Sl. No.	Monitoring Station Code	Location	Distance from Road edge (m)	Latitude	Longitude	Date of Monitoring
1	SW 1	Kaladia River (Bangaon)	138 (Downstream)	26°26’53.82”N	91°11’47.25”E	25/12/2019
2	SW 2	Buradiya /Tihu	38	26°24’16.86”N	91°12’21.44”E	25/12/2019

Sl. No.	Monitoring Station Code	Location	Distance from Road edge (m)	Latitude	Longitude	Date of Monitoring
		River (Kharia)	(Downstream)			

Source: Primary Survey by Noida Testing Laboratory

Figure 4.11: Photos of Surface Water Sampling



Kaladia River (Bangaon Ch.10+400)



Buradiya/Tihu River (Kharia Ch. 4+700)

e) Groundwater Quality

The water samples as collected were analysed in laboratory and the result was compared against IS 10,500: 2012 for drinking water standards. The results are presented in above table. Ph found ranging from 6.62 to 7.12 in ground water samples taken along the proposed alignment. The chloride content varies from 32.10 to 40.10 mg/l. Chloride value is well within the prescribed norms of CPCB. The concentration of Nitrate ranges below detectable limit. The concentration of iron in ground water has been found to vary from 0.088 to 0.092 mg/l. iron content found well within the permissible limit. Conductivity varies from 310 to 522 µS/cm. Total Dissolve Solid varies from 184 to 324mg/l.

Table 4-12: Ground Water Monitoring Results

S. No.	Parameters	Test Method	Unit	GW 1	GW 2	Limits as IS Standard: 10500	
						Desirable Limits	Extended Limits
1	Ph	IS-3025(P-11)	---	6.62	7.12	6.5	8.5
2	Colour	IS-3025(P-04)	Hazen	<1.0	<1.0	5	25
3	Odour	IS-3025(P-05)	---	Agreeable	Agreeable	-	-
4	Temperature	IS-3025(P-09)	ºC	22.0	20.6		
5	Turbidity	IS-3025(P-10)	NTU	<1.0	<1.0	1	5
6	Conductivity @25^{0}C	IS-3025(P-14)	µS/cm	310	522	-	-
7	Sulphate (SO4)	IS-3025(P-24)	mg/l	15.81	42.12	200	400
8	Nitrate (NO3)	IS-3025(P-34)	mg/l	2.16	3.88	45	No Relaxation

S. No.	Parameters	Test Method	Unit	GW 1	GW 2	Limits as IS Standard: 10500	
						Desirable Limits	Extended Limits
9	Total Hardness(as CaCO3)	IS: 3025 (P- 21)	mg/l	81.0	146	200	600
10	Chloride(as Cl)	IS: 3025 (P- 32)	mg/l	32.10	40.10	250	1000
11	Fluoride (as F)	IS: 3025 (P-60)	mg/l	0.24	0.38	1.0	1.5
12	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.092	0.088	0.3	No Relaxation
13	Dissolve Oxygen	IS: 3025(P-58)	mg/l	7.1	7.3	-	-
14	Total Dissolved Solid	IS-3025(P-16)	mg/l	184	324	500	2000
15	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	19.69	32.86	75 -	200
16	Magnesium (as Mg)	IS: 3025 (P-46)	mg/l	7.78	15.55	30	1000
17	Arsenic (as As)	IS-3025(P-37)	mg/l	BDL	BDL	0.01	No Relaxation
18	Lead (as Pb)	IS-3025(P-47)	mg/l	BDL	BDL	0.01	No Relaxation
19	Copper (as Cu)	IS-3025(P-42)	mg/l	BDL	BDL	0.05	No Relaxation
20	Zinc (as Zn)	IS-3025(P-49)	mg/l	0.086	0.204	5.0 -	15.0
21	Manganese (as Mn)	IS-3025(P-59)	mg/l	BDL	BDL	0.1	0.3
22	Total Chromium (as Cr)	IS-3025(P-52)	mg/l	BDL	BDL	0.05	No Relaxation
23	Sodium (as Na)	IS-3025(P-45)	mg/l	21.2	25.6	---	---
24	Potassium (as K)	IS-3025(P-45)	mg/l	1.9	1.6	---	---
25	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P- 23)	mg/l	96.0	168	200	600
26	Total Solid	IS-3025(P-16)	mg/l	184.6	324.7	---	---
27	Phosphate (as P)	IS-3025(P-31)	mg/l	BDL	BDL	---	---
28	Nitrite (as NO_2)	IS-3025(P-34)	mg/l	BDL	BDL	---	---
29	Total Suspended Solid	IS-3025(P-17)	mg/l	<1.0	<1.0	---	---
30	Faecal Coliform	IS-1622	---	Absent/ 100ml	Absent/ 100ml	Absent/ 100ml	Absent/100ml
31	Total Coliform	IS-1622	---	Absent/ 100ml	Absent/ 100ml	Absent/ 100ml	Absent/100ml

Source: Primary Survey by Noida Testing Laboratories

f) Surface Water Quality

Surface water quality monitoring revealed that all surface water bodies meet CPCB water quality criteria Class C. It can be concluded that the surface water is suitable for propagation of Wildlife and fisheries, irrigation and Industrial cooling purpose. Presence of Coliform indicates, the surface water is contaminated with human excreta, household waste, etc.

Table 4-13: Surface Water Test Result

S. No.	Parameters	Test Method	Unit	SW 1	SW 2	Tolerance Limit IS:2296 CLASS C
1	Ph	IS-3025(Part-11)		7.48	7.58	6.5 -8.5
2	Temperature	IS:3025(Part-9)	ºC	18	20.4	-
3	Turbidity	IS-3025(P-10)	NTU	6.9	10.4	-
4	Conductivity @25^{0}C	IS-3025(P-14)	µS/cm	252	366	-
5	Sulphate (SO4)	IS: 3025 (P- 24)	mg/l	-	19.7	400
6	Nitrate (NO3)	IS:3025(Part-34)	mg/l	2.10	2.9	50
7	Total Hardness (as CaCO3)	IS: 3025 (P- 21)	mg/l	80.0	136	-
8	Chloride (as Cl)	IS: 3025 (P- 32)	mg/l	14.32	32.9	600
9	Fluoride (as F)	IS: 3025 (P- 30)	mg/l	0.39	0.39	1.5
10	COD (as O2)	IS:3025(Part-58)	mg/l	24.0	34.0	-
11	Iron (as Fe)	IS: 3025 (Part – 53)	mg/l	0.37	0.502	50
12	Dissolve Oxygen	IS:3025(Part-58)	mg/l	6.1	4.9	4.0
13	Total Dissolved Solid	IS-3025(P-16)	mg/l	161	232	1500
14	BOD (3 days at 27^{0}C)	IS:3025(Part-44)	mg/l	5.6	7.2	3.0
15	Calcium (as Ca)	IS-3025(P-40)	mg/l	17.64	41.68	-
16	Magnesium (as Mg)	IS-3025(P-46)	mg/l	8.75	7.78	-
17	Arsenic (as As)	IS: 3025 (Part – 37)	mg/l	BDL	BDL	0.2
18	Lead (as Pb)	IS: 3025 (Part – 47)	mg/l	BDL	BDL	0.1
19	Copper (as Cu)	IS: 3025 (Part – 42)	mg/l	BDL	BDL	1.5
20	Zinc (as Zn)	IS: 3025 (Part – 49)	mg/l	0.22	0.28	15.0
21	Manganese (as Mn)	IS: 3025 (Part – 45)	mg/l	BDL	BDL	-
22	Total Chromium (as Cr)	IS: 3025 (Part – 52)	mg/l	BDL	BDL	0.05
23	Sodium (as Na)	IS-3025(P-45)	mg/l	10.2	21.0	-
24	Potassium (as K)	IS-3025(P-45)	mg/l	1.20	3.1	-
25	Total Alkalinity (as $CaCO_3$)	IS-3025(P-23)	mg/l	92.0	156	-
26	Total Solid	IS-3025(Part-16)	mg/l	170.2	246.3	-
27	Phosphate (as P)	IS-3025(Part-31)	mg/l	0.102	0.182	-
28	Nitrite (as NO_2)	IS-3025(Part-34)	mg/l	BDL	BDL	-
29	Total Suspended Solid	IS-3025(Part-17)	mg/l	9.2	14.3	-
30	Total Coliform	IS – 1622	MPN/100 ml	232	328	5000

Source: Primary Survey by Noida Testing Laboratories

E. Biological Environment

a) Forests of Assam

Forests of Assam have rich biodiversity of flora and fauna. It has a wide range of forests viz. Evergreen and Semi Evergreen forests, Mixed Deciduous forests, Sal Forests, Riverine forests, Moist Savannah, dry Savanna, and Dry Miscellaneous Type of forests. The state also has a humid weather which combined with the rich forest biodiversity gives the state several endemic species of flora and fauna. The state has many varieties of important commercial crops including rice, banana, citrus, ginger and tea. The state boasts of 3010 species of flowering plants including 347 medicinal plants, 102 endemic and restricted range plants, 182 species of orchids, 42 species of Bamboos and 14 species of cane. Different Forest types in the state can be classified as below:

- Tropical Wet Evergreen Forests
- Tropical Semi-Evergreen Forests
- Tropical Moist Deciduous Forests
- Sub-tropical Broadleaf Hill Forests
- Sub-tropical Pine Forests
- Littoral and Swamp Forests
- Grassland and Savannahs

A total of 26,832 sq km (37.21%) of the geographical area of the state is covered by forest. These forests have 193 species of mammals including 10 primates, 820 species and subspecies of birds, 185 species of fish, 405 species of butterflies, 115 species of reptiles, 46 species of amphibians and 39 species of snails. The state has 4% of its total green cover notified as Protected Area, comprising of 5 National Parks and 20 Wildlife Sanctuaries. The state also has 2 UNESCO World Heritage sites and 2 Biosphere reserves, 4 Tiger Reserves and 5 Elephant Reserves.

Based on the Primary survey and discussion with the DFO while doing tree inventory for tree felling permission, it was noted that no forest land notified under the Indian Forest Act – 1927 are reported within the proposed ROW.

b) Important Flora of the State

The state is rich with several important flora species. Different types of species are prevalent in different type of forest in the state. Each of these forest types, regions for the same and the prevalent flora species in each are given below.

The state is rich with several important flora species. Different types of species are prevalent in different type of forest in the state. Each of these forest types, regions for the same and the prevalent flora species in each are given below.

Evergreen Forests:

Evergreen Forests are mainly found in Lakhimpur, Dhemaji, Dibrugarh, Sibasagar, Tinsukia, Cachar extending upto Panchnadi in north bank and Golaghat district. Present species in these forests includes the following.

Table 14: Present Species in Evergreen forests of Assam

Sr. No.	Dominant Families
1	Dilleniaceae
2	Anonaceae
3	Clusiaceae
4	Magnoliaceae
5	Fabaceae

Sr. No.	Dominant Families
6	Myrtaceae
7	Styraceae
8	Ebenaceae
9	Myristicaceae
10	Lauraceae

Sr. No.	Dominant Families
11	Euphorbiaceae
12	Fagaceae
13	Myrtaceae
14	Styraceae
15	Ebenaceae
16	Myristicaceae

Sr. No.	Dominant Families
17	Lauraceae
18	Euphorbiaceae
19	Fagaceae
20	Arecaceae
21	Poaceae
22	Dipterocarpaceae

Deciduous Forests:

Deciduous Forests lie mainly in Dhubri, Kokrajhar, Goalpara, Bongaigaon, Chirang, Baksa, Nalbari and Udalguri regions in the state. Various species under this includes the following.

Table 15: Present Species in Deciduous forests of Assam

Sr. No.	Dominant Families
1	Lagerstroemia parviflora
2	Kydia calycina
3	Schima Wallichi
4	Careya arborea
5	Gmelina arborea

Sr. No.	Dominant Families
6	Cassia fistula
7	Albizzia lucida
8	A. Odoratissima
9	Millusa velutina
10	Stereospermum chelonoides

Swamp Forests

These forests are usually found in low lying areas, abandoned river channels etc. Dominant species in these includes:

Table 16: Present Species in Swamp forests of Assam

Sr. No.	Dominant Families
1	Crataeva lophosperma
2	Eugenia species
3	Duabanga grandiflora
4	Te rminalia myriocarpa
5	Largerstroemia flos-regina
6	Trewia nudiflora
7	Ficus pyriformes
8	Hygrorhiza aristate
9	Vossia procera
10	Panicum proliferum

Sr. No.	Dominant Families
11	Phragmities communis
12	P.karka
13	Arundo donax
14	Nymphaeceae
15	Lamnaceae
16	Alismaceae
17	Naiadaceae
18	Eriocauleceae
19	Cyperaceae

Grass lands:

Grasslands in the state is found in the riparian belt and in low rainfall areas. Some of the species in these grasslands are as follows:

Table 17: Present Species in Grasslands of Assam

Sr. No.	Dominant Families
1	Saccharum
2	Anthistena

Sr. No.	Dominant Families
3	Erianthus
4	Arundo

Sr. No.	Dominant Families
5	Phragmities
6	Imperata arundinaceae
7	Aptuda varia

Sr. No.	Dominant Families
8	Andropogon jwarancusa
9	Nardus contortus
10	Setaria glauca

Some of the species of plants of medicinal importance to the state are as follows:

Table 18: Plants of medicinal importance to the state

Sr. No.	Scientific Name	Common Name	Uses
1	*Flacoutia jangomas*	Paniol	The fruits from the plant are used as a medicine to treat jaundice. Leaves and Roots are taken for schistoosmiasis, malaria and diarrhoea. Roots of the plant are believed to treat pneumonia, intestinal worms and act as pain reliever.
2	*Baccaurea ramiflora*	Leteku	The bark, roots and wood from this plant are harvested for medicinal use and is used to treat skin diseases.
3	*Garcinia lanceifolia*	Rupahi thekera	The fruits from this plant are used for preparation of soft drinks and used as a medicine for diarrhoea.
4	*Myrica esculenta*	Nagatenga	The fruits have antioxidant, anviral and antidiarrhoeal properties.
5	*Garcinia pedunculata*	Bor thekera	This dried fruit is used to treat dysentery. The bark of this fruit is used to dye clothes.
6	*Carissa carandas*	Karza tenga	The fruit is antiscorbutic and is used for anaemia. It is also an ingredient in jelly, jam syrup and chutney.
7	*Ajuga integrifolia*	Nilakantha	This plant is aromatic, astringent and tonic. It is useful in treatment of agues. Roots are helpful in treatment of diarrhoea and dysentery. The leaves are used in the treatment of fever substituting quinine.
8	*Andrographis paniculata*	Sirata/Kalmegh	The plant extract has antityphoid and antifungal properties. It is also reported to be helpful as antihepatotoxic, antibiotic, antimalarial, antihepatitic, antithrombogenic, anti-inflammatory, anti-snake venom and antipyretic.
9	*Bacopa monnieri*	Brahmi	It is used in Ayurvedic treatment for epilepsy and asthma. It is also used for ulcers, tumors, enlarged spleen, indigestion etc.
10	*Centella asiatica*	Manimuni	This has antibacterial, antiviral, anti-inflammatory, antiulcerogenic, anxiolytic, nervine and vulnerary properties and acts as cerebral tonic.
11	*Cheilocostus speciosus*	Jomlakhuti	This plant has uses in Ayurveda to treat fever, rash, asthama, bronchitis and intestinal worms.
12	*Catharanthus roseus*	Nayantara	This species is cultivated for herbal medicine and is prevalent in Ayurveda as a cure against several diseases like diabetes, malaria and Hodgkin's lymphoma.
13	*Amaranthus spinosus*	Khutura xak	This is used in treatment of diarrhoea, excessive menstruation and snake bites.

c) Methodology

Site visits were undertaken in the month of Jan-Feb of 2020 during which primary studies including enumeration of trees & identification of flora and fauna (as part of biodiversity study) were carried out to assess the existing ecological status of the project area along the road alignment.

The floral assessment was based on tree enumeration, identification of vegetation type/species, agricultural crops & consultations with the locals. Identification of species were done with the help of taxonomy manual, published literatures, reports and websites (BSI, ZSI and State/District Forest Departments). The faunal species (terrestrial, aerial and aquatic) of the project area have been developed through direct sighting and through secondary means like nests, roosts, pug marks, droppings, etc. followed by consulting authentic secondary information i.e., Published Research and Forest Working Plan & consultations with local inhabitants to verify the presence of the species along with their common names.

Ecological sensitivity along with critical habitats (National Park, Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered, vulnerable and range restricted species etc.) in the project area has also been referred and crosschecked with the help of IBAT tool. Species have Been classified as critically endangered, endangered, threatened etc. as per IUCN Red list and Scheduled Species as per WPA (1972).

d) Forest Area and Types at State and District level

The major categories of vegetation in Assam are Tropical Evergreen Forests, Tropical Semi-Evergreen Forests, Tropical Moist & Dry Deciduous Forests, Grasslands & Savannas, Temperate Forests and Sub-tropical Pine Forests etc.

As per ISFR, 2019, Forest Cover in the State is 28,326.51 sq.km which is 36.11 % of the State's geographical area. In terms of forest canopy density classes, the State has 2,794.86 sq.km under Very Dense Forest (VDF), 10,278.91 sq.km under Moderately Dense Forest (MDF) and 15,252.74 sq.km under Open Forest (OF). The total forest cover of the Barpeta district is 115.18 sqkm, which is 5.05% of its geographical area (Table 4.14).

Table 4-19: Project District Forest Cover

District	Geographical Area (km^2)	Very Dense Forest (km^2)	Mod. Dense Forest (km^2)	Open Forest (km^2)	Total (km^2)	% of GA
Barpeta*	2,282.00	-	33.21	81.97	115.18	5.05
Assam	**78,438**	**2,794.86**	**10,278.91**	**15,252.74**	**28,326.51**	**36.11**

*Source: ISFR Vol- II; Assam 2019 * Forest details of Bajali district is not available.*

The location of the proposed project lies in the Barpeta and Bajali Districts of Assam which is situated on the western part of Brahmaputra Valley (right bank of Brahmaputra). The natural vegetation in the districts are falls in the Tropical Semi Evergreen type. The proposed road development project passes through the agricultural fields and human settlements where natural as well as planted trees are found.

e) Protected Areas

This project road is neither passing through any eco-sensitive/ protected area nor within 10.0 km radius. Nearest Eco-sensitive/protected area is Manas National Park which is located at 21.3 km from the Project Road. Location of the project road and protected areas of Assam is given in Figure 4.12. Location of nearest protected area and project road is given in Figure 4.13, Nearest elephant corridor from the project road is given in Figure 4.14.

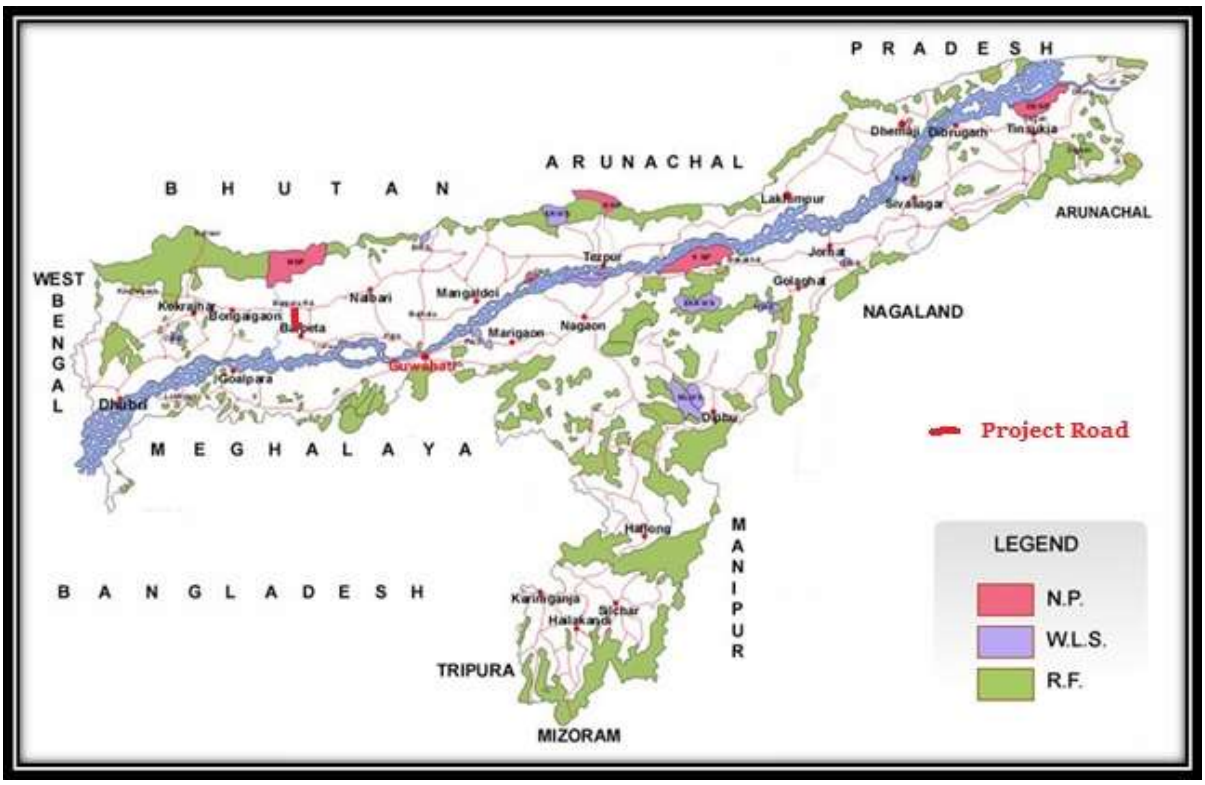


Figure 4.12: Location of the project road and protected areas of Assam

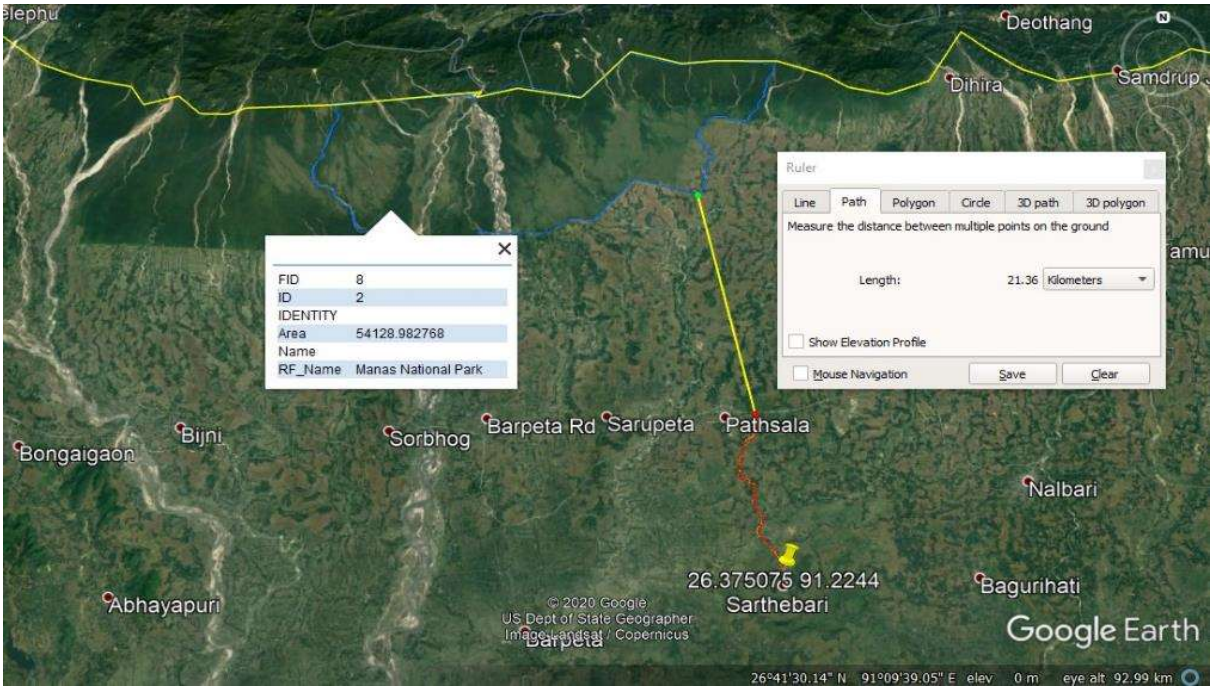


Figure 4.13: Distance between the project road and nearest protected areas

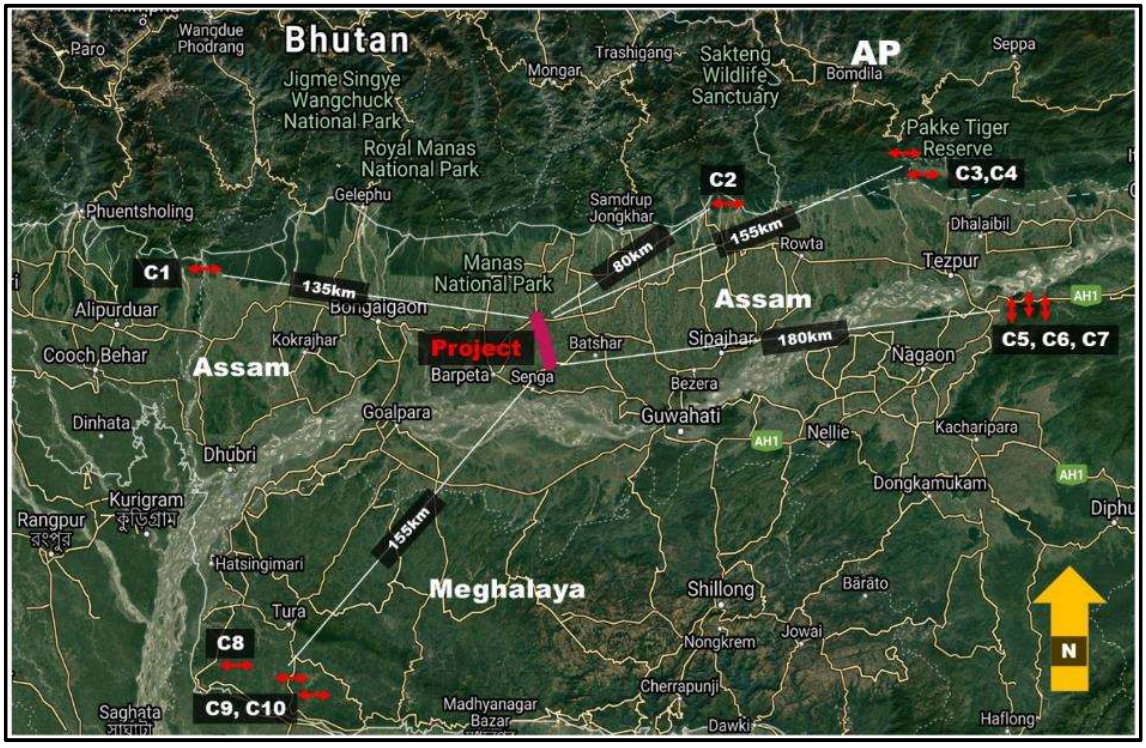


Figure 4.14: Map Showing Distances between Project Alignment and Nearest Elephant Corridors

Details of Corridors mentioned in map:

C1: Buxa-Ripu at Sankosh in Assam (Arial Distance: 135 km Approx.)
C2: Bornandi-Khalingduar in Assam (Arial Distance: 80km Approx.)
C3: Pakka-Doimara at Tipi in Arunachal Pradesh (Arial Distance: 155km Approx.)
C4: Pakka-Doimara at Dozling in Arunachal Pradesh (Approx. Arial Distance: 155km Approx.)
C5: Kukurakala-Bagser at Amguri in Assam (Arial Distance: 180km Approx.)
C6: Kaziranga-Karbi Anglong at Haldibari in Assam (Arial Distance: 185km Approx.)
C7: Kaziranga-Karbi Aglong at Kanchanjuri in Assam (Arial Distance: 190km Approx.)
C8: Ranggira-Nokrek in Meghalaya (Arial Distance: 160 km Approx.)
C9: Imangiri-Nokrek in Meghalaya (Arial Distance: 153 km Approx.)
C10: Siju-Rewak in Meghalaya (Arial Distance: 155km Approx.)

Sources:

1. Right of Passage: Elephant Corridors of India (2017), Conservation Reference Series, Wildlife Trust of India and MoEFCC.
2. Website Article "Right of Passage: National Elephant Corridors Project" https://www.wti.org.in/projects/right-of-passage/
3.Google Maps

f) Project Corridor and its ecological sensitivity

Project Corridors	
A07	
Name of the corridor	Sarthebari Pathsala Raipur Road
District	**Barpeta & Bajali**
Proximity to PAs or other sensitive areas	• Manas NP is located at 23km towards north. • No major threatened flora and fauna reported along the corridor and in its indirect influential Zone.

Project Corridors	
A07	
Flora	Tropical Semi Evergreen type. (No rare endangered species as per IUCN Red List / NWPA reported from Project area)
Other	Golden apple *Aegle marmelos,* Pineapple *Anonas comosus,* areca palm *Areca catechu,* Jackfruit, *Artocarpus heterophyllus,* Neem, *Azadirachta indica,* shisham *Dalbergia sisoo,* Cotton *Bombax ceiba,* Papaya *Carica papaya,* Lemon *Citrus limon,* gamhar *Gmelina arborea,* Chalmogra *Gynocardia odorata,* Crepe Flower *Lagerstomia parviflora,* Mountain Pepper *Litsea cubeba,* Mangoes *Mangifera indica,* white cedar *Melia*
	Threatened Flora of Assam: Assam Cycas *pectinate,* Chooa oil tree *Vatica lanceaefolia,* Spicer's Slipper Orchid *Paphiopedilum spicerianum,* Sia-nahor *Mesua assamica,* Kothalua-sopa *Magnolia mannii,* Bar-gahori-sopa *Magnolia griffithii*, Cathcart's Magnolia *cathcartii*

g) Floral Species of the project area

The core area of this road project is almost plain with major land use as agricultural and human settlement. There are no reserve or protected forest occurs along the road alignment except some natural vegetation patches. An inventory on the floral elements found in the project area are given below[2];

The common trees along the agriculture and villages are, *Aegle marmelos*, *Anonas comosus, Areca catechu, Artocarpus heterophyllus, Azadirachta indica, Dalbergia sisoo, Bombax ceiba, Carica papaya, Citrus limon, Gmelina arborea, Gynocardia odorata, Lagerstomia parviflora, Litsea cubeba, Mangifera indica, Melia azedarach, Moringa oleifera, Musa paradisiaca, Phyllanthus emblica, Shorea robusta, Spondias mangifera, Syzygium cumini, Terminalia chebula* and *Zizyphus mauritiana* etc.

In shrubs following species are common; *Abroma augusta, Adhatoda vasica, Agave americana, Aloe barbadensis, Argemone mexicana, Boehmeria macrophylla, Canna indica, Clerodendrum indicum, Chloranthus elatior, Clausena heptaphylla, Caesalpinia bonduc, Calotropis gigantea, Cassia occidentalis, Cassia tora, Clerodendrum glandulosum, Clerodendrum viscosum, Colocasia esculenta, Croton bonplandianum, Datura metal, Eupatorium odoratum, Ficus racemosa, Globba clarkei, Glycosmis arborea, Jatropha curcas, Lantana camara, Mussaenda roxburghii, Phlogacanthus curviflorus* and *Phyllanthus* sp. Etc. Common climbers in the region are *Cuscuta reflexa, Dioscorea alata, Jasminum auriculatum, Smilax ovalifolia, Vitex negundo* etc.

The most frequent herb species are: *Achyranthes aspera, Alternanthera sessilis, Amaranthus spinosus, Amaranthus viridis, Arisaema tortuosum, Boerhavia diffusa, Bryophyllum pinnatum, Cassia occidentalis, Cassia sophera, Cassia tora, Colocasia esculenta, Croton bonplandianum, Curcuma amada, Euphorbia neriifolia, Mirabilis jalapa, Oxalis corniculata, Solanum torvum, Vinca rosea (Nayantara) etc.* Whereas common ferns include *Palhinea cernua, Selaginella helferi, Adianiujn caudatun, Blechnum orientale, Christella parasitica, Dicranopteris linearis, Onychium siliculossum, Pteris biaurta* and *Tectaria variolosa etc.* Grasses of the area are *Cyperus brevifolius, Cyperus iria, Imperata cylindrica, Oplismenus burmannii, Sacciolepis indica, Panicum sp., Setaria indica, Stellaria glauca* and *Scripus juncoides.*

h) Faunal Diversity of the Study Area

The proposed road development project passes mainly through the agriculture fields and human settlements with small patches of natural vegetations and therefore supports limited faunal variety in compassion to the forested areas. Lists of mammals, birds, reptiles, amphibians their common

[2] **Sources: (i)**Primary Survey. **(ii)** Biodiversity of Assam, Assam state biodiversity board, http://asbb.gov.in /biodiversity.html **(iii)** K. K. Sarmah and S. K., 2008.Borthakur Phytogeography of Barpeta & Bajali Districts of Assam, India. Pleione 2(2): 203 – 210. **(iv)** Kalita G., Sarma P. & Mishra R. & Rout S., 2015. Traditionally used medicinal Plants of Barpeta & Bajali Districts, Assam. Journal of Medicinal Plants Studies. 8. 8-17.

name, IUCN status and Wildlife (Protection) Act, 1972 Schedule is given below in table 4.14 to 4.16. As per this assessment, a total of 13 species of mammals, 53 species of reptiles-amphibians and 98 species of birds are reported from the proposed project area.

Table 4-20: Mammals Reported in the Study Area

Sl. No.	Scientific Name	Common Name	IUCN Status/ WLP Schedule
1	*Anourosorex squamipes*	Mole Shrew	LC
2	*Bandicota bengalensis*	Lesser Bandicoot Rat	LC
3	*Cynopterus sphinx*	Short nosed Indian fruit Bat	LC
4	*Funambulus palmarum*	Indian Palm Squirrel	LC/ IV
5	*Herpestes javanicus*	Small Indian Mongoose	**LC/ II**
6	*Lepus nigricollis*	Indian Hare	LC/IV
7	*Macaca assamensis*	Assamese Macaque	**VU/II**
8	*Paradoxurus hermaphroditus*	Common Palm Civet	LC
9	*Pteropus giganteus*	Indian flying Fox	LC/IV
10	*Rhizomys pruinosus*	Hoary Bamboo Rat	LC
11	*Suncus murinus*	Asian House Shrew	LC
12	*Sus scrofa*	Wild Boar	LC/III

Sources: (i) Primary survey (ii) Biodiversity of Assam, Assam state biodiversity board, http://asbb.gov.in/ biodiversity.html. (iii) Wild Biodiversity of Barpeta Anchalik BMC: Wild Animals (Mammals, Birds, Reptiles, Amphibia, Insects, others) India Biodiversity Portal, https://indiabiodiversity.org/ dataTable/show/1754528.

Table 4-21: Reptiles and Amphibians Reported in the Study Area

S.N.	Scientific Name	Common Name	IUCN Status/ WLP Schedule
1	*Ahaetulla nasuta*	Common Green Whip Snake	IV
2	*Boiga multomaculata*	Naril-arangba	NE/ IV
3	*Bungurus fasciatus*	Banded Krait	LC
4	*Calotes microlepis*	Numityungbi Chum	-
5	*Calotes versicolor*	Indian Garden Lizard	LC
6	*Coelognathus radiatus*	Rat Snake	LC
7	*Eutropis carinata*	Common Skink	LC
8	*Fejervarya limnocharis*	Common Pond Frog	LC
9	*Hemidactylus frenatus*	House Gecko	LC
10	*Hoplobatrachus tigerinus*	Indian Bull Frog	LC
11	*Hylarana garoensis*	Water Frog	LC/IV
12	*Mabuya carinata*	Common Skink	-
13	*Naja kaouthia*	Monocled Cobra	**LC/II**
14	*Oligodon cyclurus*	North-eastern Kukri Snake	LC
15	*Polypedates leucomystax*	Tree Frog	LC
16	*Ptyas mucosa*	Common Rat Snake	LC/NA

Sources: (i) Primary Survey. (ii) Aaranyak: Herpetological Research and Conservation Division (HRCD), https://www.aaranyak.org/showsubsubpage.asp?ssubid=35&subid=3&id=2. (ii) Ahmed, M.F., Das A. & Dutta S.K. (2009). Amphibians and Reptiles of Northeast India – A Photographic Guide. Aaranyak, Guwahati, India, xiv-168.

Table 4-22: List of Birds reported in the Study Area.

S.N.	Scientific Name	Common Name	IUCN Status/ WLP Schedule
1	*Acridotheres tristis*	Common Myna	LC/IV
2	*Aegithina tiphia*	Common Iora	LC/IV

S.N.	Scientific Name	Common Name	IUCN Status/ WLP Schedule
3	*Anas acuta*	Pintail	LC
4	*Anas crecca*	Common Teal	LC
5	*Anastomus oscitans*	Asian Openbill	LC/ IV
6	*Anthus rufulus*	Paddyfield Pipit	LC/IV
7	*Apus affinis*	House swift	LC/IV
8	*Ardea cinerea*	Grey Heron	LC
9	*Ardea purpurea*	Purple Heron	LC
10	*Ardeola grayii*	Indian Pond-Heron	LC/IV
11	*Botaurus stellaris*	Great Bittern	LC
12	*Bubulcus ibis*	Cattle Egret	LC/IV
13	*Carpophaga aenothorax*	Green Imperial Pigeon	LC/IV
14	*Centropus sinensis*	Crow Pheasant	LC/IV
15	*Chrysocolaptes festivus*	White-naped Woodpecker	LC/IV
16	*Columba livia*	Blue Rock Pigeon	LC/IV
17	*Copsychus saularis*	Magpie-Robin	LC/IV
18	*Coracias benghalensis*	Indian Roller	LC/IV
19	*Corvus splendens*	House Crow	LC/IV
20	*Cuculus canorus*	Common Cockoo	LC
21	*Dendrocitta vagabunda*	Tree Pie	LC/IV
22	*Dicaeum agile*	Thick-billed Flowerpecker	LC/IV
23	*Dicrurus adsimilis*	Black Drongo	LC/IV
24	*Dinopium benghalense*	Black-rumped Flameback	LC
25	*Estrilda amandava*	Red Munia	LC/IV
26	*Ficedula parva*	Red breasted flycatcher	LC/IV
27	*Gallinula chloropus*	Common Moorhen	LC
28	*Halcyon capensis*	Stork-billed Kingfisher	LC/ IV
29	*Hydrophasianus chirurgus*	Jacana	LC/IV
30	*Irena puella*	Fairy blue Bird	LC/IV
31	*Lanius schach*	Long-tailed Shrike	LC/IV
32	*Megalaima asiatica*	Blue throated Barbet	LC/IV
33	*Merops orientalis*	Green Bee-eater	LC/IV
34	*Micropternus brachyurus*	Rufous Woodpecker	LC/IV
35	*Nectarinia asiatica*	Purple Sunbird	LC/IV
36	*Oriolus xanthornus*	Black-hooded Oriole	LC/IV
37	*Orthotomus sutorius*	Tailor Bird	LC/IV
38	*Ocyceros birostris*	Grey hornbill	LC/IV
39	*Passer domesticus*	House Sparrow	LC/IV
40	*Pericrocotus cinnamomeus*	Small Minivet	LC/IV
41	*Phalacrocorax carbo*	Large Cormorant	LC/IV
42	*Ploceus philippinus*	Baya weaver	LC/IV
43	*Psittacula alexandri*	Red-breasted Parakeet	LC/IV
44	*Pycnonotus cafer*	Red-ventured Bulbul	LC/IV
45	*Streptopelia chinensis*	Spotted dove	LC/IV
46	*Sturnus contra*	Pied myna	LC/IV
47	*Tachybaptus ruficollis*	Little Grebe	LC/IV
48	*Tadorna ferruginea*	Ruddy Shelduck	LC
49	*Terpsiphone paradisi*	Indian Paradise Flycatcher	LC/IV
50	*Threskiornis aethiopicus*	Black Headed Ibis	LC
51	*Trevon phoenicoptera*	Green pigeon	LC/IV

S.N.	Scientific Name	Common Name	IUCN Status/ WLP Schedule
52	*Tringa glareola*	Wood Sandpiper	LC/IV

Source: (i)Primary Survey (ii) Bird Checklists of the World Barpeta, https://avibase.bsc-eoc.org/checklist.jsp?region=Inneasba (iii) Saikia M.K. and Saikia P.K., 2016. New records of forest birds in North and South Bank Landscapes of Assam, India. PhD Thesis, Guwahati University Assam.

i) Agricultural crops and economically important species

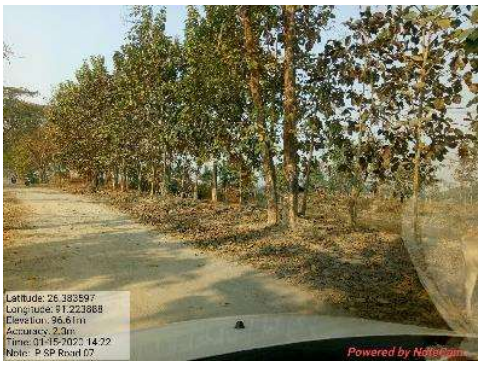
Same as the pattern of the State Assam, agriculture is main occupation of the Barpeta and Bajali Districts. Rice is the main food crop and main diet in the study area. Other cash crops include; jute, sugarcane, fruits, tea, pulses, potatoes, cotton etc. Other important crops of this area are pulses (*Pisum sativum, Phaseolus mungo, Cajanus cajan, Lathyrus sativus*), Oil seeds (*Brassica nigra and Helianthus annuus*), varieties of vegetables (*Raphanus sativus, Brassica oleracea, Brassica oleracea, Brassica oleracea, Brassica oleifera, Beta vulgaris, Coccinia indica, Cucumis sativus, Cucumis melo, Cucumis utilissimus, Solanum melongena* etc.), tubers (*Solanum tuberosum, Ipomoea batatas, Manihot utilissima* etc.). (*Source: Assam Agriculture Contingency Plan for District: Barpeta, http://www.crida.in/CP-2012/statewiseplans/Assam/ASSAM18-Barpeta-30.10.12.pdf).*

j) Trees

During primary survey of the proposed road, trees were found beyond the earthen shoulders of the existing road. The species of trees was identified during primary survey as well as tree inventory and tree numeration. 999 trees are within the PROW which require felling, details of tree enumeration are given in **Annexure 26.**



Peepal Tree



Teak Tree



Bamboo Grove



Gulmohar Tree

Figure 15: Trees along the Project Road

k) Heritage Trees

There are a range of criteria that designate a tree as a heritage tree. These attributes—both material and non-material—makes the tree stand out. The material attributes could be age or size of the tree. It could also be the result of the form or shape of the tree. Further, it could be that the tree is a rare species or a tree at risk of being lost. The non-material criteria relate to cultural and aesthetic aspects. It could be that the tree has a historical or cultural association either with a person, an event or a place. It could also be a tree associated with myth or folklore.

In order to identify Heritage trees in the study area a detailed field study was conducted. As per the study conducted no trees of cultural significance have been identified along the road.

l) Nesting Trees

As per the detailed site study conducted and tree inventory conducted with the forest department officials, no nesting trees have been found within the proposed RoW of the project road.

m) Sericulture

Sericulture is the major agro-based industry generating large number of employment in the rural areas of Assam with minimum investment cost. It plays a very vital role in the socio-economic development of the weaker section of the rural population especially during their off-agricultural season. Muga silk (Antheraea assamensis) and Eri Silk worm rearing (Samia cynthia ricini) and production of silk yarn and fabric is wide spread amongst the people of Dhemaji and Dhakuakhana. The larvae of these silk worms feed on som leaves (Machilus gamblei) and sualu (Litsea monopetala) leaves. The silk produced from these silk worms are natural golden colored and glossy in texture. Muga and Pat silk are famous from these silk worms. Since, cultivation of these silk worms is important to the economy of the locals. Som and suala trees are necessary for this region.

A detailed study was conducted to identify Sericulture activities in the project region. No location was identified where sericulture has been carried out.

n) Rice cultivation

Assam has always been a rice growing state. Some of the special classes of rice in the state include joha or aromatic rice, bora or waxy rice and chokuwa or soft rice. Many of the rice in the state can also be divided into Autumn Rice, Winter Rice, Summer Rice and Jhum cultivation. Black rice has been the latest addition to the rice cultivation in the state. Black rice is a common name for a range of rice belonging to Oryza Sattiva L. species. These varieties grow well in tropical zones like Japan, Korea, Myanmar, China and North-east India. These black rice variety are beneficial not only for the health consideration but also due to the fact that these varieties are more resilient to the effect of climate change. These varieties can grow well even at a higher temperature and flood conditions.

A detailed study was conducted to identify black rice cultivation in the project region, 1 location has been identified along the project road.

Sr. No.	Chainage	Location	Side	Approx. Distance from Road edge
1	12+600	Bagana	Left	20 m



Figure 4.16: Location of Black Rice Cultivation



Figure 4.17: Location of Black Rice Cultivation

o) Tea Estate

Tea Plantations are an important constituent of biodiversity of Assam and play a major role in conservation of biodiversity of the region. Several tea germplasms (a total of 1074) have been identified in the state of Assam. Some of the species identified are C. kissi, C. caduca, C. drupifera etc. Since cultivation of tea depends closely on the water availability, water quality, humidity, pests and several other biological factors. It is important to conserve the biodiversity of the region to maintain the micro-climate around the tea estates. Also, several wild varieties of tea are also found naturally in the forest of the state. Such wild varieties of plant need to be conserved to ensure that the genetic diversity of the tea plants is not lost. Since, tea plantation is highly critical to changes in temperature, pests and other factors, gene pool conservation is important to ensure further development and continued productivity of the tea estates in the state. Hence, the developmental activities in this region should not affect the tea plants growing in wild or in the abandoned tea estates.

A detailed study was conducted to identify tea estates along the project road. No tea estates are located along the project road.

p) Aquatic Life

There are several ponds, streams found along the project road and Kaldia and Buradiya/Tihu river also flowing across the project alignment. These water bodies support a verity of water loving species of plants. The aquatic macrophytes, phytolnakton and zooplankton found in the water bodies of the project area are listed in table 4.18, 4.19and 4.20 respectively.

Table 4-23: Aquatic macrophytes found in the study area.

S.No.	Species	Family
1	*Azolla pinnata*	Azollaceae
2	*Canna indica*	Cannaceae
3	*Cyperus bulbosus*	Cyperaceae
4	*Eclipta prostrata*	Asteraceae
5	*Eichhornia crassipes*	Pontederiaceae
6	*Enhydra fluctuans*	Asteraceae
7	*Hydrilla verticillata*	Hydrocharitaceae
8	*Hydrocotyl sibthorpioides*	Apiaceae
9	*Hygrophila polysperma*	Acanthaceae
10	*Ipomoea aquatica*	Convolvulaceae
11	*Marsalia quadrifolia*	Marseliaceae
12	*Nelumbo nucifera*	Nymphaeaceae
13	*Nymphaea alba*	Nymphaeaceae
14	*Persicaria hydropipper*	Polygonaceae

Table 4-24: Phytoplankton reported from the study area.

SN	Group/Family	Species
1	Cyanophyceae	*Anabaena sp., Aphanizomenon sp., Aphanocapasa sp., Chaetophora sp., Coelospharium sp., Mougeotia sp., Nostoc sp., Phormidium sp., Polycystis sp., Protococcus sp., Rivularia sp., Spirulina sp., Tribonema sp.*
2	Chlorophyceae	*Ankistrodesmus sp., Cladophora sp., Microspora sp., Spriogyra sp.*
3	Bacillariophyceae	*Cyclotella sp., Cymbella sp., Fragillaria sp., Melosira sp., Navicula sp., Nitzschia sp., Pinnularia sp., Synedra sp., Tabellaria sp.*
4	Desmidiaceae	*Closierium sp., Genicularia sp., Gonatozygon sp., Micrastereias sp., Peniurn sp., Tctmemorus sp.*

Table 4-25: Zooplankton reported from the study area.

SN	Group/Family	*Species*
1	Protozoa	*Aconthocystis sp., Codonella sp., Eudorina sp., Eugtypha sp., Euplotes sp., Frontonia sp., Oxytricha sp., Pandörina sp., Peridinium sp., Pleodorina sp., Spirostomum sp., Uroglena sp., Vampyretla sp., Volvox sp.*
2	Copepoda	*Canthocamptus sp., Cyclops sp., Diaptomus sp., Eubranchipus sp., Eurycerus sp., Limnocalanus sp., Nauplius larvae*
3	Cladocera	*Alonella sp., Bosmina sp., Camptocercus sp., Ceriodaphnia sp., Chydorus sp., Daphnia sp., Diaphnosoma sp., Macrothrix sp., Polyphemus sp., 88 approx.., Simocephalus sp.*
4	Rotifers	*Brachionus sp., Chromogaster sp., Dicranophorous sp., Filinia sp., Hexarthra sp., Keratella sp., Platyias sp.*
5	Coleoptera	*Chironomous sp., Tanytarsus sp.*
6	Trichoptera	*Limnocalanus sp., Molana sp.*
7	Hemiptera	*Hespero corixa*

Sources: (I) Primary Survey, (ii) Choudhury B., (2020). Present Status of Plants Found in the Wetlands of Barpeta District of Assam, North East India. Paripex – Indian Journal of Research,9:5. (iii) Dutta, T., Deka, U., & Rabha, P.K. (2014). Diversity of aquatic macrophytes of Kapla beel (wetland) of Barpeta district, Assam, India. Annals of Biological Research, 5, 41-45. (iv) Sharma, S. and Sharma, B. K. (2008). Zooplankton Diversity in Floodplain Lakes of Assam. Rec. zool. Surv. India, Occ. Paper No., 290: 1-307 (Published by the Director, Zool. Surv. India, Kolkata).

River Kaldia and Buradiya/Tihu are major source of fishes along the project road. Ponds are also used for fisheries activities. A list of the common available fishes in the area has been given in the Table 4-21.

Table 4-26: Fishes Reported in the Study Area

S.N.	Name of the Species	Common Name	Family	IUCN Status
1	*Ailia coila*	Gangetic ailia	Schilbeidae	NT
2	*Amblyceps mangois*	Indian torrent catfish	Amblycipitidae	LC
3	*Aspidoparia jaya*	Jaya	Cyprinidae	LC
4	*Bagarius*	Goonch	Sissoridae	NT
5	*Barilius barna*	Barna baril	Cyprinidae	LC
6	*Barilius vagra*	Vagra baril	Cyprinidae	LC
7	*Catla*	Catla	Cyprinidae	LC
8	*Chaca*	Square head catfish	Chacidae	LC
9	*Chanda nama*	Elongate glassperchlet	Ambassidae	LC
10	*Chitala*	Clown Knifefish	Notopteridae	NT
11	*Cirrhinus mrigala*	Mrigal carp	Cyprinidae	LC
12	*Danio acquipinnatus*	Giant danio	Cyprinidae	LC
13	*Garra gotyla*	Sucker head	Cyprinidae	LC
14	*Glossogobius giuris*	Bar eyed goby	Gobidae	LC
15	*Hara*	Hara	Sissoridae	LC
16	*Lebeo dero*	Kalabans	Cyprinidae	LC
17	*Lebeo rohita*	Roho labeo	Cyprinidae	LC
18	*Monopterus cuchia*	Gangetic mud eel	Symbranchidae	LC
19	*Mystus bleekeri*	Days mystus	Bagridae	LC
20	*Mystus vittatus*	Stripped dwarf catfish	Bagridae	LC
21	*Nandus*	Gangetic leaf fish	Nandidae	LC
22	*Neotropius atherinoides*	Indian potasi	Schilbeidae	LC
23	*Pangasius*	Pangas catfish	Pangasiidae	LC
24	*Puntius conchonius*	Rosy barb	Cyprinidae	LC
25	*Puntius ticto*	Ticto barb	Cyprinidae	LC

S.N.	Name of the Species	Common Name	Family	IUCN Status
26	*Rita*	Rita	Bagridae	LC
27	*Sperata seenghala*	Giant river catfish	Amblycipitidae	LC
28	*Systomus sarana*	Olive barb	Cyprinidae	LC
29	*Tetradon cutcutia*	Ocellated pufferfish	Tetradontidae	LC
30	*Wallago attu*	Wallago	Siluridae	**Vu**
Abbreviations: EN – Endangered; CR – Critically Endangered; NT – Near Threatened; VU – Vulnerable. LC – Least Concern; NE – Not Evaluated,				

Sources: (i)Primary Survey (ii) Talukdar J.K. & Rajbongshi M.K. 2018, Ichthyofaunal Diversity and Conservation Status of Puthimari Beel of Barpeta, Assam, India, IJAASR Volume 3, Issue 1. (iii) Sugunan, V. V., Bhattacharjya B.K. ,2000. Ecology and beel fisheries in Assam, Barackpore West Bengal, 1- 65, (iv) Government of Assam Fishery Directorate of Fisheries https://fisheriesdirector.assam.gov.in/

F. Socio - Economic Environment

Socio-economic information is an important tool to assist in identifying people who are likely to be affected both positively and negatively by the proposed project. Effective socio-economic analysis will facilitate understanding of the needs, demands, preferences, capacities and constraints of these people. It will also enhance understanding of other relevant factors, such as social organizations and networks, livelihood patterns and resource use, knowledge base and leadership patterns. The socio-economic information will facilitate understanding of the chronic and sudden risks these people face, the processes that have resulted in their marginalization, poverty and vulnerability, and the causes and effects of exclusion.

The objective of this socio economic information will help in presenting a socio-economic profile of the project area with particular reference to indigenous people, communicable diseases especially HIV/AIDS, human trafficking, poverty level, gender issues, local economy like agriculture, industry, health and educational status in accordance with applicable policy guidelines.

a) Socio Economic Features

Demographically, the state has population 31205576 (Census 2011) with a population density of 397 person per sq. km. Nagaon has been recorded as most populous district accounting 9.07 % to total population of the state. The population density is highest in the Kamrup (Metropolitan) district having 2010 persons per sq.km. Whereas in the project districts the population density are 520 persons per sq. km in Barpeta district.

Table 4-27: Demographic Indicators of Assam

S. No.	Indicators	Rural	Urban	Total
1	Population	26,807,034	4,398,542	31,205,576
2	Male	13,678,989	2,260,454	15,939,443
3	Female	13,128,045	2,138,088	15,266,133
4	Population Density	-	-	397
5	Decadal Growth Rate	15.47	27.89	17.07
6	Pop. Of SC (2009-10)	15.54% of total	-	27.43 lakh
7	Pop. Of ST (2009-10)	31.55 % of total	-	38,84,371
8	Sex Ratio (no. of females per 1000 males)	960	946	954
9	Child Sex Ratio (0-6 Year)	964	944	962
10	Literacy (%)	69.34	88.47	72.19

Source: Census of India, 2011, GOI, NSSO, Primary data (2009-10)

Literacy rate in Assam has seen upward trend and is 72.19 percent as per 2011 population census. Of that, male literacy stands at 77.85 percent while female literacy is at 63.00 percent. The literacy rate is highest in Kamrup district (88.64%) and lowest in Dhubri district (59.36%). Sex Ratio in Assam is 954 for each 1000 male, which is above the national average of 940.

The entire project stretch are in Barpeta & Bajali district. The project road corridor is 90 approx.. 17.653 km in length and starts at Sarthebari, at Y-intersection of SH-9 and SH-9A and ends at Pathsala town. It is a part of the SH-9A Sarthebari-Rampur-Pathsala road. The project stretch is passing through Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk and Raipur.

b) Religion

It is observed that Barpeta & Bajali districts has a majority of Muslim population which is about 70.74 % of the district total population. Hindus comprise about 29.11 % of the total population. Religion as professed by inhabitants are given in Table 4.23.

Table 4-28: Religion wise Population

Sl No	Description	Barpeta
1	Muslims	70.74 %
2	Hindu	29.11 %
3	Christian	0.06 %
4	Sikh	0.01 %
5	Buddhist	0.00 %
6	Jain	0.02 %
7	Others	0.001 %
Total population of Barpeta **1,693,622**		

Source: Census 2011

c) Language

The language spoken widely in Barpeta is Assamese, Bengali and Bodo.

d) Demography

Total population in the 1693622 which includes 867004 males and 826618 females. The districts have a population density of 520 inhabitants per square kilometre. Its population growth rate over the decade 2001–2011 was 21.4%. Barpeta has a sex ratio of 953 females for every 1000 males, and a literacy rate of 63.81. Sex ratio and literacy rate are important parameter to assess the development of a community. Literacy rate can be uplifted through infrastructure development projects. Sex ratio is directly related to health and educational status of the community. Improvements of connectivity will lead to access to educational institutions, health institutions etc. The project road passing through Barpeta and Bajali districts are not falling under schedule VIth of constitution of India. Demography details of the project road is given in Table 4.24.

Table 4-29: Demographic Profile

Sl. No.	Description	Barpeta & Bajali
1	Total Population	1,693,622
2	Male	867,004
3	Female	826,618
4	Sex Ratio	953
5	Schedule Caste	95320
6	Schedule Tribe	27344
7	Density	742

Sl. No.	Description	Barpeta & Bajali
8	Percentage of Decadal growth rate	21.43%
9	Literates	63.81
10	Male	69.29
11	Female	58.06

Source: *Census of India, 2011, GOI*

e) Working profile

Working profile provides a picture of the inhabitants' engagement in economic activities. Majority of the main workers (more than 6 months engagement under period of reference) are into cultivation. Out of the marginal workers (less than 6 months engagement under period of reference) majority of the marginal workers are engaged as cultivators (Table 4-25).

Table 4-30: Distribution of Main workers and Marginal Workers in Barpeta & Bajali Districts

Total Workers	Main workers					Marginal workers				
	Total	Cultivators	Agricultural Labourers	House hold Industry	Others	Total	Cultivators	Agricultural Labourers	House hold Industry	Others
561824	439453	184770	56932	16499	181252	122371	20489	42014	13843	46025

Source: Statistical Handbook of Assam, 2016

f) Education

Population of Barpeta & Bajali districts are well educated. Total literate persons are about 897058, Literate male is 499038 (57.55%) and Literate female 398020 (48.15%).

The Barpeta & Bajali districts are the known for educational institutes with schools, colleges and universities. There are 1841 primary schools, 225 ME schools, 160 High schools, 41 higher secondary schools, 18 nos of government aided college and 1 no of law college in Barpeta & Bajali districts. Pathsala town, which is end point of the project road is the famous for its educational institutes. However, due to the improvement of existing road, the project will ensure safe and efficient access to higher education for the pupils of the villages, adjacent to the proposed alignment.

g) Connectivity

Barpeta & Bajali districts are well connected by both railway and road with the state headquarters as well as with the rest of the country. The railway which links Assam with the rest of the country runs through the districts. The NH-31 is also passed through these districts. There is a State Highway connecting Barpeta town, the district headquarters with Howli. There are quite a number of arterial roads connecting the district headquarter with other important centers within and outside the district.

According to Statistical Handbook Assam, 2012, the district possesses a total road length 1824 kms as on 31-03-2012 of which 158 kms, 171 kms, 1463 kms and 31 kms are State Highway, Major District Roads, Rural Roads and Urban Roads respectively. The road length per lakh of population is 107.73 kms and the road length per hundred km2 geographical areas of the district is 68.13 km in 2012.

h) Economy

Agriculture is the mainstay of the economy of the people of the district. About 70% of the people of the district depend on agriculture. The soil and climatic condition of the district are good enough for agricultural activities. The rainfall is also sufficient to grow paddy, mustard, potatoes, jute, wheat and vegetables. The principal crops cultivated are –Rice, wheat, sugarcane, potato, soya bean, mustard, and seasonal vegetables.

i) Industry

Barpeta & Bajali are industrially backward districts of Assam. The districts do not possess any major public sector industry. The small-scale industries too are comparatively few. The district is, however, rich in cottage industries like pottery, black smithy, gold and silver smithy, cane and bamboo works, furnisher, bricks etc. Barpeta town was once famous for Ivory products which had a great demand in and outside the state. The industry has now virtually closed down due to non- availability of raw materials as a result of animal protection Act in force. The existing industries can be classified mainly into:

(I) Manufacturing of food products

(II) Manufacturing of wood and wood products, furniture and fixtures and

(III) Manufacturing of non-metallic mineral products.

j) Tourist Places

Barpeta & Bajali districts have many important places of religious importance of which mention may be made of Barpeta town, Sundaridiya, Patbausi, Sorbhog (Barnar), Baradi, Chunpara bheti, Ganak kuchi etc. as many great Vaishnavite reformers like Shrimanta Sankar Deva, Madhab Deva and their followers during 15th century had founded their religious Satras in these places (Table 4-26).

Table 4-31: Tourist locations in Project Area

Project District	Major Tourist Locations
Barpeta & Bajali	Barpeta Satra (Monastery), Sundaridiya, Patbausi, Baradi, Chunpara bhethi/ Chinpara bhethi, Ganak kuchi, Barnagar, Parithareswar Devalaya

Source: District Webpage

Demographic profile of project road is given in **SA & RAP Report, Section 3.5** i.e, Socio-economic Profile of Affected Family.

5. ANALYSIS OF POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Introduction

This chapter presents key environmental issues associated with various aspects of the proposed project. The environmental impacts caused due to the development of the project road sections can be categorised as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the project whereas the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action. Interaction of the project activities with environmental attributes is presented as Activity-Impact matrix in Table 5.1.

The Corridor of Impact (COI) is the proposed construction width, which is varying from 15 m in built-up areas and 20 m in rural/open country area.

Table 5-1: Activity-Impact Identification Matrix

Sl. No.	Activities	Type of Impact							
		Air	Water	Noise	Flora	Fauna	Drainage	Soil	Topography
1.	Labour camp activities		-ve/t						
2.	Quarrying	-ve/t		-ve/t	-ve/t		-ve/t	-ve/p	
3.	Material transport and storage	-ve/t		-ve/t					
4.	Drilling, blasting and hill cutting	-ve/t		-ve/t	-ve/t	-ve/t			
5.	Earthwork						-ve/p	-ve/t	-ve/t
6.	Payment works	-ve/t	-ve/t	-ve/t	-ve/t			-ve/t	-ve/p
7.	Use of construction equipment's	-ve/t	-ve/t	-ve/t		-ve/t			
8.	Tree cutting	-ve/p		-ve/p	-ve/p				
9.	Drainage work						-ve/t		
10.	Culvert and bridge construction		-ve/t	-ve/t			-ve/t		
11.	Stripping of topsoil							-ve/p	
12.	Debris generation						-ve/t	-ve/t	
13.	Oil and grease							-ve/t	
14.	Construction in forest and sensitive areas	NA	NA	NA	NA	NA	NA	NA	NA

Notes: t – temporary, p – permanent. Impact indicated in bold letters indicates significant impacts.

Identification and assessment of the potential environmental impacts are based on secondary information supplemented by field visits. Impacts on various environmental components have been assessed at four different stages, namely:

- The project location
- Design and pre-construction
- Construction
- Operation stages

A few permanent as well as short-term and long-term adverse effects, mainly at the construction and operation stages, are, nonetheless, anticipated. Temporary short-term impacts can be kept in check through proper planning and adopting environment friendly road construction methods and the appropriate regulatory measures.

B. Positive Environmental Impacts due to Improvement of Subproject Road

The positive impacts expected from the improvement of the project road of Sarthebari to Pathsala includes:

- Improved quality of life for the rural population in the project influence: this as a result of better access to markets, health, education and other facilities; and the derived stimulus for local economic activity.
- A more efficient and safe road transport system: through reduced travel times and distance, reduced road accidents, reduced emission, reduced vehicle operating and maintenance costs and reduced transportation costs for goods.
- The facilitation of tourism to Jagganath Temple at Bongaon.
- Interstate connectivity to remote districts and direct connectivity to NH 27 from remote villages.

C. Adverse Environmental Impacts due to improvement of subproject road

The adverse environmental impacts anticipated from the improvement of the project road section are:

- Change in topography and land use due to acquisition of land for widening of the existing road.
- Loss of productive soil and agriculture land.
- Cutting of roadside trees that falls within formation width i.e. 10-20 m may reduce the ecological balance of the area and increase soil erosion problem.
- Noise, air and water pollution and disposal of construction waste, during construction, will adversely impact both residents. These latter effects should, however, only be temporary/reversible.
- Several quarries and other sources will be established, which will change the landscape. However, the operation of quarries is an independent and already regulated activity. Adverse impacts on water quality of rivers crossing or running parallel to the proposed alignment in the form of silt deposition and runoff during construction are expected. However, this is short term and will be taken care of by controlled construction activities.
- Improvement on existing road and construction of new road and bridges, although limited, may enhance soil erosion, landslips and reduce the micro-level ecological balance of the area. Construction may also disturb the habitation of fauna living in this area. These should, however, be only temporary/reversible effects. The improvement will also require the cutting of trees.
- Minor impacts of noise and air quality for those now living and workings close to the project road will deteriorate during the construction period and afterwards during operation.

D. Impacts Related to Project Location, Preliminary Planning and Design

a) Topography, Land Acquisition and Loss of Productive Land

To the extent practicable, the widening/improvement of the existing roads Shall be accommodated within the existing right of way. This project will require acquisition of about 20.65 ha. of land for proposed improvement. Although land acquisition requirement has been kept to minimum level, it will have impacts on topography and change in land use. Loss of agriculture land and productive soil is also anticipated due to additional land acquisition. To minimize land acquisition and soil productivity, the following mitigation measures have been/will be adopted during the detailed design and construction stage of the project:

- One bypass is proposed to bypass the Pathsala settlement/Railway line and most of stretch is following the existing road to minimize the land acquisition with realignments and curve improvements.
- Topsoil management during construction.
- Use of existing tracks to the extent possible.

b) Forest Clearing and Tree Felling

There is no diversion of forest land involves, land clearing will involve cutting of 999 no. of existing trees. Problem of soil erosion is expected in some locations. To minimize loss of trees, the following mitigation measures will be adopted during the construction stage of the project:

- Widening proposal considered within COI with minimal tree cutting.
- Land stabilization measures in identified areas prone to erosion.
- Adopting Environmentally Friendly Road Construction (EFRC) methods.

Mitigation Measure:

- Tree Plantation shall be carried out in the available land along the project road or as per the direction of forest department.
- Total Compensatory Plantation will be **1:10** ratio (9990 trees shall be planted) i.e for every cut of one tree 10 trees will be planted. (Plantation will be done by respective Forest department)
- Regular maintenance of all trees planted shall be carried out as per the direction of the forest department.

c) Borrow Pits and Quarries Operation

There is a need to establish construction camps and related facilities, such as borrow pits and quarries. These must be in environmentally sound and socially safe areas. It is expected that construction materials for the road works will be mined mostly from approved quarries. The following criteria is applied for locating the borrow areas in general:

- Borrow areas are not established in ecologically sensitive areas.
- Villagers are consulted regarding the design and location of all borrow areas – these should ensure the safety of local communities and, if possible, should incorporate beneficial post construction features for the villages.
- Located away from the road as well as settlements facing the road, to minimise visual impacts.
- Construction camps for labourers should be located at least 500 m away from settlements and 1 km away from forest / protected areas.
- Living accommodation and ancillary facilities should be erected and maintained to standards and scales approved by the Engineer-in-Charge.
- Toilets and urinals should be provided in accessible places away from the asphalt plant and mixing yard.

d) Cultural Heritage

There are no adverse impacts anticipated on historical places/monuments. Care must be taken to avoid any damage to these structures. Earthworks, as associated with the road construction/improvement works, or deriving from secondary sites such as quarries or borrow pits, may reveal sites or artefacts of cultural/archaeological significance. In the event of such discovery,

the concerned authorities should be informed and the requirement to take such action should be incorporated in contract documents.

e) Other Impacts Deriving from the Project Planning and Design Process

During preliminary planning and design of this project, following mitigation measures need to be adopted:

- Optimum sitting and control of borrow areas.
- Reduced incidence of slope failures due to inadequate drainage.
- Providing adequate culverts/drains.
- Providing side-drainage structures.
- Mechanized construction methods and thereby, for example, reduced use of firewood for heating bitumen.
- Maximizing safety and thereby reducing traffic accidents.
- Reducing travel times and, thereby, fuel consumption and emissions.
- Adequate signages for wildlife protections.
- Increased accessibility for residents to education and health facilities, markets etc., and for others who might come for tourist or other purposes.
- Improving the socio-economic conditions of residents in the project areas of influence.

As part of the engineering works for this work, the following guiding principles have been used in determining the alignments:

Table 5-2: Guiding Principles for Determining the Alignments

S. No	Environmental Issue	Measures taken
1	Alignment	Final alignment has been determined to minimize land take, tree removal, air pollution and the impact on people and animals and to avoid unfavourable geological condition and cultural relics.
2	Balancing cut and fill	The design attempted to equalize cut and fill. The centreline has been aligned so that on all slopes below 60 degrees, half cut, and half fill is achieved.
3	Soil erosion	Temporary and permanent drainage systems have been designed to minimize the soil erosion.
4	Dust and air pollution	Borrow sites, waste disposal sites and asphalt mixing sites have been identified – keeping in mind environmental issues such as dust.
5	Cultural heritage	Any archaeological sites identified along the alignment should be excavated prior to construction.
6	Wildlife Habitat	Care taken in preservation of wildlife and construction workers should be educated on wildlife protection.

E. Environmental Impacts – Construction Stage

a) Topography & Geology

The impacts on existing topographical setting originate primarily from embankment preparation and opening borrow pits to fulfil the requirement of huge quantity of earth material. Disfiguration of land may result from unplanned opening of borrow pits/quarry sites. Aggregate and sand will be procured from the authorized suppliers and prevalent rules will be followed for borrowing of soil. Hence the impact on geology of the region is insignificant.

Impacts:

- Disfiguration of topography due to digging of borrow pits.

- Uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.
- Disturbance on geological setting due to quarrying.

Seismological Characteristics of the Area: The project road is in Zone-V (having high seismic intensity) of the seismic map of India (as per IS:1893, Part-1, 2002), and therefore it will have a high risk of potential damage due to earthquake.

Road Building Materials: During road construction mainly stone aggregates & bitumen will be required for pavement, while stone aggregates, sand & cement will be required for concrete making for rigid pavement, bridges, culverts, urban drains etc. Diesel will be required to run construction equipment. Stone aggregates and sand will be brought from existing licensed quarries. The contractors usually depend on the local commercial suppliers for obtaining various construction materials. Active existing sources are most likely to be used with cost and the quality considerations. The estimated raw materials requirement during construction stage is given in Table 5.3.

Table 5-3: Raw Material Required during Construction

S. No.	Item & Unit	Quantity	Mode of transport	Source
1.	Blue metal (m^3)	36063	Truck	Existing licensed quarries
2.	Sand (m^3)	9085	Truck	Existing licensed quarries
3.	Cement (MT)	7604	Truck	Local traders
4.	Bitumen (MT)	2278	Truck	Refinery
5.	Steel (MT)	1853	Truck	Local traders
6.	Earth (m^3)*	430964	Truck	Identified Borrow areas

Borrow Areas: About 430964 cubic meters of borrow materials is to be used for the project road. This must be obtained from earth generated through cutting of the road or from the existing borrow areas. The details of proposed borrow areas investigated with their respective locations; corresponding chainage and lead from nearest point to project road are tabulated in Table 5.4.

Table 5-4: Location of Proposed Borrow Areas

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location/ Village Name	Lead from Nearest Point on Project Road (km)	Photographs
1.	5+000	LHS	Naligaon	0.100	

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location/ Village Name	Lead from Nearest Point on Project Road (km)	Photographs
2.	13+000	RHS	Bagana	0.500	

Establishment of Quarries & Crushers: Contractor will be required to establish quarries & crushers for the project and shall obtain statutory clearance (such as NOC from SPCB etc.) from concerned authorities before start of stone crushing operation. The maintenance and management of access road/haul road could be a major impact. It is appropriate to consider the environmental implications in the selection of crusher areas since poor maintenance may create dust pollution, contribute to noise pollution, water pollution as well as loss of natural resources. Or they may also procure aggregate materials from already established quarries and crushers having all statutory clearances. Details of Quarry area is given in Table 5.5.

Table 5-5: Location of available Coarse Aggregate Crusher Location

Source ID	Design Chainage	Side	Lead (km)	Ownership Details	Village name	Photos
CA-1	0+000	RHS	88	Vinayak Stone Crusher Owner name : Kamal PH-9435075949	Moduki	
CA-2	0+000	RHS	85	Trimurthi Stone Crusher Owner name : Nabalem PH-7002481029 , 9864425884	Rani	

Mitigation Measures: All construction works are directly related to the land environment. Therefore, contractor needs to prepare/follow several mitigation/management plan/guidelines for various construction activities. These guidelines are listed below and detailed out in "Annexes of EIA & ESMP".

- Guidelines for Siting and Layout of Construction Camp (**Annex-5**)
- Guidelines for Siting, Operation and Re-Development of Borrow Areas (**Annex-6**)
- Guidelines for Siting, Operation and Re-development of Quarrying and Stone Crushing Operations (**Annex-7**)
- Guidelines for Siting and Management of Debris Disposal Site (**Annex-8**)
- Guidelines for Preparing Comprehensive Waste Management Plan (**Annex-9**)

Some of the important provisions are given below:

- Earthquake resistance structures with seismic retainers at major bridges are being planned to be constructed under the project. Design of all structures like bridges and CD structures have taken the area's seismic characteristics into account.
- Opening new borrow pits will be in accordance with the IRC: 10-1961 specifications. Topsoil from the new borrow pits should be preserved and reused in restoring the pits to the satisfaction of the Supervision Consultant. Opening up of new borrow pits will be restricted to 1.0m depth followed by resurfacing of pits with topsoil (15 cm).
- No borrow pits will be allowed in the forest land.
- Uncontrolled digging of borrow pits will be avoided to prevent water accumulation in abandoned pits which results in breeding ground of vector disease.
- Road building materials will be procured from existing approved and licensed quarries only where crusher is already operating. Therefore, mitigative measure for the environmental impacts due to quarrying and rehabilitation plan of the quarries is the responsibility and scope of the licence holder of the quarry.
- On owner's choice, borrow pits will be converted to water bodies (pond) with proper landscaping (i.e. rectangular in shape, proper sloping and plantation on the bank) which will add scenic beauty in those localities.

b) Construction Camp

Impacts:

- Influx of construction workforce & suppliers who are likely to construct temporary camps.
- Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers.
- Generation of solid and liquid waste from construction camp.

Mitigation Measures:

- Temporary construction camps at designated & demarcated sites with adequate sanitation, drinking water supply & primary health facilities.
- Proper accommodation will be provided in the locality for the migrant construction engineers & officers.
- Most of the construction work is labour intensive. As most of the job will be done by Contractors, it will be ensured that the Contractor's workers are provided with adequate amenities, health & sanitation facilities in the camp by the Contractor. Such facilities shall include potable water supply, sanitary facilities, solid waste collection & disposal system, primary health facilities, day care facilities and temporary electrification (if possible).

- It will be ensured through contract agreement that the construction workers are provided fuel for cooking to avoid cutting of trees for fuel wood from the adjoining areas.
- Domestic as well as the sanitary wastes from construction camp will be cleared regularly.

c) Waste Management

- The Contractor should provide separate garbage bins in the camps for bio-degradable, non-biodegradable waste and ensure that these are regularly emptied and disposed-off in safe and scientific manner.
- The disposal of kitchen waste and other biodegradable matter will be disposed in approved landfills through arrangement with local civic bodies or used as manure for gardening.
- Non-biodegradable waste like discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, metal containers, strips and scraps of metal etc. and other such materials will be sold/recycled or disposed in approved landfills through arrangement with local civic bodies.
- No incineration or burning of wastes should be carried out.
- Septic tank with soak pits provided for toilets should be sited, designed, built and operated in such a way that no health hazard occurs and no pollution to the air & water takes place.
- Soak pits must be provided to collect wastewater from bathrooms and kitchen.

d) Soil

Impacts:

Soil Erosion: Erosion of topsoil can be considered a moderate, direct and long-term negative impact resulting from construction and maintenance of the road. Erosion problems may occur on newly constructed slops and fills depending on the soil type, angle of slope, height of slope and climatic factors like wind (direction, speed & frequency) and rain (intensity & duration). In the project road, embankment will be raised. Slope protection measures (stone pitching or turfing with Coir Geotextile & vetiver grasses) form part of good engineering practice and therefore, it has been incorporated into the ESMP.

Construction of Bridges & Culverts: Along the corridor one new major bridge and 16 box culverts are proposed. Construction of bridges involves excavation for construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation may take place during the monsoon. During the construction period, some amount of drainage alteration and downstream contamination take place.

Soil Contamination: Contamination of the soil may take place from the following activities at the construction zones, construction labour camps and other auxiliary facilities required for the construction. Details of the activities from which contamination may occur are given below:

- Scarified bitumen wastes, excess production of bituminous product
- Debris generation due to dismantling of structures
- Maintenance of the machinery and operation of the diesel pumps, diesel generator sets, diesel storage and during transportation
- Operation of hot mix plant
- Storage and stock yards of bitumen
- Form various activities in the labour camps

Mitigation Measures:

- The top soil from all sites including road side widening and working area, cutting areas, quarry sites, borrow areas, construction camps, haul roads in agricultural fields (if any) and areas to

be permanently covered shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse. At least 10% of the temporary acquired area shall be earmarked for storing topsoil. Contractor must strictly follow the "Guidelines for Topsoil Conservation and Reuse" as given in **Annex-10**.

- **Slope Stabilization:** Adequate measures like adequate drainage, embankment consolidation & slope stabilization will be taken along the road to avoid soil erosion. The slopes have been restricted to 1 vertical: 2 horizontals for most of the sections. Soil erosion through embankments will be prevented and controlled by stone pitching or turfing with coir geotextile & vetiver grasses & bamboo. Bioengineering is the technique of utilizing vegetation in addressing geotechnical problems. Environmental uncertainties are prompting engineers to favour bioengineering measures. Vegetation as an aid to artificial methods in controlling surficial soil erosion is gaining larger acceptability among engineers all over the world. Growth of appropriate vegetation on exposed soil surface is facilitated by use of natural geotextiles such as coir geotextiles. Properly designed coir geotextiles laid on slopes or any other exposed soil surface provides a cover over exposed soil lessening the probability of soil detachment and at the same time reduces the velocity of surface runoff, the main agent of soil dissociation. Road slope stabilization can range from allowing native grass to re-establish on a disturbed slope to building an engineered wall. Guideline on Slope Stabilization is given in **Annex-11.**
- **Recycling of Scarified Materials:**

  The embankment height of the project road will be raised about 1m. Therefore, the scarify material shall be reused partially and fully with GSB. Some of the advantages associated with recycling are:

  - Preservation of environment
  - Reduction in greenhouse gases emission
  - Conservation of energy
  - Conservation of fresh material
  - Minimization of health hazards
  - Minimization of cost of construction
- **Disposal of Bituminous Waste:** no bituminous waste will be generated for disposal.
- Accidental spills of lubricants/oil and molten asphalt will be avoided by following the "Guideline for Storage, Handling, Use and Emergency Response for Hazardous Substances" as given in **Annex-12**.
- Oil Interceptor shall be provided for wash down, refuelling areas and accidental spill of oil and diesel.

Vehicle parking area of the construction camp will be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly slopped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor.

e) Land Use

Construction Phase: Widening of existing road will lead to change in land use pattern of areas adjacent to the road that comes under the proposed ROW. The existing land adjacent to the road at present is mainly of agricultural use with some roadside residential & commercial plots which will need to be acquired for widening of the road.

Preparatory activities like clearing of ROW, construction of temporary construction camps and godowns, storage of construction materials etc. will be confined within the Construction camp site. This will not hamper the land use aspects outside ROW. However, indirectly there may be some change in the land use pattern of the proximate area due to influx of construction workforce and supplier who are likely to construct temporary tents in the vicinity.

Impacts:

- Loss of agricultural land due to widening & improvement of the road.
- Changes in existing land use pattern of the proposed ROW for widening & improvement of the road.

Mitigation Measures:

- Earth material generated from excavation of roadways & drainage will be reused to the maximum possible extent as filling material during site development.
- The small amount of construction debris and surplus excavated material will be disposed of by mechanical transport in suitable pre-identified (jointly by project proponent & local administration) dumping areas in tune with the local condition to avoid land degradation & waterlogging due to indiscriminate dumping.
- Construction camp will be provided for construction personnel to avoid indiscriminate settlement of construction workers & labourers.
- Regular inspection of haul roads and construction site will be carried out to ensure regular and timely removal of construction debris to the designated dumping sites.
- Construction activities will be kept confined to proposed ROW only.

f) Drainage & Hydrological Flow

The project road runs through plain terrain. There is 02 river crossing the project stretch with some minor drains. During heavy rainfall these natural drainage channels carry swift flow. As the existing CD structures and bridges will be suitably augmented & additional CD structures will be constructed, it will not obstruct the water flow in the channels. Therefore, no impact on drainage is envisaged.

Impacts:

- Change in drainage pattern of the land around realignment.
- Increased incidence and duration of floods due to obstruction of natural drainage courses by the road embankment.
- Chances of filling of existing drainage courses during earth filling.
- There may be potential drainage impacts relating to the establishments of construction camps and various plants such as hot mix plant, batching & asphalt mixing plants etc. drainage impacts at these locations may result in loss of topsoil.
- The proposed road upgradation and improvement temporarily affected two rivers (Kalidia & Buradiya/Tihu), some streams and ponds, during the construction activity. The details are provided in the Table 5.6.

Table 5-6: Water bodies are likely to be affected due to Proposed Road.

Sl. No	Feature / Structure	Chainage (Km)	Distance from ECL (m)	Settlement	Side	GPS Coordinates	Remarks
1	Pond	0+300	3	Sarthebari	RHS	N 26.371015, E 91.224373	Outside RoW
2	Pond	0+900	2	Serthebari	LHS	N 26.37627, E 91.224387	Outside RoW
3	Pond	6+800	3.5	Serthebari	RHS	N 26.415885, E 91.208375	Slightly impacted
4	Pond	9+500	4.5	Bangaon	LHS	26°26'37.92"N 91°12'11.13"E	Slightly Impacted
5	Pond	12+500	8	Niz Saldah	LHS	N26.462412, E 91.19151	Slightly impacted

Mitigation Measures:

- Improvement in 8 minor/major bridge and 13 culverts with one new major bridge and 16 new culverts are proposed to construct for maintaining the natural drainage system of the area. Cross drainage structures are designed to avoid any compromise on the flow part.
- Adequate roadside drains will be provided along the road to facilitate its better maintenance and increase in the life of the carriageway. This will also help in avoiding soil erosion and land degradation due to water stagnation on the either side of the road.
- Detailed drainage survey and hydrological investigations have been carried out and accordingly capacity of existing drainage works & cross drainage structures have been duly augmented, wherever necessary, to accommodate high discharges to avoid flooding & formation of water pool.
- All bridges have been designed for a return period of 100 years.
- Structures which fail against 100 years flood have been recommended for replacement with a new one.
- Adequate new drainage works & Culvert) structures have been provided for smooth passage of runoff to avoid flooding.
- Filling of existing drainage courses will be strictly avoided.
- Construction works of culverts and bridge are taken up during the lean flow periods in summer to minimize the impacts on drainage.
- Construction work near natural drainage channels/low lying areas have to be carried out in such a way that flow of water is not blocked and even if it has to be blocked then the contractor must ensure that the local communities are informed about the same in advance.
- Suitable drainage at construction site & camp will be provided to eliminate the chances of formation of stagnant water pools that leads to soil erosion & breeding of mosquitoes.
- Stone pitching.

g) Water Use

Impacts:

During construction period water is required for compaction of embankment, dust suppression, concrete making and domestic use in construction camp. The estimated tentative water requirement during construction stage is given in Table 5.7.

Table 5-7: Breakup of Fresh Water Requirement during Construction

Sl. No.	Purpose	Quantity (KL)
1.	For road construction: a) Construction related to earthwork b) Construction of GSB c) Construction of WMM d) Bridges, culverts, retaining walls & other structures	77,979

Mitigation Measures:

- Minimum use of water from existing sources for construction purpose will be ensured to minimize likely impacts on other users.
- The contractor will arrange water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.

- If new tube-wells are to be bored, due to the non-availability of water required for construction, prior sanctions and approvals by the Ground Water Department must be obtained by the Contractor.
- Wastage of water during the construction should be minimized.

h) Water Quality

Impacts:

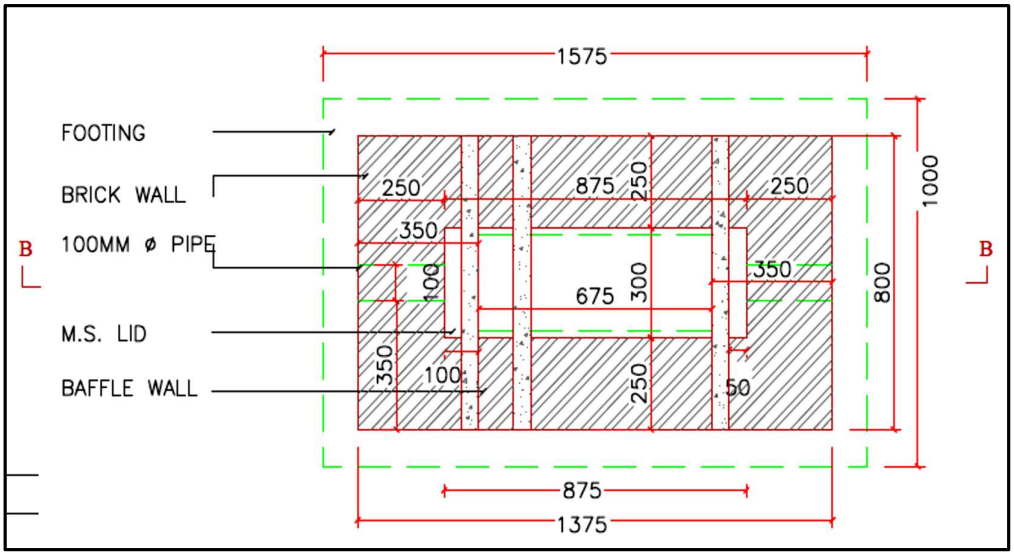
- Turbidity is likely to increase due to drilling / dredging / piling for erection of column / pillars and slope disturbance along the bank of the river. Increased load of fine sediment will make the water more turbid. If the concentrations are exceptionally high, smaller fish can be harmed. Heavier sediment may smother the algae growing in the lower strata and would alter the substratum of the watercourse. Excessive sediment loads / siltation may also mean disruption to areas where fish lay their eggs. Increase in turbidity may also lead to increase in temperature which would be harmful for aquatic species.
- Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of worker's camps and from spillage in vehicle parking and / or fuel and lubricant storage areas. Contamination of water due to chemicals present in paints used on bridges is also possible.
- During construction phase, leakage of POL could lead to an increase in water pollution level of the region. Anticipated potential impacts are due to spillage of construction materials, such as, cement, POL, bitumen etc. falling into the drainage channels from workshops, construction camps, quarry/ borrow areas etc. of the Contractor.
- Accident involving hazardous materials (bitumen) may cause pollution but the occurrence of large-scale spillage of bitumen is extremely rare.
- Increase of sediment load in the runoff from construction sites and increase in turbidity in receiving streams/water bodies.
- Water pollution due to sewage from construction camps.

Mitigation Measures:

- Silt fencing shall be provided along the river banks up to at least 5 m from the edge on both side of the river. Bridge/ culvert construction activity shall be preferably carried out in the non-monsoon season to minimize the impact.
- Turbidity curtain / Piling protector made of impermeable fabric shall be used around piles while removal and construction of cofferdams so that turbidity increase is contained within the curtain area. The curtains shall be removed only after certain duration of finishing piling work. Continuous monitoring of turbidity and temperature is proposed during construction activities for bridges. Use of lead-based paints in painting bridge components shall be strictly prohibited.
- Construction debris/oily waste should not be dumped in the water body. Immediately after completion of the work, the construction waste, if deposited on river or canal bed shall be removed. On site re-fuel area for vehicles and equipment's should be established away from water bodies.
- Quality of construction wastewater emanating from the construction site will be controlled through suitable drainage system with silt traps for arresting the silt/sediment load before its disposal into the main natural drainage system around the site.
- Proper sanitation facilities will be provided at the construction site to prevent health related problems due water contamination.

- An effective traffic management plan is to be implemented to avoid any accidental spillage of hazardous materials.
- All the construction and preparatory activities including construction of culverts and bridges will be carried out during dry seasons only.
- The CD structures should not be drained to the agricultural and horticultural farms or to the immediate vicinity of houses of the villagers.
- The fuel storage and vehicle cleaning area shall be stationed at least 500m away from the nearest drain/water body.
- Provision for oil interceptors shall be made at all the construction camps/workshop areas to separate the oil and grease waste generated from servicing of equipment and vehicles used in the construction.
- The unlined roadside drains in rural stretches carrying storm water will be connected to the nearest natural drainage channel, water bodies with silt traps.
- Construction camps should be established at least 500 m away from the water bodies and no discharge should be allowed to be disposed in to the water bodies. Oil interceptors are proposed in fuel storage and labour camp area. A tentative layout for oil interceptor is shown in Figure 5.1.

Figure 5.1: Typical design of Oil Interceptor



- **Water Quality Monitoring:** Apart from provision of the mitigation measures, water quality shall be monitored to understand the effectiveness and further improvement in designs in reducing the concentration of pollutants. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the Environmental Monitoring Plan (Table-9.3 of Chapter-9). The maximum desirable limits as per the water quality standards are given in Annex-3 and the monitored values should correspond with the table. All deviated results shall be reported to Environmental Specialist of the Supervision Consultant for remedial measures. It should be ensured that no construction camps or stockyards are set up near rivers, irrigation canals and water bodies to prevent oil spills.
- **Silt Fencing:** Silt fencing will be provided to prevent sediments from the construction site entering the nearby watercourses. The silt fencing consists of geo textile with extremely small size supported by a wire mesh mounted on a panel made up of

angle/wooden frame and post. The frame will be installed at the edge of the water body along which construction is in progress. It is proposed to install silt trap at the edge of all water bodies located along the project road, major and minor bridge locations. Further, silt fence will be mounted in guiding drains at 3 to 5 m in the upstream direction depending on the gradient of the guiding drains. However, location of silt traps will depend on contractor's proposal for site facilities and work sites and should be provided in the contractor's proposals. This will be checked by Environmental Specialist of the Supervision Consultant and monitored by PMC & PWD (EAP).

- **Oil Interceptor:** Oil and grease from road run-off is another major concern during construction as well as operation. During construction, discharge of oil and grease is most likely from workshops, oil and waste oil storage locations, vehicle parking areas of the contractor camp. Therefore, location of Oil Interceptors has been considered such that each construction camp having refuelling stations, oil and lubricants storage places will have one oil interceptor to stop & separate the floating oils. The arrested products shall be disposed as per MoEF&CC and CPCB guidelines. However, the number of interceptors shall increase as the situation demands or during the accidental spillages. Actual number will be decided by the Contractor with the consent of Environmental Specialist of the Supervision Consultant.

i) Water Bodies

- There are two ponds, which are located within the CoI.
- All streams crossing the road will not be altered and ponds have been saved. Hence, there will be no significant impact on roadside water bodies.

Table 5-8: List of Water Bodies Located along the COI

S.No	Chainage (Km)	Feature/Structure	Distance from ECL(m)	Side	Length	Height of (B/W)	Length	GPS Coordinates
1	0+300	Pond	3	RHS	60	1.5	60	N26.371015 E91.224373
4	0+900	Pond	2	LHS	35	0	0	N 26.37627 E91.224387
3	1+150	Pond	4	LHS	30	0	0	N26.378602 E91.224348
	4+700	River	0	Crossing	Crossing	Crossing	Crossing	26°24'17.90"N 91°12'22.95"E
4	6+000	Pond	3.5	RHS	30	0	0	N26.415885 E91.208375
	10+400	River	0	Crossing	Crossing	Crossing	Crossing	26°26'57.90"N 91°11'49.13"E
5	12+400	Pond	8	LHS	33	0	0	N26.462412 E 91.19151

*Source: Design report # Distance in meter from existing centreline; *B/W= Boundary Wall*

j) Enhancement of Water Body at 4 locations

Enhancement measures have been proposed for roadside ponds with followings as a part of enhancement:

- Deepening of the water body up to 2 m (earth excavation)
- Stabilization of the slope using bamboos.
- Turfing of surrounding area of water body

- Sitting arrangement with RCC Precast Benches with back support
- Pathway with Interlocking Paver Blocks & sand filling
- Approach Road beautification

k) Air Quality

Particulate matter would be the predominant pollutant affecting the air quality during the construction phase as it is likely to generate considerable quantities of dust, especially during dry condition. Dust will be generated mainly during excavation, backfilling, hauling & transportation activities through unpaved haul roads, loading/ unloading & transportation of construction materials, spilling of material during transportation, and open storage of fine construction materials.

Undesirable gaseous pollutants will be generated mostly by the automobile traffic and construction machineries. Pollutants of primary concern include $PM_{2.5}$ and PM_{10}. However, suspended dust particles may be coarse and will be settled within a short distance of construction area. Therefore, impact will be temporary and restricted within the closed vicinity along the road only. Further, this would not lead to any tangible effect, as the expected traffic volume is low. Operation of hot mix plants and Asphalt plants will cause emission of fumes and gases.

Impacts:

- Deterioration of air quality due to fugitive dusts emission from construction activities like excavation, backfilling & concreting, and hauling & dumping of earth materials & construction spoils, and vehicular movement along unpaved roads.
- Deterioration of air quality due to gaseous emissions from construction equipment & vehicular traffic.
- Deterioration of air quality due to emission from asphalt and hot mix plants.
- Emission of Carbon monoxide, sulphur-di-oxide, nitrogen oxides etc. will be generated from the hot mix plant.

Mitigation Measures:

Dust Control:

- Proper and prior planning and appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructural supports needed for construction will be ensured to shorten the construction period vis a vis reduce pollution.
- Construction materials will be stored in covered godowns or enclosed spaces to prevent the windblown fugitive emissions.
- Truck carrying soil, sand and stone will be duly covered to avoid spilling.
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads & vulnerable areas of the construction sites from trucks or other suitable means will be undertaken to control fugitive dust during material handling & hauling activities particularly near habitation especially in the dry seasons.

Emission Control:

- **Use of Recycled Asphalt Cold Mix Technology:** Most bituminous mixes are produced at a very high temperature (nearly 160°C), mainly because bitumen is very viscous at low temperatures and cannot coat the aggregates, unless heated to high temperatures. Technologies are available, which can facilitate the coating at low temperatures by increasing the surface area of bitumen or by reducing the surface tension at the aggregate bitumen interface with use of certain additives, thereby making the mixing possible at much

lower temperature, saving energy and releasing less pollutants in the atmosphere. It is proposed to follow IRC Guideline on the subject.

- During construction period, all activities are to adhere to the contractual obligations and all clearances and approvals such as 'Consent to Establish' and 'Consent to Operate' shall be obtained from the State Pollution Control Board under Air Act. All vehicles operating for the Contractor, and the consultants shall obtain Pollution under Control (PUC) certificate.
- All required clearances are to be obtained from the State Pollution Control Board, SEIAA / MoEF&CC and the Mining Department for establishing quarries, borrow areas and crushers. Contractor should submit copy of such clearances to Supervision Consultant and monitored by PMC & PWD (EAP) before start of activities.
- Asphalt and hot mix plants will be located at least 500 m away from inhabited areas and sensitive receptors such as school, hospital, temple etc. A written agreement with the landowner clearly specifying the terms and conditions of opening, operation and closing activities of the Contractor must be part of the management plan.
- Pollution control devices such as bag filter/cyclone separators/scrubbers shall be installed to control emissions from hot mix plants, crushing units and concrete batching plants. Height of the stacks shall be as per the statutory requirements.
- It will be ensured that all the construction equipment & vehicles are in good working condition, properly tuned and maintained to keep emissions within the permissible limits and engines turned off when not in use to reduce pollution.

l) Air Quality Monitoring:

Apart from provision of the mitigation measures, air quality shall be monitored. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the Environmental Monitoring Plan (Table-9.3 of Chapter-9). The maximum desirable limits as per the National Ambient Air Quality Standards are given in Annex-2 and the monitored values should correspond with the table. All deviated results shall be reported to Supervision Consultant for remedial measures.

m) Noise level

Pre-Construction Stage and Construction Stage

Impact

Site clearing activities, movement of man and machineries, crusher & mixing plants operation, etc. are likely to increase the noise level of project region impacting especially the social sensitive receptors listed in Table 5.12.

Onsite Workers will be the most exposed to the highest noise levels generated from different construction activities due to their proximity to the noise sources.

About 90 dB (A) of noise shall be generated from construction activity which shall attenuate to less than 55 dB(A) i.e., day time prescribed noise level at about 100m and less than 45 dB (A) i.e, night time prescribed noise level at about 300 m. Comparison of distance vs Noise level (considering two Noise source of Intensity 90 dB(A) are working in parallel) for day and night time are shown in Figures 5.2 and 5.3.

Figure 5.2: Day-time Construction Noise Intensity vs Distance from the Source

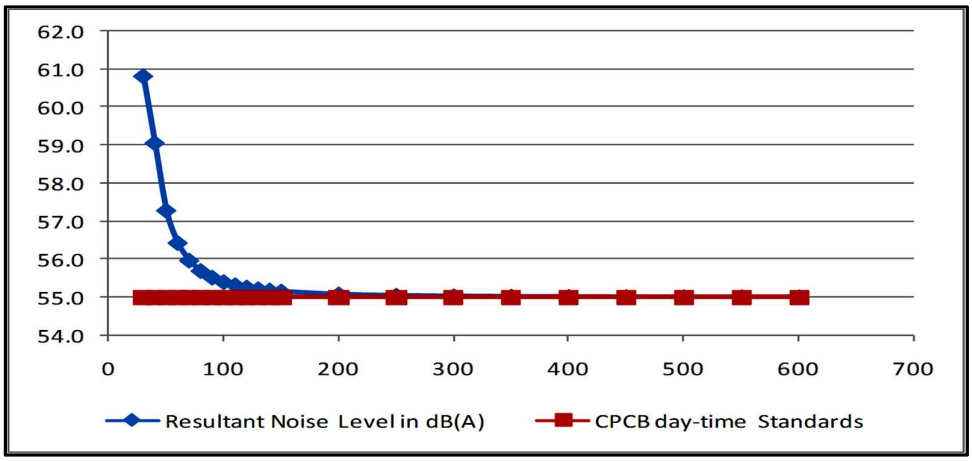
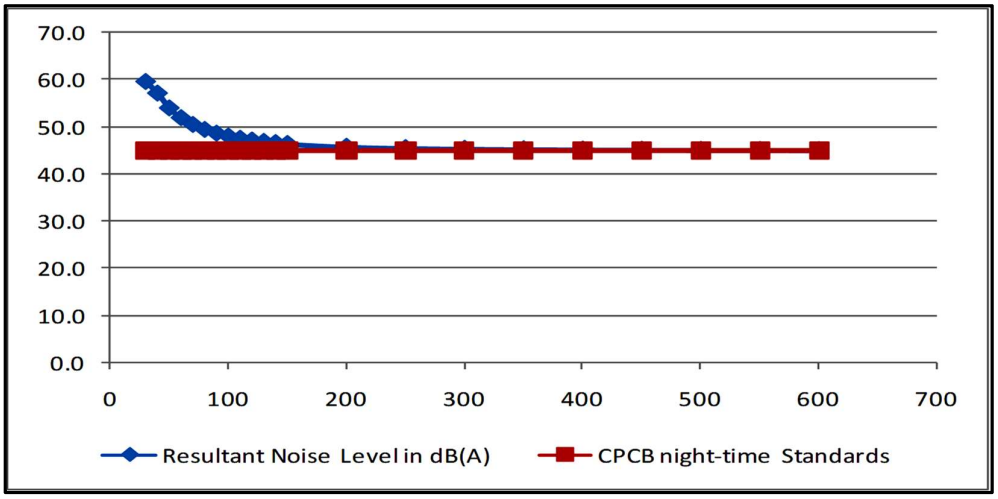


Figure 5.3: Night-time Construction Noise Intensity vs Distance from the Source



Part of project stretch is proposed adjacent to settlement areas. Therefore, the impact due to the noise shall be significant at these locations. Prior mitigation measures shall be required for neutralizing the affects.

Mitigation Measures

Construction camp shall be established at least 500 m away from nearest habitation and other sensitive receptors. Temporary noise barriers should be provided surrounding the high noise generating construction equipment during work near to settlement area. Stationary noise source like generator sets shall be provided with an acoustic shield around them. The plants, equipment and vehicle used for construction should strictly conform to CPCB standards. Vehicles and equipment should be fitted with silencer and maintained accordingly.

Noise generating activities should be scheduled based on community welfare. Noise level should regularly be monitored as per monitoring plan and if the noise level at any time found to be higher, then immediate measure to reduce noise in that area should be ensured. The following mitigation measures as given in table below need to be worked out for the noise impacts associated with the various construction activities.

Table 5-9: Summary of Mitigation Measures for Construction Stage

Source of Noise Pollution	Impacts	Generic Mitigation Measures
• Utilisation of heavy construction machinery. • Construction of structures and facilities. • Crushing plants, asphalt production plants; and • Loading, transportation and unloading of construction materials	Increased Noise Levels causing discomfort to local residents and workers	• All construction equipment, plants, machinery and vehicles will follow prescribed noise standards. • All construction equipment used for an 8 hour shift shall conform to a standard of less than 90 dB (A). If required, machinery producing high noise as concrete mixers, generators etc. must be provided with noise shields. • At construction sites within 500 m of human settlements, noisy construction activities shall be stopped between 9.00 PM and 6.00 AM. • Vehicles and construction machinery shall be monitored regularly with attention to silencers and mufflers to maintain noise levels to minimum. • 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) per 8-hour shift. • Hot mix plant, batching or aggregate plants shall not be located within 1000 m of sensitive land use and settlements. • After proposed strengthening project road shall facilitate free flow of the traffic. Therefore, proposed strengthening is likely to reduce the noise associated with existing traffic jam scenario.

n) Ecological Resources

Following impacts on the terrestrial flora, fauna and aquatic life have been envisaged in the construction phase of the project.

Impact on Flora

The proposed road is not passing through any forest area. Trees and vegetations on the RoW shall be cleared for the road. This felling of trees shall have manifold impacts. i.e. increased erosion, loss of habitat, loss of shade etc. Workers residing in the area shall use firewood from surrounding increasing the risks of bush fire-accidents that may spread.

Impact on Fauna

The proposed project road is not passing through any eco-sensitive / protected areas or located inside or within a 10 km distance from such areas. No movement of sensitive wildlife was reported near the project road. Hence no direct impact is envisaged on any major wildlife. Moreover, the study area is mainly agricultural land and devoid of any natural forest, wild mammals / larger animals are not commonly seen except domesticated animals. The removal of trees for the clearing of RoW results in loss of micro-ecosystems, therefore, removal of vegetation, ultimately affects the terrestrial fauna, avifauna and insects etc. which are dependent on these micro-habitats. The movements of the worker and sounds of the machines also frighten the fauna and interfere with their routine habits.

Impact on Aquatic life

A large quantity of construction material like stones, pebbles, gravel and sand are stored & used in construction phase. There are always possibilities of contamination of the waterbodies like ponds,

canals etc. due to spillage of construction material. This sediment loading & increased turbidity shall result in decline in the number and diversity of aquatic flora and fauna.

Mitigation Measures

- Labour camps shall be setup only after obtaining proper permissions from the Engineer and alternate fuel shall be provided to the labourers in the labour camps to ensure that no firewood will be used for cooking etc. The camps shall have proper toilets with sanitary disposal of wastes. Smoking, hunting & fishing in the wild are prohibited and the contractor shall conduct regular awareness trainings related to non-use of firewood, prohibition on smoking in natural areas, bush fires accidents, safe handling of animals (if encountered), prohibition of fishing etc.
- All staff / workers will be instructed not to chase/hunt if any wildlife seen near the project area. The incidence of sighting wildlife near project site should be reported to Forest Department.
- No labour camps shall be permitted in the vicinity of any water body in order to avoid the deterioration of water quality and any human induced impact on aquatic life nor shall workers be permitted to use waterbodies for bathing and washing.
- Noise will be kept under control by regular maintenance of equipment and vehicles. Noisy activity shall be prohibited during night.
- The loss of trees and ecosystem shall have to be compensated through compensatory plantations in accordance with the principles of the Forest (Conservation) Act and Forest Policy. Such compensation shall be done with native species and proper care of the saplings will be taken to ensure their survival.
- Due to restriction of ROW Plantation shall be carried out at the land suggested by Forest department which act as a new habitat for avifauna, lesser mammals & insects.
- Plantation along the proposed highway shall act as a new habitat for avifauna, lesser mammals & insects. Plantation of fruit bearing species will provide additional habitats to avifauna dwelling in the area.
- Moreover, all provisions of Environmental & Social Management Plan made for the air, water, noise pollution control will be implemented, and thus will be also helpful to control the negative impacts on the flora and fauna.
- Designates place will be used to store the construction material. Proper care will be taken that no spill of the construction material or the debris shall take place and get mixed into any river body or eroded in heavy rains.
- No labour camps shall be permitted in the vicinity of any water body in order to avoid the deterioration of water quality and any human induced impact on aquatic life nor shall workers be permitted to use waterbodies for bathing and washing.

o) Socio-economic Impacts

The impact of the improvements of project road on the socio-economic environment will be significantly beneficial. Improved access and reduced travel time and cost will be major stimuli to economic growth, particularly in rural areas. Better access of agricultural goods to market will be important and a major contributor to poverty reduction.

Increased labour mobility will occur. This has both positive and negative impacts. Increased access is a two-way phenomenon, and the corollary to increased access to the project areas is increased access for the residents of these areas to more urban lifestyles. Out-migration may result. There is also the likelihood of the relocation of homes and businesses to new roadside locations.

During construction, benefits to local people can be maximised if the contractor recruit's construction workers locally regardless of gender. Where possible, he/she should also not discriminate in the employment of women.

The perceived social impact assessment for the project road has been performed and prepared. In this analysis, effort has been made to discuss likely impact on structures separately based on private, community, religious and government, impact on population especially vulnerable population, encroachers and titleholders' etc. The major findings of the social impact assessment study on the population and properties along the project roads are summarized here as follows.

Enumeration of properties reveals an impact on total of 254 properties (Private, Religious, Community and Government) in project roads due to the implement of project section. The total number of private properties to be affected due to the project is estimated to be 193 in number. Out of these private properties, 68 are commercial, 53 are residential and 8 are res-cum-commercial properties. The total number of families to be affected by this project is 228. There are 22 government, 3 community and 36 religious properties to be affected. Nearly 69% of the structures are fully impacted. Out of total structures, most of the structures that have been enumerated during social survey within proposed ROW are Permanent (29%) followed by Temporary 25%, Semi-permanent 13% and 33% other structures such as boundary wall and shed. The total private land to be acquired or transferred for this project road is approximately 20.65 Ha.

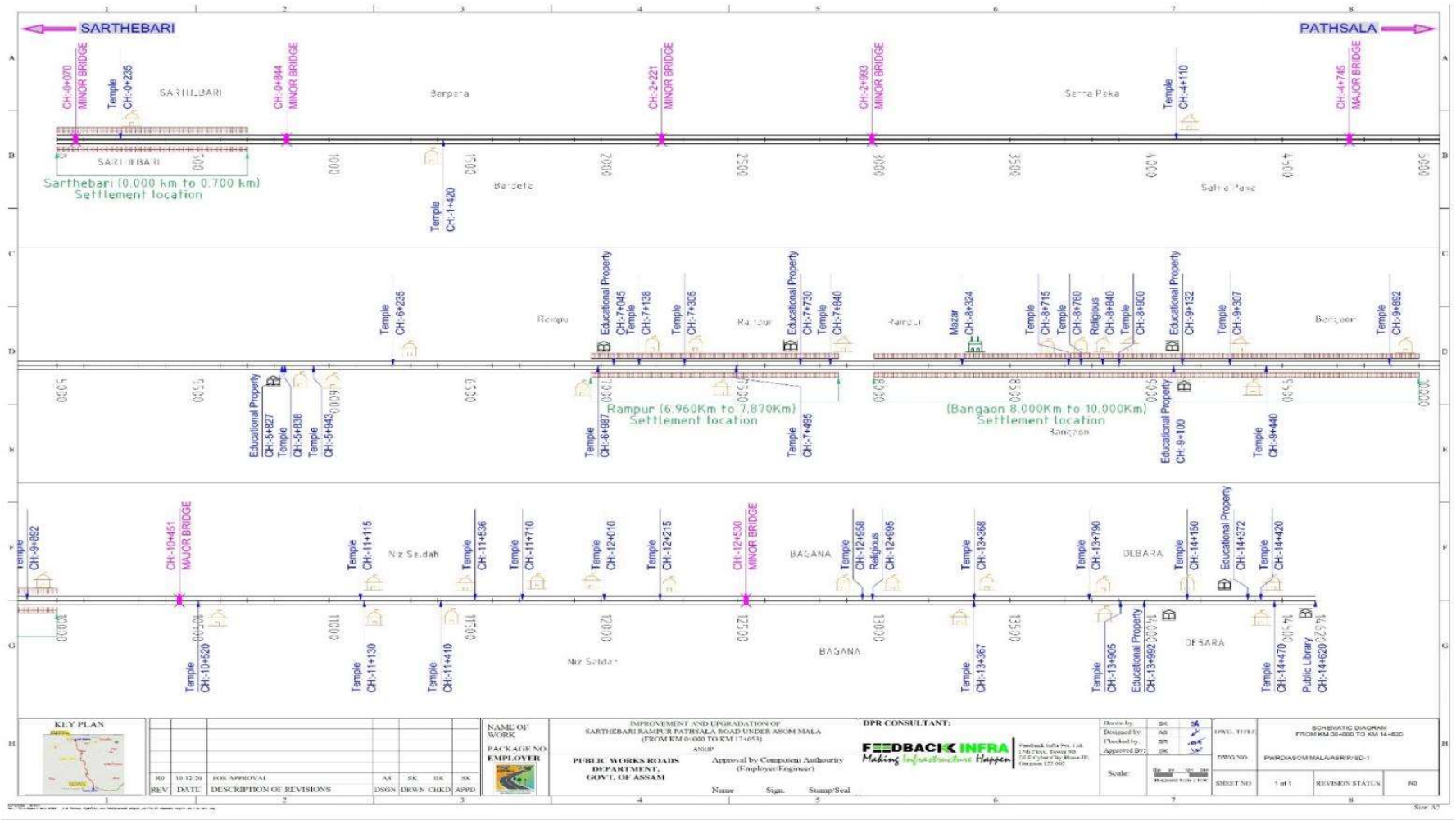
The project affects 18 villages, fall under the jurisdiction of Barpeta & Bajali districts. It is understood that project stretch passing through Barpeta & Bajali districts which are not coming under as schedule VIth tribal area/district. No indigenous peoples impact involving direct or indirect impacts to the dignity, human rights, livelihood systems or territories or natural or cultural resources that are used, owned, occupied or claimed by indigenous peoples as their ancestral domain or asset, is anticipated. The assessed impacts to scheduled tribe populations (2 affected families) are involuntary resettlement impacts. The project area does not fall in a scheduled area or ITDP area, nor has recorded presence of particularly vulnerable tribal groups. Hence, the need for an Indigenous Peoples Plan is not assessed for this project.

p) Educational, Medical and Religious Properties Impacts

Roadside amenities, religious and cultural properties generally include:

- Educational institutions (schools & colleges)
- Medical amenities (hospitals & health centres)
- Religious properties (temples, mosques, church etc.

Figure 5.4: Schematic diagram of common property resource along the project road is given in figure below.



Due to additional land acquisition & widening of the road, there will be some impact on the roadside educational, medical and religious places. The impacts on roadside religious and cultural properties are given in Table 5.10.

Table 5-10: Number of Roadside Religious Properties Affected

Sl.	Design Chainage	Side	Name of Town/Village	Cultural/ Religious Structure
1	0.235	LHS	Sarthebari	Lakhi Temple
2	1.420	RHS	Bargomura	Shiva Temple
3	4.110	LHS	Batiya	Shiva Temple
4	5.838	RHS	Parakushi	Shiva Temple
5	5.943	RHS	Parakushi	Shiva Temple
6	6.235	LHS	Kaskuri	Shiva Temple
7	6.987	RHS	Rampur	Shiva Temple
8	7.138	LHS	Rampur	Shiv mandir
9	7.305	LHS	Rampur	Shiva Temple
10	7.495	RHS	Rampur	Shiva Temple
11	7.840	LHS	Rampur	Shiva Temple
12	8.324	LHS	Bangaon	Statue/Mazar
13	8.715	LHS	Bangaon	Shiva Temple
14	8.760	LHS	Bangaon	Shiva Temple
15	8.840	LHS	Bangaon	Shiva Temple
16	8.900	LHS	Bangaon	Shiva Temple
17	9.307	LHS	Bangaon	Shiva Temple
18	9.440	RHS	Bangaon	Shiva Temple
19	9.892	LHS	Bangaon	Shiva Temple
20	10.520	RHS	Bugan	Shiva Temple
21	11.115	LHS	Bugan	Shiva Temple
22	11.130	RHS	Bugan	Dev Sthan
23	11.410	RHS	Bugan	Krishna Temple
24	11.536	LHS	Bugan	Shiva Temple
25	11.710	LHS	Bugan	Shiva Temple
26	12.010	LHS	Bugan	Shiva Temple
27	12.215	LHS	Bugan	Shiva Temple
28	12.958	LHS	Tapattari	Shiva Temple
29	12.995	LHS	Tapattari	Shiva Temple
30	13.367	RHS	Tapattari	Shiva Temple
31	13.368	LHS	Tapattari	Shiva Temple
32	13.790	LHS	Malipara	Shiva Temple
33	13.905	RHS	Malipara	Shiva Temple
34	14.150	LHS	Malipara	Shiva Temple
35	14.420	LHS	Malipara	Shiva Temple
36	14.470	RHS	Malipara	Shiva Temple

Source: Primary survey

Table 5-11: List of Sensitive receptors along the project road

Sl. No	Chainage (Km)	Feature/ Structure	Distance from ECL (m)	Settlement	Side	Length along road (m)	Height of Boundary wall – m (if any)	GPS Coordinates
1	0+156	Sarthebari public Library	5	SARTHEBARI	LHS	30	1.5	26°22'10.68"N 91°13'28.02"E
2	5+827	Government anganwadi	6	PARAKUSI	RHS	12	0	26°24'46.84"N 91°12'28.83"E
3	7+045	Educational property, Rampur High school	9	RAMPUR	LHS	30	2	26°25'25.15"N 91°12'20.24"E
4	7+730	College	10	RAMPUR	LHS	80	1.5	26°25'41.93"N 91°12'9.44"E
5	9+100	Bangaon LP School	4	BANGAON	RHS	22	0	26°26'29.98"N 91°12'12.12"E
6	9+132	Bangaon H S School	5	BANGAON	LHS	70	1	26°26'31.00"N 91°12'12.35"E
7	9+880	Government L.P school	6	BANGAON	LHS	100	0	26°26'48.54"N 91°12'6.45"E
8	13+992	Malipara AWC Kendra	5	MALIPARA	RHS	20	0	26°28'31.85"N
9	14+200	School	4	MALIPARA	LHS	30	0	26°28'41.51"N 91°11'45.12"E

Source: Primary survey

- Out of 9 educational institutions along the project road, out of 9 Sensitive receptor 6 will be partially affected.
- There will be no impact on medical amenities (PHC) along the road.



School Ch. 0+156



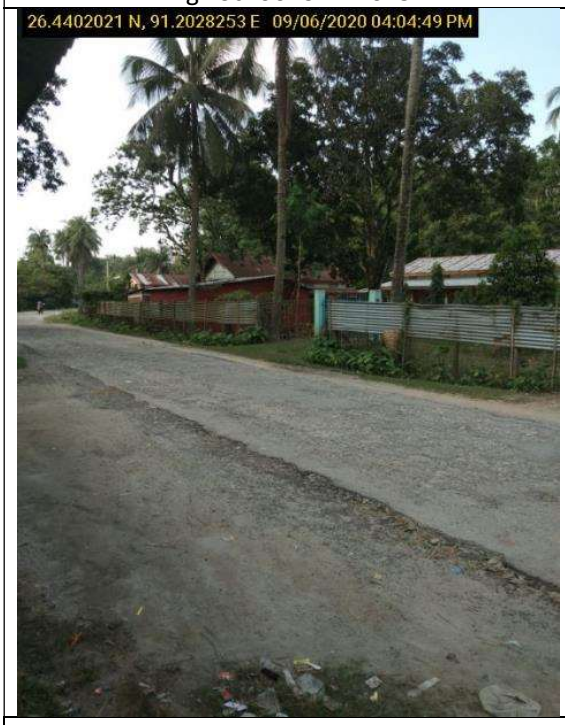
Anganwari Ch. 5+827



High School Ch. 7+045



College Ch. 7+730



School Ch. 9+100



School Ch. 9+132



School Ch. 9+880



Anganwari Ch. 13+992



School Ch. 14+200

Mitigation Measures:

- Ramble strips and Speed Breaker should be provided at above Sensitive receptors.
- Affected Boundary wall will be reconstructed.

Impact on Land

The total land including private and government land to be acquired or transferred is approximately **20.65 Ha**. Collection of revenue maps for this stretch has been completed and digitization work is in progress. Actual land requirement/ land to be acquired shall be extracted with respect to the proposed right of way. This shall be done after super imposing proposed alignment on the digitized revenue map. However, for the time being, consultant's LA team estimated the tentative land

requirement as mentioned above with respect to the physical availability of land at site. The details of affected land are presented in Table 5.12.

Table 5-12: Type of Land Affected

Type of land		Area (ha.)
Private	Agriculture/Non-irrigated	20.65
Public	Government Land/ Waste land	0
	Forest land	nil
	Total	**20.65**

Impacts on Structure in the Project Area

After considering the mitigation measures, total 254 structure shall be affected that will impact the living and livelihood of the people. The details are given in Table 5.13.

Table 5-13: Details of Affected Structures

Sl. No.	Category	No. of Structure
1	Residential	53
2	Commercial	68
3	Residential - Cum Commercial	8
4	Religious Properties	36
5	Community	3
6	Govt	22
7	Others	64
Total		**254**

Extent of impact

The structures identified as likely to be affected are further classified with respect to the extent impact. To assess the quantum of impact, three categories like '0 to 10%'; '11 to 40%' and '41 to 100%' have been generated. Properties identified under 0 to 10% category shall be considered as properties having minor impact or insignificant impact and 11 to 40% category shall be properties having moderate impact whereas 41 to 100% category shall be considered as properties having major impact or significant impact. Details of the same is summarised in Table 5.14.

Table 5-14: Extent of Impact

Sl. No.	Type of major buildings	0-10%	11-40%	41-100%	Total
1	Residential	0	26	18	**44**
2	Commercial	1	35	45	**81**
3	Residential - Cum Commercial	0	10	9	**19**
4	Religious Properties	0	4	12	**16**
5	Educational institutions	0	2	1	**3**
6	Govt/Community	0	1	0	**1**
7	Others	0	0	51	**51**
	Sub-total	**1**	**78**	**136**	**215**
	% age on total	0.47	36.28	63.26	

Mitigation Measures:

Consultant had taken all the efforts to reduce negative social impact especially dismantling of private and community buildings along the project road. This has been done through proposing reduced right of way through compromising design standard at all the urban/ congested locations.

q) Rehabilitation & Resettlement

The resettlement cost estimate for the RP includes compensation for structure at replacement cost without depreciation, compensation for livelihood loss, resettlement assistances and cost of RP implementation. The total resettlement cost for the project is INR Rs. 4,73,42,000/- (4.73 Cr.). The EA will provide the necessary funds for compensation for land and structures and R&R assistance. The EA will ensure timely availability of funds for smooth implementation of the RP.

r) Employment & Trading Opportunities

It is estimated that a substantial construction personnel including skilled, semi-skilled and unskilled labourers employed by various contractors will work at site during the peak period of construction phase. Since most of sizeable labour force will be drawn from neighbourhood, no change in demographic profile is anticipated. Only for a few skilled personnel, brought to site from outside the locality, proper housing/ accommodation would be provided in the construction camps. Due to employment opportunities, some competition for workers during construction phase is therefore anticipated.

The construction materials like stone chips and sand will be procured locally from identified quarry sites. The other important materials like cement, steel will be procured through various local sources. Thus, there is a possibility of generation of local trading opportunities, though temporary.

Mitigation Measures:

- Most of the unskilled construction labourers will be recruited from the local areas to create some employment opportunities and sense of wellbeing among local people. This will also reduce social tension of migration.
- Some of the construction materials like stone chips & sand will be procured locally. Thus, there is a possibility of generation of local trading opportunities, though temporary.

Migration

From the viewpoint of employment of migrant skilled workers, the project is small. Therefore, no social tension is expected due to very small number migrant skilled workers. As the construction phase has a very short time span in comparison to the operation phase, it would not have any long-term effect. Moreover, the different groups of people engaged in different construction activities will leave the place after specified time span.

s) Occupational Health & Safety

Impacts:

- Health & safety related problems to construction workers due to inadequate health & safety measures.

Mitigation Measures:

- Adequate safety measures complying with the occupational safety manuals will be adopted by the contractor to prevent accidents/hazards to the construction workers. Guideline for Preparing of Safety Management Plan for workers is attached as **Annex-13**.
- A road safety, traffic management and accident management plan are to be prepared by the Contractor prior to the start of the construction activity.
- Periodic health check-up of construction workers will be done by the contractor.
- Personal protective equipment will be provided to the construction workers.

t) Community health and safety

Impacts:

- Operation of heavy construction machinery, movement of construction vehicles, site clearance activities, demolition of existing structures and excavation activities generates fugitive dust emissions. The fugitive dust/ vapors if not contained, can spread beyond immediate project area, which may discomfort the community. Health effects of inhaling fugitive dust includes Irritation to the eyes, nose and throat, respiratory distress, coughing and difficulty in breathing, etc.
- The construction activities will cause traffic disruption along the road A07. In addition, the construction activities can potentially block local roads and routes and cause traffic congestion. Further, there are chances of increase on incidence of road accidents due to disruptions caused in existing traffic movements.
- Increased noise levels during construction activities have the potential to result in adverse impacts to Neighbouring communities and other sensitive receptors (such as students at schools and other educational institutes, patients at hospitals, etc.).
- Construction activities will likely bring in social changes to local communities within and around the Project Area. Project-related health and safety effects on local communities will primarily result due to influx of migrant labour in the area. In view of the prevailing COVID-19 pandemic, migrant labour may act as significant health and safety risks to the local community particular children, therefore contractors and workers would need to take additional measure to avoid the spread of the disease.
- Workers/labour influx in the vicinity of a community may strain the existing infrastructure, the water and sanitation, electricity and transport systems.
- Specific concern over construction workers causing social problems within the local communities and impacting on safety and security, including gender-based violence issue.
- Conflict with local communities over usage of key services such as food, water, transport by influx of labour or may be due to differences in culture, language and ethnicity.
- Unhygienic conditions and improper disposal of sewage and wastewater from labour camps and construction debris can contaminate the ground water resources in the area and may cause spread of communicable and vector borne disease.

Mitigation Measures:

- The contractor will prepare and implement an Occupational Health and Safety (OHS) Plan that will also cover communities' health and safety aspects; the safety procedures will have a brief on "Do" and "Don'ts" considering GoI guidelines on COVID 19. For details and preparation of COVID-19 Response and Management Plan is given in **Annex-19**.
- Proper traffic diversion and management will be ensured during construction at the intersections and construction areas. Proper warning signs will be displayed at the construction sites. Guideline for Preparing of Traffic Management Plan is attached as **Annex-14**.
- Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. Awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means.
- The community will be informed about the nature of construction activities and the associated health and safety risks.
- The construction sites will be fenced as appropriate to minimize entry of the local communities in the work areas.

- GRM will be established to address community grievances related to health and safety aspects.

  Construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.

F. Environmental Impacts - Operation Phase

a) Topography, Geology & Land Use

During operation phase of the project road, no impact is anticipated on the topography and geology of the area. the temporarily modified land use pattern such as temporary construction camps/tents would be dismantled. The road, after completion of its development, would consist of neat landscape to lead to a pleasing outlook.

The existing road passes through mainly agricultural field and some congested stretches of residential/commercial areas. The safe & quicker accessibility would result in increased scope of commercial, industrial and residential development along the project corridor. Squatter settlement and encroachment along the project road is very likely to take place unless proper controlled measures are adopted.

Impacts:

- Likely change of land use due to squatter / encroachment within ROW.
- Likely change of land use due to induced roadside development outside the ROW.

Mitigation Measures:

- Immediately after the construction phase, it is necessary to ensure that no further deterioration or major land use changes such as ribbon development takes place in a manner that will jeopardize the interests of the State.
- Squatter development within the ROW shall be strictly avoided by proper regulation and vigilance.
- Land use control measures will be prepared & administered to avoid occurrence of induced development as far as possible.
- Planning agencies and Collector / Revenue Officer will be made involved for controlled development and prohibiting squatter/encroachment within ROW.

b) Water Quality

Widening will result in increase of surface run-off due to more paved road surface. It will have adverse impact on ground water recharging if measures are not taken during the design stage.

Impacts:

- Increase of surface run-off due to more paved road surface.
- Filthy environment due to improper maintenance of drainage.
- Chances of contamination of water bodies from road surface run off containing oil spills due to traffic movement & accidents.

Mitigation Measures:

- Longitudinal roadside drains of enough capacity will be provided on both sides of the road to accommodate increased run-off. The out fall for these drains will be the nearby culverts/bridges or natural drainage channel. Silt fencing will be provided to sediment entering the water courses.

- Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.
- Regular maintenance of rainwater harvesting structures shall be done during the operation stage to prevent choking of these structures.
- Regular monitoring of water quality at specified representative locations will be conducted at fixed interval.

c) Air Quality

Prediction of Impacts

Generation of exhaust gases is likely during the construction stage due to movement of heavy vehicles & machinery, oil tankers, etc. SO_2, NO_2 and HC are likely to be emitted from hot mix plant operations. Volatile toxic gases may also be released due to heating process during bitumen production. Although the impact is much localized however, it can spread downwind depending on the wind speeds. Construction vehicles shall also be releasing exhaust gases.

The major impact on air quality during operation stage will be due to plying of vehicles. The impacts on air quality will at any given time depend upon traffic volume/rate of vehicular emission within a given stretch and prevailing meteorological conditions. Air pollution impacts arise from two sources:

- Inadequate vehicle maintenance.
- Use of adulterated fuel in vehicles.

d) Air Quality Impact Prediction Modelling using CALINE 4 Dispersion Model:

CALINE 4 (Caltrans, 1989) is a simple line source Gaussian plume dispersion model that predicts air impacts near roadways. The model is broadly divided into five screens such as Job Parameters, Run Conditions, Link Geometry, Link Activity and Receptor Positions.

CALINE-4 has high applicability in Indian scenario and is a recommended model by USEPA for prediction of air quality from line sources like highway projects.

Approach and Methodology

Emission Factors were arrived using standard values prescribed by The Automotive Research Association of India, Pune under Air Quality Monitoring Project-Indian Clean Air Programme (ICAP). Traffic data of the year 2049-50 has been used for assessment for worst case scenario. Table 5.15below presents the Traffic and emission factor considered for the dispersion modelling.

Table 5-15: Traffic and Emission Factors for Traffic Sections

Year	Parameter	Traffic volume per day	Emission Factor (gm/mile/vehicle) for CO
2049-50	CO	10922	2.44
	NO_X		0.88
	PM		0.14

Prediction Results

Dispersion model software was run by using data as discussed in previous sections. The output results at various distances along the project road for projected year 2049-50 are presented in Table 5.16.

Table 5-16: Predicted Pollutant Concentration

Parameter	Resultant Ambient Concentration at various distance from Centre Line					
	10m	20m	40m	60m	80m	100m
Carbon Monoxide (CO) in mg/m3	0.13	0.07	0.04	0.03	0.02	0.02

Parameter	Resultant Ambient Concentration at various distance from Centre Line					
	10m	20m	40m	60m	80m	100m
NOx in µg/m3	9.2	5.2	4.3	3.1	2.5	2.1
Particulate Matter in µg/m3	7.3	4.3	2.1	1.5	1.2	1.0

Conclusion

Considering that CO concentration in study area was found 0.65 mg/m^3 and predicted maximum incremental concentration of 0.13 mg/m^3 at RoW edge (i.e., nearest possible receptor), the maximum resultant CO concentration shall be in the tune of 0.78 mg/m^3 in respect to 2 mg/m^3 of Ambient Air Quality Standards. Hence, predicted CO concentration including ambient level shall remain well within the National Ambient Air Quality Standards for the projected years 2059-60. Detail modelling report is attached as **Annex-22**.

Mitigation Measures

- Vehicular emission will be controlled through enforcement of laws and public awareness. It will be ensured that all the vehicles have vehicular emission within the permissible limits.
- Truck parking lay-byes and bus bays will be provided at required locations to facilitate smooth traffic flow vis a vis reduce air pollution.
- Regular monitoring of ambient air quality at specified representative locations will be conducted at fixed interval.
- Remaining Roadside plantation along the road will act as sink of air pollutants. Pollution resistant species, which can grow in high pollutants concentrations and absorb pollutants will be planted as proposed under Greenbelt Development Plan.
- The designed road surface will generate lesser dust due to the paved shoulders in settlement areas.
- Improvement in road surface condition and traffic capacity will reduce the local congestion in the built-up areas and provide a smooth traffic flow.
- The net air quality impacts during the operation phase would be reduced after widening and improvement of the project.
- Regular maintenance and pollution check are proposed for construction vehicles and machineries.
- Low Sulphur fuel shall be used in construction vehicles and machinery.
- Hot mix Plant to be installed in down wind direction from nearby settlement at minimum 500m distance.

Other measures such as the reduction of vehicular emissions, ensuring vehicular maintenance and upkeep, educating drivers about driving behaviour. However, these measures are beyond the scope of the project but will be far more effective in reducing the pollutant levels. PWD together with the Motor vehicles Department and SPCB can arrange for provision for inspection of PUC certificates.

e) Noise Level

Operation Stage

Impact

Road noise depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface. Noise is a major area of concern, especially since sensitive receptors (school, health centre, etc.) have been identified in proximity of the road. CoRTN (Calculation of Road Traffic Noise) model developed by UK Department of Transport is used for

assessment of Noise Impact Intensity at various distances from the project road. Traffic Noise has been estimated for uninterrupted traffic flow condition.

Limitations

Metrological conditions are not taken into account and Model does not take background noise into account such as trains, aero plane, industry, daily activities, market activities, etc.

Classification of Vehicles

In CoRTN model vehicles are classified onto two categories:

- Light vehicles
- Heavy vehicles

Approach, Methodology & Validation

The model has been validated for Indian Conditions by CSIR Central Road Research Institute and published the validation in 2008 vide paper titled "Validation of Noise Prediction Model for an Urban Area". The present model used for the project is derived from the CSIR CRRI validated and modified model.

Input Traffic

CoRTN model software was run by using traffic forecast data of year 2049-50 for assessment of worst-case scenario. The traffic assessment along the road is based on the homogeneous traffic sections, as they are going to act as points where traffic will join or leave the road (Table 5-17). The Table 5.18 below lists traffic projected on the road during Year 2049-50.

Table 5-17: Traffic Distribution Across the Project Sections

Section No	Starting		Ending		Length (km)	Survey Location
	Existing Chainage	Place	Existing Chainage	Place		
I	Ch. 0.000	Sarthebari (SH 9 Jn)	Ch. 17.653	Pathsala (Near Rly station)	17.653	8.7000

Table 5-18: Traffic Projection

Two wheeler	Auto / 3 wheeler	Car	Mini bus	Standard bus	LMV	LCV	2 Axle	3 Axle
8256	366	1254	0	25	627	24	29	0
MAV	**Others**	**Tractor**	**Tractor trailer**	**Cycle**	**Cycle rickshaw**	**Animal drawn**	**Total Vehicles**	**Total PCU**
0	0	2	33	305	1	1	10922	6883

Result Discussion

Considering individual sections have different traffic intensity, therefore, variation in the noise level increments is observed along the project corridor. The increment noise level will attain to the standards of residential i.e., 55 dB(A) at 9m from the RoW edge.

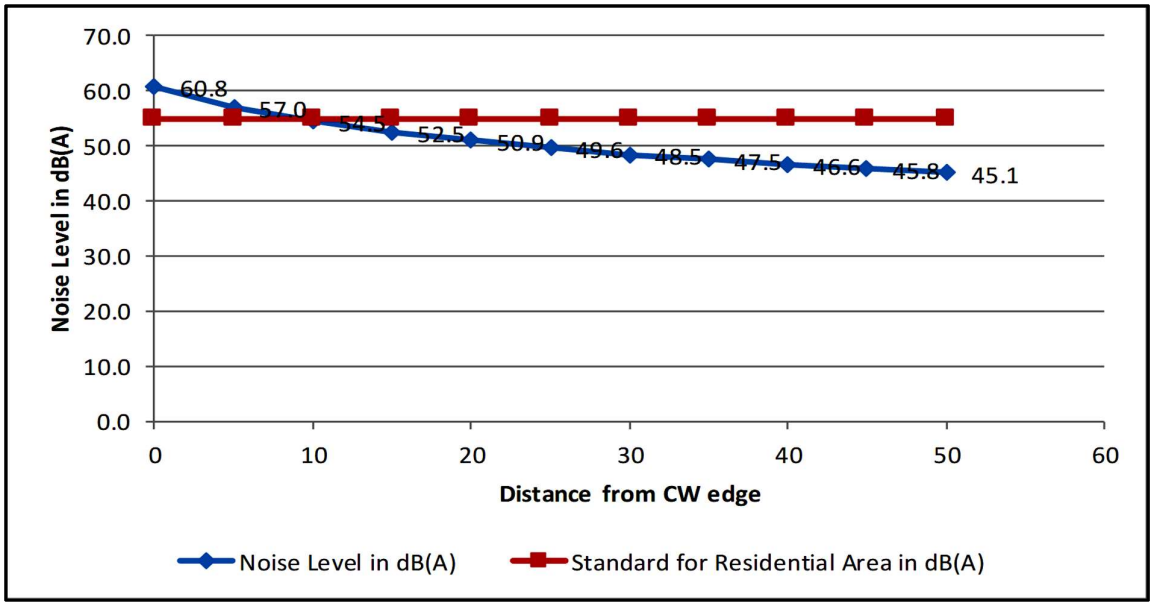
Table 5.19 and Figure 5.5 below shown the Noise level due to traffic activities at various distances against the Noise standards for Rural and residential areas. Details modelling noise result is given in **Annex-23**.

Table 5-19: Noise Level due to Vehicular Traffic (Year 2049-50)

Dist. from RoW edge (m)	Resultant Noise Level in Section 1	Noise Standards for daytime in dB(A)
0	60.8	55
5	57.0	55

Dist. from RoW edge (m)	Resultant Noise Level in Section 1	Noise Standards for daytime in dB(A)
10	54.5	55
15	52.5	55
20	50.9	55
25	49.6	55
30	48.5	55
35	47.5	55
40	46.6	55
45	45.8	55
50	45.1	55

Figure 5.5: Noise Intensity due to Vehicular Operation vs Noise Standards during year 2049-50



Mitigation Measures

Though the level of discomfort caused by noise is subjective, however, there is a definite increase in discomfort with an increase in noise levels. 7 educational facilities and 2 health centres are located within or near vicinity of the project road.

To reduce noise and vibrations, compound wall as noise barriers (Wall of 2m height) is proposed in front of education or health facilities located within 9m (14m from C/L) from the RoW edge and having no physical noise barrier or alike. As per research carried out in the developed countries, a masonry wall has Noise Reduction Coefficient (NRC) value between 0.2 to 0.5. Details of noise barrier location is provided in Table 5.20.

Table 5-20: Noise Barrier Locations

Sl. No	Chainage (Km)	Feature/ Structure	Distance from ECL (m)	Settlement	Side	Length along road (m)	Height of Boundary wall – m (if any)	GPS Coordinates
1	0+156	Sarthebari Public Library	5	SARTHEBARI	LHS	30	1.5	26°22'10.68"N 91°13'28.02"E
2	5+827	Government	6	PARAKUSI	RHS	12	0	26°24'46.84"N

Sl. No	Chainage (Km)	Feature/ Structure	Distance from ECL (m)	Settlement	Side	Length along road (m)	Height of Boundary wall – m (if any)	GPS Coordinates
		Anganwadi						91°12'28.83"E
3	7+045	Educational property, Rampur High school	9	RAMPUR	LHS	30	2	26°25'25.15"N 91°12'20.24"E
4	7+730	College	10	RAMPUR	LHS	80	1.5	26°25'41.93"N 91°12'9.44"E
5	9+100	Bangaon LP School	4	BANGAON	RHS	22	0	26°26'29.98"N 91°12'12.12"E
6	9+132	Bangaon H S School	5	BANGAON	LHS	70	1	26°26'31.00"N 91°12'12.35"E
7	9+880	Government L.P School	6	BANGAON	LHS	100	0	26°26'48.54"N 91°12'6.45"E
8	13+992	Malipara AWC Kendra	5	MALIPARA	RHS	20	0	26°28'31.85"N
9	14+200	School	4	MALIPARA	LHS	30	0	26°28'41.51"N 91°11'45.12"E
Total Length						322		

The issue for provision of Noise barrier needs to be discussed during construction phase. The contractor will hold a discussion with stakeholders related to sensitive receptor during construction stage of the road. No horn zone sign and speed breaker/Ramble strips shall also be placed in near vicinity of sensitive receptors areas.

To reduce traffic induced noise, noise barrier in the form of solid boundary wall is proposed for sensitive receptors. The noise barrier wall shall be constructed by excavation of foundation, laying of brick masonry wall, plastering and painting. It is also proposed to plant shade and flowering trees within the boundary of the sensitive receptors, between the building line and the compound wall. Creepers may be planted in consultation with the local forest officials to give an aesthetic look.



Figure 5.6: Representative photos of Noise Barriers (Bricks type)

The issue for provision of Noise barrier needs to be discussed during construction phase. The contractor will hold a discussion with stakeholders related to sensitive receptor during construction stage of the road.

- Vehicular noise & use of horns will be controlled through enforcement of laws and public awareness. It will be ensured that all the vehicles are using proper horn as per norms to keep noise within the permissible limits.

- Silence zones will be demarcated and road signs prohibiting the use of horns will be displayed at residential areas, sensitive locations and silence zones.
- Regular monitoring of noise level at specified representative locations will be conducted at fixed interval.
- Remaining roadside plantation with suitable species near sensitive receptors and inhabited areas will result in partial noise attenuation.
- Maintenance of noise barrier.

f) Vegetation and Wildlife

Impacts:

- In operation phase, roads are considered as the major cause of the pollution due to the vehicular movement. This affects the biotic components in the surrounding.
- The noise caused by the vehicular movements shall disturb and frighten the fauna & their habitats.
- Oil spills, fuel and toxic chemicals in the event of accidents may cause harm to the aquatic life.
- Road kills & accidents are also a common phenomenon where the domesticated and wild fauna get injured or killed while crossing the roads. Roads also isolate the habitats, and act as barrier in the corridors/migratory routes.
- Illegal felling of roadside plantation.

Mitigation Measures:

- Different provisions of mitigation measures for the pollution reduction as described in the ESMP shall be complied to control the undesirables.
- Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.
- Plantation along the ROW will be maintained properly and will be protected from illegal felling.
- Plantation along the ROW will be protected from illegal felling.
- Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.

G. Cumulative & Induced Environmental Impact

As part of ESIA for the project road, an attempt was made to assess the cumulative impacts of other developmental programs within project area. In order to assess cumulative impacts due to project, the project area is reviewed for existing project and proposed development within 5km of the proposed project, assuming that beyond 5 km area cumulative impacts are unlikely to occur. Review of the available and latest information indicates that Baretta is industrially backward district that does not possess any major public sector industry. Further, no major industries in public or private sector in the urban areas has come up due to lack of infrastructure facilities and basic amenities, however there are some small-scale industries like bell/brass metal at Sarthebari town and a few scattered brick kilns along the existing road. The operation of intermittent brick kilns combine with construction activities of the Project can contribute to air pollution. Cumulative impacts on air, noise and community may also occur during the construction phase if the construction of other nearby projects coincides with that of the proposed project, which could trigger increase in traffic levels and traffic congestions in the area. In such case, care should be paid to ensure the cumulative impact/s is/are minimised.

H. Potential Environmental Enhancement/ Protection Measures

Annex 5 to Annex 14 of this EIA Report presents good environmental management practices and guide documents in the following aspects of road construction:

- Camp Site Management – Annex 5
- Debris Disposal Management – Annex 8
- Borrow Area Management – Annex 6
- Quarry Area Management – Annex 7

I. Potential Environmental Enhancement/ Protection Measures

a) Traffic Management Plan

A traffic management plan is site-specific and needs to cover the design, implementation, maintenance, and assure temporary traffic management measures while the work or activity is being carried out along the road corridor. It explains how road users - including cyclists and pedestrians - will be directed around a worksite, or other temporary road disruption, to minimize inconvenience while providing safe conditions for both the road user and those carrying out the activity.

Any traffic management plan must contain the specifics of the work being done, such as the specific location, date/times of works, who is doing the work, the work methodology, temporary speed limit information (as needed), contact details, as well as a traffic management diagram, and it must comply with the Code of Practice for Temporary Traffic Management.

Figure 5.7: Temporary diversion of reconstruction of CD Structure

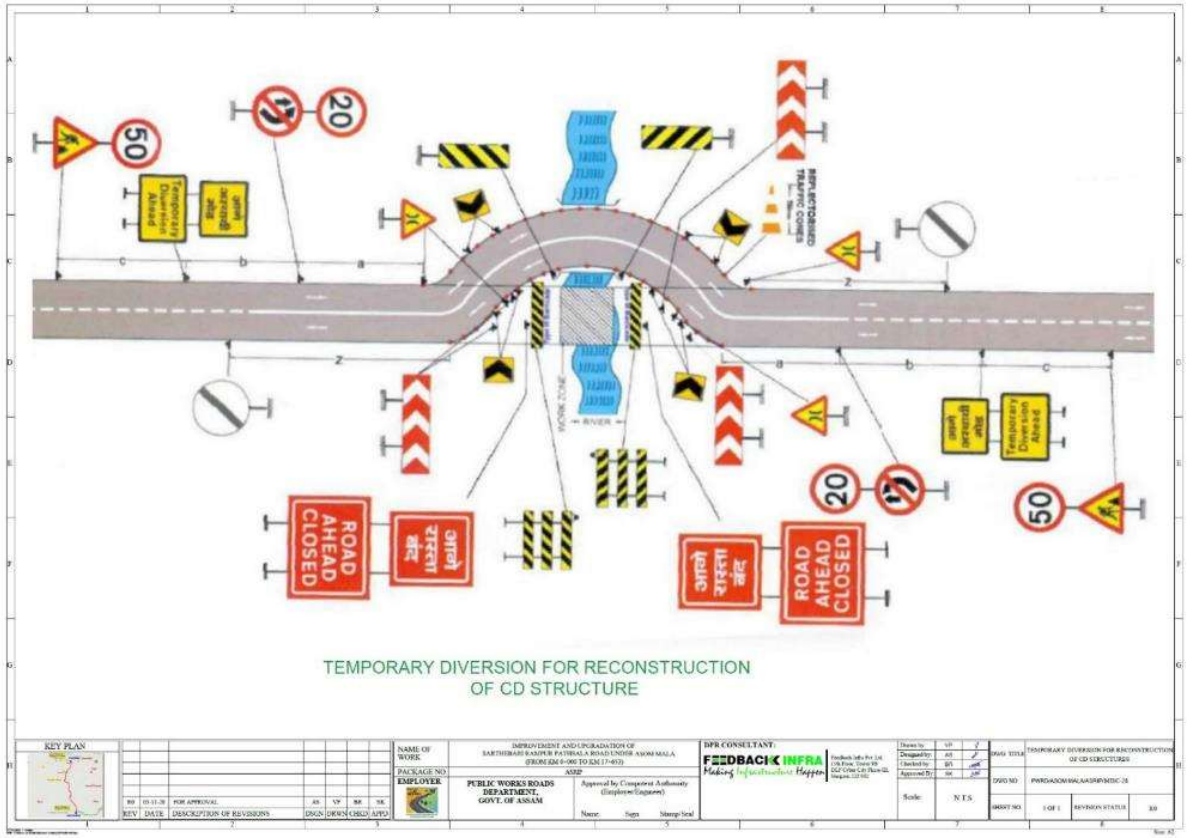
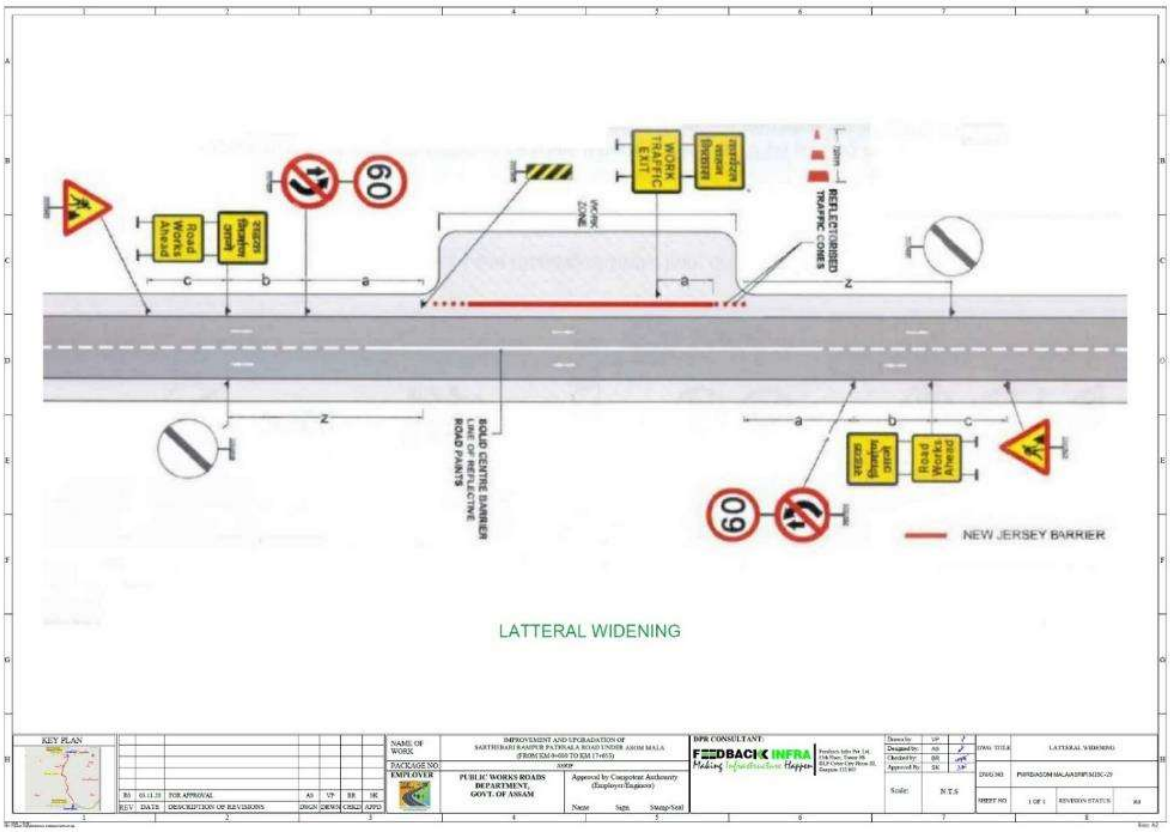


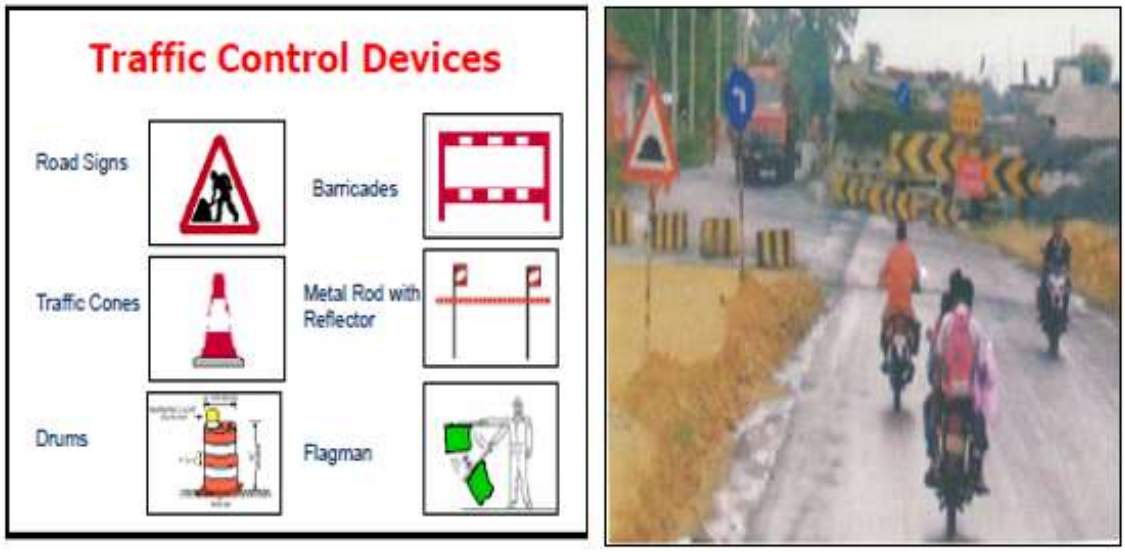
Figure 5.8: Lateral Widening



b) Road Safety Plans – (During Construction)

A work zone is an area of a highway where road user operating conditions are changed because of construction and maintenance activities. The construction and maintenance activities would involve movement of workers and construction equipment requiring dedicated space for performing the activities and moving materials for the activities. The presence of regular traffic and works traffic makes the work zone a potential zone of conflict resulting in disruption to normal traffic and hazards. A work zone is typically distinguished by the presence of signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating flashing or oscillating or strobe lights installed on roadside or a vehicle-mounted sign posted to indicate the work zone, and continues to delineate the channelized vehicle paths till up to the end road work sign.

Figure 5.9: Traffic Control Devices



c) Road Safety Plans – (Post Construction)

At this stage the observations are given for the checking of Whatever the provision and improvement recommended during Road safety Audit at various stages i.e. Existing audit stage, Preliminary design stage and Detailed design stage and execution of same during construction stage. On the basis of this observations the appropriate recommendations are provided as final improvement proposal at post construction/ pre-opening stage.

6. CLIMATE CHANGE IMPACTS AND RISKS

Rapid increase in numbers of motor vehicles on road in Assam has been observed over the past decades. Due to lack of adequate public transport system where buses comprise of only 1% of the total population of vehicles on road, and due to availability of easy loans, most of the people are aspiring to buy their own vehicles. As a result, two wheelers are 57% of the total vehicle mix in the State, and cars follow suit with a 21% share in 2013-14. The road transport sector being a direct consumer of fossil fuel, emits GHG into the atmosphere. With increase in population and per capita rise in number of personal vehicles, GHG emissions are likely to rise. Use of public transport system need to control future emissions in the future and to ease off the pressure of vehicles on the roads, hence. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and behavioural changes of the population whereby they use more and more non-motorized transport at short distances and public transport for long distances. The Guwahati city is already in the process of developing the Bus Rapid Transit system, but further development of the public transport system is required. Other major cities also need to embrace the same for an orderly functioning road transportation system in the cities of Assam.

A. Climate Change Mitigation

The Transport Emissions Evaluation Model for Projects (TEEMP)[3] developed by Clean Air Asia[4] was utilized to assess the CO_2 gross emissions with and without the project improvements. The main improvement from the project that was considered for the model are better surface roughness with initially 2.5 m/km which may deteriorate over a period but not less than 3.1 m/km and widening of roads from single lane to 2 lane carriageways with paved shoulder configuration. These were translated into impacts on traffic speed and hence fuel consumption. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit.

Information that was fed into the model for projecting the CO_2 emissions were:

- The project will rehabilitate and widen 17.653 km of the SH-09 from Sarthebari to Pathsala Town via Rampur which will have homogeneous sections.
- The road configuration will change from single lane to 2 lanes with paved shoulder with carriageway width of 10.0 m and will have an asphalt bituminous surface.
- Construction will take place over a period of 30 months in 2021-23 and road operations will begin in 2023.
- The design life of the road is 20 years (2023 to 2043)
- Other improvements include the repair or reconstruction of damaged culverts, introduction of lined longitudinal and cross drains for the road and removal of irregularities on the existing vertical profile and road safety appurtenances.

Traffic forecasts were taken from the detailed project report. Maximum PCU for 2 lane carriageways with paved shoulder were considered as 36000 PCU/day in consistent to IRC guidelines. The

[3] TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

[4] A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

volume/capacity saturation limit was taken at 2.0 for optimum travel speed and fuel consumption. Emission factors were mostly taken from the CPCB/MoEF&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds *et.al* (2011) Climate and Health Relevant Emission from in-Use Indian for different vehicles are as follows:

Table 6-1: CO_2 Emission Factors

Vehicle Type	Gasoline	Diesel
2-Wheel	2.28 kg/l	
3-Wheel		2.63 kg/l
Cars/ Jeeps	2.59 kg/l	2.68 kg/l
LCV		3.21 kg/l
Bus		3.61 kg/l
HCV		3.50 kg/l

It was assumed that in Homogeneous Section-I, 2-wheelers and 3-wheelers have average trip distance of 1/3rd of the total road length and all other vehicles do use the entire length as average trip distance. Furthermore, 2-wheelers and 3-wheelers constitute 100% and 90%, respectively of the total local traffic. It has also been assumed that over the time, the fleet composition will change, and the assumptions taken for the same are as Table 6.2.

Table 6-2 Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Year 2039		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2-Wheel		50%	50%		30%	70%	-
3-Wheel	80%	20%			40%	60%	
Cars/ Jeeps		40%	40%	20%		40%	60%
LCV/Bus/HCV		70%	20%	10%	10%	40%	50%

In absences of any standard climate change modelling practices of AIIB, CO_2 emissions from road construction were estimated by using the emission factor for rural/ urban roads, by using ADB - Carbon footprint 4 (http://www.adb.org/documents/reports/estimating-carbon-footprints-road-projects/default.asp), which is equivalent to 109,600 kgCO_2/km of road construction.

a. Estimated Carbon Emissions

The proposed road upgrading resulting to surface roughness and road capacity improvements have implications in CO_2 emissions. Improved roughness results to higher speed and lesser emissions while increase road users increases emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit.

CO_2 emissions will also result from the processing and manufacturing of raw materials needed to upgrade the project road and in the case of project, to upgrade and strengthen the road length of approximately 17.653 km, total CO_2 emissions will be of the order of 1934.768 (109.6X17.653) tons (Table 6.3).

Table 6-3 Estimated Total CO_2 Emissions during Road Construction

Road Section	Length (km)	Emission Factor (ton CO_2/km)	CO_2 Emission (tons)
HS-I	17.653	109.6	1934.768
Total	**17.653**		1934.768

The design life of roads is 20 years. Total CO_2 emission at Business-As-Usual scenario was estimated at 2,318.06 tons/year, without and with-induced traffic are 2,579.74 tons/year and 2,786.37 tons/year respectively. These values are below the 100,000 tons per year threshold set in the ADB Policy. Therefore, it is not necessary to implement options to reduce or offset CO_2 emissions under the project. Overall Project's CO_2 emission intensity indicators are provided in Table 6.4. Details of Modelling result is given in **Annex-24.**

Table 6-4: Project CO_2 Emissions Intensity Indicators

Particular	CO_2		
	Business-As-Usual	Project (without Induced Traffic)	Project (with Induced Traffic)
tons/km	4,070.68	4,530.21	4,893.07
tons/year	2,318.06	2,579.74	2,786.37
tons/km/year	131.31	146.14	157.84
g/tkm	83.20	92.60	92.37
g/tkm	82.70	92.04	91.80

The with-project scenarios will be having higher CO_2 emissions. Furthermore, with project scenarios (both without and with induced traffic), there will be increase in the CO_2 emission levels over the time due to the increase in the traffic volume, however, the emissions will be controlled by maintaining the road roughness below 3.0 m/km during the entire project life as well as enhanced capacity of the road. This will result in annual CO_2 emissions of the project road much below the threshold limit of 100,000 tons/year.

B. Climate Change Impacts & Risks

In today's world, climate change is considered the most serious global challenge. Changes in the atmosphere have been detected that could drastically alter the climate system and the balance of ecosystems. Atmospheric changes are linked to an increase in greenhouse gases (GHGs), chiefly on account of anthropogenic releases attributed to fossil fuel consumption, land use changes, deforestation etc. Research has established that carbon dioxide (CO_2) levels in the atmosphere have risen by 35% since the pre-industrial era. Rising CO_2 concentrations increase the energy retention of Earth's atmosphere, leading to a gradual rise of average temperatures and global warming. Sector specific climate risks screening has been done based on secondary sources to analyse impact on road components due to likely change in climatic variables, mainly temperature and precipitation.

Temperature & Precipitation: With the "Tropical Monsoon Rainforest Climate", Assam is temperate (summer max. at 35–39 °C and winter min. at 5–8 °C) and experiences heavy rainfall and high humidity. The climate is characterized by heavy monsoon downpours, which reduce summer temperatures, enable formation of foggy nights and mornings in winters. Spring (Mar–Apr) and autumn (Sept–Oct) are usually pleasant with moderate rainfall and temperature. For ascertaining long term climate trends, State level climate data for the period 1951 to 2010 has been analysed by the India Meteorological department. This analysis is based on 282 stations for temperature and 1451 stations for rainfall across the country. In Assam, the analysis is based on data collected from 6 Stations for temperature and 12 Stations for rainfall. The analysis indicates that the mean temperature in the State has increased by +0.01°C/year. There is also an increase in seasonal temperatures across seasons with pronounced warming in post monsoon and winter temperatures. The annual rainfall has also decreased by -2.96 mm/years during the same period.

Table 6-5: Climate trends in Assam between 1951 and 2010

	Annual	Winter	Summer	Monsoon	Post Monsoon
Mean Max Temp (°C/year)	+0.02	+0.02	No Trend	+0.02	+0.02
Mean Min Temp (°C/year)	+0.01	+0.02	+0.02	+0.02	+0.02

	Annual	Winter	Summer	Monsoon	Post Monsoon
Mean Temp (°C/year)	+0.01	+0.02	+0.02	+0.02	+0.02
Rainfall (mm/year)	-2.96	+0.08	-0.56	-2.19	-0.75

Source: *Assam State Action Plan on Climate Change*

Increased temperature and precipitation will have following impacts:

- **High Precipitation Impacting Roads/Bridge/Embankment:** Heavy rains can cause disruption of the road networks, decreased accessibility, erosion of roads and embankments, surface water drainage problems, slope failures, landslides, among others. Increased river flow resulting from precipitation and storminess may result in damages to bridges, pavements, and other road structures. Bridge/culvert capacities are reduced or exceeded, causing upstream flooding to occur.
- **High Temperature Impacting Road Stability**: Extreme heat, combined with traffic loading, speed and density can soften asphalt roads, leading to increased wear and tear. It is likely that there would be concerns regarding pavement integrity such as softening, traffic-related rutting, embrittlement, migration of liquid asphalt. Additionally, thermal expansion in bridge expansion joints and paved surfaces may be experienced.

Earthquake: The project road is situated in the Zone V (having high seismic intensity) of the Seismic Map of India (as per IS: 1893, Part I, 2002) and therefore has a high risk of potential damage due to earthquake. Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone V.

Drought: The monsoon in the region normally commences around the months of April and May and is active till the end of October. The pre-monsoon period is often marked by severe cyclonic storms and hailstorms. The annual cyclonic depressions in the Bay of Bengal along the coast of Bangladesh cause severe storms to hit the bordering states of Meghalaya and Tripura. Considerable variation in the precipitation during a particular month /period at a given place has also been observed, and this variation results in drought like conditions in many parts of the region.

Cyclone: It can be concluded from the analysis of past meteorological data that cyclone; dust storms are extreme rare in the study area. Impact of cyclone is likely to be low.

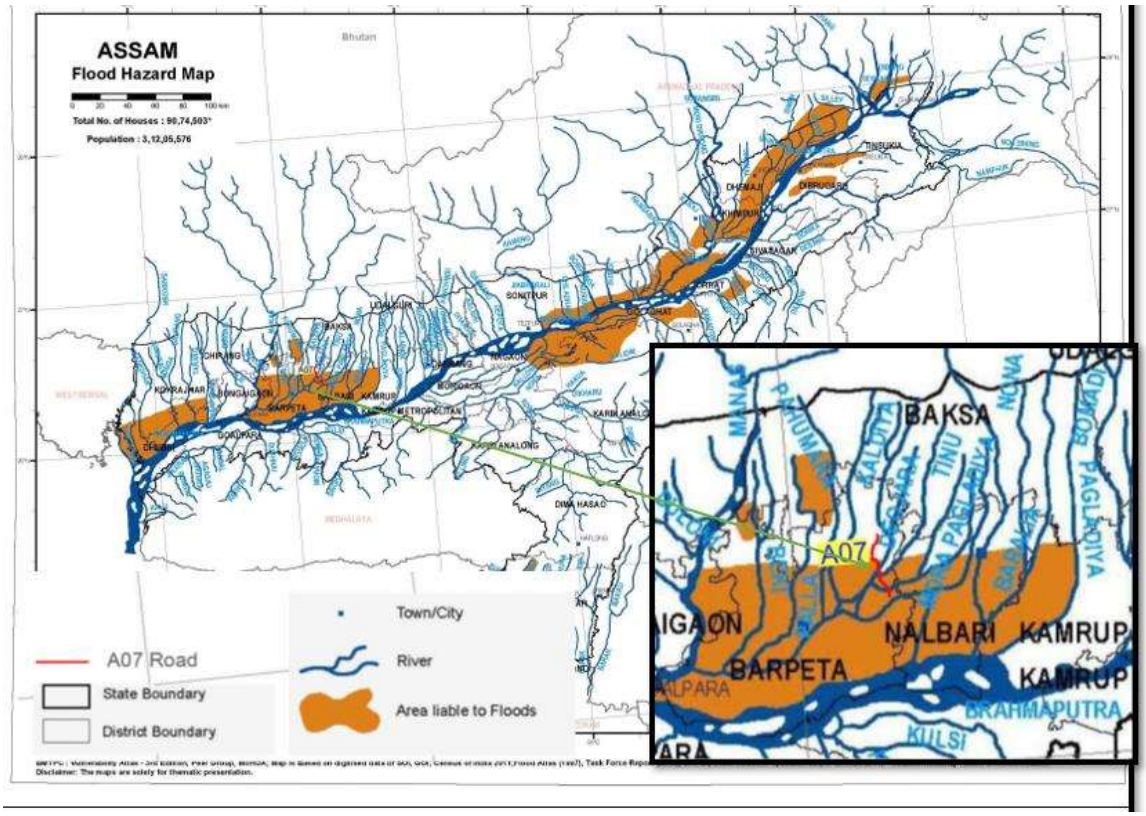
Flood: Districts Barpeta & Bajali faces the incidents of flood at every year mainly by the rivers Manas, Beki, Pahumara, Kaldia and their tributaries. These flood incidents are sometimes of high intensity and cause damages to the agricultural lands and lives of cattle and people as well.

Key engineering measures taken to address flood risks in the design are:

- Increase in embankment height,
- Construction of new side and lead away drains,
- Construction of new culverts and widening of existing ones.
- Widening of bridges.

Cross drainage structures, embankment and Roadside drains would have been considered anyway in the conventional design as the issue of flooding is a threat to the sustainability of the road. However, these measures also contribute to adaptation of the roads for future increases in precipitation. This risk screening and risk identification exercise has helped to ensure that the project road with climate risks have adequate risk mitigation or adaptation measures. Provisions have also been made in the bidding documents for the Contractor to prepare contract package specific EMP's based on the final detailed design to address a range of issues including climate related risks and vulnerabilities. Flood zone map of the project road is given below

Figure 6.1:Flood Hazard Map of the project Road



The Project Road conform to design requirements set in IRC SP 73-2018 wherever applicable and IRC: 37-2018. Following is some of the Design Considerations made on climate related risks driven by various factors.

Table 6-6 Impact of Climate Change and Disaster on Road Transportation and Potential Design Considerations for the Future

		Primary Impacts	Secondary Impacts	Design Considerations
	Temperature increase	<u>Road Investment</u> Road investment marginalized by excessive migration due to water scarcity (local roads).		• Consideration of appropriate design life. • Design based on existing traffic (Low Volume Road).
		<u>Pavement</u> Increased fatigue bituminous pavement needing additional maintenance cost. Deterioration of gravel surface due to excessive moisture loss leading to additional cycle of resurfacing.	Increased VOC with additional consumption of fuel. Possibility of increase in road accidents.	• Flexible Pavement is adapted. • Control soil moisture. • Adapt gravel sealing. • Additional road safety provision.
		<u>Bridges</u> Thermal expansion of bridges. Buckling of joints of steel structure. Higher corrosion activity at locations with high humidity.		• Careful attention to material used for joints. • Extensive use corrosion protection material.

		Primary Impacts	Secondary Impacts	Design Considerations
	Temperature decrease	<u>Pavement</u> Affect road transport operations. Increased OM costs	Increase in road accidents	• Adapting micro-texture pavement standards for urban and high-volume roads.
	High rainfall/flooding	<u>Pavement</u> Deterioration of gravel surface due to excessive moisture. Deterioration of bituminous pavement with faster deterioration trend calling for early intervention for periodic maintenance or overlay.	Increased VOC with additional consumption of fuel. Possibility of increase in road accidents. Increased maintenance cost	• Adopt resilience drainage system. • Improve soil strengthening and rock stabilization technique. • Resilience asphalt and concrete pavement. • Regular survey and maintenance measures.
		<u>Road Embankment & Drainage Structures</u> Damage to road drainage structures including foundation resulted due to high runoff. Breaching of road embankments resulting loss of road section. Submersion of road. Landslides and roadblocks. Erosion.	Traffic disruption. Road closure for indefinite period. Weakening of pavement structures due to submersion of road embankment for longer period of time.	• Improved drainage systems to avoid erosion of road materials. • Proper discharge estimation to design the size and shape of drains and drain. • Slope protection at steep slopes. • The drainage system includes drainage and cross drainage structures such as cascades, small check walls, culverts and causeway. • Improved planning of roads with proper cross section and standard dimensions Proper subsurface drains and catch drains. • Increase road surface camber for quick removal of surface water for pavement. • Building line defense for embankment to prevent complete failure (reinforced earth).
		<u>Bridges</u> Scouring of bridge foundation. Submersion of bridge. Bridge washout.	Disruption of traffic.	• Creating additional freeboard (flood return period estimation). • Protection of river and banks. • Revising bridge selection criteria specific. • Location with possible climate change impact.
Earthquake		<u>Road Embankment & Drainage Structures</u> Failure of embankment and drainage structures.	Traffic disruption. Damage to utilities (urban roads). Traffic disruption.	• Building second line defense for embankment to prevent complete failure (reinforced earth).

		Primary Impacts	Secondary Impacts	Design Considerations
		Bridges. Damage to bridge bearing & column.		• Classifying roads and developing and implementing special code/norms for roads and associated utilities (urban roads). • Quality control regime to be developed and implemented in bridge building in remote area (local road).
Landslides		<u>Road Embankment & Drainage Structures</u> Failure of embankment and drainage structures.	Traffic disruption. Damage to utilities (urban roads).	• Vulnerability of the road slopes regularly checked and monitored. • Side slope of embankments affected by flood shall be protected with pitching over granular filter. The pitching shall be extended up to 0.5m above the HFL. All other locations, side slopes, shall be protected by seeding & mulching as per clause 308 of Specification of road & bridge works (MORT&H).

Considering that, the changes in rainfall patterns have increased the risk of floods in the project areas. Recent floods in the State are a revelation and have made disaster managers and policy makers take a fresh view of risks and vulnerability of the State from floods. Initial assessments of existing roads have noted the inadequacies of cross-drainages to deal with flood discharges along the road alignments. To tackle the issue of conveyance of flood effluents during times of intense precipitation, proposals have made to upgrade the existing dimensions of cross-drainages. For instance, pipe culverts and slab culverts are to be replaced by Box Culverts with higher discharge capacities.

7. CONSULTATION, PARTICIPATION & INFORMATION DISCLOSURE

Public Consultation and Public Participation are two effective tools of social interaction. Public Consultation is an important tool to build up confidence between the stakeholders and the project formulators to minimize the risk of delay of project implementation. It also counters erroneous information, if any, about the project. It helps the project proponent (PWD (EAP) make informed assessment of public opinion about the project, and the nature and extent of opposition likely to occur during the implementation stage.

Public Participation, on the other hand, helps project implementation to a great extent. The purpose of involving the public in general and project affected persons, in the decision making process is to have a fair interaction with all community groups and ensuring them that every attempt would be made to minimize negative impacts of the project, and that adequate mitigation measures would be taken to compensate the loss of the affected persons, if any. Thus, it ensures partnering between the community and the project proponent leading to timely completion of the project with least social cost and disruption. Moreover, experience indicates that unexpected project effects on the local community generally gives rise to significant issues and concerns among Project Affected Persons (PAPs). These problems get reduced when people are properly informed and consulted about the project and given the opportunity of being heard. Similarly, Non-Governmental Organizations (NGOs) will frequently come forward to advocate on behalf of the stakeholders, including PAPs. By making NGO's party to the decision-making process, future litigation at later stages can be avoided.

Public Consultation Meeting (PCM) provides an opportunity for the general public, private and community bodies to know the environmental and social impacts as a result of project implementation. Thus, the meeting is held open to all general public who are concerned with the project during the initial stage. Major purpose of the public consultation of environmental issues in the EIA study is to appraise the stakeholders on potential environmental impacts and collect their feedback so that adequate safeguards can be considered during the planning phases.

A. Objectives of the Consultation

The main objective of the consultation process is to minimize negative impacts of the project and to maximize the benefits from the project to the local population. Specific objectives of the consultation process that has been initiated while preparing the present EIA are listed below.

- Promote public awareness and improve understanding of the potential impacts of proposed projects,
- Sharing of information with stakeholders on the proposed project and key findings of the EIA,
- Solicit the views of affected communities/individuals on environmental and social aspects,
- Acquiring community feedback about the Project, perceived impacts and preferred mitigation measures, and to collect information on environmental, ecological, and socio-economic baseline in the project area,
- Identify contentious local issues which might jeopardize the implementation of the project,
- Establish transparent procedures for carrying out proposed works,
- Inform the affected populace about the entitlement framework and to settle problems with mutual consent, and
- Create accountability and sense of local ownership during project implementation.

B. Consultation Stage

As part of the project, the consultations are considered at following stages:

Table 7-1: Public Consultation Level and Stages

Levels	Stages of Consultation	Public Consultation Organizer	Stages	Target
Project Proponent level and Village/Community Level	1	Developer/ Client	During Project Planning and Land Procurement Stage	Local community, land aggregator, village president/sarpanch, village administrative officer and land seller
Project Pre-construction Stage by EIA Team	2	EIA Team	During Preconstruction stage	Project Affected Persons/ Village Panchayat/ Influential Person of the Society/ Local Community/ Government Officials

C. Methodology of the Consultation

Arrangement: Major settlements located close to project roads were selected for conducting public consultation. Affected communities and stakeholders were invited to attend the meeting. Effort was made to make the gathering representative of the local population directly or indirectly affected by the potential impacts. During the meetings, no person is prevented from entering and/or leaving the PCM as he/she shall so desire.

Discussions, Questions and Answers: The support team and local enumerators (Local Languages speaking) were selected for field work and meeting with people. Local enumerators are selected to have Assamese dialect of language of PAPs and other stakeholders. This also helped to make the participation of local people in the process of survey. Resource persons were identified in each corridor stretch to facilitate consultation. These resource persons informed local people about the project regularly and appraised project related information to the people and to the project preparation team.

During consultation meeting, the participants were explained the proposed improvement proposal and potential environmental impacts due to the proposed highway. Thereafter, a session for question and answer was kept facilitating interaction with the stakeholders, exchange of information, & direct communication and collect their opinion on the environmental issues.

Stakeholder Consultation: Consultations with various stakeholders were carried out at various levels in the project area during project preparation. Key stakeholders consulted including affected people, vulnerable groups as well as other community members living along the project road, and community-based organizations and business communities in the area. Moreover, revenue officials, village heads and head of Gram Panchayat were also consulted. The consultation methods included general public consultation meetings and focus group discussions (FGDs).

Table 7-2: Consultation Methods adopted in Project.

Stakeholders	Methods
Local communities	Individual Interviews, field level observations, community consultations & meetings
Village Headmen & Gram Panchayat members (local elected representatives)	Small discussions
Women's belonging to various socio-economic groups	Groups Focus Group Discussions (FGDs)
Affected Shopkeepers, tenants and squatters	Focus Group Discussions (FGDs)
Other vulnerable groups	Focus Group Discussions (FGDs)
Consultation with Government Departments	Focus Group Discussions (FGDs)

Collection of Feedback: A feedback questionnaire has been prepared and during the meetings ***(*Annex-17***). Participants were encouraged to provide their opinion through the feedback questionnaire; However, it was kept voluntary. The issues broadly covered in questionnaire included the following topics.

- Disturbance due to present traffic scenario with respect to environmental pollution and road safety.
- Anticipation of disturbance due to the improvement proposal with respect to environmental pollution and road safety.
- Expectation on road safety measures in the improvement proposal.
- Accidents and conflicts involving wildlife, if any.
- Preference of avenue trees, if any.
- Forest, Wildlife and environmental sensitive area.
- Historical and Archaeological sites.
- Flora & fauna of the area.

Record of the Meeting: General information of the participants such as Name, gender, and name of the village the participant belongs to along with their signature was recorded during the public consultation meetings and is attached in the report as **Annex 17**. Registration was kept voluntary. With exception of few isolated cases, almost all the participants registered themselves.

D. Consultation Performed

Public consultations with stakeholders were carried out at various levels in the project area during project preparation between 24th June 2020 to 28th November 2020. Local people and PAPs were informed 7 days before the meetings over the phone and through the panchayat Pradhan, market president, village representative/ member of Panchayat/ Municipality for venue, date, time and agenda of the meeting. The consultations were conducted in public halls, religious places, marketplaces, government offices with different stakeholders ensuring uninterrupted attendances from all the villagers and interested persons. Care was taken on the venue date and time of the meeting, so that there will be no hindrances for the weaker section of the people, viz., housewives, elderly persons, physically challenged persons etc.
Key stakeholders consulted included affected people, women community, vulnerable groups as well as other community members living along the project road, and community-based organizations and business communities in the area. Moreover, revenue officials, village heads, head of Gram Panchayat and village administrative officers were also consulted.
The COVID-19 safety protocols at that time of the consultation were also followed. In view of the prevailing COVID-19 pandemic, the participants of the meetings had taken additional measure by using sanitizer, masks and maintain social distancing to avoid the spread of the disease. The participants were encouraged to avoid contact with each other as far as possible and wash their hands at regular intervals.

Summary of stakeholder consultation is given in **Table 7.3** and **7.4** and photographs and attendance sheets are summarized in **Figure 7.1**.

Table 7-3: Public/Stakeholder Consultation Details

Sl. No.	Village Name	Date	District	Male Participants	Female Participants	No. of Participants	Types of PC/FGD
1	Sarthebari (Km. 0.100)	28/11/2020	Barpeta	16	0	16	Consultation with Market President and shop owners

Sl. No.	Village Name	Date	District	Male Participants	Female Participants	No. of Participants	Types of PC/FGD
2	Khudragomura, Sarthebari (Km. 1.000)	24/06/2020	Barpeta	10	0	10	Consultation with local resident and shop owners
3	Parkuchipam (Km. 5.800)	24/11/2020	Barpeta	15	0	15	Consultation with Farmers
4	Bongaon (Km. 8.600)	24/06/2020 & 28/10/2020	Barpeta	15	0	15	Consultation with Shopkeepers & farmers
5	Bongaon (Km. 9.000)	26/11/2020	Barpaeta	17	3	20	Consultation with Village sarpanch/Gaon Bura and affected PAPs
6	Bugan (Km. 10.400)	28/10/2020	Barpeta	13	0	13	Consultation with Affected People
7	Tapattari (Km. 12.000)	29/10/2020	Barpeta	18	0	18	Consultation with Local Resident and farmers
8	Malipara (Km. 14.200)	28/10/2020	Barpeta	15	0	15	Consultation with shop owners
9	Malipara (Km. 14.700)	26/11/2020	Barpeta	21	0	21	Consultation with Temple Committee (SC Community)
10	Dubi (Km. 15.500)	24/06/2020	Barpeta	9	0	9	Consultation with affected people
11	Raipur/Bamunkushi (Km. 16.100)	26/11/2020	Barpeta	0	7	7	Consultation with Women
12	Raipur/Bamunkushi (Km. 15.800)	26/11/2020	Barpeta	0	10	10	Consultation with Women
13	Raipur/Dharamtula (Km. 17.400)	26/11/2020	Barpeta	14	3	17	Consultation with gram panchayat member and farmers
Total				**90**	**20**	**110**	

E. Proceedings and outcomes of consultations

Followings are the issue discussed/raised from the stakeholders and responses to the suggestions from the consultants.

Table 7-4: Proceedings and outcomes of consultations

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
1	Sarthebari 28/11/2020	16 Consultation	• Proposed improvement to be done towards RHS of	• The stakeholders' concerns and suggestion has been considered

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
	11:00 AM	with market president and shop owners	the existing road as government land is available. • Flood issue	and incorporated in the design, wherever technical feasible. Proper design and drainage adopted to mitigate the risk of flood.
			• People get 2 hours to reach pathsala from Sarthebari due to bad condition of the existing road so participants asked road should be constructed as soon as possible.	
2	Khudragomura, Sarthebari 24/06/20 3.20 PM	10 Consultation with local resident and shop owners	• Avoid acquisition of main building, being used as commercial purposes. • Ruble strips and Speed breaker should be provided at village road	• The business communities were told that all the efforts will be made to avoid the acquisition of main building. However, if required temporary structures within Row will be dismantled to facilitate the road construction. • Ruble strips and Speed breaker provision at village road
			• Proposed improvement to be done towards RHS of the existing road as government land is available	• The stakeholders were told that their concerns would be considered and shall be incorporated in the design, if technically feasible
			• How will be the Compensation provided?	• It is informed that as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015 compensation will be provided.
			• Will there be employment for the local people?	• They were informed that local people will be given preference to work as laborers depending upon their skill
3	Parkuchipam	13 Consultation with Forest Official and project affected persons	• Compensation should be given to the trees and squatter. • What about tree compensation	• Compensation of trees will be as given as per directives of Revenue/Forest department. • Avoid Tree cutting at maximum extent. Tree cutting will be only up to the formation width.
			• Compensation should be given based on market rate. • Ruble strips and Speed breaker should be provided at village road	• It is informed that as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015 compensation will be provided. • Ruble strips and Speed breaker provision at village road
4	Bongaon 24/06/2020 & 28/10/2020 4.00 PM	15 Consultation with Shopkeepers & farmers	• All the participants are of the opinion that acquisition of land and assets to be minimised as these locations are having	• The stakeholders were told that their concerns would be considered and shall be incorporated in the design, if technically feasible.

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
			more commercial importance	
			• Local people suggested for widening the existing road in the market within ROW	• Suggestions has been addressed after consultation with the design Engineers and accordingly design has been finalised by minimising RoW.
			• Compensation Provisions for both Land and Structures	• It is informed that as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015 compensation will be provided.
			• People wanted to know when the work will start. Whether the local People can work as laborers during project work?	• They were informed that they will get opportunity to work as laborers during construction.
			• Religious structures (Mazar and Temple) should be saved from acquisition and shifting of alignment to the RHS	• Mazar (Km. 8.164) and Temple (Km. 9.742) could not be saved due to geometric constraints. Village community would be consulted during construction. • Ruble strips and Speed breaker provision at village road
5	Near Temple, Bongaon 26/11/2020 03:00 PM	31 Consultation with Village sarpanch/Gaon Bura and affected PAPs	• Improvement of the existing curves throughout the proposed project.	• Most of the curves has been improved and incorporated in the design.
			• Drain should be developed on both side of the proposed project.	• Drain would be developed in each town/settlement.
			• Compensation should be provided based on market rate as well as provide employment opportunities of the affected persons during construction. • Ruble strips and Speed breaker should be provided at village road. • Water Quality issue >100 feet GW level is good for drinking purpose. Whereas <50 feet quality is not good for drinking purpose. • Dust emission and control	• It is informed that as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015 compensation will be provided. • Also affected persons would be preferred for employment during construction based on their skills. • Hand pump >100 feet should be proposed at Boangon near Jagannath Temple. • Emitted dust during construction will be control by water sprinkling.
6	Bugan 28/10/2020 2.00 PM	13 Consultation with Affected People	• Suggested widening of road with available ROW. • Suggestions for drain on both side of road, rest house, public toilet and	• Suggestions will be addressed after consultation with the design Engineers, if feasible

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
			pump house for drinking water in the market area	
			• People wanted to know whether they will be getting any compensation for the loss of their land and other assets.	• This was informed that they will get the compensation and assistances as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015.
			• They wanted to know whether the squatters and encroachers will get compensation or not.	• This was clarified that the non-titleholder will get compensation against the structure and trees in addition to various resettlement allowances;
			• Employment for the local people.	• They were informed that local people will be given preference to work as laborers depending upon their skill
7	Tapattari 29/10/2020 4.00 PM	18 Consultation with Local Resident and farmers	• Land acquisition should be minimised	• Suggestions were addressed after consultation with the design Engineers, and wherever it is feasible reducing the acquisition is incorporated.
			• Compensation procedure	• The Consultant informed the house that compensation matter will be dealt with as per the provision of "'The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, Rules 2015
			• Suggestions for box culvert, drain on both side of road, rest house, public toilet and streetlight in the market area	• Suggestions will be addressed after consultation with the design Engineers, if feasible
			• Suggested for widening the existing road in the market within ROW	• Suggestions has been addressed after consultation with the design Engineers and accordingly design has been finalised.
			• Adequate support should be provided to the affected households for the restoration of their livelihood	• Adequate support provisions for SC, ST and other vulnerable households for livelihood restoration have been integrated into the Resettlement Framework.
8	Malipara 28/10/2020 10.00 AM	15 Consultation with shop owners	• Suggestions for drain on both side of road, rest house, ATM, government hospital and a village auditorium hall in the Malipara Chowk	• Suggestions for ATM, hospital and auditorium hall are out of project purview and regarding drain and rest house, concern will be addressed after consultation with the design

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
				Engineers, if feasible
			• Businessmen wanted to know whether they will be getting any compensation for the loss of their land and other assets.	• This was informed that they will get the compensation and assistances as per the provision of resettlement framework, Assam Rules 2015, RFCT LARR Act 2013 and AIIB policy.
			• DPs of the affected structures/land requested to realign the road, so that their structures/land may not be affected.	• They were told that re-alignment is not possible as there is no major impact. However, the structures within corridor of the impact, will be adequately compensated.
			• Employment Opportunity	• They were informed that local people will be given preference to work as laborers depending upon their skill
			• Religious structures (Temple) should be saved from acquisition	• Temple (Km. 13.785) could not be saved due to geometric constraints. Village community would be consulted during construction.
9	Malipara 26/11/2020 02.10 PM	10 Consultation with schedule caste community and member of temple committee	• People are very much supported to the project. • People have no issue for land acquisition, but compensation should be given based on market rate.	• This was informed that they will get the compensation and assistances as per the provision of resettlement framework, Assam Rules 2015, RFCT LARR Act 2013.
			• Committee member of the temple are suggested that shiv temple/library may be shifted if executive authority provide better compensation.	
			• Employment opportunity	• They were informed that local people will be given preference to work as laborers depending upon their skill.
10	Dubi 24/06/2020 5.07 PM	10 Consultation with affected people	• People welcomed the project	• They were given an idea of the design and given an awareness of the project impacts.
			• Provision of a bus stop and public conveniences should be provided	• Bus stop is proposed in design
			• Compensation/ Assistance for temporary disruption in business	• The business communities were told that they will be adequately compensated and assisted as per provision of resettlement framework, government Rules 2015 and Act 2013.

Sl. No.	Location/Date /Time	No. and Profile of Attendees	Issue Discussed	Measures Suggested/Incorporated
			• Are the non-titleholders entitled for the benefits?	• It was clarified that non-titleholder will get the benefits except for the cost of land.
11	Raipur/Bamankushi	7 Consultation with women	• Women wants engagement in skill development program as well as economic assistance	
12	Raipur/Bamankushi	10 Consultation with women	• Employment opportunities	• Local labour and women labor will be preferred during construction.
			• Safety signage should be marked in the residential area. • Traffic speed near the settlement area should be restricted.	• Appropriate measures will be taken for safety.
13	Raipur/Dharamtala	17 Consultation with gram panchayat member and farmers	• Compensation should be given based on market rate.	• It is informed that as per resettlement framework, LARR Act 2013 and Assam LARR Rules 2015 compensation will be provided.
			• Employment opportunity	• They were informed that local people will be given preference to work as laborers depending upon their skill.
			• Provision for development of irrigation system for double crop in a year.	

Figure 7.1: Photographs of Public/Stakeholder Consultation



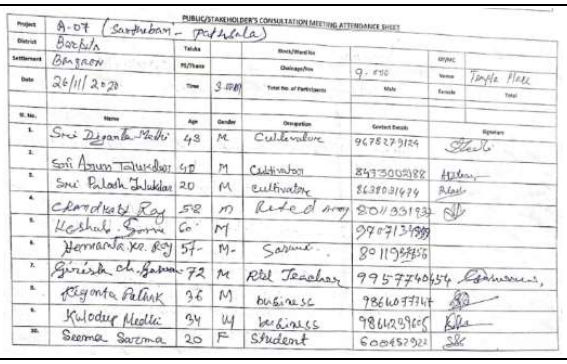


PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project								
District	Barpeta	Taluka	Patta	Block/Ward No		GP/MC	9 No- Pub mtg	
Settlement	Parkuchikam	PS/Thana	Sarthebari	Chainage/Km	15+800	Venue	Parkuchikam	
Date	24/11/2020	Time	2:30PM	Total No. of Participants	Male	Female	Total	
Sl. No.	Name	Age	Gender	Caste	Occupation	Contact Details	Signature	
1.	Sri Biswa Kalita	57	M	G	Farmer.		Biswa Kalita	
2.	Manikanta Deka	48	M	G	Do	7896163480		
3.	Jayanta Talukdar	18	M	G	Student	8135905792	Jayanta Talukdar	
4.	Pradip Deka	45	M	Cg		9577134960		
5.	Ganga Ram Pathak	52	M	SC	Bussiness	9707664702		
6.	Benjit Deka Talukdar	45	M	G	Govt	9678120665		
7.	Benjit Deka	42	M	G	Govt	7002241167		
8.	Utham ch. Deka	55	M	G	Govt.	6000947571		
9.	Asizur Rehman	42	M	G	Govt	6900739472		
10.	Shri Hanatan Deka	45	M	G	Labour			
11.	Phoxon Das	30	M	SC	Labour	6001627539		
12.	Hiren Roy	35	M	SC	Labour			
13.	Pranab Shan Nath	30	M	SC	Labour	9127248849		

Consultations with Forest official at Parkuchikam



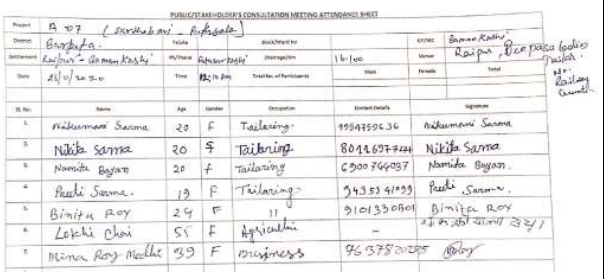


PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Pathsala)						
District	Barpeta	Taluka		Block/Ward No		GP/MC	
Settlement	Bongaon	PS/Thana		Chainage/Km	9.450	Venue	Temple Hall
Date	26/11/2020	Time	3.00	Total No. of Participants	Male	Female	Total
Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature	
1.	Sri Diganta Medhi	43	M	Cultivator	9678273124		
2.	Sri Arjun Talukdar	40	M	Cultivator	8473009288		
3.	Sri Palash Talukdar	20	M	cultivator	8638031674		
4.	Chandrakanta Roy	58	M	Retired army	8011331934		
5.	Keshab Sarma	Co	M		9707137999		
6.	Hemanta Kr. Roy	57	M	Sarma	8011988556		
7.	Girish ch. Sarma	72	M	Ritd Teacher	9957740454		
8.	Digonta Pathak	36	M	business	9864077747		
9.	Kulodeep Medhi	34	M	business	9864298105		
10.	Seema Sarma	20	F	Student	6001452922		

Consultation with the Affected Shop owner at Bongaon



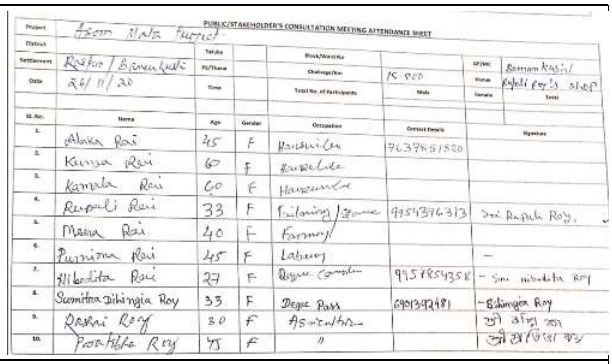


PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Pathsala)						
District	Barpeta	Taluka		Block/Ward No		GP/MC	Barman Kachari
Settlement	Rajpur - Barman Kachari	PS/Thana	Rampur Pathsala	Chainage/Km	16.100	Venue	Rajpur, Pre para Godrej Dealer.
Date	26/11/2020	Time	12.15 pm	Total No. of Participants	Male	Female	Total
Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature	
1.	Nikumani Sarma	20	F	Tailoring	9954759536	Nikumani Sarma	
2.	Nikita Sarma	20	F	Tailoring	8011697744	Nikita Sarma	
3.	Namita Bayan	20	F	Tailoring	6900746037	Namita Bayan	
4.	Pachi Sarma	19	F	Tailoring	9435341099	Pachi Sarma	
5.	Binita Roy	24	F	11	9101330801	Binita Roy	
6.	Lakhi Choi	55	F	Agriculture	-		
7.	Mina Roy Medhi	39	F	Business	9613780295		

Consultation with women at Raipur-Bamankushi (Km 16.100)





PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	Alaka Rai	45	F	Housewife	9637851520	
2.	Kunja Rai	60	F	Housewife		
3.	Kamala Rai	60	F	Housewife		
4.	Rupali Rai	33	F	Tailoring/Farm	9954376313	Smt. Rupali Roy.
5.	Mana Rai	40	F	Farmer		
6.	Purnima Rai	45	F	Labour		–
7.	Nibedita Rai	27	F	Degree Complete	9957854358	– Smt. Nibedita Roy
8.	Sumitra Bibingia Roy	33	F	Degree Pass	(901)39248)	– Bibingia Roy
9.	Rakhi Roy	30	F	Assistant		
10.	Pratikha Roy	45	F	"		

Consultation with women at Raipur-Bamankushi (Km 15.800)





PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	RATAN KUMAR KALITA	46	M	Rtd. Army	9854775265	
2.	PARESH ROY	60	M	Retd Irrigation	9954911907	
3.	HIRANYA DAS	40	M.	Irrigation	9954039369	
4.	Bipul Dutta	35	M	Block	9954649913	
5.	Manoj Kr Roy	40	M	Ward Member	9954082259	
6.	Madhab Das	40	M	Ward Member	8761086226	
7.	Bhaskar Rao	40	M	Gr.S. PRP	9954769926	
8.	Ratanani Kalita Kalita	71	M	Retired		
9.	Lakshya Jyoti Nath	38	M	Businessman	9365991170	
10.	Gopal K Roy	49		Grambarasi	9954187068	

Consultation with gram panchayat member and farmers (Raipur/Dharmatal)

Details of Photographs, attendance sheet and Minutes are given in **Annexure-17.**

F. Public Disclosure

The Government of India has enacted RTI Act in 2005. It mandates timely response to citizen requests for government information from various Public Authorities under the government of India as well as the State Governments. It is in this direction and as a constant endeavour of Government of Assam and PWD (EAP) to provide as much information to the public, suo-moto at regular intervals through various means of communication, including internet (through an exclusive PWD (EAP) website) so that public have minimum resort to the use of RTI Act, 2005 to obtain information.

According to the requirement of the act, each Public Authority in the state government is required to produce a manual in form of handbook containing all the information of the concerned government.

Under this Act the following information is uploaded as a part of RTI Act, 2005.

- Organization - Particulars, Functions & Duties
- Personnel - Powers and Duties
- Decision Making
- Delegation of Power
- Reference Manual
- Documents
- Public Consultation
- Directory
- Remuneration, Compensation
- Budget
- Concessions, Permits.

Information in Electronic Form: The details in respect of the information, available to or held by it, reduced in an electronic form is made available through www.apwd.in website. Effective project planning has required regular consultation with a wide range of project stakeholders. Based on the extensive public outreach program, including public meetings, public hearings and individual group consultations, the local community is well informed of the project objectives, likely impacts and essential provisions of compensation policy through the Project's conduct of the following activities:

- Information dissemination campaigns using media, notice of meetings or information leaflets.
- Holding Public/Stakeholder Consultation Meetings and Focus Group Discussions (FGDs).
- Arranging interviews with the communities and their stakeholder groups.
- Formation of focus groups involving key stakeholders, like local/community leaders, women, the poor, and other groups.
- Setting up various committees for planning, implementation and monitoring of construction and operations.

Involvements of the PAPs in a formal grievance redress process. To discuss and seek opinion/suggestion from the communities and other stakeholders, their representatives were invited to participate in various meetings regarding project related issues involving impact and mitigation and compensation procedures in light of AIIB guidelines.

EIA Disclosure: This draft EIA document will be disclosed at the website of APWD at www.apwd.in. The final EIA will also be disclosed in a similar way. The Executive Summary of the EIA will be translated into Hindi and Assamese languages and placed on the same website, in addition to being available locally at the project site (PMU office, contractor's office). The final EIA report shall also be disclosed on AIIB website.

8. GRIEVANCE REDRESS MECHANISM

A project specific GRM with Grievance Redressal Cell (GRCs) shall be developed for managing grievances arising from the Project activity. The GRM will describes the grievance redressal process for handling grievances arising from the various stakeholders and will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. Records of grievances received, corrective actions taken, and their outcomes shall be properly maintained. Grievances, if any, may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned official/s. The Social / Environmental Expert in the concerned agency shall be responsible for coordination of grievance/complaints received. The complainant may take recourse to the Court of law, if dissatisfied with the verdict of the GRM.

A. Mechanism for Grievance Redressal

The GRM shall be established at four levels viz. Site Level (First Level Grievance), PIU Level (Second Level Grievance), PMU Level (Third Level Grievance) and Court of Law (Third Level Grievance) to address grievances/ complaints. The grievance redress mechanism is given in **Figure 8.1**. The project-specific GRM is not intended to bypass the government's own redress process; rather it is intended to address affected people's concerns and complaints promptly, making it readily accessible to all segments of the affected people, and is scaled to the risks and impacts of the project.

First Level: When grievances arise, complainant will first need to contact the respective person of the Contractor, CSC and the site engineers. The site level resolution of complaints shall be done within 2 weeks. The Contractor will maintain the records of complaints and the outcome of the solutions.

Second Level: The complainant will need to contact PIU to file complaints on non-resolution at the site level. The address and contact number of the PMU office will be provided in the project information leaflet. The PIU, supported by CSC, is the second tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Environmental officer of PIU, supported by CSC, will be designated as the key officers for grievance redress. Resolution of complaints will be done within 2 weeks. At this stage, Environmental officer will inform the PMU for additional support and guidance in grievance redress matters, if required. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, etc.). Grievances will be documented and personal details of the complainant (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number will be assigned to each grievance. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 2 weeks. The contractor will have observer status on GRC.

Third Level: The Environmental Officer of each PIU will activate the second tier of GRM by referring the unresolved issues (with written documentation) to the PMU, who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). A hearing will be called by the GRC, if necessary, where the affected person may present his/her concern/issues. The process will facilitate resolution through mediation.

Fourth Level: Alternatively, the affected person can also seek alternative redress through the appropriate court of law. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

The PMU and PIUs, supported by CSC, will make the public aware of the GRM through public awareness campaigns. The grievances can be raised through various methods:

- Modules in e-portal/ website of Asom Mala.
- Dropping complaints in grievance boxes placed in the offices of a) PMU, b) respective PIUs and c) Site offices/ CSC.
- E-mails to respective email address.
- SMS or WhatsApp to respective mobile number(s) dedicated for GRM.
- Using the complaint register and complaint forms (Figure 4) available at the office of PMU/ PIU/ Site offices/ CSC.

All the documents will be made available to the public including information on the contact number, e-mail addresses, addresses of the respective offices of PMU/ PIU/ Site offices/CSC/AE/ RP Implementing Agency and contact person for registering grievances, and will be widely disseminated throughout the project area by the safeguard officers in the PMU and PIUs supported by the CSC/AE/RP Implementing Agencies.

B. Grievance Redress Committee (GRC)

A Grievance Redress Committee (GRC) will be established at the PWRD state level and at the PIU level to assure accessibility for APs. The GRCs are expected to resolve grievances within a stipulated time period of 2 weeks each at the Site level and PIU level, and one month at the PMU level. If the displaced person is not satisfied with the decision of the GRC, the complainant can approach the court of law. At any point in the redressal process the aggrieved person can approach the Land Acquisition and Resettlement and Rehabilitation Authority.

The PMU level GRC will comprise of the:

- Chief Engineer (EAP), PWRD, GoA or any authorised person, who should not below the rank of Executive Engineer
- Nodal Officer, Asom Mala – Member Secretary
- Resettlement Officer, PMU supported by RP Implementation Agency and/ or PCMC
- Environmental Officer, PMU supported by CMC and/ or PCMC
- Representatives from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council
- Representative from the PIU, supported by RP Implementation Agency
- A representative from IP community for IP related issue, if any
- Representative from local forest authority, if grievances of forest aspects
- Representative from Pollution Control Board, if grievances of environmental aspects
- Representative of the Land Revenue department, if grievances of land related issues

The PIU level GRC will comprise of the:

- Representative of PIU, above the rank of Sub-Divisional Officer
- Resettlement Officer, PIU supported by RIA
- Environmental Officer, PIU supported by CSC/AE
- A representative from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council.
- A representative for women from a relevant agency which could be from the government, or RP Implementation Agency or local community
- A representative from Vulnerable DPs
- A representative of the local Deputy Commissioners office (land), if the grievance is of acquisition land related issues

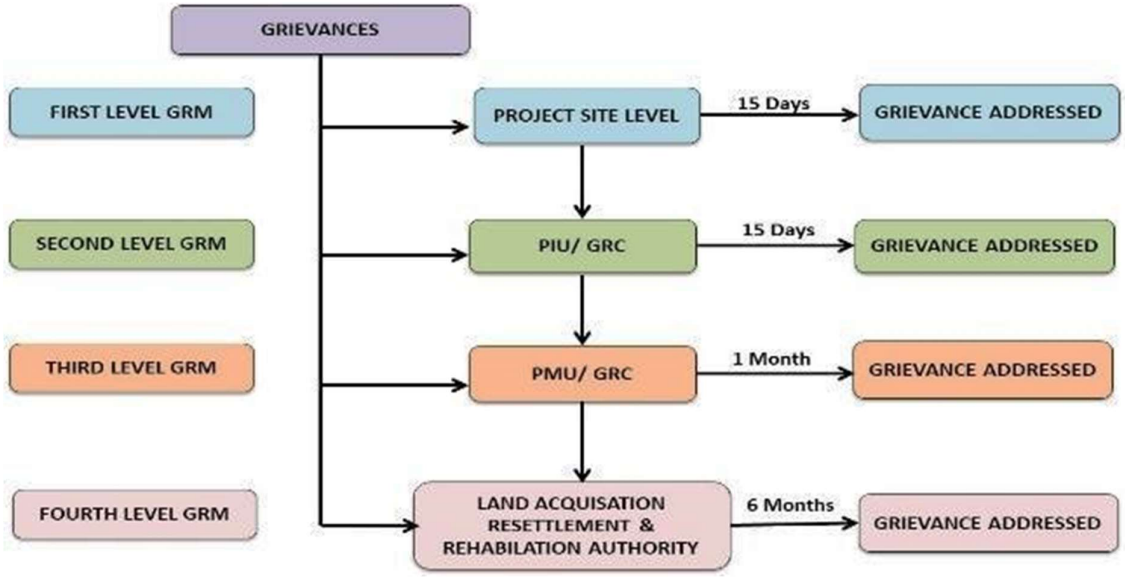
- A representative of local Pollution Control Authority (for environmental issues related grievances)
- A representative from IP community for IP related issue, if any.

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

C. Grievance Redress Process

The Grievance Redress Process is presented in **Figure 8.1**.

Figure 8.1: Environmental and Social Grievance Redressal Process



The grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number will be assigned to each grievance, including the following elements:

- initial grievance sheet (including the description of the grievance) with an acknowledgement of receipt given to the complainant when the complaint is registered;
- grievance monitoring sheet with actions taken (investigation, corrective measures); and
- closure sheet, one copy of which will be handed over to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the PMU office. Should the grievance remain unresolved, the person can seek alternative redress through the appropriate court of law which will be the last level recourse or the AIIB's redress mechanism.

During preparation of EIA or at least during pre-construction stage local communities in project areas shall be informed on grievance redress procedure and contact persons for lodging complaint/s. All the parties involved in project implementation i.e. contractor, CSC/AE, and PIU shall maintain complaint registers at their respective offices.

Environment Safety Officer of contractors and Construction Supervision Consultant shall promptly investigate and review environmental complaints and implement appropriate corrective actions to mitigate cause of the complaints. However, in all cases, it shall be responsibility of contractors to act immediately upon receiving any complaint related to construction activities at site and camps.

The GRC meeting shall be conducted within 30 days of constitution and subsequently it shall be conducted every month to review status of pending cases.

The PMU, with the assistance of the PCMC will be responsible for processing, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

The monitoring reports of the ESMP implementation will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the PIU, at what level of jurisdiction, number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared, with details such as name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance(i.e., open, closed, or pending).

All costs involved in resolving the complaints (meetings, consultations, communication, and information dissemination) shall be borne by the PMU.

9. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

A. Introduction

These can include reducing pollutant discharge at source or protecting the sensitive receptor. An effective mitigation strategy will utilise a combination of both options to arrive at practically implementable measures. Conscious efforts shall be worked out to minimise any adverse impacts on the various environmental and social components. Where the impacts on various environmental components shall be unavoidable, suitable mitigation designs shall be worked out.

B. Objectives of Environmental & Social Management Plan

Objective of the Environmental & Social Management Plan (ESMP) is to ensure that the environmental and social quality of the zone under impact does not deteriorate beyond the expected level due to construction and operation of the project and that appropriate mitigation measures are defined against the anticipated impacts.

- Achieve regulatory compliance with respect to environment, health, safety and social aspects.
- Formulate and implement a robust Environmental and Social Management System in line with the recommended Environmental & Social Management Plan.
- Positively contribute to the environmental conservation of resources and sustainable development principles.
- Deliver sustained Environmental performance by adopting continual improvement principles and global best practices.
- To ensure that the component of facility is operated in accordance with the design; and
- To addresses public complaints during construction and operation of the facility.

C. Impacts and Mitigation Measures

The Contractor shall implement the ESHS plan specified below as part of his Work. The aspects given in ESHS are mandatory in nature and thus, the Contractor should invariably adhere to it and implement it.

It is deemed that the costs associated with carrying out the requirements of the ESHS shall be deemed to be included in the overall cost of the project and incidental to the works, unless separate items are included in the Bill of quantities. All the provisions are applicable to the sub-contractors as well. However, the main Contractor will be responsible in case of any non-compliance on part his sub-contractors. The Engineer shall regularly monitor the compliance of ESHS by the Contractor and / or by their Sub-contractors. The Contractor shall submit Monthly, Quarterly and additional environmental reports in the format prescribed/desired by the Engineer. The Contractor shall implement all mitigation measures for which responsibility is assigned to him as stipulated in the ESHS. Any lapse in implementing the same shall attract penalties.

The Contractor shall take all reasonable steps to protect the environment on and off the site; and to avoid damage or nuisance to persons or to property of the public or others including any living entity resulting from pollution, noise or any other causes arising as a consequence of his methods of execution.

The Engineer shall maintain record of compliance or non-compliance of the ESHS. On observing any non-compliance, the Engineer shall issue a notice to the Contractor, to correct the same. In case of any failure to correct the non-compliance within the specified / stipulated timeframe, the Contractor shall be liable for the penalties as included in the Contract Data. Stage wise Environmental, Social, Health & Safety Management Plan measures are given in **Table 9.1**.

Table 9-1: Stage Wise Environmental, Social, Health & Safety Management Plan

I. Environmental

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
A. Pre-Construction and Design Stage			
1. Tree Cutting			
1.1. Reduction in forest cover, hence deterioration in climatic conditions. Increase in Green House effect/climate change impact	• Geometric adjustments made to minimize tree cutting. • Widening to be accommodated within available ROW such that minimal tree cutting is required. • Obtain tree cutting permission from forest/Revenue department as the case may be. • Compensatory plantation with respect to trees cut (999) with preference to fast growing species as per the orders of Forest department. • Additional Plantation of 9990 trees on both side of the road in non-residential areas will be done with 5m center to center spacing between two trees as per the order of Forest department	Project areas	PWRD, ASSAM/ Forest Department
2. Joint Field Verification			
2.1.	• The Engineer - Incharge of Supervision Consultant and the Contractor shall carry out joint field verification to ascertain the necessity of saving trees, environmental and community resources wherever such representations or suggestions in writing have been received and forwarded by the Employer/Authority or by the Engineer in accordance with the local situations. • The complaints/suggestions together with the observations and expert opinion of the joint verification team containing the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESHS shall be summarized in a written document containing all the details with date, time, place and signature of the individuals involved and this shall be sent to PMU for approval.	RoW / CoI / Project influence areas	Contractor; Environmental Officer of CSC

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
B. Construction Stage			
1. Procurement of Machinery - Crushers, Hot-mix Plants & Batching Plants			
1.1. Air, noise and water Pollution	• Specifications of crushers, hot mix plants and batching plants (existing or new) shall comply with the requirements of the relevant current emission control legislations. • The Consent to Establish (CTE) & Consent to Operate (CTO) shall be obtained from the SPCB, Assam for the establishment and operation of these plants. • Only Crushers licensed by the State Pollution Control Board (SPCB) shall be used. • The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - Incharge of CSC before entering into formal agreement with a land owner for setting-up such sites.	Crushers, Hotmix plants & Batching Plants	Contractor
2. Procurement of Other Construction Vehicles, Equipment and Machinery			
2.1. Air, noise and water Pollution	• The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. • 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 ASPCB. • Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A), when measured at one metre distance 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, which shall be produced to the PMU for verification whenever required. • Ambient Air Quality monitoring has to be performed by the	Throughout the project area	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	Contractor as per the Environmental Monitoring Program and in accordance with the general and specific condition of CTO.		
3. Air Quality			
3.1. Emission of air pollutants (HC, SO2, NOx, CO etc.) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching and asphalt mixing plants and crushers at downwind direction (1 km) from nearest settlement. • Only licensed crushers be used. • DG sets with stacks of adequate height should be used. • Ambient air quality monitoring • Following traffic management • Construction work should be carried out in non-peak hours. • LPG should be used as fuel source in construction camps instead of wood. • Contractor to prepare traffic management and dust suppression plan duly approved by PWD. • The contractor shall maintain a separate file and submit PUC certificates for all vehicles/ equipment/ machinery that are being used for the project	Built-up-Stretches are: Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Raipur/Dharmatala Sensitive Receptors in close vicinity are: School 0+156 (LHS), 5+827 (RHS), 7+045 (LHS), 7+730 (LHS), 9+100 (RHS), 9+132 (LHS), 9+880 (LHS), 13+992 (RHS), 14+200 (LHS)	Contractor
4. Land and Soil			
4.1. Land use Change and Loss of productive/ top soil	• No agricultural areas to be used as borrow areas to the extent possible. • Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use. • If using agricultural land, top soil to be preserved and laid over either on embankment slope for growing vegetation.	Throughout project section and borrow areas Land identified for construction camp	Contractor
4.2. Slope failure and soil erosion due to construction activities, earthwork and cut and fill stockpiles etc.	• Care should be taken that the slope gradient shall not be steeper than 2H:1V. • Earth stockpiles to be provided with gentle slopes to avoid soil erosion.	Throughout the project road	Contractor
4.3. Borrow area management	• Non-productive barren land shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than	Borrow site location as identified in DPR or any selected borrow area	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	25%. • The 15 cm topsoil to be stockpiled within the site of identified borrow area for use at the rehabilitation stage as preventive measure. The stockpiles shall be covered with gunny bags / tarpaulin. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation. • Borrow areas not to be dug continuously. • Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Engineer		
4.4. Quarry Operations	• No quarry and/or crusher units shall be established, which is within 1000m from the residential/ settlement locations, forest boundary, wildlife movement path, breeding and nesting habitats and national parks/sanctuaries. • Aggregates should be sourced from existing licensed quarries. • Copies of consent/approval/ rehabilitation plan for new quarry or use of existing quarries should be sought. • The contractor will develop a quarry redevelopment plan as per mining rules of state. • Obtain environmental clearance from DEIAA in case of opening new quarry. • Contractor shall work out haul road network to be used for transport of quarry materials and report to Engineer who shall inspect and approve the same.	Location specified as per DPR or another quarry source selected.	Contractor
4.5. Contamination of soil due to leakage/spillage of oil, bituminous debris generated from demolition and road construction	• Construction vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. • Fuel storage and refuelling sites to be kept away from drainage channels. • Unusable debris shall be dumped in ditches and low-lying areas. • To avoid soil contamination Oil-Interceptors shall be provided at wash down and refuelling areas. • Waste oil and oil-soaked cotton/ cloth shall be stored in	Fuelling station, construction sites, construction camps and disposal location	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF&CC/SPCB authorized vendors. • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes shall be disposed of in identified dumping sites approved by State Pollution Control Board. • Soil quality monitoring		
4.6. Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	• Construction vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. • Fuel storage and refuelling sites to be kept away from drainage channels. • Unusable debris shall be dumped in ditches and low-lying areas. • To avoid soil contamination Oil-Interceptors shall be provided at wash down and refuelling areas. • Construction vehicles, machinery and equipment to be stationed in the designated ROW to avoid compaction. • Approach roads/haul roads shall be designed along the barren and hard soil area to reduce the compaction. • Transportation of quarry material to the dumping site through existing major roads to the extent possible to restrict wear and tear to the village roads. • Land taken for construction camp and other temporary facility shall be restored to its original facility.	Parking area, haulage roads and construction yards	Contractor
5. Water Resources			
5.1. Sourcing of water during construction	• Requisite permissions shall be obtained for abstraction of groundwater if used. • Water availability to nearby communities should remain unaffected. • Water intensive activities not to be carried out during summer. • Provision of water harvesting structures to augment groundwater condition in the area	Throughout the project site especially construction sites/camps.	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
5.2. Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains. • The Contractor shall take all precautionary measures to prevent the generated wastewater from entering into streams, water bodies or the irrigation channels arising due to construction activity. • Contractor shall avoid construction works close to the streams or water bodies during monsoon.	Throughout the Project section	Contractor
5.3. Alteration in surface water hydrology due to embankment	• Existing drainage should be maintained and enhanced. • Provision shall be made for adequate size and number of cross-drainage structures esp. in the areas where land is sloping towards road alignment. • Culverts reconstruction shall be done during lean flow period. In some cases, these minor channels may be diverted for a very short period and shall be brought back to its original course immediately after construction. • Road level shall be raised above HFL level as per IRC MORTH guidelines	Waterways streams/nallahs along the section	Contractor
5.4. Siltation in water bodies due to construction activities/earthwork.	• Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. • Provision of Silt fencing shall be made at water bodies. • Earthworks and stone work to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. • Silt and sediments shall be collected and stockpiled for possible reuse. • Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. • Earthwork should be prevented from impeding natural flow of rivers, streams for existing drainage system.	Major ponds along the entire project stretch	Contractor
5.5. Deterioration in surface water quality due to leakage from vehicles and equipment and	• No vehicles or equipment should be parked or refuelled near water bodies to avoid contamination from fuel and lubricants. • Oil and grease traps and fuelling platforms to be provided at re-	Major ponds along the entire project stretch	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
wastes from construction camps.	fuelling locations. • All chemicals and oil shall be stored away from water bodies. and concreted platform with catchment pit for spills collection • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors Construction camps shall be sited away from water bodies. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality to be monitored periodically.		
6. Flora and Fauna			
6.1. Vegetation loss due to site preparation and construction activities.	• Compensatory plantations in the ratio as per Assam Government's policy and their maintenance. • Plantation of 17210 nos. trees on both sides of the road with 5m center to center distance in non-residential areas along the stretch on both sides. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Use of LPG for cooking in camps to avoid tree cutting. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation Controlled use of pesticides and fertilizers.	Throughout the project corridor	PWRD, ASSAM/ Forest Department
7. Construction Camps/ Occupational Health			
7.1. Impact associated with location	• Layout of camps shall be prepared by contractor and reviewed by PWD. • All camps should be established with prior permission from PCB. • Construction camps shall not be proposed within 1000m of Ecologically sensitive areas. • Location's for stockyards for construction materials shall be identified at least 1000 m from watercourses. The waste disposal	Construction camps	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	and sewage system for the camp shall be designed, built and operated such that no odour is generated. • Layout of the campsite shall be approved by the CSC prior to its establishment. • Top soil shall be preserved as mentioned in the Clause 12		
8. Dismantling of Bridgework / Culverts			
8.1. Generation of C & D waste, air and water pollution	• Bridges and culverts shall be planned for demolition during dry season when the flows are lowest. • In case of perennial streams, water shall be diverted away from the work area temporarily and water way shall be protected from contamination through silt fencing. • Prevent earthwork, stonework, materials and appendage from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems	Bridge and Culvert locations	Contractor
9. Management of Construction Debris			
9.1. Selection of dumping site	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and EA. • Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality. • Unproductive/ waste land shall be selected for dumping sites away from residential areas and water bodies. • Dumping sites must be having adequate capacity equal to the number of debris generated. • Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	Throughout the project corridor	Contractor
9.2. Reuse and disposal of construction and dismantled waste	• All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed of at pre-designated disposal locations, with approval of the concerned Engineer. • The bituminous wastes shall be disposed in secure landfill sites	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. • Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.		
10. Site Restoration and rehabilitation			
10.1. Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the 'AE'. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including culverts, 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, to the satisfaction of the AE. • All the opened borrow areas will be rehabilitated and 'AE' will certify.	Throughout the project corridor, construction camp sites and borrow areas	Contractor
C. Operation Stage			
1. Air Quality			
1.1. Air pollution due to vehicular movement.	• Compensatory tree plantations considered as roadside plantation shall be maintained as prescribed by Assam Governments' Policy. • Regular maintenance of the road will be done to ensure good surface condition. • Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. • Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption. • Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment. • Ambient Air Quality monitoring	Throughout the corridor	Operation and Maintenance Agency
2. Noise			
2.1. Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained.	Sensitive receptors	Operation and Maintenance Agency

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	• The effectiveness of the measures should be monitored and if need be, solid noise barrier shall be placed. • Ambient Noise Quality monitoring.		
3. Land and Soil			
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures. • Necessary measures to be followed wherever there are failures	At embankment slopes and other probable soil erosion areas	Operation and Maintenance Agency
4. Water resources			
4.1 Siltation	• Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion. • Monitoring of surface water bodies	Near surface water bodies	Operation and Maintenance Agency
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. • Monitoring of water borne diseases due to stagnant water bodies	Near water bodies and cross drainage structures and side drains	Operation and Maintenance Agency
5. Flora			
5.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Project tree plantation site	Operation and Maintenance Agency

II. Social

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
A. Pre-Construction and Design Stage			
1. Loss of Land and Assets			
1.1. Livelihood loss to affected persons	• Road improvement work to be accommodated within available ROW to the extent possible • Social Impact Assessment and Resettlement Plan to be undertaken as per State, National Act, Rules & policy and AIIB guidelines.	Land Acquisition involved along the project road. Details to be provided in Social Assessment report	PWRD, ASSAM

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Complete all necessary land and property acquisition procedures prior to the commencement of civil works in that stretch. • Adherence to land acquisition procedure, Compensation and assistance in accordance to approved Resettlement Plan (RP) • Implementation of Rehabilitation & Resettlement as per approved RP.		
2. Relocation of Cultural Property			
2.1.Loss of heritage	• In case there is an impact on religious and/ or cultural properties, they will be relocated at suitable locations, as desired by the community before construction starts. • For partially impacted structures enhancement measures shall be applied at the same sites before construction begins, depending on the availability of space, requirement of the communities and fund availability. • As far as possible, the architectural elements of the structure should be conserved/ reflected/ translated into the design of new structures in accordance with consultations with the community. • Meaningful Community meetings shall be conducted to discuss relocation aspects, siting of structures etc. • Relocation sites for all cultural properties shall be selected in consultation with concerned communities, local administrative authorities/departments as the case may be.	Throughout project corridor, if any	Civil Construction Contractor
B. Construction Stage			
1. Labour Codes			
1.1. Labour	• All the Labour Codes and Acts in effect will have to be maintained properly. • No Child labour (person below 14 years of age) will be allowed to work in any capacity in the construction.	Construction site, offices, Labour Camp etc.	Contractor
2. Procurement of Machinery - Crushers, Hot-mix Plants & Batching Plants			
1.2. Air, noise and water Pollution	• Hot-mix and batching plants shall be sited sufficiently away (1000m) away from residential / settlement locations, forest areas, wildlife movement areas and commercial establishments,	Crushers, Hotmix plants & Batching Plants	Contractor

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
	preferably in the downwind direction. • Hot mix plant should be fitted with dust extraction unit. • DG sets with stacks of adequate height and use of low sulphur diesel as fuel.		
3. Flora and Fauna			
2.1 Vegetation loss due to site preparation and construction activities.	• Preference to locals in plantation activities • Regular maintenance of all trees planted.	Throughout the project corridor	Contractor with Forest Department
4. Construction Camps/ Occupational Health			
3.1 Impact associated with location	• Construction camps shall not be proposed within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community.	All construction camp	Contractor
C. Operation Stage			
1. Noise			
1.1. Noise due to movement of traffic	• Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Sensitive receptors	Operation and Maintenance Agency

III. Health

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
A. Construction Stage			
1. Air Quality			
1.1. Dust Generation due to construction activities, transport, storage and handling of construction materials	• Contractor to submit location and layout plan for storage areas of construction materials approved by Authorities. • Transport, loading and unloading of loose materials through covered vehicles. • Storage areas to be located downwind of the habitation area. • Dust Suppression/ water spraying using tankers on earthworks, unpaved haul roads and other dust prone areas	Throughout the project corridor	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	twice a day using minimum four tankers a day, during construction period. • Provision of PPEs to workers.		
2. Noise			
1.2. Noise from construction vehicles, equipment and machinery.	• The contractors will provide prior notification to the community on the schedule of noisy construction activities. • All equipment to be timely serviced and properly maintained. • Timing of noisy construction activities shall be done during night time and weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated. • Bottlenecks to be removed. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment to be used for construction. • Construction activities should be carried out in non-peak hours. • High noise producing machineries should be placed at least 500 m away from residences. • Contractor shall provide noise barriers to the suggested locations of identified schools/ Temples/health centers prior to commencement of work. • Honking restrictions near sensitive areas. • Noise monitoring as per EMOP, based on the monitoring results, the Engineer, if required, shall recommend any additional noise mitigation measures required to be implemented by the Contractor.	Built-up-Stretches are: Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Raipur/Dharmatala Sensitive Receptors in close vicinity are School 0+156 (LHS), 5+827 (RHS), 7+045 (LHS), 7+730 (LHS), 9+100 (RHS), 9+132 (LHS), 9+880 (LHS), 13+992 (RHS), 14+200 (LHS)	Contractor
2. Land and Soil			
2.1. Borrow area management	• Transportation of earth materials should be done in covered vehicles. • Borrow area shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else,	Borrow site location as identified in DPR or any selected borrow area	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	it shall be converted into fish pond to prevent it from mosquito breeding.		
3. Construction Camps/ Occupational Health			
3.1. Impact associated with location	• 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 shall be provided by the contractor	All construction camp	Contractor
1.3. Worker's Health in construction camp	• The location, layout and basic facility provision of each labor camp will be submitted to AE and approved by EA. • The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. • Adequate water and sanitary latrines (separate for males and females) with septic tanks and soak pits shall be provided. • Preventive medical facilities including health personal in camp along with tie ups with nearest hospital or health facility. • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. • No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. • Awareness raising to immigrant workers/local community on communicable diseases such as COVID-19 and sexually transmitted diseases such as HIV, AIDs and others. • 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 per IS provision and to	All construction camp	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	the satisfaction of the „ Engineer".		
1.4. Covid-19 Health & Safety (General Directions to the workers)	• Avoid handshake, Only Namaste. • Non-essential physical work that requires close contact between workers should not be carried out. • Work requiring physical contact should not be carried out. • Plan all other work to minimize contact between workers. • Wash hands often (every 1-2 hrs. or frequently as possible) with soap for at least 20 seconds • Use hand sanitizer. • No person should enter the work site other than the authorized persons mentioned by supervisor during start of work. • All must implement social distancing by maintaining a minimum distance of 6-feet from others at all times to eliminate the potential of cross contamination. • Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing i.e., 6 ft from others. • Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion. • All individual work group meetings/ talks should follow social distancing. • At each job briefing/toolbox talk, employees are asked if they are experiencing any symptoms, and are sent home if they are. • Each worksite should have laminated COVID-19 safety guidelines and handwashing instructions. • All restroom/toilet facilities should be cleaned (min twice a day), and handwashing facility must be provided with soap, hand sanitizer and paper towels. • All surfaces should be regularly cleaned, including mobiles,	All construction camp	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	tabletops /surfaces, door handles, laptops, records, etc. • All common areas and meeting areas are to be regularly cleaned (min twice a day) and disinfected at least twice a day. • All persons to maintain their own water bottle, and should not be shared. • To avoid external contamination, it is recommended everyone bring food from home. • Please maintain Social Distancing separation during breaks and lunch. • Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough /sneeze into your upper sleeves or elbow. Do not cough or sneeze into your hands. • Clean your hands after coughing or sneezing thoroughly by using soap and water (minimum for 20 seconds). If soap and water are not available, please use a hand sanitizer. The Contractor shall ensure adequate quantities of sanitizer and soap are made available at all locations including site offices, meeting rooms, corridors, washrooms /toilets, etc. as appropriate. • Avoid touching eyes, nose, and mouth with your hands. • To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings. • Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.		
1.5. Workplace prevention practices (Safety measures for ongoing Covid-19 Pandemic)	• At the start of each shift, confirm with all employees that they are healthy and inform all workers of reusable and disposable PPE. • Outside person(s) should be strictly prohibited at worksite • All construction workers will be required to wear cut-resistant gloves or the equivalent. • Use of eye protection (reusable safety goggles/face shields) is	All construction camp	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	recommended. The supply of eye protection equipment to the workers is considered as a standard part of PPE during construction works. • In work conditions where required social distancing is impossible to achieve, such employees shall be supplied with standard face mask, gloves, and eye protection. • All employees shall drive to work site as per the prevailing guidelines of the Government. • When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant (with 1% sodium hypochlorite solution daily) prior to entry. Adequate quantity of the disinfectant shall be provided by the Contractor at all such site-specific locations. • Workers should maintain separation of 6' from each other. • Multi person activities will be limited where feasible (two persons lifting activities) • Gathering places on the site such as sheds and/or break areas will be eliminated, and instead small break areas will be used with seating limited to ensure social distancing. • Contact the cleaning person of the worksite and ensure proper COVID-19 sanitation processes. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with gloves, gown and face mask for each cycle of cleaning. • The Contractor shall make available adequate supply of PPE and chemicals while the threat of COVID-19 continues. • Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles. • All employees to maintaining good health by getting adequate sleep; eating a balanced, healthy diet, avoid alcohol; and		

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	consume plenty of fluids. • Continuation of works in construction project with workers available on site and no workers to be brought in from outside. • The site offices shall have adequate ventilation. The air conditioning or ventilation systems installed at the site offices would have high-efficiency air filters to reduce the risk of infection. The frequency of air changes may be increased for areas where close personal proximity cannot be fully prevented such as control rooms, elevators, waiting rooms, etc. • The Contractor shall carry out contactless temperature checks for the workers prior to site entrance, during working hours and after site works to identify persons showing signs of being unwell with the COVID-19 symptoms.		

IV. Safety

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
A. Pre-Construction and Design Stage			
1. Alignment			
1.1. Risk due to constricted sections, pavement damage due to use of unsuitable sub-grade material and inadequate drainage provisions in habitat area	• CBR value of subgrade adopted in consistent to MORTH guidelines. • Increase in vent size of cross drains with inadequate waterways. • Maintain road level above HFL as per site conditions and MORTH guidelines. • Provision of new cross drainage structures • Cover drains in built up area. • Side drains on hill side in Ghat section and open lined drain in open areas all along the alignment	Geometric improvement of curves CD structures proposed for improvement. Covered drain.	DPR Consultant during preliminary and detailed design
1.2. Safety along the proposed alignment	• Horizontal and vertical profile to be improved as per MORTH/IRC specifications considering land availability.	Built-up-Stretches are: Built-up-Stretches are:	DPR Consultant during preliminary and detailed

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Speed limitations near built up sections and sensitive locations by installing rumble strips/speed breakers etc. • Provision of side-walks in built up sections over cover drains. • Provision of cautionary and warning signs, boards near built up sections, sensitive receptors and forest areas. • Provision of safety kerb at all bridges. • Signs and marking viz. delineators, object markers, safety barriers at hazardous locations. • Improvement of all major junctions as per MORTH guidelines • Provision of Solar blinkers and Solar street lights	Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Raipur/Dharmatala Sensitive Receptors in close vicinity are: School 0+156 (LHS), 5+827 (RHS), 7+045 (LHS), 7+730 (LHS), 9+100 (RHS), 9+132 (LHS), 9+880 (LHS), 13+992 (RHS), 14+200 (LHS)	design
2. Natural Hazards			
2.1. Damage to pavement integrity like rutting, embankment softening and migration of liquid asphalt.	• Design considers the risk of climate change in the region and accordingly uses asphalt specifications	Entire stretch	DPR Consultant
2.2. Earthquake	• Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to seismic zone of the project area	Entire stretch	DPR Consultant during preliminary and detailed design
2.3. Flooding/Water Logging	• CD structures designed and improved for 50-year return period. • Roadside drains improved. • CD structures to be reconstructed/ improved.	Anticipated water logging location as per TCS Type II Anticipated water logging and flood prone location as per TCS Covered drain	DPR Consultant during preliminary and detailed design
3. **Shifting of Utilities and common property resources**			
3.1. Disruption of utility services and common property resources to local community	• Geometric adjustments made to minimize shifting needs or loss to any facilities. • All telephone and electrical poles/wires, underground cables/pipelines should be shifted before start of construction. • Necessary permissions and payments should be made to	Throughout project corridor	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	relevant utility service agencies to allow quick shifting and restoration. • Local people must be informed through appropriate means. about the time of shifting of utility structures and potential disruption of services if any • Relocation of. wells, hand pumps at suitable locations with consent from local community. • Early completion of works for schools, colleges and health centres including shifting of gates and construction of boundary walls shall be planned during holidays so that the risk of accidents and disturbance to day-to-day activity of such institutions are minimized. • Proper placement (as per codes) of passenger shelters/bus stops shall be ensured to prevent distress to the commuters and passengers. • Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments. Concerned authority, local body and public must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any, so as to ensure that work does not get affected.		
B. Construction Stage			
1. Noise			
1.1. Noise from construction vehicles, equipment and machinery.	• PPEs to workers	Built-up-Stretches are: Sarthebari, Gomura, Batiya, Lankeparakuchi, Parakuchi, Rampur, Bongaon, Bugan, Tapattari, Malipara, Dubi, Dubi Chowk, Raipur/Dharmatala Sensitive Receptors in close vicinity are: School 0+156 (LHS), 5+827 (RHS), 7+045	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
		(LHS), 7+730 (LHS), 9+100 (RHS), 9+132 (LHS), 9+880 (LHS), 13+992 (RHS), 14+200 (LHS)	
2. Land and Soil			
2.1.Borrow area management	• No borrow areas shall be opened within 500m of wildlife movement zones and forest areas. The borrow areas shall be at least 300m from schools and village access roads.	Borrow site location as identified in DPR or any selected borrow area	Contractor
3. Flora and Fauna			
3.1.Vegetation loss due to site preparation and construction activities.	• Restrict tree cutting up to toe line considering safety to road users. • Roadside trees to be removed with prior approval of competent authority.	Throughout the project corridor	Contractor with Forest Department
4. Traffic Management and Safety			
4.1.Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the AE. • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance	Throughout the project corridor	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	from "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.		
4.2.Safety of Workers and accident risk from construction activities	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retroflector signage, in local language at the construction sites. • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor shall not employ any person below the age of 18 years for any work and also declare at site. • Use of hazardous material should be minimized and restricted. • Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. • Accident Prevention Officer must be appointed	Construction sites	Contractor
4.3.Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. • Provision of temporary diversions and awareness to locals before opening new construction fronts. • Alternate access facility to common properties near construction zones • Speed limitation wherever animal movement is anticipated.	Throughout the project corridor, construction sites	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
4.4. Pedestrians, cattle movement	• Temporary access and diversion, with proper drainage facilities. • Access to the schools, temples and other public places must be maintained when construction takes place near them. • Speed Limitation wherever cattle movement is expected. • If any wild animal is found near the construction site at any point of time, the contractor shall acquaint the Engineer and execute the Engineer's. • instructions for dealing with the same. • The Engineer shall report to the nearby forest office (range office) and shall take appropriate steps/ measures in consultation with the forest officials.	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	Contractor
C. Operation Stage			
1. Noise			
1.1. Noise due to movement of traffic	• Speed limitation and honking restrictions near sensitive receptors locations.	Sensitive receptors	Operation and Maintenance Agency
2. Maintenance of Right of Way and Safety			
2.1. Accident Risk due to uncontrolled growth of vegetation	• Maintain shoulder completely clear of vegetation. • Minimum offset as prescribed in IRC: SP:21-2009 to be maintained. • Regular maintenance/trimming of plantation along the roadside • No invasive plantation near the road. • Ensure no fuel accumulation and clearances of vegetation by burning near forest areas to avoid forest fires	Throughout the corridor especially near accident prone curves and forest areas	Operation and Maintenance Agency
2.2. Accident risks associated with traffic movement	• Traffic control measures, including speed limits, will been forced strictly. • Further encroachment of squatters within the ROW will be prevented. • No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained. • Highway patrol unit(s) for round the clock patrolling. Help lines	Throughout the Project route	Operation and Maintenance Agency

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	for accident reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.		
2.3. Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system • Emergency plan for vehicles carrying hazardous material	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Operation and Maintenance Agency

D. Chance Find Archaeological Property and Procedures

It will be ensured that the Contractor takes the reasonable precautions to prevent his/her workers or any other persons from removing and damaging any property, article, or thing of archaeological importance. Upon discovery of such property, article, or thing, contractor will, immediately suspended the work, notify – PMU of such discovery and carry out the PMU instructions for dealing with the same. The PMU will seek direction from the Archaeological Survey of India (ASI) or the State Archaeological Department before instructing the Contractor to recommence the work in the site.

The Archaeological structures identified along the route alignment should be protected/ preserved or enhanced as per the law. During excavation, if any treasure, archaeological artefacts are found the same will be intimated in writing to District Collector or Commissioner /Archaeology department as per the provisions of Section-4 of "Indian Treasure Trove Act, 1878 as amended in 1949". The construction activity will be suspended temporarily during this process.

E. Environmental and Social Monitoring & Reporting Program

The purpose of the environmental monitoring program is to ensure that the envisaged purpose of the project is achieved and results in desired benefits to the target population. To ensure the effective implementation of the ESMP, it is essential that an effective monitoring program be designed and carried out. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the ESMP.
- To evaluate the adequacy of Environmental Impact Assessment
- To suggest improvements in management plan, if required
- To enhance environmental quality
- To satisfy the legal and community obligations

The environmental monitoring plan contains:

- Performance Indicators
- Environmental & Social Monitoring Program
- Reporting Formats
- Necessary Budgetary Provisions

a) Performance Indicators

The physical, biological and social components identified to be particularly significant in affecting the environment at critical locations have been suggested as Performance Indicators. The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficiency of environmental and social 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 that have been devised to determine efficiency and utility of the proposed mitigation measures.

The Performance Indicators and monitoring plans prepared are presented in **Table 9.2** below.

Table 9-2 Performance Indicators

Sl. No.	Details	Indicators	Stage	Responsibility
A.	**Pre-Construction Stage: Environmental Management Indicators and Monitoring Plan**			
1.	Location of construction camps must be	Construction	Pre-construction	Contractor

Sl. No.	Details	Indicators	Stage	Responsibility
	identified and parameters indicative of environment in the area has to be reported.	camp		
2.	Location of borrow areas must be finalized and parameters indicative of environment in the area has to be reported.	Borrow areas	Pre-construction	Contractor
3.	Location of Quarry and Stone Crusher sites must be finalized and parameters indicative of environment in the area must be reported.	Quarry and Stone Crusher sites	Pre-construction	Contractor
4.	Locations for Debris Disposal Site must be identified and parameters indicative of environment in the area must be reported.	Debris Disposal Site	Pre-construction	Contractor
5.	Progress of tree removal marked for cutting is to be reported	Site clearing	Pre-construction	Contractor
B.	**Construction Stage: Environmental Condition Indicators and Monitoring Plan**			
1.	The parameters to be monitored as per frequency, duration & locations of monitoring specified in the Environmental Monitoring Program prepared (Refer **Table-9.3**)[5]	Air quality	Construction	SC through NABL approved monitoring agency
		Noise level	Construction	SC through NABL approved monitoring agency
		Ground Water quality	Construction	SC through NABL approved monitoring agency
		Surface Water quality	Construction	SC through NABL approved monitoring agency
		Soil quality	Construction	SC through NABL approved monitoring agency
2.	Progress of measures suggested as part of the strategy is to be reported	Tree plantation (if any)	Construction	Contractor
3.	Contractor shall report implementation of the measures suggested for topsoil conservation to Environmental Specialist of SC	Topsoil Conservation	Construction	Contractor
4.	Contractor shall report implementation of the measures suggested for slope stabilization and sediment control to Environmental Specialist of SC	Slope Stabilization and Sediment Control	Construction	Contractor
5.	Contractor shall report implementation of the measures suggested for waste management to Environmental Specialist of SC	Waste Management Plan	Construction	Contractor

[5] In case, the PWD (EAP) does not agrees with this responsibility being vested with the AE, then the contractor shall carry out the monitoring which shall be vetted by the AE.

Sl. No.	Details	Indicators	Stage	Responsibility
6.	Contractor shall report implementation of the guideline to ensure worker's safety during construction to Environmental Specialist of SC	Worker's Safety during Construction	Construction	Contractor
C.	**Operation Stage: Management & Operational Performance Indicators**			
1.	The number of trees surviving during each visit will be compared with the number of saplings planted. To be done twice in a year (pre monsoon & post monsoon seasons)	Survival rates of trees	Operation	Environmental Specialist of SC up to construction period, and then Environmental Cell of PMU, PWD (EAP) over a period of 10 years
2.	Environmental Specialists of SC, PMC will undertake joint site visit with the Contractor to determine whether the borrow areas, quarry areas, debris disposal site have been rehabilitated in line with Guidelines	Rehabilitation of Borrow areas, Quarry area, Debris Disposal site	Operation	Environmental Specialists of SC & PMC /PWD (EAP)
3.	The PMU will visit sensitive locations along with the environmental monitoring agency (responsible for monitoring of noise levels during operation stage) to check the efficiency of the noise barriers	Utility of noise barriers for sensitive receptors	Operation	PMU/PWD (EAP)

b) Monitoring Schedule

The detail monitoring schedule during construction and operation stages are presented in Table 9.3. For each of the environmental condition indicator, the monitoring program specifies:

- Parameters to be monitored.
- Location of the monitoring sites
- Frequency and duration of monitoring
- Institutional responsibilities for implementation and supervision

c) Social Monitoring

The most crucial components/ indicators to be monitored are specific contents of the activities and entitlement matrix. The Resettlement Action Plan will contain indicators and benchmarks for achievement of the objectives under resettlement program. These indicators and benchmarks are of three kinds:

- Process indicators including project inputs, expenditures, staff deployment, etc.
- Output indicators indicating results in terms of numbers of displaced people compensated and resettled, training held, credit disbursed, etc. and
- Impact indicators related to the longer-term effect of the project on people's lives.

Table 9-3: Environmental Monitoring Program

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
Air	Construction	PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO	Respirable Dust Sampler to be located 50 m from the selected locations in the downwind direction. Use CPCB specified method	Ambient Air quality standards CPCB	24 hr. continuous for three seasons in a year for 2.5 years (once in a season)	Monitoring near all hot mix plant locations approved by the Engineer. Monitoring at construction sites near sensitive locations (28 Samples)	Contractor through approved monitoring agency
	Operation				24 hr. continuous, for three seasons for a year (once in a season)	Ambient Air Quality Monitoring (At 1 location where environmental monitoring during baseline data generation done) (12 Samples)	
Noise	Construction	Noise levels as Leq in dB	IS:4954-1968 as adopted by CPCB for identified study area CPCB/IS:4954-1968 Using Noise Level Meter	National Ambient Noise Standard specified in EPA,1986	24 hr. continuous (once in a month) for three seasons in a year for 2.5 years	At equipment yards/ Hot mix plants/ Construction Camps & Sensitive areas (28 Samples)	Contractor through approved monitoring agency
	Operation				24 hr. (once in a month) for three seasons in a year for 1 year	Near Sensitive and residential/Commercial areas as directed by the Engineer (12 Samples)	
Water Quality	Construction	pH, BOD, COD, Turbidity, Total Hardness, SS and others.	Grab Sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	Once in a Season for three seasons in a year for 2.5 years	Surface Water Quality (28 Samples) Discharge Water Quality (As per suggestion in monitoring plan)	Contractor through approved monitoring agency
	Operation				Once in a Season	(12 Samples)	

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
					for three seasons in a year for 1 year		
Soil Quality	Construction	NPK (ICAR Standards)	As approved by Authority Engineer	ICAR standards	Once in a Season for three seasons in a year for 2.5 years	At productive agricultural lands abutting traffic detours and traffic diversions, to be identified by the Engineer (28 Samples)	Contractor through approved monitoring agency
	Operation				Once in a Season for three seasons in a year for 1 year	At accident/spill locations involving bulk transport carrying hazardous material (12 Samples)	
Drainage Congestion	Construction	As approved by Authority Engineer	Visual Checks	Non-Specific	Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	Contractor
	Operation			Non-Specific		Once in a year before rainy season	Contractor
Borrow Areas	Construction	IRC guidelines	Visual Checks	IRC guidelines + Compliance conditions of SEIAA	Borrow areas to be operated	Once in a month	Contractor with approval from PWD, Assam.
	Operation	Rehabilitation as per IRC guidelines	Visual Checks		Closed Borrow Areas	Quarterly for 1 year	PWD, Assam / AE
Construction sites and labour camps	Construction	Rapid audit as per reporting format	Hygiene, drainage Medical Facilities Etc.	IRC guidelines	Construction Sites and Camp	Quarterly during construction period	Contractor with approval from PWD, Assam
Tree Plantation	Construction	Surveillance monitoring of trees felling		As approved by Authority Engineer	Throughout the Project Section	During site clearance in construction phase	Compensatory: PWRD, Assam / Local Forest Departments
	Operation	Audit for survival rate of trees plantation		IRC: SP:2009	Throughout the Project Section		The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch.

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
							After this period PWRD, Assam will be responsible for monitoring additional plantation
Record of Accident	Construction		Type, nature and cause of accidents. Methodology as approved by Authority Engineer	As approved by Authority Engineer	Throughout the stretch including construction sites, crusher, diversions, Hot Mix Plant, earthwork, demolition site etc.	Occurrence of accidents	Contractor
	Operation			-	Throughout the stretch	Occurrence of accidents	Road Safety unit of PWRD, Assam with support from local police

F. Environmental and Social Reporting System

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

- Reporting of environmental management indicators
- Reporting for operational performance indicators at the PMU level

Environmental monitoring involves regular checking of the environmental management issues detailed in the ESMP and to ascertain whether the mitigation measures are achieving their objectives, according to the ESMP, with the progress of the works. It provides the necessary feedback for project management to keep the program on schedule will still achieving the expected outcomes. The Contractor, SC and PMU are three components of the reporting system for environmental conditions and management indicators. The reporting system to be followed in construction phase is presented in Table 9.4.

- The reporting system will start with the Contractor, who is the main executor of the implementation activities. The Contractor will report to the Environmental Specialist of SC who in turn shall report to the PMU. The Contractor will submit monthly and quarterly environmental compliance reports along with formal monthly and quarterly reporting to the SC.
- The SC will submit separate quarterly environmental monitoring reports to PMU in addition to submission of the summary of the activities of the month in the formal monthly report including any deviations and corrective actions.
- PMU will be responsible for preparation of the targets for identified non-compliances.
- A full record of construction activities will be kept as a part of normal contract monitoring system. Reporting and Monitoring Systems for various stages of construction and related activities have been proposed are to ensure timely and effective implementation of the ESMP.

During the operation phase, the supervision as well as reporting responsibilities will lie with the PWD (EAP) site offices and overall supervision will be the responsibility of Environmental Specialist at PWD (EAP) head office in Guwahati.

Table 9-4: Reporting System during Construction Phase

Format No.	Item	Contractor	Construction Supervision Consultant		PMU	
		Implementation and Reporting to CSC	Supervision	Reporting to PMU	Oversee/ Field Compliance Monitoring	Reporting to Environment Officer of PMU
C1	Monitoring of construction site and construction camp	Before the start of work	-	Quarterly	-	Quarterly
C2	Target sheet for pollution monitoring	-	As required	After Monitoring	-	After Monitoring
C3	Target sheet for roadside plantation	-	Monthly	Quarterly	Quarterly	Bi-Annual
C4	Target sheet for monitoring of cleaning	-	Monthly	Quarterly	Quarterly	Bi-Annual

Format No.	Item	Contractor	Construction Supervision Consultant		PMU	
		Implementation and Reporting to CSC	Supervision	Reporting to PMU	Oversee/ Field Compliance Monitoring	Reporting to Environment Officer of PMU
	water bodies					
O1	Target sheet for pollution monitoring	-	-	-	As per Monitoring plan	After Monitoring
O2	Target sheet for survival reporting of roadside plantation	-	-	-	Quarterly	After Monitoring
O3	Target sheet for monitoring of cleaning water bodies	-	-	-	Quarterly	After Monitoring

Formats will be developed and provided by the Engineer to the contractor.

Social Reporting System:

Social Reporting Requirements:

Project Division Office responsible for supervision and implementation of the Resettlement Action Plan will prepare monthly progress reports on resettlement activities and submit to PWRD. PWRD will submit semi-annual reports to AIIB.

The external monitoring expert responsible for monitoring of the Resettlement Action Plan implementation will submit a semi-annual review report to PWRD to determine whether resettlement goals have been achieved, more importantly whether livelihoods and living standards have been restored/ enhanced and suggest suitable recommendations for improvement.

The Independent Monitor for process monitoring under land being purchased under Mutual consent. The report shall be prepared and submitted to PWRD and AIIB on requirement basis till the process for purchase is complete.

G. Institutional Arrangement

Public Works Roads Department (PWRD), Government of Assam will be the executing agency. The Chief Engineer (EAP) will be the Project Director (PD) of state level Project Management Unit (PMU). PD PMU will be assisted by an Assistant Executive Engineer as Nodal Officer of Asom Mala Program. **Figure 9.1** shows the implementation arrangement for Asom Mala Program.

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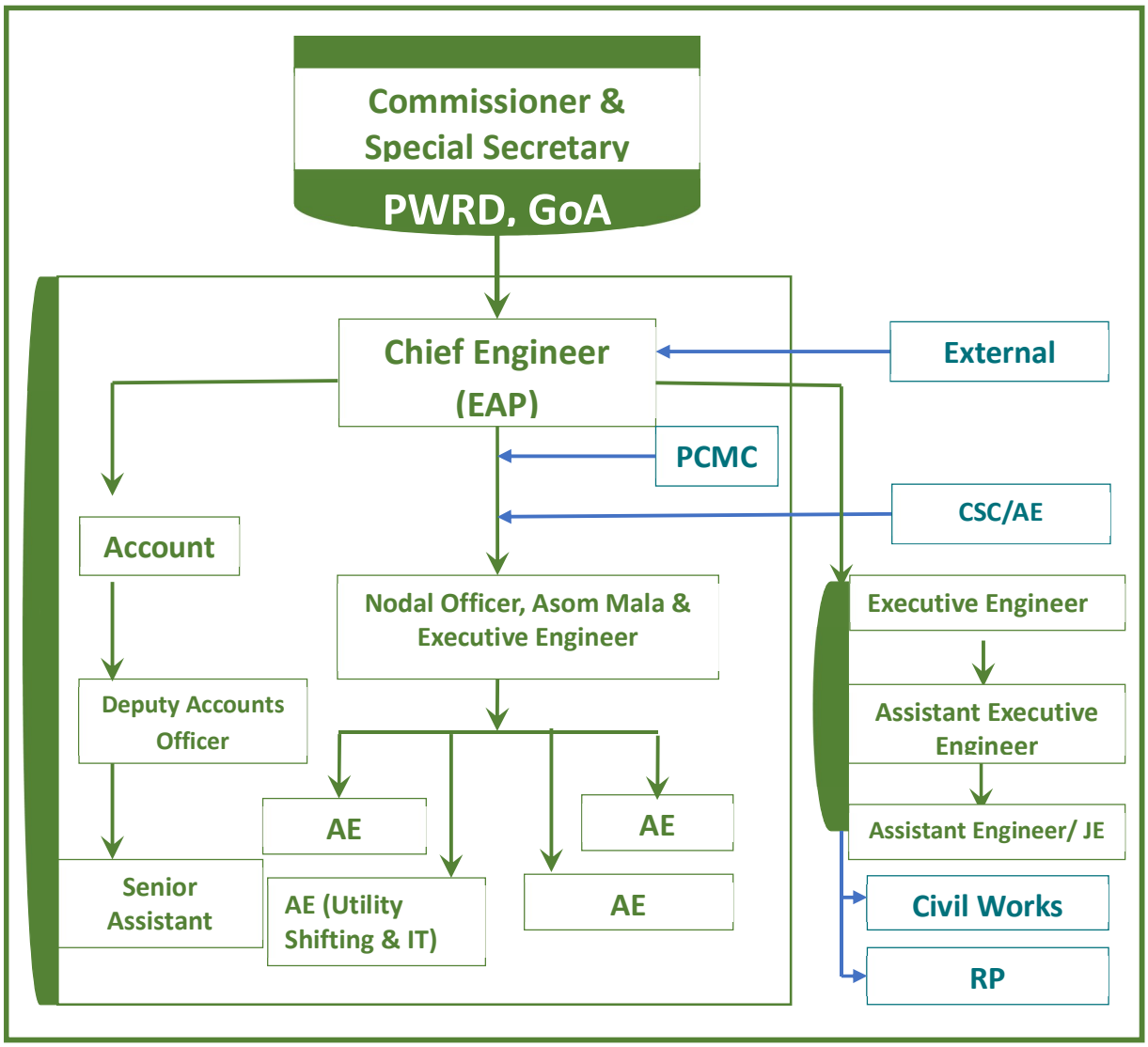


Figure 9.1: Implementation Arrangement for Environmental and Social Safeguards

H. Program Management Unit (PMU)

The PMU will be responsible for overall execution and technical supervision, monitoring, and financial control of the project. The PMU will be assisted by Program Coordination and Management Consultant (PCMC). The PMU will be responsible for the following:

i. appointing Independent External Monitors, RP Implementing Agencies, Authority Engineers, Contract Supervision Consultants, Civil work contractors, other Implementing Agencies for PIU level/ Contract level/ Sub-project level/ PMU level, as and when where required;

ii. Liaising with district administration for direct purchase or land acquisition

iii. Preparation of ESMPF, Resettlement Planning Framework (RPF), Indigenous Peoples Planning Framework (IPPF) for ASRIP projects of Asom Mala program;

iv. Review and approving of Resettlement Plan (RP), Environmental and Social Management Plan (ESMP) and all other social and environmental safeguards documents and reports;

v. Ensuring timely disbursement of compensation and assistance to the displaced persons in close coordination with the concerned line departments;
vi. Monitoring of implementation and monitoring of RP and ESMP;
vii. Proactive and timely measures to address all social and environment safeguards including measures and clearances;
viii. monitoring, addressing and resolving grievances;
ix. ensuring availability of budget for implementation activities; and
x. ensuring disclosure of relevant frameworks, implementation and management plans and monitoring documents.

The PMU will seek government clearances for submission and disclosure of the environmental, social and resettlement report to AIIB. It will also coordinate with national and state agencies to resolve inter-departmental issues, if any.

I. Responsibilities of the Project Implementation Units (PIUs)

The PWRD had already established separate state road divisions in each district. These will be responsible to implement all the project related activities in their respective districts/ divisions including the road strengthening and widening works, implementation of road rehabilitation works, land acquisition and forest clearances, data-collection, preparation and implementation of contracts and coordination with local administration and local communities to seek their support.

The PWRD's Superintending Engineers (SEs) in the field will closely monitor and guide the field divisions in implementing all the project related activities in their respective jurisdiction. The SEs will undertake quarterly management meetings with the contractors; coordinate with district administration, forest department, water supply, electricity, and revenue departments to resolve any land acquisition, site readiness, material availability, and law and order or social issue. The PIUs will be supported by CSC and RP Implementation Agency (RIA) to implement environmental and social safeguards activities. The PIU will undertake internal monitoring and supervision and record observations throughout the project period to ensure that the safeguards and mitigation measures are provided as intended.

J. Responsibilities of the Project Coordination and Support Consultant (PCMC)

A PCMC has been mobilized to provide high quality technical advice and implementation support to PWRD for all the project components under Asom Mala program. The PCMC shall support the Program Management Unit (PMU) for all aspects of Asom Mala program. An Environmental Specialist shall also be appointed as part of the PCMC team to (i) prepare ESMPF for sub-project roads under ASRIP; (ii) review the Environmental Assessment and ESMP prepared by the DPR Consultants in the planning phase; (iv) assist in the monitoring and supervision of ongoing subprojects and ESMP implementation; (v) monitor the implementation of ESMP carried out by the PIU level; and (vi) ensure all subprojects meet safeguard requirements as agreed in the loan covenant and in line with this ESMPF. In addition, (s)he shall play a central role in ensuring capacity building on environmental management of the PMU, RP Implementation Agencies and line departments through capacity development support and training.

K. Responsibilities of the Construction Supervision Consultant (CSC)/ Authority Engineer (AE)

The CSC is the supervising authority for contractors following item rates and the AE is the supervising authority for contractors that follow the EPC modality. They are also responsible for reviewing and approving the detailed engineering design prepared by the EPC contractor. Other than the difference mentioned above, the following are the responsibilities of the CSC and AE:

i. Review the environmental and social reports and management plans to understand the background issues of the respective project corridor
ii. Review and approve the revised ESMP and other required sub-plans such as traffic management plan, health and safety plan, waste management plan etc. prepared by the contractor
iii. Conduct regular site inspections and monitor implementation of the ESMP and EMOP by the contractor
iv. Provide on-site training and technical guidance to the contractor workers as necessary
v. Review the monthly reports prepared and submitted by the contractor
vi. Where necessary identify the need for corrective actions and issue official notices to the contractor to implement the corrective actions with clear timeline
vii. If there are any complaints or grievances, facilitate consultations with the respective complainant and ensure the grievances are addressed in accordance with the GRM system
viii. Regularly convene meetings to discuss progress or issues on environment safeguards to ensure that all parties (contractor, PIU, PCMC) are on the same page on requirements and milestones for environment safeguards
ix. Based on site inspections and review of reports submitted by the contractor prepare semi-annual (for category A project corridors) and annual (for category B project corridors) Environmental Monitoring Reports for review and approval by the PMU/PCMC. These reports shall be further forwarded to AIIB for disclosure on their website

L. RP Implementation Agency (RIA)

An RP Implementation Agencies will be hired to assist PIU to, (i) implement the Resettlement Plans and Indigenous Peoples Plan, if any (ii) conduct consultations and create public participation in the project and conduct verification surveys and (iii) update respective Resettlement Plan and Indigenous Peoples Plan, if required, in line with the Resettlement Planning Framework and Indigenous Peoples Planning Framework, respectively.

M. Environmental and Social Management Budget

The capital cost of ESMP **is Rs.1.02 Cr.** The details ESMP budget is provided in Table 9.5.

Table 9-5: ESMP Non-Civil cost

Non - Civil Costs							
Sr. No.	**SOR Item No.**	**Ref. of MoSRT&H**	**Description**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**
			Sub Head No-1 Pre-construction Activity (Tree Cutting)				
1			Tree cutting along the project road [Letter No. B/RST/Genl/ 264 dated 26/4/2021	m3			2297947
			Sub Head No-2 Compensatory Plantation				
2			Creation of plantation measuring 4 Ha Block plantation and 5 years maintenance. [Letter No. B/RST/Genl/ 264 dated 26/4/2021	No.			2444873
			Sub Head No-3 Administrative Charges including logistics				

Non - Civil Costs							
Sr. No.	**SOR Item No.**	**Ref. of MoSRT&H**	**Description**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**
3			Data processing, administrative support, stationery etc.	LS			1050000
4			Digital Camera for the Environment Cell	No.	1	35990	35990
			Sub Head No-4 Environmental Awareness and Training				
5			Providing Environmental awareness and training during first 5 years of project implementation	Past Project Experience			337500
Total Cost							**6166310**
Total Cost @ 12% GST							**6906267**

Table 9-6: ESMP Cost for Tender

Environment Management Cost							
Sr. No.	**SOR Item No.**	**Ref. of MoSRT&H**	**Description**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**
1			**Environmental Monitoring Costs**				
1.1			Ambient air quality monitoring along the project road for particulate matter (PM2.5 and PM10), sulphur dioxide (SO2), oxides of nitrogen (NOX); and carbon monoxides (CO) using standard analysis technique in accordance with the National Ambient Air Quality Standards formulated by MoEF&CC and the World Bank (IFC) Air Quality. Standards				
			Near all hot mix plant locations approved by the Engineer	No. of Samples	14	2500	35000
			Construction sites near sensitive locations	No. of Samples	14	2500	35000
			At 2 location during operation stage where monitoring had been done during construction stage	No. of Samples	12	2500	30000
1.2			Sound Pressure Level (SPL) measurements along the project road using standard analysis technique in accordance with the National Ambient Air Quality Standards in respect of noise formulated by MoEF&CC and the World Bank (IFC) Air Quality. Standards				
			At equipment yards/ Hot mix plants/ Construction Camps	No. of Samples	14	1000	14000
			Near known nesting sites - as	No. of	14	1000	14000

Environment Management Cost							
Sr. No.	**SOR Item No.**	**Ref. of MoSRT&H**	**Description**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**
			directed by the Engineer	Samples			
			During Operation Stage as directed by the Engineer	No. of Samples	12	1000	12000
1.3			Water Quality Testing for parameters as per IS: 10500-2012 along the road in accordance with CPCB norms				
			Surface Water Quality testing during Construction Stage	No. of Samples	28	4000	112000
			Discharge Water Quality testing during Operation Stage	No. of Samples	12	4000	48000
1.4			Soil Quality Testing along the project road in accordance with CPCB norms				
			During Construction stage at productive agricultural lands abutting traffic detours and traffic diversions, to be identified by the Engineer	No. of Samples	28	4200	117600
			During Operation stage At accident/spill locations involving bulk transport carrying hazardous material.	No. of Samples	12	4200	50400
Total monitoring Cost							**468000**
2			**Mitigation / Enhancement Cost**				
2.1			***Enhancement of Road side ponds***				
			Enhancement of 4 ponds	No.	4	500000	2000000
2.2			***Oil Interceptors***				
			Oil interceptors at parking/ servicing of construction vehicles	No.	1	60000	60,000
2.3			***Noise Barriers at Sensitive locations***				
			Provision of Noise barrier at sensitive areas like schools and hospitals. The noise barriers of hollow brick wall/ reinforced concrete panels with height of 3.5m. School location: 9+100 (R), 9+132 (L) and 14+200 (R)	Rm	100	4000	400000
Total Mitigation / Enhancement Cost during Construction phase							**2460000**
Total Environmental Management Cost							**2928000**
Total Environmental Management Cost (Including GST @ 12%)							**3279360**

Total ESMP Cost (INR) = ESMP Non civil cost + ESMP cost for Tender

= (6906267+3279360) = 10185627

10. CONCLUSIONS & RECOMMENDATIONS

A. Conclusions

As per AIIB Safeguard Policy, proposed project is tentatively categories as "**Category B**" project. The EIA Report attempts to identify significant potential environmental impacts associated with the construction and operational phases of the proposed road project. Apart from positive impacts road projects could also generate some adverse direct and indirect environmental impacts. Direct environmental impacts are usually due to construction activities, while indirect environmental impacts are usually related to the operation of improved roads.

Most of the adverse impacts of road project during construction period are temporary in nature. These impacts can be minimized through specific engineering solutions. Environment friendly construction methodology has been incorporated into the project design and Environment & Social Management Plan has been prepared to minimize the overall impact on environmental attributes by the proposed project works. Therefore, it is unlikely to cause any significant adverse environmental impacts and no further detailed study is required.

The EIA study has primarily tried to focus on the potential impacts due to the proposed project and to propose mitigation measures through an appropriate ESMP for the project. Based on the findings during the Environmental Assessment the following can be safely deduced:

- The project roads are neither new State Highways nor a State Highway expansion projects in hilly terrain (above 1000 MSL) and or ecological sensitive areas. Thus, the project does not trigger the EIA Notification 2006 & amended thereof. **Hence, Prior Environmental Clearance is not required for the project road.**
- There is no Wildlife Sanctuary/ National Park within 10 km radius of the proposed project. **Hence, Recommendation under Wildlife Protection Act shall not be required for this project road.**
- There are no patches of forest land along the project road, legal status of which shall be finalised based on the joint inspection with the authorities and proposed design of the road & shall be updated in the subsequent stages. **Forest Conservation Act shall not be applicable for this road.**
- The project roads involve widening of the existing roads to overcome design deficiencies in short patches and thus minor diversion of Forest land and LA might be involved. These shall be as per procedure laid down by the Govt. of Assam, Govt. of India.
- Several trees within the ROW are needed to be felled for winding purpose and safety. Permissions to be obtained from Forest Authorities before felling.

B. Recommendations

Conservation and Ecosystem Management has vital role to minimize the impact of highway construction. Maintaining natural flows of rivers, streams etc. without changing the gorge of flow at highway site also contribute to conservation of ecosystem.

Bioengineering is the technique of utilizing vegetation in addressing geotechnical problems, which is the only environment friendly and sustainable technology to control soil erosion and slope stabilization in highway project.

Waste plastic creates problem to the environment. The best way of disposal of waste plastic is its recycling to the maximum extent and waste plastic has great potential for use in bituminous construction. Plastics increase the melting point of the bitumen as well as its addition in small dose helps in substantially improving Marshall Properties, fatigue life and other properties. Use of this

technology can not only strengthens the road construction but also increases the road life, and also help to improve the environment.

As discussed above, the Environmental Management Plan has been prepared incorporating various modern technologies and guidelines to reduce the environmental impacts of highway construction to make it a Green Highway. Therefore, it is recommended to strictly follow the ESMP and associated Guidelines during construction phase and operation phase of the project.

Green Highway considerations at Construction Stage

- Use of Waste Plastic in Road Construction
- Slope stabilization using Coir Geotextile and Vetiver Grass
- Native indigenous trees species with large canopy cover shall be planted. One sq. m. of green canopy absorbs 0.2 kg of CO_2 and other waste gases.
- Preservation of fertile topsoil
- Adequate number to cross drainage structures proposed to maintain natural flows of streams without changing the gorge of flow at highway site.
- Rainwater Harvesting Structures to improve ground water level.
- Provision of LPG in construction camp as fuel source
- Utilization of low electrical equipment viz. CFL, LED etc. in construction camp
- Utilization of solar panels in camps, offices and execution sites
- Disposal of hazardous and non-hazardous waste from construction site and reporting its environmental compliances to concerned authorities.
- Reduction in fuel consumption & lower down fuel demand in machinery & vehicles

ANNEXURE 1: PROPOSED CROSS SECTIONS

Typical Cross-sections of road, bridges, ROB, RUB and Culvert

The basic principle followed in the design is to develop a cross section based on guidelines for preparation of Detailed Project Reports under Asom Mala Program vide Lr. No. CE/ASOMMALA/12/2019/41 dated 06.02.2020. The design of the proposed cross sections is given and details are presented in Table 3.6 & 3.7.

Table 1: List of Typical Cross Sections

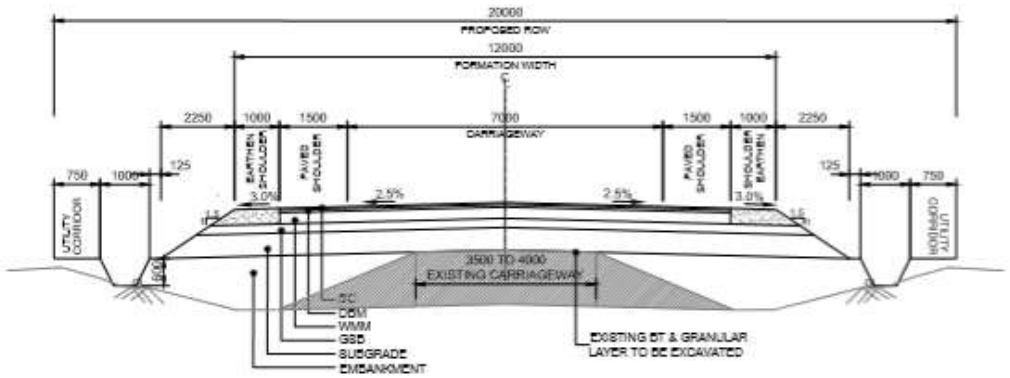
Sl No.	Description	Type of TCS	Length
1	Two Lane with Paved Shoulders Reconstruction (Open Country - Plain Terrain at Embankment up to 1.5m)	TCS1	2.640
2	Two Lane with Paved Shoulders Reconstruction (Built-up Area - Plain Terrain)	TCS2	6.563
3	Two Lane Without Paved Shoulders Reconstruction (Built-up Area - Plain Terrain)	TCS3	2.610
4	Two Lane with Paved Shoulders in Realignment Locations (Open country - Plain Terrain) up to 1.5m Embankment	TCS4	5.770
5	Major Bridge	--	0.070
Total Length (km)			**17.653**

Table 2: Details of Proposed Cross Sections

Element	Width (m)	Total Width (m)
Rural Cross Section-2 Lane with Paved Shoulder (C/S Type 1B and 9)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Earthen Shoulders	2 X 1.00	2
Utility Corridor	2 X 0.75	1.5
Space left for future widening and Unlined Drain	Varies	
Right of Way	20m	
Built up Cross Section-2 Lane (C/S Type 10)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Footpath cum Drain	2 X 1.50	3
Utility Corridor	2 X 1	2
Right of Way	15 m	
Built up Cross Section-2 Lane (C/S Type 11)		
Main Carriageway	1 X 7.50	7.5
Footpath cum drain	2 X 1.50	3
Utility Corridor	2 X 1.00	2
Right of Way	12.5m	
Realignment Cross Section-2 Lane (C/S Type 17)		
Main Carriageway	1 X 7.00	7
Paved shoulder	2 X 1.50	3
Element	Width (m)	Total Width (m)
Earthen Shoulders	2 X 1.00	2
Utility Corridor	2 X 0.75	1.5
Space left for future widening and Unlined Drain	Varies	
Right of Way	20m	

Typical Cross Sections Layout

Design Chainage FROM	Design Chainage TO	Applicable LENGTH
1800	2590	980
2890	3090	180
3360	3550	190
5930	6200	270
8210	8700	490
10050	10210	160
12480	12880	400



TCS: 1 TYPICAL CROSS SECTION FOR TWO LANE WITH PAVED SHOULDERS RE-CONSTRUCTION (OPEN COUNTRY - PLAIN TERRAIN AT EMBANKMENT UP TO 1.5M)

PAVEMENT COMPOSITION (mm)					TOTAL (mm)
BC	DBM	WMM	GSB	SG	
40	60	250	200	500	1050

KEY PLAN

NAME OF WORK

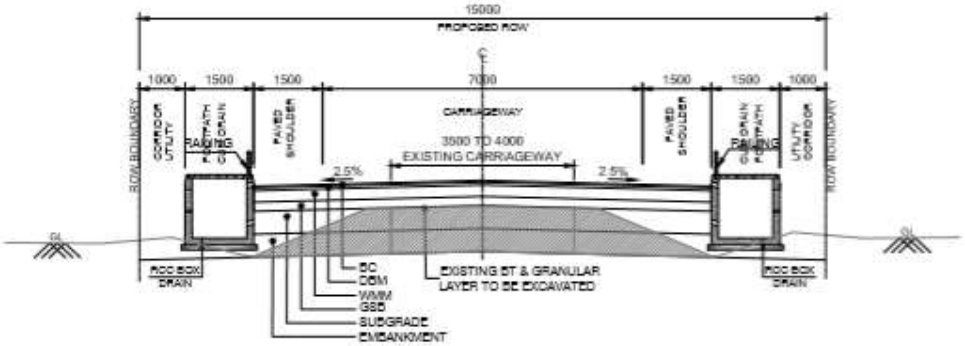
PACKAGE NO.

EMPLOYER

PUBLIC WORKS ROADS DEPARTMENT, GOVT. OF ASSAM

EPC CONSULTANT: FEEDBACK INFRA

Design Chainage FROM	Design Chainage TO	Applicable LENGTH
0	1600	1600
2050	4400	650
6200	6450	250
6450	6580	130
6580	6870	290
6870	7090	220
7090	7270	180
7270	8050	780
9410	10050	640
11850	12480	630
13570	14070	500
14810	14750	140
17300	17653	352.594



TCS: 2 TYPICAL CROSS SECTION FOR TWO LANE WITH PAVED SHOULDERS RE-CONSTRUCTION (BUILT-UP AREA - PLAIN TERRAIN)

PAVEMENT COMPOSITION (mm)					TOTAL (mm)
BC	DBM	WMM	GSB	SG	
40	60	250	200	500	1050

KEY PLAN

NAME OF WORK: IMPROVEMENT AND UPGRADATION OF SARTHEBARI-RAMPUR PATHSALA ROAD UNDER ASOM MALA (PROVISION OF TCS:2 (7+653))

PACKAGE NO:

ENGLOVER

PUBLIC WORKS ROADS DEPARTMENT, GOVT. OF ASSAM

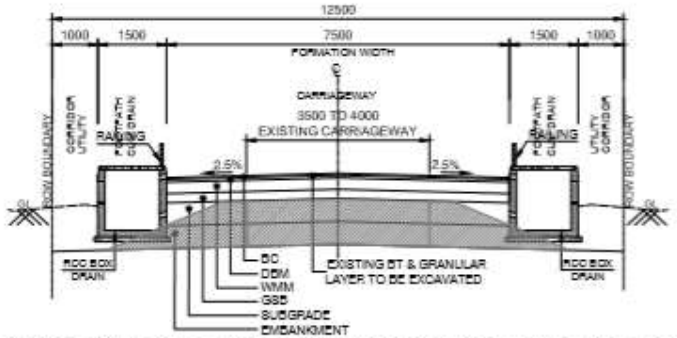
Approved by Competent Authority (Employer/Engineer)

Name: Sign: Stamp/Seal:

IPE CONSULTANT: FEEDBACK INFRA Making Infrastructure Happen

TYPICAL CROSS SECTION TCS-2

Design Chainage FROM	Design Chainage TO	Applicable LENGTH
8700	9410	710
11180	11350	170
11350	11850	500
12880	13370	490
14070	14610	540



TCS: 3 TYPICAL CROSS SECTION FOR TWO LANE WITHOUT PAVED SHOULDERS RE-CONSTRUCTION (BUILT-UP AREA - PLAIN TERRAIN)

PAVEMENT COMPOSITION (mm)					TOTAL (mm)
BC	DBM	WMM	GSB	SG	
40	60	250	200	500	1000

KEY PLAN

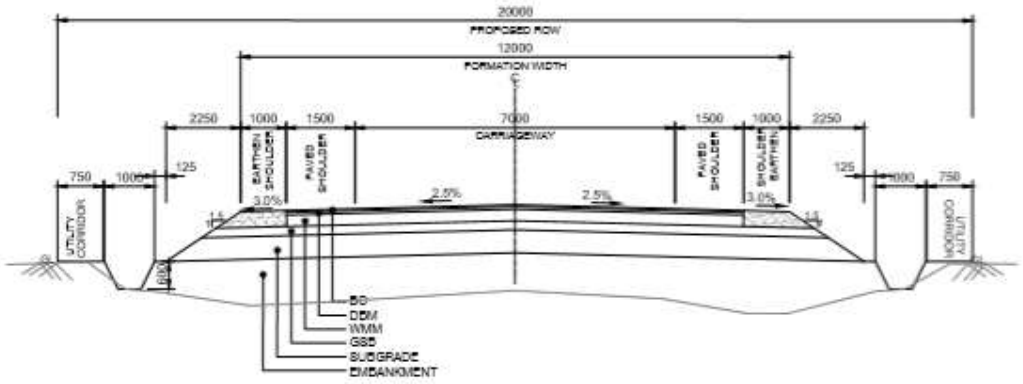
NAME OF WORK: IMPROVEMENT AND UPGRADATION OF SARTHEBARI RAMPUR PATHSALA ROAD UNDER ASOM MALA (PLAIN TERRAIN) (CH. 0+000 TO CH. 17+653)

PACKAGE NO:

EMPLOYER: PUBLIC WORKS ROADS DEPARTMENT, GOVT. OF ASSAM

DPR CONSULTANT: FEEDBACK INFRA

Design Chainage FROM	Design Chainage TO	Applicable LENGTH
2550	2880	330
3060	3360	300
4400	5930	1530
8050	8210	160
10210	10415	205
10485	11180	695
14750	17300	2550



TCS: 4 TYPICAL CROSS SECTION FOR TWO LANE WITH PAVED SHOULDERS IN REALIGNMENT LOCATIONS (OPEN COUNTRY - PLAIN TERRAIN) UPTO 1.5M EMBANKMENT

PAVEMENT COMPOSITION (mm)					TOTAL (mm)
BC	DBM	WMM	GSB	SG	
40	80	250	280	500	1050

KEY PLAN

NAME OF WORK

PACKAGE NO

EMPLOYER

PUBLIC WORKS ROADS DEPARTMENT, GOVT. OF ASSAM

Approved by Competent Authority (Employer/Engineer)

DPR CONSULTANT:

FEEDBACK INFRA

Making Infrastructure Happen

Scale: N.T.S.

TYPICAL CROSS SECTION TCS-4

ANNEXURE 2: GOI/WHO AMBIENT AIR QUALITY STANDARDS

The air quality parameters as per CPCB standard procedure and further recommendation of the World Bank as per direction of Environment Specialist of IE shall be regularly monitored at identified locations from the initiation of the project just after award of job to concessionaire. Ambient air quality shall be monitored in accordance with the National Ambient Air Quality Standards as given in below table.

The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 1.

Table 1: National Ambient Air Quality Standards GOI

Sl. No.	Pollutants	Time-weighted average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Areas (notified by Central Government)	
1	Sulphur Dioxide (SO_2) µg/m^3	Annual*	50	20	- Improved West & Gaeke
		24 hours**	80	80	- Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2) µg/m^3	Annual*	40	30	- Modified Jacob and Hochheiser (Na-Arsenite)
		24 hours**	80	80	- Chemilumiscence
3	Particulate Matter (size less than 10 µm) or PM_{10} µg/m^3	Annual*	60	60	- Gravimetric
					- TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ µg/m^3	Annual*	40	40	- Gravimetric
					- TOEM
		24 hours**	60	60	- Beta attenuation
5	Ozone (O_3)µg/m^3	8 hours**	100	100	- UV photometric
					- Chemilumiscence
		1 hours**	180	180	- Chemical Method
6	Lead (Pb) µg/m^3	Annual*	0.5	0.5	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
		24 hours**	1	1	- ED-XRF using Teflon filter
7	Carbon Monoxide (CO) (mg/m^3)	8 hours**	2	2	- Non Dispersive Infra-Red (NDIR) spectroscopy
		1 hours**	4	4	
8	Ammonia (NH_3) µg/m^3	Annual*	100	100	- Chemilumiscence
		24 hours**	400	400	- Indophenol Blue Method
9	Benzene (C_6H_6) µg/m^3	Annual*	5	5	- Gas chromatography based continuous analyser
					- Adsorption and Desorption followed by GC analysis
10	Benzo(a) Pyrene Particulate Phase only	Annual*	1	1	- Solvent Extraction followed by HPLC/GC analysis

Sl. No.	Pollutants	Time-weighted average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Areas (notified by Central Government)	
	ng/m^3				
11	As ng/m^3	Annual*	6	6	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Ni ng/m^3	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

** Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.*

*** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be compiled 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.*

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or monitoring and further investigation.

Source: MoEF&CC Notification dated 16th November, 2009

WHO IFC Std. of Ambient Air

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]

	Averaging Period	Guideline value in µg/m^3
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM_{10}	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

ANNEXURE 3: INDIAN STANDARD DRINKING WATER SPECIFICATION

Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO, coliform count, total suspended solids, total dissolved solids, Iron, Fluorides etc. shall be monitored at all identified locations from initiation of the project just after award of job to concessionaire as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500:2012, presented in Table 1 & 2 respectively. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 1: Primary Water Quality Standards

S. No.	Designated Best Use	Class of Water	Criteria
1	Drinking Water source (with conventional treatment)	A	Total Coliform MPN/100 ml shall be 50 or less pH between 6.5 to 8.5 Dissolved Oxygen 6 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 2 mg/l or less
2	Outdoor bathing (organised)	B	Total Coliform MPN/100 ml shall be 500 or less pH between 6.5 to 8.5 Dissolved Oxygen 5 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 3 mg/1 or less
3	Drinking Water source (without conventional treatment)	C	Total Coliform MPN/100 ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 3 mg/1 or less
4	Propagation of Wildlife	D	pH between 6.5 to 8.5 for fisheries Dissolved Oxygen 4 mg / l or more Free Ammonia (as N) 1.2 mg/l or less
5	Irrigation, Industrial Cooling, Controlled Waste	E	pH between 6.0 to 8.5 Electrical Conductivity at 25°C µmhos/cm Max. 2250 Sodium absorption rations Max. 26 Boron, Max.2 mg/l

Ref: CPCB (1999). Bio mapping of rivers, Parivesh New Letter, 5 (iv), Central Pollution Control Board, Delhi, PP.20.

Table 2: Indian Standard Drinking Water Specifications: IS 10500:2012

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
Essential Characteristics						
1	Colour, Hazen Units, Max.	5	Above 5, consumer acceptance decreases	15	IS 3025 (Part 4)	Extended to 15 only if toxic substances, in absence of alternate sources.

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
2	Odour	Agreeable	-	Agreeable	IS 3025 (Part 5)	A test cold and when heated. Test at several dilution
3	Taste	Agreeable	-	Agreeable	IS 3025 (Part 7 & 8)	Test to be conducted only after safety has been established
4	Turbidity NTU, Max.	1	Above 5, consumer acceptance decreases	5	3025 (Part 10): 1984	
5	PH value	6.5 to 8.5	Beyond this range the water will not affect the mucous membrane and /or water supply system	No relaxation	IS 3025 (Part 11)	
6	Total hardness (as $CaCO_3$) mg/1, Max.	300	Encrustation in water supply structures an adverse effect on domestic use	600	IS 3025 (Part 21)	
7	Iron (as Fe) mg /l Max.	0.3	Beyond this limit taste/appearance are affected has adverse effect on domestic uses and water supply structures and promotes iron bacteria	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
8	Chlorides (as Cl) mg/1 Max.	250	Beyond this limit, taste corrosion and palatability are affected	1000	IS 3025 (Part 32)	
9	Residual, free chloride, mg/1 Min.	0.2		1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be Min. 0.5 mg/1
Desirable characteristics						
1	Dissolved solids mg/1 Max.	500	Beyond the palatability decreases and may cause gastro intestinal irritation	2000	IS 3025 (Part 16)	
2	Calcium (as Ca) mg/1 Max.	75	Encrustation in water supply structure and adverse effects on domestic use	200	IS 3025 (Part 40)	

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
3	Magnesium (as Mg) mg/1, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	100	IS 3025 (Part 46)	
4	Copper (as Cu) mg/1 Max.	0.05	Beyond taste, discoloration of pipes, fitting and utensils will be caused beyond this	1.5	IS 3025 (Part 42)	
5	Manganese (as Mn) mg/1, Max.	0.1	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures.	0.3	IS 3025 (Part 59)	
6	Sulphate (as 200 So2), mg/1, Max.	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	IS 3025 (Part 24)	May be extended up to 400 provided (as Mg) does not exceed 30
7	Nitrate (as No2) mg/l, Max.	45	Beyond this methemoglobinemia take place	No relaxation	IS 3025 (Part 34)	To be tested when pollution is suspected
8	Fluoride (as F) mg/1, Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	IS 3025 (Part 60)	To be tested when pollution is suspected
9	Phenolic compounds (as C6H5OH) mg/1, Max.	0.001	Beyond this it may cause objectionable taste and odour	0.002	IS 3025 (Part 43)	To be tested when pollution is suspected
10	Mercury (as Hg) mg/1, Max.	0.001	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 48)	To be tested when pollution is suspected
11	Cadmium (as cd), mg/1, Max.	0.003	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 41)	To be tested when pollution is suspected
12	Selenium, (as Se). mg/l, Max.	0.01	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 56)	To be tested when pollution is suspected
13	Arsenic (As) mg/1, Max.	0.01	Beyond this the water becomes toxic	0.05	IS 3025 (Part 37)	To be tested when pollution is suspected
14	Cyanide (as CN) mg/1, Max.	0.05	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 27)	To be tested when pollution is suspected
15	Lead (as Pb), mg/1, Max.	0.01	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 47)	To be tested when pollution is suspected

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
16	Zinc (as Zn) mg/1, Max.	5	Beyond this limit it can cause astringent taste and an opalescence taste and an opalescence in water	15	IS 3025 (Part 49)	To be tested when pollution is suspected
17	Anionic detergents (as MBAS) mg/1, Max.	0.2	Beyond this it can cause a light froth in water	1	Annex K of IS 13428	To be tested when pollution is suspected
18	Chromium (as Cr6+) mg/1, Max.	0.05	May be carcinogenic above this limit	No relaxation	IS 3025 (Part 52)	To be tested when pollution is suspected
19	Poly nuclear aromatic hydra carbons (as PAH) mg/1, Max.	0.0001	May be carcinogenic above this limit	No relaxation	APHA 6440	-
20	Mineral oil mg/1, Max.	0.5	Beyond this limit undesirable taste and odour after chlorination take place.	0.03	IS 3025 (Part 39)	-
21	Pesticides mg/1, Max.	-	Toxic	-	-	-
22	Radioactive material	-	-	-	IS 14194	-
23	Alpha emitters bq/1, Max.	0.1	-	No Relaxation	-	-
24	Beta emitter pci/1, Max.	1.0	-	No Relaxation	-	-
25	Total alkalinity (as $CaCO_3$), mg/l, max	200	Beyond this limit taste becomes unpleasant	600	IS 3025 (Part 23)	-
26	Aluminium (as Al) mg/1, Max.	0.03	Cumulate effect is reported to cause dementia	0.2	IS 3025 (Part 55)	-
27	Boron mg/1, Max.	0.5	-	1.0	IS 3025 (Part 57)	-

Source: Indian Standard Drinking Water Specification – IS 10500:2012

ANNEXURE 4: GOI/WHO AMBIENT NOISE LEVEL STANDARDS

Noise Quality Monitoring

The noise level shall be monitored at designated locations in accordance with the Ambient Noise Quality standards as given in table below.

Table 1: National Ambient Noise Quality Standards

Category of Area / Zone	Limits in dB(A) Leq	
	Day Time	Night Time
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence Zone	50	40

Note: (1) Day time shall mean from 6.00 a.m. to 10.00 p.m. (2) Night time shall mean from 10.00 p.m. to 6.00 a.m. (3) Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority (4) Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

WHO Noise Std.

Table 1: Guideline values for community noise in specific environments.

Specific environment	Critical health effect(s)	L_{Aeq} [dB(A)]	Time base [hours]	L_{Amax} fast [dB]
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility & moderate annoyance, daytime & evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms & pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoor	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music and other sounds through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservations areas	Disruption of tranquillity	#3		

#1: As low as possible.

ANNEXURE 5: GUIDELINES FOR SITING AND LAYOUT OF CONSTRUCTION CAMP

A. Siting

The following guidelines shall be followed while siting the construction camps:

- The construction camps shall be located at least 500 m away from habitation. The living accommodation and ancillary facilities for labour shall be erected and maintained to approved standards and scales.
- Non-agricultural land should be used, as for as possible
- Not within 1,000 m of either side of locations of Forest areas.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

B. Layout

Contractor shall 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 development and maintenance of construction camp. A conceptual layout of a typical construction site has been presented in **Figure-A.** The contractor during the progress of work shall provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the Engineer of IE. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force. Vehicle parking area is to be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly slopped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor.

C. Drinking Water

The contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible. All potable water storage facilities must be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier units shall be installed for providing potable water. As far as possible, shallow wells should not be used as potable source of water. However, if water is drawn from any existing well, irrespective of its location from any polluting sources, regular disinfection of the water source (which may include application of lime, bleaching power and potassium permanganate solution) has to be ensured at weekly/fort nightly interval. All open wells will be entirely covered and will be provided with a trap door to prevent accidental fall and contamination from dust, litter etc. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. A reliable pump will be

fitted to each covered well. A drain shall be constructed around the well to prevent flow of contaminated water into the well from road, camp or other sources.

Contractor's vehicles shall not be allowed to wash in the river / stream / pond. This is to avoid potential pollution from oil residues.

D. Sanitation Facilities

Construction camps shall be provided sanitary latrines and urinals. Adequate number of toilets shall be provided separately for men and women depending on their strength. Sewerage drains should be provided for the flow of used water outside the camp. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly 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 be regularly emptied at designated disposal place in a hygienic manner.

Portable toilets may be brought to use and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

E. Shelter at Workplace

At every workplace, there shall be provided free of cost, four suitable shelter, two for meals and two others for rest, separately for use of men and women laborers. The height of shelter shall not be less than 3 m from floor level to lowest part of the roof. Sheds shall be kept clean and space provided shall be the basis of at least 0.5 m^2 per head.

F. Canteen Facilities

A cooked food canteen on a reasonable scale shall be provided for the benefit of workers wherever it is considered necessary and should generally conform to sanitary requirements of local medical, health and municipal authorities including such precautionary measures as necessary to prevent soil pollution of the site.

G. First Aid Facilities

At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances shall be provided as per the Factory Rules. Workplaces in remote location and far away from regular hospital shall have indoor health units with one bed for every 250 workers. Suitable transport shall be provided to facilitate taking injured and ill persons to the nearest hospital. At every work place an ambulance room containing the prescribed equipment and nursing staff shall be provided.

H. Health Care Facilities

- Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, duty staffs, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.
- The health centre should have MCW (Mother & Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should provide with regular vaccinations required for children.

I. Day Care Facilities

At every construction site, provision of a day care shall be worked out so as to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a hut for use of children under the age of 6 years belonging to such women. Huts shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Hut shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provisions of sweepers to keep the places clean. There shall be two maid servants (or aayas) in the satisfaction of local medical, health, municipal or cantonment authorities. Where the number of women workers is more than 25 but less than 50, at least one hut and one maid servant should be provided to look after the children of women workers. Size of cares shall vary according to the number of women workers employed.

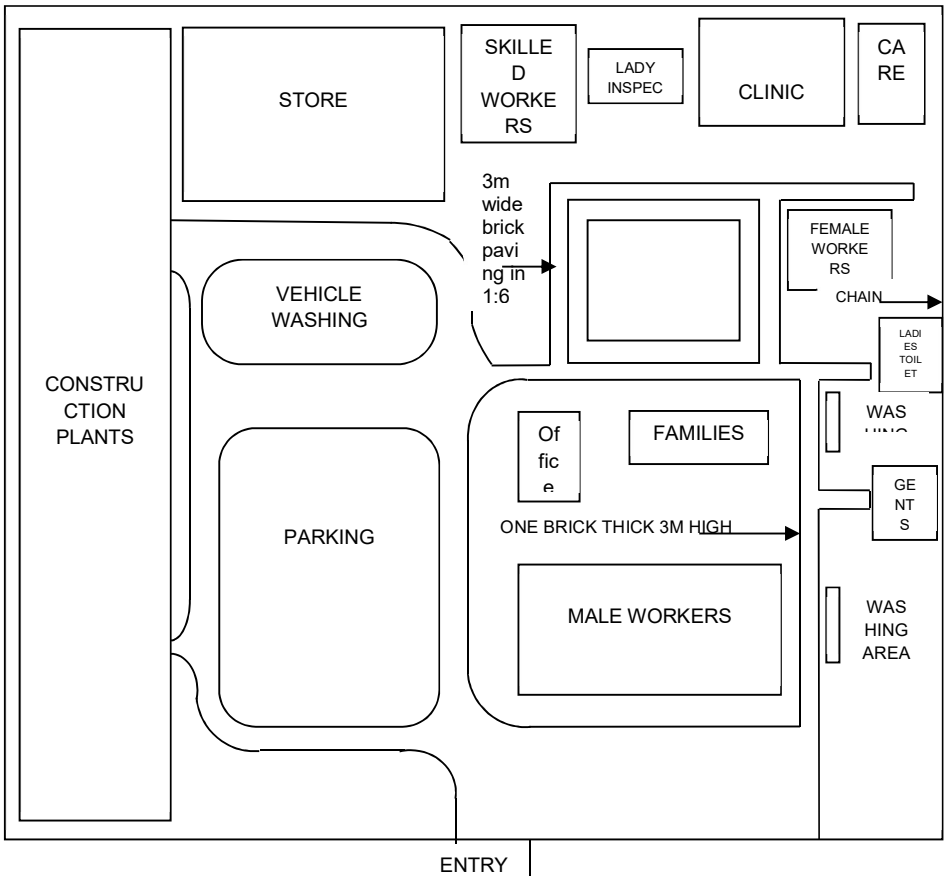


Figure: A Typical Layout of Construction Camp

ANNEXURE 6: GUIDELINES FOR SITING, OPERATION AND RE-DEVELOPMENT OF BORROW AREAS

A. Introduction

Potential sources of earth (borrow areas) for the construction of embankment and subgrade were identified on both sides of project road. The details of proposed borrow areas identified/investigated with their respective locations; corresponding chainages and lead from nearest point to project road shall be filled/maintained as per tabulated below:

Table 1: Location of Proposed Borrow Area

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location/Village Name	Lead from Nearest Point on Project Road (km)
1.	5+000	LHS	Naligaon	0.100
2.	13+000	RHS	Bagana	0.500

However, borrow areas for the project will be finalized by the Contractor. All provisions stipulated in this guideline shall be strictly adhered to. The finalization of all such locations will depend on the approval given by the Environmental Specialist of the Independent Engineer (IE) on technical and environmental grounds. This includes on-site verification by the IE to cross-check the correctness of details provided by the Contractor in the prescribed format. Only after receipt of the written approval from the IE, the Contractor shall enter into a formal agreement with landowner.

B. Siting

The selection of borrow areas shall be based on environmental considerations apart from civil engineering considerations. Environmental considerations dictate that:

- Borrow areas should be located away from human habitation (1 km away) to avoid breeding of mosquitos and other organisms during monsoon when the borrow areas are flooded.
- Borrow areas should be at a distance of about 1.5 km from ecologically sensitive area i.e. Reserve Forest, Protected Forest, Sanctuary, National Park and any archaeological sites
- Borrow areas should be generally on degraded land unsuitable for any productive purpose. Government or community land should be preferred to private land. Productive agricultural land should not as far as possible, be used for borrowing earth and where it is used, the productive topsoil must be stored and reuse.
- Borrow areas should not, as far as possible, obstruct the natural drainage of the ground and bunds and/or boundary drains should be created on their periphery to restore the flow of natural run off.
- Borrow areas should not be selected near sensitive locations such as banks or beds of rivers or channels, which can adversely affect the river hydrology and hydraulics, or along the road or rail embankment, which, apart from threatening the embankment may enhance the severity of accidents if these happen, or close to public structures such as transmission towers whose foundation can be endangered.
- Borrow area sites must be authorized sites. If located on private land, there should be written consent of the owner in the form of lease agreement permitting the use of the land for borrowing earth. If located on government or community land, the permission should be of the appropriate authority.

Avoid locating borrow area close to any road (maintain at least 30m distance from ROW and 10 m from toe of embankment, whichever is higher);

C. Borrow Area Operations

- Excavation in the areas should be planned keeping in view the end use of the borrow area land the shape and dimensions of the area to be excavated from (length, breadth and depth) should be accordingly decided. Generally, the depth of excavation should not be deeper than 2 m from the consideration of safely of the humans or animals against accidental fell into the ditch.
- The eventual slope of the excavation should be 2 (H):1(V) from the consideration of safety of the slopes as well as humans.
- There should be safe access to the earth moving equipment and transport vehicles into the borrow areas
- The approach to the borrow areas from the public or private haul roads should have a reasonable design to withstand the movement of transport vehicles.
- Dust palliation measures should be taken to minimise dust pollution on the approach roads (e.g. watering, spraying of lime or cement slurry or bitumen emulsion, etc.)
- Spillage of materials under transit on to the haul roads or main roads through gaps in the transport vehicles should be guarded against buy plugging such gaps. Similarly, Wind blowing of the materials in transit should be checked by suitable covers.
- Where productive agricultural land is used for borrow areas, the top soil in 150 mm thickness should be scrapped, stock piled and re-used for rehabilitation of borrow areas. At least 10% of the temporary land should be earmarked for stockpiling. The topsoil should be seeded and mulched to cover the slopes, or any degraded area in thickness between 75 -150 mm.

D. Borrow Area Rehabilitation Plan

The borrow area must be rehabilitated after completion of the work and rehabilitation plan should be prepared in advance in consultation with the community. The area shall be restored to a safe and secure area usable to the public enabling safe access and entry to the restored site by filling the borrow pit floor to approximately the access road level. Some indicative rehabilitation measures could be community water storage facility, pisciculture ponds, recreational spots, landscape enhancement, or rehabilitation by re-vegetation of the borrow area. Where re-vegetation is done, it should be ensured that:

- Vegetative cover is established on all affected land
- Topsoil is placed, seeded and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the reclamation phase
- Selection and use of vegetative cover should take into account soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, sufficient to assure a 75% survival rate
- The planning results in 90% ground coverage
- The site should be inspected when the planting is completed and again at one year to ensure compliance whit the reclamation plan

E. Borrow Area Documentation

1) Location reference and potential yield: The information as per the table below should be contained in the documentation:

Sample No.	Name of Village	Material Type	Site identification		
			Nearest Chainage (Km)	Left / Right	Offset from nearest Chainage (m)
1	2	3	4	5	6

Approximate Quantity (Cum)				Available land / Terrain	Surrounding Land / Terrain	Remarks
Length (m)	Breadth (m)	Depth (m)	Total (cum)			
7	8	9	10	11	12	13

2) Land use and vegetative cover (exiting)

- Existing land use (agricultural/barren/scrub/grazing/any other type)
- Vegetation /trees to be removed
- Erosion /degradation potential
- Distance and name of the nearest settlement
- Distance from the nearest surface water body
- Drainage pattern of the area
- Distance of the nearest reserve forest / eco-sensitive area (if any)
- Distance of the nearest sacred tree (if any)
- Distance from the nearest school/hospital/primary health center
- Daily / occasional or avenues for generation of income for adjoining community

3) Borrow area and community features

- Area (in Sq. m)
- Type of Access / width / kutcha / pucca etc. from carriageway
- Soil type
- Slope / drainage characteristics
- Water Table of the area or identify from nearest well etc. /ask people
- Land-use type such as barren / agricultural / gazing land
- Social features of settlement / community and its proximity to
- Present use of the borrow area by the community
- Identification of any other community facility in the vicinity of the borrow pit

4) Plans and photographs

- Borrow area site plans showing the land use, habitation, drainage pattern and structures and other physical features such as access roads, haul roads, existing community facilities (roads, schools, playgrounds, community facilities, religious places etc.)
- Before and after photographs of the borrow areas.

ANNEXURE 7: RE-DEVELOPMENT OF QUARRYING AND STONE CRUSHING OPERATIONS

Guidelines for Siting, Operation and Re-Development of Quarrying and Stone Crushing Operations

A. Introduction

Three stone quarries are identified along the project road section and samples are collected and tested. The materials have been tested to ascertain their suitability for road construction and compliance with the specifications requirements. The sampling locations, name of quarry /village and approximate lead distances from project site shall be maintained as per below table:

Table 1: Location of Stone / Coarse Aggregate Material

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Source and Village Name	Lead From Nearest Point on Project Road (km)	Approx. Quantity
1					
2					

It is therefore suggested to use manufactured sand which can be obtained by crushing the stone at crusher plant itself, in the pavement construction as well as concreting of the structures. Details of identified/investigated locations of sand shall be maintained as per table below:

Table 2: Location of Fine Aggregate Material (Sand)

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location / Village Name	Lead From Nearest Point on Project Road (km)
1				
2				

B. Overview

A quarry is a type of open-pit mine from which rock or minerals are extracted for building materials, such as dimension stone, construction aggregate, riprap, sand, and gravel. Quarrying causes environmental damages like air and noise pollution, water logging etc. and requires permission from regulatory authorities like mining department, state pollution control board etc. It requires a careful approach in the site selection process, scientific method of quarrying and appropriate measures to redevelop it.

C. Criteria for Locating the Site/s

The selection of a quarry is sole responsibility of the contractor and should be undertaken in adherence to the rules & regulations of the authorities. Following criteria should be followed while selecting a quarry site:

- To the extent possible barren land or waste lands shall be preferred during site selection and fertile land and agricultural land shall be avoided.
- There shall be no quarrying of sand in any riverbed or adjoining area or any other area which is located within 500 meters radial distance from the location of any bridge, water supply system, infiltration well or pumping installation of any of the local bodies or Central or State Government

- Department or any area identified for locating water supply schemes by any of the Government Department or other bodies.
- Quarry site shall be located at a minimum distance of 1km from any human settlements and 100 meters from any surface water body / natural drainage channel.
- Locate the quarry and crusher at a min. distance of 1.5 km away from forests / wildlife habitats / ecologically sensitive areas
- Access roads to quarry sites must be wide enough for heavy vehicle movement without inconvenience to local traffic.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Environmental Specialist of the Independent Engineer without which any activity shouldn't be started on the site.

D. Finalization of Selected Site/s

The selected site/s shall be approved by IE and PIU, after considering the compliance with the ESMP clauses. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the IE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

E. Setting up of quarrying and Stone Crusher

Quarrying involves not only extraction of material (rock) but also crushing and screening that makes the rock suitable for use as construction material. Following are the major parameters to be considered before the start of quarrying and stone crushing operations:

Site Preparation

The stripping, stacking and preservation of topsoil will be mandatory and absolutely no activity should be allowed prior to the satisfactory completion of this conservation measure as per guidelines in ESMP. The boundary of the quarry should be demarcated using barbed wire fencing in order to avoid the future dispute over land as well as to avoid accidental trespassing of people. There should be recorded documents of exact no of trees cut. Contour trenches should be dug along the quarry area boundary and at any other appropriate places considering the topography to reduce the surface run off and conserve soil and water. Side slopes shall be constructed with slope drains at applicable locations to provide drainage and avoid any landslides. All the drainage constructed should be linked to existing drainages in order to avoid flooding and water logging.

Setting up of a Quarry Site

The layout of a quarry should provide a gravity flow of material from the face to the crusher, from the crusher to the storage bin and from the bin to the hauling equipment. Adequate arrangements should be made for avoiding fugitive emissions from quarry and crusher premises. This will include:

a. housing the noise and dust producing units of the crusher plant in a building with wall of minimum 23 cm thickness and with suitable roofing
b. control of air pollution through provision of in-built dust extraction systems in the crusher unit and all transfer points
c. a chimney of appropriate height for the DG set (as specified by SPCB)
d. water sprinkling facilities for the camp premises
e. facilities to store water required for 3 days use

Consent to Operate the crusher unit should be obtained from SPCB under Air (Prevention and Control of Pollution) Act, 1981 before starting the operation.

Safety Aspects

- Blasting timings in quarry should be fixed avoiding the rush hours and these timings should be adhered to in order to avoid the conflict between the surrounding communities or population. Provide warning sirens 10 minutes before each explosion as a warning alarm to people in and outside the quarry. Damaged explosives must be disposed-off in a safe manner away from the operational area. Speed of the vehicles around the quarry should be restricted to a low speed in order to reduce the noise pollution and dust generation. Workers should not be exposed to sound of more than 85 – 90 dB for more than eight hours a day and shall be provided with adequate safety wears and personal protective equipment like ear muffs / plugs etc. Fire extinguishers should be provided in the site office.
- Traffic movements should be restricted along the access road around times that children walk to and from school. Proper first aid facilities should be provided within the site office and in case of an accident, quick access to nearby hospital /clinic should be provided.

Facilities for Workers

- Potable drinking water should be provided in the site office in a hygienic environment sufficient for all the people.
- Adequate no. of toilets shall be provided for the workers with adequate water supply, proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honeycomb wall and 75cm thick, 2mm sand envelope around that.
- The sewage system for the camp must be properly sited, designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Waste Disposal

- The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and hazardous wastes in the camps and ensure that these are regularly emptied and disposed-off in a hygienic manner.
- No incineration or burning of wastes shall be carried out by the Contractor.
- The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.
- POL (petroleum, oil and lubricants) waste shall be disposed-off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Quarry areas should be protected from illegal dumping of waste by third parties. The overburden should kept as minimum to maximize the commercial efficiency of the quarry, it can be utilized for creating earth bunds to mitigate the noise and visual impacts and also for the site rehabilitation process.
- No quarry waste shall be dumped within a 100 m either side of the road. The overburden should be reused or disposed properly. Site for overburden disposal should be planned within the quarry site or any other appropriate site.

Training to Workers

- Workers shall be trained in smooth and safe operation of plants and equipment, their regular maintenance and various safety measures to be followed as well as about the need and importance for adherence to these measures.
- All the drivers should be trained about safe driving and should be made aware about the need to observe caution while plying through access roads, especially during the time when children walk to and from school.
- Conduct education programs with the locals regarding the potential impacts of blasting, blasting warning systems, schedules etc.

Information Dissemination

- There should be a sign board of size 6' x 4' mentioning the project details and contractor's details to disseminate the information to the public.
- There should be a second sign board displaying the latest air and noise monitoring data against the standards specified.
- Warning sign boards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken.

Other Mitigation Measures

- The quarry should not damage any building, work, property or rights of other persons.
- The quarry should not alter any right of way, well or tank.
- Roads inside the crusher premises should be tarred or concreted.
- Water course, if any, from a higher slope should be properly drained out.
- Strom water drainage shall be provided to prevent water logging and flooding in and around the area.
- The possibility of collecting the storm water in a pit or a tank should be explored so that it can be reused for dust suppression and the dependence on other water sources could be reduced. If this is not possible, the water should be safely channelled out of the quarry without disturbing any nearby human settlement.
- A register should be provided in the camp site for public to record their grievances if any.
- Environmental monitoring (air, noise, surface & ground water) should be conducted on quarterly basis.
- The concerned authority – IE / PIU should regularly review the environmental, health and safety aspects. If any adverse effect on environment, habitat and concern of safety is noticed, appropriate measures should be taken as suggested by IE or should arrange an alternative for road construction materials.
- In the case of existing quarries and additional quarries, the contractor has to ensure that all actions in these quarries are in compliance with ESMP.

F. Operation of Quarry Site and Stone Crushing Unit

- No quarrying operation shall be done without the approval from the concerned authority.
- The equipment used in quarry should be wear faced, which extends the equipment life and reduce the demand for spare parts.
- Adopt controlled blasting techniques and conduct quarrying in a skillful, scientific and systematic manner.

- All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter.
- Accessory facilities to be provided in the quarry includes sprinklers to spray water for dousing the dust generation, noise suppressers and rubberized mounting to reduce noise and vibration and tarpaulins or covers over material transporting vehicles.
- Provide sufficient water storage facility for 2 days' use.
- Measures have to be taken to reduce the dust generation during drilling operation. Deep wetting of drilling zones also to be done by water sprinkling and drilling machine shall be fitted with dust suppression, collection and disposal arrangements.
- To avoid spillage of fuel and lubricants, the vehicles and equipment should be properly maintained and repaired. Maintenance should be carried out on impervious platforms with spill collection provisions.

Following conditions regarding sound generation should be complied with in a quarry / crusher unit:

- The sound level (L_{eq}) measured at a distance of 1 m from the boundary of the site shall not exceed 55 dB(A) during daytime (6 a.m. to 6 p.m.) and 45 dB(A) during night time (6 p.m. to 6 a.m.).
- The DG set shall be provided with exhaust muffler /acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A) and its emission levels should be within relevant SPCB guidelines.
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.

G. Quarry Management Plan

Quarry Management Plan shall be documented as follows for each quarrying sites:

Sl. No.	Item	Unit	Details
1.	Name / identity of the location		
2.	Nearest project road Chainage		
3.	Name of the owner		
4.	Area involved	m^2	
5.	Existing land use (verification from land records with Revenue Dept.)		
6.	Land use of the area surrounding the proposed site including a Map		
7.	Access Roads – existing conditions, proposed development and maintenance		
8.	Tree cutting and vegetation clearance if any, along with compensation measures	Nos.	
9.	Arrangement with the owner (agreement with land owner should be attached as an annexure)		
10.	Quantity of material to be quarried	Cum	
11.	Machinery and equipment to be used		
12.	Copy of the Consents to Establish and Operate should be attached as an annexure		
13.	Copy of the license from Mining and Geology, Police and Fire Department		
14.	Conditions laid down in the clearances / licenses and plans to ensure compliance		
15.	Information on whether or not the quarry shall be closed under this project. If yes, the proposed closure and restoration plan.		

Sl. No.	Item	Unit	Details
16.	Concern of the local people living in the immediate / near vicinity (through dialogue / consultation)		
17.	Photographs showing before and after conditions as well as during operations at regular intervals		
18.	Quarry Site Plan		
19.	Quarry Operation Plan		
20.	Quality Plan		
21.	Safety Plan		
22.	Waste Management Plan		
23.	Restoration and Rehabilitation Plan		
24.	Monitoring Plan		

H. Redevelopment of Quarry Area

The main objective of the redevelopment of quarries is to make the area safe and secure place and adapt it to a suitable land use like leisure place or fishing place etc. which is suitable for the physical environment as well as for the community around. Along with the preparation of quarry and crusher management plan the contractor should also prepare a re-development plan, which will be submitted for approval to IE who in turn will be responsible for approving and monitoring these plans. The restoration plan should indicate following points:

- List of structures to be demolished and list of the cleanup activities that needs to be undertaken.
- Presence of facilities that could be put in use by the landowner if it is a leased out private land or community in case of a public property
- The proposed use of the quarry site with a layout plan showing the proposed facilities / improvement measures, list of local plant species that could be planted etc.
- Photographs of the site before and during the quarrying process

Possible re-development options include the following:

- Re-vegetation of the quarry to merge with surrounding landscape with reuse of topsoil mixed together with farm yard manure.
- Development of exhausted quarries as water bodies, where the quarry pit is developed into pond or a rainwater harvesting structure
- Pits created as a result of blasting could be filled with over burden which are removed and stockpiled in other areas or with construction debris. Topsoil should be spread back and trees should be planted along the boundary.
- Tree plantation wherever possible depending on the proposed use, erosion control measures etc. should be taken up as part of the redevelopment plan.

I. De-mobilization of the Site

- The contractor should clear all temporary structures; dispose all building debris, garbage, night soils and POL waste as per the approved debris management plan.
- All disposal pits or trenches should be filled in, disinfected and effectively sealed off.
- Once the re-development plan is implemented and the site is restored, the same should be intimated to IE by the contractor.
- The IE shall ensure that all clean-up and restoration operations are completed satisfactorily, and written approval is given to the contractor before the 'works completion' certificate is issued / recommended.

- The PIU shall ensure through site inspection that the Contractor and IE have complied with all these provisions.
- The site can then be handed over to the concerned owner or local bodies or for local communities.
- Certification / documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEXURE 8: GUIDELINES FOR SITING AND MANAGEMENT OF DEBRIS DISPOSAL SITE

A. Overview

Construction of highways generates huge quantity of building debris which needs to be disposed off in previously identified sites suitable for such an activity. This process entails scrutiny of the sites with respect to their location and this section details out the criteria to be followed in doing so. Moreover, it also guides the contractor as to how to prepare the site without causing much impact on the surrounding environment.

B. Criteria for Locating the Site/s

The locations of debris disposal must be selected such that:

- The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities.
- Debris disposal site should be at least 200 m away from surface water bodies.
- No residential areas should be located downwind side of the site.
- The site should be minimum 1000 m. away from ponds / lakes or other water bodies, protected areas, forests, wildlife habitats, ecologically sensitive areas, seasonal streams, rivers, canals, flood plains, educational institutions, medical centers, religious sites, cultural or heritage sites and play grounds.
- The local governing body and the community should be consulted while selecting the site.
- The selected site should meet with the local regulatory requirements (including those of SPCB, Municipalities etc.).
- The site should preferably be owned by government so that there is no need to acquire the land for the same.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Sr. Environmental Specialist of the Independent Engineer. Any activity on the site can be initiated only after obtaining permission form the IE.

C. Finalization of Selected Site/s

The selected site/s shall be approved by Environmental Specialist of the Independent Engineer and PIU, after considering compliance with the ESMP clauses and this guideline. No agreements or payments shall be made to the landowner/s prior to receipt of a written approval from the IE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

D. Disposal Site Management Plan

The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Debris Disposal Site Management Plan comprising the following details:

- ***Details of site:*** Copy of approved site identification report along with location plan on a village map showing the site, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.
- ***Arrangements within the Camp:*** A layout plan showing the existing trees, green belt, locations were contour trenches should be dug etc.

- ***Mitigation Measures:*** Measures will be undertaken as per the ESMP while preparing the site and dumping the waste should be separately listed out.
- ***Other details:*** Any other relevant details like copy of approvals / clearances obtained, species wise no. of trees to be cut and the details of topsoil to be removed and conserved like quantity, location of storing etc. shall also be provided. All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided wherever necessary. The debris site management plan should be submitted to the IE for a written approval before any physical work is undertaken. The IE will carefully examine the proposals considering the various ESMP and regulatory provisions and provide suggestions, as necessary to the contractor who will implement it within the stipulated time period.

E. Setting up of Debris Disposal Site

Following steps has to be undertaken while setting up a debris disposal site:

- Top soil conservation has to be undertaken as per the guidelines given in ESMP.
- Considering the topography of the site contour trenches should be made along the site boundary to prevent soil erosion.
- Fencing should be provided for the debris disposal site to prevent trespassing of humans and animals into the area as well as to prevent spread of the waste material through action of wind, water, scavengers or rag pickers.
- No of trees cut should be recorded and three times the same should be planted as green belt development or elsewhere as part of the project.
- Provide proper drainage facility so that the runoff from the site doesn't contaminate any nearby surface water sources.

F. Redevelopment of Debris Disposal Site

Along with the format seeking permission / approval for the disposal site / location from the Independent Engineer, the contractor shall also submit a rehabilitation plan for the area. Following points have to be kept in view while undertaking the rehabilitation measure:

- The dump sites shall be suitably rehabilitated by planting local species of shrubs and other plants.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the reclamation phase
- Selection and use of vegetative cover should consider soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department.
- The vegetative cover is acceptable if within one growing season of seeding
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, enough to assure a 75% survival rate
- The planning results in 90% ground coverage
- Rehabilitation can also include conversion into farmland, playground, parking area, block plantation area etc.
- Care should always be taken to maintain the hydrological flow in the area.

ANNEXURE 9: GUIDELINES FOR PREPARING COMPREHENSIVE WASTE MANAGEMENT PLAN

A. Overview

A comprehensive waste management plan shall be prepared by the contractor prior to initiation of any works. The purpose of the plan is to provide standardized procedures for the clearance, removal and disposal of waste generated during the construction work as well as to establish the most efficient and cost-effective methods to resolve waste disposal issues.

B. Preparation of Comprehensive Waste Management Plan

The Contractor should prepare a Comprehensive Waste Management Plan to be submitted to Sr. Environmental Specialist of the Independent Engineer for approval prior to setting up of construction and labour camp and it should comprise the following details:

- Categorization of waste into degradable, biodegradable and hazardous categories and list out different types of waste that falls in each of these categories
- Estimates about the quantity of waste generated in each category and type of storage units required.
- Detail the provisions for storage and handling of waste until disposed. A plan of the respective camps / areas like construction camp, labour camp etc. to be attached indicating the space allocated for storage and handling of wastes.
- Detail the precautions to be taken while storing, handling and disposing each type of waste, trainings to be imparted to workers to create awareness about waste management.
- Details of each debris disposal site
- Copy of approved site identification report along with location plan on a village map showing the waste disposal sites, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use (like residences, agricultural land, water bodies etc.), photograph of the site showing the topography and other existing features.
- All staff and workers involved in the highway construction should be imparted training about comprehensive waste management plan including the need for such a plan, its components and measures adopted by the contractor for implementing it. In addition, all personnel involved should be made aware about various steps and measures each of them has to follow so as to ensure the compliance to the comprehensive waste management plan.
- Precautions to be adopted during disposal of waste material

The contractor shall take the following precautions during transportation and disposal of waste material:

- A register should be kept for recording the details of the waste generated and their disposal.
- The pre-designated disposal sites should be a part of Comprehensive Solid Waste Management Plan and should be identified prior to initiation of any work on a particular section of the road.
- The contractor will take full care to ensure that public or private properties are not damaged/ affected during the site clearance for disposal of debris and the traffic is not interrupted.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the contractor will immediately remove all such waste material/s and restore the affected area to its original state to the satisfaction of Sr. Environmental Specialist of the Independent Engineer.

- Contractor should ensure that any spoils / materials unsuitable for embankment fill shall not be disposed off near any water course; water body; agricultural land; flood plains, forests etc. pasture; eroded slopes; and in ditches, which may pollute the surrounding.
- Contractor should ensure effective water sprinkling during the handling and transportation of materials where dust is likely to be created.
- Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.

C. Waste Disposal in Construction Camp

- Concrete flooring and oil interceptors should be provided for hot mix plant area, workshops, vehicle washing and fuel handling area.
- POL (petroleum, oil and lubricants) waste shall be stored safely in separate containers and should be disposed-off by transfer only to recycler / re-refiners possessing valid authorization from the State Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Water separated and collected from oil interceptor should be reused for dust suppression.
- There should be a register to record the details of the oil wastes generated at the workshops and oil storage areas.
- The Contractor will provide separate garbage bins in the camps and ensure that these are regularly emptied and disposed-off in safe and scientific manner as per the Comprehensive Solid Waste Management Plans approved by the IE.
- No incineration or burning of wastes shall be carried out.
- Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or will be sold / given out for recycling.
- Septic tank must be provided for toilets and the sludge should be cleared by municipal exhausters.

D. Waste Disposal in Labour Camp

- The Contractor should provide separate garbage bins in the camps for bio-degradable, non-biodegradable and domestic hazardous waste and ensure that these are regularly emptied and disposed off in safe and scientific manner.
- The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site to avoid smell and pests. The contractor may use the compost from such wastes as manure in the plantation sites.
- Noon-biodegradable waste like discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, metal containers, strips and scraps of metal etc. and other such materials shall be either reused or should be sold /given out for recycling.
- **No incineration or burning of wastes should be carried out.**
- Effluent treatment system like septic tank with soak pits provided for toilets should be sited, designed, built and operated in such a way that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.
- Soak pits must be provided to collect wastewater from bathrooms and kitchen.

E. Disposal of Bituminous Waste

- The bituminous waste should be used for development of roads inside the construction camps, haul roads or for filling potholes in rural roads.
- Non reusable bituminous waste to be dumped in 30 cm thick clay lined pits with the top 30 cm layer covered with good earth for supporting vegetation growth over a period only after obtaining approval of Sr. Environmental Specialist of the Independent Engineer.
- The Contractor will suitably dispose-off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of Sr. Environmental Specialist of the Independent Engineer.
- Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies.

ANNEXURE 10: GUIDELINES FOR TOP-SOIL CONSERVATION AND REUSE

Guidelines for Top-Soil Conservation and Reuse

1. The top soil from all sites including road side widening and working area, cutting areas, quarry sites, borrow areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse.
2. At least 10% of the temporary acquired area for construction purposes shall be earmarked for stockpiling of fertile topsoil
3. The locations for stacking will be pre-identified in consultation and with approval of Environmental Specialist of the Independent Engineer.
4. The following precautionary measures will be taken by the contractor to preserve the stockpiles till they are re-used:
   - Slop of the stockpiles should not exceed 1:2 (vertical to horizontal), and height is restricted to 2m to retain soil and allow percolation of H2O.
   - The edges of pile should be protected by silt fencing and allow percolation of water, which will help to retain soil
   - Multiple handling kept to a minimum to ensure that no compaction occurs.
   - Stockpiles shall be covered with empty gunny bags or will be planted with grasses to prevent the loss during rains.
5. Such stockpiled topsoil will be utilized for
   - Covering reclamation sites or other disturbed areas including borrow areas (not those in barren areas).
   - Top dressing and raising turfs in embankment slopes
   - Filling up of tree pits
   - For developing median plantation
   - In the agricultural fields of farmers, acquired temporarily that needs to be restored.
6. Residual topsoil, if there is any, shall be utilized for the plantations works along the road corridor. The utilization as far as possible shall be in the same area from where topsoil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by the Environmental Specialist of the Independent Engineer.

ANNEXURE 11: GUIDELINES ON SLOPE STABILIZATION

A. Introduction

Erosion Control on roads is fundamental for the protection of water quality. Soil stabilization and erosion control practices are needed and should be used in areas where soil is exposed. Bare ground should be covered, typically with grass seed and some form of matting or mulch. This will help prevent erosion and subsequent movement of sediment into river, streams, lakes and ponds. This movement of sediment can occur during and after road construction. Erosion control measures need to be implemented immediately following construction and every time an area is disturbed.

B. Soil Erosion Control

Soil erosion is the process of detachment and transportation of soil particles by wind, water principally. Normally non-cohesive soil particles are blown away by wind erosion. The kinetic energy of falling raindrops causes detachment of soil particles and subsequently carried away by surface run-off. Erodibility co-efficient of soil and impact of raindrops are determinant factors in the process. This is guided by the nature of soil (clay content), particle size distribution and soil condition like saturation, density, permeability, plasticity etc. Dislodged soil particles flow down the slope with the overland flow, eroding and destabilizing the soil-body. When the intensity of rainfall increases surface run-off velocity accelerates and facilitates carriage of subsequent particles and ultimately results in disorders in the form of rill to gully and finally to erosion ditches. These disorders will impair slope stability worst if not controlled with proper protective measures.

Ground cover is considered as the most suitable solution for erosion protection. Tress, grass and other plant species are natural soil-binders and provide the best natural solution against erosion. In bio-engineering, plants have mainly two functions viz. hydrological and mechanical. Hydrological effects of plants are many such as interception (rain drops strike the leaves first before striking the ground soil), storage (leaves and stems hold water for some time before it eventually reaches the ground), infiltration (stems and shoots roughen and loosen the ground, enabling water to infiltrate more easily) etc. Mechanical function of plant is to reinforce the soil by binding the loose soil particles with its fibrous root system.

Bio-engineering is the technique of utilizing vegetation in addressing geotechnical problems. Environmental uncertainties are prompting engineers to favour bioengineering measures. Vegetation as an aid to artificial methods in controlling surficial soil erosion is gaining larger acceptability among engineers all over the world. Growth of appropriate vegetation on exposed soil surface is facilitated by use of natural geotextiles such as **Coir Geotextiles**. Properly designed Coir Geotextiles laid on slopes or any other exposed soil surface provides a cover over exposed soil lessening the probability of soil detachment and at the same time reduces the velocity of surface runoff, the main agent of soil dissociation. Natural geotextiles bios-degrade quicker than man-made counterpart but facilitate growth of vegetation quicker and better due to its inherent characteristics. Road slope stabilization can range from allowing **native grass (Vetiver grass)** to re-establish on a disturbed slope to building an engineered wall.



Coir geo-textiles specifications: Grade I- 400g/m²

C. Role of Coir Geotextile in Slope Stabilization

Coir is a biodegradable organic fibre material which is coarse, rigid and strong. The constituents of coir have been found to be mostly cellulose and lignin. Coir fibre is weather resistant and resistant to fungal and bacterial decomposition. The rate of decomposition of coir is much less than any other natural fibre. These characteristics are attributed due to the high lignin content in the fibre. Coir in the form of woven mesh mattings or non-woven stitch bonded blankets are used in engineering applications in the geotechnical field. Due to growing awareness to preserve environment, use of biodegradable natural material has gained popularity. The natural fibre, coir, which has been used in geotextiles for the past 20 years, has already proved its worth.

Coir geotextiles are made from coconut fibre extracted from the husk of coconut. Like other polymeric counterparts, coir geotextiles are developed for specific application in civil engineering like erosion control, ground improvement, filtration, drainage, riverbank protection, road pavements, slope stability etc. This biodegradable and environment friendly material is virtually irreplaceable by any of the modern synthetic substitutes.

Coir geo-textiles specifications: Grade III-900gm/m^2



Coir geo-textiles specifications: Grade II-700gm/m^2



❖ **<u>Advantages of Coir Geotextile</u>**

- The high tensile strength of coir fiber protect steep surface from heavy flows and debris movement
- It can withstand considerable pedestrian movement and vehicular traffic without deterioration
- Easy to install and huge contour of the soil surface due to its heavy weight and ability to absorb water

- Totally Biodegradable, 100% natural
- Water absorbent, thus act as mulch on the surface and as a wick in the soil mantle
- Environmentally friendly and aesthetically pleasing and nonpolluting
- Provides excellent microclimate for plant establishment and healthy growth
- The thick and protruding fibers from the yarn render an extra protection against soil erosion and Provide roughness to the surface floor and hold the soil particles in place.
- The coir geo textile gives the grass plenty of room to grow and at the same time provides large number of "CHECK DAMS" per square meter of soil media
- During the manufacturing process of coir yarn, non-chemicals are used
- Holds the seeds and saplings in place
- Allows sunlight to pass through

Coir Geotextile is laid on the shoulder and slope surface helped retain the soil particles and prevented detachment of soil particles from the prepared slope. Establishment of vegetation ensured stabilization of the soil on the slope surface. It is a bio-degradable natural geotextile, can conveniently be used for controlling surface soil erosion and help growth of vegetation as a bio-engineering measure. After biodegradation coalesces with the soil and adds nutrient to the soil and fosters growth of vegetation.



Coir Mesh 400 gsm



Coir Geo-textile laid on the Embankment

Role of Vetiver Grass in Slope Stabilization

Vetiver grass (Chrysopogon zizanioides) **is native to India.** It has been shown to be a simple and economical method to conserve soil by slowing the velocity of water and trapping sediment, filtering out nutrients, and stabilizing steep slopes. In western and northern India, it is popularly known as khus. Several aspects of Vetiver make it an excellent erosion control plant in warmer climates:





- Vetiver grass does not have stolons or rhizomes. It's massive finely structured root system that can grow very fast; in some applications rooting depth can reach 3 to 4m in the first year. This deep root system makes Vetiver plant extremely drought tolerant and difficult to dislodge by strong current.
- Stiff and erect stems, which can stand up to relatively deep water flow
- Highly resistance to pests, diseases and fire
- A dense hedge is formed when planted close together acting as a very effective sediment filter and water spreader
- New roots grow from nodes when buried by trapped sediment. Vetiver will continue to grow up with the deposited silt eventually forming terraces, if trapped sediment is not removed.
- Tolerance to extreme climatic variation such as prolonged drought, flood, submergence and extreme temperature from -14°C to +55°C
- Tolerance to wide range of soil pH from 3.3 to 12.5 without soil amendment
- High level of tolerance to herbicides and pesticides
- Highly efficient in absorbing dissolved nutrients such as N and P and heavy metals in polluted water.
- Highly tolerant to growing medium high in acidity, alkalinity, salinity and magnesium
- Highly tolerant to Al, Mn and heavy metals such as As, Cd, Cr, Ni, Pb, Hg, Se and Zn in the soils
- As typical tropical grass, Vetiver is intolerant to shading. Shading will reduce its growth and in extreme cases, may even eliminate Vetiver in the long term. Therefore, Vetiver grows best in the open and weed free environment, weed control may be needed during establishment phase. On erodible or unstable ground Vetiver first reduces erosion, stabilizes the erodible ground (particularly steep slopes), then because of nutrient and moisture conservation, improves its microenvironment so other volunteered or sown plants can establish later. Because of these characteristics Vetiver can be considered as a nurse plant on disturbed lands





Vetiver Grass used for Slope Stabilization in Bridge ↑ & Road ↓ Embankment

- Vetiver is useful to treat pollution due to its capacity to quickly absorb nutrients and heavy metals, and its tolerance to elevated levels of these elements. Although the concentrations of these elements in Vetiver plants is often not as high as those of hyper-accumulators, it's very fast growth and high yield allows Vetiver to remove a much higher volume of nutrients and heavy metals from contaminated lands than most hyper-accumulators.
- When planted closely together, Vetiver plants form dense hedges that reduce flow velocity, spread and divert runoff water and create a very effective filter that controls erosion. The hedges slow down the flow and spreads it out, allowing more time for water to soak into the ground.
- Acting as a very effective filter, Vetiver hedges help to reduce the turbidity of surface run-off. Since new roots develop from nodes when buried by trapped sediment, Vetiver continues to rise with the new ground level. Terraces form at the face of the hedges, this sediment should never be removed. The fertile sediment typically contains seeds of local plants, which facilitates their re-establishment.



D. Cost Analysis

Cost of slope stabilization using Coir Geo-textile and Vetiver Grass is **Rs. 450/- per square meter**, which includes coir geo-textiles (erosion control blanket) 600 to 700 GSM woven or non-woven type (inclusive of transportation to site), GI hooks of 4 mm diameter U-Shaped point sharp edges of 300 mm length, installation charges, coir mat spreading, cutting, seeds mix broadcasting, over lapping, watering for 7-9 days twice per day and after complete installation of work get the quality certification from the authorized technical agency.



Planting Vetiver Grass on Coir

Vetiver Grass after 15-20 days of Plantation





Vetiver Grass after 60-90 days of Plantation

ANNEXURE 12: GUIDELINES FOR STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS SUBSTANCES

A. Handling Hazardous Substances (including Chemicals)

- As far as practicable the hazardous materials will be stockpiled under proper mechanical loading, unloading and stacking aided by manual labour where necessary.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically and store accordingly after proper labeling.
- Stock taking of all hazardous will be mandatory together with enforcement of manufacturer's or supplier's safety standard/s and drill exercises.
- New and less known chemicals and building materials, for which toxicological studies are wanted, need to be properly evaluated prior to their inclusion in the materials list.
- All containers should be clearly labeled to indicate contents.
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- Ensure use of correct personal protective equipment before allowing workers to handle chemicals.
- When opening containers, ensure holding of a rag over the cap / lid or use of safety gloves, as some volatile liquids tend to spurt up when released.
- Eye fountain, emergency shower and breathing apparatus should be available near the workplace.
- Ensure immediate medical attention in case of spill / splash of a chemical.
- Safety instructions for handling emergency situations shall be displayed prominently at both the storage and use locations.

B. Refueling / Maintenance procedure

- Truck or suitable containers will bring in all fuel and fluids. There will be no storage of fuel, oil or fluids within 200m of a water line.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal facilities;
- Following re-fueling and maintenance, the absorbent blankets (if any) and spill pans will be picked up and the fuel truck or container moved outside of the 200m wide area.

C. Emergency Spill Procedure

The applicable emergency spill procedure as outlined below and / or as directed by the manufacturer / supplier shall be followed:

Spill Procedure (inside the stream)

In the case of a spill, overflow or release of fluid into the stream waterway (whether water is flowing during the spill or not), do what is practical and safely possible to control the situation, then get help.

1) Stop the flow

- ✓ Stop the release into the stream waterway
- ✓ Shutdown equipment
- ✓ Close valves and pumps
- ✓ Plug hoses

2) Remove Ignition sources

- ✓ Shut off vehicles and other engines
- ✓ Do not allow tiger torches, 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)

3) Contact the Environmental Officer and initiate emergency response

- ✓ Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- ✓ The Environmental Officer 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 Engineer through his designated Environmental Officer
  - ❖ The Client
  - ❖ Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.
  - ❖ Site safety Officer

4) Cleanup and Disposal

- ✓ Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment.

5) Reporting

- ✓ The Contractor's Environmental Officer will document the event and submit repots to the Engineer, the client and appropriate regulatory agencies like the Pollution Control Board.

6) Procedure Review

- ✓ The Engineer will review the report, determine if changes are required to be incorporated in the plan of activity under the revised guidelines and recommendation/s that have been suggested by the technicians / manufacturer / supplier / fire brigade / SPCB / Environment Expert of the PIU, as the case may be.

Spill Procedure (on Land)

In the case of a spill, overflow or release fluid onto land, do what is practical and safety possible to control the situation and then get help.

1) Stop the flow

- ✓ Stop the release into the waterbody
- ✓ Shutdown equipment
- ✓ Close valves and pumps
- ✓ Plug hoses

2) Remove Ignition sources

- ✓ Shut off vehicles and other engines
- ✓ Do not allow tiger torches, 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)

3) Contain the Spill

- ✓ Dike around the spill to contain the material
- ✓ Spread absorbent or place a spill blanket on the spill
- ✓ Enlist the help of personnel on site
- ✓ Notify your supervisor as soon as possible

4) Notification

Appropriate parties to be notified of the spill are

- ✓ The Contractor's Project Manager
- ✓ The Engineer through his designated Environmental officer
- ✓ The Client
- ✓ Regulatory Agencies like Pollution control Board, Municipal Authorities, as applicable
- ✓ Site Safety coordinator

5) Cleanup and Disposal

- ✓ The Engineer's Environmental officer will ensure that a proper cleanup and disposal method is determined. Absorbent pads will soak up the spilled material. The pads will be contained and removed from site for disposal at a licensed (authorized) facility.

6) Reporting

- ✓ The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution control Board(s)

7) Procedure Review

- ✓ The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes.

ANNEXURE 13: SAFETY MANAGEMENT PLAN

In order to ensure worker's safety while undertaking various operations / stages of construction many safety measures needs to be followed, which are listed down below:

A. Tree Felling

- Use hard hats during tree felling
- Ensure safe use and storage of tools such as axes, power chain saw, hand saw of different types, HDPE ropes of approved thickness to drag felled trees and logs.
- Keep the saw blades in proper lubrication and sharpened state for efficient workability.
- Determine proper foot and body position when using the implements for felling, cutting and dragging.
- Wear appropriate foot protection
- Avoid cutting overhead branches
- Keep first aid kits ready at the site.
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines, buildings, vehicles and domestic cattle that may create unsafe work situations.
- Prior to felling, determine the safest direction of fall and orient fixing of ropes and cutting positions accordingly.
- Determine the proper hinge size before directing the fall.
- Keep machineries and workers ready for speedy removal of the tree from the main traffic movement area.
- Keep flag men and warning signal signage at either end of felling area to control movement of traffic and warn passers-by

B. Plant Sites, Construction Camp and Quarry Areas

- Install perimeter fencing
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit, as necessary
- Provide adequate space / area for loading and unloading, storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous locations
- Provide areas for collecting garbage and other waste material, and also arrange for their regular / periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities
- Provide defined access roads and movement areas within the site
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers
- Provide and enforce use of PPE at plant and quarry sites

C. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water
- Keep all walkways and circulation areas clear and unobstructed at all times

- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these should be collected immediately
- Use metal bins for collection of oily and greasy rags
- Stack raw materials and finished products out of walkways
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fittings clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people
- Store all flammable materials in appropriate bins, racks or cabinets with proper cover and labels as required for various products
- Make sure that hazardous / dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures.
- Display 'no smoking' signs in areas with high risks of fire, (e.g. near fuelling areas, diesel /oils / lubricant /paint storage area, hessians, rubber, wood and plastic etc.) in and around working area

D. Safety during Excavation

- The risk of accidents involving people and vehicles remains high in excavated sites. All pits or excavations shall to be barricaded to warn the road users and residents and to avoid any unauthorized entry of persons, children, domestic cattle or wildlife. For deep excavations and culvert construction sites, painted GI sheets, delineators, lamps (as required) and retro-reflective signage shall be used.
- Excavation more than 1.5 m is to be done in steps of minimum 500 mm offsets with plank and stuttering support, as required under contract clauses.
- For excavation in slippery or water logged area, try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping.
- For excavation for drain, the area should be properly barricaded with sign boards and illumination / lamps for night time safety. In congested stretches, watchmen / guards can also be placed for vigil.
- Snake bites or Scorpion stings during excavation - in areas with vegetation, tall grasses and forest cover, the contractor shall provide the labour with gum boots and gloves. He shall also make snake antidotes available on site. Emergency vehicles should also be kept ready to rush the patient to the nearest hospital.

E. Safety during Some Typical Construction Work

Centering and Scaffolding

- Many a times ballies joined together give away due to weak joints. Use of metal scaffolding and centering plates with metal fasteners are the safest and highly recommended materials for use in all road construction works for ensuring safety, stability and casting of structures. All such scaffolding should be placed on a firm and a level base on the ground for ensuring stability. No wooden scaffolding or bamboo scaffolding is to be used for any casting of heavy (RCC) structural construction as the risk to safety of workers is higher.

- Railings are to be provided along working platforms and ladders for better safety. Nets shall be hung below the scaffolding or structures where work is on-going to prevent fall of debris, stones, bricks, equipment and other heavy to retain soil objects and even workmen, which could be fatal.

Form-work for small/light beams and slabs

- The collapse of bottom of the beam that may bring down the slab as well is a risk in such operations, which may injure the labour or supervision staff. Slender ballies without bracing are not be allowed for such works. No concreting should be allowed without bracing at 300 mm above ground and at midway for normal beams and slabs. The bracings should be for the support of beams as well as the slabs.
- Direct ballies support from the ground and the practice of tying planks with binding wire to the steel reinforcement shall not be allowed. A temporary railing and properly based working platforms along the periphery of slab reduces risk to the life of labour and supervision staff.

Dismantling of Scaffoldings

- Dismantled materials may fall on passer-by and workers. Workers could also get injured during the removal of such materials. Prior to dismantling of scaffoldings / working platforms, the area of operation should be closed for all outsiders. No one should be allowed within 50 m. from the place of demolition.
- Helmets, safety belts and other PPE must be worn by all the workers engaged in such a work. This work requires careful handling by an experienced supervisor / work force and should be executed with utmost caution. Gradual dislodging and use of PPE is required.

Column Reinforcements

- The tendency of bar-benders is to tie the vertical steel with coir rope or 8 mm steel rods as ties on all four sides of the column reinforcements. Reinforcement to columns shall be by welding MS rods with metal scaffolding to keep it in position till the final casting of RCC is done.

Falling of Objects or Debris from a Height

- At bridges construction sites (or in work areas at a height above ground level) thick nylon net or hessian barriers shall be used to prevent any splinter, debris, mortar or concrete from falling onto the passersby or workmen around.

Site Cleaning

- Throwing of waste materials, broken concrete pieces, brick bats, sand etc. straight from the top of a structure onto the ground can injure a worker or a passerby. Such materials should be brought to the ground with the help of lift or the use of rope over pully with a bucket.

Operation of Excavators

- Ensure that excavators are operated by authorized persons who have been adequately trained.
- Prevent any unauthorized use of the excavators.
- Ensure that only experienced and competent persons are engaged in supervising all excavations and leveling activity.
- Check and maintain as per the manufacturer's manual.
- Issue relevant information, including that related to instructions, training, supervision and safe system of work in writing and provides expert supervision for guidance.

- Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
- During tipping or running alongside the trenches, excavators must be provided with stop blocks.
- Excavators must be rested on firm ground after field operation away from the road
- Locate and identify underground services including telephone cables, OFC cables, sewerage and drainage lines, water supply, electrical cables etc. by checking with all concerned underground utility providers.
- When reversing or in cases where the operator's view is restricted, adequate supervision and signaling arrangements shall be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator and ensure replacement / repair to avoid mishap and break down.
- Check that all linkages / hinges are properly lubricated and linkage pins are secured. Never use improper linkage pins.

Operation of Trucks and Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer’s requirements
- All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Follow safe driving principles including speed limits as per traffic signage.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

Manual Handling and Lifting

- Avoid manual handling of heavy and hazardous objects and chemicals.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- The hazardous and poisonous materials should not be manually handled without proper equipment /gears and prior declaration of the risks needs to be made to the involved workers.

- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control / supervise / guide movement of equipment and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects, which are dangerous.
- Loading and unloading from vehicles shall be under strict supervision.

Gas Welding

- The welders and welding units should follow all the basic principles of welding for safety and security
- Use face shield to protect the eyes
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots / gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.



- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glare moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not encounter hot metal.
- Do not use gas cylinders for supporting work or as rollers. While using LPG or CNG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedure have to be followed for safety and security of men and materials.

F. Electrical Hazards in Construction Areas

Statutory warning leaflets / posters are to be distributed / displayed by the Contractor in the vicinity of work sites for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed / in progress.

- All wires shall be treated as live wires
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.

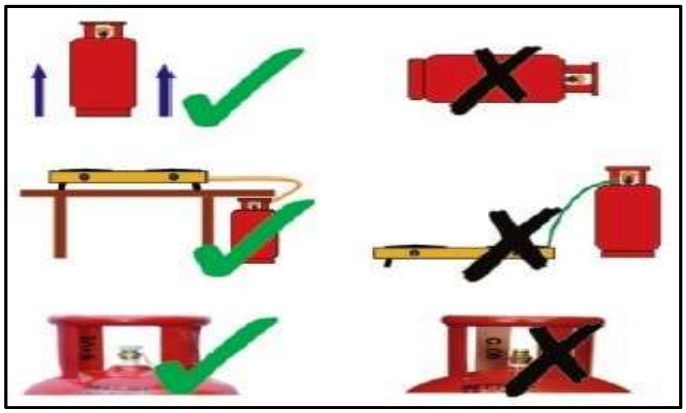




- Never used damaged wires for electrical connection
- Demolition, tree felling and removal of overhead transmission lines shall be undertaken with strong, efficient and closely monitored arrangements to avoid accidents.

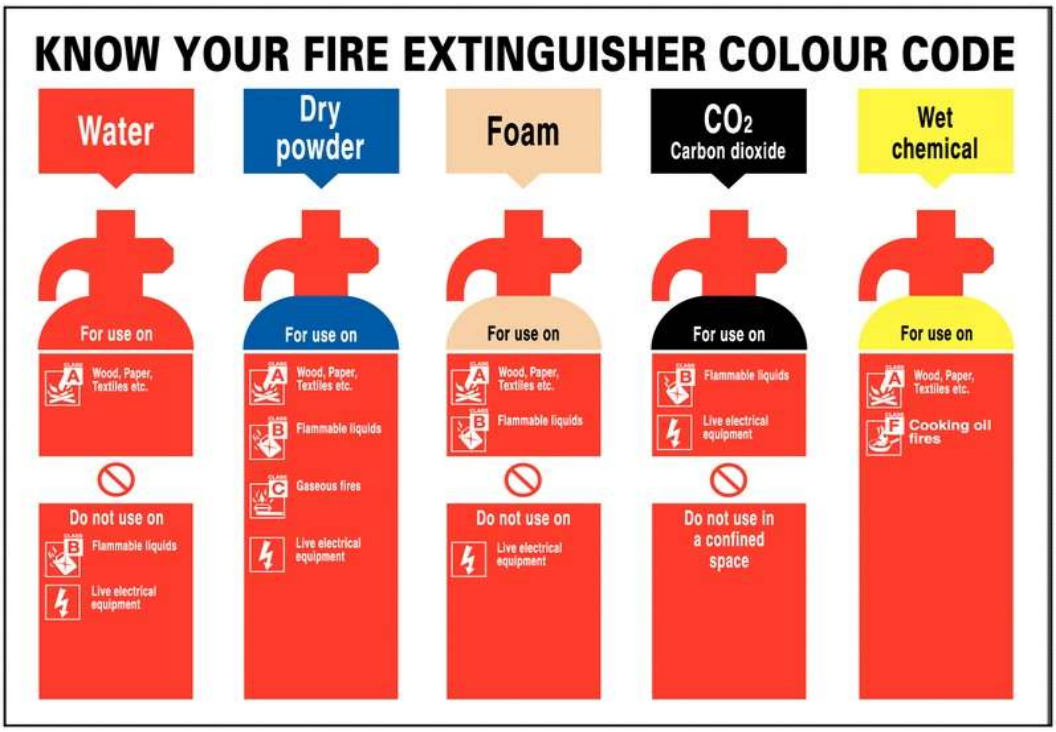
G. Use and Storage of Gas (LPG)

- Store filled LPG cylinder in a secure area – mark this as a no smoking area.
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders
- Never weld near the cylinder
- Store empty cylinders secured and upright
- Make sure that the cylinder is closed immediately after use
- Investigate immediately if there is the smell of LPG or gas
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.



H. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems
- Display sufficient warning signs
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically
- When fire breaks out alert all persons through fire alarms or other methods.
- Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point.
- Call-up Fire Service
- Fire officers to carryout head count at the assembly point.



I. Noise Hazards and its Control

- Plan camp lay-out in a manner that ensures barriers /buffers between residential / office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors / ear plugs to prevent excess noise affecting the workmen.

- Reduce noise at source by: use of improved equipment; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipment and machineries.
- Screening locations with noise absorbing material; making changes in the process / equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipment with fasteners.
- Appoint a competent person to carryout a detailed noise assessment of the site; designate ear protection zone/s; give training / instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipment.

J. Personal Protective Equipment (General)

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipment is in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean. PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.



Eye Protection

- Road construction work sites, quarries and crushers are full of dust particles, sand, splinter, harmful gases, bright light and welding arc lights, which are injurious for the eyes. Therefore, eye protection and adequate lighting in work areas is required. All workers, supervisors and inspection officers and dignitaries coming over for study of works should be compelled to

wear eye protecting glasses /goggles properly fitting the eye sockets to prevent damage due to dust, gases and other particles.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers /officials while working and / or inspecting a work sites. Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or earmuffs to the workers and to those who need to get in and out of a high noise area frequently.
- Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive.
- Use earmuffs where a large attenuation of up to 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use earmuffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with earmuffs. Use soap and water or the recommended solvent for cleaning earmuffs.

Respiratory (Protective) Equipment

- Wear suitable masks for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, working at crusher sites etc.
- Provide training to all persons using the masks / respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use
- Store respirators properly when not in use

Safety Footwear

- Wear suitable footwear for work
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury and keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

K. First Aid

- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries / accidents.

L. Accident Investigations

- Carryout the investigation/s as quickly as possible
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one / limited source of evidence.
- Check all the log books, stock registers, issue registers and movement registers on site
- Safety regulations, traffic signals and signal men activities, signage, as well as other field positions and keep a record of all investigations through audio-visual and electronic medium for presenting an evaluation of the incident/s.
- After completion of the investigation / enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipment and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

ANNEXURE 14: GUIDELINES FOR PREPARATION OF TRAFFIC MANAGEMENT PLAN

The Contractor shall always carry out work on the road in manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the Environmental Specialist of the Independent Engineer (IE), provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the IE regarding traffic arrangements during construction.

Traffic Safety and Roads Works



- Delineate advance warning zones, transition zones and construction zones at both ends of a work front. Use devices such as regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights, reflectors and signal men in appropriate manner round the clock.
- No work front should be 'touched' without putting appropriate safety measures in place. Environmental Specialist of the Independent Engineer will be responsible to ensure that the permission for any activity is not given without the required safety plan and practices in place.



- Put signage at appropriate locations as per the road construction activity plan to warn the road users, construction vehicles / equipment operators, pedestrians and local residents about the work in progress, speed controls, hindrances / blockages, diversions, depressions etc. in lines with contract requirements and IRC guidelines.
- Signage has to be: (i) simple, easy-to-understand and should convey only one message at a time; (ii) has florescent and reflective properties of the paints; (iii) broad, prominent and with appropriate size of letters and figures; (iv) placed at the appropriate 'point/s' as specified in the IRC guidelines to allow proper stoppage / reaction time to approaching vehicles.
- Express a regret signage for the inconvenience caused and alert about the dangers ahead on account of construction activity.
- Different sign boards shall have a mix of pictorial signs and messages in local language, Hindi and English.
- While using barricades, ensure that traffic is kept away from work areas and the road user is guided to the safe, alternative movement track.



- Ensure that excavation sites are provided with effective barriers and reflecting signage to prevent any accidental approach by vehicles during the day or night.
- Provide proper uniform (light reflecting garments) to flagmen engaged in traffic control at diversions so that they can be singled out from the moving traffic.
- Prevent entry of cattle and wildlife through proper fencing / barricading around the excavation sites.
- Provide wide red and green flags or red and green lights to flagmen for controlling traffic. In high traffic zones and congested areas, use of wireless communication devices with protective headgear and shoes by flagmen has to be ensured to prevent confusion and minimize the risk of accidents.



Ensuring Traffic Control

- Where the execution of the works requires temporary closure of road traffic use, the Contractor should provide and maintain temporary traffic diversions. The diversions should generally consist of 200 mm thickness of gravel laid directly upon natural ground and earthworks.
- Where the execution of the works requires single-lane operation on public road, the Contractor should provide and maintain all necessary barriers, warning signs and traffic control signals.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the Carriageway) the lane width path for traffic should be clearly marked with the aid of pavement markings and painted drums or a similar device. At night, the passage should be delineated with lanterns or other suitable light source.
- 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 should 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 should be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the IE shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs should be of design and of reflector type.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor should remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.





ANNEXURE 15: GUIDELINES FOR SEDIMENT CONTROL

Right at the initial stage of the work, the operations such as clearing and grubbing, roadway and drainage excavation, embankment / sub-grade construction, bridges and other structures across, pavement courses and shoulders are undertaken. These activities generate huge wastes and debris, which should not find their way into drainage channels and water courses nor should remain exposed to wind at the site and allowed to erode and contaminate productive soils or generate windblown dust particles in the atmosphere.

Erosion and sediment control measures shall, therefore, be planned to prevent soil erosion and sedimentation. These measures may involve temporary measures at construction stage, such as of temporary berms, dikes, sediment basins, slope drains, use of temporary mulches, fabrics, mats, seeding or other control devices .Permanent erosion control measures aim at preventing erosion during the project life cycle and should be planned as a part of the project design. These may involve turfing or pitching the embankment Slopes, turfing / mulching / vegetating the exposed areas, vegetating or reinforcing the cut slopes by appropriate methods such as shot-creting, rock bolting, soil-nailing, gabions etc.

Sediment control, whether temporary or permanent, would be mostly project and site specific. However, some of the generic measures shall be as follows.

- Debris generated at construction site must be removed immediately and dumped at the designated dump sites after useful recyclable materials are sorted out, and properly stocked or stacked.
- The site cleared after removal of debris would usually be prone to erosion. These areas should be treated by mulching and other dust palliation measures.
- There could be many mulching options such as seeding top soil and spreading the mulch (organic) to permit growth of grass, or other methods like mulches of tiles, brick bats, stone chips, or any other non-erodible wastes, which cover the exposed soil, allow moisture to be retained within soil and prevent erosion.
- Dust palliation measures by any suitable commercially available dust palliatives, application of water, cement, lime or bitumen emulsion in thin application to bind the dust particles together.
- All slush at construction sites, which after drying up become erodible must be either dredged and removed or treated appropriately in-situ (say by mulching).
- Temporary drains combined with sedimentation tanks should be created at the periphery or edge of the work sites to arrest the sediments brought by rains or construction activities requiring water and discharge only sediment free water into the water courses.

ANNEXURE 16: TREE PLANTATION STRATEGY

A. Avenue Plantation

The greenbelt development aims for overall improvement in the environmental condition of the project area. Greenbelt development along the road addresses the loss of flora due to the execution of the proposed project. The other objectives are to combat soil erosion, enhance greenery in the area, to control air/noise pollution, mitigate climate change, maintain and improve the ecological and environmental balance.

Trees bind soil and control erosion, attract birds/ bees, provide shades, cooling effect and provide aesthetic value to the surroundings. Green belts are also effective mode to control air pollution, where green plants form a surface capable of absorbing air pollutants and forming a sink of pollutants. Leaves with their vast area in a tree crown, absorbs pollutants on their surface, thus effectively reduce pollutant concentration in the ambient air.

Table 1: Specifications for Plantation

S.N.	Items	Description
1	No. of Rows	1 row on each side of road outside drain line
2	No. of trees per Km	333
3	Spacing between the plants	3 m
4	Size of Pits	60 x 60 x 60 cm
5	Height of Plant	1.5 to 2m
6	Age of Plant	Not less than 2 Years

** Plantation cost includes maintenance for 5 years.*

B. Protection & Precautionary Measures

- Plantation activity should be carried out in monsoon season.
- All plants supplied must be planted within three days of removal from the nursery.
- The plants must be watered daily in initial stages; watering 2-3 times a week is a must.
- 2 kg of compost / manure is suggested for each pit before plantation.
- To ensure better growth and survival of plants, surface should have enough soil (upto 45cm depth).
- Nurseries can be developed by local habitants with technical guidance from Forest Department so that saplings are available locally.
- Continuous monitoring of plant growth, immediate replacement of causalities, supplementation of nutrients, rescheduling watering regime are important aspects for survival of the plantation.
- Fencing of single row plantation shall be done by using iron/brick/cement guards.
- Progress of planting and status of plantation shall be monitoring on continuous basis for 5 Years.
- The survival rate of sapling should be maintained at 90% after raising the plantation with normal shape and size. Dead sapling shall be replaced.

Table 2: List of Tree Species Suggested for Plantation

Sl. No.	Scientific name	Common Name	Importance
1	*Ailanthus excelsa*	Maharukh	Pollution Sink, Noise Barrier

Sl. No.	Scientific name	Common Name	Importance
2	*Alstonia scholaris*	Saptaparni	Pollution Sink, Aesthetic Value, Medicinal Value
3	*Azadirachta indica*	Neem	Noise barrier, Pollution sink, Economic & Medicinal Value
4	*Bombax ceiba*	Semal	Aesthetic Value, Economic Value
5	*Butea monosperma*	Dhak	Aesthetic value, Pollution sink
6	*Calistemon viminalis*	Bottle Brush	Aesthetic value, Pollution Sink
7	*Cassia fistula*	Amaltas	Landscaping, Flowering plant, Pollution sink, Medicinal Value
8	*Dalbergia sissoo*	Sheesham	Economic Value, Pollution Sink
9	*Ficus bengalensis*	Bargad	Noise barrier, Pollution sink, Medicinal Value & Religious value
10	*Ficus religiosa*	Peepal	Noise barrier, Pollution sink, Religious values
11	*Melia azedarach*	Bakain	Noise Barrier, Pollution Sink, Economic and Medicinal Value
12	*Moringa oleifera*	Sahajana	Economic Value, Medicinal value
13	*Pongamia pinnata*	Karanj	Economic and Medicinal Value
14	*Syzygium cumini*	Jamun	Pollution sink, Economic Value
15	*Tamarindus indica*	Imli	Noise barrier, Pollution sink, Economic & Medicinal Value
16	*Tecomella undulata*	Rohira	Aesthetic Value, Economic and Medicinal Value
17	*Terminalia arjuna*	Arjun	Noise barrier, Pollution sink, Medicinal Value

ANNEXURE 17: ATTENDANCE SHEET OF PUBLIC CONSULTATION

Details of Public Consultation Meeting Bongaon

Detailed Project Reports for improvement of SH and MDRs under Axom Mala

Public Consultation/ Focus Group Discussion

Opinion Sheet

Venue: Temple Place, Bongaon Date& Time: 26.11.2020 / 03:00 PM

Name & Address Phone no.	Bongaon village, Near the Temple
Opinion/ Suggestion	• Resident asked for improving the existing culvert throughout the road from starting to end. • Road to be construct within this financial Year (31.03.2021). • Proposed Roads will paved the socio. economic empowerment, based on access to finance, services and employment. • Drain should be developed on both sides in the Bongaon village. • compensation should be provided based on market rate and Provide employment opportunities of the affected families during the construction.
Name & Signature	

Remarks of consultant:
Remarks of client:

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Pathsala)						
District	Barpeta	Taluka		Block/Ward No		GP/MC	
Settlement	Bangaon	PS/Thana		Chainage/Km	9.000	Venue	Temple Place
Date	26/11/2020	Time	3.00PM	Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	Sri Diganta Medhi	43	M	Cultivator	9678279124	
2.	Sri Arjun Talukdar	40	M	Cultivator	8473002188	
3.	Sri Palash Talukdar	20	M	cultivator	8638031474	
4.	Chandikant Roy	58	m	Retired Army	8011331937	
5.	Keshab Sarma	60	M		9707134899	
6.	Hemanta Kr. Roy	57	M	Sarani	8011987456	
7.	Giriska ch. Sarma	72	M	Rtd Teacher	9957740454	
8.	Digonta Pathak	36	M	business	9864077747	
9.	Kulodeep Medhi	34	M	business	9864239605	
10.	Seema Sarma	20	F	Student	6009529222	

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project							
District	BARPETA	Taluka		Block/Ward No		GP/MC	
Settlement	Bangaon	PS/Thana		Chainage/Km	9.000	Venue	Temple Place
Date	26/11/2020	Time	3.00PM	Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	Sri-Dasarath Roy	70	m	Retired Army	9957903549	
2.	" Umesh Talukdar	72	m	Retired. Teacher	9435311492	
3.	" Jogendranath Sarma	72	m	" "	9954717099	
4.	" Tarak ch. Talukdar	71	m	" "	7399257025	
5.	" Arjun Talukdar	45	m	cultivator	9957251732	
6.	" Pulak Medhi	42	m	shop keeper	9957792553	
7.	" Haridas pathak	40	m	cultivator	—	
8.	" palash Talukdar	43	m		9957251732	
9.	Ratul Medhi	34	M	Business	9954471177	
10.	" Shanaraigram Das	55	m		8486208608	

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project							
District	Barpeta	Taluka		Block/Ward No		GP/MC	Bangaon
Settlement	~~Mali~~ Bangaon	PS/Thana		Chainage/Km	14-700	Venue	Temple Place
Date	26/11/2020	Time	03:00pm	Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
11.	Padma Nath Medhekar	42	M	Farmer	—	
12.	Utpal Das	38	M	Businessman	7002607932	
13.	Dipika Sharma	40	M	Business	—	
14.	Jyotirekha Medhi	44	M	Farmer	7575998905	
15.	Pradip Choudhury	55	M	Education	9957215975	
16.	Dimbeswar Talukdar	40	M	Businessman	—	
17.	Dhiraj Gam	39	M	Businessman	9101627259	
18.	Kuhi Sarma	13	F	Student	—	
19.	Hiramakshi Kalita	31	F	Student	8486744947	
20.	Pritha Sarma	31	M		7002170771	
21.	Jarak Ch. Talukdar	70	M	Retire Teacher	7399257038	

Community Consultation Attendance Sheet

Project	Sarthebari – Pathsala Road – 07							
District		Taluka			Block/Ward No		GP/MC	
Settlement		PS/Thana			Chainage/Km		Venue	
Date		Time			Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Caste	Occupation	Contact Details	Signature
1.	Mitul Patwari	56	M		Business	7954647575	
2.	Bishakesh Tamuli	44	M		Business	9707698149	9101736601
3.	Krishan Deka	40	M		Worker	97547 98224	
4.	Boleram Deka	52	M		Business	986439 8905	
5.	Pradeep Deka	64	M		Agriculture	–	Smt Pratibha Deka.
6.	Paresh Deka	68	M		Retired Teacher	8486906440	Paresh Deka
7.	Niranjan Deka	48	M		Worker	9085698425	Niranjan Deka
8.	Pagan Talukda	34	M		Business	9401763504	
9.	Anup Talukda	37	M		Business	9101438120	
10.	Dipen Ahuyan	41	M		Job	9864617240	Dipen Ahuyan
11.	Pabitra Talukdar	48	M		Business	9957251772	Pabitra Talukdar
12.	Bashista Das	24	M		Student	8723039126	Bashista Das
13.	Samir Deka	25	M		Job	9531232634	Samir Deka
14.	Rajmohan Deka	50	M		Agriculture	–	–
15.	Nandeswar Deka	74	M		Retired Teacher		
16.	Umesh Deka	55	M		PHD Worker	9520557291	

Bongaon

Community Consultation Attendance Sheet

Project	Sarthebari – Pathsala Road – 17.							
District		Taluka			Block/Ward No		GP/MC	
Settlement		PS/Thana			Chainage/Km		Venue	
Date		Time			Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Caste	Occupation	Contact Details	Signature
1.	Mitul Patwari	56	M		Business	7954647575	
2.	Bishakesh Tamuli	44	M		Business	9707698149	9101736601
3.	Krishan Deka	40	M		Worker	97547 98224	
4.	Boleram Deka	52	M		Business	986439 8905	
5.	Pradeep Deka	64	M		Agriculture	–	Sri Pradip Deka.
6.	Paresh Deka	68	M		Retired Teacher	8486906440	Paresh Deka
7.	Niranjan Deka	48	M		Worker	9085698425	Niranjan Deka
8.	Fagan Talukda	34	M		Business	9401763504	
9.	Anup Talukda	37	M		Business	9101438120	
10.	Dipen Ahuyan	41	M		Job	9864617240	Dipen Ahuyan
11.	Pabitra Talukdar	48	M		Business	9957251772	Pabitra Talukdar
12.	Bashista Das	24	M		Student	8723039126	Bashista Das
13.	Samir Deka	25	M		Job	9531232634	Samir Deka
14.	Rajmohan Deka	50	M		Agriculture	–	–
15.	Nandeswar Deka	74	M		Retired Teacher		
16.	Umesh Deka	55	M		PHD Worker	9582055729 1	

Bongaon

Details of Public Consultation Meeting Malipara

Detailed Project Reports for improvement of SH and MDRs under Axom Mala

Public Consultation/ Focus Group Discussion

Opinion Sheet

Venue: Malipara (Dubi) Date& Time: 24/11/2020

Name & Address Phone no.	Manta Malakar 9101844704

Opinion/ Suggestion

1. People are very much supported to this project.
2. People suggested that if there is land acquisition they have no problem but compensation should be provided as per market rate.
3. Suggested for shifting of Temple, (Shiv Temple).
4. Provision of employment during construction.

Name & Signature

Remarks of consultant:
Remarks of client:

Project Name/No. Annexure

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Rampara)						
District	Barpeta	Taluka		Block/Ward No		GP/MC	DUBI (MANIPARA)
Settlement	Malipara	PS/Thana		Chainage/Km	14.700	Venue	near Public Library
Date	26/11/2020	Time	02:10 PM	Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	Bikshit Malakar	40	M	Painter	8876486224	Pavikshit Malakar
2.	Pradip Malakar	50	M	Business	9707508792	Pradip Malakar
3.	Akhim Malakar	20	M	Student/Beam Builder	9678963641	- Akhim Malakar.
4.	Ramkanta Malakar	50	M	Mistry/ Farmer	—	—
5.	Lalit Malakar	70	M	Farmer	-	-
6.	Durgadhar Malakar	65	M	Farmer	-	-
7.	Manta Malakar	53	M	Service	9101844704	- (Secy.)
8.	Chankya Malakar	45	M	Mistree	8486176917	- Sankaya Malakar
9.	Kishore Malakar	38	M	Driver / Private	8486994804	- Shri Kishore Malakar
10.	Jintu Malakar	23	M	Degree Lastt (Arts)	9101624649	- Jintu Malakar

all people are se

Details of Public Consultation Meeting Parakuchipam

Detailed Project Reports for improvement of SH and MDRs under Axom Mala

Public Consultation/ Focus Group Discussion
Opinion Sheet

Venue: Parakuchipam Date& Time: 24/11/2020

Name & Address Phone no.	
Opinion/ Suggestion	1) Try to avoid land acquisition, if not possible, only land should be acquired as minimum 2) Compensation as per market rate. 3) Employment to local people during construction. Name & Signature

Remarks of consultant:
Remarks of client:

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project								
District	Barpeta	Taluka	Para	Block/Ward No		GP/MC	3 No. Pub. mee.	
Settlement	Parakuchipam	PS/Thana	Sarthebari	Chainage/Km	54+800	Venue	Parakuchipam	
Date	24/11/2020	Time	2:30PM	Total No. of Participants	Male	Female	Total	
Sl. No.	Name	Age	Gender	Caste	Occupation	Contact Details	Signature	
1.	Sri Dipam Kalita	57	M	G	Farmer.		Dipam Kalita	
2.	Manikanta Deka	48	M	G	Do	7896163480		
3.	Jayanta Talukder	18	M	G	Student	8135945732	Jayanta Talukdar	
4.	Pradip Deka	45	M	G		9577134960		
5.	Gangga Ram Pathak	52	M	SC	Bussiness	9707664702		
6.	~~Rupjit Deka~~ Utham Ch. Deka	45	M	G	Govt	9678120665		
7.	Bonjit Deka	42	M	G	Govt	7002241167		
8.	Utham ch. Deka	55	M	G	Govt.	6000947571		
9.	Asizur Rehman	42	M	G	Govt	6900739472		
10.	Shri Hemanta Deka	45	M	G	Labour			
11.	Phiroz Das	36	M	SC	Labour	6001627539		
12.	Hemen Roy	35	M	SC	Labour			
13.	Pranabjyoti Nath	30	M	SC	Labour	9127248949		

Details of Public Consultation Meeting Raipur Dharmatala

Detailed Project Reports for Improvement of SH and MDRs under Asom Mala

Public Consultation/ Focus Group Discussion

Opinion Sheet

Venue: Raipur @ Dharmatala Date& Time: 11.30 AM

Name & Address Phone no.	
Opinion/ Suggestion	1) Maximize the land for those who have minimum land. 2) Compensation should be proper market rate along with factor 3) Employment opportunity. 4) People welcome this project 5) Provision of Irrigation system for Double crops.

Letpal Kr Roy. (G.B)
Name & Signature

Remarks of consultant:
Remarks of client:

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Pathsala)						
District	Barpeta	Taluka		Block/Ward No		GP/MC	Banarkuchi
Settlement	Raipur @ Dharmatala	PS/Thana		Chainage/Km	17.400	Venue	U. TARENI DUTTA S Hall
Date	26/11/2020	Time	11.30 AM	Total No. of Participants	Male	Female	Total

Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature
1.	RATAN KUMAR KALITHA	46	M	Retd. Army	9896775205	
2.	PARESH ROY	60	M	Retd Irrigation	9954914907	
3.	HIRANYA DAS.	40	M.	Irrigation.	9954039367	
4.	Binod Dutta	35	M	Business	9954644913	
5.	Manoj Kr Roy	40	M.	ward Member	9954082259	
6.	Madhab Das	40	M	Ward Member	8761086226	
7.	Bhaskar Rao	40	M	Gr. S. BJP	9954769925	
8.	Tarani Kanta Kalita	71	M	Retired		
9.	Lakshya Jyoti Dutta	38	M	Business	9365991170	
10.	Letpal K. Roy	49		Gramsevak.	9954187068	

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	A-07 (Sarthebari - Pathsala)						
District	~~Nagaon~~ ~~Morigaon~~ Barpeta	Taluka		Block/Ward No		GP/MC	Ramankushi
Settlement	Rajpur - Dharamtula	PS/Thana		Chainage/Km	17.400	Venue	Lt. TARINI DUTTA's Home
Date	26/11/2020	Time	11:30am	Total No. of Participants	Male	Female	Total
Sl. No.	Name	Age	Gender	Occupation	Contact Details	Signature	
1.	Gopal Kalita	51	M	Farmer	9954385559		
2.	Purabi Dutta	35	F	farmer	-		
3.	Rumi Dutta	31	F	"	-		
4.	ARUP DUTTA	40	M	Business	7086215951		
5.	Nilay Dutta	24	M	Employee	9957457487		
6.	Tarini Dutta	40		Farmer	6001467482		
7.	Mahendra Nath Roy	64		G. B.	9678220098		
8.							
9.							
10.							

Photographs of Public Consultation:





Consultation with market president and shop owners at Sarthebari





Consultations with resident and shop owner at Sarthebari





Consultations with Forest official at Parkuchikam





Consultation with the Affected People at Bangaon Village





Consultation with the Affected People at Bangaon Village




Consultation with the Affected Shop owner at Bugan




Consultation with the Affected Shop owner at Tapattari




Consultation with the Affected Shop owner at Malipara




Consultation with schedule caste community and member of temple committee




Consultation with the Affected Shop owner at Dubi




Consultation with women at Raipur-Bamankushi (Km 16.100)




Consultation with women at Raipur-Bamankushi (Km 15.800)





Consultation with gram panchayat member and farmers

ANNEXURE 18: IMPACTS OF CLIMATE CHANGE ON ROAD TRANSPORT IN THE STATE OF ASSAM

1. Introduction

The PWRD road project is mainly linked to road transport engineering aspects of augmentation, rehabilitation, and widening initiatives with the primary objective of supporting the State's accelerated economic development. This climate risk and vulnerability Adaptation (CRVA) is an essential component, the study needs to demonstrate that climate considerations have been integrated into the DPR of the project road.

Projected change in the global climate is almost certain to have a significant impact on the appraisal, planning, design, construction, operation, and maintenance of road infrastructure. The environmental impact reports of the project roads state that climate change and its associated impacts will be experienced through changing temperatures and precipitation, changes in the frequency and severity of climate extremes, and the dynamics of hazardous conditions. Existing roads designed and constructed decades ago were meant to typically withstand local weather and climate but now underexposures and sensitivities to climate-related extremes, the need for the adaptation to climate change has been recognized by the State Government.

As per the Assam State Action Plan on Climate Change, Rapid increase in numbers of motor vehicles on road in Assam has been observed over the past decade. The on-road vehicle population in the State reached 1.98 million in 2013-14 from 0.53 million in 2001-01. The growth has been at a compounded annual growth rate of 12.7%. The number of Motor vehicles registered in the State is 6360 per lakh of population.

Due to the lack of adequate public transport systems where buses comprise only 1% of the total population of vehicles on road, and due to the availability of easy loans, most of the people are aspiring to buy their vehicles. As a result, two-wheelers are 57% of the total vehicle mix in the State, and cars follow suit with a 21% share in 2013-14.

The road transport sector is a direct consumer of fossil fuel, emits GHG into the atmosphere. With an increase in population and per capita rise in the number of personal vehicles, GHG emissions are likely to rise. The use of the public transport system needs to control future emissions in the future and also to ease off the pressure of vehicles on the roads, hence. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and also behavioral changes of the population whereby they use more and more non-motorized transport at short distances and public transport for long distances. The Guwahati city is already in the process of developing the Bus Rapid Transit system, but further development of the public transport system is required. Other major cities also need to embrace the same for an orderly functioning road transportation system in the cities of Assam.

The roads and bridges built for the transport sector are also susceptible to floods and landslides in the State, the intensity of which is likely to increase in the future. In this context therefore roads, bridges need to be built keeping in view the maximum projected intensity of extreme events.

Suggested Strategies for the transport sector

Sr. No.	Action	Cost (INR Cr)	Sources of Fund	Priority	Department Responsible
1	Installation of CNG pump stations across major cities of Assam; 100 depots	25	Funded	VH	Department
2	Procurement of CNG enable buses, 1000 buses	250	JNNURM	VH	Department of Transport
3	Assess req of non-motorized transport	2	State	H	Department of

Sr. No.	Action	Cost (INR Cr)	Sources of Fund	Priority	Department Responsible
	numbers and Introduce tracks for non-motorized transport along existing roads, 10 major cities		Govt./Central Govt.		Transport
4	Retrofitting all Public Vehicles with CNG Kit – Policy regulations to be formulated	100		VH	Department of Transport
5	Introducing intelligent traffic management systems, 10 major cities	10		H	Department of Transport
6	Construct parking slots in Guwahati, Tinsukia, Dibrugarh, Nagaon, Tezpur, Jorhat, and Silchar. Partial cost of construction, 7 major cities	35		H	Department of Transport
7	Promote better driving practices and maintenance of vehicles among truck, bus and car drivers to enhance fuel efficiency	1		H	Department of Transport

Source: Assam State Action Plan on Climate Change

2. Review of Climate Change Literatures Specific to Assam

With the "Tropical Monsoon Rainforest Climate", Assam is temperate (summer max. at 35–39 °C and winter min. at 5–8 °C) and experiences heavy rainfall and high humidity. The climate is characterized by heavy monsoon downpours, which reduce summer temperatures, enable the formation of foggy nights and mornings in winters. Spring (Mar-Apr) and autumn (Sept-Oct) are usually pleasant with moderate rainfall and temperature. For ascertaining long term climate trends, State level climate data for the period 1951 to 2010 has been analyzed by the India Meteorological Department. This analysis is based on 282 stations for temperature and 1721 stations for rainfall across the country. In Assam, the analysis is based on data collected from 6 Stations for temperature and 12 Stations for rainfall. The analysis indicates that the mean temperature in the State has increased by +0.01°C/year. There is also an increase in seasonal temperatures across seasons with pronounced warming in post-monsoon and winter temperatures. The annual rainfall has also decreased by -2.96 mm/year during the same period.

Climate trends in Assam between 1951 and 2010

Annual		Winter	Summer	Monsoon	Post Monsoon
Mean Max Temp	+0.02 (°C/yr)	0.01	No trend	0.01	0.02
Mean Min Temp	+0.01 (°C/yr)	0.02	0.01	0.01	0.02
Mean Temp (°C/yr) +0.01		0.01	No trend	0.01	0.02
Rainfall (mm/yr) -2.96		0.08	-0.56	-2.19	-0.75

Source: Assam State Action Plan on Climate Change

Projected Changes in Climate

	2021-2050 wrt BL	Remarks
Mean Temperature	1.7-2.0°C	All across Assam
Annual Rainfall	-5 to 5%	North-western districts
	5-10%	North-Eastern districts
	10-25%	Central, South Eastern districts
Extreme rainfall days	5-38%	Rainfall >25 to 150 mm
Drought weeks	-25% to >75%	Southern districts show a marginal reduction in drought weeks but rest of the district show an increase by more than 75% wrt BL

Source: Assam State Action Plan on Climate Change

ANNEXURE 19: GUIDANCE FOR CONSTRUCTION WORKERS/ CONTRACTORS IN VIEW OF COVID-19

Ministry of Home Affairs and Ministry of Health and Family Welfare, GoI have issued various Guidelines to be followed during COVID-19:-(https://www.mha.gov.in/notifications/circulars-covid-19,

https://www.mha.gov.in/sites/default/files/PR_ConsolidatedGuidelinesofMHA_28032020_0.pdfhttps://www.mohfw.gov.in/. Further, amendments on COVID-19 various orders are updated from time to time on https://www.mha.gov.in/media/whats-new, need to be followed in all operations. In addition, various guidelines / interim notes for construction sites have been prepared by institutions and organizations, some of which are listed below:

a) ILO's Guidance: Considerations for employment intensive works in response to COVID 19 (April 12, 2020). https://www.ilo.org/wcmsp5/groups/public/---edemp/documents/publication/wcms_741669.pdf
b) WB's ESF/Safeguards interim note: COVID-19 considerations in construction/civil works projects (April 7, 2020)
c) WHO's guidelines: Getting your workplace ready for COVID-19 (March 03, 2020) https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf; Water, sanitation, hygiene, and waste management for the COVID-19 virus (March 19, 2020) https://www.who.int/publications-detail/water-sanitation-hygiene-and-waste-management-for-covid-19;
Rational use of personal protective equipment (PPE) for coronavirus disease (March 19, 2020)https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3- eng.pdf.
d) IASC Interim Guidance: Scaling-Up COVID-19 Outbreak Readiness and Response Operations in Humanitarian Situations, Including Camps and Camp-Like Settings (March 7, 2020) https://interagencystandingcommittee.org/other/interim-guidance-scaling-covid-19-outbreak-readiness and-response-operations-camps-and-camp
e) IDB's Guidance for infrastructure projects on COVID-19 https://www.idbinvest.org/en/download/9625
f) IFC Guidance: Workers' accommodation: processes and standards (2009) http://documents.worldbank.org/curated/en/604561468170043490/pdf/602530WP0worke10Box358316B01PUBLIC1.pdf

Labor would continue to be the major player in construction activities in CPRR. In view of the prevailing COVID-19 pandemic, the contractors and workers would need to take additional measure to avoid the spread of the disease. On the basis of above guidelines/guidance notes, a brief "To Do" list is summarized below (sl.no.in brackets refer to the above-mentioned guidelines/guidance notes). For details and preparation of COVID-19 Response and Management Plan, the above documents may be referred.

Brief 'To Do' List

Daily Drill:

1. All workers to report some time earlier before the start of the shift. An attendance register is to be maintained for each shift. Social distancing of at least 2m to be followed in the holding area. The focal point to provide information update. (a, c, d)
2. The workers need to wash their hands thoroughly (for at least 20-30 seconds) with soap or use sanitizers just before reporting screening. Adequate provision for hand washing, soaps, sanitizers needs to be made at the reporting location. (a, b, c)
3. Health screening to be done for all workers in the shift - including temperature monitoring using a non-contact thermometer. Any worker reporting with temperature higher than 37.3 ^{o}C shall be sent to the isolation quarters and periodic observation be made. (a, b, c, d)
   - In case the worker shows symptoms of the pandemic (including COVID-19), the procedures as laid down by the national and state laws need to be followed for testing, quarantine of at least 14 days or hospitalization, depending upon individual case.
   - All the co-workers in the shift, and other persons with known contact history in the construction site should be quarantined for a period of at least 14 days, followed by regular check-ups/ observation/ examinations as laid down by the national and state laws.
4. The workers found fit need to proceed to work with all required personal protective equipment, e.g. masks, gloves, goggles, boots, helmets, harness, etc. (a, b, c)
5. The workers be encouraged to avoid contact with co-workers as far as possible and wash their hands at regular intervals. (a, b, c)
6. Lunch/meal break be staggered into two so that workers proceed for lunch/meal at different times (a).
7. There needs to be a provision of separate drinking bottles/cups for each worker, and these need to be cleaned thoroughly after meals. (a)
8. Proper hand washing arrangement (water/soaps/sanitizers) needs to be ensured at eating locations. Hand washing facilities are ideally to be located within 5m of toilets and at close range of eating space. (a, b)
9. The workers returning to the shift after lunch/meal break need to thoroughly wash their hands and follow the same procedure as that followed at the start of the shift. (a, b)
10. At the close of shift, the workers need to thoroughly wash their hands with soap/sanitizers etc. (a, b)
11. The PPE should be thoroughly washed/cleaned/sanitized (depending upon the type of PPE) after the shift ends. (a)
12. The meal timings should be phased in each shift during which the sensitive areas of the workplace should be cleaned / sanitized as far as possible. (b)
13. The time between two shifts should be used for cleaning and sanitizing machines, hand tools and areas of regular contact – grab handles, control levers, steering wheels, control panels – shall be regularly cleaned, and at the end of shifts used across shifts (or continuous operations) where operators/helpers change. (a)

General Guidance for contractors:

1. Site specific Risk assessment needs to be undertaken and COVID-19 Response and Management Plan be prepared for all sites. (a, b, d, e)

2. Protocols for medical treatment, etc. should be prepared/followed, including for reporting, referral, treatment and discharge as per national and state laws and other guidelines. (a, b, c, d)
3. A health and safety officer to be deployed as the focal point at all project sites, and wherever, the same is not in place, urgent action needs to be taken by the contractor to recruit someone. (a, b)
4. Register for all the workers needs to be maintained, along with their health records (a, b, d).
5. Limit the number of workers on site at any one time to minimize contact, including exploring operations for multi-shift working rotation. (a, b, d)
6. Entry/exit to the site should be documented. Transport vehicles used during construction activities to carry construction materials should be sanitized on regular basis (at least once a day). (a, b)
7. Hygienic living conditions need to be ensured in the camp sites with regular/daily cleaning, adequate hand washing facilities. Adequate provision for solid waste management needs to be provided. (a, b, d, f)
8. Provide health and safety training/orientation on COVID-19, or any other pandemic, to all workers and staff.(a, b, d)
9. Ensure adequacy of necessary supplies of energy, water, food, medical supplies, cleaning equipment, PPE (both for regular use and those for medical exigencies) etc. (a, b, c, d, f)
10. Quarantine and isolation facilities should be established in the camps (WHO Guidelines). The isolation facilities should have separate and dedicated toilets with proper arrangement for cleaning and removal of faeces. (c)
11. Any medical waste produced during the care of ill workers should be disposed as per the national and state laws or relevant guidelines (e.g. WHO guidelines from time to time). PPE used for medical treatment/care purposes should be stored securely and kept separate from other waste. Current WHO recommendations are to clean utility gloves or heavy duty, reusable plastic aprons. with soap and water and then decontaminate them with 0.5% sodium hypochlorite solution after each use. Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused; (a, b, c)
12. Incentivize workers lodging in the local community to move to site accommodation. (b)
13. The community should be made aware, through posters etc., of procedures put in place at site to address issues related to COVID-19. This should include all measures being implemented to limit or prohibit contact between workers and the community. (a, b, c, d)

ANNEXURE 20: COMPLAINT REGISTER AND COMPLAINT FORMS

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Hindi, Assamese or any other local languages, if any)

The Public Works Roads Department, Government of Assam welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date:	**Place of Registration:**	
Contact Information/Personal Details:		
Name:	**Gender:**	**Age:**
Home Address:		
Village/Town:		
District:		
Phone No.:		
Email:		
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below:		
If included as attachment/note/letter, please tick here:		
How do you want us to reach you for feedback or update on your comment/grievance?		

For Official Use only

Registered by: (Name of Official Registering Grievance)
If : ❖ Note/Letter ❖ E-mail ❖ Verbal/Telephonic
Reviewed by: (Names/ Positions of Official(s) reviewing grievance)
Action taken:

Whether Action taken disclosed: ❖ Yes ❖ No
Means of Disclosure:

অভিযোগ পন্জীয়ন প্র-পত্রৰ নমুনা

প্রকল্প ৰুপায়ণ সম্পর্কত অসম চৰকাৰৰ গড়কাপ্তানী বিভাগে অভিযোগ, পৰামর্শ, অনুসন্ধান, মন্তব্য বিচাৰে। স্পষ্টীকৰন আৰু প্রতিক্রিয়াৰ বাবে অভিযোগকাৰীৰ লগত যোগাযোগ কৰিবলৈ সক্ষম হবলৈ আমি অভিযোগকাৰী সকলক তেওঁলোকৰ নাম আৰু ঠিকনাৰ তথ্য দিবলৈ আহ্বান জনাওঁ।

আপুনি যদি আপোনাৰ ব্যক্তিগত তথ্য দিব বিচাৰে আৰু সেই তথ্য গোপন ৰাখিব বিচাৰে, তেনেহলে আপোনাৰ নামৰ ওপৰত (গোপনীয়/CONFIDENTIAL) লিখি দিব/টাইপ কৰি দিব।

তাৰিখঃ	পন্জীয়নৰ স্থানঃ	
যোগাযোগৰ তথ্য/ব্যক্তিগত তথ্যঃ		
নামঃ	লিঙ্গঃ	বয়সঃ
ঠিকনাঃ		
গাওঁ/চহৰঃ		
জিলাঃ		
ফোন নং		
ই-মেইলঃ		
অভিযোগ/পৰামর্শ/মন্তব্য/প্রশ্ন - আপোনাৰ অভিযোগৰ সবিশেষ (কোন, কি, ক'ত আৰু কেনেকৈ) তলত দিবঃ		
যদি সংযোজন/চিঠি/টোকা আদি গাথি দিয়া হৈছে, তেনেহলে ইয়াত টিক চিন্হ দিবঃ		
প্রতিক্রিয়া অথবা আপোনাৰ অভিযোগ/মন্তব্য সংক্রান্তত নতুন তথ্যৰ বাবে আমাক আপোনাৰ লগত কেনেধৰণে যোগাযোগ কৰাটো বিচাৰে?		

কার্য্যালয়ৰ ব্যৱহাৰৰ বাবে

পঞ্জীয়ন কৰোতাঃ (অভিযোগ পঞ্জীয়নকাৰী বিষয়াৰ নাম)
যদিঃ • টোকা/চিঠি • ই-মেইল • মৌখিক/টেলিফোনযোগে
পর্যবেক্ষণকাৰীঃ (পর্যবেক্ষণকাৰী বিষয়াৰ নাম আৰু পদবি)
ইতিমধ্যে লোৱা ব্যৱস্থাঃ
ইতিমধ্যে লোৱা ব্যৱস্থা প্রকাশ কৰা হৈছে নে নাইঃ ❖ হৈছে ❖ হোৱা নাই
প্রকাশ কৰাৰ ধৰণঃ

ANNEXURE 21: EIA NOTIFICATION FOR EXEMPTION OF EC FOR BORROW AREA FOR LINEAR PROJECTS

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 28th March, 2020

S.O. 1224(E).—WHEREAS, *vide* the Mineral Laws (Amendment) Act, 2020 (2 of 2020), the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) (hereinafter referred to as MMDR Act) has been amended with effect from the 10th day of January, 2020 and, *inter alia*, new section 8B relating to the provisions for transfer of statutory clearances has been inserted;

AND WHEREAS, sub-section (2) of section 8B of the MMDR Act provides that notwithstanding anything contained in this Act or any other law for the time being in force, the successful bidder of mining leases expiring under the provisions of sub-sections (5) and (6) of section 8A and selected through auction as per the procedure provided under this Act and the rules made thereunder, shall be deemed to have acquired all valid rights, approvals, clearances, licences and the like vested with the previous lessee for a period of two years;

AND WHEREAS, sub-section (3) of section 8B of the MMDR Act provides that notwithstanding anything contained in any other law for the time being in force, it shall be lawful for the new lessee to continue mining operations on the land, in which mining operations were being carried out by the previous lessee, for a period of two years from the date of commencement of the new lease;

AND WHEREAS, in pursuance of the aforesaid amendment to the MMDR Act, the Central Government deems it necessary to align the relevant provisions of the notification of the Government of India in the erstwhile Ministry of Environment and Forests number S.O. 1533 (E), dated the 14th September, 2006 (hereinafter referred to as the EIA Notification, 2006);

AND WHEREAS, the Ministry of Environment, Forest and Climate Change is in the receipt of representations for waiver of requirement of prior environmental clearance for borrowing of ordinary earth for roads; and manual extraction of lime shells (dead shell), shrines, etc., within inter tidal zone by the traditional community;

Now, therefore, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), read with sub-rule (4) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government, after having dispensed with the requirement of notice under clause (a) of sub-rule (3) of the rule 5 of the said rules, in public interest, and in supersession of the notification number S.O. 4307(E), dated the 29th November, 2019, hereby makes the following further amendments in the EIA Notification, 2006, namely:-

In the said notification,-

(i) in paragraph 11, after sub-paragraph (2), the following sub-paragraph shall be inserted, namely:-

"(3) The successful bidder of the mining leases, expiring under the provisions of sub-sections (5) and (6) of section 8A of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) and selected through auction as per the procedure provided under that Act and the rules made thereunder, shall be deemed to have acquired valid prior environmental clearance vested with the previous lessee for a period of two years, from the date of commencement of new lease and it shall be lawful for the new lessee to continue mining operations as per the same terms and conditions of environmental clearance granted to the previous lessee on the said lease area for a period of two years from the date of commencement of new lease or till the new lessee obtains a fresh environmental clearance with the terms and conditions mentioned therein, whichever is earlier:

Provided that the successful bidder shall apply and obtain prior environmental clearance from the regulatory authority within a period of two years from the date of grant of new lease.";

(ii) in the Schedule, against the item 1(a), in the column (5), after clause (2) of the Note, the following clause shall be inserted, namely:-

"(3) The evacuation or removal and transportation of already mined out material lying within the mining leases expiring under the provisions of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), by the previous lessee, after the expiry of the said lease, shall not form the part of the mining capacity so permitted to the successful bidder, selected through auction as per the procedure provided under that Act and the rules made thereunder.";

(iii) for Appendix-IX, the following Appendix shall be substituted, namely:-

"APPENDIX-IX

EXEMPTION OF CERTAIN CASES FROM REQUIREMENT OF ENVIRONMENTAL CLEARANCE

The following cases shall not require Prior Environmental Clearance, namely:-

1. Extraction of ordinary clay or sand by manual mining, by the Kumhars (Potter) to prepare earthen pots, lamp, toys, etc. as per their customs.
2. Extraction of ordinary clay or sand by manual mining, by earthen tile makers who prepare earthen tiles.
3. Removal of sand deposits on agricultural field after flood by farmers.
4. Customary extraction of sand and ordinary earth from sources situated in Gram Panchayat for personal use or community work in village.
5. Community works, like, de-silting of village ponds or tanks, construction of village roads, ponds or bunds undertaken in Mahatma Gandhi National Rural Employment and Guarantee Schemes, other Government sponsored schemes and community efforts.
6. Extraction or sourcing or borrowing of ordinary earth for the linear projects such as roads, pipelines, etc.
7. Dredging and de-silting of dams, reservoirs, weirs, barrages, river and canals for the purpose of their maintenance, upkeep and disaster management.
8. Traditional occupational work of sand by Vanjara and Oads in Gujarat vide notification number GU/90(16)/MCR-2189(68)/5-CHH, dated the 14th February, 1990 of the Government of Gujarat.
9. Manual extraction of lime shells (dead shell), shrines, etc., within inter tidal zone by the traditional community.
10. Digging of wells for irrigation or drinking water purpose.
11. Digging of foundation for buildings, not requiring prior environmental clearance, as the case may be.
12. Excavation of ordinary earth or clay for plugging of any breach caused in canal, nallah, drain, water body, etc., to deal with any disaster or flood like situation upon orders of the District Collector or District Magistrate or any other Competent Authority.
13. Activities declared by the State Government under legislations or rules as non-mining activity."

[F. No. Z-11013/47/2018-IA II (M)]

GEETA MENON, Jt. Secy.

Note: The principal notification was published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii) *vide* number S.O. 1533 (E), dated the 14th September, 2006 and subsequently amended *vide* the following numbers:-

1. S.O. 1949 (E), dated the 13th November, 2006;
2. S.O. 1737 (E), dated the 11th October, 2007;
3. S.O. 3067 (E), dated the 1st December, 2009;
4. S.O. 695 (E), dated the 4th April, 2011;
5. S.O. 156 (E), dated the 25th January, 2012;
6. S.O. 2896 (E), dated the 13th December, 2012;
7. S.O. 674 (E), dated the 13th March, 2013;
8. S.O. 2204 (E), dated the 19th July, 2013;
9. S.O. 2555 (E), dated the 21st August, 2013;
10. S.O. 2559 (E), dated the 22nd August, 2013;

14. S.O. 1599 (E), dated the 25th June, 2014;
15. S.O. 2601 (E), dated the 7th October, 2014;
16. S.O. 2600 (E), dated the 9th October, 2014;
17. S.O. 3252 (E), dated the 22nd December, 2014;
18. S.O. 382 (E), dated the 3rd February, 2015;
19. S.O. 811 (E), dated the 23rd March, 2015;
20. S.O. 996 (E), dated the 10th April, 2015;
21. S.O. 1142 (E), dated the 17th April, 2015;
22. S.O. 1141 (E), dated the 29th April, 2015;
23. S.O. 1834 (E), dated the 6th July, 2015;
24. S.O. 2571 (E), dated the 31st August, 2015;
25. S.O. 2572 (E), dated the 14th September, 2015;
26. S.O. 141 (E), dated the 15th January, 2016;
27. S.O. 648 (E), dated the 3rd March, 2016;
28. S.O. 2269(E), dated the 1st July, 2016;
29. S.O. 2944(E), dated the 14th September, 2016;
30. S.O. 3518 (E), dated 23rd November 2016;
31. S.O. 3999 (E), dated the 9th December, 2016;
32. S.O. 4241(E), dated the 30th December, 2016;
33. S.O. 3611(E), dated the 25th July, 2018;
34. S.O. 3977 (E), dated the 14th August, 2018;
35. S.O. 5733 (E), dated the 14th November, 2018;
36. S.O. 5736 (E), dated the 15th November, 2018;
37. S.O. 5845(E), dated the 26th November, 2018;
38. S.O. 345(E), dated the 17th January, 2019;
39. S.O. 1960(E), dated the 13th June, 2019;
40. S.O. 236(E), dated the 16th January, 2020;
41. S.O. 751(E), dated the 17th February, 2020; and
42. S.O. 1223(E), dated the 27th March, 2020.

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ANNEXURE 22: AIR MODELLING OUTPUT DATA

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: CO-A-07
RUN: (MULTI-RUN/WORST CASE HYBRID)
POLLUTANT:

I. SITE VARIABLES

VD= 0.0 CM/S Z0= 10. CM ALT= 64. (M)
VS= 0.0 CM/S

II. METEOROLOGICAL CONDITIONS

RUN	* U (M/S)	BRG (DEG)	CLASS	AMB (PPM)	MIXH (M)	SIGTH (DEG)	TEMP (C)
1. Hour 1	* 1.0	WORST	3 (C)	2.0	250.	20.00	30.0
2. Hour 2	* 1.0	WORST	3 (C)	2.0	300.	20.00	32.0
3. Hour 3	* 1.0	WORST	3 (C)	2.0	400.	20.00	34.0
4. Hour 4	* 1.0	WORST	2 (B)	2.0	600.	20.00	34.0
5. Hour 5	* 1.0	WORST	2 (B)	2.0	800.	20.00	36.0
6. Hour 6	* 1.0	WORST	1 (A)	2.0	1200.	20.00	39.0
7. Hour 7	* 1.0	WORST	2 (B)	2.0	1200.	20.00	40.0
8. Hour 8	* 1.0	WORST	2 (B)	2.0	800.	20.00	41.0

III. LINK GEOMETRY

LINK DESCRIPTION	* X1	Y1	X2	Y2	* TYPE	H (M)	W (M)
A. L1	* 0	0	0	9500	* AG	0.0	16.0
B. L2	* 0	9500	0	17400	* AG	0.0	16.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: CO-A-07
RUN: (MULTI-RUN/WORST CASE HYBRID)
POLLUTANT:

IV. EMISSIONS AND VEHICLE VOLUMES

RUN	* LINK A	B
1 VPH	* 455	455
EF	* 244.	244.
2 VPH	* 455	455
EF	* 244.	244.
3 VPH	* 455	455
EF	* 244.	244.
4 VPH	* 455	455
EF	* 244.	244.
5 VPH	* 455	455
EF	* 244.	244.
6 VPH	* 455	455
EF	* 244.	244.
7 VPH	* 455	455
EF	* 244.	244.
8 VPH	* 455	455
EF	* 244.	244.

V. RECEPTOR LOCATIONS AND MULTI-RUN AVERAGE CONCENTRATIONS

RECEPTOR	* COORDINATES (M) X	Y	Z	* AVG (PPM)
1. RS11	* 2	6000	1.8	* 12.9
2. RS12	* 12	6000	1.8	* 8.3
3. RS13	* 32	6000	1.8	* 4.9
4. RS14	* 52	6000	1.8	* 4.1
5. RS15	* 72	6000	1.8	* 3.6
6. RS16	* 92	6000	1.8	* 3.4
7. RS17	* 112	6000	1.8	* 3.2*

* PPM to mg/m3 and Conversion formula applied.

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: PM-A-07
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Particulates
(NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 1.0 M/S Z0= 10. CM ALT= 64. (M)
BRG= WORST CASE VD= 0.0 CM/S
CLAS= 3 (C) VS= 0.0 CM/S
MIXH= 250. M AMB= 0.0 PPM
SIGTH= 20. DEGREES TEMP= 30.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. L1	*	0	0	0	9500	* AG	455	14.0	0.0	16.0
B. L2	*	0	9500	0	17400	* AG	455	14.0	0.0	16.0

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. RS11	*	2	6000	1.8
2. RS12	*	12	6000	1.8
3. RS13	*	32	6000	1.8
4. RS14	*	52	6000	1.8
5. RS15	*	72	6000	1.8
6. RS16	*	92	6000	1.8
7. RS17	*	112	6000	1.8

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: PM-A-07
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Particulates
(NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	* PRED * CONC/LINK * BRG * (DEG)	* CONC * (PPM)	A	B
1. RS11	* 358.	* 731.4	****	7.8
2. RS12	* 349.	* 433.8	****	5.8
3. RS13	* 348.	* 212.9	****	5.8
4. RS14	* 348.	* 153.4	****	5.9
5. RS15	* 346.	* 123.2	****	5.4
6. RS16	* 345.	* 104.2	99.2	5.0
7. RS17	* 343.	* 90.8	86.2	4.6

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NOX-A-07
RUN: Hour 1
POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 1.0 M/S Z0= 10. CM ALT= 64. (M)
BRG= 270.0 DEGREES VD= 0.0 CM/S
CLAS= 3 (C) VS= 0.0 CM/S
MIXH= 250. M TEMP= 30.0 DEGREE (C)
SIGTH= 20. DEGREES

NOX VARIABLES

NO2= 0.00 PPM NO= 0.00 PPM O3= 0.00 PPM KR= 0.000 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	* LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. L1	* 0	0	0	9500	* AG	455	*****	0.0	16.0
B. L2	* 0	9500	0	17400	* AG	455	*****	0.0	16.0

III. RECEPTOR LOCATIONS

RECEPTOR	* COORDINATES (M) X	Y	Z
1. RS11	* 2	6000	1.8
2. RS12	* 12	6000	1.8
3. RS13	* 32	6000	1.8

4. RS14 * 52 6000 1.8
5. RS15 * 72 6000 1.8
6. RS16 * 92 6000 1.8
7. RS17 * 112 6000 1.8

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NOX-A-07
RUN: Hour 1
POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	* PRED * CONC (PPM)	* CONC/LINK * A	B
1. RS11	4.91	4.91	0.00
2. RS12	6.70	6.70	0.00
3. RS13	3.74	3.74	0.00
4. RS14	2.69	2.69	0.00
5. RS15	2.15	2.15	0.00
6. RS16	1.81	1.81	0.00
7. RS17	1.58	1.58	0.00

ANNEXURE 23: NOISE MODELLING OUTPUT DATA

		2049-50 Section 1 (Sarthebari to Pathsala)																									
		TIME	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00
Input	No. of Traffic	q	325	622	865	861	898	885	822	694	943	1109	1085	656	368	275	187	73	39	14	19	6	3	18	37	107
Calculated		L10	67.32	70.14	71.57	71.55	71.73	71.67	71.35	70.61	71.95	72.65	72.55	70.37	67.86	66.59	64.92	60.83	58.11	53.66	54.99	49.98	46.97	54.75	57.88	62.49
		V	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		p	7.38	4.82	4.74	5.69	5.35	6.10	7.66	7.49	6.57	5.95	5.99	9.91	4.89	6.55	10.70	4.11	12.82	21.43	36.84	50.00	100.00	83.33	16.22	11.21
Input	No. of Heavy Vehicles	f	24	30	41	49	48	54	63	52	62	66	65	65	18	18	20	3	5	3	7	3	3	15	6	12
		ΔpV	3.89	3.46	3.45	3.61	3.55	3.68	3.93	3.91	3.76	3.66	3.66	4.27	3.48	3.75	4.39	3.34	4.68	5.69	7.06	7.97	10.31	9.66	5.10	4.46
		ΔG	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
		G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fixed- CRRI	Surface Correction	Surface Corr.	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
		Cd	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13	-1.13
Input	Height of receptor	h	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Input	Distance from edge of nearside carriageway	d	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Calculated	Diagonal Distance of the Receptor	d'	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52
No Use		h	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
No Use		H	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
		Cg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		θ(View Angle)	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
		Cv	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37	-18.37
Calculated	Path Difference due to Barrier	δ	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81
		SB	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
		BR	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82	14.82
		X	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57

		2049-50 Section 1 (Sarthebari to Pathsala)																								
		TIME	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00
	54.91	Cr	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Fixed- CRRI	Segment Angle	θ'	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
Fixed- CRRI	Segment Angle	θ	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
		L10,i	**52.50**	**54.90**	**56.31**	**56.46**	**56.58**	**56.65**	**56.58**	**55.82**	**57.00**	**57.60**	**57.51**	**55.94**	**52.63**	**51.64**	**50.60**	**45.46**	**44.08**	**40.64**	**43.34**	**39.24**	**38.57**	**45.70**	**44.28**	**48.25**
		Honking Noise	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
		Cycle Noise	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Cmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
		Noise Level, 2059-60	**55.60**	**58.00**	**59.41**	**59.56**	**59.68**	**59.75**	**59.68**	**58.92**	**60.10**	**60.70**	**60.61**	**59.04**	**55.73**	**54.74**	**53.70**	**48.56**	**47.18**	**43.74**	**46.44**	**42.34**	**41.67**	**48.80**	**47.38**	**51.35**
		Leq with correction, 2059-60	53.04	55.29	56.62	56.75	56.87	56.93	56.87	56.15	57.26	57.83	57.75	56.26	53.15	52.23	51.25	46.42	45.12	41.89	44.43	40.57	39.94	46.65	45.31	49.04
		Leq without correction, 2059-60	50.12	52.37	53.70	53.84	53.96	54.02	53.95	53.24	54.35	54.91	54.83	53.35	50.24	49.31	48.33	43.51	42.21	38.97	41.51	37.66	37.03	43.73	42.39	46.12
		TIME	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	1.00	2.00	3.00	4.00	5.00	6.00

Output

	Distance (m)	Section 1
5	0	60.8
10	5	57.0
15	10	54.5
20	15	52.5
25	20	50.9
30	25	49.6

	Distance (m)	Section 1
35	30	48.5
40	35	47.5
45	40	46.6
50	45	45.8
55	50	45.1

ANNEXURE 24: TEEMP MODELLING OUTPUT DATA

Basic

Type of road	Rural Road
Number of sections to be assessed	1
Starting Year of assessment	2020
Number of Years to be assessed	31
Number of Days/Year	365
Induced traffic elasticity (with lane kilometres)	0.25
Which year shall you start considering induced traffic?	2
Volume/Capacity Saturation Limit	1

Number of Lanes	Maximum PCU
1	4,000
1.5	12,000
2	36,000
4	80,000

Section

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
BAU	Lane Width (m)	3	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
	Lane Length (km)	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
	Number of Lanes	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
With Project	Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Lane Length (km)	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
	Number of Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Traffic volume/day

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
2-wheeler	854	932	1017	1331	1742	1901	2057	2225	2408	2605	2819	3019	3233	3463	3709	3972	4203	4446	4704	4977	5266	5524	5794	6078	6376	6689	6976	7276	7589	7915	8256
3-wheeler	44	48	52	69	90	98	106	114	123	132	143	152	161	172	183	194	204	214	225	236	248	259	269	281	293	305	316	328	340	352	366
Car	151	165	180	235	308	336	362	391	421	454	489	521	554	589	627	667	701	736	772	811	852	887	925	963	1004	1046	1085	1125	1166	1210	1254
LMV/LCV	55	60	66	87	114	125	136	147	161	174	190	204	221	238	256	277	295	313	334	356	379	402	424	449	475	502	529	557	586	617	651
Bus	5	5	6	7	9	9	10	10	11	11	12	13	13	14	14	15	16	16	17	18	18	19	20	20	21	22	22	23	24	24	25
2 Axle	3	3	4	5	6	6	7	8	8	9	9	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	29
Bullocart	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bicycle	561	550	539	528	518	507	497	487	478	468	459	450	441	432	423	414	406	398	390	382	374	367	359	352	345	338	332	325	318	312	306

Average Trip Distance

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
2-wheeler	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
3-wheeler	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Car	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
Multi Axle	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
Bus	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
2 Axle	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653	17.653
Bullocart	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Bicycle	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Output Emission Intensity Indicators

Details	CO2		
	Business-As-Usual	Project (without Induced Traffic)	Project (with Induced Traffic)
tons/km	4,070.68	4,530.21	4,893.07
tons/year	2,318.06	2,579.74	2,786.37
tons/km/year	131.31	146.14	157.84
g/pkm	83.20	92.60	92.37
g/tkm	82.70	92.04	91.80

ANNEXURE 25: TREE LIST

Sl. No.	Chainage (M)	Total Tree
1	0 to 1000	38
2	1000 to 2000	77
3	2000 to 3000	44
4	3000 to 4000	68
5	4000 to 5000	80
6	5000 to 6000	52
7	6000 to 7000	66
8	700 to 8000	49
9	8000 to 9000	64
10	900 to 10000	62
11	10000 to 11000	13
12	11000 to 12000	81
13	12000 to 13000	58
14	13000 to 14100	141
15	14100 to 16550	84
16	16550 to 17653	22
Total		**999**

Bohori Beat

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
1	Aahat	3.00	1.50		L	Branch
2	Devdaru	1.50	6.00		L	
3	Do	1.40	6.00		L	
4	Raintree	1.80	2.00		L	Branch
5	Bel	1.70	1.00		L	Branch
6	Bhelkor	1.50	6.00		R	
7	Aahat	2.20	2.00		L	Branch
8	Aahat	3.50	2.00		L	Branch
9	Moj	1.10	2.50		L	
10	Aahat	3.00	4.00		L	Branch
11	Bot	1.10	1.00		L	Branch
12	Bhelkor	1.40	3.00		L	Branch
13	Moj	1.00	3.00		L	Branch
14	Aam	1.10	3.00		L	Branch
15	Aam	1.00	3.00		L	Branch
16	Teak	1.10	7.00		L	
17	Silikha	0.90	2.50		L	Branch
18	Aam	0.90	2.50		L	Branch
19	Aam	0.80	2.50		L	Branch
20	Kadam	0.90	4.00		L	
21	Silikha	1.00	4.00		L	
22	Silikha	0.65	2.00		L	
23	Kadam	1.00	5.00		L	
24	Kadam	1.80	10.00		R	
25	Bhelkor	0.80	2.50		R	Branch

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
26	Do	1.00	4.00		R	
27	Bel	0.80	1.50		L	Branch
28	Aam	0.70	3.50		L	Branch
29	Aam	0.70	3.00		L	Branch
30	Bhelkor	1.00	2.50		R	Branch
31	Moj	0.80	5.00		L	
32	Gomari	0.80	4.00		L	
33	Kadam	0.80	4.00		L	
34	Simul	0.65	3.00		L	Branch
35	Aahat	2.40	1.00		L	Branch
36	Moj	0.80	4.00		L	
37	Gomari	0.90	7.00		L	
38	Moj	0.80	3.50		L	Branch
39	Bot	1.60	1.00		R	Branch
40	Bonun	1.50	1.00		R	Branch
41	Bhelkor	0.60	4.00		L	
42	Bhelkor	1.10	8.00		L	
43	Kadam	0.70	3.00		R	
44	Silikha	0.65	4.00		R	
45	Kadam	0.70	3.00		R	
46	Kadam	0.60	3.00		R	
47	Sonaru	0.70	3.00		L	
48	Do	0.80	1.50		L	Branch
49	Kadam	1.10	6.00		L	
50	Aam	0.90	5.00		L	
51	Arjun	1.00	5.00		L	
52	Gomari	0.70	4.00		L	
53	Arjun	1.10	2.00		L	Branch
54	Bhelkor	0.80	1.00		R	Branch
55	Kadam	1.60	9.00		L	
56	Sonaru	0.70	4.00		L	
57	Aam	0.70	2.00		L	Branch
58	Aam	0.70	2.00		L	
59	Bhelkor	1.50	4.00		L	Branch
60	Bhelkor	1.60	7.00		L	Branch
61	Bhelkor	1.30	5.00		L	Branch
62	Ajar	0.90	3.00		L	Branch
63	Raintree	2.00	2.00		L	Branch
64	Bhelkor	1.60	3.50		L	Branch
65	Do	1.70	6.00		L	
66	Bhelkor	1.00	2.00		L	Branch
67	Raintree	3.60	2.50		L	Branch
68	Bhelkor	1.80	6.00		L	Branch
69	Do	1.20	3.00		L	Branch
70	Raintree	2.30	5.00		L	Branch
71	Simul	2.20	13.00	Do	L	
72	Bhelkor	1.50	5.00	Do	L	Branch
73	Simul	1.50	10.00	Do	L	
74	Copper Pod	1.60	4.00	Do	R	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
75	Bhelkor	2.60	4.00	Do	R	Branch
76	Bhelkor	1.50	5.00	Do	R	Branch
77	Raintree	0.70	4.00	Do	R	
78	Bhelkor	1.20	3.50	Do	R	Branch
79	Bhelkor	1.20	4.00	Do	R	Branch
80	Bhelkor	1.00	5.00	Do	R	
81	Bhelkor	1.60	2.50	Do	L	Branch
82	Simul	1.50	12.00	Do	L	
83	Teak	0.60	4.00	Do	R	
84	Teak	0.65	4.00	Do	R	
85	Teak	0.60	4.00	Do	R	
86	Teak	0.65	5.00	Do	R	
87	Teak	0.60	6.00	Do	R	
88	Teak	0.60	3.00	Do	R	
89	Teak	0.60	4.00	Do	R	
90	Bhelkor	1.20	3.50	Do	L	
91	Teak	0.65	4.00	Do	R	Branch
92	Teak	0.60	4.00	Do	R	
93	Teak	0.60	3.00	Do	R	
94	Teak	0.70	3.00	Do	R	
95	Bhelkor	1.20	4.00	Do	R	Branch
96	Bhelkor	1.00	1.50	Do	L	Branch
97	Raintree	2.20	5.00	Do	L	Branch
98	Simul	1.20	10.00	Do	L	
99	Bhelkor	1.40	4.00	Do	R	Branch
100	Raintree	2.30	3.00	Do	R	Branch
101	Bhelkor	1.40	2.50	Do	R	Branch
102	Raintree	3.30	0.90	Do	R	Branch
103	Raintree	2.40	1.50	Do	R	Branch
104	Raintree	2.40	2.00	Do	R	Branch
105	Raintree	2.40	4.50	Do	R	Branch
106	Raintree	3.00	2.00	Do	R	Branch
107	Raintree	2.90	1.20	Do	R	Branch
108	Raintree	2.20	2.50	Do	L	Branch
109	Bhelkor	1.80	4.00	Do	L	Branch
110	Raintree	3.00	3.50	Do	R	Branch
111	Raintree	2.00	4.00	Do	R	Branch
112	Bhelkor	1.80	1.50	Do	L	Branch
113	Bhelkor	0.90	2.00	Do	L	
114	Bhelkor	1.20	5.00	Do	L	
115	Bhelkor	1.20	1.00	Do	L	Branch
116	Bhelkor	1.30	3.00	Do	L	Branch
117	Bhelkor	1.20	2.50	Do	L	Branch
118	Dumbaru	1.00	2.00	Do	L	Branch
119	Raintree	1.80	2.00	Do	L	Branch
120	Bhelkor	0.90	1.00	Do	L	Branch
121	Bhelkor	1.90	2.50	Do	R	Branch
122	Bhelkor	1.50	2.50	Do	L	Branch
123	Dumbaru	1.50	1.00	Do	L	Branch

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
124	Bhelkor	0.70	3.00	Do	L	Branch
125	Bhelkor	0.90	2.00	Do	L	Branch
126	Bhelkor	0.80	3.00	Do	L	
127	Arjun	0.65	1.00	Do	R	Branch
128	Sonaru	0.90	3.00	Do	L	
129	Kadam	0.90	3.00	Do	R	
130	Bhelkor	0.80	1.50	Do	L	Branch
131	Bhelkor	0.70	1.00	Do	L	Branch
132	Bhelkor	0.60	1.50	Do	L	Branch
133	Bhelkor	0.90	2.00	Do	L	Branch
134	Bhelkor	1.10	2.50	Do	L	Branch
135	Bhelkor	1.00	2.50	Do	R	
136	Bhelkor	1.00	1.00	Do	R	Branch
137	Bhelkor	1.10	2.00	Do	L	Branch
138	Bhelkor	1.30	2.50	Do	L	Branch
139	Bhelkor	0.90	1.00	Do	L	Branch
140	Bhelkor	0.70	1.50	Do	R	Branch
141	Moj	0.70	1.50	Do	R	Branch
142	Bhelkor	1.00	4.00	Do	R	
143	Bhelkor	1.00	1.50	Do	R	Branch
144	Bhelkor	1.10	1.50	Do	R	Branch
145	Gomari	0.90	4.00	Do	R	
146	Bhelkor	1.80	3.50	Do	R	
147	Bhelkor	0.90	1.50	Do	R	Branch
148	Bhelkor	0.70	3.00	Do	R	
149	Bhelkor	0.70	2.00	Do	R	
150	Bhelkor	0.80	4.00	Do	R	Branch
151	Dumbaru	1.00	1.00	Do	R	Branch
152	Bhelkor	0.80	4.00	Do	R	
153	Koros	0.60	2.00	Do	L	
154	Bhelkor	0.80	3.00	Do	L	Branch
155	Bhelkor	0.80	4.00	Do	L	Branch
156	Bhelkor	0.80	1.50	Do	L	Branch
157	Bhelkor	1.00	4.00	Do	L	Branch
158	Ajar	0.90	1.00	Do	L	Branch
159	Bot	2.00	1.50	Do	L	Branch
160	Bhelkor	0.80	3.00	Do	L	
161	Ajar	0.80	2.00	Do	L	
162	Bhelkor	0.80	4.00	Do	L	
163	Bhelkor	0.70	2.50	Do	L	
164	Karos	0.90	2.00	Do	L	Branch
165	Karos	0.80	2.00	Do	L	Branch
166	Karos	0.60	3.00	Do	L	Branch
167	Karos	0.70	4.00	Do	L	
168	Karos	1.00	1.00	Do	L	Branch
169	Karos	0.70	2.00	Do	L	
170	Karos	0.70	3.00	Do	L	
171	Karos	0.80	4.00	Do	L	
172	Karos	0.60	4.00	Do	L	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
173	Karos	0.90	4.00	Do	L	
174	Karos	0.80	3.00	Do	L	Branch
175	Karos	0.80	3.00	Do	L	Branch
176	Karos	0.70	4.00	Do	L	
177	Karos	0.80	6.00	Do	L	Branch
178	Karos	0.70	3.00	Do	L	
179	Bhelkor	1.00	4.00	Do	L	Branch
180	Bhelkor	1.00	5.00	Do	L	
181	Karos	0.70	1.50	Do	L	
182	Karos	0.70	2.00	Do	L	
183	Karos	0.70	1.00	Do	L	Branch
184	Karos	0.80	1.00	Do	L	Branch
185	Karos	0.80	1.50	Do	L	Branch
186	Karos	0.70	2.00	Do	L	
187	Karos	0.70	2.00	Do	L	
188	Karos	0.60	4.00	Do	L	Branch
189	Karos	1.00	1.00	Do	L	Branch
190	Karos	0.80	3.00	Do	L	
191	Dumbaru	1.40	3.00	Do	L	Branch
192	Karos	0.80	4.00	Do	L	
193	Karos	0.70	2.00	Do	L	
194	Karos	0.90	5.00	Do	L	
195	Karos	1.00	1.00	Do	L	Branch
196	Karos	0.80	4.00	Do	L	
197	Karos	0.80	1.00	Do	L	Branch
198	Karos	0.80	2.00	Do	L	
199	Bhelkor	1.00	3.50	Do	L	
200	Bhelkor	0.60	2.50	Do	R	
201	Ajar	0.70	2.00	Do	R	
202	Bhelkor	0.80	3.00	Do	R	
203	Bhelkor	0.80	4.00	Do	R	
204	Ajar	0.70	3.00	Do	R	
205	Ajar	0.70	3.50	Do	R	
206	Jam	0.80	2.00	Do	R	Branch
207	Ajar	0.80	4.00	Do	L	
208	Ajar	0.70	2.00	Do	L	
209	Jam	1.40	1.00	Do	L	Branch
210	Bhelkor	0.80	2.00	Do	L	
211	Bhelkor	0.90	4.00	Do	R	Branch
212	Bhelkor	1.60	3.00	Do	R	Branch
213	Bhelkor	0.80	3.50	Do	R	
214	Ajar	0.80	4.00	Do	R	
215	Poma	0.80	3.00	Do	R	
216	Ajar	0.80	4.00	Do	L	
217	Ajar	0.70	1.00	Do	L	Branch
218	Jam	1.10	6.00	Do	L	
219	Ajar	0.60	3.00	Do	R	
220	Gomari	0.80	6.00	Do	L	
221	Sonaru	0.90	4.00	Do	R	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
222	Aahat	1.20	1.50	Do	R	Branch
223	Moj	1.00	4.00	Do	L	
224	Bhelkor	0.80	3.00	Do	R	
225	Bhelkor	1.10	5.00	Do	R	
226	Moj	1.00	5.00	Do	L	
227	Moj	0.90	9.00	Do	R	
228	Sonaru	1.50	7.00	Do	R	
229	Moj	0.90	5.00	Do	R	
230	Moj	0.70	5.00	Do	L	
231	Gomari	1.00	2.00	Do	L	Branch
232	Gomari	0.90	7.00	Do	L	
233	Gomari	0.80	5.00	Do	L	
234	Amlokhi	0.80	4.00	Do	L	
235	Aam	0.80	3.00	Do	L	
236	Bhelkor	1.00	6.00	Do	L	
237	Moj	0.70	3.00	Do	L	
238	Bhelkor	2.00	10.00	Do	L	Branch
239	Bhelkor	0.70	4.00	Do	L	
240	Bhelkor	1.40	6.00	Do	L	Branch
241	Ajar	1.80	6.00	Do	R	Branch
242	Ajar	1.50	6.00	Do	R	Branch
243	Bhelkor	1.80	9.00	Do	R	Branch
244	Poma	0.80	6.00	Do	R	Branch
245	Aahat	2.50	1.00	Do	L	
246	Bel	0.80	4.00	Do	L	
247	Aam	0.80	2.00	Do	R	
248	Bhelkor	0.90	4.00	Do	R	
249	Kadam	1.50	7.00	Do	L	
250	Bhelkor	1.00	7.00	Do	R	
251	Bhelkor	1.00	5.00	Do	R	
252	Bhelkor	1.00	3.00	Do	R	
253	Bhelkor	0.90	5.00	Do	L	
254	Aahat	2.50	1.00	Do	R	Branch
255	Gomari	0.70	2.50	Do	R	
256	Kadam	1.20	8.00	Do	R	
257	Kadam	1.00	8.00	Do	R	
258	Aahat	0.90	1.00	Do	R	Branch
259	Moj	0.80	4.00	Do	L	
260	Moj	0.60	2.00	Do	L	Branch
261	Moj	0.70	4.00	Do	L	
262	Aahat	0.70	2.00	Do	L	
263	Kadam	1.00	10.00	Do	R	
264	Kadam	0.80	7.00	Do	R	
265	Aahat	0.70	2.00	Do	R	Branch
266	Kadam	0.80	1.00	Do	R	Branch
267	Bhelkor	0.90	4.00	Do	R	
268	Aahat	0.90	3.00	Do	L	Branch
269	Aahat	2.00	3.00	Do	L	Branch
270	Kadam	0.90	8.00	Do	L	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
271	Kadam	0.90	8.00	Do	R	
272	Bhelkor	0.80	1.00	Do	R	Branch
273	Moj	0.90	2.00	Do	L	Branch
274	Bhelkor	0.70	3.00	Do	L	
275	Moj	0.80	1.50	Do	R	Branch
276	Simul	1.00	8.00	Do	R	
277	Aahat	0.80	2.50	Do	L	
278	Aahat	1.20	1.00	Do	L	Branch
279	Aahat	1.30	1.00	Do	L	Branch
280	Aahat	1.00	2.00	Do	L	Branch
281	Aahat	1.10	3.00	Do	L	
282	Aahat	1.50	1.00	Do	L	Branch
283	Aahat	1.20	2.50	Do	L	Branch
284	Aahat	1.40	2.00	Do	L	Branch
285	Bhelkor	0.80	3.00	Do	L	
286	Aahat	1.00	4.00	Do	L	
287	Ghora Neem	1.00	3.00	Do	L	
288	Kadam	0.80	2.00	Do	L	
289	Aam	0.90	2.00	Do	L	Branch
290	Kadam	1.20	4.00	Do	L	Branch
291	Aahat	2.50	1.00	Do	L	Branch
292	Kadam	1.50	10.00	Do	L	
293	Kadam	1.20	9.00	Do	L	
294	Aahat	0.90	2.00	Do	L	Branch
295	Ghora Neem	0.90	5.00	Do	L	
296	Bhelkor	0.90	4.00	Do	L	
297	Bhelkor	2.00	10.00	Do	L	Branch
298	Aahat	1.00	2.00	Do	L	Branch
299	Aahat	1.00	2.00	Do	L	Branch
300	Aahat	1.00	3.00	Do	L	Branch
301	Dumbaru	0.90	2.00	Do	L	Branch
302	Karos	1.00	1.00	Do	L	Branch
303	Karos	0.80	2.00	Do	L	Branch
304	Moj	1.70	4.00	Do	L	Branch
305	Karos	0.70	1.50	Do	L	Branch
306	Karos	0.80	3.00	Do	L	
307	Karos	0.70	2.00	Do	L	Branch
308	Bhelkor	0.80	2.00	Do	L	Branch
309	Aahat	3.60	1.00	Do	R	Branch
310	Aahat	1.00	4.00	Do	R	
311	Aahat	0.80	3.00	Do	R	
312	Aahat	1.00	1.50	Do	R	Branch
313	Aahat	1.10	3.00	Do	R	Branch
314	Aahat	1.00	5.00	Do	R	
315	Aahat	1.40	5.00	Do	R	Branch
316	Aahat	1.20	2.00	Do	R	Branch
317	Karos	0.90	3.00	Do	R	Branch
318	Karos	0.80	1.50	Do	R	Branch
319	Karos	0.70	1.50	Do	R	Branch

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
320	Karos	1.40	2.50	Do	R	Branch
321	Bher	0.80	4.00	Do	R	
322	Bher	0.90	3.00	Do	R	Branch
323	Aahat	0.80	1.50	Do	R	Branch
324	Bhelkor	1.20	7.00	Do	R	Branch
325	Bhelkor	0.80	7.00	Do	R	
326	Bhelkor	1.00	6.00	Do	R	
327	Bhelkor	1.20	10.00	Do	R	
328	Aahat	1.00	10.00	Do	R	
329	Aahat	0.80	5.00	Do	R	Branch
330	Aahat	0.80	4.00	Do	R	Branch
331	Aahat	1.00	3.00	Do	R	Branch
332	Aahat	0.90	4.00	Do	R	
333	Aahat	0.90	6.00	Do	R	
334	Kadam	0.90	3.00	Do	R	
335	Kadam	0.80	10.00	Do	R	
336	Bhelkor	0.80	5.00	Do	R	
337	Kadam	0.80	7.00	Do	R	
338	Aam	0.90	4.00	Do	L	Branch
339	Karos	0.70	5.00	Do	L	
340	Kadam	0.60	6.00	Do	R	
341	Bhelkor	0.90	4.00	Do	R	
342	Kadam	0.60	3.00	Do	R	
343	Kadam	1.20	3.00	Do	R	Branch
344	Aam	1.80	4.00	Do	L	
345	Aam	0.80	3.00	Do	L	Branch
346	Kathal	0.60	2.00	Do	L	
347	Aam	1.30	3.00	Do	L	Branch
348	Bhelkor	1.10	4.00	Do	L	
349	Bukul	0.80	2.00	Do	R	
350	Sammi	0.80	3.00	Do	R	
351	Silikha	0.60	1.00	Do	R	
352	Bhelkor	2.10	6.00	Do	R	
353	Jam	0.70	2.00	Do	R	
354	Kadam	2.20	10.00	Do	L	
355	Kadam	1.80	6.00	Do	L	
356	Bhelkor	0.90	3.00	Do	R	
357	Kadam	1.10	3.00	Do	L	
358	Bhelkor	2.10	3.00	Do	R	
359	Bhelkor	1.60	3.00	Do	R	
360	Bhelkor	1.30	4.00	Do	R	Branch
361	Bhelkor	0.80	3.00	Do	R	
362	Bhelkor	1.10	4.00	Do	R	
363	Kadam	0.80	2.00	Do	L	
364	Bhelkor	0.70	2.00	Do	L	
365	Bhelkor	1.10	3.00	Do	R	
366	Pakri	0.90	3.00	Do	R	
367	Aam	0.90	4.00	Do	L	
368	Aam	0.80	3.00	Do	L	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
369	Gamari	0.80	3.00	Do	L	
370	Gamari	2.10	3.00	Do	L	
371	Gamari	1.80	5.00	Do	L	
372	Karos	1.90	7.00	Do	L	
373	Bhelkor	0.80	3.00	Do	L	
374	Kathal	1.10	2.00	Do	L	
375	Kathal	2.10	4.00	Do	L	
376	Silikha	0.80	2.00	Do	L	
377	Aam	0.80	3.00	Do	L	
378	Aam	0.80	3.50	Do	L	
379	Kadam	0.70	3.00	Do	L	
380	Aam	0.70	2.00	Do	L	
381	Aam	0.90	3.00		L	Branch
382	Aam	0.90	4.00		L	Branch
383	Aam	0.70	3.00		L	Branch
384	Aam	0.70	2.00		L	Branch
385	Aam	0.90	4.00		L	Branch
386	Pakri	2.10	4.00		L	
387	Pakri	1.90	3.00		L	
388	Bhelkor	1.10	2.90		L	
389	Bhelkor	0.90	4.00		L	
390	Bhelkor	0.80	3.50		L	
391	Pakri	2.50	4.00		L	
392	Aam	0.90	3.00		L	
393	Aam	1.10	4.00		L	
394	Aam	1.00	5.00		L	
395	Pakri	1.20	4.00		L	
396	Ahot	1.40	4.00		L	
397	Ahot	1.50	5.00		L	
398	Ahot	1.30	2.00		L	
399	Shegun	1.80	6.00		L	
400	Pakri	5.00	3.00		L	
401	Pakri	3.00	4.00		L	
402	Pakri	0.80	3.00		L	Branch
403	Pakri	4.00	3.00		L	Branch
404	Aam	0.90	2.00		L	Branch
405	Aam	0.80	3.00		L	Branch
406	Aam	0.80	3.00		L	Branch
407	Aam	2.10	3.00		L	Branch
408	Aam	0.90	2.00		L	Branch
409	Gomari	1.00	2.00		L	Branch
410	Pakri	2.20	2.00		L	Branch
411	Pakri	3.20	5.00		L	Branch
412	Teak	1.90	4.00		L	Branch
413	Ghora Nim	0.90	4.00		L	Branch
414	Gamari	1.80	4.00		L	Branch
415	Dumbaru	3.10	5.00		L	Branch
416	Pakri	1.10	3.00		L	Branch
417	Pakri	2.40	5.00		L	Branch

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
418	Aam	0.90	2.00		L	Branch
419	Jam	0.80	2.00		L	Branch
420	Kadam	0.90	3.00		L	Branch
421	Kadam	0.80	3.00		L	Branch
422	Bhelkor	0.80	1.00		L	Branch
423	Bhelkor	2.80	1.00		R	Branch
424	Bhelkor	2.80	1.00		L	Branch
425	Bhelkor	0.80	1.00		L	Branch
426	Gomari	0.90	4.00		L	Branch
427	Dumbaru	1.20	4.00		L	Branch
428	Arjun	0.90	5.00		L	Branch
429	Poma	0.70	2.00		L	Branch
430	Silikha	0.90	2.00		R	Branch
431	Bhelkor	0.80	2.00		R	Branch
432	Kadam	0.90	3.00		R	Branch
433	Kadam	1.20	6.00		L	Branch
434	Kathal	0.90	3.00		L	Branch
435	Kathal	0.90	2.50		L	Branch
436	Jalphai	0.70	2.00		L	Branch
437	Bhelkor	0.90	2.00		L	Branch
438	Bhelkor	1.20	5.00		R	Branch
439	Kadam	0.80	3.00		L	Branch
440	Aam	0.80	2.00		L	Branch
441	Kadam	0.90	2.50		L	Branch
442	Kadam	0.90	3.00		L	Branch
443	Aam	0.80	2.00		L	Branch
444	Kadam	1.40	3.00	Rampur	L	Branch
445	Aam	2.20	2.00		L	Branch
446	Dumbaru	1.80	3.00		L	Branch
447	Aam	0.90	2.00		L	Branch
448	Kadam	1.00	3.00		L	Branch
449	Bot	1.00	2.00		L	Branch
450	Bot	1.20	3.00		L	Branch
451	Kadam	1.40	4.00		L	Branch
452	Kadam	1.00	2.00		L	Branch
453	Kadam	1.70	7.00		L	Branch
454	Kadam	0.60	3.00		L	Branch
455	Silikha	0.60	3.00		L	Branch
456	Aam	0.90	3.00		L	Branch
457	Silikha	1.40	8.00		L	Branch
458	Kadam	0.80	5.00		L	Branch
459	Sonaru	1.30	3.00		L	Branch
460	Kadam	1.30	6.00		L	Branch
461	Kadam	1.60	8.00		L	Branch
462	Moni Sal	0.80	2.00		R	Branch
463	Aam	1.90	5.00	Rampur	R	Branch
464	Kadam	0.90	4.00		R	
465	Kadam	1.00	8.00		R	
466	Kadam	1.00	10.00		L	

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
467	Sonaru	0.90	4.00		R	Branch
468	Poma	0.80	2.00		L	Branch
469	Gomari	0.70	2.00		L	
470	Sonaru	0.80	1.50		L	Branch
471	Aahat	4.00	5.00		L	Branch
472	Aahat	2.00	8.00		L	
473	Aahat	2.00	3.00		L	Branch
474	Dumbaru	0.90	3.00		L	Branch
475	Bhelkor	1.00	2.00		L	
476	Kadam	0.90	5.00		L	
477	Bhelkor	1.00	2.00		R	Branch
478	Aahat	0.70	1.50		L	
479	Bhelkor	0.80	2.50		R	
480	Bhelkor	0.80	2.00		L	
481	Bhelkor	0.80	2.00		L	Branch
482	Bhelkor	0.70	2.00		R	
483	Bhelkor	0.90	1.50		R	Branch
484	Bhelkor	1.00	2.00		L	Branch
485	Bhelkor	0.80	2.00		L	
486	Bhelkor	1.00	2.00		R	Branch
487	Bhelkor	1.00	2.50		R	Branch
488	Bhelkor	0.90	4.00		R	Branch
489	Bhelkor	0.90	3.00		L	
490	Bhelkor	0.90	2.50		L	
491	Pakri	1.00	3.00		L	Branch
492	Pakri	0.90	3.00		L	
493	Bhelkor	1.20	7.00		L	
494	Bhelkor	1.10	3.00		L	Branch
495	Bhelkor	1.30	4.00		L	
496	Aahat	2.00	1.00		R	Branch
497	Bhelkor	0.80	1.00		R	Branch
498	Bhelkor	0.90	1.00		R	Branch
499	Bhelkor	0.80	1.00		R	Branch
500	Bhelkor	0.90	2.00		R	
501	Bhelkor	1.00	5.00		R	
502	Aahat	1.00	2.00		L	
503	Aahat	1.00	4.00		L	
504	Aahat	1.00	2.50		R	
505	Bhelkor	0.70	3.00		R	
506	Kadam	0.70	6.00		R	
507	Aahat	0.70	4.00		R	
508	Aahat	0.70	3.00		R	
509	Kadam	0.80	4.00		R	
510	Aahat	0.80	3.00		R	
511	Bhelkor	0.70	2.00		R	
512	Bhelkor	0.70	2.00		R	
513	Kadam	0.60	3.00		R	
514	Bhelkor	0.70	4.00		R	
515	Bhelkor	0.90	2.00		R	Branch

Sl. No.	Species	Girth with Breast height	Approximate height	Location	Side	Remarks
516	Do	0.70	3.00		R	
517	Do	0.70	1.00		L	Branch
518	Do	1.00	3.00		L	
519	Aahat	0.90	2.00		R	
520	Devdaru	0.70	6.00		L	
521	Kathal	0.70	2.00		R	
522	Aam	0.70	4.00		R	
523	Aam	0.80	4.00		R	
524	Aam	0.70	2.00		L	
525	Aam	0.60	4.00		L	
526	Aam	0.70	4.00		L	
527	Debdaru	0.60	4.00		L	
528	Aam	1.10	4.00		L	
529	Silikha	0.80	4.00		L	
530	Kadam	0.70	3.00		R	
531	Bhelkor	0.60	4.00		R	
532	Aam	0.80	4.00		R	
533	Gamari	0.80	6.00		R	
534	Aam	1.20	4.00		L	
535	Kadam	0.70	3.50		R	
536	Aam	1.40	3.00		R	Branch
537	Bhelkor	1.00	2.00		R	Branch
538	Aam	0.60	2.00		L	

Pathsala beat

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
1	Mango	2.00	1.20	R	Branch
2	Kathal	3.00	0.80	L	
3	Bel	2.50	0.75	R	
4	Silikha	4.00	0.90	R	
5	Gomari	4.00	0.90	L	
6	Gomari	3.50	0.80	L	
7	Moj	5.00	1.00	L	
8	Kadam	4.00	0.70	L	
9	Kadam	4.00	0.70	L	
10	Mango	3.00	0.85	R	
11	Silikha	4.50	1.00	L	
12	Mango	4.00	0.80	L	
13	Mango	3.00	0.65	L	
14	Kadam	6.00	1.10	R	
15	Kadam	3.00	0.70	R	
16	Mango	5.00	2.30	L	
17	Sawara	3.00	2.50	L	
18	Gomari	3.00	1.50	R	
19	Mango	1.05	2.40	L	Branch
20	Sonaru	3.00	0.70	R	
21	Sonaru	2.00	0.70	R	
22	Sonaru	3.00	0.90	R	
23	Moj	1.05	0.65	R	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
24	Moj	2.00	0.70	R	
25	Bor Sowba	2.50	1.40	R	
26	Moj	3.00	1.10	R	
27	Moj	2.00	0.70	R	
28	Karos	3.05	1.30	R	
29	Saytam	8.00	1.60	L	
30	Pakari	7.00	3.10	L	2 Branch
31	Kadam	4.00	0.80	R	
32	Gomari	5.00	1.00	R	
33	Mango	3.00	0.75	R	
34	Silikha	4.00	0.80	R	
35	Mango	3.50	1.30	R	
36	Mango	2.50	0.90	R	
37	Silikha	4.00	0.80	R	
38	Mango	2.00	0.70	R	
39	Kadam	6.00	1.10	R	
40	Moj	4.50	1.40	R	
41	Mango	8.00	1.50	L	
42	Pakari	9.00	3.20	L	
43	Pakari	7.50	2.90	L	
44	Mango	3.00	0.70	L	
45	Pakari	4.00	2.10	L	
46	Pakari	8.00	1.90	L	
47	Bhomora	8.00	2.20	L	
48	Bot Gose	2.50	2.20	L	
49	Bot Gose	2.50	3.00	L	
50	Bot Gose	1.50	2.80	L	
51	Mango	4+4	2.00	R	2 Branch
52	Mango	2.50	0.65	R	
53	Mango	3.00	9.00	R	
54	Jum	4.50	1.00	R	
55	Gomari	3.00	0.80	L	
56	Mango	6.00	2.00	L	
57	Sawara	3.00	1.10	R	
58	Gohara	3.00	0.60	R	
59	Gohara	3.00	0.85	R	
60	Gomari	4.00	1.50	R	
61	Kathal	3.00	1.00	R	
62	Mango	2.00	0.70	R	
63	Mango	3.00	1.50	R	
64	Gomari	3.50	1.20	R	
65	Bhelkor	3.00	0.90	R	
66	Pakari	3.50	1.00	R	
67	Kadam	8.00	1.90	R	
68	Bhelkor	2.00	2.10	R	3 Branch
69	Silikha	4.00	0.85	R	
70	Silikha	4.00	1.00	R	
71	Mango	3.00	0.90	R	
72	Mango	2.50	0.70	R	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
73	Kadam	5.00	1.00	R	
74	Kadam	5.50	0.90	R	
75	Gomari	3.50	0.90	R	
76	Gomari	2.00	0.60	R	
77	Gomari	2.50	0.70	R	
78	Kadam	6.00	1.80	R	
79	Pakari	4.00	0.80	R	
80	Pakari	5.00	1.20	R	
81	Kadam	4.00	0.90	L	
82	Kadam	4.00	1.00	L	
83	Silikha	4.00	0.80	R	
84	Gomari	3.00	0.70	L	
85	Kadam	4.00	0.80	L	
86	Silikha	3.00	0.80	R	
87	Silikha	3.00	0.80	R	
88	Debodaru	2.50	0.80	L	
89	Gomari	5.00	1.20	L	
90	Bel	4.00	1.00	L	
91	Neem	3.50	1.00	R	
92	Poma	2.50	0.60	R	
93	Pakari	2.00	1.00	L	
94	Kadam	3.00	0.65	L	
95	Kadam	4.00	0.90	L	
96	Kadam	5.00	0.80	L	
97	Kadam	4.00	1.00	L	
98	Jum	6.00	1.20	L	
99	Jum	6.00	0.70	L	
100	Kadam	7.00	0.65	L	
101	Mango	4.00	0.90	L	
102	Mango	3.50	0.80	L	
103	Gomari	4.00	0.80	R	
104	Pakari	21.00	1.5+1.5+1.5	R	3 Branch
105	Barun	3.00	0.80	L	
106	Ou Tenga	3.00	0.60	L	
107	Kadam	5.00	1.20	L	
108	Kadam	6.00	1.10	R	
109	Kadam	4.00	0.65	L	
110	Kadam	2.00	0.60	L	
111	Moj	4.00	0.90	L	
112	Kadam	5.00	1.00	L	
113	Kadam	3.00	0.70	L	
114	Gomari	3.50	0.70	R	
115	Pakari	3.00	1.20	R	
116	Kadam	8.00	1.20	R	
117	Kadam	3.50	0.80	R	
118	Kadam	5.50	1.00	R	
119	Kadam	7.00	1.20	R	
120	Kadam	6.00	1.10	R	
121	Kathal	2.50	0.65	L	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
122	Kadam	7.00	1.10	L	
123	Kadam	4.00	0.80	L	
124	Pakari	3.00	1.20	L	
125	Mango	4.00	0.80	L	
126	Bakul	3.00	0.90	R	
127	Chandan	3.00	0.60	L	
128	Mango	6.00	2.00	R	
129	Bhelkor	3.00	0.75	L	
130	Mango	7.00	1.30	R	
131	Dambaru	4.50	1.10	L	
132	Mango	4.00	0.95	L	
133	Kadam	5.00	1.00	R	
134	Kadam	7.00	1.20	R	
135	Mango	3.50	0.95	L	
136	Mango	2.00	0.65	L	
137	Sonaru	4.00	0.90	L	
138	Bel	4.50	1.00	R	
139	Pakari	5.00	1.80	R	
140	Pakari	8.00	3.50	R	
141	Silikha	7.00	2.20	R	
142	Kadam	5.00	1.30	L	
143	Gomari	4.00	6.00	L	
144	Kadam	9.00	3.00	R	
146	Kadam	5.00	1.40	L	
147	Kadam	5.00	1.00	L	
148	Kadam	7.00	1.10	R	
149	Kadam	4.00	6.00	R	
150	Kadam	6.00	1.00	R	
151	Mango	3.00	1.20	L	
152	Mango	4.00	1.10	L	
153	Mango	4.00	1.30	L	
154	Mango	4.00	1.50	L	
155	Segun	6.00	1.10	L	
156	Segun	5.00	0.90	L	
157	Mango	4.00	1.20	L	
158	Mango	7.00	2.20	L	
159	Moj	5.00	1.70	R	
160	Bel	5.00	1.40	L	
161	Bel	4.00	1.10	L	
162	Bhelkor	5.00	0.70	L	
163	Bakul	3.50	1.10	L	
164	Bhelkor	5.00	1.10	L	
165	Bakul	4.00	1+1	R	2 Branch
166	Kadam	2.50	0.60	L	
167	Kadam	6.00	1.00	L	
168	Karos	2.00	0.80	L	
169	Bhelkor	2.00	0.70	L	
170	Bhelkor	3.00	0.70	L	
171	Bhelkor	3.00	0.80	L	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
172	Bhelkor	2.50	0.70	L	
173	Bhelkor	2.00	0.65	L	
174	Mango	3.00	2.00	R	
175	Mango	2.50	1.70	R	
176	Pakari	1+3+3+3+3	3+1+1+1+1	R	4 Branch
177	Mango	2.50	1.30	R	
178	Krishnasura	5.00	1.20	R	
179	Silikha	3.50	0.70	R	
180	Kadam	5.00	1.40	R	
181	Karos	3.00	0.80	R	
182	Kadam	3.50	1.30	R	
183	Silikha	3.00	0.80	R	
184	Mango	4.00	1.10	R	
185	Ukeliptas	6.00	0.80	R	
186	Gomari	7.00	1.20	R	
187	Mango	4.00	1.00	R	
188	Kadam	2.50	0.60	R	
189	Kadam	6.00	1.10	R	
190	Kadam	5.00	0.95	R	
191	Ukeliptas	6.00	1.05	R	
192	Silikha	2.00	0.60	R	
193	Kadam	6.00	1.20	R	
194	Gomari	4.50	0.90	R	
195	Segun	3.00	0.60	R	
196	Ahat	1.50	2.00	L	Branch
197	Pakari	5.00	1.10	L	
198	Kadam	4.00	0.80	R	
199	Kadam	4.00	0.70	R	
200	Silikha	4.50	0.80	R	
201	Gomari	4.00	0.70	R	
202	Kadam	4.50	1.10	R	
203	Bel	3.50	0.70	L	
204	Mango	4.00	0.90	L	
205	Titashop	3.50	0.75	L	
206	Mango	3.50	1.20	L	
207	Mango	3.00	1.00	R	
208	Kadam	2.50	0.60	R	
209	Kadam	6.00	1.20	R	
210	Mango	3.50	1.50	R	
211	Kadam	5.50	1.30	R	
212	Mango	4.00	0.70	R	
213	Mango	7.00	1.60	R	
214	Kadam	5.00	1.00	R	
215	Mango	4.00	0.80	R	
216	Amlokhi	4.00	0.80	L	
217	Beat	3.00	2.80	R	
218	Mango	4.00	1.30	L	
219	Mango	2.00	0.65	R	
220	Mango	4.00	1.00	R	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
221	Mango	4.50	0.90	R	
222	Mango	4.00	0.70	R	
223	Mango	5.50	1.00	R	
224	Mango	5.00	0.90	R	
225	Moj	3.00	0.70	R	
226	Silikha	3.00	0.60	L	
227	Mango	3.00	0.70	R	
228	Kadam	6.00	1.50	R	
229	Mango	5.00	0.90	R	
230	Kadam	7.00	1.00	L	
231	Poma	4.50	0.90	L	
232	Gohara	4.00	0.70	L	
233	Silikha	4.00	0.80	R	
234	Kadam	5.00	0.85	L	
235	Kadam	5.00	0.95	L	
236	Kadam	4.00	0.80	L	
237	Kadam	8.00	1.20	L	
238	Bel	2.50	0.70	L	
239	Mango	2.50	0.70	L	
240	Kathal	3.00	0.80	L	
241	Mango	4.00	1.00	R	
242	Mango	3.50	0.80	R	
243	Mango	3.00	0.80	L	
244	Dambaru	4.50	0.90	R	
245	Mango	5.00	0.80	L	
246	Mango	2.50	0.60	L	
247	Kathal	3.00	0.70	L	
248	Gomari	5.00	0.80	L	
249	Mango	3.00	0.70	R	
250	Poma	3.50	0.90	L	
251	Mango	3.00	0.75	L	
252	Mango	5.00	1.20	L	
253	Mango	4.00	1.10	L	
245	Mango	2.50	0.70	R	
255	Mango	4.50	0.70	R	
256	Mango	4.50	1.00	R	
257	Moj	3.00	1.20	L	
258	Mango	3.00	0.70	R	
259	Kathal	2.50	0.65	R	
260	Mango	3.50	0.80	R	
261	Karos	2.50	0.80	L	
262	Mango	4.00	0.70	L	
263	Mango	6.00	1.20	L	
264	Mango	5.00	1.00	L	
265	Mango	5.00	1.00	L	
266	Dambaru	6.00	2.10	L	
267	Moj	7.00	0.90	L	
268	Poma	3.00	0.70	L	
269	Bel	4.00	0.75	L	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
270	Mango	5.00	1.10	R	
271	Mango	3.50	0.70	R	
272	Pakari	1.5+3+3+3	3.5+1.5+1.5+1.5	R	3 Branch
273	Jam	5.00	1.00	R	
274	Kadam	6.00	0.95	L	
275	Sonaru	4.50	0.95	L	
276	Moj	3+2	0.90+0.75	L	2 Branch
277	Silikha	5.00	0.75	R	
278	Mango	4.50	0.90	R	
279	Mango	4.00	0.80	R	
280	Amara	5.00	1.00	R	
281	Pakari	5.00	1.00	L	
282	Mango	3.50	0.70	R	
283	Kadam	10.00	1.40	R	
284	Mango	3.00	0.70	R	
285	Pakari	6.00	2.10	R	
286	Simolu	5.00	0.90	R	
287	Simolu	5.00	0.80	R	
288	Jam	6.00	1.20	R	
289	Pakari	6.00	1.30	L	
290	Gomari	5.00	1.00	L	
291	Pakari	4.00	1.00	R	
292	Dambaru	5.00	1.20	R	
293	Jam	4.50	1.20	L	
294	Gomari	5.00	0.80	R	
295	Jam	5.50	1.00	L	
296	Jam	5.00	1.00	L	
297	Mango	6.00	1.20	L	
298	Jam	5.50	1.00	L	
299	Jam	5.50	1.20	R	
300	Karos	4.00	1.00	R	
301	Jam	2.50	0.80	R	
302	Mango	6.00	1.50	R	
303	Mango	6.00	1.40	R	
304	Gohara	2.00	0.60	L	
305	Kathal	4.50	0.90	R	
306	Kadam	8.00	1.20	R	
307	Kadam	7.00	1.20	L	
308	Mango	4.00	0.70	R	
309	Mango	3.00	0.60	R	
310	Mango	4.00	0.80	R	
311	Kadam	5.00	0.70	R	
312	Jam	5.50	1.10	R	
313	Jam	3.00	0.70	R	
314	Silikha	3.30	0.65	R	
315	Mango	5.50	1.00	R	
316	Mango	4.50	1.10	R	
347	Poma	7.00	1.20	R	
318	Radha Sura	5.00	2.30	R	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
319	Kadam	5.00	1.20	R	
320	Kadam	4.00	1.00	L	
321	Kadam	5.00	0.95	L	
322	Pakari	4+3+3	4+1.20+1.20+1.20	R	3 Branch
323	Karos	2.00	0.80	R	
324	Karos	3.50	1.40	R	
325	Kadam	6.00	1.00	L	
326	Karos	4.00	1.50	R	Branch
327	Karos	3.00	1.00	R	
328	Kadam	5.00	0.80	L	
329	Jam	3.00	0.70	L	
330	Karos	2.00	1.00	L	
331	Mango	2.50	0.90	R	
332	Mango	2+3+2+2	2.20+1.10+1.00+0.90	R	3 Branch
333	Karos	5.00	1.40	R	
334	Karos	1+4+2	1.50+4+2	R	Branch
335	Pakari	4+2+2+2	4+1.80+1.40+1.20	R	Branch
336	Pakari	3.00	2.00	L	2 Branch
337	Pakari	4.00	2.20	L	2 Branch
338	Karos	5.00	1.60	R	
339	Krishnasura	7.00	1.50	L	
340	Mango	3.50	1.50	L	
341	Mango	4.00	0.80	L	
342	Mango	4.00	0.90	L	
343	Kadam	3.00	0.80	L	
344	Bel	3.00	0.70	L	
345	Karos	2.50	0.70	L	
346	Sagun	4.00	1.10	L	
347	Karos	8.00	2.00	L	
348	Karos	3.00	1.50	R	
349	Kadam	4.50	0.80	L	
350	Kadam	2.50	0.65	R	
351	Mango	4.00	1.20	R	
352	Mango	4.50	1.30	R	
353	Kadam	4.00	1.00	R	
354	Mango	4.50	0.80	R	
355	Kathal	3.00	1.00	L	
356	Koray	6.00	1.00	L	
357	Kadam	3.00	0.60	L	
358	Mango	2.00	0.65	R	
359	Kadam	6.00	1.10	L	
360	Amara	3.00	1.00	R	
361	Kadam	6.00	1.00	L	
362	Kadam	6.00	1.00	L	
363	Amara	3.00	0.70	L	
364	Kadam	4.50	0.90	L	
365	Silikha	4.50	0.80	L	
366	Dambaru	4.00	1.30	R	
367	Pakari	6.00	1.50	R	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
368	Pakari	4.00	1.40	R	
369	Kadam	5.00	1.10	R	
370	Kadam	8.00	1.00	R	
371	Gomari	4.50	1.50	R	
372	Kadam	6.00	1.00	R	
373	Mango	3.00	1.50	R	
374	Kadam	8.00	1.20	R	
375	Kathal	3.00	0.80	R	
376	Mango	4.00	0.65	L	
377	Kathal	3.00	0.80	L	
378	Kadam	4.00	0.70	R	
379	Jam	4.50	1.40	R	
380	Kathal	2.50	0.80	R	
381	Sal	5.00	1.00	L	
382	Mango	4.50	1.00	R	
383	Amara	5.00	1.20	R	
384	Moj	6.00	0.90	R	
385	Bel	4.00	0.90	R	
386	Mango	6.00	1.40	R	
387	Dambaru	3.50	1.00	L	
388	Kadam	4.00	0.65	R	
389	Kadam	6.00	1.00	R	
390	Kadam	7.00	1.10	R	
391	Kathal	2.50	0.65	R	
392	Poma	5.00	1.00	R	
393	Mango	4.50	1.20	R	
394	Mango	4.00	0.70	R	
395	Kadam	3.50	0.70	L	
396	Poma	5.00	1.00	R	
397	Mango	2.50	0.80	R	
398	Mango	4.00	1.00	R	
399	Kadam	7.00	2.00	L	
400	Mango	5.00	2.10	L	
401	Kadam	6.00	1.60	L	
402	Kadam	6.00	1.00	R	
403	Kathal	6.00	2.00	R	
404	Botgass	1+5+2+5	5+2+2+1.5	R	3 Branch
405	Pakari	5.00	1.50	R	
406	Kadam	3.00	0.70	M	
407	Kadam	4.00	0.80	M	
408	Gomari	2.50	0.80	M	
409	Gomari	4.00	2.00	M	
410	Koray	6.00	2.00	M	
411	Gomari	2.50	1.80	M	
412	Gomari	3.50	1.20	M	
413	Amlokhi	2.00	0.90	M	
414	Pakari	2.5+5+5	2.5+1.40+1.40	M	
415	Dambaru	5.00	1.40	M	
416	Kadam	1.90	2.00	M	

Sl. No.	Species	Approximate height (M)	Girth with Breast height (M)	Side	Remarks
417	Kadam	4.50	0.95	M	
418	Kadam	4.00	0.80	M	
419	Kadam	3.00	0.70	M	
420	Pakari	3+3+3	1.80+1+1	M	
421	Pakari	6.00	1.80	M	
422	Kadam	6.00	1.00	M	
423	Kadam	4.00	0.80	M	
424	Pakari	6.00	1.50	M	
425	Pakari	6.00	1.20	M	
426	Pakari	4.00	1.60	M	
427	Mango	5.00	2.00	M	
428	Mango	4.50	1.60	M	
429	Pakari	6.00	1.80	M	
430	Moj	5.00	1.70	M	
431	Gomari	4.50	0.80	M	
432	Gomari	4.50	0.80	M	
433	Kadam	5.00	1.00	M	
434	Kadam	5.00	1.40	M	
435	Mango	5.00	1.00	M	
436	Moj	6.00	0.80	M	
437	Bhelkor	4.00	0.80	M	
438	Mango	1+4+4+4+5	3+1.5+1.5+1.5+1.5	M	
439	Amara	3.00	0.90	M	
440	Mango	3.00	0.80	M	
441	Mango	4.00	0.80	M	
442	Mango	4.00	0.80	M	
443	Arjun	5.00	1.00	M	
444	Kadam	11.00	2.10	M	
445	Simolu	12.00	2.00	M	
446	Simolu	3.00	0.70	M	
447	Simolu	10.00	1.60	M	
448	Simolu	3.00	0.65	M	
449	Moj	6.00	1.70	M	
450	Jam	4.50	0.90	M	
451	Silikha	6.00	0.80	M	
452	Gohara	7.00	1.20	M	
453	Bhoggas	6.00	1.00	M	
454	Mango	7.00	1.10	M	
455	Silikha	7.00	1.10	M	
456	Mango	2.00	0.60	M	
457	Mango	3.00	0.70	M	
458	Mango	2.50	0.60	M	
459	Gomari	4.00	0.70	M	
460	Mango	4.00	0.80	M	
461	Jam	3.50	0.70	M	

ANNEXURE 26: TREE CUTTING ESTIMATE FROM DIVISIONAL FOREST OFFICER

GOVERNMENT OF ASSAM
OFFICE OF THE DIVISIONAL FOREST OFFICER::NORTH KAMRUP DIVISION::RANGIA

Letter No.B/RST/Genl/ 264 Date: 26/4/2021

To,
The Executive Engineer, P.W.R.D.
Bhabanipur, Patacharkuchi &
Sarukhetri Territorial Road Division,
Pathsala, Dist-Bajali(Assam)

Sub:- Consultancy services of preparation of feasibility study/detail project report for the improvement of SH & MDRs under Asom Mala Group-2 Satheibari Rampur Pathshala Road, REG.Tree Cutting estimate.

Ref:- This office letter No. B/TIM/RST/5209-14, dt-11.11.2020.

Sir,

With reference to the letter no. cited above, I would like to inform you that, the estimate for operation of 538 nos. standing trees near by Sarthebari to Bon Gaon PWD Road and 461 nos of trees from Bon Gaon to Pathsala(Dharamtala) PWD Road along with the estimate for creation of plantation measuring 4 Ha. Block plantation together 4 years maintenance are furnish herewith. The charge for operation of trees, transportation, etc along with the cost of Compensatory Afforestation in the ratio 1:10 (As per Green tribunal order) may kindly be submitted in favour of the undersigned, by Demand Draft or may be transferred electronically to A/C No. 10968146243 of State Bank Of India, Rangia Branch (IFS code – SBIN0001171), as per estimates enclosed herewith.

Abstract :

1)	Transportation, etc for 538 nos. of trees – (Sarhaibari to Bon Gaon)0	Rs.	12,41,001.00
2)	Transportation, etc for 461 nos. of trees – (Bon Gaon to Pathsala "Dharamtala")	Rs.	10,56,496.00
3)	Compensatory Afforestation for 2500 nos of trees With 4 (four) years maintenance	Rs.	24,44,873.00
		Rs.	47,42,370.00

(Rupees Forty Seven lakhs Forty Two thousand three hundred seventy) only.

This is for favour of your kind information and necessary action.

Enclo : As stated above.

Yours faithfully

Divisional Forest Officer
North Kamrup division, Rangia

Memo No.A/RST/Genl/ 107 Date: 26/4/2021

Copy to the Chief Conservator of Forests(T), Central Assam Circle, Guwahati – 29 for favour of his kind information.

Divisional Forest Officer
North Kamrup division, Rangia

E/RST/genl./9 ::: Phone No. 03621-240571 ::: email:dfo.t.northkamrup@gmail.com

Detail Estimate for Adv. Works, creation & maintenance up to 5th year of 4 Ha. Block Plantation

Area 4 Ha.
Spacing (m x m) 2 x 2
Number of saplings/Ha. 2500
Length of fencing (R.M) 800
Wages rate (Rs.) 273

Particulars of Works	Units	Qty./ Ha.	Total Qty.	Rate/ Unit	Amount (Rs.)	Applicable rate of GST/Cess			Total Amount
						GST @ 12%	L/Cess @ 1%	Con. Profit @ 10%	
ERECTION OF FENCING									
a) Cost of full chain link Goat proof fencing (4' ht with 10 guage 3" dia link) with 3 strand barbed wire (one strand below the chain link and two strand above the chain link) to be filled on pre-cast RCC pillars of specific specification and size as per detail specification attached at 2.5 m apart. Including transportation. fitting and fixing for 800 R.M. @ Rs. 1016/RM as per estimate.	R.M.		800	1016	812800				
Sub-Total	**R.M**				**812800**	**56896**	**8128**	**0**	**877824**
INFRASTRUCTURE IN PLANTATION AREA									
Construction of camp hut as per estimate with installation of ring/tube well	No.		1	150000	150000				
Cost of tools & implements	No.		1	5000	5000				
Cost of RCC signboard & Gate including fitting and fixing of the same	No.		1	30000	30000				
Camp accessories	No.		1	5000	5000				
Sub-Total				**190000**	**190000**	**13300**	**1900**	**0**	**205200**
ADVANCE WORK									
Site selection, surveying, demarcation, Jungle cutting, burning etc. 20 Dls/ ha.	Dl.s.	20	80	273	21840				
Preparation and acquisition of polypot saplings in the field nursery for planting 2500 Nos. Seedling / ha. @ Rs 8/- per polypot / Stump	No.	2500	10000	8	80000				

Preparation of polypot saplings in the field nursery for vacancy filling									
(a) 25 % mortality expected during 1st year (to be planted in the field during the 2nd year) i.e. 625 seedlings / ha. @ Rs 8/- per polypot/stump.	Nos.	625	2500	8	20000				
(b) 20 % mortality expected during 2nd year (to be planted in the field during the 3rd year) i.e. 500 seedlings / ha. @ Rs 8/- per polypot/stump.	Nos.	500	2000	8	16000				
Cost of bamboo, making of stacking & Transportation etc.	Nos.	625	2500	1	2500				
Line alignment, carriage of stacking materials and fixing the stacking @ 5 Dls./ha.	Dls.	5	20	273	5460				
Sub-Total					**145800**	**17496**	**1458**	**14580**	**179334**
CREATION & 1ST YEAR MAINTENANCE									
Soil working, digging of pits, freshening of pits, cost of fertile soil, showing of seeds, carriage of stamps, polypot seedling and planting at the plantation site including, dibbling of seeds wherever necessary to complete raising of plantation with all necessary operation @ 40 Dls / ha.	DLs	40	160	273	43680				
1st weeding @ 18 Dls/Ha	DLs	18	72	273	19656				
2nd weeding @ 15 Dls/Ha	DLs	15	60	273	16380				
3rd weeding @ 12 Dls/Ha	DLs	12	48	273	13104				
4th weeding @ 9 Dls/Ha	DLs	9	36	273	9828				
Cattle watching, upkeepment of plantation, mulching and fire protection works @ 1 DL/25 Ha./year	DLs.	1	365	273	99645				
Sub- Total					**202293**	**24275**	**2023**	**20229**	**248820**
2ND YEAR MAINTENANCE									
Vacancy filling including soil working, carriage of stumps/ polypot seeding	DLs	10	40	300	12000				
1st weeding @ 18 Dls/Ha	DLs	18	72	300	21600				
2nd weeding @ 15 Dls/Ha	DLs	15	60	300	18000				
3rd weeding @ 12 Dls/Ha	DLs.	12	48	300	14400				
4th weeding @ 9 Dls/Ha	DLs	9	36	300	10800				

Cattle watching, upkeepment of plantation, mulching and fire protection works @ 1 DL./25 Ha./year	DLs.	1	365	300	109500				
Sub- Total					**186300**	**22356**	**1863**	**18630**	**229149**
3rd YEAR MAINTENANCE									
Vacancy filling including soil working, carriage of stumps/ polypot seeding	DLs	10	40	330	13200				
1st weeding @ 15 Dls/Ha	DLs	15	60	330	19800				
2nd weeding @ 12 Dls/Ha	DLs.	12	48	330	15840				
3rd weeding @ 10 Dls/Ha	DLs.	10	40	330	13200				
4th weeding @ 8 Dls/Ha	DLs	8	32	330	10560				
Cattle watching, upkeepment of plantation, mulching and fire protection works @ 1 DL./25 Ha./year	DLs.	1	365	330	120450				
Sub- Total					**193050**	**23166**	**1931**	**19305**	**237452**
4TH YEAR MAINTENANCE									
1st weeding @ 15 Dls/Ha	DLs.	15	60	363	21780				
2nd weeding @ 12 Dls/Ha	DLs.	12	48	363	17424				
3rd weeding @ 10 Dls/Ha	DLs.	10	40	363	14520				
Cattle watching, upkeepment of plantation, mulching and fire protection works @ 1 DL/25 Ha./year	DLs.	1	365	363	132495				
Sub Total					**186219**	**22346**	**1862**	**18622**	**229049**
5TH YEAR MAINTENANCE									
1st weeding @ 12 Dls/Ha	DLs.	12	48	399	19152				
2nd weeding @ 10 Dls/Ha	DLs	10	40	399	15960				
3rd weeding @ 8 Dls/Ha	DLs	8	32	399	12786				
Cattle watching, upkeepment of plantation, mulching and fire protection works @ 1 DL/25 Ha./year	DLs.	1	365	399	145635				
Sub total					**193533**	**23224**	**1935**	**19353**	**238045**
Grand Total					**2109995**	**203059**	**21100**	**110719**	**2444873**

(Rupees Twenty Four Lakhs Forty-Four Thousand Eight Hundred Seventy Three) Only

Counter Signature

Divisional Forest Officer
North Kamrup Division
Barpeta

Submitted by

Range Forest Officer
Barpeta Road Range
Barpeta Road.

GOVT. OF ASSAM
OFFICE OF THE RANGE FOREST OFFICER :: BARPETA ROAD FOREST RANGE ::
BARPETA ROAD

Memo No. BR/78/Enumeration/ 2883 Dt. 23/02/2021

To,

The Divisional Forest Officer,
North Kamrup Division, Rangia.

Sub :- Consultancy Service for preparation of fesibility study/ Detailed Project report for the improvement of SH & MDRs under Asom Mala Group-2 Sarthebari Rampur Pathsala Road Reg. Tree cutting estimate.

Ref :- Your's letter No. B/TIM/RST/5209-14, dt. 11-11-2020.

Sir,

With reference to above, I have the honour to submit herewith the Enumeration Report & Estimate for Operation of SH & MDRs under Asom Mala Group-2-Sarthebari Rampur Pathsala Road, Reg. Tree cutting estimate, falling in the jurisdication of Pathala Forest Beat from Bongaon to Pathsala(Dharamtala).

This is for favour of your kind information and necessary action.

Enclosed :- As stated above.

Yours faithfully,

Range Forest Officer
Barpeta Road Range
Barpeta Road

Estimate showing the Operational Cost for tree cutting of Road side standing trees under the project for the improvement of SH & MDRs under Asom Mala Group-2 Sarthebari Rampur Pathsala(Dharamtala)Reg Road.Reg tree cuting estimate from Bongaon to Pathsala(Dharamtala) Road.

Total Number of Trees = 461 Nos.
" Volume = 306.231 M^3
Govt.Royalty of Trees = 3,06,231/-

Operation Cost :-

1. Felling,Sectioning etc. @ 1050/- Per cum x 306.231 M^3 = 321543/-
2. Dragging Cost upto Diesel Point @ 700/- per cum x 306.231 Cum. = 214361/-
3. Transporting to Timber Depot including Stacking etc.@ 1250/-per cum x 306.231 Cum. = 382788/-
4. Maintenance of Depot including Hiring of land enhancement of watch & word etc. @ 300/- per Cum.x 306.231 Cum. = 91869/-
5. Contingency @ 5% on operational cost for T.A./D.A. of field staff @ 150/- per cum x 306.231 Cum. = 45935/-

Total = Rs.1056496/-

(Rupees Ten lakhs fifty six thousand four hundred ninety six)only.

Submitted

FOREST BEAT OFFICER
PATHSALA

Range Forest Officer
Barpeta Road Range
Barpeta Road.

Counter Signature

Divisional Forest Officer
North Kamrup Division
Kamrup

(1)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtak)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
1	Aum	1.20	2.00	0.600	Bun-Gaon	Right	Branch
2	Kathal	0.80	3.00	0.180	"	Left	
3	Ball	0.70	2.00	0.100	"	Right	
4	Silikha	0.90	4.00	0.280	"	"	Branch
5	Gamari	0.90	4.00	0.280	"	Left	"
6	Gamari	0.80	3.05	0.180	"	"	"
7	Moj	1.00	5.00	0.380	"	"	Branch
8	Kadam	0.70	4.00	0.100	"	"	
9	Kadam	0.70	4.00	0.100	"	"	
10	Aum	0.85	3.00	0.280	"	Right	Branch
11	Silikha	1.00	4.50	0.380	"	Left	"
12	Aum	0.80	4.00	0.180	"	"	"
13	Aum	0.65	3.00	0.100	"	"	
14	Kadam	1.10	6.00	0.480	"	Right	Branch
15	Kadam	0.70	3.00	0.100	"	"	
16	Aum	2.20	5.00	2.140	"	Left	Branch
17	Sowra	2.50	3.00	3.681	"	"	
18	Gamari	1.50	3.00	1.000	"	Right	Branch
19	Aum	2.40	1.50	2.500	"	Left	"
20	Sonalu	0.70	3.00	0.100	"	Right	"
21	Sonalu	0.70	2.00	0.100	"	"	
22	Sonalu	0.90	3.00	0.280	"	"	Branch
23	Moj	0.70	1.50	0.100	"	"	"
24	Moj	0.70	2.00	0.100	"	"	"
25	Bor Sowla	1.40	2.50	0.850	"	"	"
26	Moj	1.10	3.00	0.480	"	"	"
27	Moj	0.70	2.00	0.100	"	"	"
28	Kathal	1.30	3.50	0.720	"	"	"
29	Sajjan	1.60	8.00	1.140	"	Left	"

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P.T.O

(2)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Sarthebari to Pathsala)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
30	Pakari	3·10	7·00	6·220	Bongaon	Left	Branch
31	Kadam	0·80	4·00	0·180	"	Right	"
32	Gamari	1·00	5·00	0·380	"	"	"
33	Aum	0·75	3·00	0·180	"	"	"
34	Silikha	0·80	4·00	0·180	"	"	"
35	Aum	1·30	3·50	0·720	"	"	"
36	Aum	0·90	2·50	0·280	"	"	"
37	Silikha	0·80	4·30	0·180	"	"	"
38	Aum	0·70	2·00	0·100	"	"	
39	Kadam	1·10	6·00	0·480	"	"	Branch
40	Moj	1·40	4·50	0·850	"	"	"
41	Aum	1·50	8·00	1·000	"	Left	"
42	Pakari	3·20	9·00	6·220	"	"	"
43	Pakari	2·90	7·00	3·681	"	"	"
44	Aum	0·70	3·00	0·100	"	"	"
45	Pakari	2·10	4·00	1·960	"	"	"
46	Pakari	1·90	7·00	1·610	"	"	"
47	Bhamara	2·20	8·00	2·140	"	"	"
48	Bolgoss	2·20	2·50	2·140	"	"	"
49	Botgoss	3·80	2·50	6·220	"	"	"
50	Botgoss	2·80	1·50	3·681	"	"	"
51	Aum	2·00	8·00	2·495	"	Right	"
52	Aum	0·65	2·50	0·100	"	"	
53	Aum	0·90	3·00	0·280	"	"	Branch
54	jum	1·00	4·50	0·380	"	"	"
55	Gamari	0·80	3·00	0·180	"	Left	"
56	Aum	2·00	6·00	2·435	"	"	"
57	Saoka	1·10	3·00	0·380	"	Right	"
58	Gohara	0·60	3·00	0·100	"	"	

44·192
+ 17·011
61·803

P.T.O

(3)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
59	Gohora	0·85	3·00	0·280	Bragaon	Right	Branch
60	Gamari	1·50	4·00	1·000	"	"	"
61	Kathal	1·00	3·00	0·380	"	"	"
62	Aum	0·70	2·00	0·100	"	"	
63	Aum	1·50	3·00	1·000	"	"	Branch
64	Gamari	1·20	3·50	0·600	"	"	"
65	Bhalkar	0·90	3·00	0·280	"	"	"
66	Pakari	1·00	3·50	0·380	"	"	"
67	Kadam	1·90	8·00	1·610	"	"	"
68	Bhalkar	2·10	2·00	1·960	"	"	"
69	Silikha	0·85	4·00	0·280	"	"	"
70	Silikha	1·00	4·00	0·380	uppanoy	"	Branch
71	Aum	0·90	3·00	0·280	and	"	"
72	Aum	0·70	2·50	0·100	Bogama	"	
73	Kadam	1·00	5·00	0·380	"	"	Branch
74	Kadam	0·90	5·50	0·280	"	"	"
75	Gamari	0·60	2·00	0·100	"	"	
76	Gamari	0·70	2·50	0·100		"	
77	Kadam	0·80	2·00	0·180		"	
78	Gamari	0·70	2·50	0·100		"	
79	Kadam	1·80	5·50	1·440		"	Branch
80	Pakari	0·80	3·50	0·180		"	"
81	Pakari	1·20	5·00	0·600		"	"
82	Kadam	0·90	4·00	0·280		Left	
83	Kadam	1·00	4·00	0·380		"	Branch
84	Silikha	0·80	4·00	0·180		Right	"
85	Gamari	0·70	3·00	0·100		Left	
86	Kadam	0·80	4·00	0·180		"	Branch
87	Silikha	0·80	3·00	0·180		Right	"

13·290
+61·803
75·093

P.T.O

(4)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dhaveamtaki)

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
88	Debadaru	0·80	2·50	0·180	uppanoy	Left	
89	Gamari	1·20	5·00	0·600	and	"	Branch
90	Ball	1·00	4·00	0·380	Bagana	"	"
91	Neem	1·00	3·50	0·380	"	Right	"
92	Poma	0·60	2·50	0·100	"	"	
93	Pakari	1·00	2·00	0·380	"	Left	Branch
94	Kadam	0·65	3·00	0·100	"	"	
95	Kadam	0·90	4·00	0·280	"	"	Branch
96	Kadam	0·80	5·00	0·180	"	"	
97	Kadam	1·00	4·00	0·380	"	"	Branch
98	jum	1·20	6·00	0·600	"	"	"
99	jum	0·70	5·50	0·100	"	"	"
100	Kadam	0·85	6·00	0·280	"	"	"
101	Aum	0·90	4·00	0·280	"	"	"
102	Aum	0·80	3·50	0·380	"	"	"
103	Gamari	0·80	4·00	0·180	"	Right	
104	Pakari	1·50	7·00	1·000	"	"	Branch
105	Bareun	0·80	3·00	0·180	"	Left	"
106	Odenga	0·60	3·00	0·100	"	"	"
107	Kadam	1·20	5·00	0·600	"	"	"
108	Kadam	1·10	5·50	0·480	"	Right	"
109	Kadam	0·65	3·50	0·100	"	Left	
110	Kadam	0·60	2·00	0·100	"	"	
111	Nej	0·90	4·00	0·280	"	"	Branch
112	Kadam	1·00	5·00	0·380	"	"	"
113	Kadam	0·70	3·00	0·100	"	"	
114	Gamari	0·70	3·50	0·100	"	Right	
115	Pakari	1·20	3·00	0·600	"	"	Branch
116	Kadam	1·20	7·50	0·600	"	"	"

9·200

75·093

84·293

P.T.O

(5)

Enumeration report of standing trees under the project for the improvement of SH& MDRs unde. Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtaki)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
117	Kadam	0.80	3.50	0.180	upparny	Right	Branch
118	Kadam	1.00	5.50	0.380	Gaon Bogang-	"	"
119	Kadam	1.20	6.50	0.600		"	"
120	Kadam	1.20	6.00	0.600		"	"
121	Kothal	0.65	2.50	0.100		Left	"
122	Kadam	1.10	6.00	0.480		"	"
123	Kadam	0.80	4.00	0.180		"	"
124	Pakari	1.20	3.00	0.600		"	"
125	Aum	0.80	4.00	0.180		"	"
126	Bakul	0.90	3.00	0.280		Right	"
127	Chandan	0.60	3.00	0.100		Left	
128	Aum	2.00	6.00	1.780		Right	Branch
129	Bhalkoa	0.75	2.50	0.100		Left	
130	Aum	1.30	7.00	2.300		Right	Branch
131	Dompora	1.10	4.50	1.960		Left	"
132	Aum	0.95	4.00	0.380		"	"
133	Kadam	1.00	5.00	0.380		Right	"
134	Kadam	1.20	7.00	0.600		"	"
135	Aum	0.95	3.50	0.380		Left	"
136	Aum	0.65	2.00	0.100		"	
137	Sonalu	0.90	4.00	0.280		"	Branch
138	Ball	1.00	4.50	0.380		Right	"
139	Pakari	1.80	5.00	1.440		"	"
140	Pakari(Thorn)	3.50	8.00	3.681		"	"
141	Silikha	2.20	6.50	2.140		"	"
142	Silikha	0.70	4.00	0.100		"	"
143	Kadam	1.30	5.00	0.720		Left	"
144	Gamari	0.60	4.00	0.100		"	
145	Kadam	3.00	9.00	6.220		Right	"

26.721
@ 84.293
111.014 m³

P.T.O

(6)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Bhamenta(A))

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
146	Kadam	1.40	5.00	0.850	upporiey	Left	Branch
147	Kadam	1.00	5.00	0.380	Bajoon	"	"
148	Kadam	1.10	7.00	0.480	"	Right	"
149	Kadam	0.60	4.00	0.100	"	"	
150	Kadam	1.00	6.00	0.380	"	"	Branch
151	Aum	1.20	3.00	0.600	"	Left	"
152	Aum	1.10	4.00	0.480	"	"	"
153	Aum	1.30	4.00	0.720	"	"	"
154	Aum	1.50	4.00	1.000	"	"	"
155	Segun	1.10	6.00	0.480	"	"	"
156	Segun	0.90	5.00	0.280	"	"	"
157	Aum	1.20	4.00	0.600	"	"	"
158	Aum	2.20	7.00	2.140	"	"	"
159	Nahar	1.70	5.00	1.290	"	Right	"
160	Bail	1.40	5.00	0.850	"	Left	
161	Bail	1.10	4.00	0.480	"	Left	
162	Bhalkor	0.70	5.00	0.100	"	"	
163	Bakul	1.30	3.50	0.480	"	"	Branch
164	Bhalkor	1.10	5.00	0.480	"	"	"
165	Bakul	1.00	1.00	0.380	"	Right	"
166	Kadam	0.60	2.50	0.100	"	Left	
167	Kadam	1.00	6.00	0.380	"	"	Branch
168	Karash	0.80	2.00	0.180	Upodary	"	"
169	Bhalkor	0.70	2.00	0.100	"	"	
170	Bhalkor	0.70	3.00	0.100	"	"	
171	Bhalkor	0.80	3.00	0.180	"	"	
172	Bhalkor	0.70	2.50	0.100	"	"	
173	Bhalkor	0.65	2.00	0.100	"	"	
174	Aum	2.00	3.00	1.780	"	Right	Branch

15.570.
111.014
126.584

(7)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
175	Aum	1.70	2.50	1.290	Jopetiany	Right	Branch
176	Pakari	3.10	6.00	6.220	"	"	Branch
177	Aum	1.30	2.50	0.720	"	"	"
178	Krishnachura	1.20	5.00	0.600	"	"	"
179	Silikha	0.70	3.50	0.100	"	"	"
180	Kadam	1.40	5.00	0.850	"	"	"
181	Karaish	0.80	3.00	0.180	"	"	"
182	Kadam	1.30	3.50	0.720	"	"	"
183	Silikha	0.80	3.00	0.180	"	"	"
184	Aum	1.10	4.00	0.480	"	"	"
185	Eukeliptas	0.80	6.00	0.180	"	"	
186	Gamari	1.20	7.00	0.600	"	"	Branch
187	Aum	1.00	4.00	0.380	"	"	"
188	Kadam	0.60	2.50	0.100	"	"	
189	Kadam	1.00	5.00	0.380	"	"	Branch
190	Kadam	0.95	5.00	0.380	"	"	"
191	Eukeliptas	1.05	6.00	0.480	"	"	
192	Silikha	0.60	2.00	0.100	"	"	
193	Kadam	1.20	6.00	0.600	"	"	Branch
194	Gamari	0.90	4.50	0.280	"	"	"
195	Segun	0.60	3.00	0.100	"	"	
196	Betgam	2.20	1.50m	2.140	"	Left	Branch
197	Pakari	1.10	5.00	0.420	"	"	"
198	Kadam	0.80	4.00	0.180	"	Right	
199	Kadam	0.70	4.00	0.100	"	"	
200	Silikha	0.80	4.50	0.180	"	"	
201	Gamari	0.70	4.00	0.200	"	"	
202	Kadam	1.10	4.50	0.480	"	"	Branch
203	Ball	0.70	3.50	0.100	"	Left	

18.680
126.584
145.264

(8)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
204	Aum	0.90	4.00	0.280	Japotlay	Left	Branch
205	Titashop	0.75	3.50	0.180	"	"	
206	Aum	3.20	3.50	0.600	"	"	Branch
207	Aum	1.00	3.00	0.380	"	Right	"
208	Kadam	0.60	2.50	0.100	"	"	
209	Kadam	1.20	6.00	0.600	"	"	Branch
210	Aum	1.50	2.50	1.000	"	"	"
211	Kadam	1.90	5.50	0.720	"	"	"
212	Aum	0.70	4.00	0.100	"	"	
213	Aum	1.60	7.00	1.170	"	"	Branch
214	Kadam	1.00	5.00	0.380	"	"	"
215	Aum	0.80	4.00	0.180	"	"	
216	Amlakhi	0.80	4.00	0.180	"	Left	
217	Bot	2.80	8.00	6.220	"	Right	Branch
218	Aum	1.30	4.00	0.720	"	Left	"
219	Aum	0.65	2.00	0.100	"	Right	"
220	Aum	1.00	4.00	0.386	"	"	Branch
221	Aum	0.90	4.50	0.280	"	"	"
222	Aum	0.70	4.00	0.100	"	"	
223	Aum	1.00	5.50	0.380	"	"	Branch
224	Aum	0.90	5.00	0.280	"	"	"
225	Moj	0.70	3.00	0.100	"	"	
226	Sikhia	0.60	3.00	0.100	"	Left	
227	Aum	0.70	3.00	0.100	"	Right	
228	Kadam	1.10	6.00	0.480	"	"	Branch
229	Aum	0.90	5.00	0.280	"	"	"
230	Kadam	1.00	7.00	0.380	"	Left	"
231	Poma	0.90	4.50	0.280	"	"	"
232	Gohorea	0.70	4.00	0.100	"		

17.120
145.264
162.384



(7)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharsan (V) (A)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
233	Silikha	0·80	4·00	0·180	Japottory	Right	
234	Kadam	0·85	5·00	0·280	"	Left	
235	Kadam	0·95	5·00	0·380	"	"	Branch
236	Kadam	0·80	4·00	0·180	"	"	
237	Kadam	1·20	8·00	0·600	"	"	Branch
238	Bali	0·70	2·50	0·100	"	"	
239	Aum	0·70	2·50	0·100	"	"	
240	Kathal	0·80	3·00	0·180	"	"	Branch
241	Aum	1·00	4·00	0·380	"	Right	"
242	Aum	0·80	3·50	0·180	"	"	
243	Aum	0·80	3·00	0·180	"	Left	
244	Dumbaru	0·90	4·50	0·280	"	Right	Branch
245	Aum	0·80	3·00	0·180	"	Left	"
246	Aum	0·60	2·50	0·100	"	"	
247	Kathal	0·70	3·00	0·100	"	"	
248	Gamari	0·80	5·00	0·180	"	"	
249	Aum	0·70	3·00	0·100	"	Right	
250	Pama	0·90	3·50	0·280	"	Left	
251	Aum	0·75	3·00	0·180	"	"	
252	Aum	1·20	5·80	0·600	"	"	Branch
253	Aum	1·10	4·00	0·420	"	"	"
254	Aum	0·70	2·50	0·100	"	Right	
255	Aum	0·70	4·50	0·100	"	"	
256	Aum	1·00	4·50	0·380	"	"	Branch
257	Moj	1·20	3·00	0·600	"	Left	"
258	Aum	0·70	3·00	0·100	"	Right	
259	Kathal	0·65	2·50	0·100	"	"	
260	Aum	0·80	3·50	0·180	"	"	Branch
261	Karoah	0·80	3·50	0·180	"	Left	"

6960
161_384
169·344

(10)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
262	Aum	0.70	4.00	0.100	Tapeshwary	Left	
263	Aum	1.20	6.00	0.600	"	"	Branch
264	Aum	1.00	5.00	0.380	"	"	"
265	Aum	1.00	5.00	0.380	"	"	"
266	Dumbor	2.10	6.00	1.960	"	"	"
267	Moj	0.90	7.00	0.280	"	"	"
268	Poma	0.70	3.00	0.100	"	"	
269	Ball	0.75	4.00	0.180	"	"	
270	Aum	1.00	5.00	0.380	"	"	Branch
271	Aum	0.70	3.50	0.100	"	"	
272	Pakari	3.50	1.50	6.220	"	Right	Branch
273	Jum	1.00	5.00	0.380	"	"	"
274	Kadam	0.95	6.00	0.380	"	Left	"
275	Simolu	0.95	4.50	0.380	"	"	"
276	Moj	0.90	3.00	0.280	"	"	"
277	Silekha	0.95	5.00	0.380	"	Right	"
278	Aum	0.90	4.50	0.280	"	"	"
279	Aum	0.80	4.00	0.180	"	"	"
280	Amarea	1.00	5.00	0.380	"	"	"
281	Pakari	1.00	5.00	0.380	"	Left	"
282	Aum	0.70	3.50	0.100	"	Right	
283	Kadam	1.40	10.00	0.850	"	"	Branch
284	Aum	0.70	3.00	0.100	"	"	
285	Pakari	2.10	6.00	1.960	"	"	Branch
286	Simolu	0.90	5.00	0.280	"	"	"
287	Simolu	0.80	5.00	0.180	"	"	"
288	Jum	1.20	6.00	0.600	"	"	"
289	Pakari	2.30	6.00	0.720	"	Left	"
290	Gamari	1.00	5.00	0.380	"	"	"

18.870
169.344
188.214

(11)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Bharamtola)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
291	Pakari	1.00	4.00	0.380	Topathory	Right	Branch
292	Dumboru	1.20	5.00	0.600	"	"	"
293	Jum	1.20	4.50	0.600	"	Left	"
294	Gamari	0.80	5.00	0.180	"	Right	"
295	Jum	1.00	5.50	0.380	"	Left	"
296	Jum	1.00	5.50	0.380	"	"	"
297	Aum	1.20	6.00	0.600	"	"	"
298	Jum	1.00	5.50	0.380	"	"	"
299	Jum	1.20	5.50	0.600	"	"	"
300	Karoah	1.00	4.00	0.380	"	Right	"
301	Jum	0.80	2.50	0.180	"	"	
302	Aum	1.50	6.00	1.000	"	"	Branch
303	Aum	1.40	6.00	0.850	"	"	"
304	Gahorea	0.60	2.00	0.100	"	Left	
305	Kathal	0.90	4.50	0.280	"	Right	Branch
306	Kadam	1.20	8.00	0.600	"	"	"
307	Kadam	1.20	7.00	0.600	"	Left	"
308	Aum	0.70	4.00	0.100	"	Right	
309	Aum	0.60	3.00	0.100	"	"	
310	Aum	0.80	4.00	0.180	"	"	Branch
311	Kadam	0.70	5.00	0.100	"	"	
312	Jum	1.10	5.50	0.480	"	"	Branch
313	Jum	0.70	3.00	0.100	"	"	
314	Silikha	0.65	3.50	0.100	"	"	
315	Aum	1.00	5.50	0.380	"	"	Branch
316	Aum	1.10	4.50	0.480	"	"	"
317	Pama	1.20	7.00	0.600	"	"	"
318	Radhasura	2.30	5.00	3.256	"	"	"
319	Kadam	1.20	5.00	0.600	"	"	"

11.566
188.214
199.780

(12)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
320	Kadam	1.00	4.00	0.386	Jafotary	2 of t	Branch
321	Kadam	0.90	5.00	0.280	"	"	"
322	Pakari	4.00	2.00	6.220	"	Right	"
323	Karash	0.80	2.00	0.180	"	"	"
324	Karash	1.40	3.50	0.850	"	"	"
325	Kadam	1.00	6.00	0.386	"	2 of t	"
326	Karash	1.50	4.00	1.000	"	Right	"
327	Karash	1.00	3.00	0.386	"	Right	"
328	Kadam	0.80	5.00	0.180	"	2 of t	
329	Jam	0.70	3.00	0.100	"	"	
330	Karash	1.00	2.00	0.380	"	"	Branch
331	Aem	0.90	2.50	0.280	"	Right	"
332	Aem	1.00	2.20	0.380	"	"	"
333	Karash	1.40	5.00	0.850	"	"	"
334	Karash	1.50	5.00	1.000	"	"	"
335	Pakari	4.00	6.00	6.220	"	"	"
336	Pakari	2.00	3.00	1.786	"	2 of t	Branch
337	Pakari	2.20	4.00	2.140	"	"	"
338	Karash	1.60	5.00	1.140	"	Right	"
339	Krishnochura	1.50	7.00	1.000	"	2 of t	"
340	Aem	1.50	3.50	1.000	Dubi	"	"
341	Aem	0.80	4.00	0.180	(Malipara)	"	"
342	Aem	0.90	4.00	0.286	"	"	"
343	Kadam	0.80	9.00	0.180	"	"	
344	Ball	0.70	3.00	0.100	"	"	
345	Karash	0.70	2.50	0.100	"	"	
346	Sagun	1.10	4.00	0.480	"	"	Branch
347	Karash	2.00	8.00	1.780	"	"	"
348	Karash	1.50	3.00	1.000	"	Right	"

30.220
199.780
230.000

(13)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtola)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
349	Kadam	0.80	4.50	0.180	Dulai	Left	Branch
350	Kadam	0.65	2.50	0.100	(Naikata)	Right	
351	Aam	1.20	4.00	0.600	"	"	Branch
352	Aam	1.30	4.50	0.720	"	"	"
353	Kadam	1.00	4.00	0.280	"	"	"
354	Aam	0.80	4.50	0.180	"	"	"
355	Kathal	1.00	9.00	0.980	"	Left	
356	Kalay	1.00	6.00	0.380	"	"	Branch
357	Kadam	0.60	3.00	0.100	"	"	
358	Aam	0.65	2.00	0.100	"	Right	
359	Kadam	1.10	6.00	0.480	"	Left	Branch
360	Amora	1.00	3.00	0.380	"	Right	"
361	Kadam	1.00	6.00	0.380	"	Left	"
362	Kadam	1.00	6.00	0.380	"	"	"
363	Amara	0.70	3.00	0.100	"	"	
364	Kadam	0.90	4.50	0.280	"	"	
365	Sukha	0.80	4.50	0.180	"	"	Branch
366	Dumbre	1.30	4.00	0.720	"	Right	"
367	Pakari	1.50	6.00	1.000	"	"	"
368	Pakari	1.40	4.00	0.850	"	"	"
369	Kadam	1.10	5.00	0.480	"	"	"
370	Kadam	1.00	8.00	0.380	"	"	"
371	Gamari	1.50	4.50	1.000	"	"	"
372	Kadam	1.00	6.00	0.380	"	"	"
373	Aam	1.50	3.00	1.000	"	"	"
374	Kadam	1.20	8.00	0.600	"	"	"
375	Kathal	0.80	3.00	0.180	"	"	
376	Aam	0.65	4.00	0.100	"	Left	
377	Kathal	0.80	3.00	0.180	"	"	

12.170
2 30.000
242.170

(14)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharamtala)

SL NO	Species (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
378	Kadam	0·70	4·00	0·100	Dulal (Kalipara)	Right	
379	Jem	1.40	4·50	0·850	"	"	Branch
380	Kathal	0·80	2·50	0·180	"	"	
381	Sal	1·00	5·00	0·380	"	Left	Branch
382	Aum	1.00	4·50	0·380	"	Right	"
383	Amara	1·20	5·00	0·600	"	"	"
384	Mej	0·90	6·00	0·280	"	"	"
385	Ball	0·90	4·00	0280	"	"	"
386	Aum	1.40	6·00	0·850	"	"	"
387	Duamboru	1.00	3·50	0·380	"	Left	Branch
388	Kadam	0·65	4·00	0·100	"	Right	
389	Kadam	1·00	6·00	0·380	"	"	Branch
390	Kadam	1·10	7·00	0·480	"	Left	"
391	Kathal	0·65	2·50	0·100	"	Right	
392	Poma	1.00	5·00	0·380	"	"	Branch
393	Aum	1.20	4·50	0·600	"	"	"
394	Aum	0·70	4·00	0·100	"	"	
395	Kadam	0·70	3·50	0·100	"	Left	
396	Poma	1·00	5·00	0·380	"	Right	Branch
397	Aum	0·80	2·50	0·180	"	"	
398	Aum	1·00	4·00	0·380	"	"	Branch
399	Kadam	2·00	7·00	1·780	"	Left	"
400	Aum	2·10	5·00	1·960	"	"	"
401	Kadam	1·60	6·00	1.140	"	"	"
402	Kadam	1.00	6·00	0·380	"	Right	"
403	Kathal	2·00	6·00	1·780	"	"	"
404	Bolgach	5·00	6·00	6·220	"	"	Branch
405	Pakari	1·50	5·00	1·000	"	"	"
406	Kadam	0·70	3·00	0·100	"	Middle	

21·820
242 170
263·990

(157)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Bharaan tale)

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
407	Kadam	0.80	4.00	0.180	Dubi	Middle	Branch
408	Gamari	0.80	2.50	0.180	(Mail para)	"	"
409	Gamari	2.00	4.00	1.780	"	"	"
410	Karoy	2.00	6.00	1.780	"	"	"
411	Gamari	0.80	2.50	0.180	"	"	"
412	Gamari	1.20	3.50	0.600	"	"	"
413	Amlekhi	0.90	2.00	0.280	"	"	"
414	Pakari	2.50	2.50	9.681	Bamunkuchi	"	"
415	Dumbarua	1.40	5.00	0.850	"	"	"
416	Kadam	2.00	9.00	1.780	"	"	"
417	Kadam	0.95	4.50	0.380	"	"	"
418	Kadam	0.80	4.00	0.180	"	"	
419	Kadam	0.70	3.00	0.100	"	"	
420	Pakari	1.80	3.00	1.440	"	"	Branch
421	Pakari	1.80	6.00	1.460	"	"	"
423	Kadam	0.80	4.00	0.180	"	"	
424	Pakari	1.50	6.00	1.000	"	"	"
425	Pakari	1.20	6.00	0.600	"	"	"
426	Pakari	1.60	4.00	1.140	"	"	"
427	Aum	2.00	5.00	1.780	"	"	"
428	Aum	1.60	4.50	1.140	"	"	"
429	Pakari	1.80	6.00	1.440	"	"	"
430	Moj	1.70	5.00	1.290	"	"	"
431	Gamari	0.80	4.50	0.180	"	"	"
432	Gamari	0.80	4.50	0.180	"	"	"
433	Kadam	1.00	5.00	0.380	"	"	"
434	Werum	1.40	5.00	0.850	"	"	"
435	Aum	1.00	5.00	0.380	"	"	"
436	Moj	0.80	6.00	0.180	"	"	"

25.551
263.990
289.541

(17)

Enumeration report of standing trees under the project for the improvement of SH& MDRs under Asommala Group-2 Sarthebari Rampur Pathsala Road ,Reg tree cutting estimate from Bun gaon to Pathsala (Dharcamtoli)

SL NO	Specics (Local Name)	Girth with breast height (mtr)	approximate height (mtr)	As per local volume table	Location	Side	Remarks
437	Jalkor	0·80	4·00	0·180	Barmanikuri	Middle	"
438	Aum	3·00	6·00	6·220	"	Right	Branch
439	Amra	0·90	3·00	0·280	"	Middle	"
440	Aum	0·80	3·00	0.280	Dharcamtoli	"	"
441	Aum	0·80	4·00	0·280·	"	"	"
442	Aum	0·80	4·00	0280	"	"	"
443	Arjun	1·00	5·00	0·380	"	"	"
444	Kadam	2·10	11·00	1·960	"	"	"
445	Simolu	2·00	12·00	1.780	"	"	"
446	Simolu	0·70	3·00	0·100	"	"	
447	Simolu	1·10	10·00	0·480	"	"	Branch
448	Simolu	0·65	3·00	0.100	"	"	
449	Jaggi	1·70	6·00	1.290	"	"	Branch
450	Jiam	0·90	4·50	0·280	"	"	"
451	Silikha	0·80	6·00	0·180	"	"	"
452	Gohora	1·20	7·00	0·600	"	"	"
453	Bhojgam	1·00	6·00	0·380	"	"	"
454	Aum	1·10	7·00	0·480	"	"	"
455	Silikha	1·10	7·00	0·480	"	"	"
456	Aum	0·60	2·00	0·100	"	"	
457	Aum	0·70	3·00	0·100	"	"	
458	Aum	0·60	2·50	0·100	"	"	
459	Gamari	0·70	4·00	0.100	"	"	
460	Aum	0·80	4·00	0·180	"	"	Branch
461	Jiam	0·70	3·50	0·100	"	"	"
				16·690			
				289·511			
				306·201			

Asstt. Engineer, P.W.D. Thawanipur, Patacharkuchi & Sarukhetri Territorial Road Division, Pathsala

Range Forest Officer Barpeta Road Range Barpeta Road.

FOREST BEAT OFFICER PATHSALA

23/2/21

1021
26/2/21

25/2/2021

GOVT. OF ASSAM
OFFICE OF THE RANGE FOREST OFFICER :: BARPETA ROAD FOREST RANGE ::
BARPETA ROAD

Memo No. BR/78/Enumeration/ 2882 Dt. 23/02/2021

To,

The Divisional Forest Officer,
North Kamrup Division, Rangia.

Sub :- Consultancy Services for preparation of fesibility study/ Detailed project report for the improvement of SH & MDRs under Asom Mala Group-2-Sarthebari Rampur Pathsala Road, Reg. Tree cutting estimate.

Ref :- Your's letter No. B/TIM/RST/5209-14, dt. 11-11-2020.

Sir,

With reference to above, I have the honour to submit herewith the Enumeration Report & Estimate for Operation of SH & MDRs under Asom Mala Group-2-Sarthebari Rampur Pathsala Road, Reg. Tree cutting estimate, falling in the jurisdiction of Bahari Forest Beat from Sarthebari to Bongaon.

This is for favour of your kind information and necessary action.

Enclosed :- As stated above.

Yours faithfully,

Range Forest Officer
Barpeta Road Range
Barpeta Road

Estimate showing the operational cost for tree cutting of road side standing trees under the project for the improvement of SH &MDRs under Asom Mala Group-2-Sarthebari Rampur- Pathsala Road, from Sarthebari to Bon Gaon.

Total number of Trees = 538 nos.

Total volume = 359.71 cum

Total Govt. Royalty of Trees = 4,40,174/-

Operational cost:-

1. Felling, sectioning etc. @ 1050.00 per cum x 359.71	= Rs.	377696.00
2. Dragging cost up to Diesel point @ 700.00 per cum. x 359.71	= Rs	251797.00
3. Transporting to Timber Depot including stacking etc. @ 1250.00 per cum. x 359.71	= Rs.	449638.00
4. Maintenance of Depot including Hiring of Land, enhancement of watch & ward etc. @ 300.00 per cum x 359.71	= Rs.	107913.00
5. Contingency @ 5% on operational cost for T.A. / D. A. of Field staff @ 150.00 per cum x 359.71	= Rs.	53957.00
	Total = Rs.	12, 41,001.00

(Rupees Twelve Lac Forty one Thousand only.

4/2/2024

Asstt. Engineer
Bhawanipur Sarthebari
& Sarukhetri Territorial
Road Division, Pathsala

Submitted

Forest Beat Officer
Bahari Beat

Range Forest Officer
Barpeta Road Range
Barpeta Road.

Counter Signature

Divisional Forest Officer
North Kamrup Division
Rangia

Enumeration report of standing trees under the project for the improvement of SH &MDRs under AsomMala Group-2-Sarthebari Rampur Pathsala Road, Reg. Tree cutting estimatefrom Sarthebari to Bon Gaon.

Sl. No	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
1	Aahat	3.00	1.50	6.220	Sarthebari	Left	Branch
2	Devdaru	1.50	6.00	1.000	-do-	-do-	
3	-do-	1.40	6.00	0.850	-do-	-do-	
4	Rain tree	1.80	2.00	1.440	-do-	-do-	Branch
5	Bel	1.70	1.00	1.290	-do-	-do-	Branch
6	Bhelkor	1.50	6.00	1.000	-do-	Right	
7	Aahat	2.20	2.00	2.140	-do-	Left	Branch
8	-do-	3.50	2.00	6.220	-do-	-do-	Branch
9	Moj	1.10	2.50	0.480	-do-	-do-	
10	Aahat	3.00	4.00	6.220	-do-	-do-	Branch
11	Bot	1.10	1.00	0.480	NatunTalukdar Chupa	-do-	Branch
12	Bhelkor	1.40	3.00	0.850	Gomura	-do-	Branch
13	Moj	1.00	3.00	0.380	-do-	-do-	Branch
14	Aam	1.10	3.00	0.480	-do-	-do-	Branch
15	-do-	1.00	3.00	0.380	-do-	-do-	Branch
16	Segun(Teak)	1.10	7.00	0.480	-do-	-do-	
17	Silikha	0.90	2.50	0.280	-do-	-do-	Branch
18	Aam	0.90	2.50	0.280	-do-	-do-	Branch
19	Aam	0.80	2.50	0.180	-do-	-do-	Branch
20	Kadom	0.90	4.00	0.280	-do-	-do-	
21	Silikha	1.00	4.00	0.380	-do-	-do-	
22	-do-	0.65	2.00	0.100	-do-	-do-	
23	Kadom	1.00	5.00	0.380	-do-	-do-	
24	Kadom	1.80	10.00	1.440	-do-	Right	
25	Bhelkor	0.80	2.50	0.180	-do-	-do-	Branch
26	-do-	1.00	4.00	0.380	-do-	-do-	
27	Bel	0.80	1.50	0.180	-do-	Left	Branch
28	Aam	0.70	3.50	0.100	-do-	-do-	Branch
29	Aam	0.70	3.00	0.100	-do-	-do-	Branch
30	Bhelkor	1.00	2.50	0.380	-do-	Right	Branch
31	Moj	0.80	5.00	0.180	-do-	Left	
32	Gamari	0.80	4.00	0.180	-do-	-do-	
33	Kadom	0.80	4.00	0.180	-do-	-do-	
34	Simul	0.65	3.00	0.100	-do-	-do-	Branch
35	Aahat	2.40	1.00	2.500	-do-	-do-	Branch
36	Moj	0.80	4.00	0.180	-do-	-do-	
37	Gamari	0.90	7.00	0.280	-do-	-do-	
38	Moj	0.80	3.50	0.180	-do-	-do-	Branch
39	Bot	1.60	1.00	0.140	Bor Gomura	Right	Branch
40	Barun	1.50	1.00	1.000	-do-	-do-	Branch

Contd, Page No. 2

	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
1	Bhelkor	0.60	4.00	0.100	Bor Goumura	Left	
2	-do-	1.10	8.00	0.480	-do-	-do-	
3	Kadom	0.70	3.00	0.100	-do-	Right	
4	Silikha	0.65	4.00	0.100	-do-	-do-	
5	Kadom	0.70	3.00	0.100	-do-	-do-	
6	Kadom	0.60	3.00	0.100	-do-	-do-	
7	Sonaru	0.70	3.00	0.100	-do-	Left	
8	-do-	0.80	1.50	0.180	-do-	-do-	Branch
9	Kadom	1.10	6.00	0.480	-do-	-do-	
0	Aam	0.90	5.00	0.280	-do-	-do-	
1	Arjun	1.00	5.00	0.380	-do-	-do-	
2	Gohera	0.70	4.00	0.100	-do-	-do-	
3	Arjun	1.10	2.00	0.480	-do-	-do-	Branch
4	Bhelkor	0.80	1.00	0.180	-do-	Right	Branch
5	Kadom	1.60	9.00	1.140	-do-	Left	
6	Sonaru	0.70	4.00	0.100	-do-	-do-	
7	Aam	0.70	2.00	0.100	-do-	-do-	Branch
8	-do-	0.70	2.00	0.100	-do-	-do-	
9	Bhelkor	1.60	4.00	1.140	-do-	-do-	Branch
0	Bhelkor	1.60	7.00	1.140	-do-	-do-	Branch
1	Bhelkor	1.30	5.00	0.720	-do-	-do-	Branch
2	Aajar	0.90	3.00	0.280	-do-	-do-	Branch
3	Rain Tree	2.00	2.00	1.780	-do-	-do-	Branch
4	Bhelkor	1.60	3.50	1.140	-do-	-do-	Branch
5	-do-	1.70	6.00	1.290	-do-	-do-	
6	-do-	1.00	2.00	0.380	-do-	-do-	Branch
7	Rain Tree	3.60	2.50	6.220	-do-	-do-	Branch
8	Bhelkor	1.80	6.00	1.440	-do-	-do-	Branch
9	-do-	1.20	3.00	0.600	-do-	-do-	Branch
0	Rain Tree	2.30	5.00	2.300	-do-	-do-	Branch
1	Simul	2.20	13.00	2.140	-do-	-do-	
2	Bhelkor	1.50	5.00	1.000	-do-	-do-	Branch
3	Simul	1.50	11.00	1.000	-do-	-do-	
4	Radhasura (Copper od	1.60	4.00	1.140	-do-	Right	
5	Rain Tree	2.60	4.00	2.500	-do-	-do-	Branch
6	Bhelkor	1.50	5.00	1.000	-do-	-do-	Branch
7	Gamari	0.70	4.00	0.100	-do-	-do-	
8	Bhelkor	1.20	3.50	0.600	-do-	-do-	Branch
9	Bhelkor	1.20	4.00	0.600	-do-	-do-	Branch
0	Bhelkor	1.00	5.00	0.380	-do-	-do-	
1	Bhelkor	1.60	2.50	1.140	-do-	Left	Branch
2	Simul	1.50	12.00	1.000	-do-	-do-	
3	Segun(Teak)	0.60	4.00	0.100	-do-	Right	
4	-do-	0.65	4.00	0.100	-do-	-do-	

Contd. Page no.3

Sl. No	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
85	Segun(Teak)	0.60	4.00	0.100	Bor Gomura	Right	
86	-do-	0.65	5.00	0.100	-do-	-do-	
87	-do-	0.60	6.00	0.100	-do-	-do-	
88	-do-	0.60	3.00	0.100	-do-	-do-	
89	-do-	0.60	4.00	0.100	-do-	-do-	
90	Bhelkor	1.20	3.50	0.600	-do-	Left	Branch
91	Segun(Teak)	0.65	4.00	0.100	-do-	Right	
92	Segun	0.60	4.00	0.100	-do-	Right	
93	-do-	0.60	3.00	0.100	-do-	-do-	
94	-do-	0.70	3.00	0.100	-do-	-do-	
95	Bhelkor	1.20	4.00	0.600	-do-	-do-	Branch
96	-do-	1.00	1.50	0.380	-do-	Left	Branch
97	Rain Tree	2.20	5.00	2.140	-do-	-do-	Branch
98	Simul	1.90	10.00	1.610	-do-	-do-	
99	Bhelkor	1.40	4.00	0.850	-do-	Right	Branch
100	Rain Tree	2.30	3.00	2.300	-do-	-do-	Branch
101	Bhelkor	1.40	2.50	0.850	-do-	-do-	Branch
102	Rain Tree	3.30	0.50	6.220	-do-	-do-	Branch
103	-do-	2.40	1.50	2.500	-do-	-do-	Branch
104	-do-	2.40	2.00	2.500	-do-	-do-	Branch
105	-do-	2.40	4.50	2.500	-do-	-do-	Branch
106	-do-	3.00	2.00	6.220	-do-	-do-	Branch
107	-do-	2.90	1.20	2.500	-do-	-do-	Branch
108	-do-	2.20	2.50	2.140	-do-	Left	Branch
109	Bhelkor	1.80	4.00	1.440	Botia	-do-	Branch
110	Rain Tree	3.00	3.50	6.220	-do-	Right	Branch
111	-do-	2.00	4.00	1.780	-do-	-do-	Branch
112	Bhelkor	1.80	1.50	1.440	-do-	Left	Branch
113	-do-	0.90	2.00	0.280	-do-	-do-	
114	-do-	1.20	5.00	0.600	-do-	-do-	
115	-do-	1.20	1.00	0.600	-do-	-do-	Branch
116	-do-	1.30	3.00	0.720	-do-	-do-	Branch
117	-do-	1.20	2.50	0.600	-do-	-do-	Branch
118	Dumbaru	1.20	2.00	0.600	-do-	-do-	Branch
119	Rain Tree	1.80	2.00	1.440	-do-	-do-	Branch
120	Bhelkor	0.90	1.00	0.280	-do-	-do-	Branch
121	-do-	1.90	2.50	1.610	-do-	Right	Branch
122	-do-	1.50	2.50	1.000	-do-	Left	Branch
123	Dumbaru	1.50	1.00	1.000	-do-	-do-	Branch
124	Bhelkor	0.70	3.00	0.100	-do-	-do-	
125	-do-	0.90	2.00	0.280	-do-	-do-	Branch
126	-do-	0.80	3.00	0.180	-do-	-do-	
127	Arjun	0.65	1.00	0.100	-do-	Right	

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
128	Sonaru	0.90	3.00	0.280	Botia	Left	
129	Kadam	0.90	3.00	0.280	-do-	Right	
130	Bhelkor	0.80	1.50	0.180	-do-	Left	Branch
131	Bhelkor	0.70	1.00	0.100	-do-	-do-	Branch
132	-do-	0.60	1.50	0.100	-do-	-do-	Branch
133	-do-	0.90	2.00	0.280	-do-	-do-	Branch
134	-do-	1.10	2.50	0.480	-do-	-do-	Branch
135	-do-	1.00	2.50	0.380	-do-	Right	
136	-do-	1.00	1.00	0.380	-do-	-do-	Branch
137	-do-	1.10	2.00	0.480	-do-	Left	Branch
138	-do-	1.30	2.50	0.720	-do-	-do-	Branch
139	-do-	0.90	1.00	0.280	-do-	-do-	Branch
140	-do-	0.70	1.50	0.100	-do-	Right	Branch
141	Moj	0.90	1.50	0.280	-do-	-do-	Branch
142	Bhelkor	1.00	4.00	0.380	-do-	-do-	
143	-do-	1.00	1.50	0.380	-do-	-do-	Branch
144	Bhelkor	1.10	1.50	0.480	-do-	-do-	Branch
145	Gamari	0.90	4.00	0.280	-do-	-do-	
146	Bhelkor	1.80	3.50	1.440	-do-	-do-	
147	-do-	0.90	1.50	0.280	-do-	-do-	Branch
148	-do-	0.70	3.00	0.100	-do-	-do-	
149	-do-	0.70	2.00	0.100	-do-	-do-	
150	-do-	0.80	4.00	0.180	-do-	-do-	Branch
151	Dumbaru	1.00	1.00	0.380	-do-	-do-	Branch
152	Bhelkor	0.80	4.00	0.180	-do-	-do-	
153	Karos	0.60	2.00	0.100	-do-	Left	
154	Bhelkor	0.80	3.00	0.180	-do-	-do-	Branch
155	-do-	0.80	4.00	0.180	-do-	-do-	Branch
156	-do-	0.80	1.50	0.180	-do-	-do-	Branch
157	-do-	1.00	4.00	0.380	-do-	-do-	Branch
158	Ajar	0.90	1.00	0.280	-do-	-do-	Branch
159	Bot	2.00	1.50	1.780	Kalatuli pathar	-do-	Branch
160	Bhelkor	0.80	3.00	0.180	-do-	-do-	
161	Ajar	0.80	2.00	0.180	-do-	-do-	
162	Bhelkor	0.80	4.00	0.180	-do-	-do-	
163	-do-	0.70	2.50	0.100	-do-	-do-	
164	Karos	0.90	2.00	0.280	-do-	-do-	Branch
165	-do-	0.80	2.00	0.180	-do-	-do-	Branch
166	-do-	0.60	3.00	0.100	-do-	-do-	Branch
167	-do-	0.70	4.00	0.100	-do-	-do-	
168	-do-	1.00	1.00	0.380	-do-	-do-	Branch
169	-do-	0.70	2.00	0.100	-do-	-do-	
170	-do-	0.70	3.00	0.100	-do-	-do-	

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Sl.	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
171	Karos	0.80	4.00	0.180	Kalatuli pathar	Left	
172	Karos	0.60	4.00	0.100	-do-	-do-	
173	-do-	0.90	4.00	0.280	-do-	-do-	
174	-do-	0.80	3.00	0.180	-do-	-do-	Branch
175	-do-	0.80	3.00	0.180	-do-	-do-	Branch
176	-do-	0.70	4.00	0.100	-do-	-do-	
177	-do-	0.80	6.00	0.180	-do-	-do-	Branch
178	-do-	0.70	3.00	0.100	-do-	-do-	
179	Bhelkor	1.00	4.00	0.380	-do-	-do-	Branch
180	-do-	1.00	5.00	0.380	-do-	-do-	
181	Karos	0.70	1.50	0.100	-do-	-do-	
182	-do-	0.70	2.00	0.100	-do-	-do-	
183	-do-	0.70	1.00	0.100	-do-	-do-	Branch
184	-do-	0.80	1.00	0.180	-do-	-do-	Branch
185	-do-	0.80	1.50	0.180	-do-	-do-	Branch
186	-do-	0.70	2.00	0.100	-do-	-do-	
187	-do-	0.70	2.00	0.100	-do-	-do-	
188	-do-	0.60	4.00	0.100	-do-	-do-	Branch
189	-do-	1.00	1.00	0.380	-do-	-do-	Branch
190	-do-	0.80	3.00	0.180	-do-	-do-	
191	Dumbaru	1.40	3.00	0.850	-do-	-do-	Branch
192	Karos	0.80	4.00	0.180	-do-	-do-	
193	-do-	0.70	2.00	0.100	-do-	-do-	
194	-do-	0.90	5.00	0.280	-do-	-do-	
195	-do-	1.00	1.00	0.380	-do-	-do-	Branch
196	-do-	0.80	4.00	0.180	-do-	-do-	
197	-do-	0.80	1.00	0.180	-do-	-do-	Branch
198	-do-	0.80	2.00	0.180	-do-	-do-	
199	Bhelkor	1.00	3.50	0.380	-do-	-do-	
200	-do-	0.60	2.50	0.100	-do-	Right	
201	Ajar	0.70	2.00	0.100	-do-	-do-	
202	Bhelkor	0.80	3.00	0.180	-do-	-do-	
203	-do-	0.80	4.00	0.180	-do-	-do-	
204	Ajar	0.70	3.00	0.100	-do-	-do-	
205	-do-	0.70	3.50	0.100	-do-	-do-	
206	Jam	0.80	2.00	0.180	-do-	-do-	Branch
207	Ajar	0.80	4.00	0.180	-do-	Left	
208	-do-	0.70	2.00	0.100	-do-	-do-	
209	Jam	1.40	1.00	0.850	-do-	-do-	Branch
210	Bhelkor	0.80	2.00	0.180	-do-	-do-	
211	-do-	0.90	4.00	0.280	-do-	Right	Branch
212	-do-	1.60	3.00	1.140	-do-	-do-	Branch
213	-do-	0.80	3.50	0.180	-do-	-do-	
214	Ajar	0.80	4.00	0.180	-do-	-do-	

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
215	Poma	0.80	3.00	0.180	Botia	Right	
216	Ajar	0.80	4.00	0.180	-do-	Left	
217	-do-	0.70	1.00	0.100	-do-	-do-	Branch
218	Jam	1.10	6.00	0.480	-do-	-do-	
219	Ajar	0.60	3.00	0.100	-do-	Right	
220	Gamari	0.80	6.00	0.180	-do-	Left	
221	Sonaru	0.90	4.00	0.280	-do-	Right	
222	Aahat	1.20	1.50	0.600	-do-	-do-	Branch
223	Moj	1.00	4.00	0.380	-do-	Left	
224	Bhelkor	0.80	3.00	0.180	-do-	Right	
225	-do-	1.00	3.00	0.380	-do-	-do-	
226	Moj	1.00	5.00	0.380	-do-	Left	
227	-do-	0.90	9.00	0.280	-do-	Right	
228	Sonaru	1.50	7.00	1.000	-do-	-do-	
229	Moj	0.90	5.00	0.280	-do-	-do-	
230	-do-	0.70	5.00	0.100	-do-	Left	
231	Gamari	1.00	2.00	0.380	-do-	-do-	Branch
232	-do-	0.90	7.00	0.280	-do-	-do-	
233	-do-	0.80	5.00	0.180	-do-	-do-	
234	Amlokhi	0.80	4.00	0.180	-do-	-do-	
235	Aam	0.80	3.00	0.180	-do-	-do-	
236	Bhelkor	1.00	6.00	0.380	-do-	-do-	
237	Moj	0.70	3.00	0.100	-do-	-do-	
238	Bhelkor	2.00	10.00	1.780	-do-	-do-	Branch
239	-do-	0.70	4.00	0.100	-do-	-do-	
240	-do-	1.40	6.00	0.850	-do-	-do-	Branch
241	Ajar	1.80	6.00	1.440	-do-	Right	Branch
242	-do-	1.50	6.00	1.000	-do-	-do-	Branch
243	Bhelkor	1.80	9.00	1.440	-do-	-do-	Branch
244	Poma	0.80	6.00	0.180	-do-	-do-	
245	Aahat	2.50	1.00	2.500	-do-	Left	Branch
246	Bel	0.80	4.00	0.180	-do-	-do-	
247	Aam	0.80	2.00	0.180	-do-	Right	
248	Bhelkor	0.90	4.00	0.280	-do-	-do-	
249	Kadom	1.50	7.00	1.000	-do-	Left	
250	Bhelkor	1.00	7.00	0.380	-do-	Right	
251	-do-	1.00	5.00	0.380	-do-	-do-	
252	-do-	1.00	3.00	0.380	-do-	-do-	
253	-do-	0.90	5.00	0.280	-do-	Left	
254	Aahot	2.50	1.00	2.500	-do-	Right	Branch
255	Gohera	0.70	2.50	0.100	-do-	-do-	
256	Kadom	1.20	8.00	0.600	-do-	-do-	
257	-do-	1.00	8.00	0.380	-do-	-do-	
258	Aahot	0.90	1.00	0.280	-do-	-do-	Branch

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
259	Moj	0.80	4.00	0.180	Botia	Left	
260	-do-	0.60	2.00	0.100	-do-	-do-	Branch
261	-do-	0.70	4.00	0.100	-do-	-do-	
262	Aahot	0.70	2.00	0.100	-do-	-do-	
263	Kadom	1.00	10.00	0.380	-do-	Right	
264	-do-	0.80	7.00	0.180	-do-	-do-	
265	Aahot	0.70	2.00	0.100	-do-	-do-	Branch
266	Kadom	0.80	1.00	0.180	-do-	-do-	Branch
267	Bhelkor	0.90	4.00	0.280	-do-	-do-	
268	Aahot	0.90	3.00	0.280	-do-	Left	Branch
269	-do-	2.00	3.00	1.780	-do-	-do-	Branch
270	Kadom	0.90	8.00	0.280	-do-	-do-	
271	-do-	0.90	8.00	0.280	-do-	Right	
272	Bhelkor	0.80	1.00	0.180	-do-	-do-	Branch
273	Moj	0.90	2.00	0.280	-do-	Left	Branch
274	Bhelkor	0.70	3.00	0.100	-do-	-do-	
275	Moj	0.80	1.50	0.180	-do-	Right	Branch
276	Simul	1.00	8.00	0.380	-do-	-do-	
277	Aahot	0.80	2.50	0.180	-do-	Left	
278	-do-	1.20	1.00	0.600	-do-	-do-	Branch
279	-do-	1.30	1.00	0.720	-do-	-do-	Branch
280	-do-	1.00	2.00	0.380	-do-	-do-	Branch
281	-do-	1.10	3.00	0.480	-do-	do-	
282	-do-	1.50	1.20	1.000	-do-	-do-	Branch
283	-do-	1.20	2.50	0.600	-do-	-do-	Branch
284	-do-	1.40	2.00	0.850	-do-	-do-	Branch
285	Bhelkor	0.80	3.00	0.180	-do-	-do-	
286	Aahat	1.00	4.00	0.380	-do-	-do-	
287	Ghora neem	1.00	3.00	0.380	-do-	-do-	
288	Kadom	0.80	2.00	0.180	-do-	-do-	
289	Aam	0.90	2.00	0.280	-do-	-do-	Branch
290	Kadom	1.20	4.00	0.600	-do-	-do-	Branch
291	Aahat	2.50	1.00	2.500	-do-	-do-	Branch
292	Kadom	1.50	10.00	1.000	-do-	-do-	
293	-do-	1.20	9.00	0.600	-do-	-do-	
294	Aahot	0.90	2.00	0.280	-do-	-do-	Branch
295	Ghora neem	0.90	5.00	0.280	-do-	-do-	
296	Bhelkor	0.90	4.00	0.280	-do-	-do-	
297	-do-	2.00	10.00	1.780	-do-	-do-	Branch
298	Aahot	1.00	2.00	0.380	-do-	-do-	Branch
299	-do-	1.00	2.00	0.380	-do-	-do-	Branch
300	-do-	1.00	3.00	0.380	-do-	-do-	Branch
301	Dumbaru	0.90	2.00	0.280	-do-	-do-	Branch
302	Karos	1.00	1.00	0.380	-do-	-do-	Branch

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
303	Karos	0.80	2.00	0.180	Botia	Left	Branch
304	Moj	1.70	4.00	1.290	-do-	-do-	Branch
305	Karos	0.70	1.50	0.100	-do-	-do-	Branch
306	-do-	0.80	3.00	0.180	-do-	-do-	
307	-do-	0.70	2.00	0.100	Parakuchi pam	-do-	Branch
308	Bhelkor	0.80	2.00	0.180	-do-	-do-	Branch
309	Aahat	3.60	1.00	6.220	-do-	Right	Branch
310	-do-	1.00	4.00	0.380	-do-	-do-	
311	-do-	0.80	3.00	0.180	-do-	-do-	
312	-do-	1.00	1.50	0.280	-do-	-do-	Branch
313	-do-	1.10	3.00	0.480	-do-	-do-	Branch
314	-do-	1.00	5.00	0.380	-do-	-do-	Branch
315	-do-	1.40	5.00	0.480	-do-	-do-	Branch
316	-do-	1.20	2.00	0.600	-do-	-do-	Branch
317	Karos	0.90	3.00	0.280	-do-	-do-	Branch
318	-do-	0.80	1.50	0.180	-do-	-do-	Branch
319	-do-	0.70	1.50	0.100	-do-	-do-	Branch
320	-do-	1.40	2.50	0.850	-do-	-do-	Branch
321	Bher	0.80	4.00	0.180	-do-	-do-	
322	-do-	0.90	3.00	0.280	-do-	-do-	Branch
323	Aahat	0.80	1.50	0.180	-do-	-do-	Branch
324	Bhelkor	1.20	7.00	0.600	-do-	-do-	Branch
325	-do-	0.80	7.00	0.180	-do-	-do-	
326	-do-	1.00	6.00	0.380	-do-	-do-	
327	-do-	1.20	10.00	0.600	-do-	-do-	
328	Aahat	1.00	10.00	0.380	-do-	-do-	
329	-do-	0.80	5.00	0.180	-do-	-do-	
330	-do-	0.80	4.00	0.180	-do-	-do-	Branch
331	-do-	1.00	3.00	0.380	-do-	-do-	Branch
332	-do-	0.90	4.00	0.280	-do-	-do-	Branch
333	-do-	0.90	6.00	0.280	-do-	-do-	
334	Kadom	0.90	3.00	0.280	-do-	-do-	
335	-do-	0.80	10.00	0.180	-do-	-do-	
336	Bhelkor	0.80	5.00	0.180	-do-	-do-	
337	Kadom	0.80	7.00	0.180	-do-	-do-	
338	Aam	0.90	4.00	0.180	-do-	Left	Branch
339	Karos	0.70	5.00	0.100	-do-	-do-	
340	Kadom	0.60	6.00	0.100	-do-	Right	
341	Bhelkor	0.90	4.00	0.280	-do-	-do-	
342	Kadom	0.60	3.00	0.100	-do-	-do-	
343	-do-	1.20	3.00	0.600	-do-	-do-	Branch
344	Aam	1.80	4.00	1.440	-do-	Left	Branch
345	-do-	0.80	3.00	0.180	-do-	-do-	
346	Kathal	0.60	2.00	0.100	-do-	-do-	

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
347	Aam	1.30	3.00	0.720	Parakuchi pam	Left	Branch
348	Bhelkor	1.10	4.00	0.480	-do-	-do-	Branch
349	Bakul	0.80	2.00	0.180	-do-	Right	
350	Gamari	0.80	3.00	0.180	-do-	-do-	
351	Xilikha	0.60	1.00	0.100	-do-	-do-	Branch
352	Bhelkor	2.10	6.00	1.960	-do-	-do-	Branch
353	Jam	0.70	2.00	0.100	-do-	-do-	
354	Kadom	2.20	10.00	2.140	-do-	Left	Branch
355	-do-	1.80	6.00	1.440	-do-	-do-	Branch
356	Bhelkor	0.90	3.00	0.280	-do-	Right	
357	Kadom	1.10	3.00	0.480	-do-	Left	Branch
358	Bhelkor	2.10	3.00	1.960	-do-	Right	Branch
359	-do-	1.60	3.00	1.140	-do-	-do-	Branch
360	-do-	1.90	4.00	1.610	Kaskuri pathar	-do-	Branch
361	-do-	0.80	3.00	0.180	-do-	-do-	
362	-do-	1.10	4.00	0.480	-do-	-do-	Branch
363	Kadom	0.80	2.00	0.180	-do-	Left	
364	Bhelkor	0.70	2.00	0.100	-do-	-do-	
365	-do-	1.10	3.00	0.480	-do-	Right	Branch
366	Aahat	0.90	3.00	0.280	-do-	-do-	Branch
367	Aam	0.90	4.00	0.280	-do-	Left	Branch
368	-do-	0.80	3.00	0.180	-do-	-do-	
369	Gamari	0.80	3.00	0.180	-do-	-do-	Branch
370	-do-	2.10	3.00	1.960	-do-	-do-	Branch
371	-do-	1.80	5.00	1.440	-do-	-do-	Branch
372	Karos	0.90	7.00	0.280	-do-	-do-	
373	Bhelkor	0.80	3.00	0.180	-do-	-do-	Branch
374	Kathal	1.10	2.00	0.480	-do-	-do-	Branch
375	-do-	2.10	4.00	1.960	-do-	-do-	Branch
376	Xilikha	0.80	2.00	0.180	-do-	-do-	
377	Aam	0.80	3.00	0.180	-do-	-do-	Branch
378	-do-	0.80	3.50	0.180	-do-	-do-	Branch
379	Kadom	0.70	3.00	0.100	-do-	-do-	
380	Aam	0.70	2.00	0.100	-do-	-do-	Branch
381	-do-	0.90	3.00	0.280	-do-	-do-	Branch
382	-do-	0.90	4.00	0.280	-do-	-do-	Branch
383	-do-	0.70	3.00	0.100	-do-	-do-	
384	-do-	0.70	2.00	0.100	-do-	-do-	Branch
385	Aam	0.90	4.00	0.280	-do-	-do-	Branch
386	Aahat	2.10	4.00	1.960	-do-	-do-	Branch
387	-do-	1.90	3.00	1.610	-do-	-do-	Branch
388	Bhelkor	1.10	2.50	0.480	-do-	-do-	Branch
389	-do-	0.90	4.00	0.280	-do	-do-	Branch
390	-do-	0.80	3.50	0.180	-do-	-do-	

Contd. Page no.10

	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
391	Aahat	2.50	4.00	2.500	Kaskuri pathar	Left	Branch
392	Aam	0.90	3.00	0.280	-do-	-do-	Branch
393	-do-	1.10	4.00	0.480	-do-	-do-	Branch
394	-do-	1.00	5.00	0.380	-do-	-do-	Branch
395	Aahat	1.20	4.00	0.600	-do-	-do-	Branch
396	-do-	1.40	4.00	0.850	-do-	-do-	Branch
397	-do-	1.50	5.00	1.000	-do-	-do-	Branch
398	Aahat	1.30	2.00	0.720	-do-	-do-	Branch
399	Segun	1.80	6.00	1.440	-do-	-do-	Branch
400	Aahat	5.00	3.00	6.220	-do-	-do-	Branch
401	Gamari	3.00	4.00	6.220	-do-	-do-	Branch
402	Aahat	0.80	3.00	0.180	-do-	-do-	Branch
403	-do-	4.00	3.00	6.220	-do-	-do-	
404	Aam	0.90	2.00	0.280	-do-	-do-	Branch
405	-do-	0.80	3.00	0.180	-do-	-do-	Branch
406	-do-	0.80	3.00	0.180	-do-	-do-	Branch
407	-do-	2.10	3.00	1.960	-do-	-do-	Branch
408	-do-	0.90	2.00	0.280	Rampur	-do-	Branch
409	Gamari	1.00	2.00	0.380	-do-	-do-	Branch
410	Aahat	2.20	2.00	2.140	-do-	-do-	Branch
411	-do-	3.20	5.00	6.220	-do-	-do-	Branch
412	Tetu	1.90	4.00	1.610	-do-	-do-	Branch
413	Gahera	0.90	4.00	0.280	-do-	-do-	
414	-do-	1.80	4.00	1.440	-do-	-do-	
415	Dumbaru	3.10	5.00	6.220	-do-	-do-	
416	Aahat	1.10	3.00	0.480	-do-	-do-	
417	-do-	2.40	5.00	2.500	-do-	-do-	
418	Aam	0.90	2.00	0.280	-do-	-do-	
419	Jam	0.80	2.00	0.180	-do-	-do-	
420	Kadam	0.90	3.00	0.280	-do-	-do-	
421	-do-	0.80	3.00	0.180	-do-	-do-	
422	Bot	0.80	1.00	0.180	-do-	-do-	
423	Bot	2.80	5.00	2.500	-do-	-do-	Branch
424	-do-	2.80	6.00	2.500	-do-	-do-	
425	Bhelkor	0.80	1.00	0.180	-do-	-do-	
426	Gamari	0.90	4.00	0.280	-do-	-do-	
427	Dumbaru	0.90	4.00	0.280	-do-	-do-	
428	Arjun	0.90	5.00	0.280	-do-	-do-	
429	Poma	0.70	2.00	0.100	-do-	-do-	
430	Xilikha	0.90	2.00	0.280	-do-	-do-	
431	Bhelkor	0.80	1.00	0.180	-do-	-do-	
432	-do-	0.90	3.00	0.280	-do-	Right	
433	Kadom	1.20	6.00	0.600	-do-	Left	
434	Kathal	0.90	3.00	0.280	-do-	-do-	

Contd. Page no.11

	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
435	Kathal	0.90	2.50	0.280	Kaskuri pathar	Left	Branch
436	Gamari	0.70	2.00	0.100	-do-	-do-	
437	Jalphai	0.90	2.00	0.280	-do-	-do-	Branch
438	Bhelkor	1.20	5.00	0.600	-do-	Right	Branch
439	Kadom	0.80	3.00	0.180	-do-	Left	
440	Aam	0.80	2.00	0.180	-do-	-do-	Branch
441	Kadom	0.90	2.00	0.280	-do-	-do-	Branch
442	-do-	0.90	3.00	0.280	-do-	-do-	
443	Aam	0.80	2.00	0.280	-do-	-do-	Branch
444	Kadom	1.40	3.00	0.850	Rampur	-do-	Branch
445	Aam	2.20	2.00	2.140	-do-	-do-	Branch
446	Dumbaru	1.80	3.00	1.440	-do-	-do-	Branch
447	Aam	0.90	2.00	0.280	-do-	-do-	
448	Kadom	1.00	3.00	0.380	-do-	-do-	Branch
449	Bot	1.00	2.00	0.380	-do-	-do-	
450	-do-	1.20	3.00	0.600	-do-	-do-	Branch
451	Kadom	1.40	4.00	0.850	-do-	-do-	Branch
452	-do-	1.00	2.00	0.380	-do-	-do-	Branch
453	Kadom	1.70	7.00	1.290	-do-	-do-	Branch
454	-do-	0.60	3.00	0.100	-do-	-do-	
455	Xilikha	0.60	3.00	0.100	-do-	-do-	
456	Aam	0.90	3.00	0.280	-do-	-do-	
457	Xilikha	1.40	8.00	0.850	-do-	-do-	
458	Kadom	0.80	5.00	0.180	-do-	-do-	
459	Sonaru	1.30	3.00	0.720	-do-	-do-	
460	Kadom	1.30	6.00	0.720	-do-	-do-	Branch
461	-do-	1.60	8.00	1.140	-do-	-do-	Branch
462	Moni sal	0.80	2.00	0.280	-do-	Right	Branch
463	Aam	1.90	5.00	1.610	-do-	-do-	Branch
464	Gamari	0.90	4.00	0.280	-do-	-do-	
465	Kadom	1.00	8.00	0.380	-do-	-do-	
466	-do-	1.00	10.00	0.380	-do-	Left	
467	Sonaru	0.90	4.00	0.280	-do-	Right	Branch
468	Poma	0.80	2.00	0.180	-do-	Left	Branch
469	Gohera	0.70	2.00	0.100	-do-	-do-	
470	Sonaru	0.80	1.50	0.280	-do-	-do-	Branch
471	Aahot	4.00	5.00	6.220	Bongaon	-do-	Branch
472	-do-	2.00	8.00	1.780	-do-	-do-	
473	-do-	2.00	3.00	1.780	-do-	-do-	Branch
474	Dumbaru	0.90	3.00	0.280	-do-	-do-	Branch
475	Bhelkor	1.00	2.00	0.380	-do-	-do-	
476	Kadom	0.90	5.00	0.280	-do-	-do-	
477	Bhelkor	1.00	2.00	0.380	-do-	Right	Branch
478	Aahot	0.70	1.50	0.100	-do-	Left	

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Sl	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
479	Bhelkor	0.80	2.50	0.180	Bongaon	Right	
480	-do-	0.80	2.00	0.180	-do-	Left	
481	-do-	0.80	2.00	0.180	-do-	-do-	Branch
482	-do-	0.70	2.00	0.100	-do-	Right	
483	-do-	0.90	1.50	0.280	-do-	-do-	Branch
484	-do-	1.00	2.00	0.380	-do-	Left	Branch
485	-do-	0.80	2.00	0.180	-do-	-do-	
486	-do-	1.00	2.00	0.380	-do-	Right	Branch
487	-do-	1.00	2.50	0.380	-do-	-do-	Branch
488	-do-	0.90	4.00	0.280	-do-	-do-	Branch
489	-do-	0.90	3.00	0.280	-do-	Left	
490	-do-	0.90	2.50	0.280	-do-	-do-	
491	Aahat	1.00	3.00	0.380	-do-	-do-	Branch
492	-do-	0.90	3.00	0.280	-do-	-do-	
493	Bhelkor	1.20	7.00	0.600	-do-	-do-	
494	-do-	1.10	3.00	0.480	-do-	-do-	Branch
495	-do-	1.30	4.00	0.720	-do-	-do-	
496	Aahot	2.00	1.00	1.780	-do-	Right	Branch
497	Bhelkor	0.80	1.00	0.180	-do-	-do-	Branch
498	-do-	0.90	1.00	0.280	-do-	-do-	Branch
499	-do-	0.80	1.00	0.180	-do-	-do-	Branch
500	-do-	0.90	2.00	0.280	-do-	-do-	
501	-do-	1.00	5.00	0.380	-do-	-do-	
502	Aahot	1.00	2.00	0.380	-do-	Left	
503	-do-	1.00	4.00	0.380	-do-	-do-	
504	-do-	1.00	2.50	0.380	-do-	Right	
505	Bhelkor	0.70	3.00	0.100	-do-	-do-	
506	Kadom	0.70	6.00	0.100	-do-	-do-	
507	Aahat	0.70	4.00	0.100	-do-	-do-	
508	-do-	0.70	3.00	0.100	-do-	-do-	
509	Kadom	0.80	4.00	0.280	-do-	-do-	
510	Aahat	0.80	3.00	0.180	-do-	-do-	
511	Bhelkor	0.70	2.00	0.100	-do-	-do-	
512	-do-	0.70	2.00	0.100	-do-	-do-	
513	Kadom	0.60	3.00	0.100	-do-	-do-	
514	Bhelkor	0.70	4.00	0.100	-do-	-do-	
515	-do-	0.90	2.00	0.280	-do-	-do-	
516	-do-	0.70	3.00	0.100	-do-	-do-	
517	-do-	0.70	1.00	0.100	-do-	Left	
518	-do-	1.00	3.00	0.380	-do-	-do-	
519	Aahot	0.90	2.00	0.380	-do-	Right	
520	Devdaru	0.70	6.00	0.100	-do-	Left	
521	Kathal	0.70	2.00	0.100	-do-	Right	
522	Aam	0.70	4.00	0.100	-do-	-do-	

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	Species (local name)	Girth with Breast height (mtr.)	Approximate Height (mtr.)	As per local volume table	Location	Side	Remarks
523	Aam	0.80	4.00	0.180	Bongaon	Right	
524	-do-	0.70	2.00	0.100	-do-	Left	
525	-do-	0.60	4.00	0.100	-do-	-do-	
526	-do-	0.70	4.00	0.100	-do-	-do-	
527	Devdaru	0.60	4.00	0.100	-do-	-do-	
528	Aam	1.10	4.00	0.480	-do-	-do-	
529	Xilikha	0.80	4.00	0.180	-do-	-do-	
530	Kadom	0.70	3.00	0.100	-do-	Right	
531	Bhelkor	0.60	4.00	0.100	-do-	-do-	
532	Aam	0.80	4.00	0.180	-do-	-do-	
533	Gamari	0.80	6.00	0.180	-do-	-do-	
534	Aam	1.20	4.00	0.600	-do-	Left	
535	Kadam	0.70	3.50	0.100	-do-	Right	
536	Aam	1.40	3.00	0.850	-do-	-do-	Branch
537	Bhelkor	1.00	2.00	0.380	-do-	-do-	Branch
538	Aam	0.60	2.00	0.100	-do-	Left	

Total – 538 nos. Total volume – 359.71 cum.

4/2/2020

Assistant Engineer
Bhawanipur & Sarukhetri Territorial Road Division, Pathsala

Range Forest Officer
Barpeta Road Range
Barpeta Road.

Submitted

Forest Beat Officer
Bahari Beat

ANNEXURE 27: LAB REPORT

NOIDA TESTING LABORATORIES

(An ISO : 9001 : 2008, 14001 : 2004 & OHSAS : 18001 : 2007 Certified & NABL Accredited Laboratory)

MoEF & CC (Ministry of Environment, Forest & Climate Change) Recognized Laboratory.

Analyzing for an Assured Future

☎ +91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

TEST CERTIFICATE

Environmental Monitoring Report (Final)

Project Name	:	**Baseline Environmental Monitoring** for Consultancy Services For preparation of Detailed Project Reports for Improvement of SH and MDRs under Axom Mala – Group 2 in the state of Assam.
Client	:	**PWRD, Assam**
Consultant Details	:	**Noida Testing Laboratories GT-20, Sector -117,Noida , Gatum Budh Nagar-201301**
Reports Name	:	**Environmental Monitoring Report (Final)**
Issue No.	:	**FIPL/-00002022/19-20/GP-02 / 04**
Issue Date	:	**16/03/2020**

Laboratory : *GT-20, Sector-117, Noida, Gautam Budh Nagar - 201301*
E. : *noida.laboratory@gmail.com, info@noidalabs.com* ***W.:*** *www. noidalabs.com*

TABLE OF CONTENT

1. PROJECT DESCRIPTION

1.1. Project road -

1.2. Project Proponent

Public Works and Roads Department, Assam, India has embarked on the development of Economic Corridors, Inter Corridors and Feeder Routes to improve the
Efficiency of Freight movement in India under Asommala Pariyojna in state of Assam. The proposal will help in easing traffic congestion & Efficiency of Freight movement in Assam. The proposed Economic Corridors, Inter Corridors and Feeder Routes will help in through movement of traffic going towards Assam to other nearby states.

1.3. Client

PWRD, Assam

1.4. Study Area

The Study Area Details given below.

1.5. Study Period

Duration and details of the study period (December 2019 – Feb 2020)

1.6. Consultant / Laboratory

Noida Testing Laboratories, GT-20, Sector -117, Noida, Gatum Budh Nagar-201301

Consultant's Disclosure

Give brief summary of the works undertaken along with the certifications received (NABL, MoEF&CC ISO certificates etc.). The certificates shall be attached as annexure along with the details of approved parameters (NABL Scope)

1.6.1. Team Members

Sl. No.	Name	Qualification	Experience	Project Involvement
1	R.K. Singh	M.Sc.	14 Years	Industrial Monitoring, Highways, Construction Projects
2.	Diksha Joshi	M.Sc.	4.0 Years	Mining, Highways, Construction Projects

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

3.	Rahul Sharma	M.Sc.	3.0 Years	Mining, Highways, Construction Projects
4.	Varun Jain	M.Sc.	3.0 Years	Mining, Highways, Construction Projects
5.	Swati Sharma	M.Sc.	2.0 Years	Industrial Monitoring, Highways, Construction Projects
6.	Shivika Sharma	M.Sc.	2.0 Years	Mining, Highways, Construction Projects
7.	Prashant Kaushik	B.Sc	4.0 Years	Industrial Monitoring, Highways, Construction Projects
7.	Pankaj Sharma	B.Tech (Biotechnology)	7.Years	Mining, Highways, Construction Projects

BASELINE ENVIRONMENT

1.7. Meteorology

Meterological data were collected at Bongaon, meteorological data of December 2019 to February 2020 months was collected to assess the long-term meteorological scenario of the area. The data collected shows almost similar nature of atmospheric scenario due to geo-graphic equality of the stations.

Months	Temperature (°C)			Relative Humidity (%)			Average Wind Speed (kmph)	Total Rainfall (mm)
	Max	Min	Avg.	Max	Min	Avg.		
Dec 2019	28.6	9	18.8	76	30	53	7.8	1.2
Jan 2020	24.7	7.6	16.1	84	24	54	6.4	0.0
Feb 2020	29.8	10.5	20.1	90	44	67	10.6	2.0
Average	27.7	9.03	18.4	83.3	32.7	58	8.3	1.1

1.8. Air Quality

1.8.1. Monitoring Locations

Two monitoring locations have been selected around the project corridor. Logistic considerations such as accessibility, security, and availability of reliable power supply etc. were also examined while finalizing the stations. Details of monitoring locations are depicted in **Table 1**.

Table 1: Ambient Air Quality Monitoring Stations

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

Sl. No.	Monitoring Station Code	Location	Latitude / Longitude	Area Categorization	Distance from Road edge (m)	Height from Ground Level (m)
1	AQ 1	Raipur	26°28'43.27"N 91°11'45.64"E	Residential	5	3
2	AQ2	Sarthebari	26°22'12.38"N 91°13'26.73"E	Residential	20	5

1.8.2. Methodology

Monitoring was conducted for the following parameters:

- Particulate Matter 10 (PM_{10})
- Particulate Matter ($PM_{2.5}$)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_2)
- Carbon Monoxide (CO)

It was ensured that the equipment was placed at a height of at least 3 to 6 m above the ground level at each monitoring station, for negating the effects of windblown ground dust. Also distance of the sampler to any air flow obstacle i.e. buildings, must be more than two times the height of the obstacle above the sampler has been ensured. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results. Monitoring has been carried out as per the latest CPCB and MoEF&CC guidelines and notifications.

2.2.3 Duration and Frequency of Monitoring

The monitoring has been carried out at a frequency of two samples per week at each of two locations, adopting a continuous 24-hour schedule for the period of Dec - 2019 to Feb 2020.

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

2.2.4 Sampling & Analytical Techniques with NAAQ Standards

With a view to collecting the samples, Ecotech & Lata Envirotech make calibrated Respirable Dust Samplers along with Gaseous attachment and Fine Particulate Samplers have been used. The RDS was well capable of drawing air at a flow rate of 1 to 1.3 m^3/min with very little pressure drop for RDS and the Impactor system of FPS is designed to operate at an air flow rate of 1 m^3/hr. Filter papers were used for the collection of PM_{10} & $PM_{2.5}$. SO_2 was collected by drawing air at a flow-rate of 0.5 litres per minute (lpm) through an absorbing solution i.e., Sodium tetrachloromercurate (TCM) (West and Gaek Method), Place 30ml absorbing solution (TCM) in impinge and sampling for 24 hrs, NO_2 were collected by drawing air at a flow rate of 0.4 litres per minute (lpm) through the mixture of absorbing solutions i.e. sodium hydroxide and sodium arsenite (Jacobs and Hochheiser Method), Place 30ml absorbing solution in impinge and sampling for 24 hrs Carbon Monoxide was collected in bladders on 8 hourly basis and analyzed by Non Dispersive Infra Red Spectroscopy (NDIR).

National Ambient Air Quality Standard is presented in **Table 2.**

Table 2: National Ambient Air Quality Standards

Pollutant	Concentration in µg/mg^3		
	Time	Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
Sulphur Dioxide (µg/m^3)	Annual Avg.* 24 hours**	50 80	20 80
Oxides of Nitrogen (µg/m^3)	Annual Avg. 24 hours	40 80	30 80
PM10 (µg/m^3)	Annual Avg. 24 hours	60 100	60 100
PM2.5 (µg/m^3)	Annual Avg. 24 hours	40 60	40 60
Carbon Monoxide (mg/m^3)	8 hours 1 hour	2 4	2 4

Source: Gazette of India Notification, dated 16th Nov, 2009

Project Name - **Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.**

** Annual Arithmetic Means 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*

2.2.5 Results

Statistical analysis (minimum, maximum, arithmetic mean, standard deviation and 98-percentile values) of the ambient air quality in study area are shown in **Table 3-9.**

Table 3: Particulate Matter10 (µg/m^3)

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
1	AAQ1	58.46	72.56	3.61	72.20	67.64
2	AAQ2	61.22	72.65	3.29	72.52	67.76

Table 4: Particulate Matter2.5 (µg/m^3)

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
1	AAQ1	24.48	36.82	3.67	36.66	29.75
2	AAQ2	24.33	36.78	3.91	36.78	29.33

Table 5: Sulphur Di-oxide (µg/m^3)

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
1	AAQ1	6.47	10.88	0.92	10.75	9.81
2	AAQ2	5.56	10.66	1.59	10.62	9.07

Table 6: Oxides of Nitrogen (µg/m^3)

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
1	AAQ1	8.52	15.89	2.09	15.88	13.69

Project Name - **Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.**

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
2	AAQ2	9.64	15.99	1.81	15.94	12.70

Table 7: Carbon Monoxide (mg/m^3)

S. No.	Station	Min.	Max.	Std dev.	P98	Mean
1	AAQ1	0.35	0.65	0.09	0.65	0.54
2	AAQ2	0.30	0.63	0.09	0.61	0.49

Table 8: Consolidated 98th Percentile Values (µg/m3 except CO in mg/m^3)

S. No.	Station Name	PM 10	PM2.5	SO2	NOx	CO
1	AAQ1	72.20	36.66	10.75	15.88	0.65
2	AAQ2	72.52	36.78	10.62	15.94	0.61

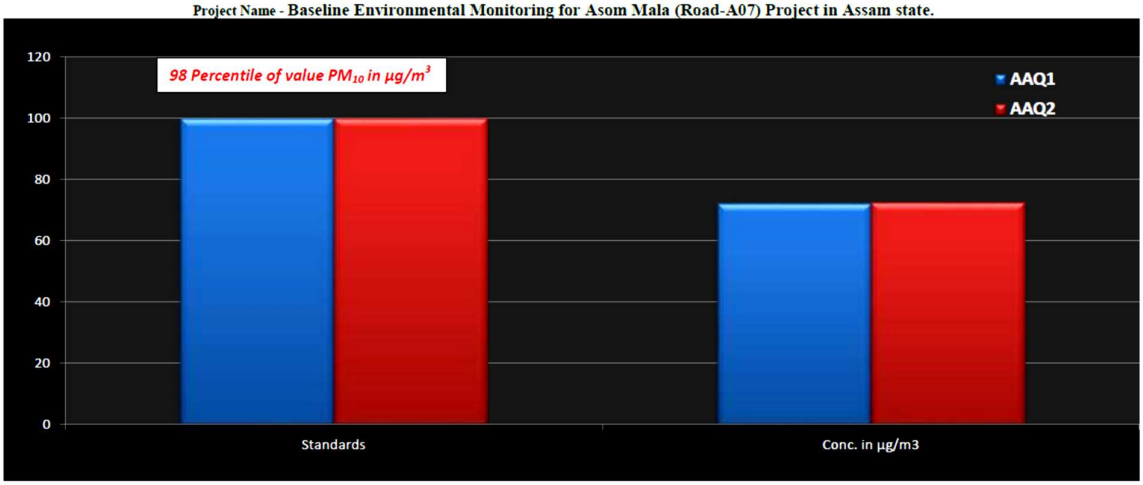
The detailed on-site twice in a week monitoring results corresponding to all air quality locations for the entire monitoring period (Dec 2019 – Feb 2020). 98th percentile value of each ambient air quality parameter corresponding to locations are graphically presented along with the NAAQS values in **Figure 1** to **Figure 5.**

2.2.6 Particulate Matter10 (PM 10)

The 98th percentile value of PM 10 varies between 72.20 µg/m^3 at Raipur & 72.52 µg/m^3 at Sarthebari. The below **Figure 1** shows the comparison of PM10 value with the NAAQ standard. The concentration of PM10 was found well below the NAAQ standards at all the locations.

Figure 1: Baseline PM10 Concentration v/s NAAQ Standards

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

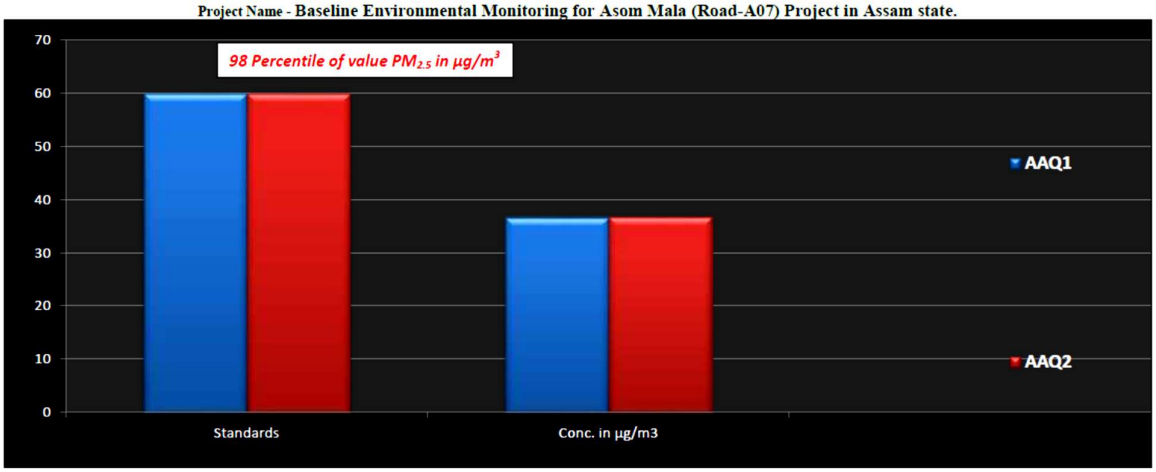


2.2.7 Particulate Matter 2.5 (PM 2.5)

The 98th percentile value of PM 2.5 varies between 36.66 µg/m^3 at Raipur & 36.78 µg/m^3 at Sarthebari. The below **Figure 2** shows the comparison of PM 2.5 value with the NAAQ standard. The concentration of PM 2.5 was found well below the NAAQ standards at all the locations

Figure 2: Baseline PM2.5 Concentration v/s NAAQ Standards

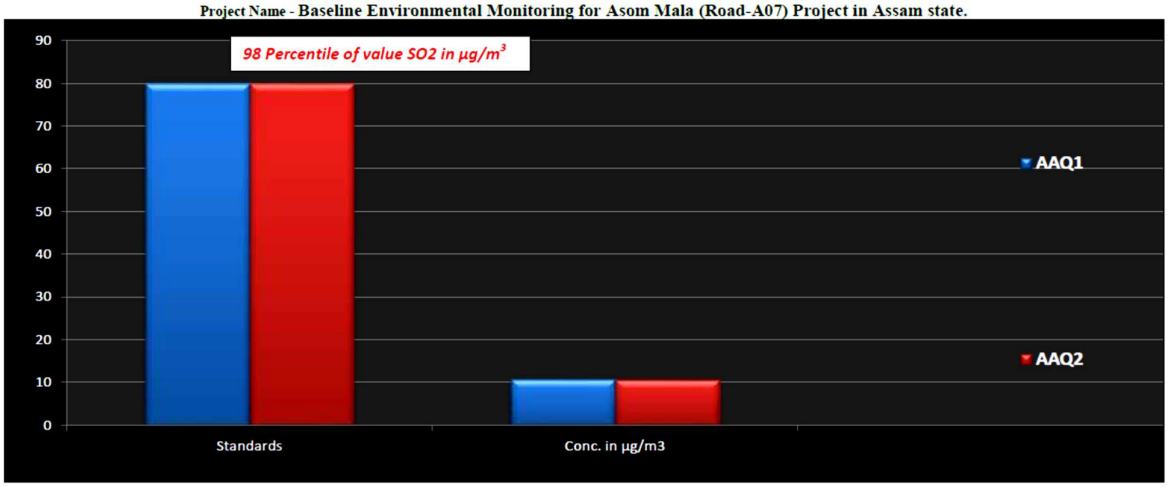
Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.



2.2.8 Sulphur Dioxide (SO2)

The 98th percentile value of SO2 varies between 10.62 µg/m^3 at Sarthebari & 10.75 µg/m^3 at Raipur. The below **Figure 3** shows the comparison of SO_2 value with the NAAQ standards.

Figure 3: Baseline SO2 Concentration v/s NAAQ Standards

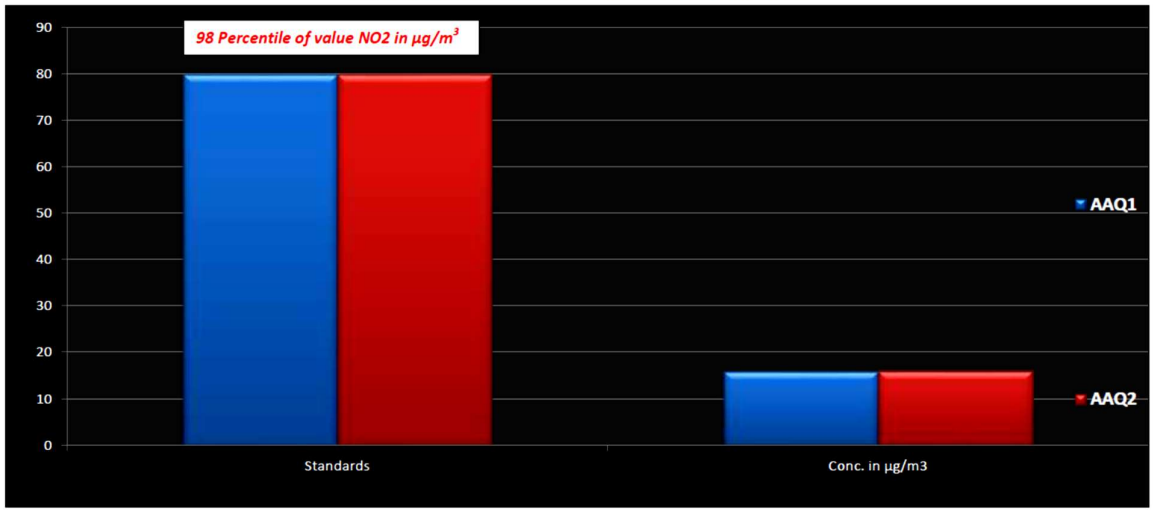


2.2.9 Nitrogen Dioxide (NO2)

The 98th percentile value of NO2 varies between 15.88 µg/m^3 Raipur & 15.94 µg/m^3 at Sarthebari. The below **Figure 4** shows the comparison of NO_2 value with the NAAQ standards.

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

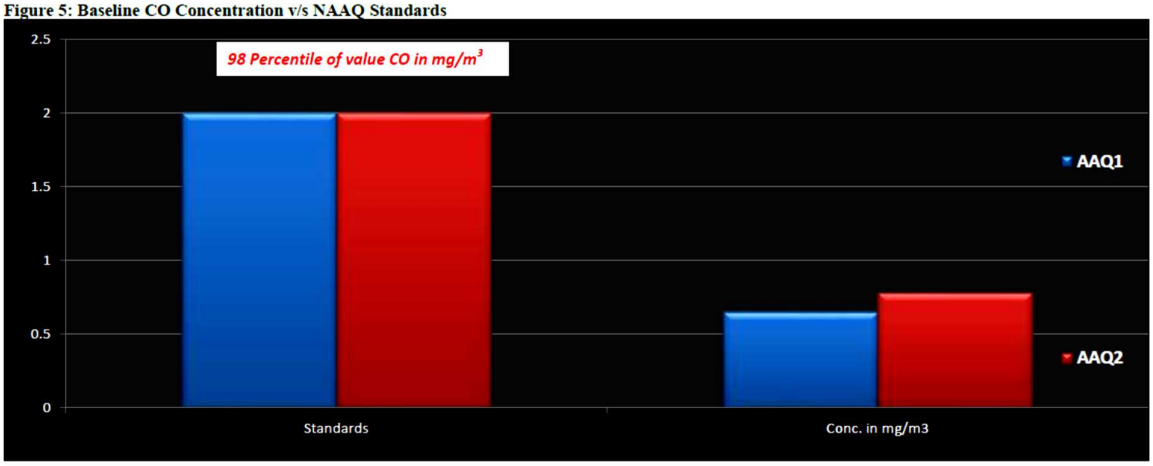
Figure 4: Baseline NO_2 Concentration v/s NAAQ Standards

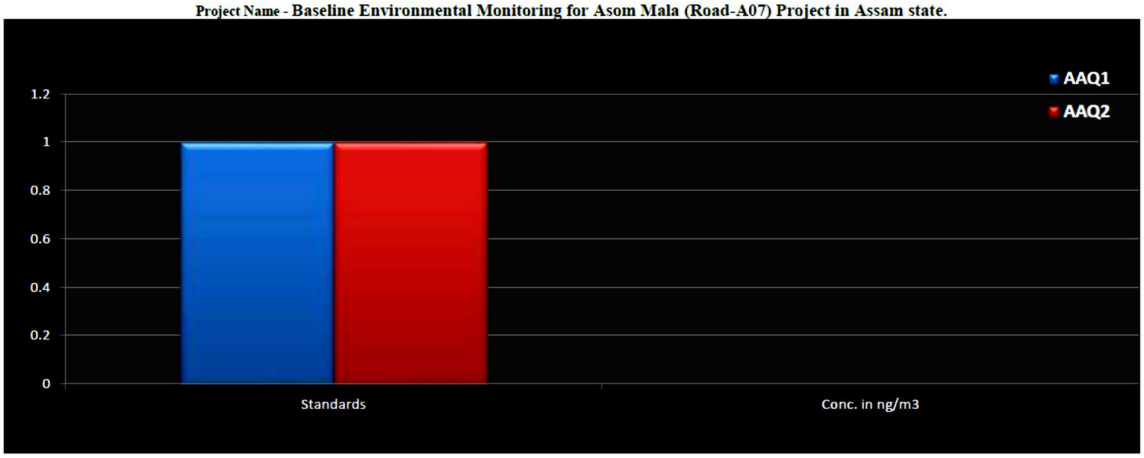


2.3.0 Carbon Monoxide (CO)

The 98th percentile value of CO varies between 0.61 mg/m^3 at Sarthebari & 0.65 mg/m^3 at Raipur. The below **Figure 5** shows the comparison of CO value with the NAAQ standards.

Figure 5: Baseline CO Concentration v/s NAAQ Standards





Source: Gazette of India Notification, dated 16th Nov, 2009
** Annual Arithmetic Means 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*

2.3.1 Inference

Two samples were collected from different – 2 locations. The air quality was found well within the under limit as per NAAQS Norms.

Project Name - **Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.**

2.4.0 Water Quality

2.4.1 Ground & Surface Water Scenario

To assess the impact of the water quality along with other discharges on the water quality within the study area, Two Ground Water & Two Surface Water Sampling locations have been selected. The water quality sampling locations are given in below (Table No. -9)

2.4.2 Monitoring Locations

Give in tabular format (given below). Also inform the changes in the locations if any and reasons behind the same.

Table Number – 9 (Ground & Surface Water Sampling Locations)

Sl. No.	Monitoring Station Code	Location	Distance from Road edge (m)	Latitude	Longitude	Date of Monitoring
1	GW 1	Debara	28	26°28'29.10"N	91°11'38.99"E	25/12/2019
2	GW 2	BamunPaka	5	26°23'32.39"N	91°13'7.45"E	25/12/2019
1	SW 1	Kaladia River (Bangaon)	138 (Down-stream)	26°26'53.82"N	91°11'47.25"E	25/12/2019
2	SW 2	Tihu River (Kharia)	38 (Down-stream)	26°24'16.86"N	91°12'21.44"E	25/12/2019

2.4.3 Methodology

The samples were analyzed for relevant physical and chemical parameters for baseline data generation. All the basic precautions were taken care to avoid any contamination during the sampling. Analysis of the

Sample was carried out as per established standard methods and procedures prescribed by CPCB, IS 3025 Codes and APHA 22nd edition 2012.

2.4.4 Results

Provide the results for surface & ground water locations in tabular format for all the parameters tested along with the standards

Table Number – 10 (Ground Water Quality Results)

S. No.	Parameters	Test Method	Unit	GW 1	GW 2	Limits as IS Standard : 10500	
						Desirable Limits	Extended Limits
1	pH	IS-3025(P-11)	---	6.62	7.12	6.5	8.5

Project Name - **Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.**

S. No.	Parameters	Test Method	Unit	GW 1	GW 2	Limits as IS Standard : 10500	
						Desirable Limits	Extended Limits
2	Colour	IS-3025(P-04)	Hazen	<1.0	<1.0	5	25
3	Odour	IS-3025(P-05)	---	Agreeable	Agreeable	-	-
4	Temperature	IS-3025(P-09)	°C	22.0	20.6		
5	Turbidity	IS-3025(P-10)	NTU	<1.0	<1.0	1	5
6	Conductivity @25°C	IS-3025(P-14)	µS/cm	310	522	-	-
7	Sulphate (SO4)	IS-3025(P-24)	mg/l	15.81	42.12	200	400
8	Nitrate (NO3)	IS-3025(P-34)	mg/l	2.16	3.88	45	No Relaxation
9	Total Hardness(as CaCO3)	IS: 3025 (P- 21)	mg/l	81.0	146	200	600
10	Chloride(as Cl)	IS: 3025 (P- 32)	mg/l	32.10	40.10	250	1000
11	Fluoride (as F)	IS: 3025 (P-60)	mg/l	0.24	0.38	1.0	1.5
12	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.092	0.088	0.3	No Relaxation
13	Dissolve Oxygen	IS: 3025(P-58)	mg/l	7.1	7.3	-	-
14	Total Dissolved Solid	IS-3025(P-16)	mg/l	184	324	500	2000
15	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	19.69	32.86	75 -	200
16	Magnesium (as Mg)	IS: 3025 (P-46)	mg/l	7.78	15.55	30	1000

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

S. No.	Parameters	Test Method	Unit	GW 1	GW 2	Limits as IS Standard : 10500	
						Desirable Limits	Extended Limits
17	Arsenic (as As)	IS-3025(P-37)	mg/l	BDL	BDL	0.01	No Relaxation
18	Lead (as Pb)	IS-3025(P-47)	mg/l	BDL	BDL	0.01	No Relaxation
19	Copper (as Cu)	IS-3025(P-42)	mg/l	BDL	BDL	0.05	No Relaxation
20	Zinc (as Zn)	IS-3025(P-49)	mg/l	0.086	0.204	5.0 -	15.0
21	Manganese (as Mn)	IS-3025(P-59)	mg/l	BDL	BDL	0.1	0.3
22	Total Chromium (as Cr)	IS-3025(P-52)	mg/l	BDL	BDL	0.05	No Relaxation
23	Sodium (as Na)	IS-3025(P-45)	mg/l	21.2	25.6	---	---
24	Potassium (as K)	IS-3025(P-45)	mg/l	1.9	1.6	---	---
25	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P- 23)	mg/l	96.0	168	200	600
26	Total Solid	IS-3025(P-16)	mg/l	184.6	324.7	---	---
27	Phosphate (as P)	IS-3025(P-31)	mg/l	BDL	BDL	---	---
28	Nitrite (as NO_2)	IS-3025(P-34)	mg/l	BDL	BDL	---	---
29	Total Suspended Solid	IS-3025(P-17)	mg/l	<1.0	<1.0	---	---
30	Faecal Coliform	IS-1622	---	Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml
31	Total Coliform	IS-1622	---	Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

Table Number – 11 (Surface Water Quality Results)

S. No.	Parameters	Test Method	Unit	SW 1	SW 2	Tolerance Limit IS:2296 CLASS C
1	pH	IS-3025(Part-11)		7.48	7.58	6.5 -8.5
2	Temperature	IS:3025(Part-9)	°C	18	20.4	-
3	Turbidity	IS-3025(P-10)	NTU	6.9	10.4	-
4	Conductivity @25°C	IS-3025(P-14)	µS/cm	252	366	-
5	Sulphate (SO4)	IS: 3025 (P- 24)	mg/l	-	19.7	400
6	Nitrate (NO3)	IS:3025(Part-34)	mg/l	2.10	2.9	50
7	Total Hardness(as CaCO3)	IS: 3025 (P- 21)	mg/l	80.0	136	-
8	Chloride(as Cl)	IS: 3025 (P- 32)	mg/l	14.32	32.9	600
9	Fluoride (as F)	IS: 3025 (P- 30)	mg/l	0.39	0.39	1.5
10	COD (as O2)	IS:3025(Part-58)	mg/l	24.0	34.0	-
11	Iron (as Fe)	IS: 3025 (Part - 53)	mg/l	0.37	0.502	50
12	Dissolve Oxygen	IS:3025(Part-58)	mg/l	6.1	4.9	4.0

Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

S. No.	Parameters	Test Method	Unit	SW 1	SW 2	Tolerance Limit IS:2296 CLASS C
13	Total Dissolved Solid	IS-3025(P-16)	mg/l	161	232	1500
14	BOD (3 days at 27^{0}C)	IS:3025(Part-44)	mg/l	5.6	7.2	3.0
15	Calcium (as Ca)	IS-3025(P-40)	mg/l	17.64	41.68	-
16	Magnesium (as Mg)	IS-3025(P-46)	mg/l	8.75	7.78	-
17	Arsenic (as As)	IS: 3025 (Part - 37)	mg/l	BDL	BDL	0.2
18	Lead (as Pb)	IS: 3025 (Part - 47)	mg/l	BDL	BDL	0.1
19	Copper (as Cu)	IS: 3025 (Part - 42)	mg/l	BDL	BDL	1.5
20	Zinc (as Zn)	IS: 3025 (Part - 49)	mg/l	0.22	0.28	15.0
21	Manganese (as Mn)	IS: 3025 (Part - 45)	mg/l	BDL	BDL	-
22	Total Chromium (as Cr)	IS: 3025 (Part - 52)	mg/l	BDL	BDL	0.05
23	Sodium (as Na)	IS-3025(P-45)	mg/l	10.2	21.0	-
24	Potassium (as K)	IS-3025(P-45)	mg/l	1.20	3.1	-
25	Total Alkalinity (as $CaCO_3$)	IS-3025(P-23)	mg/l	92.0	156	-
26	Total Solid	IS-3025(Part-16)	mg/l	170.2	246.3	-
27	Phosphate (as P)	IS-3025(Part-31)	mg/l	0.102	0.182	-



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

S. No.	Parameters	Test Method	Unit	SW 1	SW 2	Tolerance Limit IS:2296 CLASS C
28	Nitrite (as NO_2)	IS-3025(Part-34)	mg/l	BDL	BDL	-
29	Total Suspended Solid	IS-3025(Part-17)	mg/l	9.2	14.3	-
30	Total Coliform	IS - 1622	MPN/100 ml	232	328	5000

2.4.5 Inference

Four water samples (two ground water & two surface water samples) were collected from different - 2 locations. The water quality was found well within the desirable limit.

2.5.0 Noise Quality

Major Sources of Noise in the Study Area

The vehicular movement on highway is one of the major sources of noise, which significantly increases ambient noise levels. Also, there are a number of other occasional domestic and commercial noise sources such as loudspeaker, generator set etc.

2.5.1 Monitoring Locations

In the present study, sound pressure levels (SPL) have been measured by a sound level meter (Model: Lutron Make SL – 4033SD). Since loudness of sound is important for its effects on people, the dependence of loudness upon frequency must be taken into account in environmental noise assessment. This has been achieved by the use of A-weighting filters in the noise measuring instrument which gives a direct reading of approximate loudness. A-weighted equivalent continuous sound pressure level (Leq) values have been computed from the values of A-weighted sound pressure level measured with the help of noise meter.



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

A total of Two (2) locations have been selected for measurement of ambient noise levels, covering Residential and Silence areas. These locations have been given in table 11.

Table Number – 11 (Noise Monitoring Locations)

Monitoring Station Code	Location	Date of Sampling	GPS Coordinates	Area Category	Distance from Road edge (m)	Observed Noise Levels in dB (A)		Noise Quality Standards in dB (A)	
						L_{eq} day	L_{eq} night	L_{eq} day	L_{eq} night
N 1	Raipur	25/12/2019	26°28'43.27"N 91°11'45.64"E	Residential	7 (m)	54.9	43.4	55	45
N 2	Sarthebari	25/12/2019	26°22'13.23"N 91°13'27.14"E	Silence	10 (m)	45.8	37.4	50	40

2.5.2 Methodology

At each location, noise monitoring has been carried out once in a month during the entire study period (Dec 2019 – Feb 2020) over a period of twenty-four hours to obtain Leq values at uniform time intervals of 1 hour. In each hourly time interval Leq values have been computed from SPL readings taken at uniform time intervals of 15 minutes. For each location, day and night time Leq values have then been computed from the hourly Leq values such that comparison could be made with the national ambient noise standards which is presented in table 12.

2.5.3 Results

An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time.

Dec 2019 – Fab 2020 results are presented in below.

Table Number – 12 (Noise Monitoring Results)



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

Monitoring Station Code	Observed Noise Levels in dB (A)								Noise Quality Standards in dB (A)	
	L10	L50	L90	L_{eq} Day	L_{eq} Night	Leq	Max Value	Min Value		
N1	51.2	48.3	46.4	54.9	43.4	49.1	58.6	40.1	55	45
N2	43.8	40.7	38.0	45.8	37.4	41.6	49.2	34.2	50	40

2.5.4 Inference

Two Noise Monitoring data were collected from different - 2 locations. The Noise level was found well within limits as per CPCB Norms.

2.5.5 Soil Quality Analysis

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project area representing various land use conditions. The samples were collected by ramming a core-cutter into the soil up to 90-cm depth. Four locations are selected for soil sampling. At each location, soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and homogenized. The homogenized samples were analysed for physical and chemical characteristics. The sealed samples were sent to laboratory for analysis. Soil samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis" (M.L. Jackson, 1967). The details of the sampling locations are given in table 13.

2.5.6 Monitoring Locations

Table Number – 13 (Soil Sampling Locations)

S. No.	Monitoring Station Code	Location	GPS Coordinates	Date of Sampling



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

1	S1	Debara	26°28'28.02"N 91°11'38.64"E	25-12-2019
2	S2	Bamun Paka	26°23'32.39"N 91°13'7.45"E	25-12-2019

2.5.7 Methodology

Two locations are selected for soil sampling. At each location, soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and homogenized. The homogenized samples were analysed for physical and chemical characteristics.

(A) Physical Parameters

The important physical characteristics of soil are bulk density, porosity and texture. Colour of soil along the proposed study area varies from light brownish to dark brownish.

(B) Chemical Parameters

A brief summary of chemical characteristics are given below:

pH of soil in the proposed study area is found to be in the range of 7.12 to 7.58, the soil are, therefore, moderately alkaline. Conductivity of soil in the proposed study area is found to be in the range of 0.19 to 0.205 ms/cm. Available phosphorous of soil samples along the proposed study area ranges from 49.2 to 63.1 mg/kg. Potassium content as K in soil samples along the proposed study area is found in the range of 152.3 to 162.2 mg/kg. Total organic matter in soil samples along the proposed Study area is found to be fairly high (0.52 – 0.64 %), therefore the soil is fertile in terms of productivity.

2.5.8 Results

Provide the results for soil locations in tabular format for all the parameters tested along with the standards

Table Number – 14 (Soil Quality Results)



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

Sl. No	Parameter	Locations		Unit	Standards
		S8	S9		
1.	pH(1:5 suspension)	7.02	7.24	-	IS:2720(Part-26)
2.	Electrical Conductivity at 25°C (1:5suspension.)	224	196	µS/cm	IS:2720(Part-21)
3.	Infiltration Rate	264	178	mm/hr	STP/SOIL
4.	Organic Matter	0.62	0.56	% by mass	IS:2720(Part-22)
5.	Sulphate	52.24	71.2	mg/kg	STP/SOIL
6.	Potassium (as K)	220.4	154.3	mg/kg	STP/SOIL
7.	Moisture Retention Capacity	94	64	% by mass	STP/SOIL
8.	Porosity	96	43.1	% by mass	STP/SOIL
9.	Sand	52.4	55.20	% by mass	STP/SOIL
10.	Clay	34.8	32.2	% by mass	STP/SOIL
11.	Silt	12.8	12.60	% by mass	STP/SOIL
12.	Texture	Sandy Clay	Sandy Clay Loam	-	STP/SOIL
13.	Sodium Sulphate	0.053	0.056	% by mass	STP/SOIL
14.	Nitrogen	432	362	mg/kg	STP/SOIL
15.	Phosphorus	62.10	50.2	mg/kg	STP/SOIL
16.	Bulk Density	1.19	1.30	gm /cc	STP/SOIL



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

Sl. No	Parameter	Locations		Unit	Standards
		S8	S9		

Table 12: Standard Classification of Soil

S. No.	Soil Test	Classification
1.	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.0 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mmho/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (Kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better



Project Name - Baseline Environmental Monitoring for Asom Mala (Road-A07) Project in Assam state.

S. No.	Soil Test	Classification
		>300 sufficient
5	Phosphorus (Kg/ha)	Upto 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6	Potash (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

2.5.8 Inference

On behalf of study of soil quality both physical & chemical parameters, the soil are fertile in terms of productivity.



ANNEXURE 28: BIODIVERSITY ASSESSMENT REPORT

ASSAM SECONDARY ROAD NETWORK IMPROVEMENT PROJECT

Biodiversity Assessment Report (Draft)

(Revision 1)

Prepared for Public Works Roads Department Assam

September, 2021

About the Authors of this Report

THE TEAM

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Mr. Satish Kumar Damodara is a graduate in civil engineering with postgraduate qualification in Environmental Planning, with an experience of 23 years. He is trained in Environmental Impact Assessments, Environmental Management and implementation, and in GIS maping and remote sensing. His areas of expertise include, interpretation and impact assessments for environmental and social attributes, prediction modeling of air, noise and water quality, conducting land suitability analysis towards finalizing the strategic plan for the project towns and spatial analysis using SQL. He has been leading complex spatial and environmental assessment projects as Project Manager/Team Leader/Subject Lead covering master planning and infrastructure design components of large infrastructure development projects. He is a permanent employee of LASA and has International experience of working in South East Asia, South Asia, Sub Saharan Africa and Middle East.

Mr. Satish has been instrumental in preparing the Environmental Codes of Practice for PMGSY Roads in India, way back in 2004. The codes have been subsequently adopted in several rural road projects across India and have been followed in several state road projects. He has made his mark in environmental and social management plan not only in India but also in countries such as Ethiopia and Uganda where an ESMP for one of the World Bank project has been prepared way back in 2009. The ESMP has been subsequently adopted as a template in several projects across Uganda and Sub-Saharan Africa.

Many of the projects undertaken by Mr. Satish are funded by international funding agencies such as The World Bank, Asian Development Bank (ADB), AIIB, KfW, USAID and NORAD apart from national agencies and local bodies, like NHAI, State PWRDs, Urban Development Authorities, and Industrial Development Agencies.

Reviewed by
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Renowned Biodiversity Expert

Dr. P.C. Bhattacharjee, a retired Professor & Head, Department of Zoology, Gauhati University, Assam, India is a renowned **Biodiversity Expert** with 41 years of teaching experience. He is instrumental in wildlife studies in North East India and he has published 100+ scientific papers, article and co-authored 3 books. He has guided a number of Ph.D students). He has attended a number of conferences, national and international seminars, workshops and delivered lectures, on topics related to Environment, Ecology and Biodiversity. He is a Biodiversity and Ecology Specialist for many important projects funded by ADB, World Bank etc.

Dr. P.C. Bhattacharjee is a **Trustee and Vice chairman** of **Wildlife Trust of India** and was a Member of National Biodiversity Authority, Member of Assam State Biodiversity Board, Assam State wildlife Board and Wetland Authority of Assam. He was also Vice-President, Primate Research Center (PRC). At present he is the President of North East Science Movement (NESM)- Affiliated to Vigyan Bharati.

Dr. P.C. Bhattacharjee is a member of **International Ornithological Congress** (Senior Fellow), **IUCN-SIS-Primate specialist Group**; He was Coordinator, North East, Mid-Winter water fowl census, under Wetland International (2004 to 2016). He is recipient of a number of life time achievement awards which includes Government of Assam, by Chief Minister of Assam, 2020 (Wildlife Conservation); Balipara Foundation, 2020.

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ABBREVIATIONS

AIIB	:	Asian Infrastructure Investment Bank
ASRIP	:	Assam Secondary Road Network Improvement Project
EAP	:	Externally Aided Project
GoA	:	Government of Assam
GoI	:	Government of India
IUCN	:	International Union for Conservation of Nature
MDR	:	Major District Roads
MDB	:	Multilateral Development Banks
PPP	:	Public Private Partnerships
SH	:	State Highways

1. Introduction

Biodiversity encompasses all levels of biological diversity including natural ecosystems, wild species (flora, fauna), Aquatic ecosystem, agricultural ecosystems, domesticated species and varieties. This is an outcome of ecological and evolutionary processes taking place gradually in any ecosystem. The term biodiversity is usually defined as the total variety and variability among living organisms and the ecological complexes they inhabit. Biodiversity is vital to the fulfillment of human needs; a biodiversity rich region offers wide possibilities and opportunities for sustaining human welfare including adoption to changes.

2. Biodiversity of the State

India is one of the 17 Mega biodiverse countries in the world and accounts for 7 to 8 % of the recorded species. The State of **Assam is an integral unit of the Eastern Himalayan Biodiversity Region; one of the two biodiversity "Hot Spots" in the country.** Being the core component of Northeast India, Assam has the important feature of Indo Malayan, Indo Chinese characteristics contributing to its biodiversity. The climatic variations and wide variety in physical features have resulted in diversity of ecological habitats such as forests, grasslands, wetlands, which harbor and sustain wide ranging floral and faunal species placing.

The state of Assam possesses largely tropical type of vegetation containing areas of evergreen, semi-evergreen, deciduous forests and grasslands besides patches of riparian forest found along the river banks. As per Revised Survey of Forest Types in India, Champion and Seth categorized as many as fifty one different forest types/ sub types for this region. Broadly, these are Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests, Tropical Moist Deciduous Forests, Sub-tropical Broadleaf Hill Forests, Sub-tropical Pine Forests, Littoral and Swamp Forests, Grassland and Savannah.

With respect to Flora, Assam has rich biodiversity of bamboo, Cane, Medicinal Plant and many endemic plant species. Assam is home to a good number of plants having medicinal uses, altogether, 952 plants species have been identified which have uses in medical practices in some form or other. Endemic species are found in very limited areas of the state. Altogether about 165 species of plants have been reported, which are restricted in distribution to certain pockets in Assam and N.E. Region. However, around 100 such species have distribution restricted to Assam only. Some of these (Plants & trees) are e.g. Accacia gageana, Adiantum assamicum, Alseodaphne andersonii, Alseodaphane khasyana, Angiopteris assamica, Cedrela fabrifuga, Cinnamomum cacharensis, Coelogyne assamica, Combretum wallichii, Dinochloa indica, Diospyros cacharensis, Dipterocarpus mannii, Eugenia cyanophylla, bamboos e.g. Bambusa cacharensis, Bambusa mastersii, Chimnobambusa griffitheana, orchids e.g. Bulbophyllum elassonotum, Bulbophyllum vireus, Dendrobium assamicum etc.

With reference to **Rare and Endangered Floral** Species under IUCN red List, about 9 wild species are reported as extinct while around 284 species of plants are observed to be critically endangered, 149 species as endangered, 58 species as vulnerable, 13 species as near threatened.

Assam is a geographical part of the transitional zone between the Indian, Indo Malayan and Indo Chinese Biographical regions. Assam is endowed with favourable climate, topographic and edaphic factors support luxuriant growth of diverse ecosystem and wild fauna (mammals, primates, reptiles, amphibians, fishes, mollusks, birds, butterflies, moths etc.) as inhabitants.

Mammalian diversity of Assam is represented by 193 species, which are widely distributed in this region. But some of the species like one horned rhinoceros, water buffalo, pigmy hog, swamp deer, golden langur, hoolock gibbon have their distribution limited to isolated pockets and protected areas. In case of Primate Diversity, out of 15 Indian primate species 9 are found in Assam. Hoolock gibbon is the

only ape found in India. The other major primate species are capped monkey, golden langur, rhesus macaque, stump tailed macaque, pigtail macaque, Assamese macaque, and slow Lorries.

With respect to Reptilian Diversity, Assam's varied physiographic conditions support a rich variety of reptilian population like Gangetic gharial, 19 species of tortoises, 77 species of lizards and snakes. In Amphibian, Assam and other parts of the N.E. region have 70 species of Amphibions, Gangenophis fulleri and Ichthyphis garoensis are endemic to Assam.

Assam is one of the "**endemic bird areas**" of the world. Assam has **950 bird species**; this is home to 53.5% of the bird species of Indian Sub-Continent, where 17 species of birds are endemic to Assam. **45 species** of birds from Assam has been recognized as **threatened** under the Indian Red Data Book.

Due to having Brahmaputra and Barak River basin, Assam region is recognized as one of the hot spots of fresh water fish biodiversity. Amongst 197 species; food, sports and ornamental fish species are reported from the North East region, of which 185 species are reported from Assam. Commercially main fish species include, **Rohu, Katla, Pabha, Pabda Chital, Magur, Singi, Sol**, etc.

Butterflies play an important role in pollination of plants and biodiversity conservation. Around total 1500 species of butterflies from India, half are reported from Assam and Northeast India.

Protected Area Network: The protected area network of Assam includes 5 National Parks and 18 wildlife sanctuaries covering an area of 0.40 million ha constituting 4.98% of the geographical area. The state has three Tiger Reserves, namely Kaziranga NP, Manas NP, and Nameri NP. Kaziranga National Park and Manas National Park are in the list of Natural World Heritage sites. **Majuli** Island is **Biodiversity heritage site;** this is spread over an 875 sq. km. area. In addition to this, few of the Protected Area and its buffer zone have also been identified as **Elephant reserve** like Sonitpur ER, **Dihing-Patkai ER**, Kaziranga-Karbi Anglong ER, Dhansiri-Lungding ER, Chirang-Ripu ER.

Eco-Sensitive Zone: Ministry of Environment, Forest & Climate Change has notified 0-10 km ranges of Buffer area from the boundary of National Park and Wild Life sanctuary as Eco Sensitive Zone (under Wild Life conservation strategy 2002). In this context, many of the protected area's buffer zone (0 - 10 km periphery) has been notified as eco sensitive zone by its default definition. In the state of Assam, recently a few of the Protected Areas (PA) have their notified Eco sensitive zone viz. **Nameri NP, Sonai Rupai WLS, Amchang WLS, Dibru Saikhowa NP, Hollongapar Gibbon WLS & Chakrashila WLS**. The process of demarcation of Buffer area as eco-sensitive zone is still under process in Assam for remaining PAs. Therefore, PAs, which has not demarcated its Eco sensitive zones, the buffer area of 10 km from the protected area boundary has been considered as eco sensitive zone.

3. Project Corridors

The GoA has embarked upon the Asom Mala to objectively develop the secondary network of the State in the next 15 years. The Asom Mala is an umbrella program with several transport related projects under it and funded from various sources, including those funded from the State Budget (SOPD), Externally Aided Project (EAP) funded by Multilateral Development Banks (MDB) like AIIB, ADB, World Bank, JICA, etc. The Assam Secondary Road Network Improvement Project (ASRIP) has been taken up as an EAP aided by AIIB. The Project corridors included under ASRIP are presented in table below:

Table 1: Project Corridors

Sl. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
1	A31	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Lakhimpur & Majuli	19.3
2	A15	Dhodar Ali (Kamargaon to Kamarbandha)	Golaghat	42.1
3	A07	Sarthebari Rampur Pathsala Raipur Road	Barpeta & Bajali	20.8

Sl. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
4	A22	Dhakuakhana Butikur Tiniali Telijan	Lakhimpur & Dhemaji	32.8
5	A30	Moran Naharkatia Duliajan	Dibrugarh	70.6
6	A20	Sivasagar to Nakachari	Sivasagar & Jorhat	63.4
			Total =	**250**

Biodiversity is assessed by mapping the study area with respect to (I) IUCN Red List (II) Protected areas, important species and biodiversity area, forest and other potentially sensitive areas. The present report describes briefly the biodiversity around the project corridors, sensitive hotspots in terms of significant flora & Fauna.

4. Objective

The Biodiversity Assessment Report is a safeguard document that sets out the mitigation and management requirements and responsibilities to be implemented on site to fulfill the Project's biodiversity conservation intentions.

5. Screening of the Project Corridors for Biodiversity

Ecological set-up, favourable geographical location and diversified topographical and climatic conditions were major factors driving the high biodiversity in the state of Assam. Different types of terrestrial and aquatic ecosystem are the ideal conditions for functioning of different types of natural seen in the state with rich biodiversity. Topographically, Assam may conveniently be divided into two major divisions, i.e., the plains and the hills. Assam falls under the regime of sub-tropical monsoon climate. The climate of Assam is characterized by moderate to heavy rainfall accompanied by high percentage of relative humidity and tolerably high temperature in summer and drought with considerably low temperature in winter.

Table below entails about the project corridors and their sensitive analysis with respect to biodiversity impact (please refer below **Table 2**, **Figure 1**).

Table 2: Project corridors & its ecological sensitivity

	Project Corridors					
	A31	A15	A07	A22	A30	A20
Name of the corridor	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Dhodar Ali (Kamargaon to Kamarbandha	Sarthebari Pathsala Raipur Road	Dhakuakhana Butikur Tiniali Telijan	Moran Naharkatia Duliajan	Sivasagar to Nakachari
District	Lakhimpur & Majuli	Golaghat	Barpeta & Bajali	Lakhimpur & Dhemaji	Dibrugarh	Sivasagar & Jorhat
Proximity to PAs or other sensitive areas	• The Project corridor is located at a distance of around 1.5km from Pabho Reserve Forest and it crosses Luit River and Subansiri River near Majuli Island. The area is endowed with rare & threatened Bird Species. • Majuli is a major Island of India and Asia, **it is notified as Biodiversity Heritage site under Government of Assam Gazette Notification dated 29 March 2017 under Section 37 of Biological Diversity Act, 2000.** • The sensitive area around the road stretch may have good biodiversity of fishes, bird and Dolphins. Project involves bridge construction at Subansiri and Luit River. Construction specific Fish and dolphin management plan shall be incorporated in the EMP and PIU/PMU will ensure its effectively implementation by	• **Nambor Doigrung WLS is located at an aerial distance of around 5 km from the project road (Golaghat Town)** • Dhansiri River is flowing at a distance of around 50m from the project road from Ch 2+600 to Ch 3+400. • Occasional Elephant Movement has been reported as per DFO Golaghat and Community consultation • The Protected area has significant number of threatened and endangered wild life fauna and birds.	• Manas NP is located at 23km towards north • No major threatened flora and fauna reported along the corridor and in its indirect influential Zone.	• No Protected Areas/ WLS falls within 10 km Boundary of Project Road. • No major threatened flora and fauna reported along the corridor and in its indirect influential Zone.	• **Dehing Patkai Wildlife Sanctuary is around 4 km from the project road (Bhadoi Panchali).** • **Dehing Patkai WLS has good habitat for elephant, the WLS is an Elephant Reserve.** • Elephant & other wildlife movement is not reported as per DFO Digboi and community consultation.	• **Hollongapar Gibbon Wild Life Sanctuary is located around 6km from the project road.** • The sanctuary has good number of primates and rich habitat of other wild fauna and avi fauna. • The corridor is not within the ESZ and wildlife movement has not been reported as per community consultation.

Project Corridors						
	A31	A15	A07	A22	A30	A20
Name of the corridor	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Dhodar Ali (Kamargaon to Kamarbandha	Sarthebari Pathsala Raipur Road	Dhakuakhana Butikur Tiniali Telijan	Moran Naharkatia Duliajan	Sivasagar to Nakachari
	contractor.					
Flora	Tropical Wet Evergreen Forest (No rare endangered species reported from Project area)	Tropical Semi Evergreen type (No rare endangered species reported from Project area)	Tropical Semi Evergreen type. (No rare endangered species reported from Project area)	Tropical Wet Evergreen Forest (No rare endangered species reported from Project area)	Tropical Rainforest (No rare endangered species reported from Project area)	Tropical Rainforest (No rare endangered species reported from Project area)
Other	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silkha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Ajhar, Simul, Silikha, etc. are the tree species observed.	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silkha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Ajhar, Simul, Silikha, etc. are the tree species observed.	Aegle marmelos, Anonas comosus, Areca catechu,Artocarpus heterophyllus, Azadirachta indica, Dalbergia sisoo, Bombax ceiba, Carica papaya, Citrus limon,Gmelina arborea, Gynocardia odorata, Lagerstomia parviflora, Litsea cubeba, Mangifera indica, Melia	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silkha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Ajhar, Simul, Silikha, etc. are the tree species observed.	Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahor, Elephant apple, different species of Dimoru were observed	Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahor, Elephant apple, different species of Dimoru were observed.
	Threatened Flora of Assam: Cycas pectinate, Vatica lanceaefolia, Paphiopedilum spicerianum, Mesua assamica, Magnolia mannii, Magnolia griffithii, Magnolia cathcartii					

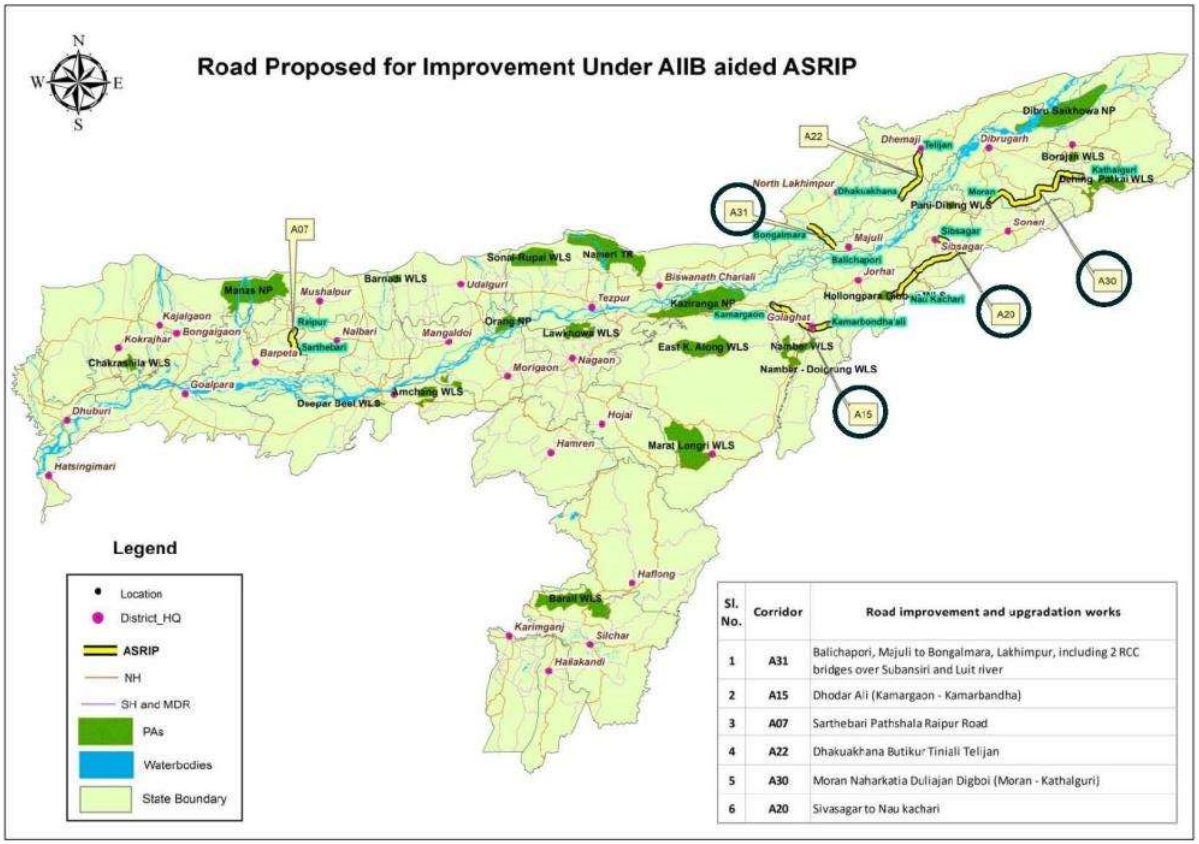


Figure 1: Project Corridor and Eco Sensitive area

6. Clearances

All the project corridors were pre-existing long before notification of any protected area. None of the project roads pass through any Wildlife Sanctuary or National Parks or Protected Areas. Moreover, none of the project roads are legally notified State Highways, hence clearance for environmental and wildlife from Ministry of Environment, Forest and Climate Change is not required.

7. Applicable Rules and Regulations

The following act & regulation of Government of India and State are enacted to ensure the protection of significant Flora and Fauna along with overall environmental security. Though project does not pass through any Wildlife Sanctuary / National Park, however, the security and protection of rare and endangered species is important because few PAs are noticed within 10 km periphery of the project corridors and further it shall need to ensure its compliance and protections by implementing the corridor specific Biodiversity Management Plan (**Table 6 to Table 8**) under strict supervision and monitoring by CSC/ AE/ PIU. The following acts shall be required to be ensured by contractor and construction worker should be aware of these act and penalties thereof.

Sl. No.	Regulations	Relevance	Purpose	Salient Feature
1	The Biological Diversity Act, 2002	▪ A31 - a portion of the project road is located within Majuli Island which is notified as Biodiversity Heritage Site by Govt of Assam in March 2017 under the Act.	It aims at the conservation of biological resources, managing its sustainable use and enabling fair and equitable sharing benefits arising out of the use and knowledge of biological resources with the local communities.	▪ This act prohibits, any person or organization (either based in India or not) obtaining any biological resource occurring in India for its research or commercial utilization. ▪ The act stipulates all offences under it as cognizable and non-bailable.
2	The Wild Life (Protection) Act, 1972	▪ A31-presence of Ganges River Dolphin in Subansiri River ▪ Applicable for A15 as there were incidences of occasional elephant crossing	This Act provides Order, rules and regulations for protection of the country's wild animals, birds, and plant species, in order to ensure environmental and ecological security.	▪ The Act prohibited the hunting of endangered species animal specified in Schedule I & II
3	Forest Conservation Act 1980 and Amendments	▪ Applicable for all Corridors as roadside tree cutting is required.	This Act governs Rules and Regulation for protection and security of Forest.	▪ Section 2 of this Act deals with a restriction on the de-reservation of forests or the use of forest land for non-forest purposes.

8. Biodiversity Screening

A. Corridor A15, A30, A20 - Applicable for Wild Fauna

In the indirect influence area i.e. 10 km periphery of the project corridors, the sensitivity and risk with respect to Wild life, natural habitat has been studied. Based on the details of protected area network of Assam, the corridors of A15, A30 & A20 have some sensitivity towards its natural habitats.

Though above mentioned corridors (A15, A30, A20 & A31) have land use of majorly agricultural and built-up areas, protected areas such as Dhing Patkai WLS, Biodiversity Heritage site i.e. Majuli Island, and River Dhansiri (river tributaries of Brahmaputra), Nambor Doigrung WLS & Hollongapar Gibbon WLS are observed within 10 km periphery of project corridors. In order to protect the critical wildlife habitats, the road upgradation work shall incorporate the requisite management measures for protection of significant wild life habitats.

The Project Corridor A15 Dhodar Ali (Kamargaon to Kamarbandha) is an existing intermediate lane road, originally constructed in around the year 1687, much before the notified protected areas. The Dhodar Ali is a 212-km-long road starting from Kamargaon (NH 715) in Golaghat to Jeypur in Dibrugarh touching Mariani and Jorhat. It runs through five districts of Upper Assam viz. Golaghat, Jorhat, Sivasagar, Charaideo and Dibrugarh, holding significance for several neighbouring states. This road connects mainly small scale and large-scale tea industries, oil refineries, Gas plants, and places of historic importance as well. The project road is located in Golaghat district of Assam, which is famous for its numerous small scale tea gardens and Numaligarh Oil Refinery, this corridor passes parallel to NH 129 and connects Golaghat town directly to NH 715 at Kamargaon. Moreover, it provides the inter-lineage between rural roads and NH which further provides connectivity to major growth centres in the Upper Assam region such as Jorhat (education hub), Sivasagar (historic importance), Dibrugarh, Tinsukia, Digboi (Industrial hub) and further connects to Nagaland, Arunachal Pradesh and Myanmar.

The Dhansiri River is flowing at a distance of around 50m from the road from Ch 2+600 to Ch 3+400. As per stakeholder consultations and confirmation with Forest Office, elephants used to cross the project road on and off at 1st Km, 4th Km and 6th Km. Elephant Underpass has been proposed at 2 locations i.e., 3+630 & 6+450 and approved by the Chief Wildlife Warden, Assam (Annexure 7). Nambor Doigrung WLS is located at an aerial distance of around 5 km from the project road (Golaghat Town). The protected area has good number of rare and endangered mammals, birds and reptiles. The major fauna of the Sanctuary includes Asiatic elephant (Elephus maximus), Hoolock Gibbon (*Hoolock hoolock*), Stumped Tailed Macaque (*Macaca arctoides)*, Pig Tailed Macaque (*Macaca leonina*), Slow Loris (*Nycticebus bengalensis*), Assamese Macaque *(Macaca assamensis),* Rhesus Macaque *(Macaca mulatta),* Tiger *(Panthera tigris),* Leopard *(Panthera pardus),* Fishing Cat *(Prionailurus viverrinus),* Barking Deer *(M untiacus muntjak),* Sambar *(Rusa unicolor),* Wild Boar (*Sus scrofa*), Gaur (*Bos gaurus) etc.* Some of the important bird species found are White Winged Wood Duck (*Asarcornis scutulata*), Great Pied Hornbill *(Buceros bicornis)*, Wreathed Hornbill *(Rhyticeros undulatus),* Adjutant Stork *(Leptoptilos dubius)* etc. Tortoise *(Testudinidae),* Monitor Lizard *(Varanus),* Python *(Pythonidae)* are also found.

The Project Corridor A30 Moran Naharkatia Road is an existing intermediate lane road, originally constructed in around the year prior to 20th century, much before the notified protected areas. The project road is located in Dibrugarh District, it connects four important industrial towns of Upper Assam viz. Moran, Naharkatia, Duliajan and further to Digboi. Naharkatia is one of the commercial towns of Dibrugarh district. There are many small- and large-scale tea gardens and factories located throughout the corridor from Moran to Naharkatia. Duliajan is an industrial town of Dibrugarh District and it is particularly known for its oil industry. The Head Office of Oil India Limited, Shiv-Vani Oil & Gas Exploration Services Ltd and Assam Gas Company Limited are located in Duliajan. Digboi is known as the Oil City of Assam where the first oil well in Asia was drilled in 1866. The first refinery was started in Digboi as early as 1901. Digboi has the oldest oil well in operation. Apart from National highway 15

connecting Dibrugarh and Tinsukia, the project corridor is the only alternative to connect these 4 important places. This road will play a major role in movement of commercial traffic related to oil, gas, coal and tea between upper Assam and all other parts of India. This corridor is also be a shorter one as compared to national highway 15 to travel between Dulijan, Naharkatia and Moran.

Dhing Patkai Wild life sanctuary is located at 4 km east from the road. The Dhing Patkai WLS has significant numbers of IUCN listed and WL Scheduled fauna; it is also an elephant reserve. As per ENVIS record MOEF&CC, the total numbers of Elephant population was 295 recorded in year 2005. The Biodiversity of the WLS has good numbers of rare and endemic fauna. The major fauna of the Sanctuary includes Tiger (stray) (*Panthera tigris*), Asiatic elephant (*Elephus maximus*), leopard (*Panthera pardus*), pangolin (*Manis crassicaudata*), jungle Cat (*Felis chaus*), Indian civet (*Viverridae spp.*), giant squirrel (*Retufa bicolor*), barking deer (*Muntiacus muntjak*), sambar deer (*Cervus unicolour*), wild pig etc. Some of the important tree species found in this forest area are Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahor, Elephant apple, different species of Dimoru etc.

The Project Corridor A20 Dhodar Ali (Sivasagar to Nakachari) is also an existing intermediate lane road, originally constructed in around the year 1687, much before the notified protected areas. The road section from Nakachari to Simaluguri is a part of Dhodar Ali, an arterial road of great economic importance and traverse major cities and towns such as Golaghat, Titabor, Mariani, Amguri, Nazira, Simaluguri and Sonari. It starts at NH 715 in Golaghat district and ends at Jeypore in Dibrugarh district after passing through three other districts - Jorhat, Sivasagar and Charaideo. It provides commercial route for the major tea gardens, oil and gas fields, refineries, etc. It provides the inter-lineage between rural roads and NH which further provides connectivity to major growth centres in the Upper Assam region such as Jorhat (education hub), Sivasagar (historic importance), Dibrugarh, Tinsukia, Digboi (Industrial hub) and further connects to Nagaland, Arunachal Pradesh and on to Myanmar.

The project corridor is located around 6 km from Hollongapar Gibbon Wildlife Sanctuary and it is around 1.3 km from the ESZ. The WLS is falling under Jorhat District having total area of 20 sq.km. As per the Champion & Seth (1968) classification scheme, the major forest type in the WLS is Assam Plains Alluvial Semi Evergreen Forests /2/2B/C sparsely interspersed with wet evergreen forest patches. The vegetation is composed of several canopy layers, mostly are evergreen in nature. Major trees are Hollong (*Dipterocarpus macrocarpas*) and other associated top canopy with Hollong are Sam (*Artocarps chaplasha*), Amari (*Amoora wallichi*), Sopas (*Mcheliai spp.*), Bhelu (*Tetramels mudiflora*), Udal (*Sterculia villosa*) and Hingori (*Castanopsis spp.*), these are suitable habitat for primates **capped langur (*Trachypithecus pileatus*) and pig tailed macaque (*Macaca nemestrina*), Hoolock Gibbon (*Hoolock hoolock*).** The Sanctuary supports 11 species mammals, 5 species of reptiles and amphibians and 31 avifaunal species.

The following section entails of sensitive wild life animal occupying in the sanctuary.

Table 3: Threatened Wild Fauna of Protected Area

IUCN Red List	WLPA Schedule	Types of Animal
Endangered	Sch I	Wild Elephant (*Elephase Maximus*), Tigers (*Panthera tigris*), Otter (*Lutra lutra*), Hoolock gibbon (*Hoolock hoolock*), Capped Langur (*Trachypiyhecus pileatus*)
Vulnerable	Sch I	Clouded Leopard (*Neofelis nebulosa*), Marbled Cat (*Pardofelis marmorata*), Assamese macaque (*Macaca assamensis*), Himalayan black bear (*Salena rotos thibetanus*), common Leopard (*panther Pardus*), Sloth Bear (*Melursus urisinus*)
NA	Sch I	Slow loris (*Nycticebus bengalensis*), Golden Cat (*Catopuma temminckii*)
NA	Sch II	Jungle Cat and Wild Cat (*Felis chaus*), Rhesus macaque *(Macaca mulatta)*, Pigtailed macaque (*Macaca leonina*), Stump tailed macaque (*Macaca arctoides)*
LC	SchII	Flying fox *(Pteropus),* Wild pig *(Sus scrofa),* Sambar (*Rusa unicolor*), Barking deer

IUCN Red List	WLPA Schedule	Types of Animal
		(Muntiacus muntjak), Gaur (Bes gaurus), Serow *(Capricornis)*, Malayan giant squirrels (*Ratufa bicolor)*, Porcupine *(Hystrix brachyura)* etc.
Reptile	Sch I	Rock python *(python molurus)*, Water Monitor (*varanus*), Asian leaf turtle *(Cyclemys dentata)*, Monitor Lizard *(Varanus)*, etc.
	SchII	King cobra *(Ophiophagus Hannah)*, crab eating mongoose *(Herpestes urva)*
Important Birds		Presented in Table 4

In view of above, the significant management measures to protect the biodiversity were incorporated into the designing, construction and operation phases of the Project.

B. Corridor A31-Applicable for Birds

The Project Corridor A31 Majuli to Bhogalmara via Dhunaguri is an existing road located in the Island District of Majuli and Lakhimpur district. At present the Majuli Island[1] is not connected by road and the island is accessible by ferries from the mainland. It is proposed to connect the island to the mainland on the northern bank of the Brahmaputra River by construction of bridges over Subansiri River and Luit River. Majuli is a lush green environment-friendly, a pristine and pollution-free freshwater island in the river Brahmaputra Mostly inhabited by Tribes, the culture of Majuli is unique and quite interesting which is one of the key reasons for tourism. Majuli is also called the cultural capital of Assam, it is famous for its Satras[2]. In 15th century the first Satra was founded in Majuli. These Satras attracts tourism from all around the globe throughout the year.

The project corridor is about 1.5 km from Pabho Reserve Forest & traversing Luit and Subansiri River. Both locations are Bird Hotspot Area. Majuli is a major Island of India and Asia, the surrounding area has Threatened Bird Species. The indirect influence area i.e. 10 km periphery of the project road are noted to have significant species of Avifauna. Majuli Island is a notified Biodiversity Heritage site by Government of Assam dated 29 March 2017.

It traverse two perennial rivers i.e. Subansiri River and Luit River. It encompasses a large riverine island with innumerable small islets, locally called chapories. The topography of the region is flat floodplain with lakes (beels) and marshes. Majuli, with its fertile floodplains and highly productive wetlands, forms ideal habitats for a variety of birds. This area not only supports diverse resident birds, but also attracts a large number of migratory birds, including some uncommon species. The area has evergreen and deciduous trees, grasses, a wide variety of marsh vegetation, bamboos and canes. As per secondary reference and stakeholder consultation Majuli Island is the habitat for the following threatened bird species:

Habitat:

The majorly bird species are found in colonies in trees close to large waterbody / lakes with other extensive wetlands, preferably at height of 10–40 feet (3.0–12.2 m).

Table 4: Threatened Avifauna of Protected areas / WLS

IUCN Red list	WPA 1972	Type of Avifauna
Critical Endangered	Sch I	Oriental White-backed Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Bengal Florican (*Houbaropsis bengalensis*)
Endangered	Sch I	Greater Adjutant (*Leptoptilos dubius*), White-winged Duck (*Cairina scutulata*)
Vulnerable	Sch I	Pallas's Fish-Eagle (*Haliaeetus leucoryphus*), Lesser Adjutant (*Leptoptilos*

[1] Majuli District is the largest river island of Asia, situated on the Brahmaputra River in Northeastern Assam.
[2] Institutional centers associated with the tradition of Vaishnavism

IUCN Red list	WPA 1972	Type of Avifauna
		javanicus), Spot-billed Pelican (*Pelecanus philippensis)*, Swamp Francolin (*Francolinus gularis)*
NT	Sch I	Great Pied Hornbill (*Buceros bicornis*) (NT),
--	Sch I	Grey peacock Pheasant (*polyplectron bicalcaratum*), Wreathed Hornbill (*Aceros undulates*),
Other Species (NA)	Sch IV	Lesser Whistling-Duck *(Dendrocygna javanica),* Ruddy Shelduck (*Tadorna ferruginea*), Alexandrine Parakeet (*Psittacula eupatria*), Purple crimson sunbird (*Leptocoma zeylonica*), Scarlet backed Flower pecker (*Dicaeum cruentatum*), Steaked weaver *(Ploceus manyar*), Black Kite (*Milvus migrans*)
		Rock Pigeon *(Columba livia)*, Oriental turtle dove *(Streptopelia orientalis)*, Spotted Dove *(Spilopelia chinensis)*, Black Myna *(Gracula religiosa)*, Red collared Dove *(Streptopelia tranquebarica)*, Indian Spot billed Duck *(Anas poecilorhyncha)*, Partridge *(Francolinus gularis)*, Asian koel *(Eudynamys scolopaceus)*, Grey Headed Sandpiper *(Actitis hypoleucos)*, Asian Open Bill *(Anastomus oscitans)*, Great Egret *(Ardea alba)*, Indian Pond heron *(Ardeola grayii)*, Great cormorant (*Phalacrocorax carbo*), Darter*(Anhingidae)*, Kaleej Pheasant (*Lophura leucomelanos)*, Pied Falconet (*Mictohierax melanoleucos*)

C. Corridor A31-Applicable for Fisheries and Dolphin

The Project Corridor A31 Majuli to Bhogalmara via Dhunaguri traverses two rivers i.e. Subansiri River & Luit River. Majuli is the largest river island of Asia, situated on the River Brahmaputra in northeastern Assam. It embraces a large riverine island with innumerable small islets, locally termed as chapories. The major fishes of River Subansiri and aquatic mammal is presented in below table:

Habitat:

All the mentioned fish's species are freshwater fishes, basically found in drainage of Subansiri & Brahmaputra River Basin.

Table 5: Significant Fishes diversity of River Subansiri

IUCN status	WPA 1972	Name of Fish & Family
(NT)	NA	Chitala chitala Notopterus notopterus (Pallas) (Family-Notopteridae)
(LC)	NA	Anguilla bengalensis (Anguillidae)
(LC)	NA	Amblypharyngodon mola, Danio dangila, Devario devario, Puntius rasbora, Cirrhinus mrigala,Labeo bata, Labeo pangusi, Labeo rohita (Family Cyprinidae)
(LC)	NA	Gagata gagata,Rita rita, Ailia coila (family- Sisoridae)
(LC)	NA	Rhinomugil corsula (Family- Mugilidae)
(LC)	NA	Xenentodon cancilla (Family- Belonidae)`
Other species	NA	Psilorhynchus sucatio (psilorhynchidae), Aborichthys rosammai (Nemachelidae)
	NA	Other species of families Engraulidae, Psilorhynchidae, Balitoridae, Cobitidae, Bagridae, Siluridae, Schilbeidae, Pangasidae, Amblycipitidae, Erethistidae, Claridae, Channidae etc.

Aquatic Mammal

With regard to threatened aquatic mammal, only aquatic mammal 'Gangetic River Dolphin' is reported in the river (as per secondary records[3]). Locally this animal is known as Sisu. The Ganges River Dolphin belongs to the family Plantanistidae and inhabits Fresh water area. This species is reported in basins of River Ganga-Brahmaputra Basin, Meghana, Karnaphuli-Sangu River system. The subspecies is "endangered" under International Union for Conservation of Nature (IUCN) Red List. In the monsoon season, Ganges River Dolphin locally migrate to tributaries and then back to large River channels in dry, winter season. They also move along the coast of West Bengal. It is a national Aquatic Animal of India. The number of inhabitants in the world was estimated to be 2000 in 1990s. The main reason of declining the population trend is poaching, over catching, loss/division of habitats, River pollution, of modification of the river through inflow, or extraction sediments.

The Gangetic dolphins are found in the River Subansiri in sectors of Katori Chapori to Bodhakora, Bodhakora to Solmari, Solmari to Boroliya and Boroloiya to Silikhaguri (Source: Protection of Endangered Ganges River Dolphin in Brahmaputra River, Assam, India 2009), **Bodoti area is falling near the project corridor.**

Sectors	Area name	Location	Best estimate
I	Katoi sapori - Badhakora	N27°25′, E94°15′- N27°18′, E94°11′	2
II	Badhakora-Solmari	N27°17′, E94°11′- N27°09′, E94°10′	3
III	Solmari-Borolia	N27°09′, E94°10′- N27°01′, E94°06′	9
IV	Boroliya-Bodoti	N27°01′, E94°06′- N26°56′, E93°58″	7
V	Bodoti-Hilikhaguri	N26°55′, E93°57′- N26°51′, E93°52′	2
	Total		**23**

Multiple site visits along with local people were carried out at different timings for dolphin sighting but none was sighted in the project area (upstream and download of proposed bridge over Subansiri River). During community consultations, it was informed that sometimes one/two dolphins are usually sighted during monsoon season.

Although during winter season, the number of Dolphin could be less, construction activity may alter the habitat factors like availability of food fishes, browsing areas; alter water quality and other factors which may have adverse impact on the small population. The impact during preconstruction, construction stage may affect the aquatic habitat of the river body. Ganges river dolphin population will not suffer from habitat fragmentation as the Dolphins and other aquatic species can pass under the bridge and no habitat fragmentation will occur.

9. Anticipated Impact due to the project

Project activities which may cause negative impact on biodiversity are clearing of native vegetation (including habitat); works around watercourses; noise; disturbance of soils, consequential erosion and the mobilisation of sediment; and use of chemicals / fuels (potential for spills).

Direct Impact: Removal of native vegetation; loss of terrestrial and wetland fauna habitat; and loss of aquatic fauna habitat

Indirect Impact: Habitat fragmentation; Potential fauna displacement, altered surface water hydrology; Erosion, sedimentation and contamination; Dust; Light, noise and vibration; Mobilisation of contaminated soils; Spread of pests and pathogens; and Fire.

[3] IUCN published: Protection of Endangered Ganges River Dolphin in Brahmaputra River, Assam

Other activities of impact:

- Emanating some amount of debris during construction, that may affect the Soil & water quality
- Impact on aquatic life, dolphin due to underwater noise, drilling and blasting activity
- Noise from different equipment, construction vehicle may disturb the migratory birds & Wild Fauna
- Several small species amphibians, reptiles, fishes may suffer from habitat change due to construction activities, bridges, culverts, embankments.
- Spillage of oil and other hazardous chemicals
- Worker camps, spillage from parking areas etc.
- Pollution of surface and sub surface water
- Temporary construction and labour camps for workers can be a source of significant temporary and even permanent impact on wildlife and other resources within high-biodiversity areas. Consequently, poaching of wildlife, illegal fishing, harvest of trees for fuelwood, and other illegal activities may take place in these areas.

For any road improvement and upgradation works there would be effects on biodiversity due to road improvement works. The proposed project corridors are existing roads with single to intermediate lane which are proposed for improvement and upgradation to two lane, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side.

Mostly construction specific activities are confined and temporary in nature, these are physical construction specific impacts where the extent of effect is moderate which can be reversed once the construction completes and further minimized by having an effective construction and operation specific management measures.

10. Biodiversity Management Plan (Corridor A15, A30 & A20)

To ensure that damage to biodiversity (or other environmental concerns) is avoided or properly mitigated in the field, proper environmental management and supervision of road works is required. Additional to Environmental management measures as suggested in EIA report, Biodiversity Management Plan are required to be incorporated in project management during pre-construction, construction and operation phases. This is especially important for projects close to natural habitats and other environmentally sensitive areas, riverine ecosystem etc. **Table 6 to Table 8** below presents the necessary Biodiversity Management Plan applicable to minimize the species wise risk for Mammals, Reptile, Amphibian Birds & fishes.

Table 6: Biodiversity Management Plan (A15 Dhodar Ali)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
Pre-construction Stage						
1.	Disturbance to Natural Vegetative community	• Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species. • The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		• Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts. • Identification of sites and peak visiting period for migratory birds in the project area of influence.	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU
3.		• Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals & Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations. • As per stakeholder consultations and confirmation with Forest Office, elephants used to cross the project road on and off at 1st Km, 4th Km and 6th Km. • Elephant Underpass has been proposed at 2 locations i.e., 3+630 & 6+450 and approved by the Chief Wildlife Warden, Assam, (Annexure 7).	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	• Debris management plan as suggested in EIA should be followed strictly at site	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	• Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
Construction Stage						
6.	Sensitivity among worker and project staff	• Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species. • Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
7.	Disturbance due to excess light in eco sensitive areas	• Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	• A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
9.	Dust Issues	• Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals. • Water sprinkling shall be practised at construction sites, earthen access and haul roads.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	• Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	• Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		completed.				
12.	Overall Safety Measure	• To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area. • Construction of road with proper slope for elephant crossing at the location of identified passage along with marking of wildlife crossing and speed limit.	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
Post Construction Phases						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	• Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	• Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities. • All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species	Overall	Throughout the project stretch	Contractor	PIU
15.	Accidental discharge in water	• To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance • Oil interceptor shall be installed at plant and vehicle workshop	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	• Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining	Overall species	At bridge construction locations	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		preventive measure of oil contamination/spillage.				
17.	Sensitivity among project people, locals etc.,	• Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	• Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals are present.	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
19.		• Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration. • Period maintenance of signages installed.	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		• To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
21.		• Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		• The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		• To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be	Overall Wild fauna	Throughout the project stretch	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		erected on both the end of roads falling close to protected area - **Nambor Doirung WLS**. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information. • No honk zone & speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area • Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road. • The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.				

Table 7: Biodiversity Management Plan (A30 Moran Naharkatia Duliajan)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
Pre-construction Stage						
1.	Disturbance to Natural Vegetative community	• Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species. • The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		• Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		corridor of impacts. • Identification of sites and peak visiting period for migratory birds in the project area of influence.				
3.		• Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals & Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations.	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	• Debris management plan as suggested in EIA should be followed strictly at site	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	• Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
Construction Stage						
6.	Sensitivity among worker and project staff	• Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species. • Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
7.	Disturbance due to excess light in eco sensitive areas	• Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	• A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
9.	Dust Issues	• Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals. • Water sprinkling shall be practised at construction sites, earthen access and haul roads.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	• Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	• Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is completed.	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
12.	Overall Safety Measure	• To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area.	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
Post Construction Phases						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	• Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	• Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities.	Overall	Throughout the project stretch	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		• All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species				
15.	Accidental discharge in water	• To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance • Oil interceptor shall be installed at plant and vehicle workshop	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	• Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining preventive measure of oil contamination/spillage.	Overall species	At bridge construction locations	Contractor	PIU
17.	Sensitivity among project people, locals etc.,	• Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	• Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals are present.	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
19.		• Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		• To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
21.		• Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		• The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		• To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be erected on both the end of roads falling close to protected area – **Dihing Patkai WLS**. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information. • No honk zone & speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area • Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road. • The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU

Table 8: Biodiversity Management Plan (A20 Sivasagar to Nakachari)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
Pre-construction Stage						
1.	Disturbance to Natural Vegetative community	• Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species. • The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		• Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts. • Identification of sites and peak visiting period for migratory birds in the project area of influence.	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU
3.		• Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals & Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations.	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	• Debris management plan as suggested in EIA should be followed strictly at site	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	• Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
Construction Stage						
6.	Sensitivity among worker and project staff	• Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species. • Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
7.	Disturbance due to excess light in eco sensitive areas	• Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	• A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
9.	Dust Issues	• Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals. • Water sprinkling shall be practised at construction sites, earthen access and haul roads.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	• Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	• Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is completed.	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
12.	Overall Safety Measure	• To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area.	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
Post Construction Phases						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	• Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	• Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities. • All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species	Overall	Throughout the project stretch	Contractor	PIU
15.	Accidental discharge in water	• To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance • Oil interceptor shall be installed at plant and vehicle workshop	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	• Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining preventive measure of oil contamination/spillage.	Overall species	At bridge construction locations	Contractor	PIU
17.	Sensitivity among project people, locals etc.,	• Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	• Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		are present.				
19.		• Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		• To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
21.		• Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		• The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		• To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be erected on both the end of roads falling close to protected area – **Hollongapar Gibbon WLS**. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information. • No honk zone & speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area • Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road. • The death of animals if happening has to be reported along with lccations. If repetitive deaths are happening at the	Overall Wild fauna	Throughout the project stretch	Contractor	PIU

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.				

A. Budget of Biodiversity Management Plan (Corridor – A15, A30, A20)

Table 9 below present the cost towards monitoring and management of biodiversity. The applicable corridors (A15, A30 & A20) have eco sensitive protected areas within its 10 km periphery. Although some management measure under biodiversity management which are linked with environmental management are already covered in EMP Cost. However, other measures like awareness; training and monitoring etc. of rare and threatened species as described in the Biodiversity Management Plan has been taken into the consideration. Following tables provides the total budget of BMP.

Table 9: Budget under Biodiversity Management (A15, A30 & A20)

Particular	Duration of Project	Frequency	Unit Rs. (LS)	Total (INR)
Awareness and training biodiversity conservation	Construction (3 years)	Monthly	20,000	7,20,000
	Operation & Maintenance (one year)	Six Monthly	--	50,000
Carryout systematic field survey (involves hiring of biodiversity expert, Site survey and monitoring and keeping record of Endangered species around 10km radius project corridors	Construction (3 years)	Monthly	3,00,000	1,08,00,000
	Operation & Maintenance (one year)	Six Monthly	---	6,00,000
Silt Protection measure,	Already covered in EIA Budget			
Oil interceptors				
Compensatory Afforestation				
Water quality Monitoring				
Noise Quality Monitoring				
Air Quality Monitoring				
Awareness regarding environmental health and safety				
Elephant Underpass at 2 locations i.e., 3+630 & 6+450 (A15).	Already covered in Civil BoQ (INR 16,70,47,544)			
Total Budget (INR)				1,21,70,000

11. Biodiversity Management Plan (Corridor A31)

The preferred option for conservation is to restrain from interfering with the natural flow regime and to avoid constructing barriers to animals and sediment movement. However, socio-political conditions make it impractical to completely halt water developmental activities especially in the Subansiri basin, so the immediate goal must be to manage such activities in ways that will minimize the harm to dolphins and other aquatic species.

Access to floodplains should be preserved to ensure natural spawning and rearing habitat for fishes which are prey base of the dolphin. Information on the pre-development ecological conditions of a river

is essential for evaluating mitigation efforts (like provision of fish ways etc.) and to implement future development decisions. Post-development empirical studies are needed to monitor the operational aspects of projects as well as the effects on

- Upstream and downstream populations of cetaceans and their habitat.
- Cumulative and synergistic impacts of multiple developments should be considered in assessments of environmental impact

National Awareness about the Ganges River dolphin and the importance of freshwater ecosystems should be done by

- Identifying the target groups to execute conservation actions
- Designation of Brand Ambassadors for awareness campaigns.
- Development of education and publicity material.
- Development of a dedicated web portal for the Ganges River dolphin.
- Since the Ganges River dolphin is an endangered species, every single animal is an important source for the gene pool. Rescue and rehabilitation of dolphins is a specialized operation and there is a need to establish Rescue and Rehabilitation Centres and specialized teams in the Subansiri basin at appropriate locations.
- Dolphin Watch Programme' should be initiated to popularize Dolphin Conservation & Management Activities.

A. Project Impacts on Aquatic Ecology

As the project corridor do not passes through any protected areas and Reserved Forest, the impact is very less on biodiversity. Only the aquatic ecosystem will be affected as the bridge will be constructed over the river Subansiri. The impacts due to pre-construction, construction, and operation of the proposed project that will affect various aquatic habitats and biodiversity of the project area and monitoring are also described in next sections. Ganges river dolphin population will not suffer from habitat fragmentation as the dolphins and other aquatic species can pass under the bridge and no habitat fragmentation will be occur.

I. **Potential direct and indirect impacts of the project during construction phase in the aquatic ecology are as follows:**

- The construction phase of the bridge will lead to the release of some amount of debris and this may impact aquatic life.
- During the construction of the proposed bridge, there is a high possibility of dolphins and their habitats impacts due to high underwater noise.
- Several endangered chelonian species can potentially suffer from habitat change by the construction activities.
- Noise from different equipment, vehicles, and human traffic has the potential to disturb migratory birds.
- Filling of low-lying areas for construction of embankments for the approach road.
- Impacts on the drainage pattern due to raised embankment, introduction of new culverts.
- Increased noise level due to the movement of vehicles and construction activities.
- Increased soil erosion.
- Spillage of oils and other hazardous materials.
- Pollution of surface and sub-surface water resources.
- No direct negative impact is anticipated on other species, but care should be taken to prevent indirect negative impact such as the deterioration of habitat. There will be some temporary

physical disturbance to the aquatic environment during construction, but no chemical pollution will be caused and therefore no irreversible damage will be caused for the aquatic species.

II. Potential direct and indirect impacts of the project during operation phase are the following:

- Increased noise pollution due to the vehicular movement.
- Impact on natural drainage pattern of the project area.
- Pollution of water bodies and impacts on its ecosystem due to hazardous chemical or oil spillage into the nearby surface water bodies.

III. ACTIVITY WISE NEGATIVE IMPACT ON AQUATIC ECOLOGY:

Table 10: Negative impacts on Aquatic ecology

Sl. No	Activities	Impacts on Physical Environment	Biological Environment		Natural Drainage
	Construction Phase	**Water**	**Flora**	**Fauna**	
1	Labour Camp Activities	-Ve/T			
2	Drilling & Blasting		-Ve/T	-Ve/T	
3	Pavement Works	-Ve/T	-Ve/T	-Ve/T	
4	Use of Construction Equipment	-Ve/T			
5	Pillaring of Bridge	-Ve/T		-Ve/T	
6	Culvert & Bridge Construction	-Ve/T		-Ve/T	-Ve/P
7	Earthwork				-Ve/T
8	Quarrying				-Ve/T
9	Debris generation				-Ve/P

IV. PRE-CONSTRUCTION STAGE

a) Anticipated impacts on aquatic ecology

Impact on aquatic ecology of the river and its inherent biota owing to the construction of bridge will be probably minimal once the bridge is fully operationalized. However major, negative impact on aquatic ecology of the river is perceived to occur during the construction phase of the bridge. The possible impact on aquatic life during the construction phase of the bridge is discussed below:

- Significant sediment deposition and accumulation around bridge locations may occur as soon as construction of the bridge begins owing to natural flow obstruction. Construction of pillars acts as barriers to the natural flow leading to siltation. It has been well documented that increased sediment deposition can adversely change habitat conditions of aquatic life. Siltation can lead to fish mortality, reduced growth rates due to stress and spawning failure i.e. non-hatching of eggs. In addition, sediment deposition and accumulation can modify the suitability of fish habitats. Identified mechanisms causing changes in sediment suitability include: Altered porosity in the streambed affecting the development of fish embryo and benthic invertebrate production; reduction in the area of inter-gravel habitat for and juvenile fish; and benthic organisms; and reduction in available over wintering habitat for fish by filling of pools and interstitial voids.
- Construction activities can alter potential habitat for aquatic life or may cause direct loss of habitat of aquatic organisms. It may lead to loss of breeding and nursery grounds of fishes, owing to changes in water quality, siltation etc.
- Dredging of river bed for construction purpose, disturbs the river bed and re-suspension of sediment in the water column is likely to occur as a result of dredging action at the sediment water interface, transfer of the sediment to a transporting vessel, slop or leakage from the vessel, and disposal of the sediment. Re-suspension of the sediments causes increased turbidity which may adversely affect aquatic life by clogging gills, decreasing visibility, and preventing oxygen diffusion. Increased water turbidity with less oxygen level is particularly harmful for fishes and more importantly for river dolphins.

- A long-term impact associated with the removal of sediments during dredging is the potential exposure of contaminated sediments. Mining and other sources of pollution can result in contamination of surface sediments. Over time, deposition of upstream sediments can bury the contaminated sediments, effectively sealing them off from the aquatic organisms. During the dredging activities, the upper layers of sediment are removed, potentially exposing previously contaminated sediments. Benthic organisms are exposed to the contaminants through uptake from pores, body walls, respiratory surfaces, and through ingestion.
- Construction of the bridge would generate noise from equipment such as motors, chain saws, frontend loaders, cranes, pile drivers and power generators. The effects of construction noise would be most noticeable in the area immediately surrounding the construction site. This would have a scaring effect upon fishes and may hamper their natural movement in search of food and movement to meet other biological requirements. If blasting with explosives and pile driving is required during construction, vibration as well as noise would be generated. In-water blasting and pile driving would generate pressure waves that would pose a consistent and adverse threat to fish and other aquatic resources.
- Water that comes into contact with cement, uncured concrete, concrete dust etc. used during construction quickly produces a strong alkaline solution that causes chemical burns to fish, insects and plants. If even a small volume of concrete wastewater is allowed to enter streams, lakes or wetlands it can cause immense damage to the environment.
- Dumping or accidental discharge of chemicals used during construction may cause immense harm to the aquatic ecosystem.
- There may be physical damage on aquatic organisms leading to mortality as a result of the construction activities.
- Aquatic mammals, particularly the river dolphin, a sizeable population of which is found in Subansiri may be negatively affected owing to the construction activities. Sound and vibrations in water as well as use of high pressure water jets can affect the echolocation properties of dolphins. Moreover, concrete structures may also hamper their echolocation through which they search for food. Poor water quality in the form of high turbidity which affects feeding in dolphins, high pH and low oxygenated waters can create an unfavourable environment for dolphins in the area. Moreover, physical injury and accidental trapping of dolphins in the construction area can cause immediate mortality.

b) Mitigation Measures

- Lowering the turbidity levels of water by all possible means, by taking special care during dredging and other construction related activities can help a lot in minimizing the impact of the bridge construction activity upon aquatic life. In cases relating to high turbidity levels in water coagulants can be used.
- Care should be taken to minimize the noise and vibration created during construction.
- In cases where it is seen that breeding and nursery grounds of fishes are destroyed, artificial pools can be created along the river, preferably upstream of the construction site which will act as site for breeding and nursery rearing of fishes.
- Care should be taken not to discharge the waste materials or any construction material like cement etc. directly in to water as it affects water quality.
- Biological monitoring can be carried out as pre-construction and at regular intervals during construction which track the health of biological systems. Measuring and evaluating the condition of biological systems, and the consequences of human activities for those systems, is central to biological monitoring. It aims to distinguish between naturally occurring variation and changes caused by human activities. Biological assessments are evaluations of the condition of water-bodies using surveys and other direct measurements of resident biological organisms (macro invertebrates, fish and plants).

- Construction work should be conducted during the periods that ensured that the fisheries resources were not impacted. A primary goal in every bridge construction project should be to develop construction methods that would minimize or alleviate disturbances to the underlying ecosystem as much as possible.
- Wash water or slurry mixed with cement should be directed onto an area of ground close to the work area, where the alkaline water is absorbed by the soil and neutralized by naturally occurring chemicals in the ground. Great care should be taken to ensure the water or slurry does not run overland to the waterway. A shallow pit dug into the ground may help avoid this and constant monitoring is necessary to prevent overflow.

V. CONSTRUCTION STAGE

a) Water Environment Impacts

- The construction phase of the bridge will lead to the release of some amount of debris which needs be managed judiciously in order to maintain ecology of the area and aquatic life.
- During the construction of the proposed bridge, there is a high possibility of dolphins and their habitats impacts due to high underwater noise, water quality change, habitat geomorphology changes, prey-base depletion etc.
- Several endangered chelonian species are found in area. These species can potentially suffer from habitat change by the construction activities, but the main cause of decline of the turtles is illegal hunting by humans for their meat. Therefore, in order to minimize the negative impacts on the turtle species, habitat change should be kept at minimum and hunting activities must be completely prohibited under the contractors activities.
- Noise from different equipment, vehicles, and human traffic has the potential to disturb migratory birds, which may cause them to leave or change their flight route until the activities are over.
- Spillage of oils and other hazardous materials.
- Pollution of surface and sub-surface water resources.

b) Mitigation Measures

- Regular monitoring of the impacts of construction activities on the Gangetic dolphins and other important species should be done by dedicated wildlife experts and forest officials, so that immediate prevention activities can be undertaken.
- Channels will be kept free at all times for free movement of dolphins.
- To minimize impacts, noisy operations should be avoided during winter (Nov-Feb; when dolphin congregates into the deeper channel and pre-monsoon season (Mar-Jun; dolphin breeding time), thus from November to June, which are also the breeding season for the turtles.
- Migratory birds also stay around the area during the winter months, so avoiding noisy operations during these months also reduce the impacts on them.
- Construction activities should be carried out in close supervision of the dolphin expert.
- Measures such as the creation and monitoring of an exclusion zone of a 500m radius for at least 30 minutes before the start of construction activities shall be followed. If dolphins are observed in the exclusion zone, construction works should be delayed until they have left the area. If dolphins enter the exclusion zone after construction has commenced, construction works should cease until they have left. The contractors are recommended to adopt these mitigation measures during construction works inside the river. Acoustic deterrents can be tested to keep the dolphin away during from construction zone under the supervision of dolphin ecologist.
- Relevant information (e.g. encounter with vulnerable species during engineering work) shall be shared with the State Environment and Forest Department and concerned regional

environmental experts with which the project authority will discuss potential measures to promote conservation and monitoring of the ecosystem.

- Before construction of piers the construction site must be checked for the presence of threatened turtles, migratory birds, and other threatened species and their nests. If the turtles and/or their nest are found inside or near the construction area the animals and/or the eggs must be physically moved to safer habitat areas under the guidance of the local wildlife experts.
- All boats or ferries transporting construction material and workers will have propeller guards installed to prevent injury and death of dolphins, turtles and other aquatic fauna.
- One of the threats to bird and turtle habitat is conversion of the river edges from natural soft embankments into hard concrete embankments. Therefore, the natural bank slope is preserved and location of the bridge piers will avoid such areas. No construction camp, borrow areas or disposal sites will be established within 100m of the shorelines at the highest water level period.
- All avoidance, mitigation and enhancement measures and monitoring plans proposed to address impacts on flora, fauna and the threatened species should be updated during the detailed design stage by conducting detailed studies such as identification of the migrating routes of dolphins and birds, exact locations of turtle nesting grounds, etc.

c) Surface Water Impacts

Since, the proposed bridge shall be constructed over the Subansiri river, there shall be a direct and significant impact on the water quality of this river. Further, the proposed approach road is traversing through the other surface water bodies and water logging area such as ponds at several locations. Hence, significant impacts are anticipated on the water quality of these water bodies during construction phase. Silt load in the Subansiri River will pollute its water quality thereby affecting the river ecosystem.

Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers' camps and from spillage in vehicle parking and/or fuel and lubricant storage areas.

d) Mitigation Measures

Major construction works close to the Subansiri River and other water bodies shall be avoided during monsoon period. Disposal of waste arising from the project activities as per norms of PCB, Assam and collecting and storing of bituminous wastes and taking it to approved disposal sites shall minimize the impacts.

The probability of accidents is minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are taken care of the design stage. To minimize the oil contamination and sediment load to water bodies, provision of sedimentation tank and oil interceptor chamber can be provided.

Apart from the provision of mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in water due to construction activity shall be monitored. The frequency, duration and responsibility shall be as per the Environmental Monitoring Plan.

The issue of blocking of cross drainage should be taken care throughout the project stretch. Further, the engineering designing of left arm and right arm of south bank is totally designed to avoid any major impact on river ecology.

e) Ground Water

During the construction stage the project is not expected to alter the existing water quality on a permanent basis. There are various water bodies, along the road including rivers, and open wells. Some impacts are anticipated on the water quality of these aquifer during the construction phase.

The pillaring depth may cause the contamination in aquifer quality and the activity of approach road may impact the open well. In case of any water supply system at the downstream of the bridge location, prior information should be provided to the concerned department on the bridge construction across the river and the construction activities should avoid discharge of any hazardous chemicalsin to the river water. Laying of pavement within the formation width may lead to reductionin the ground water recharge capacity.

f) Mitigation Measures

- The proposed approach road and their slope to meet the approach road is not close to bank of river. The piling of bridge structure would be in capped manner to avoid any contamination in the river Subansiri.
- As the area involved in the road construction is very less, the chances of reduction in the ground water recharge capacity due to laying of pavement within the formation width influence shall be non-significant.
- The depth of pillaring and any activities below ground level should be restricted to upper surface only which shall not impact the aquifer quality, extend possible.
- The closure piling shall be carried out to minimize contamination of construction material to the Subansiri river.
- Ground water quality shall be monitored as per environmental monitoring programme during construction phase as well as operation phase.
- Corrective action shall be taken if the ground water quality is found deteriorating.
- The Contractor may be directed to provide immediate control measures to prevent soil erosion and sedimentation that shall adversely affect construction operations, damage adjacent properties or cause contamination of nearby streams or other watercourses.

g) Silt Fencing

Silt fencing shall be provided to prevent sediments from the construction site entering into the nearby watercourses. The silt fencing consists of geo textile with extremely small size supported by a wire mesh mounted on a panel made up of angle / wooden frame and post.

It is expected a single person shall be able to drive the angles by pressing from the top. The frame shall be installed at the edge of the water body along which construction is in progress. The numbers of such units to be installed can be decided depending upon the length of the water body along the side of the road construction. The silt fencing is given in Figure 2.

Silt fencing is proposed for a length of 250m which is sufficient to cover all minor and major bridge locations and the road side water bodies. Depending on the length of the individual water body, the number of units of silt fencing to be established is decided by the Independent Engineer.

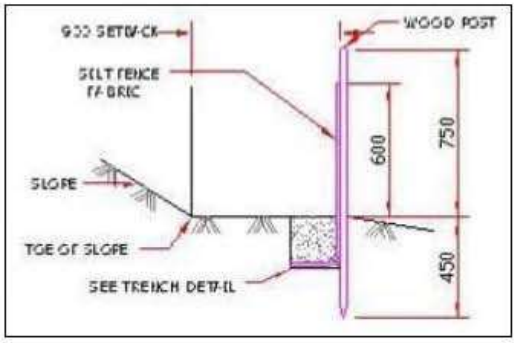


Figure 2: Silt Fencing

h) Oil Interceptor

Oil and grease from road run-off is another major concern during construction as well as operation. During construction, discharge of oil and grease is most likely from workshops, oil and waste oil storage locations, vehicle parking areas and the construction camps. A total of 3 oil interceptors shall be provided at all such locations to arrest oil and grease, as per Figure 3. The arrested products shall be disposed as per MoEF&CC and PCB, Assam guidelines.

The location of all fuel storage and vehicle cleaning area shall be at least 300m from the nearest drain / water body.

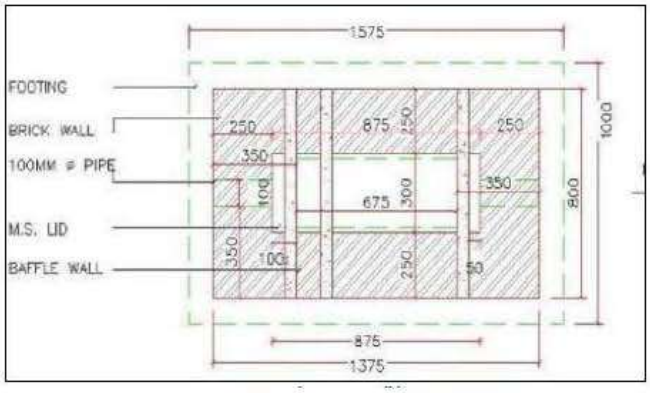


Figure 3: Oil Interceptor

VI. OPERATION STAGE

a) Ground Water Quality- Impact

Ground Water may get contaminated due to the following reasons:

- Accidental spillage
- Refueling of vehicle (bus, truck, etc.)
- Leakage of oil during transportation
- Washing of vehicles
- Routine and periodical maintenance of the approach road

b) Mitigation Measures

- Drain along with oil interceptor shall be provided on both side of bridge and its approaches.
- Automobile service centers shall be discouraged from establishing along the corridors without installing preventive measures against petroleum and oil contamination.
- It is suggested that regular monitoring by the forest department and relevant environment and wildlife experts should be done.
- Awareness programmes as training, workshops, seminars, brainstorming, etc., need to be organized to promote responsible consumerism, sustainable economic practices and the protection of endangered species for all the stakeholders.
- Research on Ganges River Dolphins needs be conducted to study in details the abundance, distribution, ecology and threats of the Ganges River Dolphin in and around the project sites. Community engagement and awareness activities regarding the conservation of Gangetic dolphin also need to be done.

B. Aquatic Conservation and Management Plan

The Aquatic Conservation and Management Plan for the proposed project have beenframed with an objective to:

- Conserve and preserve natural aquatic ecosystems around the proposed project;
- Minimize project impacts on rare, endangered or threatened species and rehabilitate keystone species, if any; and
- Develop the information database on aquatic biodiversity at the project site.

I. Establishment of an Aquatic Environment Monitoring Committee

An Aquatic Environment Monitoring Committee shall be constituted for effective implementation, monitoring and aquatic environment of the project. The committee shallHeaded by Chief Engineer, Project, PWRD, and representatives from the PWRD, members ofthe Department of Forests / Environment, Assam Biodiversity Board, Fisheries Department and Independent subject specialists.

The committee will look after the demarcated areas (10 KM radius from ROW), monitor and enforce regulatory provisions and ensure that the structure and functions of the natural ecosystems in the area are not changed or subjected to any threat. It would also propose other approaches for the biodiversity conservation plan, whenever deemed necessary.

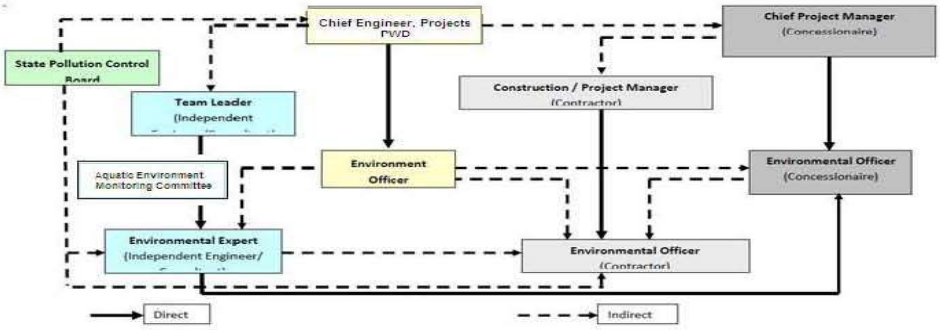


Figure 4: Proposed Organization Chart

II. Aquatic Wildlife Conservation

- Stakeholders confirmed sightings of dolphin in and around the project area. Under IUCN conservation status, River Dolphin, Endangered; are on Schedule I of the Indian Wildlife Protection Act (1972) which is the highest protection accorded to species in India.
- Promote Surveys and Monitoring in and around the Project Area (extending upto 10 Km radius of ROW). This activity is aimed at adding to the existing knowledge base on aquatic wildlife presence and movements in the vicinity of the project area. This is especially recommended so that the data collected can add to the baseline information collected during the EIA preparatory phase (adding to the seasonal data). The surveys will improve the understanding of aquatic wildlife presence, distribution, movements and seasonality in the wider vicinity of the project area. This will ensure strict monitoring of any encroachments, and also add to the biodiversity database especially for endangered species. This aquatic wildlife survey will be conducted with the assistance of the Wildlife Division, Department of Environment and Forests.
- Conservation actions as proposed by IUCN (during construction and during the initial project operation) such as conducting a comprehensive survey and monitoring in and around the project area to establish range, distribution and population status of vulnerable and critical habitats in the project area for assessingits habitat requirements and identifying threats will be undertaken.

III. Anti-Poaching Measures

- Hunting and poaching is a possibility due to the presence of construction workers. The possibility of hunting and trapping by workers during construction period will be monitored by the contractor. The overall magnitude of impact is considered to be low, extent is site specific and duration is short period.
- **Awareness Raising Programs**: Awareness will be raised among workers and contractors regarding illegal poaching and copies of the Indian Wildlife Act, Biodiversity Act, Prevention of Cruelty to Animals Act (1986), other relevant Rules and Regulations as well as Biodiversity Mitigation and Monitoring in EMP will be made available in the local language. Copies will be made available at the project site and forest ranger stations of the vicinity. Workers must be made aware of the fines and penalties for poaching, as well as the risk of job loss, if caught in these illegal activities. This will be done during the pre-construction phase, but after the Contractor has been selected and continue intermittently through the construction phase.
- **Strengthen Patrolling**: To minimize the risks of poaching, awareness raising programs will be combined with an increase in patrolling by local forest rangers (in coordination with forest department) and construction of check posts and watch towers at key locations. The choices of location of check posts and watch towers will be guided by consultations with forest rangers in the area.
- **Community Watch Program**: The project will also discuss possibilities for funding a community watch program, through hire of village guards to alert Forest Ranger officials of any illegal activities in the worker camps or at project sites.

Table 11: Biodiversity Management Plan (Corridor - A31) Pre-Construction & Construction

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
Pre - Construction					
Bottom sediment	Mobilization of bottom sediments will require	Subansiri River	During boring survey	Contractor	Project Implementation Unit (PIU)
Vegetation clearing and tree cutting	Identification and marking of endangered plant species (*Magnolia pealiana*) for transplantation	Throughout Project Corridor	Prior to tree cutting during joint survey with forest department	Contractor	Project Implementation Unit (PIU)
Construction					
Soil erosion in Embankments (Impact on topography/	Pitching shall be done for slope stabilization as per the IRC guidelines	At the embankments		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Water pollution	• Construction vehicles / equipment shall be operated and maintained in such a manner to avoid contamination of water bodies due to oil spillage. • Fuel storage shall only be done on wasteland and will be kept away from drainage channels and natural water bodies. • Oil and grease traps will be provided at fueling locations • No excavation from the bund of the water bodies. • No debris disposal near any water body. • Prior written permission from authorities for use of water for construction activity shall be submitted to IE. • Construction labours to be restricted from polluting the source or misusing the source. • Shifting of source to be completed prior to disruption of the actual source. • Alternate measures to be taken / ensured during disrupted period.	Near labor camp and sites of the installation of Construction		Contractor and Authority Engineer	Project Implementation Unit (PIU)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
	• Source to be replaced immediately, in case of accidental loss. • Construction work shall be restricted to 3m – 4m width from the existing formation near ponds. • The volume of water storage lost shall be compensated for by excavation of an equal volume of similar depth at closest possible location in the direction of flow and shall be done with the approval of the independent engineer.				
Alteration of drainage	• Diversions shall be constructed during dry season, with adequate drainage facility, and shall be completely removed before the onset of monsoon. • Debris generated due to the excavation of foundation or due to the dismantling of existing structure shall be removed from the water course. • Temporary silt fencing to be provided on the mouth of discharge into natural streams. • Continuous drain (lined /unlined) is suggested / shall be provided. Obstruction, if any, shall be removed immediately.	Throughout Project Corridor, all access roads, temporarily acquired sites.	Whenever encountered during construction	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Silting / sedimentation	• Measures suggested under "soil erosion and sedimentation control" shall be enforced. • Silt fencing is provided around water bodies. • Construction activities shall be stopped near water bodies during monsoon. • Soil trap are suggested / shall be provided in all ancillary sites and camps.		Throughout construction period	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Water pollution from labor camp.	• Labor camp shall not be allowed near any of the water bodies. • The proper sanitation facilities shall be provided.	Preapproved locations away from the water bodies		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Deposition of dust in open wells near	• The mouth/opening of the well shall be covered with suitable material during any of the construction	All the wells along the project corridor.		Contractor and Authority Engineer	Project Implementation Unit (PIU)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
construction site	activity so as to prevent dust from entering in the well.				
Fauna	• Construction workers must protect natural resources and wild animals. • Aquatic fauna shall not be affected. • Hunting shall be prohibited. Nesting grounds & migratory paths shall be protected. • All avoidance, mitigation and enhancement measures and monitoring plans proposed to address impacts on flora, fauna and the threatened species should be updated during the detailed design stage by conducting detailed studies such as identification of the migrating routes of dolphins and birds, exact locations of turtle nesting grounds, etc.		During construction	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Impact on Surface water quality due to eroded soils	• Construction work close to the watercourses or other water bodies will be avoided, especially during the monsoon period. • Increase coverage of open surface area by planting grass and creepers so that the washing away of materials from sloped surfaces would be reduced by a significant extent. • Silt curtain should be used for all underwater works. • Water quality monitoring	All the respective locations		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Bottom sediment	• Slit curtain shall be installed to prevent move of the sediment. • Construction works shall be suspended when flood warning is issued.			Contractor and Authority Engineer	Project Implementation Unit (PIU)
Endangered species	• Relevant information (e.g. encounter with vulnerable species during engineering work) shall be shared with the State Environment and Forest Department and concerned regional environmental experts. • Anti-poaching measures during the construction	Throughout the project area		Contractor and Authority Engineer	Project Implementation Unit (PIU)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
	phase should be strengthened to check for any violation of existing regulations. Awareness campaign to be made among the workers to aware them on the endangered and other important species. • Construction vehicles must be operated at safe speed to avoid collision with wildlife. Training should be provided for the vehicle operator send warning signs should be installed. • Change of geology and topography should be kept minimum. Avoid constructing labor camps and construction yards near the river banks. • To minimize impacts, noisy operations should be avoided during breeding season of the dolphins. • River flow should not be blocked at all times for free movement of dolphins. • Measures such as the creation and monitoring of an exclusion zone of a 500m radius for at least 30 minutes before the start of construction activities shall be followed. If dolphins are observed in the exclusion zone, construction works should be delayed until they have left the area. If dolphins enter the exclusion zone after construction has commenced, construction works should cease until they have left. • All activities that increase soil erosion or contribute to nutrients and pollutants to water need be minimized both on-site and off-site by using measures such as silt curtain. • Construction activities should be carried out in close supervision of the dolphin ecologist. • Construction works should be avoided or kept minimum in vicinity of the dolphins' favorable microhabitats (downstream of shallow areas/sandbars, tributary junctions)				

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
	• Dolphins are likely to prefer water depth range between 4.1 to 6 m. Therefore, movement of sediment and influx of soil/silt etc. should be avoided to keep the favorable depth range. • In case rare birds of prey are observed near the construction area, the construction work will be avoided during their breeding season. • Before construction of piers the construction site must be checked for the presence of threatened turtles, migratory birds, and other threatened species and their nests. If the turtles and/or their nest are found inside or near the construction area the animals and/or the eggs must be physically moved to safer habitat areas under the guidance of the local wildlife experts. • All boats or ferries transporting construction material and workers will have propeller guards installed to prevent injury and death of dolphins, turtles and other aquatic fauna. • One of the threats to bird and turtle habitat is conversion of the river edges from natural soft embankments into hard concrete embankments. Therefore, the natural bank slope is preserved and location of the bridge piers will avoid such areas. No construction camp, borrow areas or disposal sites will be established within 100m of the shorelines at the highest water level period.				
Underwater noise impacts on aquatic species.	• Use vibratory hammer. Under conditions where impact hammers are required for reasons of seismic stability or substrate type, it is recommended that the pile be driven as deep as possible with a vibratory hammer prior to the use of the impact hammer. • Monitor sound levels during pile driving to ensure			Contractor and Authority Engineer	Project Implementation Unit (PIU)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
	that they do not exceed the NOAA (National Oceanic and Atmospheric Administration, USA) or any other international recognized criteria. • Implement measures to attenuate the sound when sound pressure levels exceed the NOAA or any other international recognized criteria. Methods to reduce the sound pressure levels include but are not limited to: ○ Installation of underwater enclosures to minimize sound ○ Surrounding the pile with an air bubble curtain system or air-filled coffer dam. ○ Using a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore producing less sound. • Construction works should be ceased when the dolphins are observed near the work area.				
Water use	• To minimize the river pollution during construction, mitigation measures will be applied such as installing a silt fence in places close to the residential area.	At respective planned construction		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Monitoring dolphin	• Monthly monitoring • Preparation of River Dolphin rescue team • Study bio-accumulation of toxins, and their effects, in the River dolphins.				
Awareness on dolphin conservation	• Awareness	Fringe area	monthly		
	• Up gradation of dolphin monitoring stations/ observatory towers				
Workshop on dolphin conservation			one		

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
Monitoring fish, migratory birds and turtle	• Monthly monitoring. • Carry out systematic field survey and monitor the fish diversity of the area. Monitoring of fishing activity. • Awareness for conservation.				
Improvement of tank fisheries	• To improve the productivity of fishes by the local fishing community.		12 nos		
Operation Phase					
Water Quality	• Water quality monitoring		As in the EMP	Project Implementation Unit (PIU)	
Monitoring dolphin and awareness generation on dolphin conservation			Once in 6 months		
Monitoring fish, migratory birds and turtle and awareness.			Once in 6 months		

IV. Conservation of river Dolphin

- Monitoring River dolphin populations during construction and operation phase (3 years) within 10 km radius of the project.
- Prepare safe handling of River Dolphin team for rescue efforts if required.
- Study and monitor the impact of the construction activities upon dolphin population, their behaviour and habitat.
- Assessment of the habitat of the River dolphin.
- Study the movement and dispersal pattern of the River dolphin to assess the home range and habitat utilising modern technologies.
- Study bio-accumulation of toxins, and their effects, in the River dolphins.
- Ensuring Critical Levels of Water Flow in Riverine Habitats of Dolphins.
- Increase Awareness about the River dolphin and the importance of freshwater ecosystems.
- Identification of target groups to execute conservation actions.
- Development of education and publicity material.
- A workshop to be conducted for conservation of River Dolphins in the Subansiri River.
- Community Involvement in river dolphin monitoring and Conservation.

Conservation Budget: A total of **Rs. 3 crore** rupees is earmarked for conservation of dolphins. Details of the budget are as follows.

Table 12: Detail budget for Dolphin Conservation

Sl. No	Particular	Duration of Project	Frequency	Unit INR (LS)	Total (INR)
1	Monitoring dolphin (including hiring boat)	Construction (36 months)	Monthly	3,00,000	1,08,00,000
		Operation phase (36 months)	Once in 6 Months	2,50,000	15,00,000
2	River dolphin rescue team	Hiring of Boat (36 months)	Rs. 60000/ Month	21,60,000	81,00,000
		Procurement of equipment	Once	59,40,000	
		Construction (36 months)	Monthly	1,00,000	36,00,000
		Operation phase (36 months)	Once in 6 Months	1,80,000	10,80,000
3	Awareness on dolphin conservation	Construction (36 months)	Monthly	10,000	3,60,000
		Operation phase (36 months)	Once in 6 Months	10,000	60,000
4	Workshop on Dolphin Conservation				25,00,000
5	Publicity materials				3,00,000
6	Community involvement in river Dolphin Monitoring and Conservation				5,00,000
7	Study bio-accumulation of toxins and their effects in the River dolphins.				10,00,000
9	Miscellaneous				2,00,000
Total					**3,00,00,000**

C. Aquatic Ecology Monitoring Plan

Table 13: Environmental Monitoring Plan

Mitigation Measure	Phase	Parameters	Locations	Duration and frequency	Implementation	Monitoring
Water Quality	Construction	Parameters as Mentioned in IS 10500	6	Three times during the Construction Phase per year (Pre-monsoon, Monsoon and Post Monsoon)	Contractor through an NABL approved Monitoring agency	Environment Cell PWRD
	Operation		4	End of summer before the onset on monsoon, Monsoon and After Monsoon every year for 5 years	PIU	
Noise and Vibration	Construction	Noise Level in dB (A)		Noise monitoring near the pile construction (2 in each pile)	Contractor through an NABL approved Monitoring agency	Environment Cell PWRD
Fish monitoring, migratory birds and turtle monitoring	Construction			Monthly	Independent expert	Environment Cell PWRD
	Operation			Once in every 6 months	Independent expert	Environment Cell PWRD
Dolphin Monitoring	Construction			Monthly	Independent expert	Environment Cell PWRD
	Operation			Once in every 6 month	Independent expert	Environment Cell PWRD

D. Budget of Biodiversity Management Plan (Corridor A31)

Table 14 below present the cost towards monitoring and management of biodiversity of Corridors A15. Although some management measure under biodiversity management which are linked with environmental management are already covered in EMP Cost. However, other measures like awareness; training and monitoring etc. of rare and threatened species as described in the Biodiversity Management Plan has been taken into the consideration. A total of **Rs. 3 crore** rupees is earmarked for Biodiversity Management Plan, following tables provides the total budget of BMP.

Table 14: Budget of Biodiversity Management Plan (Corridor A31)

Item No.	Component	Qty.	Unit cost INR	Total Cost INR
1	Dolphin Conservation			3,00,00,000
2	Provision of Oil Interceptors	Already covered in EIA Budget		0
3	Silt fencing			
4	Water Quality monitoring and noise assessment			
Total				**3,00,00,000**

Annexure 1: Corridor 31 - Majuli Biodiversity Heritage Gazette Notification by Government of Assam

পঞ্জীভুক্ত নম্বৰ - ৭৬৮ /৯৭

Registered No.-768/97

অসম ৰাজপত্ৰ

সত্যমেব জয়তে

THE ASSAM GAZETTE

অসাধাৰণ

EXTRAORDINARY

প্ৰাপ্ত কৰ্ত্তৃত্বৰ দ্বাৰা প্ৰকাশিত

PUBLISHED BY THE AUTHORITY

নং 224 দিশপুৰ, শুক্ৰবাৰ, 26 মে', 2017, 5 জেঠ,, 1939 (শক)

No. 224 Dispur, Friday, 26th May, 2017, 5th Jaistha, 1939 (S.E.)

GOVERNMENT OF ASSAM

ORDERS BY THE GOVERNOR

ENVIRONMENT & FOREST DEPARTMENT

DISPUR :: GUWAHATI-6

NOTIFICATION

The 29th March, 2017

No. FRW 57/2005/Vol.-II/14.– In exercise of the power conferred by sub section (1) of Section-37 of the Biological Diversity Act, 2002 (No. 18 of 2003) and Rule 24(1) of the Assam Biodiversity Rules 2010, the Government of Assam hereby notifies Majuli as 'Majuli Biodiversity Heritage Site' as detailed in the schedule given below :

1. **Short Title:** This notification may be called "Declaration of Majuli as Biodiversity Heritage Site'(BHS). It shall come into force on the date of publication in the Assam Gazette.
2. **Extent of application:** This notification shall apply within the administrative boundary of Majuli District.
3. **The total area covered:** 875 Sq. Km.
4. **GPS coordinates:** The co-ordinates of Majuli qualifying the extreme points in the North, South, East, West boundaries and centre are as follows:

Sl. No.	Latitude	Longitude	Direction
1	26° 58' 30.268" N	94° 2' 23.180" E	NW
2	27° 3' 1.588" N	94° 10' 16.040" E	N
3	27° 5' 59.835" N	94° 16' 45.799" E	N
4	26° 53' 46.073" N	93° 57' 25.340" E	W
5	26° 57' 59.475" N	94° 10' 26.105" E	C
6	27° 1' 21.972" N	94° 17' 47.452" E	C
7	27° 10' 59.178" N	94° 33' 48.374" E	NE
8	26° 50' 57.455" N	94° 0' 11.644" E	SW
9	26° 50' 45.120" N	94° 6' 13.571" E	S
10	26° 53' 3.278" N	94° 17' 45.343" E	S
11	26° 57' 49.773" N	94° 24' 12.447" E	S
12	27° 8' 50.634" N	94° 35' 41.669" E	SE

5. **Boundaries: Majuli Biodiversity Heritage Sites**

North : Lakhimpur District

South : Jorhat District

East : Sivasagar & Dibrugarh Districts

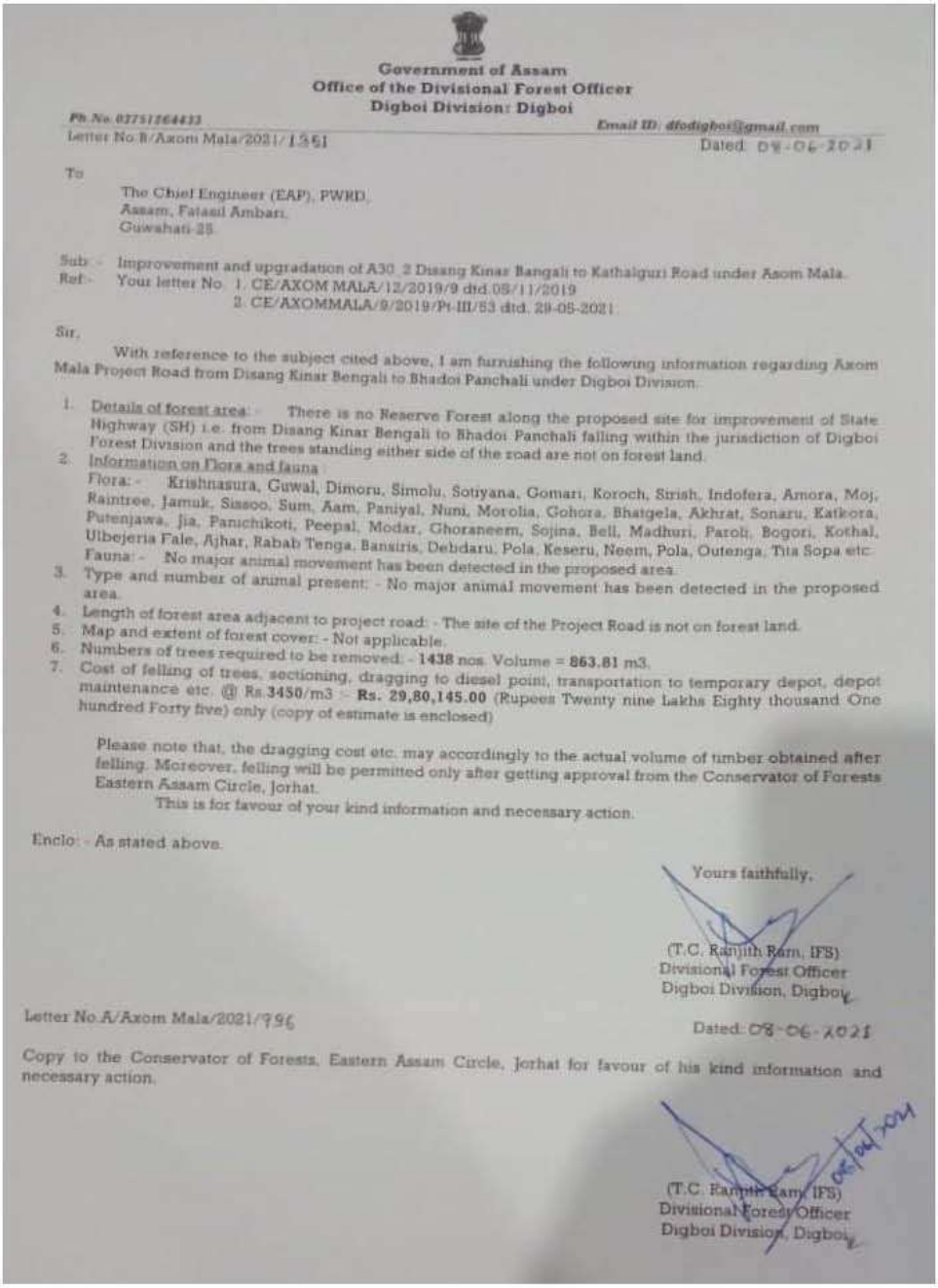
West : Sonitpur District.

6. This comes into effect from the date of publication in the official Gazette.

P. K. BORTHAKUR,
Principal Secretary to the Government of Assam,
Environment and Forest Department.

Guwahati :- Printed and Published by the Dy. Director (P & S), Directorate of Ptg. & Sty. Assam, Guwahati-21.
Ex. Gazette No. 447 - 50 + 10 - 26 - 5 - 2017.

Annexure 2: Corridor 30 – Letter from DFO, Digboi Division, Digboi



Government of Assam
Office of the Divisional Forest Officer
Digboi Division: Digboi

Ph No. 03751264433 Email ID: dfodigboi@gmail.com

Letter No.B/Axom Mala/2021/1561 Dated: 08-06-2021

To

The Chief Engineer (EAP), PWRD,
Assam, Fatasil Ambari,
Guwahati-25.

Sub :- Improvement and upgradation of A30 2 Disang Kinar Bangali to Kathalguri Road under Asom Mala.
Ref :- Your letter No. 1. CE/AXOM MALA/12/2019/9 dtd.05/11/2019
2. CE/AXOMMALA/9/2019/Pt-III/53 dtd. 29-05-2021.

Sir,

With reference to the subject cited above, I am furnishing the following information regarding Axom Mala Project Road from Disang Kinar Bengali to Bhadoi Panchali under Digboi Division.

1. Details of forest area: - There is no Reserve Forest along the proposed site for improvement of State Highway (SH) i.e. from Disang Kinar Bengali to Bhadoi Panchali falling within the jurisdiction of Digboi Forest Division and the trees standing either side of the road are not on forest land.
2. Information on Flora and fauna :
Flora: - Krishnasura, Guwal, Dimoru, Simolu, Sotiyana, Gomari, Koroch, Sirish, Indofera, Amora, Moj, Raintree, Jamuk, Sissoo, Sum, Aam, Paniyal, Nuni, Morolia, Gohora, Bhatgela, Akhrat, Sonaru, Katkora, Putenjawa, Jia, Panchikoti, Peepal, Modar, Ghoraneem, Sojina, Bell, Madhuri, Paroli, Bogori, Kothal, Ulbejeria Fale, Ajhar, Rabab Tenga, Bansiris, Debdaru, Pola, Keseru, Neem, Pola, Outenga, Tita Sopa etc.
Fauna: - No major animal movement has been detected in the proposed area.
3. Type and number of animal present: - No major animal movement has been detected in the proposed area.
4. Length of forest area adjacent to project road: - The site of the Project Road is not on forest land.
5. Map and extent of forest cover: - Not applicable.
6. Numbers of trees required to be removed: - **1438** nos. Volume = **863.81** m3.
7. Cost of felling of trees, sectioning, dragging to diesel point, transportation to temporary depot, depot maintenance etc. @ Rs.**3450**/m3 = **Rs. 29,80,145.00** (Rupees Twenty nine Lakhs Eighty thousand One hundred Forty five) only (copy of estimate is enclosed)

Please note that, the dragging cost etc. may accordingly to the actual volume of timber obtained after felling. Moreover, felling will be permitted only after getting approval from the Conservator of Forests Eastern Assam Circle, Jorhat.

This is for favour of your kind information and necessary action.

Enclo: - As stated above.

Yours faithfully,

(T.C. Ranjith Ram, IFS)
Divisional Forest Officer
Digboi Division, Digboi

Letter No.A/Axom Mala/2021/796 Dated: 08-06-2021

Copy to the Conservator of Forests, Eastern Assam Circle, Jorhat for favour of his kind information and necessary action.

(T.C. Ranjith Ram, IFS)
Divisional Forest Officer
Digboi Division, Digboi

Annexure 3: Corridor 20 – Eco Sensitive Zone Notification of Hollongapar Gibbon WLS

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 23rd September, 2019

S.O. 3462(E).—WHEREAS, a draft notification was published in the Gazette of India, Extraordinary, *vide* notification of the Government of India in the Ministry of Environment, Forest and Climate Change number S.O.1828 (E), dated 7th May, 2018, inviting objections and suggestions from all persons likely to be affected thereby within the period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

AND WHEREAS, copies of the Gazette containing the said draft notification were made available to the public on the 7th May, 2018;

AND WHEREAS, no objections and suggestions were received from persons and stakeholders in response to the aforesaid draft notification;

AND WHEREAS, the Hollongapar-Gibbon Sanctuary was notified by the Government of Assam *vide* notification No. FRS/37/97/13, dated 30.07.1997, by upgrading the conservation status of the Hollongapar Reserve Forest declared earlier *vide* notification No. 8, dated 27.08.1881;

AND WHEREAS, the Sanctuary is an important protected area situated in Jorhat District in the state Assam covering an area of 20.98621 square kilometers; the perennial river Bhogdoi along with its catchment passes through the Sanctuary and makes the ecological environment of the Sanctuary unique, several seasonal small streams comprising of Hollongapar Mouza (Taluka) and Nakachari Mouza (Taluka) of Jorhat District are the main sources of water for the animals in the Sanctuary;

AND WHEREAS, the floral biodiversity of the Sanctuary includes 74 tree species, 17 species of shrubs and 12 species of climbers; the important tree species recorded from the Sanctuary are hollong (*Dipterocarpus retusa*), sam (*Artocarpus chaplasha*), amari (*Amoora wallichii*), sopas (*Michelia spp.*), bhelu (*Tetramelos nudiflora*), udal (*Sterculia villosa*), hingori (*Castanopsis spp.*), nahor (*Mesua ferrea*), Bandordima (*Dysoxylum procerum*), Dhuna (*Canarium resiniferum*), Bhomora (*Terminalia belerica*), ful Gomari (*Gmelina Spp.*), bon bogori (*Pterospermum lanceofolum*), morhal (*Vatica lanceofolia*), sassi (*Aquilaria agolacha*), otenga (*Dillenia indica*), ajar (*Lagerstroemia flos-reginae*), bon-am (*Mangifera silvatica*), amora (*Spondias Mangifera*), uriam (*Bischofia javanica*), Selleng (*Sapium baccatum*), mahi thekera (*Garcinia morella*), katholua (*Palequium obovatium*), kumbhi (*Careya arborea*), gahori Sopa (*Magnolia Pealiana*), gomari (*Gmelina arborea*), gohora (*Premna bengalensis*), Gondhsoroi (*Cinnamonium grandiliferum*), Salmugra (*Hydrocarpus kurzil*), poreng (*Elaeocarpus robustus*), sotiona (*Alstonia scholaris*), chom (*Machilus odoratissime*), chewa (*Caryota areus*), jutuli (*Alyingia exulsa*), Jori (*Fiscus benjamine*), titasopa (*Michelia champaka*), pan chopa (*Magnolia sphenocarpa*), bohot (*Artocarpus lakoocha*), fakdema (*Triwea orentalis*), phul sopa (*Magnolia hookari*), borhomthuri (*Talauma Hodgsoni*), Bogi jamuk (*Eugenia kurzii*), Bor jamuk (*Eugenia jambulana*), bagh nola (*Litssea Sebifera*), bhatghilla (*Oroxylum Indicam*), bomora (*Terminalia belerica*), mejangkori (*Litsea citrata*), khokon (*Dubhanga sonneratoides*), rudrakha (*Elaeocarpus ganitrus*), raghu (*Anthocephallus cadamba*), simul (*Bombax ceiba*), leteku (*Baceaurea sapeda*), hilikha (*Terminalic chebula*), houra (*Trophis aspera*), haldu Sopa (*Adine cardifolia*), holokh (*Terminalia myriocarpa*), heloch (*Antidesma ghesaembilla*), bhelkor (*Trewia nudiflora*), Boal (*Cordia oblique*), bonsum (*Phoebe goalparensis*), borpat (*Ailanthas grandis*), dimaru (*Ficus Spp.*), ghora neem (*Melia indica*), hualu (*Litsaea polyantha*), Jalpai (*Elaeocarpus varunna*), kanchan (*Bauhinia purpurea*), keseru (*Heteropanax fragrams*), koroi (*Albezzia procera*), moj (*Albezzia lucida*), morolia (*Mallotus albus*), nagabhe (*Schima wallichii*), paroli (*Sterospermum chelonoides*), poma (*Cedrela toona*) and tepor tenga (*Garcinia spp.*);

AND WHEREAS, the shrubs and climbers species include Harpagondha (*Rawolfia serpentina*), Guphul (*Lantena camera*), Jarmoni (*Eupotorium odoratum*), Jetuli poka (*Rubus malucanus*), Tora (*Alpinea allughus*), Dhopattita (*Phlogarthus crriviflorus*), Nal (*Arundodonax*), Khogori (*Phragmites karka*), Nilaji bon (*Mimosa pudica*), Patidoi (*Elinogyne dichotoma*), Pochotia (*Buddlirla asiatica*), Phutuka (*Osbeckia rastrata*), Bioni Habota (*Desmodium labornifolium*), Bahok tita (*Adhatoda spp.*), Kaupat (*Phryniam spp.*), Makhioti (*Fleminzia stricta*), Mejenga (*Viburnum colebookianum*), Amoilota (*Menispermum glabrum*), Harjura lota (*Cissus quadrangularis*), Akashilota (*Trachelospermum fragrans*), Panilota (*Dillina sermentosa*), Kolialota (*Merremia umbellata*), Pipoli (*Piper longum*), Latumoni (*Abrus Precatorious*), Mekuri chali (*Combretum decandrum*), Jengu bet (*Calamus erectus*), Jati bet (*Calamus tenewise*), Raidang bet (*Calemas flagellum*) and Lejai bet (*Calemas floribundus*), etc.

AND WHEREAS, the important rare species found in the Hollongapar-Gibbon Sanctuary are *Dipterocarpus retusus* (hollong), *Ficus* spp. (fig), *Artocarpus chaplasha* (Sam-goch, Chamkathal), *Litsea citrate* (Mejangkori), *Aquilaria agallocha* (Aloewood), etc.

AND WHEREAS, the Sanctuary supports 11 species mammals, 5 species of reptiles and amphibians and 31 avifaunal species; the major fauna of the Sanctuary includes Tiger (stray) (*Panthera tigris*), Asiatic elephant (*Elephus maximus*), leopard (*Panthera pardus*), pangolin (*Manis crassicaudata*), jungle Cat (*Felis chaus*), Indian civet (*Viverridae spp.*), giant squirrel (*Retufa bicolor*), barking deer (*Muntiacus muntjak*), sambar deer (*Cervus unicolour*), wild pig (*Sus*

scorfa), five-striped palm squirrel (*Funambulus pennanti*), Indian python (*Genus python*), common monitor lizard (*Varanus grisus*), Indian tent turtle (*Kachuga tecta tecta*), geacko (*Calodactyloids aureus*), common cobra (*Naja spp.*), white winged wood duck (*Cairina scutulata*), horn bill (*Pilolaemas tickali austeni*), Indian pied horn bill (*Anthracoceros malabaricus*), osprey (*Pandion haliaetus*), hill myna (*Gracula religiosa indica*), kalij pheasant (*Lophurs leucomala*), babblers (*Timaliinae spp.*), barbets (*Capitonidae spp.*), bitterns (*Ardeidae spp.*), kingfisher (*Alcedinidae*), orioles (*Oriolidae*), bulbuls (*Pycnonotidae spp.*), owls (*Strigidae*), egrets (*Arideidae*), cormorants (*Phalacrocoracidie*), mynah (*Sturnidae*), cuckoos (*Cuculidae*), magpies (*Corvidae*), pigeons (*Columbidae*), darters (*Phalacrocoracidae*), droves (*Columbidae*), blue jays (*Coraciidae*), teals (*Anatidae*), tree Pies (*Corvidae*), bayas (*Ploceidae*), jungle fowl (*Phasianidae*), minivets (*Campephagidae*), munias (*Estrildinae*), parakeets (*Psittacidae*), wood peckers (*Picidae*) and tits (*Paridae*), etc., and the Sanctuary also protects (7) seven rare primate species that enrich the biodiversity;

AND WHEREAS, heterogeneous landscapes of the Sanctuary is an integral part of a critical elephant corridor along with Disai and Disai Valley reserved forests, and the adjoining landscape of the State of Nagaland on the south;

AND WHEREAS, the Sanctuary is situated about 3 kilometers from Mariani Mouza (Taluka) and 18 km from Jorhat city and due to the fast urbanisation it may have adverse affect on birds, animals of the Sanctuary in the long run and railway line and road also pass through the Sanctuary opening it to vehicular traffic and causing damage to the ecosystem of the Sanctuary;

AND WHEREAS, the Sanctuary is home to a variety of flora, fauna and avifauna, and provides protection to rare and endangered species of wildlife endemic, hence, it is necessary to conserve and protect the area, the extent and boundaries of which are specified in paragraph 1, around the Hollongapar-Gibbon Sanctuary as Eco-sensitive Zone from ecological, environmental and biodiversity point of view and to prohibit industries or class of industries and their operations and processes in the said Eco-sensitive Zone;

NOW, THEREFORE, in exercise of the powers conferred by sub-section (1) and clauses (v) and (xiv) of sub-section (2) and sub-section (3) of section 3 of the Environment (Protection) Act 1986 (29 of 1986) (hereafter in this notification referred to as the Environment Act) read with sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby notifies an area to an extent varying from 0 (zero) kilometer (sharing inter-State boundary with the State of Nagaland) to 22.54 kilometers around the boundary of Hollongapar-Gibbon Sanctuary, in Jorhat District in the State of Assam as the Hollongapar-Gibbon Sanctuary Eco-sensitive Zone (hereafter in this notification referred to as the Eco-sensitive Zone) details of which are as under, namely: -

1. **Extent and boundaries of Eco-sensitive Zone. –** (1) The Eco-sensitive Zone shall be to an extent of 0 (zero) kilometer (sharing interstate boundary with the State of Nagaland) to 22.54 kilometers around the boundary of Hollongapar-Gibbon Sanctuary and the area of the Eco-sensitive Zone is 264.62 square kilometres.

   (2) The boundary description of Hollongapar-Gibbon Sanctuary and its Eco-sensitive Zone is appended in **Annexure-I.**

   (3) The maps of the Hollongapar-Gibbon Sanctuary demarcating Eco-sensitive Zone along with boundary details and latitudes and longitudes are appended as **Annexure-IIA** and **Annexure-IIB.**

   (4) List of geo-coordinates of the boundary of Hollongapar-Gibbon Sanctuary and Eco-sensitive Zone are given in Table **A** and Table **B** of **Annexure-III.**

   (5) The list of villages falling in the Eco-sensitive Zone along with their geo co-ordinates at prominent points is appended as **Annexure-IV.**

2. **Zonal Master Plan for Eco-sensitive Zone.-** (1) The State Government shall, for the purposes of the Eco-sensitive Zone prepare a Zonal Master Plan within a period of two years from the date of publication of this notification in the Official Gazette, in consultation with local people and adhering to the stipulations given in this notification for approval of the competent authority in the State.

   (2) The Zonal Master Plan for the Eco-sensitive Zone shall be prepared by the State Government in such manner as is specified in this notification and also in consonance with the relevant Central and State laws and the guidelines issued by the Central Government, if any.

   (3) The Zonal Master Plan shall be prepared in consultation with the following Departments of the State Government, for integrating the ecological and environmental considerations into the said plan:-

   (i) Environment;
   (ii) Forest and Wildlife;
   (iii) Agriculture and Horticulture;

ANNEXURE- I

BOUNDARY DESCRIPTION FOR ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY IN THE STATE ASSAM

East:- From GPS Point No. 1 (94° 23' 14.681" E & 26° 41' 29.920" N) the boundary runs along the Tea Garden crossing the GPS Point No.2 till it meets the GPS Point No. 3 (94° 22' 16.632" E & 26° 40' 17.275" N). From GPS Points No.3 the boundary runs towards south along the road till it meets the GPS Points No.4 (94° 22' 27.612" E & 26° 40' 3.979" N). From GPS Points No.4 again the boundary runs along the Tea Garden boundary crossing the GPS Point No.5 till it meets the GPS Points No.6 (94° 23' 9.328" E & 26° 39' 47.632" N). From GPS Points No.6 again the boundary runs towards south along the road till it meet the GPS Points No.7 (94° 23' 36.674" E & 26° 39' 15.625" N). From GPS Points No.7 the boundary runs along the Tea Garden till it meets the GPS Points No.8 (94° 23' 54.414" E & 26° 38' 45.600" N). From GPS Point No. 8 the boundary runs towards east along the reserve forest boundary of Disai Reserve Forest crossing the GPS Point No. 9 & 10 till it meets the GPS Point No.11 (94° 27' 10.359" E & 26° 39' 16.601" N). From GPS Point No.11 the boundary runs along the reserve forest boundary (Assam Nagaland Inter-State Boundary) till it meet the GPS Point No.12 (94° 27' 57.392" E & 26° 38' 0.138" N).

South:-From GPS Point No. 12 (94° 27' 57.392" E & 26° 38' 0.138" N) the boundary runs towards west along the reserve forest boundary of Disai & Disai Valley reserve forests (Assam Nagaland Inter-State Boundary) crossing the GPS Point No. 13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28 & 29 till it meets the GPS Point No. 30 (94° 18' 59.946" E & 26° 27' 32.039" N).

West:-From GPS Point No. 30 (94° 18' 59.946" E & 26° 27' 32.039" N) the boundary runs towards north along the reserve forest boundary of Disai Valley reserve forest (Assam Nagaland Inter-State Boundary) crossing the GPS Points No. 31,32,33,34 & 35 till it meets the GPS Point No. 36 (94° 17' 4.305" E & 26° 33' 44.203" N). From GPS Point No. 36 the boundary turn towards east along the Disai Valley reserve forest boundary crossing the GPS Points No. 37,38,39,40 & 41 till it meets the GPS Point No. 42 (94° 23' 6.610" E & 26° 37' 57.755" N). From GPS Point No. 42 the boundary runs towards north along the right bank of river Bhogdai or Disai river crossing the GPS Points No. 43,44,45,46,47,48,49 & 50 till it meets the GPS Point No.51 (94° 16' 48.306" E & 26° 43' 59.786" N). 23' 24.281" E & 26° 44' 18.300" N). From GPS Point No. 56 the boundary runs towards south along the road crossing the GPS Point No.57 till it meets the GPS Point No. 58 (94° 24' 2.960" E & 26° 41' 18.688" N). From GPS Point No. 58 the boundary runs towards west along the road till it meets the GPS Point No. 59 (94° 23' 16.032" E & 26° 40' 50.899" N).

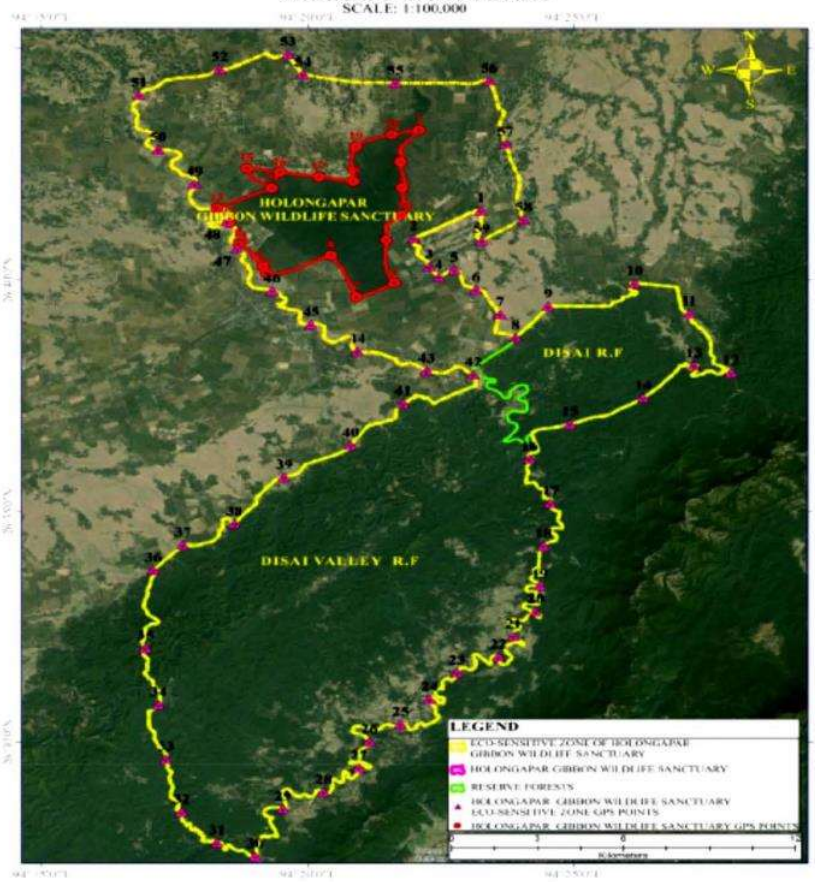
North:-. From GPS Point No. 59 the boundary runs towards north along the road till it meet the GPS Point No. 1 (94° 23' 14.681" E & 26° 41' 29.920" N). The Western boundary of the Sanctuary share inter-state boundary with Nagaland and hence is 0.0 km of Eco-Sensitive Zone is being proposed. The extent of Eco-Sensitive Zone varies from 0.0 Km (interstate boundary with Nagaland) to 22.54 km.

ANNEXURE- I

GOOGLE MAP OF ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS

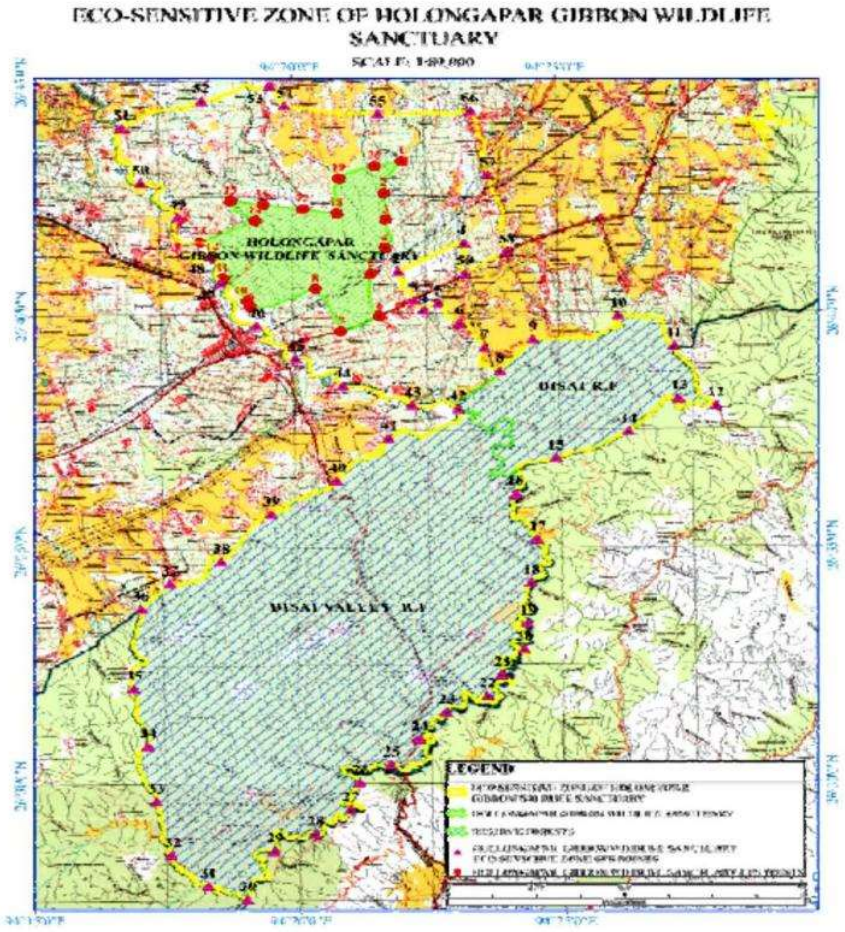
ECO-SENSITIVE ZONE OF HOLONGAPAR GIBBON WILDLIFE SANCTUARY

SCALE: 1:100,000



ANNEXURE- IIB

MAP SHOWING LANDUSE PATTERN OF ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS



ANNEXURE-III

TABLE A: GEO- COORDINATES OF PROMINENT LOCATIONS OF HOLLONGAPAR-GIBBON SANCTUARY

GPS POINTS	LONGITUDE	LATITUDE
1	94° 22' 5.369" E	26° 43' 14.526" N
2	94° 21' 44.154" E	26° 42' 33.281" N
3	94° 21' 45.902" E	26° 41' 59.451" N
4	94° 21' 44.588" E	26° 41' 24.186" N
5	94° 21' 28.134" E	26° 40' 51.434" N
6	94° 21' 37.449" E	26° 39' 56.337" N
7	94° 20' 54.065" E	26° 39' 37.576" N
8	94° 20' 25.370" E	26° 40' 32.105" N
9	94° 19' 13.121" E	26° 40' 8.556" N
10	94° 19' 8.815" E	26° 40' 17.324" N
11	94° 18' 41.036" E	26° 40' 46.645" N
12	94° 18' 30.120" E	26° 41' 14.195" N
13	94° 18' 15.841" E	26° 41' 32.983" N
14	94° 19' 18.964" E	26° 41' 59.067" N
15	94° 18' 50.889" E	26° 42' 24.862" N
16	94° 19' 27.784" E	26° 42' 19.920" N
17	94° 20' 12.239" E	26° 42' 13.733" N
18	94° 20' 50.712" E	26° 42' 7.986" N
19	94° 20' 53.612" E	26° 42' 52.873" N
20	94° 21' 34.283" E	26° 43' 8.484" N

TABLE B: GEO-COORDINATES OF PROMINENT LOCATIONS OF ECO-SENSITIVE ZONE

GPS POINTS	LONGITUDE	LATITUDE
1	94° 23' 14.681" E	26° 41' 29.920" N
2	94° 21' 58.733" E	26° 40' 54.190" N
3	94° 22' 16.632" E	26° 40' 17.275" N
4	94° 22' 27.612" E	26° 40' 3.979" N
5	94° 22' 44.856" E	26° 40' 13.435" N
6	94° 23' 9.328" E	26° 39' 47.632" N
7	94° 23' 36.674" E	26° 39' 15.625" N
8	94° 23' 54.414" E	26° 38' 45.600" N
9	94° 24' 31.095" E	26° 39' 26.119" N
10	94° 26' 8.448" E	26° 39' 56.055" N
11	94° 27' 10.359" E	26° 39' 16.601" N
12	94° 27' 57.392" E	26° 38' 0.138" N

[भाग II—खण्ड 3(ii)] भारत का राजपत्र : असाधारण 35

13	94° 27' 15.774" E	26° 38' 9.378" N
14	94° 26' 18.451" E	26° 37' 27.401" N
15	94° 24' 55.909" E	26° 36' 53.720" N
16	94° 24' 9.908" E	26° 36' 8.385" N
17	94° 24' 33.452" E	26° 35' 10.842" N
18	94° 24' 25.974" E	26° 34' 15.262" N
19	94° 24' 21.288" E	26° 33' 23.163" N
20	94° 24' 16.844" E	26° 32' 49.680" N
21	94° 23' 51.958" E	26° 32' 17.464" N
22	94° 23' 34.682" E	26° 31' 50.761" N
23	94° 22' 47.947" E	26° 31' 30.131" N
24	94° 22' 16.926" E	26° 30' 55.641" N
25	94° 21' 44.231" E	26° 30' 23.364" N
26	94° 21' 9.009" E	26° 30' 0.605" N
27	94° 20' 57.257" E	26° 29' 26.790" N
28	94° 20' 17.557" E	26° 28' 55.367" N
29	94° 19' 31.392" E	26° 28' 33.835" N
30	94° 18' 59.946" E	26° 27' 32.039" N
31	94° 18' 16.389" E	26° 27' 49.605" N
32	94° 17' 36.034" E	26° 28' 29.485" N
33	94° 17' 18.566" E	26° 29' 38.238" N
34	94° 17' 10.442" E	26° 30' 48.756" N
35	94° 16' 55.540" E	26° 32' 2.181" N
36	94° 17' 4.305" E	26° 33' 44.203" N
37	94° 17' 37.623" E	26° 34' 16.571" N
38	94° 18' 35.813" E	26° 34' 44.390" N
39	94° 19' 32.812" E	26° 35' 44.785" N
40	94° 20' 47.911" E	26° 36' 26.203" N
41	94° 21' 46.973" E	26° 37' 20.167" N
42	94° 23' 6.610" E	26° 37' 57.755" N
43	94° 22' 13.726" E	26° 38' 2.520" N
44	94° 20' 55.265" E	26° 38' 27.840" N
45	94° 20' 3.032" E	26° 39' 2.789" N
46	94° 19' 19.293" E	26° 39' 46.253" N
47	94° 18' 39.098" E	26° 40' 41.041" N
48	94° 18' 27.490" E	26° 41' 15.839" N
49	94° 17' 51.098" E	26° 42' 4.516" N
50	94° 17' 9.801" E	26° 42' 49.134" N
51	94° 16' 48.306" E	26° 43' 59.786" N

52	94° 18' 19.472" E	26° 44' 33.213" N
53	94° 19' 37.013" E	26° 44' 52.619" N
54	94° 19' 53.855" E	26° 44' 26.751" N
55	94° 21' 38.543" E	26° 44' 15.740" N
56	94° 23' 24.281" E	26° 44' 18.300" N
57	94° 23' 42.683" E	26° 42' 56.295" N
58	94° 24' 2.960" E	26° 41' 18.688" N
59	94° 23' 16.032" E	26° 40' 50.899" N

Annexure 4: Corridor 31 – Letter from DFO, Majuli (T) Forest Division, Majuli

GOVERNMENT OF ASSAM
OFFICE OF THE DIVISIONAL FOREST OFFICER
MAJULI (T) FOREST DIVISION, MAJULI

Letter No. B/MAJULI/G-29/2020/.464 **Dated 26/02/2020**

To,

The Chief Engineer (EAP)
PWRD, Assam
Fatasil Aambari, Guwahati-25

Sub: Tree cutting evaluation on Project roads.

Ref: Letter no. CE/AXOM MALA/12/2019/9 dated 5/11/2019

Sir,

I have the honour to furnish here with the details as desired.

1. Details of forest area : There is no Reserve Forest on the proposed Majuli (From Balichapori Tinali)- Balijan Ghat in Majuli district. However, the trees on either side of the road falls on Govt land and Forest department has control over the same.
2. Information on flora and fauna:
Flora: Mainly tree/ grass species are found on either side of the road viz. Simalu, Gamari, Bhelko, Ajar, Jari, Dimaru, Nahor, Bowal, Huwalu, Sationa, Uriam, Som, Aam, Krishnachura, Hilikha, Aamari, Owtenga etc and Bamboos.
Fauna: Except some birds no major fauna is available.
3. Type and number of animals present: Animals not present
4. Length of the forest area adjacent to the Project road: Govt land all along the road.
5. Map and extent of forest cover: N/A
6. Total trees to be removed: 347 = 299.2226 M3 (In Majuli district part)
7. Cost of cutting, de-branching, sectioning, dragging to diesel point, loading, transporting to temporary depot/s unloading, stacking and formation of lots complete
299.2226 M3 @ Rs. 3300/ - M3 : Rs, 9,88,000.00

(The actual volume can only calculated after completion of the timber operation)

Yours faithfully

Divisional Forest Officer
Majuli (T) Forest Division,
Majuli

Annexure 5: Corridor 31 – Letter from FBO, Bihpuria, Lakhimpur Forest Division, Lakhimpur

GOVERNMENT OF ASSAM
OFFICE OF THE FOREST BEAT OFFICER, BIHPURIA BEAT:
BIHPURIA

Memo No. B /09/ Roadside Tree / 2020 / 49 Date: 14-03-2020

To

The Forest Range Officer
Harmutty Range , Harmutty

Sub: Tree Cutting Evaluation on project works.

Sir,

With reference to the subject as mentioned above, I have the honour to inform you that, the M/S Fortress Infracon Ltd and Feedback Infra Ltd. on behalf of PWRD,GoA, has given a list of various plants falls at the roadside to be proposed for remove during road construction from Bongalmora to Dhunaguri which is under process for DPR preparation. The agency has marked all plant from shrubs, bamboos to battle nut trees falls within 8 meter from the center line of project road and included in the list. During field verification , the trees which have non valued outturn either firewood or timber has eliminated from the list and total **1044 no.s** tree carrying total approximate volume **631.705 cum** has been enumerated among the marked which details is hereby enclosed.

Also , as the data has been requested from PWRD,GoA , it is to be informed that ,no any Forest area or Wildlife Sanctuary is exist there in that land from where the road passes within Bongalmora to Dhunaguri.

The total cost to be estimated for enumeration, felling, sectioning , dragging and also depot maintaining etc. for those trees is as follows:

Total 631.705 cum x Rs.3400/cum = ***Rs. 21,47,797/= (Twenty One Lakhs Forty Seven Thousand Seven Hundred Ninety Seven)***

This is for favour of your kind information and necessary action

Enclo:As stated above.

Yours faithfully

(Sri G. Chetry , Forester 1)
Forest Beat Officer ,
Bihpuria Beat
Bihpuria

Annexure 6: Corridor 31 – NOC from Director, Inland Waterways Authority of India, Regional Office, Guwahati

भारतीय अन्तर्देशीय जलमार्ग प्राधिकरण
(पत्तन, पोत परिवहन और जलमार्ग मंत्रालय, भारत सरकार)
INLAND WATERWAYS AUTHORITY OF INDIA
(MINISTRY OF PORTS, SHIPPING AND WATERWAYS, GOVT. OF INDIA)
Regional Office : Pandu Port Complex, Pandu, Guwahati – 781 012 (ASSAM)
• Telefax No. 0361-2570099, 2570055 • Ph. No. 0361-2570109, 2676925, 2676927, 2676929
• E-mail: iwaighy@yahoo.co.in / dirguw.iwai@nic.in • **Gram:** JALMARG

No.IWAI/GHY/3(20)/NCL/2016-17 (Vol-IV)/401 **Date: 16-03-2021**

To,
The Chief Engineer
PWRD (EAP), Assam
Fatasil Ambari, Guwahati-25

Sub: NOC for construction of River Bridge across Subansiri River in NW-95-reg.

Ref: (1) Your letter No. CE/AXOM MALA/9/2019/Pt-III/25 dated 10-08-2020
(2) Report on Joint Inspection dated 22-01-2021
(3) Drawing No. LSB/SR/GAD-01 dated 06-07-2020

Sir,

Reference above, Competent Authority has accorded the approval of "Navigational Clearance" on your proposal for construction of River Bridge across Subansiri River (NW-95).

2. This approval (Navigational Clearance) is granted for construction of aforesaid bridge as indicated by you in the prescribed format of IWAI and the GAD, submitted with the proposal. The proposed construction is to be carried out as per Annex-II of IWAI's Office Memorandum dated 27-08-2007 (copy enclosed).

3. It is requested to inform the time/date of commencement of the proposed construction (stage wise/periodical) to IWAI so that the same can be monitored to ensure the required Navigational Clearance. Also, during the construction of the structure, safety of the vessels plying in the vicinity is to be ensured.

Yours faithfully,

Director

Encl: As above.

Copy to: Chief Engineer (Tech), IWAI, Noida

Annexure 7: Corridor 15 – NOC for Elephant Underpass

GOVERNMENT OF ASSAM
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS (WILDLIFE) AND
CHIEF WILDLIFE WARDEN, ASSAM :: PANJABARI :: GUWAHATI-37
Email ID: pccf.wl.assam@gmail.com

No. WL/FG.35/Upgradation of Dhodar Ali, Dated: 22.03.2021

To,

The Chief Engineer (EAP),
PWRD Assam,
Fatasil Ambari, Guwahati-25.

Sub: Improvement and upgradation of Dhodar Ali road (Kumargaon to Kamarbandha) under Asom Mala.

Ref: (i) No. CE/AXOM MALA/9/2019/Pt-I/27, Dt. 29.12.2020.
(ii) No. CE/AXOM MALA/12/2019/Pt-I/53, Dt. 22.02.2021
(iii) No. CE/AXOM MALA/12/2019/Pt/49, Dt. 16.03.2021

Sir,

With reference to your letter cited above, I wish to inform you that the improvement & upgradation of Dhodar Ali of length 42.1 Km between Kumargaon to Kamarbandha under the programme Axom Mala may be carried out subject to the modification with revised design of two underpasses of 30 mtr. length and 7 mtr. height on the identified section of the road (as per your specifications) where elephants used to cross.

This is for your kind information and necessary action.

Yours faithfully,

(M.K. Yadava, IFS)
Addl. Principal Chief Conservator of Forests, Wildlife
& Chief Wildlife Warden, Assam.

Copy for information to:

1. The Principal Chief Conservator of Forests & Head of Forest Force, Assam.
2. The Addl. Principal Chief Conservator of Forests (T), Upper Assam Zone, Guwahati.
3. The Conservator of Forests, Eastern Assam Circle, Jorhat,
4. The Divisional Forest Officer, Golaghat division, Golaghat.

Addl. Principal Chief Conservator of Forests, Wildlife
& Chief Wildlife Warden, Assam.