অসম চৰকাৰ

GOVERNMENT OF ASSAM

ASOM MALA PROGRAM

Government of Assam

Public Works Roads Department (PWRD)

Project Title: Improvement and Upgradation of A30_1 Moran Naharkatia Duliajan Digboi Road under Asom Mala

Package - I: Moran to Disang Kinar Bangali
[From Ch. 0+000 to Ch. 46+598]

Detailed Project Report

(Environmental Impact Assessment and Environmental & Social Management Plan)

(Draft)

(Revision 2)

September, 2021

ABBREVIATIONS

AADT	-	Annual Average Daily Traffic
AAQM	-	Ambient Air Quality Monitoring
AIIB	-	Asian Infrastructure Investment Bank
BDL	-	Below Detectable Limit
BOD	-	Biological Oxygen Demand
CGWA	-	Central Ground Water Authority
CO	-	Carbon monoxide
CPCB	-	Central Pollution Control Board
CSC	-	Construction Supervision Consultant
DFO	-	Divisional Forest Officer
DG	-	Diesel generating set
DO	-	Dissolved oxygen
DPR	-	Detailed Project Report
EA	-	Executing Agency
EAC	-	Expert Appraisal Committee
EIA	-	Environmental Impact Assessment
EFP	-	Environment Focal Person
EHS	-	Environmental Health and Safety
EMOP	-	Environmental monitoring plan
ESMP	-	Environmental and Social Management Plan
ESP	-	Environmental and Social Policy
ESS	-	Environmental and Social Standards
FHWA	-	Federal Highway Authority
GHG	-	Greenhouse gas
GIS	-	Geographic information system
GOI	-	Government of India
GRC	-	Grievance redress committee
GRM	-	Grievance redress mechanism
IA	-	Implementing Agency
IMD	-	Indian Meteorological Department
IRC	-	Indian Road Congress
IUCN	-	International Union for Conservation of Nature
MDR	-	Major District Road
MOEF&CC	-	Ministry of Environment, Forests and Climate Change
MORTH	-	Ministry of Road Transport and Highways
NH	-	National Highway
NOC	-	No Objection Certificate
NO_2	-	Nitrogen Dioxide
PAH	-	Project Affected Households
PAP	-	Project Affected Persons
PAs	-	Protected Areas
PCR	-	Public Community Resources
PCU	-	Passenger Car Units
PD	-	Project Director
PM	-	Particulate Matter
PIU	-	Project Implementation Unit
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PPM	-	Parts per million
PPTA	-	Project Preparedness Technical Assistance
PUC	-	Pollution under Control

PWRD	-	Public Works Roads Department
R & R	-	Rehabilitation and Resettlement
ROB	-	Road Over Bridge
ROW	-	Right of Way
RSPM	-	Respiratory suspended particulate matter
SEIAA	-	State Environmental Management Unit
SH	-	State Highway
SO_2	-	Sulphur Dioxide
SOE	-	Safeguard Officer Environment
SOI	-	Survey of India
SPCB	-	State Pollution Control Board
SPL	-	Sound Pressure Level
SPM	-	Suspended Particulate Matter
TA	-	Technical assistance
TDS	-	Total dissolved solids
TSS	-	Total suspended solids
TNM	-	Traffic Noise Model
WB	-	World Bank
WHO	-	World Health Organization
ZSI	-	Zoological survey of India

WEIGHTS AND MEASURES

dB (A)	-	A-weighted decibel
ha	-	hectare
km	-	kilometer
µg	-	microgram
m	-	meter
MW	-	megawatt
PM 2.5 or 10	-	Particulate Matter of 2.5 micron or 10-micron size

Table of Contents

EXECUTIVE SUMMARY 1

1. INTRODUCTION 7

1.1 Sub-Project Background and Rationale 7
1.2 Nature, Size and Location of the Project 10
1.3 Objective and Scope of the Study 10
1.4 Methodology Adopted for Environmental Impact Assessment Study 11
1.5 Structure of the Report 13

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK 15

2.1 National (India) Environmental Policies and regulatory Framework 15
2.2 Social Regulatory Requirements of India and State 21
2.3 International Treaties and Relevance to the Sub-Project 22
2.4 AIIB Environmental & Social Framework Requirements 22
2.5 Category of the Project as per AIIB's Framework & MOEF&CC Notification 2006 and amendments 23

3. PROJECT DESCRIPTION 25

3.1 The Sub Project 25
3.2 Location and Features of the Sub-Project Road 25
3.3 Engineering Surveys and Investigations 26
3.4 Current and Projected Daily Traffic 27
3.5 Proposed Improvement 28
3.6 Analysis of Alternatives 37
3.7 Construction Material and Source 42
3.8 Construction Camps 46
3.9 Manpower Requirement 46
3.10 Land requirement 46
3.11 Project Cost 49
3.12 Implementation Schedule 49
3.13 Sub-Project Benefits 49

4. DESCRIPTION OF THE ENVIRONMENT 51

4.1 Introduction 51
4.2 Physical Environment 52
4.3 Biological Environment 77
4.4 Socio-economic Environment 93

5. ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES 100

5.1 Introduction 100
5.2 Positive Environmental impacts due to the improvement of sub-project road 103
5.3 Adverse Environmental impacts due to the improvement of sub-project road 104
5.4 Impacts Related to Sub- Project Location, Preliminary Planning and Design 105
5.5 Environmental Impacts - Construction Stage 109
5.6 Environmental Impacts – Operation Phase 125
5.7 Cumulative and Induced Environmental Impacts 133
5.8 Potential Environmental Enhancement/ Protection Measures 135

6. CLIMATE CHANGE IMPACTS AND RISKS 145

6.1 Climate Change Mitigation....145
7. PUBLIC CONSULTATION....153
7.1 Objectives of the Consultation....153
7.2 Methodology for Consultations....153
7.3 Stakeholder Consultations....154
7.4 Public Opinion/ Views Survey....166
7.5 Disclosure....168
8. GRIEVANCE REDRESS MECHANISM....169
9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN....174
9.1 Introduction....174
9.2 Objectives of Environmental and Social Management Plan....174
9.3 Impacts and Mitigation Measures....174
9.4 Chance Find Procedure....204
9.5 Environmental and Social Monitoring and Reporting Program....204
9.6 Environmental and Social Reporting System....206
9.7 Institutional Arrangement....208
9.8 Capacity Building and Training....211
9.9 Environmental and Social Management Budget....212
10. CONCLUSIONS AND RECOMMENDATIONS....217

List of Tables

Table 1: Project Road Details of Group 3 Roads 8
Table 2: Primary and Secondary Information Sources 12
Table 3: Summary of Relevant Environmental Legislation 15
Table 4: Permissions/Clearances Required for the Subproject 20
Table 5: Applicable MEAs Related to Nature Conservation for the Asom Mala Project 22
Table 6: Summary of Road Components, Design Standard and Associated Facilities 26
Table 7: Traffic Volume/Day: (Base Year 2019-2020) 27
Table 8: Present and Projected Traffic in the road section 28
Table 9: Bus Bay & Bus Shelter Details 33
Table 10: Improvement Proposal for New Bridges 34
Table 11: Improvement Proposal for Existing Bridge 34
Table 12: Improvement Proposal for Existing Culverts 34
Table 13: Improvement Proposal for ROB 37
Table 14: Details of Realignment 39
Table 15: Location of Sand Quarry Site 42
Table 16: Details of Quarry Material Sources along the Project Corridor 43
Table 17: Details of Source and Quantity of Borrow Earth 44
Table 18: Estimated Quantities of Materials for Project 46
Table 19: Proposed Land Acquisition 46
Table 20: Soil sampling locations along the project road 52
Table 21: Soil Quality along the Project road 54
Table 22: Meteorological Data Parameters at Dibrugarh (Nearest IMD from the project road) 60
Table 23: Details of Hydrogeology in project state 61
Table 24: Groundwater sampling locations along the project road 62
Table 25: Surface water sampling locations along the project road 62
Table 26: Ground Water quality result of the project road 63
Table 27: Surface Water quality result of the project road 66
Table 28: Techniques Used for Ambient Air Quality Monitoring 70
Table 29: Air Quality Monitoring locations along the project road 70
Table 30: Ambient Air Quality along the Project Road 71
Table 31: Noise Monitoring locations along the project road 74
Table 32: Day and Night Time Leq in the Project Area 75
Table 33: Land Use Pattern Abutting Project Road 77
Table 34: Present Species in Evergreen forests of Assam 79
Table 35: Present Species in Deciduous forests of Assam 80
Table 36: Present Species in Swamp forests of Assam 80
Table 37: Present Species in Grasslands of Assam 81
Table 38: Plants of medicinal importance to the state 81
Table 39: List of National Park & Wildlife Sanctuary in the State of Assam 83
Table 40: Location of Heritage Trees along the Project Road 88
Table 41: Tea Estates along the Project Road 91
Table 42: Demographic details of Dibrugarh district 93
Table 43: Important Settlements Abutting Project Highway 95
Table 44: List of religious structures along the project road 95
Table 45: Sensitive receptors along the project road 96
Table 46: Age wise Distribution of Total Displaced Persons 96
Table 47: Social Category of the Displaced Families 97

Table 48: Educational Status 98
Table 49: Occupation Pattern 98
Table 50: Activity Impact Identification Matrix 102
Table 51: Proposed Land Acquisition 105
Table 52: Impact on Structures 108
Table 53: Sensitive Structures along the project road 111
Table 54: Typical noise levels of principal construction equipment (Noise Level in dB (A) at 50 Feet) 112
Table 55: Noise Limits for different working Environment 113
Table 56: OSHA Daily Permissible Occupational Noise Level Exposure 113
Table 57: Predicted Traffic Volume Per Hour 126
Table 58: Meteorological Data for CALINE 4 126
Table 59: Emission factors for different types of Vehicle (ARAI, 2007) 127
Table 60: Predicted Concentrations of CO in the study location (ppm) 128
Table 61: Predicted Concentrations of PM2.5 in the study location (µg/m3) 128
Table 62: Predicted Concentrations of NO2 in the study location (ppm) 129
Table 63: Anticipated Noise Levels due to projected traffic 131
Table 64: Cumulative Impact Expected Due to Project Development 134
Table 65: Vehicle Composition on subproject road 146
Table 66: CO_2 Emission Factors 146
Table 67: Emission Standards of Fleet (%) 147
Table 68: Estimated Total CO2 Emissions during Road Construction 147
Table 69: CO_2 emissions prediction using TEEMP 147
Table 70: Project CO_2 Emissions Intensity Indicators 148
Table 71: Climate trends in Assam between 1951 and 2010 149
Table 72: Possible Climate Events, Risks, and Adaptation Measures 151
Table 73: List of Public consultation and Date 154
Table 74: Identified Stakeholders 154
Table 75: Details of Public Consultation at Diksom Kinar 157
Table 76: Details of Public Consultation at Raidongia Gaon 158
Table 77: Details of Public Consultation at Derai T.E. 159
Table 78: Details of Public Consultation at Tingkhong 160
Table 79: Details of Public Consultation at Naharani 161
Table 80: Details of Public Consultation at Tingkhong Chariali 162
Table 81: Details of Public Consultation at Tingkhong No. 3 163
Table 82: Details of Public Consultation at Pithapothar 164
Table 83: Details of Public Consultation at Ofulia Chariali 165
Table 84: Peoples' Perception of Environmental Scenario 167
Table 85: Environmental, Social, Health and Safety Management Plan 175
Table 86: Environmental Monitoring Plan 200
Table 87: Detailed stage-wise reporting system 207
Table 88: Environmental and Social Training Modules 211
Table 87: Environment and Social Management Costs (Civil Cost) 212
Table 88: Environment and Social Management Costs (Non-Civil Cost) 215

List of Figures

Figure 1: Location of Project Road Corridors proposed under ASRIP for AIIB Financing 9
Figure 2: Map of Moran to Disang Kinar Bangali Road 25
Figure 3: Typical Cross Section (Type-I) 30
Figure 4: Typical Cross Section (Type-II) 30
Figure 5: Typical Cross Section (Type-III) 31
Figure 6: Soil sampling locations along the project road 53
Figure 7: Soil Sample Collection at Moranhat Town 55
Figure 8: Soil Sample Collection at Deroi Alikinor 55
Figure 9: Soil Sample Collection at No. 8 Darkhastor 56
Figure 10: Soil Map of India showing the project road 56
Figure 11: Seismic Zone Map of India showing the project road 57
Figure 12: Mean Monthly Temperature Distribution details 58
Figure 13: Annual Rainfall details 59
Figure 14: Wind rose diagram of Dibrugarh district (Nearest IMD station from the project road) 60
Figure 15: Groundwater sampling locations along the project road 62
Figure 16: Surface water sampling locations along the project road 63
Figure 17: Groundwater Sample collection at Moranhat Town 64
Figure 18: Groundwater Sample collection at Dighali No. 2 65
Figure 19: Groundwater Sample collection at No. 8 Darkhastor 65
Figure 20: Surface Water Sample collection at Deroi Alikinor 68
Figure 21: Surface Water Sample collection at Disang Kinar Bangali 68
Figure 22: Air Quality Monitoring locations along the project road 70
Figure 23: Air Quality Monitoring at Moranhat Town 72
Figure 24: Air Quality Monitoring at Bailungbheti 72
Figure 25: Air Quality Monitoring at No. 8 Darkhastor 73
Figure 26: Noise Monitoring locations along the project road 74
Figure 27: Noise Level Monitoring at Moranhat Town 75
Figure 28: Noise Level Monitoring at Bailungbheti 76
Figure 29: Noise Level Monitoring at No. 8 Darkhastor 76
Figure 30: Land use map of the project district 77
Figure 31: Forest Cover Map of Assam 79
Figure 32: Protected Areas in Assam 84
Figure 33: Nearest protected area from project road 85
Figure 34: Trees along the project road 88
Figure 35: Photographs of Heritage Trees along the Project Road 90
Figure 36: Photographs of Tea Estates along the Project Road 92
Figure 37: Dickson River along the Project Road 92
Figure 38: Road Map of Dibrugarh district 94
Figure 39: Graph representing Predicted Concentrations of CO in the study location (ppm) 128
Figure 40: Graph representing Predicted Concentrations of PM2.5 in the study location (µg/m3) 129
Figure 41: Graph representing Concentrations of NO2 in the study location (ppm) 130
Figure 42: Traffic Management Diagram 136
Figure 43: Traffic Control Devices at traffic diversion locations. 137
Figure 44: Tree Enumeration by Moran Range Forest Officials 155
Figure 45: Revenue Map Collection and Consultation at Rajgarh Revenue Circle Office 156
Figure 46: Public Consultation at Diksom Kinar 157
Figure 47: Public Consultation at Raidangia Gaon 158

Figure 48: Public Consultation at Deroi T.E. 159
Figure 49: Public Consultation at Tingkhong 160
Figure 50: Public Consultation at Naharani 161
Figure 51: Public Consultation at Tingkhong Chariali 162
Figure 52: Public Consultation at Tingkhong No. 3 163
Figure 53: Public Consultation at Pithapathor 164
Figure 54: Public Consultation at Ofulia Chariali 165
Figure 55: Public Consultation Questionnaire 166
Figure 56: Environmental and Social Grievance Redressal Process 172
Figure 57: Implementation Arrangement for Environmental and Social Safeguards 208

List of Annexures

Annexure 1: Ambient Air Quality Standards 219
Annexure 2: Ambient Noise Level Standards 221
Annexure 3: Indian Standard Drinking Water Specification IS: 10500-2012 222
Annexure 4: Record of Public Consultation 223
Annexure 5: GRM Information Sheet 239
Annexure 6: Guidelines for Borrow Area Management 243
Annexure 7: Guidelines for Emergency Management System 246
Annexure 8: Guidelines for Waste Disposal and Management 249
Annexure 9: Outline of an Environmental Monitoring Report 251
Annexure 10: Impacts of Climate Change on Road Transport in The State of Assam 255
Annexure 11: Tree Inventory 258
Annexure 12: For Workers Health & Safety in Common Operation and During Construction 293
Annexure 13: Guidelines for Siting, Management and Redevelopment of Construction Camps 302
Annexure 14: Site Selection, Layout Plan and Basic Amenities at Labour Camp 308
Annexure 15: Generic Guidelines for Environment Friendly Construction Methodology 313
Annexure 16: Guidelines for Stripping, Stocking, Preservation of Top Soil 320
Annexure 17: Baseline Monitoring Results 321
Annexure 18: Prediction of Air Quality along the Project Road 343
Annexure 19: Prediction of Noise Levels along the Project Road 371
Annexure 20: Tree Cutting Evaluation from Forest Department 377
Annexure 21: Pond Enhancement Plan 378
Annexure 22: Letter from PCCF, Assam providing GIS Maps of Protected Areas and Reserve Forests 379
Annexure 23: Biodiversity Assessment Report 381

Executive Summary

A. Introduction

This report summarizes the findings and results of the Environmental Impact Assessment (EIA) study carried out for the **A30_1 Moran Naharkatia Duliajan Digboi Road (Moran to Disang Kinar Bangali)** road under Axom Mala Program. The report describes existing environmental conditions in the project area, anticipated environmental impacts and corresponding mitigation measures, public consultation process, 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 centres 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 located in Dibrugarh District and proposed for improvement and upgradation by GoA under AIIB funding. It is an important road connecting NH 37 (at Moran), NH 315A (at Duliajan), NH 38 (at Digboi), important towns and settlements, tea estates (*Dibrugarh is known as the Tea City of India*), Kathalguri Gas base Power Plant and Digboi Refinery. The project road is important for socio-economic development of the region, connectivity with districts of Dhemaji, Jorhat, Tinsukia, Sivasagar and further connectivitity to the states of Nagaland & Arunachal Pradesh. The project road is related to overall objectives of Asom Mala Program and AIIB financing. It is proposed for geometric improvements and widening to two lanes. The roads will have a top width of 12m, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side.

This EIA report has been prepared to meet requirements of 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 **A30_1 (Moran to Disang Kinar Bangali)** falls in the district of **Dibrugarh**, passes through various junctions and spreads over various locations of the district. As per the topographic survey and alignment design the total length of the road is **46.598 km**. Dibrugarh is the administrative district in the state of Assam. Dibrugarh derived its name from Dibarumukh which is a renowned encampment of Ahoms during the Ahom Sutiya war. Dibrugarh is situated in the eastern part of Assam. The district is surrounded by Dhemaji district in the north, part of Sivasagar and Arunachal Pradesh in the south, Tinsukia district in

the east and Sivasagar district, and a part of Jorhat district in the west. In terms of area, the district occupies the 8th rank among the district of the state.

Several Common Property Resources (schools, colleges, temples, hospitals), anganwadi centers and rice mills were observed along the project road. Water bodies (ponds) were also observed along the project corridor. The project road has a single lane configuration with conditions varying from poor to fair and certain sections of the road has non-motorised roads.

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). The potentially adverse environmental and social impacts are limited in number and they are limited to the Project area, and can be successfully managed using good practice in an operational setting. 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. Description of Environment

Meteorological Conditions: Dibrugarh has a humid subtropical climate with extremely wet summers and relatively dry winters. Rainfall starts normally in April and continues up to October. Scattered rainfall also occurs in the remaining month of the year. As per Statistical Handbook, 2012 it is seen that total rainfall is recorded as 3603.5 mm as against the state total rainfall of 2296.3 mm. The highest rainfall 463.4 mm is recorded in April and July 2011 in the district. The lowest rainfall 20 is recorded in December in the district. The coldest month is January, with an average high-temperature of 22.8°C (73°F) and an average low-temperature of 9.2°C (48.6°F). The warmest month in Dibrugarh is August, with an average high-temperature of 31.8°C (89.2°F) and an average low-temperature of 24.9°C (76.8°F). November is the month with the least rainfall. Rain falls for 1.8 days and accumulates 16.4mm (0.6") of precipitation. The rainfall is recorded as 3603.5 mm as against the state total rainfall of 2296.3 mm. The highest rainfall 463.4 mm is recorded in April and July 2011 in the district. The lowest rainfall of 20 is recorded in December.

Topography: The area comprises mainly of plain areas dotted by small hillocks in the extreme southern end. There is no such high hill in the mainland of the region. The region, though has a large number of tea gardens with a flourishing business and several industries based on its rich natural resources the economy of the people is mainly dependent on agriculture. The land which was very much abundant once is now shrinking with the increase of population.

Soil: The soil of the district is fertile, acidic, and alluvial. Acidic phosphorous are good for tea cultivation. On the other hand, heavy clays with a high percentage of nitrogen in low lying areas of the district give a better yield of rice. Abundant rainfall and high humidity

throughout the year favor the cultivation of tea and rice in the district. The soil type in the areas is mainly Black soil. Soil is mostly found as sandy clay loam soil in the sampling locations and it is loaded with a sand percentage which varies from 48.32% to 49.25%. Nitrogen content varies from 1790 mg/1000g to 1870 mg/1000g and is poor in organic carbon content.

Land use: The existing land use along the subproject road is mostly semi built-up and patches of rural residential areas. The land use abutting the project road is majorly semi built-up (58.80%). The Built-up and agricultural area is 10.30% and 23.18% respectively.

Water Resources and Hydrology: The whole of the drainage of the district ultimately finds its way into the Brahmaputra which flows along the northern boundary of the district. The river is very wide and remains navigable throughout the year. A large number of rivers and their tributaries, streams and streamlets, locally called Jans flow through the district. The Brahmaputra, Buridihing, Disang with its tributaries Sessa and Dimna are the important rivers of the district.

The project road crosses the Dickson river at Ch. 15+096 and some nallahs are also observed crossing the alignment.

Air Quality: Ambient air quality for particulate matters (PM_{10} and $PM_{2.5}$), SO_2, NO_x & CO were monitored at Moranhat town, Bailungbheti, and No. 8 Darkhastor. Ambient air quality parameters are well within the NAAQ standards prescribed by MoEF&CC and WHO Ambient Air Quality guidelines (IFC EHS) for residential areas. The maximum concentration of PM_{10} is 48.3 µg/m^3 found at Bailungbheti, whereas the maximum concentration of $PM_{2.5}$ is 17.8 µg/m^3 found at Moranhat town. These levels are well within the standards prescribed by MoEF&CC (PM_{10}-100 µg /m^3 & $PM_{2.5}$-60 µg /m^3) & IFC EHS (PM_{10}-50 µg /m^3 & $PM_{2.5}$-25 µg /m^3). Other parameters monitored i.e. NO_x, SO_2, and CO were found within the permissible limits (NAAQS & IFC EHS). Overall, the air quality along the subproject road is not an issue.

Noise Quality: Ambient noise levels were monitored at Moranhat town, Bailungbheti, and No. 8 Darkhastor and are well within the permissible limits for residential areas prescribed by CPCB and World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively. The maximum recorded daytime noise level is 45.2 dB(A) at Bailungbheti and the night time noise level is 34.5 dB(A) recorded at Moranhat town.

Water Quality: To represent the true profile of the subproject area, samples from major surface water sources through which the subproject road runs were collected and analyzed as per IS- 3025. Surface water and groundwater samples were analyzed as per IS: 10500-2012.

The pH of the drinking water in the region is well within permissible limits (6.5–8.5). The level of total dissolved solids is found well within permissible limits, which varies from 150.07 mg/l to 153.23 mg/l at Disang Kinar Bangali and Deroi Alikinor respectively. The iron content for the analyzed groundwater sample is higher than the permissible standards at all the sampling locations. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. Overall, the groundwater and surface water quality in the project area is good.

Biological Environment: The subproject district, in general, have a moderate to low percentage of forest cover. Field surveys have been carried out to identify the number and type of trees to be affected by the proposed improvement work. It is envisaged that 2553 trees existing within the proposed formation width of the subproject road will be felled. Subproject road sections do not pass through any protected area such as Wildlife Sanctuary, National park, or bio–reserve. There is no wildlife sanctuary, national park, or bio-reserve within 10km from the subproject road. The nearest protected area from the project road is the Dihing Patkai National Park which is at a distance of 15 km (approx.) from the project road. No rare or endangered species are found in the corridor of impact along the subproject road.

Socio-economic Environment: As per details from Census 2011, Assam has a population of 3.12 Crores, an increase from figure of 2.67 Crore in the 2001 census. The total population of Assam as per the 2011 census is 31,205,576 of which males and females are 15,939,443 and 15,266,133 respectively. Dibrugarh district has a population of 1,326,335; out of which male constitutes 676,434 and female 649,901 of the total population.

The project road traverses through the settlements of Moran, Teloikinar Bongali, Rajgarh, Sapkait No. 1, Paniyabura Pathar No. 1, and Disang Kinar Bangali. Agriculture is the mainstay of the people. No archaeological and historical monuments are located along the project roads. 9 schools, 2 hospitals, and 7 religious structures lie in the vicinity of the project road, however, these structures will not be affected due to proposed improvement activities under the project.

E. Key Environmental Impacts

- It is envisaged that **2553** trees within the proposed formation width of the subproject road need to be felled.
- The project road crosses the Dickson river at Ch. 15+096 and which may get polluted to some extent during the construction stage.
- The project road passes through settlement areas which may cause minor disturbance to the local public due to construction activities.
- There are several sensitive receptors along the project road which may face minor inconvenience due to increased noise because of construction activities.
- The Proposed road widening activities will have an impact on **1880** structures.
- The number of projects affected people are **8445** out of which **4309** are male and 4136 are female.

F. Public Consultation

In accordance with AIIB's ESP and ESS and Environment Impact Assessment Notification of GoI (2006), public consultations were conducted as part of the environmental impact assessment study. Public Consultations were carried out at **Raidongia gaon, Diksom Kinar, Derai T.E.,** and **Tingkhong** on **18th January 2020** and **Naharani, Tingkhong Chariali, Tingkhong No. 3, Pithapothar,** and **Ofulia Chariali** on **8th November 2020** along the proposed road alignment. A total of **46** participants (**41 Males** & **5 Females)** attended the consultation sessions.

Public consultation has been conducted in the project area during the feasibility study as well as during the detailed design stage details is given in Chapter 7. Key issues raised during the consultation are:

- Effect of road on the adjacent land and compensation to the land owners
- Safety measures to be taken for accident prevention
- Tree cutting activities along the project road
- No wild animal crossing observed along the project road
- Provision of bus stops along the project road
- Road diversion and traffic management during the construction phase of the project
- No migratory birds observed along the project road and near vicinity
- Provision of speed breakers and safety signs near schools
- Employment opportunities for the locals
- Road maintenance activities in the future

Most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, boost economic development and thereby provide direct or indirect benefits to themselves. The Draft EIA will be disclosed publicly and communicated to the communities.

G. Environmental and Social Management Plan

The project road-specific Environment Management Plan has been formulated which consists of mitigation, monitoring measures, and training to effectively execute the management plan. The detailed ESMP is given in **Chapter 9** of this report. An ESMP budget of **INR 57,909,182** has been estimated in **Table 89** & **Table 90** for the implementation of the environmental and social management plan. The project will have one grievance redressal mechanism for social and environmental issues comprising a village level and district level committee. The nodal officer under a project implementation unit will be the key person to coordinate the receiving of complaints and addressing them.

Environmental Monitoring Programme (EMoP)

A comprehensive monitoring plan has been prepared for all stages of the project. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost, and responsibility for implementation and supervision. Construction Stage Monitoring to be carried out by the contractor under the supervision of the construction supervision consultant (CSC). Monitoring will focus on air, water, noise and soil erosion, drainage congestion, and compensatory tree plantation. For tree plantation, the survival rate of re-plantation shall be monitored for one year of the operation phase.

Institutional Arrangement and Capacity Building

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). PD PMU will be assisted by an Assistant Executive Engineer as Nodal Officer of Asom Mala Program.

The PMU will oversee overall execution and technical supervision, monitoring, and financial control of the project. The PMU will be supported by CSE and/ or Program Coordination and

Management Consultant (PCMC). The institution Arrangement and Capacity building is discussed in Chapter – 9, Section 9.7.

To enable PWRD officials to implement environmental safeguard requirements effectively, a training program will be conducted for the PWRD Environmental and Social Safeguard expert to improve environmental and Social awareness, construction practices, legislative compliance requirements, ESMP, and EMoP requirements, and roles and responsibilities.

H. Conclusions and Recommendation

The findings of the Environment Assessment (EA) show that overall, the project has limited and short term adverse Environmental Impacts. Effective ESMP implementation will ensure the elimination and minimization of identified adverse impacts. PWRD shall ensure that ESMP and EMoP are included in the Bill of Quantity (BOQ) and will form a part of the bid document and works contract. If there is any change in the project design the ESMP and EMOP will be accordingly modified. PWRD official & shall need capacity building and practical exposure. Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned PWRD officials.

1. Introduction

1.1 Sub-Project Background and Rationale

The state of Assam is one of the seven North-eastern states of India located at the south of eastern Himalayas along the Brahmaputra and Barak river valleys. Assam has an area of about 78,443 sq. km and a population of about 3.09 crores. The state of Assam has about 2,530 km of State Highways (SH) and 4,379 km of Major District Roads (MDR) which are being maintained and managed by the Public Works Roads Department (PWRD), Government of Assam (GOA). The GOA has embarked upon the ASOM MALA to objectively develop the SH & MDR network of the State and is planned to be an umbrella program that would have several projects under it funded from various sources.

Public Works Roads Department, Assam has undertaken the project for improvement of State Highways and Major District Roads in the next 15 years under Asom Mala. The road network development work will involve reconstruction and widening of roads with long design life, geometric improvement to bring it to proper standards, improved drainage along the roads, improving shoulders and providing paved shoulders wherever necessary, road safety improvement, etc.

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 located in Dibrugarh District and proposed for improvement and upgradation by GoA under AIIB funding. It is an important road connecting NH 37 (at Moran), NH 315A (at Duliajan), NH 38 (at Digboi), important towns and settlements, tea estates (*Dibrugarh is known as the Tea City of India*), Kathalguri Gas base Power Plant and Digboi Refinery. The project road is important for socio-economic development of the region, connectivity with districts of Dhemaji, Jorhat, Tinsukia, Sivasagar and further connectivitity to the states of Nagaland & Arunachal Pradesh. The project road is related to overall objectives of Asom Mala Program and AIIB financing. It is proposed for geometric improvements and widening to two lanes. The roads will have a top width of 12m, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side.

The project road is aimed at improving connectivity facilitating safer and more efficient access to livelihood and socio-economic opportunities for the local communities in the region. It will promote equitable growth through sustainable agriculture and rural development. The existing single-lane facility is inadequate to cater to the traffic demand and satisfactory user experience. The mentioned road stretch passes through major junctions and spreads through the remote location of the Dibrugarh District. The project road traverses through the settlements of Moran, Teloikinar Bongali, Rajgarh, Sapkait No. 1, Paniyabura Pathar No. 1, and Disang Kinar Bangali. The improvement works will provide better access to the residents of the nearby villages to market places and railway station in

Moran. The project road corridors proposed under ASRIP for AIIB financing is given in **Table 1** and the location of these project road corridors is shown in **Figure 1.**

Table 1: Project Road Details of Group 3 Roads

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
7	A20_1	Sivasagar to Chumoni	Sivasagar	18.4
8	A20_2	Balighat Tiniali to Nakachari	Sivasagar & Jorhat	45.0
Total (km)				**245.7**

Figure 1: Location of Project Road Corridors proposed under ASRIP for AIIB Financing

1.2 Nature, Size and Location of the Project

The project road from Moran to Disang Kinar Bangali traverses through settlements of Moran Town, Teloikinar Bongali, Rajgarh, Sapkait no.1, Paniyabbura Pathar No.1, and ends at Disang Kinar Bangali. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and Joypur connect the proposed project road. Railway stations at Moran have connectivity to other places along the project stretched like Naharkatia, Duliajan, etc. The project road traverses through the towns of Moranhat which further traverses through Naharkatia and Duliajan (in Package-II) and then towards Digboi and this boosts the economic factors related to the stretch.

The alignment experiences moderate agricultural activities throughout its stretch. Also, Road stretch passes through many Tea Gardens. The land use pattern of the project road is majorly semi-built-up.

The existing carriageway varies between 6 to 7 meters. The Existing RoW varies between 8.5 meters to 22.6 meters. It is single lane with paved and earthen shoulders. The proposed RoW varies between 18 to 20 meters. It is proposed for geometric improvements and widening to two lanes. The roads will have a top width of 12m, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side. Footpath and concrete drains are provided in built-up areas.

1.3 Objective and Scope of the Study

Development of any road requires land acquisition; mainly agricultural land needs to be diverted for such projects. Therefore, any such change in land use patterns may result in deterioration of soil, water, and other environmental aspects. Such projects also cause air and noise pollution especially during the construction stage on account of heavy machinery and haul vehicles. The loss of ecology is an important impact of such projects.

The Environmental Impact Assessment consists of the study, describing the current status of the environment in the project area (before the commencement of project), identification of potential impacts and its mitigation methods and formulation of an environmental and social management plan to be followed during construction and operation phase of the project. An Environment Impact Assessment study is hence an important tool to identify and handle the issues concerned with the environment that would arise due to such projects.

Preparation of EIA and implementation of all environment safeguards requirement is in accordance with relevant policies and regulation of the Government of India, Government of Assam, and the AIIB's Environmental and Social Framework.

This EIA addresses the environmental management requirements of the Government of India (GOI) and the Asian Infrastructure Investment Bank. Various agendas covered in this study are as follows.

- Provides information about the baseline environmental setting of the subproject;
- Provides information on potential environmental impacts of the proposed subproject activities with its magnitude, distribution, and duration.
- Provides information on required mitigation measures with cost to minimize the impacts.

- Analyses the alternative options considering alternative locations, designs, management approaches for selection of most feasible and environmentally acceptable options.
- Provides details of stakeholder's consultations.
- Designs an environmental management and monitoring plan with institutional measures for effective implementation of mitigation measures proposed and addressing grievances.

The environmental studies have been limited to the situation around the deemed areas of direct influence caused by constructional and operational facilities along the proposed road sections. The EIA was based on proposed road alignment and key construction activities such as site clearing, removal of trees, excavation, filling, grading and embankment formation, excavation for utility trenches, subgrade preparation, base course and asphalt overlay, shoulder, and construction of permanent structures like retaining walls, culverts, and drains. The EIA also covered ancillary activities like campsite establishment and maintenance, sourcing of materials, and operation of equipment like rock crusher and hot mix plant. The corridor of impact is taken as 10 meters on either side of the alignment. However, the study area impact zone is considered up to 5 km on both sides of road alignment to allow for coverage of indirect and induced impacts and a larger analysis of land use and other environmental features. Assessment is carried out on the following environment components: terrestrial and aquatic ecology, soil, water, air, noise, and socio-economic aspects.

1.4 Methodology Adopted for Environmental Impact Assessment Study

The methodology adopted complies with the Asian Infrastructure Investment Bank Environmental and Social Framework. The study was carried out using reconnaissance surveys, field visits, consultation with stakeholders, review of existing data, identification of adverse impacts, and preparation of environmental management and monitoring plans. The stepwise activities carried out include:

- Review of legal requirements
- Review of the feasibility study
- Reconnaissance survey for identification of key issues data requirement and preliminary consultation
- Primary and secondary data collection
- Consultation with stakeholders
- Identification of impacts and mitigation measures.

1.4.1 Data Collection

Primary and secondary data on the Physical, Ecological, and Socio-economic resources were collected to provide baseline conditions to be used in impact assessment and monitoring plan design. The type and source of information compiled in this EIA are given in the following **Table 2.**

Table 2: Primary and Secondary Information Sources

Information	Sources
Technical information on existing road features and proposed Rehabilitation work. Inventory of road features; viz. water bodies community structures, environmentally sensitive location areas, congested locations, etc.	PWRD, Design Consultant, Ground physical surveys and graphics Consultants
Climatic Condition	Indian Meteorological Department, ENVIS Website, NIC, Primary data Collection
Geology, Seismicity, Soil, and Topography	Geological Survey of India, SOI Toposheets, Primary data collection
Land Use/ Land Cover	Survey of India (SoI) Toposheet, Observation during the survey.
Drainage Pattern	Survey of India Topo sheet and field Observation
Status of forest areas, Compensatory afforestation norms, etc.	Divisional Forest Office Dibrugarh District
Status of Fishing Activity	District Fisheries Offices at Dibrugarh District
Air quality Noise, Soil, and Water	Onsite monitoring and Analysis of Field samples during the field visit
Borrow Areas, Quarries and other construction material source	Observations from site inspection surveys, PWRD
River geomorphology, hydrology, drainage, flood Patterns	Feasibility report, field observations.
Social Survey	The Secondary data collected for the project and the project influence area are from reliable secondary sources such as websites of central and state government; published documents from various departments. Initial social screening was conducted to identify the likely impacts and identify the potential impacted families and persons, Common Property Resources, agriculture land, access to services, etc. Using available RoW records with Revenue Department, the social team plotted the boundaries of private properties within the proposed RoW. A structured questionnaire was prepared to carry out the census survey covering all (100%) of the families displaced as a result of development of the project

Information	Sources
	within the proposed RoW/ CoI. To collect the information of socio-economic profile of the affected population, conventional sample of 25 percent of project displaced families was covered. Representativeness of the sample was ensured through random sampling method

1.4.2 Public Consultation

Extensive consultations were held during different stages (reconnaissance, detailed design, and design review) with key stakeholders that includes local and beneficiary population, government departments/agencies, road users, and project-affected persons. These consultations allowed the interaction between the stakeholders and road designers to identify road features and construction methods that will enhance road upgrading and minimize potential impacts. Information gathered was integrated into the project design and formulating mitigation measures and environmental and social management plan. A detailed description of public consultation is presented in **Chapter 7**.

1.5 Structure of the Report

This EIA report has been prepared as per requirements of the AIIB's Environmental and Social Framework. The report will be organized into the following ten chapters, a brief of each chapter is described below:

- **Chapter 1 - Introduction**: This section describes the background information about the project and the EIA study.
- **Chapter 2 - Policy, Legal, and Administrative Frameworks**: This section summarizing the national and local legal and institutional frameworks that guided the conduct of the assessment.
- **Chapter 3 - Project Description**: This section presents the key features and components of the proposed project.
- **Chapter 4 - Description of the Environment**: This section discussing the relevant physical, biological, and socioeconomic features that may be affected by the proposed project.
- **Chapter 5 - Anticipated Environmental and Social Impacts and Mitigation Measures**: This section presents the environmental and social impact assessment of likely positive and adverse impacts attributed to the proposed project and concomitant mitigation measures.
- **Chapter 6 – Climate Change Impacts and Risks**: This section presents the impact of project road on climate change and relevant mitigation measures.
- **Chapter 7 – Consultation, Participation and Information Disclosure**: This section describes the consultation process undertaken during the environmental examination and its results, their consideration in the project design, and manner of compliance to the AIIB's policy.
- **Chapter 8 - Grievance Redress Mechanism**: This section describing the formal and informal redress procedures for registering, resolving, and reporting complaints.

- **Chapter 9 – Environmental and Social Management Plan**: This section discussing the lessons from the impact assessment and translated into action plans to avoid, reduce, mitigate, or compensate for adverse impacts and reinforces beneficial impacts. This plan is divided into three sub-sections; mitigation, monitoring, and implementation arrangements.
- **Chapter 10 - Conclusion and Recommendation**: This section stating whether there is a need for further detailed environmental studies/assessments and highlights key findings and recommendations to be implemented by the borrower.

2. Policy, Legal and Administrative Framework

India has well defined institutional and legislative framework. The legislation covers all components of the environment viz. air, water, soil, terrestrial and aquatic flora, and fauna, natural resources, and sensitive habitats. India is also a signatory to various international conventions and protocols. The environmental legislation in India is framed to protect the valued environmental components and comply with its commitment to the international community under the above conventions and protocols. Asian Infrastructure Investment Bank has also defined its Environmental and Social Framework. This assessment is about the applicability of the above laws and regulations, conventions, protocols, and frameworks. This section summaries the following:

- National (India) Environmental Legislation and Legal Administrative Framework,
- Social Safeguard Regulatory Requirements,
- AIIB policies and categorization of the project,
- Summary of international treaties and applicability to the project

2.1 National (India) Environmental Policies and regulatory Framework

The Government of India's Environmental Legal Framework comprises a set of comprehensive acts and regulations aimed at conserving various components of the biological and physical environment including environmental impact assessment procedures and requirements for public consultation. The policies and requirements which are most relevant in the context of this project are provided in **Table 3.**

Table 3: Summary of Relevant Environmental Legislation

Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
1	Environment (Protection) Act (1986) and Rules (1986)	To protect and improve the overall environment	MoEF&CC	Yes	It is umbrella legislation and notifications, rules and schedules are promulgated under this act.
2	The 14th September 2006 EIA notification, under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986. And amendment made on 22nd August, 2013; S.O. 2559 (E).	Environmental clearance for proposed project prior to starts of construction work	MoEF&CC/ SEIAA/ SEAC	No	The project road does not require Environmental Clearance as it is neither a new State Highway nor a State Highway Expansion project in hilly areas (above 1000 AMSL) and or ecologically sensitive areas. The maximum

Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
					altitude of the project road is 120.874 m.
3	The 14th September 2006 EIA notification, under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986. Environmental Clearance under EIA notification dated 15th January 2016 issued by MoEF&CC, Letter No. 125, S.O 141E.	Permission will be required for opening new quarry or for extraction of river bed sand	0-5 Ha. Category (B2) – DEAC/DEIAA >5 Ha and <25 Ha (B2) – SEAC/SEIAA ≥25 Ha and <50Ha. Category (B1) – SEAC/SEIAA ≥50 Ha. Category (A) – MoEF&CC	Yes/No	**Yes:** If the contractor open quarries site/ Mining site to meet the Material Requirement. **No:** If the source of construction material is from authorized vendor. Environmental Clearance is exempted for sourcing or borrowing of ordinary earth for linear projects as per notification S.O. 1224 (E) dated 28th March, 2020
4	Wildlife Protection Act (1972 and amended in 1993)	To restrict project activities within National Park/ Wildlife Sanctuary/ Game Reserve/ Conservation Reserve or within its Eco Sensitive Zone (ESZ) which are declared protected under the WLPA-1972.	SBWL	No	Not Applicable. As per the Map furnished by the PCCF office, the nearest wildlife sanctuary is approx. 15 km from the proposed alignment.
4	The Water (Prevention and Control of Pollution) Act 1972 (Amended 1988) and Rules 1974	Establishment/Operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets	Consent to Establish (CtE) and Consent to Operate (CtO) under water Act 1974 from SPCB	Yes	This act will be applicable during construction for establishments of hot mix plants, construction camps, workers' camps, etc.
5	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Establishment/Operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets	Consent to Establish (CtE) and Consent to Operate (CtO) under water Act 1974 from SPCB	Yes	To control the emission and air pollutants which might be expected during operation of stone crusher, Hot Mix Plant, RCC

Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
					Plant and D.G sets
6	Noise Pollution (Regulation and Control) Act, 2000	Establishment/Operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets	Consent to Establish (CtE) and Consent to Operate (CtO) under Noise Rules, 2000. Authority SPCB	Yes	To control the noise emission generated from operation of D.G sets, Hot Mix Plant, Stone crushers, WMM Plants etc.
7	The Hazardous and Other Wastes (Management, Handling and Trans-boundary Movement) Rules 2016	To protection the general public against improper handling, storage, and disposal of hazardous wastes	State Pollution Control Board	Yes	Used of Hazardous material and handling for construction of roads
8	The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003)	To protect and manage forests	MoEF&CC	No	No diversion of forest land is required for the sub-project road.
9	Central Motor Vehicle Act (1988) and Rules (1989)	To control vehicular air and noise pollution. To regulate the development of the transport sector, check and control vehicular air and noise pollution.	State Transport Department	Yes	These rules will apply to road users and construction Machinery.
10	Ancient Monuments and Archaeological Sites and Remains Act (1958)	For construction of road falling within prohibited or regulated area of notified Ancient Monuments and Archaeological Site and Remains Act.	Archaeological Dept. GOI/State	No	No monuments and archaeological sites as listed by Central Government & State Government is reported within 100 meters (restricted Zone) and beyond 200 meters (Regulated Zone) from PROW Boundary
11	Building and Other Construction Workers (Regulation and the Employment and conditions of service) Act, 1996	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and	Ministry of Labour and Employment	Yes	A large number of construction workers skilled, semiskilled or unskilled will be employed temporarily during

Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
		welfare measures			Construction Phase of the project
12	Child labour (Prohibition and Regulation) Act, 1986	To regulate the employment of children including age limits, type of employment, the timing of work, information disclosure, and health and safety.	Ministry of Labour and Employment	Yes	This act will be applicable to prohibit employment to children below the age of 14.
13	Public Liability & Insurance Act, 1991	Regulate the employment and conditions of construction workers and provide for their safety, health and welfare measure and other matters incidental thereto.	District Collector	Yes	The contractor needs to stock hazardous materials like diesel, Bitumen, Emulsions, etc.
14	Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996	To prevent the occurrence of a chemical accident involving a fortuitous, or sudden or unintended occurrence while handling any hazardous chemical resulting in continuous, intermittent or repeated exposure to death, or injury to, any person or damage to any property	MoEF&CC	Yes	This law will be applicable as the project will involve transport and storage of hazardous chemicals.
15	Fly Ash Notification, 25th January, 2016.	Use of fly ash for road filling and for other construction works if Thermal Power Plant are located within 300 km from PROW.	MoEF&CC	No	The project road is not located within 300 km from any Coal based Thermal Power Plant.

1. Requirement of Environmental Clearance

As per provisions of Environmental Impact Assessment Notification 2006 amended (2009, 2011 and 2013), and its amendments, vide notification S.O.3067(E), dated 1st December 2009 and S.O. 2559 (E), dated 22nd August 2013; all New State Highway Projects and State Highway expansion projects in hilly terrain (above 1000 m above MSL) and or ecologically sensitive areas require Environmental Clearances from MoEF&CC.

Since the project road is neither an existing state highway nor proposed as a New State Highway and the maximum elevation of the project road is 120.874m Environmental Clearance from MoEF&CC is not required.

2. Forest Clearance

As per the Indian Forests Conservation Act (1980), any project requiring diversion of forest land for non-forestry purposes require forest clearance from MoEF&CC for the same.

As per the approved Reserve Forests map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (Annexure 22) during the initial survey, no diversion of forestland is involved in the A30_1 (Moran to Disang Kinar Bangali) road. As per the Assam (Control of Felling and Removal of trees from Non-forest lands) Rules, 2002, the felling of trees from the Non-forest area will require prior approval of the Forest Department.

3. Wildlife Clearance

As per the approved Protected Areas map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (Annexure 22) during the initial survey, the project road does not pass through any notified protected area or lies within a 10 km radius of any protected area. The nearest protected area from the project road is the Dihing Patkai National Park which is at a distance of 15 km (approx.) from the project road.

4. Permission to Withdraw Ground Water

As per the power Granted under Environmental Protection Act, 1986, Permission from Central Ground Water Authority is required for extracting groundwater for construction purposes, from areas declared as critical or semi-critical from the groundwater potential prospective point of view.

5. Required Clearances/Permissions

For the up-gradation of the project road, required clearances/permissions related to the environment have been summarized in **Table 4**.

Table 4: Permissions/Clearances Required for the Subproject

Sr. No.	Permissions/Clearances	Acts/Rules/Notifications/Guidelines	Concerned Agency	Responsibility	Time required
A. Pre-Construction Stage					
1	Permission for cutting of trees	Forest Conservation Act (1980) Procedural Guidelines developed by the Department of Environment, Government of Assam under the orders of the Honorable High Court Tree removal will be guided as per state government rules	State Forest Department for trees felling in forest areas and non-forest Areas (Compensatory tree plantation to be done as per the direction of Forest Department)	Public Works Roads Department, Assam	Permission has been granted by DFO Dibrugarh & Pending from DFO Sonitpur
B. Implementation Stage					
2	Consent to establish and operate hot mix plant, Crushers, Batching plant	Air (Prevention and Control Pollution) Act of1981	Assam State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
3	Authorization for disposal of hazardous waste	Hazardous Waste (Management and Handling) Rules 1989	Assam State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
4	Consent for Disposal of sewage from labor camps	Water (Prevention and Control of Pollution) Act 1974	Assam State Pollution Control Board (Before setting up the camp)	Contractor	Approx. 3 months

Sr. No.	Permissions/Clearances	Acts/Rules/Notifications/Guidelines	Concerned Agency	Responsibility	Time required
5	Pollution Under Control Certificate	Central Motor and Vehicle Act of 1988	Department of Transport, Government of Assam authorized testing centers	Contractor	Can be obtained instantly from verified PUC centers
6	Employing Labour/Workers	The Building and Other Construction Workers (Regulation and Employment Conditions of Service) Act, 1996	District Labour Commissioner	Contractor	Approx. 3 months

2.2 Social Regulatory Requirements of India and State

There are many rules and regulations framed by the Government of India for the protection of workers. Most of these legislations will apply to contractors in charge of construction. The executing agency will ensure compliance with these social legislations through contractual obligations and regular checks & penalties. Applicable Acts and Policies relevant in the context of the project have been reviewed and their relevance to the project are listed down below which will ensure that project activities implemented are consistent with the following regulatory/legal framework.

- Code of Social Security, 2020
- The Occupational Safety, Health and Working Conditions Code, 2020
- Child Labour (Prohibition and Regulation) Act, 1986
- Minimum Wages Act, 1948
- Workmen Compensation Act, 1923
- Payment of Gratuity Act, 1972
- Employee State Insurance Act; Employees P.F. and Miscellaneous Provision Act, 1952
- Maternity Benefit Act, 1951
- Payment of Wages Act, 1936
- Equal Remuneration Act, 1979
- Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act, 1979
- Equal Remuneration Act, 1979, Factories Act 1948 (including rules for health and safety of workers), etc.
- 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

- Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
- National Tribal Policy, 2006
- The Assam Panchayat Act, 1994
- The Right to Information Act, 2005

2.3 International Treaties and Relevance to the Sub-Project

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 **Table 5**.

Table 5: Applicable MEAs Related to Nature Conservation for the Asom Mala Project

Sr. 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

2.4 AIIB Environmental & Social Framework Requirements

The Bank determines the Project's category by the category of the Project's component presenting the highest environmental or social risk, including direct, indirect, cumulative and induced impacts, as relevant, in the Project area. The Bank conducts a review of environmental and social risks and impacts associated with the Project, regardless of the categorization being considered. As an element of the categorization process, the Bank may conduct a field-based review of the Project to provide for a refined understanding of the environmental and social risks and impacts and support the Client's preparation of a site-specific approach to the assessment of these risks and impacts. The Bank may adjust the categorization during the life of the Project if warranted by changes in the environmental and social risks and impacts.

- **Category A:** A Project is categorized A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. The Bank requires the Client to conduct an environmental and social impact assessment (ESIA) or equivalent environmental and social assessment, for each Category A Project and to prepare an ESMP or ESMPF, which is included in the ESIA report for the Project. The ESIA for a Category A Project examines the Project's potentially negative and

positive environmental and social impacts, compares them with those of feasible alternatives (including the "without Project" situation), and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance of the Project.

- **Category B:** A Project is categorized B when: it has a limited number of potentially adverse environmental and social 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 practice in an operational setting. The Bank requires the Client to conduct an initial review of the environmental and social implications of the Project. On the basis of this review, the Bank, in consultation with the Client, determines the appropriate instrument for the Client to assess the Project's environmental and social risks and impacts, on a case-by-case basis. The Bank may determine that an environmental and social assessment or another similar instrument is appropriate for the Project. The scope of the assessment may vary from Project to Project, but it is narrower than that of the Category A ESIA. As in the case of a Category A Project, the assessment examines 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.
- **Category C**: A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts. The Bank does not require an environmental and social assessment, but does require the Client to conduct a review of the environmental and social implications of the Project.
- **Category FI:** A Project is categorized FI if the financing structure involves the provision of funds to or through 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 Client, through the implementation of appropriate environmental and social policies and procedures, to screen and categorize subprojects as Category A, B or C, review, conduct due diligence on, and monitor the environmental and social risks and impacts associated with the Bank-financed subprojects, all in a manner consistent with this ESP. A Project categorized as FI is also subject to: (a) the Environmental and Social Exclusion List and applicable host country national laws for all the Bank-financed subprojects; and (b) the applicable ESSs for the Bank-financed subprojects that are classified as Category A subprojects (and if the Bank so determines, some or all of the Bank-financed subprojects that are classified as Category B subprojects).

2.5 Category of the Project as per AIIB's Framework & MOEF&CC Notification 2006 and amendments

As per provisions of Environmental Impact Assessment Notification 2006 amended (2009, 2011 and 2013), and its amendments, vide notification S.O.3067(E), dated 1st December 2009 and S.O. 2559 (E), dated 22nd August 2013; all New State Highway Projects and State

Highway expansion projects in hilly terrain (above 1000 m above MSL) and or ecologically sensitive areas require Environmental Clearances from MoEF&CC/SEAC/SEIAA.

The proposed project is widening and curve improvement road project of total length 46.598 km. Based on the topographic survey it has been reported that the maximum elevation is 120.874 meters above mean sea level (AMSL).

The project road has been evaluated and categorized as Category B project in accordance with the Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS). This categorization was primarily based on the following considerations:

- Project road is an existing road and upgrading activities are limited to the available RoW with minimum land acquisition at some locations,
- Anticipated impacts from road upgrading on relatively flat terrain along agricultural land are mostly site-specific and easily mitigated through proper design and good construction practices, majority of the activities have short-term duration co-terminus with the construction phase, and
- Project road does not pass through or located within a 10 km radius from any Critical Habitats (wildlife sanctuary, national park, or any other environmentally sensitive area), Protected Area (Forests), Natural Habitats, impact on land and water resource, etc. The nearest protected area from the project road is the Dihing Patkai National Park which is at a distance of 15 km (approx.) from the project road.
- Impact on local and regional biodiversity i.e. habitat fragmentation, degradation and loss, endemic and invasive species, over exploitation of biological resources, hydrological changes, increase in pollution load in water bodies, tree felling involve and induced climate impact.
- Impact involving social issues i.e. involuntary resettlements, loss of livelihoods, impact on indigenous peoples, impact on community and households, Vulnerable groups, etc
- Impact on land and natural resource, change in land-use patterns, Cultural resource, land acquisition, structure affected, etc.

3. Project Description

3.1 The Sub Project

The Project Road **A30_1 (Moran to Disang Kinar Bangali)** located in the district of Dibrugarh, passes through various junctions, and spreads over various locations of the district. As per the topographic survey and alignment design, the total length of the road comes out to be 46.598 km. Dibrugarh is the administrative district in the state of Assam also known as the Tea City of India. Dibrugarh derived its name from Dibarumukh which is a renowned encampment of Ahoms during the Ahom Sutiya war. Dibrugarh is situated in the eastern part of Assam. The district is surrounded by Dhemaji district in the north, part of Sivasagar and Arunachal Pradesh in the south, Tinsukia district in the east and Sivsagar district, and a part of Jorhat district in the west. In terms of area, the district occupies the 8th rank among the district of the state.

Several Common Property Resources (schools, colleges, temples, and hospitals), anganwadi centers and rice mills were observed along the project road. Water bodies (ponds) were also observed along the project corridor. The project road has a single lane configuration with conditions varying from poor to fair and certain sections of the road have a Non-motorized road.

3.2 Location and Features of the Sub-Project Road

The project road from Moran to Disang Kinar Bangali traverses through settlements of Moran Town, Teloikinar Bongali, Rajgarh, Sapkait no.1, Paniyabbura Pathar No.1, and ends at Disang Kinar Bangali. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and Joypur connect the proposed project road. Railway stations at Moran have connectivity to other places along the project stretched like Naharkatia, Duliajan, etc. The project road traverses through the towns of Moranhat which further traverses through Naharkatia and Duliajan (in Package-II) and then towards Digboi and this boosts the economic factors related to the stretch.

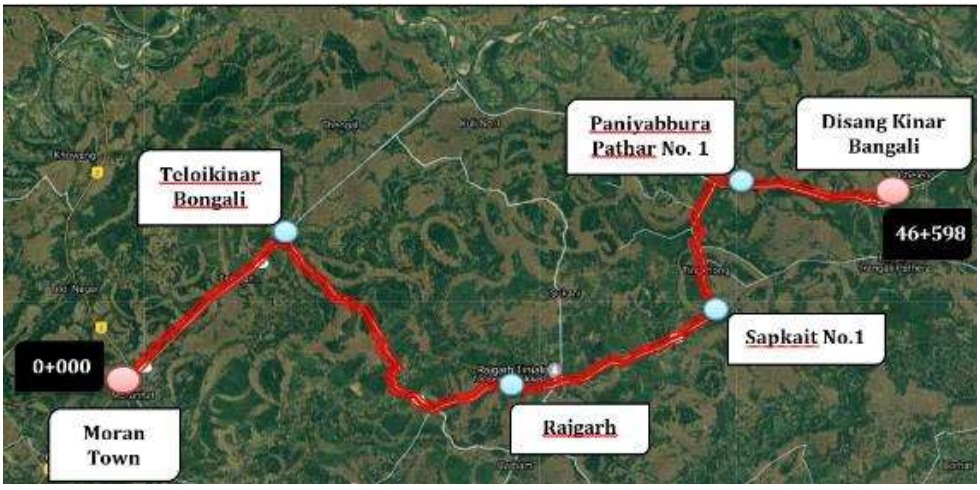


Figure 2: Map of Moran to Disang Kinar Bangali Road

The salient features of the Road are given in **Table 6**.

Table 6: Summary of Road Components, Design Standard and Associated Facilities

Road Length	46.598 Km.
Alignment	Following the existing road alignment. Except some of the locations where geometric improvements are required.
Flyovers/overpasses/ ROB	01 No. of ROB.
Bridges	05- Minor Bridges
Embankment Design	Embankment height established is having a 1m freeboard on 20 years frequency HFL Embankment height up to 3.0 m with 2H: 1V slope for embankment height from 3.0 m to 6.0 m with 1.5H: 1V slope. Construction of embankment of height more than 3.0 m, using borrow soil is recommended. However high embankment has been restricted within Row by providing retaining walls
Design Standard	As per IRC Codes and MORTH Guidelines. Vertical Clearance 0.60 m above HFL for bridges up to 30 m length 0.90m above HFL for bridges above 30 m length the discharges for which the bridge has been designed is the maximum flood discharge on record for 100 years for major bridges and 50 years for minor bridges.
Speed	65Kmph to 80Kmph.
	Permissible: 80 km/h
Horizontal Curves	As per IRC: 73 -1980
Super Elevations	The maximum value of 7% for superelevation and 15% for side friction factor, the minimum radius for horizontal curves is 230m for design speed 80Km/hr.
Vertical Curves	Grade break of 0.5%, vertical curves will be provided. Length of the vertical curve will be restricted to minimum 50m
Carriageway	7 m wide carriageway with 1.50 m to 2.50 m Earthen Shoulder.
Associated/Linked Facilities	11 - Bus Bay, Bus Shelter with Rest area has been proposed

3.3 Engineering Surveys and Investigations

Following surveys and investigations had been carried out on the subproject road for collection of data for incorporation in the Detailed Project Report (DPR) and evolve the design for improvement and up-gradation.

- Topographic surveys;
- Traffic surveys;
- Road and pavement condition survey and inventory;
- Culverts and bridges condition survey and inventories;
- Material surveys;
- Hydrology studies for new bridge structures;

- Geotechnical investigations & subsoil exploration for structures; and
- Existing utility surveys.

These surveys had been carried out in accordance with the guidelines in IRC SP: 19-2001 to fulfill the requirement in the TOR.

3.4 Current and Projected Daily Traffic

Based on the Classified Volume Count (CVC), Turning Movement Count (TMC), Origin-Destination, and Axle Load Surveys conducted for the project and consistent with applicable IRC Guidelines the average annual daily traffic at the monitoring stations is shown in the table below. The Traffic Volume/Day (Base Year 2019-2020) data has been provided in **Table 7**. The present and projected traffic for future years is shown in **Table 8**.

Table 7: Traffic Volume/Day: (Base Year 2019-2020)

Sr. No.	Types of Vehicles	Annual Average Daily Traffic (AADT) (in Vehicles)	Annual Average Daily Traffic (AADT) (in PCU's)
1	Two Wheelers	1572	786
2	3 Wheelers	011	011
3	Car/ Vans/ Jeeps	665	665
4	Mini Buses	031	047
5	Standard Buses	009	027
6	Tempo	222	333
7	LCV's (Goods)	069	104
8	2-Axle Trucks	153	459
9	3-Axle Trucks	026	078
10	Multi-Axle Trucks	032	144
11	Tractors with Trailer	003	014
12	Tractors Without Trailer	001	002
13	Cycle	713	357
14	Cycle Rickshaw	000	000
15	Animal Drawn	000	000
16	Others	002	002
Total Traffic		**3509**	**3027**
Motorized (MT)		**2794**	**2668**
Non-Motorized (NMT)		**715**	**359**

Source: Traffic Study

Table 8: Present and Projected Traffic in the road section

Sr. No.	Year	Total Vehicles	Total PCUs
1	2019-2020	4750	3736
2	2020-2021	5050	3975
3	2021-2022	5370	4230
4	2022-2023	5712	4502
5\	2023-2024	7088	5587
6	2024-2025	7544	5949
7	2025-2026	8041	6340
8	2026-2027	8573	6758
9	2027-2028	9143	7204
10	2028-2029	9753	7682
11	2029-2030	10406	8193
12	2030-2031	11020	8669
13	2031-2032	11672	9174
14	2032-2033	12365	9710
15	2033-2034	13100	10278
16	2034-2035	13882	10881
17	2035-2036	14637	11460
18	2036-2037	15436	12071
19	2037-2038	16280	12716
20	2038-2039	17172	13397
21	2039-2040	18115	14116
22	2040-2041	19062	14833
23	2041-2042	20060	15588
24	2042-2043	21112	16384
25	2043-2044	22221	17223
26	2044-2045	23391	18107
27	2045-2046	24623	19037
28	2046-2047	25923	20018
29	2047-2048	27293	21052
30	2048-2049	28738	22141
31	2049-2050	30261	23288
32	2050-2051	31867	24496

Source: Traffic Study

3.5 Proposed Improvement

Project Road will receive the following up-gradation under the project:

- Curvature improvement and realignment
- Widening
- Flexible pavement
- Rearrangement of junctions
- Roadside drains

- Bridge and cross drainage structures
- User facilities
- Traffic control and safety measures

3.5.1 Realignment and Curvature Improvement

Based on approved geometric standards the alignment plan of the existing road requires correction of existing sub-standard geometry at various locations. In plain or rolling terrain, a minimum curve radius as per design has been attempted to achieve design speed, however, an absolute minimum radius as per design is used at a location with space constraints like urban areas, structure approach, and other areas.

On sections with substandard geometry, improvements will require merging two or more existing curves resulting in a minor geometric realignment to achieve the desired geometric standards. Horizontal will be modified to accommodate the required rate of super-elevation and provide smooth riding quality. However, at locations with space constraints design speed has been restricted.

3.5.2 Proposed Cross Section Details

Carriageway Width: The carriageway configuration of two lanes with a paved and hard/earthen shoulder is proposed for the project road having a 7.0 m carriageway width.

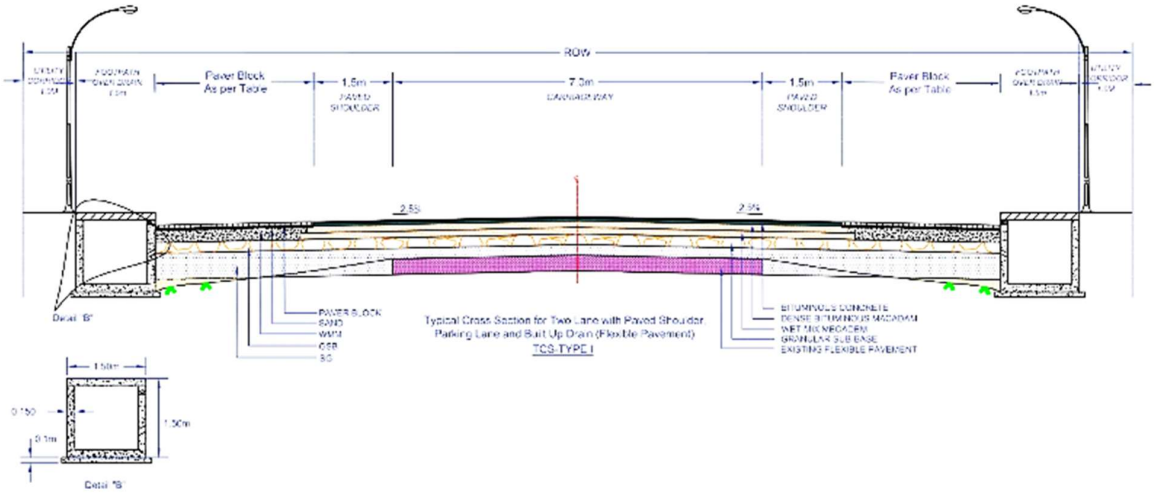
Shoulder: Paved Shoulder and Earthen shoulders are proposed to be 1.5m and 1.0m respectively on both sides of the Carriageway.

Footpath: The minimum width of footpath in urban stretches is proposed to be 1.5m. The side drain in such stretches may be accommodated under the footpath.

Utility Corridor: The minimum width of the utility corridor will be 1.0m.

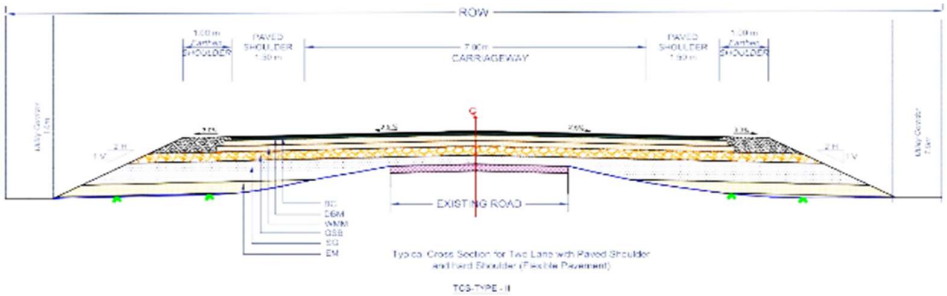
Embankment Slopes: Side slopes shall not be steeper than 2H:1V.

The typical Cross Sections for the proposed project road are shown in the following figures.



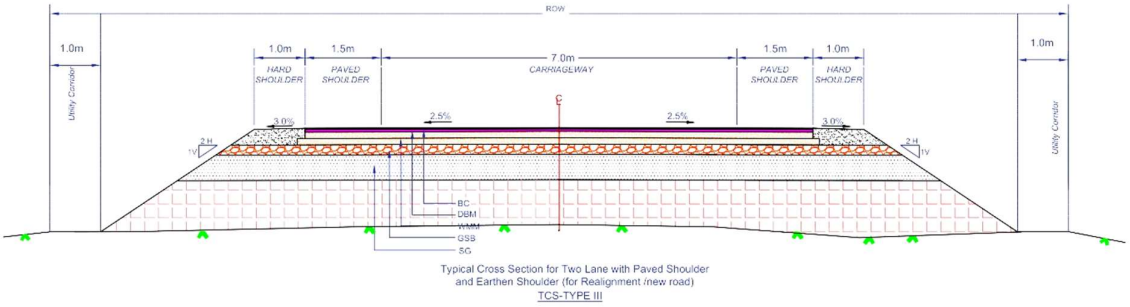
Sr No	Chainage		Length(m)	Proposed carrige way(m)	Paved shoulder (m)		Paver Block(m)		Drain (m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
A	From	To		CW	Left	Right	Left	Right	Left	Right	Left	Right				
1	0+000	1+820	1820	7	1.5	1.5	2.5	2.5	1.5	1.5	1	1	I	Buiup Area	20	BT
2	24+600	26+536	1936	7	1.5	1.5	2.5	2.5	1.5	1.5	1	1	I	Buiup Area	20	BT
3	35+200	36+540	1340	7	1.5	1.5	1.5	1.5	1.5	1.5	1	1	I	Buiup Area	18	BT
	Total		5096													

Figure 3: Typical Cross Section (Type-I)



Sr No	Chainage		Length(m)	Proposed carrige way(m)	Paved shoulder (m)		Earthen Shoulder(m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
B	From	To		CW	Left	Right	Left	Right	Left	Right	Type			
1	3+030	8+550	5520	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
2	9+800	13+150	3350	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
3	13+150	13+500	350	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
4	13+500	14+600	1100	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
5	14+600	15+050	450	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
6	15+100	15+450	350	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
7	15+750	16+400	650	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
8	16+950	17+250	300	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
9	18+150	20+150	2000	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
10	20+150	20+650	500	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
11	20+650	24+600	3950	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
12	26+536	29+600	3064	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
13	29+600	29+900	300	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
14	29+900	32+550	2650	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
15	33+110	33+510	400	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
16	33+510	35+200	1690	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
17	36+600	38+950	2350	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
18	38+950	39+800	850	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
19	39+800	40+300	500	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
20	40+300	42+850	2550	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
21	42+850	42+900	50	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
22	42+900	44+500	1600	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
23	44+500	44+650	150	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
24	44+650	45+200	550	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
25	45+700	46+609	909	7	1.5	1.5	1	1	1	1	II	Open Area	20	BT
	Total		36133											

Figure 4: Typical Cross Section (Type-II)



Sr No	Chainage		Length(m)	Proposed carrige way(m)	Paved shoulder (m)		Eartthen Shoulder(m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
C	From	To		CW	Left	Right	Left	Right	Left	Right				
1	1+820	3+030	1210	ROB								Out of Scope		
2	8+550	9+800	1250	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
3	15+050	15+100	50	Bridge										
4	15+450	15+750	300	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
5	16+400	16+950	550	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
6	17+250	18+150	900	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
7	32+550	33+110	560	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
8	36+540	36+600	60	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
9	451200	451700	500	7	1.5	1.5	1	1	1	1	III	Open Area	20	BT
			5380											

Figure 5: Typical Cross Section (Type-III)

3.5.3 Design of Road Side Drains

In built-up areas, to facilitate proper drainage of surface run-off, road-side covered RCC drains will be constructed as per IRC guidelines.

3.5.4 Pavement Design

The project road envisages two-lane carriageways with hard shoulders and upgrading of the existing pavement to carry the anticipated traffic over the design period. This would involve the construction of new pavement on the widened side and strengthening and rehabilitation of the existing pavements. Flexible asphalt pavement is proposed for the major part of the project road. The applicable IRC Guidelines would be used for this purpose, but using another internationally accepted design method (s) to ensure that the recommended design is the most appropriate.

3.5.5 Traffic Control and Safety Measures

In addition to adequate provisions for roadway width, geometric elements, and junction improvement, the following provisions will enhance the safety of road users. Due consideration has been made for the provisions contained in IRC: SP 44-1996, “Highway Safety Code”. Also, other various measures have been proposed to increase traffic control for the High-speed road.

3.5.5.1 Road Markings

Road markings perform the important function of guiding and controlling traffic on a highway. The markings serve as psychological barriers and signify the delineation of traffic

paths and their lateral clearance from traffic hazards for safe movement of traffic. Road markings are therefore essential to ensure smooth and orderly flow of traffic and to promote road safety. The Code of Practice for Road Markings, IRC: 35-2015 will be used in the study as the design basis.

The location and type of marking lines, material and colour is followed using IRC: 35-2015 – "Code of Practice for Road Markings".

The road markings are carefully planned on carriageways, intersections, parking and bridge locations.

3.5.5.2 Road Signages - Cautionary, Mandatory and Informatory Signs

Cautionary, Mandatory and Informatory signs are provided depending on the situation and function they perform in accordance with the IRC: 67-2012 guidelines for Road Signs. Overhead and Cantilever gantry sign boards are proposed at appropriate locations.

3.5.5.3 Kilometre Stone Details

The details of kilometre stones are in accordance with IRC: 8-1980 guidelines. Kilometre stones are located on the left-hand side of the road as one proceeds from the station from which the Kilometre count starts. On divided roads with a central median, kilometre stones should be provided at the left on both sides of the road i.e., independently for each direction of travel. Kilometre stones shall be fixed at right angles to the centre line of the carriageway.

3.5.5.4 200 m Stones and Boundary Stones

The details of 200m stones and boundary stones conform to IRC: 26-1967 and IRC: 25-1967 respectively. 200m stones are located on the same side of the road as the kilometre stones. The inscription on the stones shall be the numerals 2,4,6 and 8 marked in an ascending order in the direction of increasing kilometerage away from the starting station. The numerals shall be 80mm high. The colour of the numerals shall be black on a white background. Boundary stones shall be located on either side of the road opposite every 200m stone and kilometre stone. In addition, these shall be fixed at all angular points of the boundary. Where the boundary is on a curve or the land is of significant value and likely to be encroached upon, the boundary stones, as required, shall be installed at closer intervals.

3.5.5.5 Crash Barrier

Metal Beam Crash Barrier is proposed at locations where the embankment height is more than 3.0m, at horizontal curves of radius less than 230m and also at major bridge approaches.

3.5.5.6 Rumble Strips

The Road Humps are formed by providing a rounded hump of 3.7m width (17m radius) and 0.15m height for the preferred advisory crossing speed of 25kmph for general traffic as per the IRC: 99–1988 guidelines. The basic material for construction is open premix bituminous surfacing on minor roads or perpendicular arms about 25m away from the inner edge of the carriageway. Proper signs boards and markings are provided to caution the drivers in advance of the situation. Road humps are extended across carriageway up to the edge of paved shoulder.

Rumble Strips are formed by a sequence of transverse strips laid across a carriageway. Maximum permitted height of 15mm provided no vertical face exceeds 6mm. These rumble devices produce audible and vibratory effects to alert drivers to take greater care and do not normally reduce traffic speeds in themselves. The typical design details of rumble strips proposed are transverse strips of open premix bituminous surfacing 500mm wide and overall thickness 15mm laid across a carriageway up to the end of paved shoulder. There will be 6 such transverse strips spaced at 1.0m c/c. Rumble strips are proposed in advance of:

- Sharp curves with radius less than 170m.
- Transition zones (speed limit zones).
- Village/urban approaches.

Proper sign boards and marking are proposed to advise the drivers in advance of the situation.

3.5.6 Wayside Amenities

Wayside Amenities like Bus Shelters, Bus Bays are provided as mentioned in **Table 9**, Solar Street Lights are proposed at Major & Minor Junctions. Overhead Gantry is proposed at start and end of the project road and Cantilever Gantry are proposed at all the Major Junctions.

Table 9: Bus Bay & Bus Shelter Details

Sr. No.	Location	Existing Chainage		Design Chainage		Remarks
		Left	Right	Left	Right	
1	Moran Town	0+941	1+041	0+950	1+050	Bus Bay
2	Ouphulia	14+600	14+883	13+300	13+580	Bus Shelter
3	Pithaguti	19+970	20+070	18+300	18+400	Bus Shelter
4	Rajgarh Town	26+473	28+350	24+800	26+675	Bus Bay
5	Rajgarh	28+995	29+095	27+320	27+420	Bus Shelter
6	Rajgarh	29+295	29+395	27+620	27+720	Bus Shelter
7	Tingkhong No.3	35+283	34+883	33+600	33+200	Bus Shelter
8	Tingkhong	37+385	37+485	35+700	35+800	Bus Bay
9	Teenali T.E.	40+764	41+150	38+950	39+350	Bus Shelter
10	Teenali T.E.	43+225	43+325	41+425	41+525	Bus Shelter
11	Konwarigaon	44+600	44+650	42+800	42+850	Bus Shelter

Source: Detailed Project Report

3.5.7 Improvement Proposal for Cross Drainage Structure

Inventory details of existing cross drainage (CD) structures in all the stretches of the project road have been collected during the site visit. 1 Slab culvert along the project road will be replaced with a minor bridge as shown in **Table 10**. No new culverts have been proposed along the entire stretch of road. 5 minor bridges were observed along the project road

which will be retained with minor repairs as shown in **Table 11**. There are 55 culverts along the project road out of which will be reconstructed and 10 will be realigned to box culverts as shown in **Table 12**.

Table 10: Improvement Proposal for New Bridges

Sr. No.	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Vent way (No. x Length)	Width of Culvert (m)	Improvement Proposal		Remark
					Type	Size	
1	5+103	Slab Culvert	1 x 6	8.20	MNB	1 x 10	Reconstruction

Source: Detailed Project Report

Table 11: Improvement Proposal for Existing Bridge

Sr. No.	Design Chainage	Name of River / Bridge	Total Length of Bridge	Span Arrangements	Structure type	Bridge Type	Improvement Proposal
1	3+891	Local Nallah	6.4 m	2 X 3.2	Box Type	Minor Bridge	Box MNB 2 x 3.5 x 2
2	15+096	Dickson river	31.6 m	1 X 31.6	Girder & Slab	Minor Bridge	Retained with repairs
3	17+598	Local Nallah	32.4 m	1 X 32.	Girder & Slab	Minor Bridge	MNB (1 x 48) on new Alignment
4	33+296	Local Nallah	18.7 m	1 X 18.7	Girder & Slab	Minor Bridge	Retained with repairs
5	35+928	Local Nallah	6.3 m	2 X 3.15	Box Type	Minor Bridge	Box MNB (2 x 3.5 x 2.5)

Source: Detailed Project Report

Table 12: Improvement Proposal for Existing Culverts

Sr. No.	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Vent way (No. x Length) (m)	Width of Culvert (m)	Improvement Proposal		Remark
					Type	Size	
1	6+358	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.5	Reconstruction
2	8+650	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.75	Realigned
3	8+900	Box Culvert	1 x 2	12.00	Box	1 x 2.00 x 2.5	Realigned

Sr. No.	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Vent way (No. x Length) (m)	Width of Culvert (m)	Improvement Proposal		Remark
					Type	Size	
					Culvert		
4	9+150	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.5	Realigned
5	9+420	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.5	Realigned
6	9+714	Slab Culvert	1 x 4	12.00	Box Culvert	1 x 4.00 x 2.25	Realigned
7	9+796	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.25	Reconstruction
8	10+842	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2	Reconstruction
9	11+600	Slab Culvert	1 x 3	8.10	Box Culvert	1 x 3.00 x 3.5	Reconstruction
10	11+756	Slab Culvert	1 x 6	8.00	Box Culvert	1 x 6.00 x 3.5	Reconstruction
11	12+098	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.25	Reconstruction
12	13+150	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 1.5	Reconstruction
13	13+537	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.75	Reconstruction
14	13+611	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.25	Reconstruction
15	15+525	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.75	Realigned
16	15+575	Box Culvert	1 x 2	12.00	Box Culvert	1 x 3.00 x 3	Realigned
17	15+873	Box Culvert	1 x 2	12.00	Box Culvert	1 x 3.00 x 3.5	Reconstruction
18	16+368	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2	Reconstruction
19	17+002	Box Culvert	1 x 2	12.00	Box Culvert	1 x 3.00 x 3.5	Reconstruction
20	18+491	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.75	Reconstruction
21	18+563	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2.75	Reconstruction
22	18+747	Box Culvert	1 x 2	12.00	Box Culvert	1 x 3.00 x 3	Reconstruction
23	20+675	Box Culvert	2 x 2.9	12.00	Box Culvert	2 x 3 x 2.5	Reconstruction
24	21+061	Box Culvert	1 x 1.7	12.10	Box	1 x 2.00 x 2	Reconstruction

Sr. No.	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Vent way (No. x Length) (m)	Width of Culvert (m)	Improvement Proposal		Remark
					Type	Size	
					Culvert		
25	22+918	Box Culvert	1 x 2	12.20	Box Culvert	1 x 2.00 x 2.5	Reconstruction
26	23+616	Box culvert	2 x 1.8	11.50	Box Culvert	1 x 4.00 x 2	Reconstruction
27	25+621	Box Culvert	1 x 3	7.40	Box Culvert	1 x 3.00 x 2	Reconstruction
28	26+536	Box Culvert	1 x 2	11.80	Box Culvert	1 x 2.00 x 1.5	Reconstruction
29	27+499	Box Culvert	1 x 3	12.00	Box Culvert	1 x 3.00 x 2	Reconstruction
30	28+035	Box Culvert	1 x 2	11.60	Box Culvert	1 x 2.00 x 2.5	Reconstruction
31	28+918	Box Culvert	1 x 3	7.90	Box Culvert	1 x 3.00 x 3.25	Reconstruction
32	28+928	Box Culvert	2 x 2	8.00	Box Culvert	1 x 4.00 x 3.25	Reconstruction
33	30+462	Box Culvert	2 x 2	11.40	Box Culvert	1 x 4.00 x 3.5	Reconstruction
34	31+061	Box Culvert	2 x 2	11.90	Box Culvert	1 x 4.00 x 2	Reconstruction
35	31+362	Box Culvert	1 x 2	11.60	Box Culvert	1 x 2.00 x 2.25	Reconstruction
36	32+448	Box Culvert	1 x 2	12.10	Box Culvert	1 x 2.00 x 2.5	Reconstruction
37	32+691	Box Culvert	1 x 2	12.10	Box Culvert	1 x 3.00 x 3.5	Reconstruction
38	34+437	Box Culvert	1 x 2	11.80	Box Culvert	1 x 2.00 x 2.75	Reconstruction
39	35+422	Box Culvert	1 x 2	12.10	Box Culvert	1 x 2.00 x 1.75	Reconstruction
40	36+540	Box Culvert	1 x 2	11.80	Box Culvert	1 x 2.00 x 1.75	Realigned
41	37+400	Skew Box Culvert	1 x 2	11.9\12	Box Culvert	1 x 2.00 x 2	Realigned
42	38+023	Box Culvert	1 x 2	12.10	Box Culvert	1 x 3.00 x 3.25	Reconstruction
43	38+444	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 1.75	Reconstruction
44	38+674	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2	Reconstruction
45	39+274	Box Culvert	1 x 2	12.20	Box	1 x 3.00 x 3.25	Reconstruction

Sr. No.	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Vent way (No. x Length) (m)	Width of Culvert (m)	Improvement Proposal		Remark
					Type	Size	
					Culvert		
46	39+906	Box Culvert	1 x 1.6	13.00	Box Culvert	1 x 2.00 x 1.5	Reconstruction
47	40+171	Box Culvert	1 x 1.8	12.00	Box Culvert	1 x 2.00 x 2	Reconstruction
48	40+419	Box Culvert	1 x 2	11.80	Box Culvert	1 x 2.00 x 2.5	Reconstruction
49	41+197	Box Culvert	1 x 1.9	11.90	Box Culvert	1 x 2.00 x 2.25	Reconstruction
50	41+300	Box Culvert	1 x 1.9	11.90	Box Culvert	1 x 2.50 x 3	Reconstruction
51	42+068	Box Culvert	1 x 2	12.10	Box Culvert	1 x 3.00 x 3.75	Reconstruction
52	43+779	Box Culvert	1 x 2	12.10	Box Culvert	1 x 2.00 x 2	Reconstruction
53	44+124	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 1.5	Reconstruction
54	44+767	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 1.5	Reconstruction
55	45+475	Box Culvert	2 x 2.5	12.30	Box Culvert	1 x 5.00 x 4	Realigned

Source: Detailed Project Report

The improvement proposal for existing ROB is as mention below.

Table 13: Improvement Proposal for ROB

Sr. No.	Design Chainage	Total Length of Bridge	Span Arrangements	Structure type	Bridge Type	Improvement Proposal
1	2+437	6.4 m	1 X 62	Steel truss slab	Major Bridge	Retained with repairs

Source: Detailed Project Report

3.6 Analysis of Alternatives

3.6.1 With and Without Project Scenario

With Project Scenario: The "with project" scenario includes the widening of the existing road section to two-lane carriageways with paved and earthen shoulder configuration. The "with project" scenario has been assessed to be economically viable and will alleviate the existing conditions. To avoid the large-scale acquisition of land and properties, the project envisages the widening of the existing road alignment to minimize the loss of properties and livelihood of the PAPs. It would thereby, contribute to the development goals envisaged by

the Government of India, and enhance the growth potential of the state as well as the project region.

Without Project Scenario: In the case of "without project" scenario, the existing road with single lane to intermediate carriageway width will be considered as it is. Considering the present traffic volume and potential for growth in the near future, the capacity of the present road is insufficient for handling expected traffic volume and calls in for immediate improvements.

The existing road section has poor riding conditions with poor drainage conditions and poor geometry. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to a failure to initiate any further improvements and impede economic development. Hence the "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be advantageous to achieve the all-around development of the economy and progress of the State.

3.6.2 Bypass and Realignment Proposal

The road passes through semi built-up and built-up areas for most of its length and some agricultural areas are observed as well. The existing road section has poor riding conditions with poor drainage and poor geometry which are seriously impacting and deteriorating the road surface. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Detailed analyses of the alternatives have been conducted taking into account both with and without project. The project road work involves improvement and up-gradation of the existing road. No alternate alignments were accessed for the Moran to Disang Kinar Bangali road. 7 realignment has been proposed in the entire project stretch. The realignments have been proposed to improve the geometric design of the road and to achieve the design speed. The project road will provide a better level of service in terms of improved riding quality and smooth traffic flow. It will facilitate access to different parts of the region and improve the economic status of the region. The improvement of the existing road section is considered to be the best possible alignment. The proposed strengthening of the road is likely to have a positive impact on the economic value of the region. However, there is a certain environmental and social issue, these need to be mitigated for sustainable development.

The details of the realignment proposals for the project road are presented in **Table 14.**

Table 14: Details of Realignment

Sr. No.	Start Point		End Point		Length of Bypass/ Realignment (m)	Justification for Realignment
	Place	Chainage	Place	Chainage		
1. Realignment no. 1						
Existing Alignment	Kekuri Sonowal	8+600	Kekuri Sonowal	11+250	2650	i. The realignment is necessary for the development of approaching minor junction. ii. Realignment undertaken for improvement in road geometry and removal of accidental spots formed due to presence of S-curves. iii. After Realignment, comparatively less number of trees will be cut.
New Alignment	Kekuri Sonowal	8+610	Kekuri Sonowal	9+965	1355	
2. Realignment no. 2						
Existing Alignment	Kekuri	12+650	Kekuri	13+000	350	i. Design speed with existing alignment would have been constricted to 20-30 kmph. However, with realignment, the design speed is increased to 80 kmph ii. Realignment undertaken for improvement in road geometry as several S-curves are present along the existing alignment.
New Alignment	Kekuri	11+360	Kekuri	11+705	345	
3. Realignment no. 3						
Existing Alignment	Ouphulia	16+700	Ouphulia	17+250	550	i. Design speed with existing alignment would have been constricted to 20-30 kmph. However, with realignment, the design speed is increased to 80 kmph ii. Realignment
New Alignment	Ouphulia	15+400	Ouphulia	15+855	455	

Sr. No.	Start Point		End Point		Length of Bypass/ Realignment (m)	Justification for Realignment
	Place	Chainage	Place	Chainage		
						undertaken for improvement in road geometry and removal of accidental spots formed due to presence of S-curves.
4. Realignment no. 4						
Existing Alignment	Ouphulia	17+700	Dirai T.E.	18+700	1000	i. Design speed with existing alignment would have been constricted to 20-30 kmph. However, with realignment, the design speed is increased to 80 kmph ii. Realignment undertaken for improvement in road geometry and removal of accidental spots formed due to presence of S-curves.
New Alignment	Ouphulia	16+305	Dirai T.E.	17+105	800	
5. Realignment no. 5						
Existing Alignment	Dirai T.E.	18+900	Dirai T.E.	19+750	850	i. The existing bridge along the project road has been abandoned as its improper approaches were leading to an accidental spot. ii. Realignment is proposed to match the approaches for a proposed new bridge.
New Alignment	Dirai T.E.	17+305	Dirai T.E.	18+080	775	
6. Realignment no. 6						
Existing Alignment	Tingkhong	38+000	Tingkhong	39+500	1500	i. As the existing alignment passes through a densely populated area, the project road construction would lead to demolition of several existing
New Alignment	Tingkhong	36+315	Tingkhong	37+685	1370	

Sr. No.	Start Point		End Point		Length of Bypass/ Realignment (m)	Justification for Realignment
	Place	Chainage	Place	Chainage		
						structures. Realignment is proposed in Greenfield area and thus very few existing structures will be affected. ii. Design speed with existing alignment would have been constricted to 30 kmph. However, with realignment, the design speed is increased to 80 kmph iii. Realignment undertaken for improvement in road geometry and removal of accidental spots. iv. After Realignment, comparatively less number of trees will be cut.
7. Realignment no. 7						
Existing Alignment	Achabam T.E.	47+050	Disang Kinar Bangali	47+700	650	i. Realignment undertaken for improvement in road geometry and removal of accidental spots. ii. Design speed with existing alignment would have been constricted to 20-30 kmph. However, with realignment, the design speed is increased to 80 kmph iii. Less R&R issues as the realignment passes through Greenfield.
New Alignment	Achabam T.E.	45+250	Disang Kinar Bangali	45+870	620	

Source: Detailed Project Report

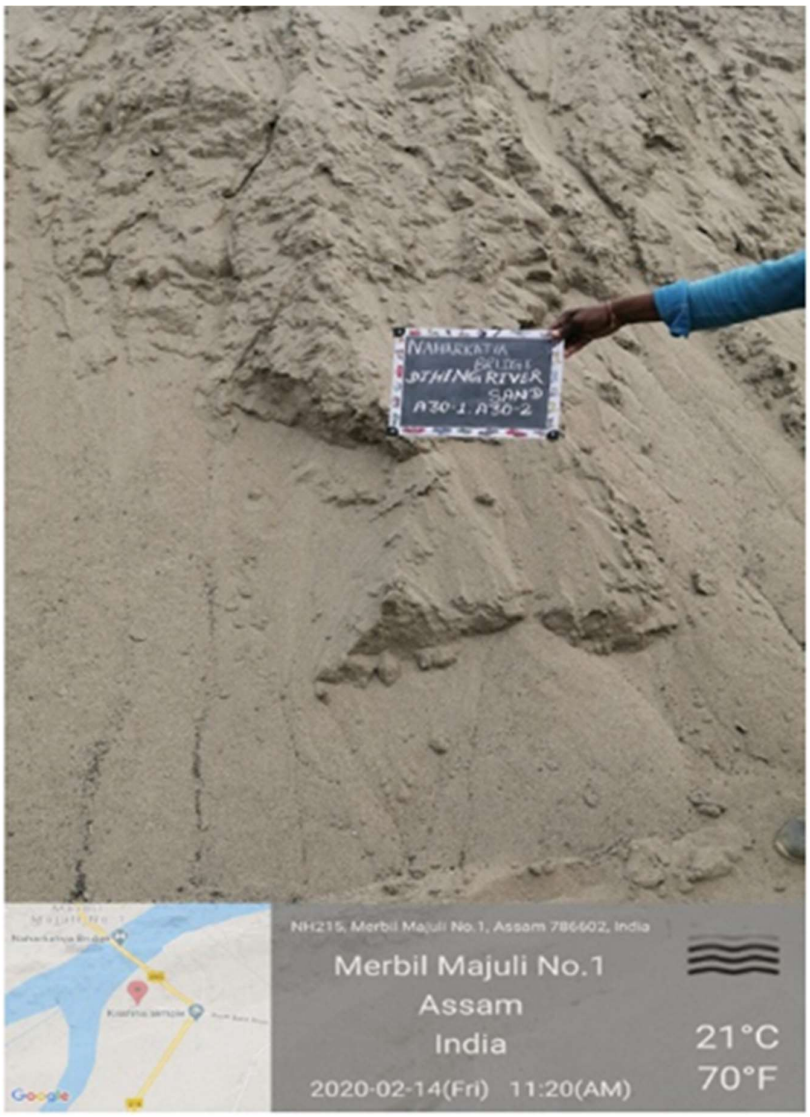
3.7 Construction Material and Source

3.7.1 Sand

The sand is found at Dihing River Sand which is at Chainage – 46+609 on the right-hand side with a Lead of 13.1Km. The sand available at this quarry location is classified to be Zone-III can be used for any construction works.

Table 15: Location of Sand Quarry Site

Location and name of quarry if any (correlated with map)	Specimen No.	Location		Side	Natural Sand				
		km	Cut/Fill Existing Road		Sieve Size (mm)	Wt. of materials Retained (g)	Cum. Wt. Of materials Retained (g)	Cum. % materials of Retained	% Passing
Dihing River Village Naharkatia Bridge	1	13		RHS	10 mm	0.0	0.00	0.00	100.00
					4.75 mm	12.8	12.80	1.16	98.84
					2.36 mm	45.1	57.90	5.26	94.74
					1.18 mm	88.3	146.20	13.29	86.71
					600 microns	135.6	281.80	25.62	74.38
					300 microns	351.2	633.00	60.55	39.45
					150 microns	458.1	1091.10	96.19	3.81
					Pan	8.9	1100.00	100.00	0.00
							Total	202.07	
					Fineness Modulus			2.02	



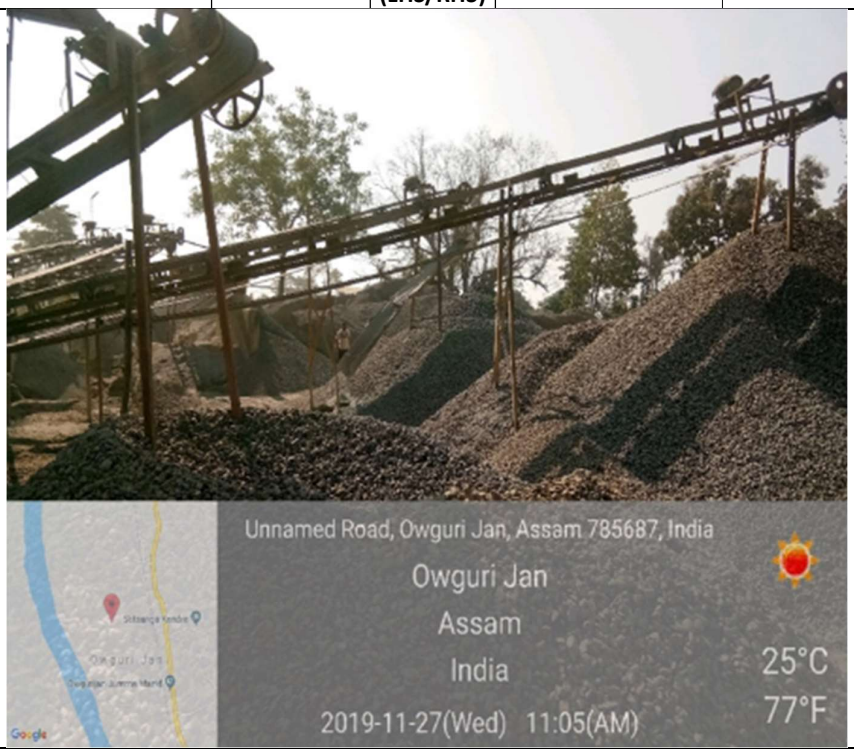
Source: Material Report

3.7.2 Aggregate

Stone quarries have been primarily identified as stone aggregate source for construction of various components of road, namely, Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Wet Mix Macadam (WMM) as well as for the cement concrete works. Investigation for the stone quarries is done based on the existing licensed quarries authorized by government agency.

Table 16: Details of Quarry Material Sources along the Project Corridor

Sr. No.	Location	Ref. Chainage	Side of Road (LHS/RHS)	Distance from Existing Road (Km)	Type of Material Available
1	Bihubor	21+000	LHS	61+000	20mm, 10mm

Sr. No.	Location	Ref. Chainage	Side of Road (LHS/RHS)	Distance from Existing Road (Km)	Type of Material Available
					

Source: Material Report

3.7.3 Borrow Earth

The borrow earth selected for embankment construction comprises primarily classified as CS according to I.S. classification. The maximum dry unit (Heavy compaction) observed as 19.60 gm/cc satisfying the MoRTH requirements for embankment soil.

Table 17: Details of Source and Quantity of Borrow Earth

Sr. No.	Borrow area Number	Borrow area name village	Location	Lead	Area available for borrow material in sq.m	Suitability for embankment/ subgrade	Available quantity in Approx cum.
1	BA-1	Near Raidangia Gaon	27.200578N, 94.93556E	100M	6476	Suitable for subgrade and embankment	3238
2	BA-2	Tenga Pani	27.268798N, 94.98978E	4.5KM	2523	Suitable for subgrade and embankment	3784
3	BA-3	No.22	27.2395178N, 94.9800343E	1KM	14798	Suitable for subgrade and embankment	8500
4	BA-4	Ouphulia,	27.212447N ,95.017773E	50M	54860	Suitable for subgrade and embankment	32000

Sr. No.	Borrow area Number	Borrow area name village	Location	Lead	Area available for borrow material in sq.m	Suitability for embankment/ subgrade	Available quantity in Approx cum.
5	BA-5	Deroi	27.20069N, 95.028332E	50M	11352	Suitable for subgrade and embankment	8000
6	BA-6	Deroi T. E.,	27.176893N, 95.046554E	200M	16179	Suitable for subgrade and embankment	7300
7	BA-7	Deroi No. 57 Darkhastar,	27.170955N, 95.049168E	300M	11514	Suitable for subgrade and embankment	6500
8	BA-8	Mohkhowa,	27.187775N, 95.083818E	1.0KM	1528	Suitable for subgrade and embankment	1000
9	BA-9	Azizbag T.E	27.204338N, 95.132538E	1.6KM	3046	Suitable for subgrade and embankment	1500
10	BA-10	Nilmoni	27.2015529N, 95.1454566E	1KM	2227	Suitable for subgrade and embankment	1200
11	BA-11	Sapekhati	27.198035N, 95.156038E	100M	14605	Suitable for subgrade and embankment	8000
12	BA-12	Rai Dangia,	27.226115N ,95.184003E	1.7KM	26063	Suitable for subgrade and embankment	18000
13	BA-13	Latumoni	27.246508N, 95.16846E	200M	8225	Suitable for subgrade and embankment	4000
14	BA-14	Shukhan Pather	27.26058N, 95.187677E	100M	16227	Suitable for subgrade and embankment	7500
15	BA-15	Konwari Gaon	27.262352N, 95.220852E	500M	13759	Suitable for subgrade and embankment	8000
16	BA-16	Bamunbari	27.2495480, 94.989819	2.1KM	158149	Suitable for subgrade and embankment	80000

Source: Material Report

3.7.4 Water Requirement

Location of water sources for the use in concrete works and for construction of road works have been identified in the vicinity of project road. Along the project road, streams/Nalas are in close proximity to some points of the alignment and cross the alignment at suitable intervals. However, to facilitate construction works it is always advisable to install deep tube wells at suitable places for obtaining water for construction purposes.

3.7.5 Materials Requirement

Total quantity of important materials required for the construction of the project is given in **Table 18**.

Table 18: Estimated Quantities of Materials for Project

Sr. No.	Material Type	Unit	Summary of Quantities
1	Embankment	Cum	518597
2	Sub-grade	Cum	267430
3	Shoulder	Cum	103095
4	WMM	Cum	125224
5	Granular Sub-base	Cum	139708

3.8 Construction Camps

Construction camp will be set up by the contractor at a suitable location along the project corridor which will be in consultation with the Project Director and Pollution Control Board Assam. As the Contractor is required to source labour from the local communities along the subproject road, the size of the construction camps will be relatively small. It is the responsibility of the Contractors to maintain a hygienic camp with adequate water and electric supply; toilet facilities should be located away from the water bodies and wells; proper disposability of domestic refuse; temporary medical facilities; pest control; clean and adequate food; and social security.

3.9 Manpower Requirement

The proposed project will involve 200 un-skilled, 200 semi-skilled, 200 skilled and 200 highly skilled labours.

3.10 Land requirement

The total land to be acquired is 176.71 acre, out of which 100.22 acre (56.71%) is government land; 68.15 acre (38.57%) is private land, while ownership status of remaining 8.33 acre (4.71%) land is yet to be established, as the revenue records are not available for these stretches. **Table 16** shows the land to be acquired for the proposed project.

Table 19: Proposed Land Acquisition

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Moran Town	Revenue Circle: Mohmora	0.61	0.00	1.88	2.49
2 No. Horu Pathar		0.00	0.00	1.58	1.58

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Amguri Gaon	& District: Charaideo	0.00	0.10	0.03	0.13
Dumar Dolong Gaon		2.34	0.00	0.00	2.34
Majpathar Gaon		0.00	0.00	3.55	3.55
Moran Nagar	Revenue Circle: Moran & District: Dibrugarh	0.05	0.00	0.77	0.81
Abhoipuria Bongali		0.00	0.00	2.46	2.46
Phatkachowa Nepali		0.53	0.00	3.41	3.94
Raidonga Gaon		0.34	0.00	2.45	2.78
Raidangia sheet Grazing		0.00	0.54	4.22	4.76
Domradalang No. 4		0.26	0.00	0.34	0.59
Domradalang No. 1		0.58	0.00	0.23	0.81
Teloijan Gaon 2nd Khanda		0.47	1.03	0.03	1.53
Teloijan Darkhsta No. 25		3.01	0.00	0.02	3.03
Teloijan Darkhasta No 26		0.00	0.00	1.39	1.39
Bamunbari T. E. 323 No. NLR Grant		1.12	0.00	0.01	1.13
Kaowimari No 2	Revenue Circle: Tingkhong & District: Dibrugarh	0.60	0.00	2.63	3.23
Kekuri Bangali		2.79	0.10	1.55	4.44
Kekuri Sonowal		2.50	0.00	2.06	4.57
2 No. Kekuri		0.02	0.00	1.44	1.46
2 No. Dighalia		2.03	0.00	4.70	6.73
Diroi Ali Kinar Gaon		0.09	0.00	1.66	1.74
Ouphulia		1.41	0.00	2.15	3.56
Diksam Block		0.61	0.00	2.30	2.90

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Diksom Kinar		0.00	0.00	2.73	2.73
Deroi T.E 3 No. Darkhasta		0.00	0.00	1.82	1.82
Deroi T.E. 8 No. Darkhasta		6.61	0.05	1.35	8.01
Deroi T.E. 5 No. Darkhasta		1.76	4.70	0.55	7.01
2 Line NH Test Map		1.67	1.22	9.54	12.43
Longboi T.E.24 No. Darkhasta		1.21	0.10	1.57	2.88
Rajgarh T. E. 332 NLR Grant		0.00	0.00	0.99	0.99
Nabhakatia Gaon		0.43	0.00	3.23	3.67
RajgarhT.E.22 No. Darkhasta		0.98	0.01	3.72	4.70
Karangani T. E. 18 No.	**Revenue Circle: Tingkhong & District: Dibrugarh**	0.23	0.00	0.24	0.47
Karangani T. E. 340 No.		2.08	0.06	0.00	2.14
Sorujoni T.E.19 Darkhasta		2.66	0.00	2.21	4.87
Nilomoni T.E 15-55-79 Grant		0.04	0.00	3.68	3.73
1 No. Sapkait		0.47	0.00	5.07	5.55
Nilomoni T.E 84 No.		0.20	0.00	1.05	1.25
2 No. Sapkait		0.25	0.00	0.05	0.30
Tingkhong T.E No. 3 RR Grant		12.57	0.00	0.10	12.68
96 No. Kachalu Pathar		0.00	0.00	0.09	0.09
Purani Sripuria		0.79	0.21	1.75	2.75

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Latumoni Gaon		3.76	0.00	1.51	5.27
Bailung bheti gaon		0.00	0.00	0.07	0.07
Teenali T.E 275-299 Grant		3.49	0.00	0.02	3.52
Teenali T.E 19-11,15-16 grant		2.94	0.00	3.60	6.53
Sukan Pathar		0.90	0.00	3.51	4.41
Pulungoni		0.42	0.05	0.07	0.54
Purani Konwari		0.60	0.00	3.00	3.60
Borpathar No.1		0.00	0.00	0.75	0.75
2 No. Ghuronia	**Revenue Circle: Naharkatiy & District: Dibrugarh**	0.00	0.00	1.20	1.20
Jamguri Konwari Gaon		0.26	0.00	2.27	2.53
Naharani		1.53	0.00	3.34	4.87
Desam T.E 184 grant		0.32	0.16	0.00	0.49
Achabam T.E		0.00	0.00	0.11	0.11
Disang Kinar Bangali		2.62	0.00	0.16	2.79
Total		**68.15**	**8.33**	**100.22**	**176.71**

Source: Social Impact Assessment Report

3.11 Project Cost

The estimated total project cost is approximately **INR 3,373,713,214**. The per kilometre cost of the project road is **INR 72,400,387.**

Source: Cost Estimate

3.12 Implementation Schedule

The project construction period will be **30 months** for the project-road. The concessionaire will be recruited for the construction and maintenance related works.

3.13 Sub-Project Benefits

The following are the expected benefits due to the improvement in the sub-project road:

- The project road would facilitate better access to the residents of the nearby villages to the railway station in Moranhat town.
- The project road would provide better access to urban areas and market places along project road such as Moranhat town, Teloikinar Bongali, and Rajgarh.
- Better level of service in terms of improved riding quality and smooth traffic flow.
- Faster transportation will ultimately lead to massive savings in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs), and total reduction in transportation costs, etc.
- With the improvement of the road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced.
- Increased road landscaping and safety features.
- Enhanced connectivity between rural & urban populations which will benefit all sections of the society like the general population, small-medium-large scale industries, farmers, businessmen, etc.
- Improved access to higher education facilities & modern health facilities.
- Strengthening both rural & urban economies which in turn will improve the economic scenario of the state and country.
- Improved road connectivity helps in better implementation and management of government schemes.
- With the improvement in the economy, more generation of employment opportunities.
- Overall Environment and social improvement of the region.

4. Description of the Environment

4.1 Introduction

To assess the impacts of the proposed improvement to the subproject road, field visits were undertaken to understand the environmental profile of the project influence area. This involved field inspections at all the sensitive locations, collection of secondary information for all the environmental components, and discussions with the officials and local populace. The profile presented below comprises of the following:

- Physical environmental components such as meteorology, geology, topography, soil characteristics, ambient air quality, noise levels, surface, and sub-surface water quality.
- Biological environmental components such as aquatic, biotic and marine flora, fauna and mammals, and
- The land environment in terms of land use, soil composition.
- Socio-economic environment in terms of demography, education, and health infrastructure.

4.1.1 Data Collection Methodology

4.1.1.1 Ambient Air Quality

Baseline data for the parameters - particulate matter size less than 10µm or PM_{10} µg/m^3, particulate matter size less than 2.5µm or $PM_{2.5}$ µg/m^3, sulphur dioxide (µg/m^3), nitrogen dioxide (µg/m^3) and carbon monoxide (µg/m^3) in the study has been generated for 24 hours for one season other than monsoon as per CPCB norms. While selecting the monitoring locations specific importance has to be given where ever sensitive environmental receptors and habitation exist.

4.1.1.2 Noise Levels

While selecting the monitoring locations specific importance has given to sensitive environmental receptors like thickly populated areas, hospitals, schools, etc. Hourly monitoring of noise levels (Leq) has been recorded for 24 hours by using an integrated noise meter. The results obtained are compared with Noise standards designated for different types of land use, i.e. residential, commercial, industrial areas, and silence zones as per the Noise Pollution (Regulation and Control) Rules 2000.

4.1.1.3 Water Quality

The monitoring of surface water and groundwater within the study area has been done. The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods given in the manual of the American Public Health Association for the Examination of Water and Wastewater (APHA).

4.1.1.4 Soil

The suggested parameters for soil analysis are pH, Electrical conductivity, sand (%), silt (%), clay (%), texture, moisture retention capacity (%), infiltration rate (mm/hour), bulk density

(gm/cc), porosity (%), organic matter (%), nitrogen (mg/1000g), potassium (mg/1000g), phosphorous (mg/1000g), sulphates and sodium sulphates.

4.1.1.5 Flora & Fauna

The data for flora and fauna in the project region were collected by conducting site survey, field observations and secondary data from forest department and other relevant sources. Tree Inventory was conducted for identification of tree species within the proposed right of way. For identification of fauna in the study region, field observations were conducted and the Divisional Forest Office having jurisdiction of the project region were consulted.

4.2 Physical Environment

4.2.1 Physiography and Soil Type

Buridihing, a tributary of Brahmaputra divides the district from east-to-west. Buridihing flows through Naharkatia and Khowang, and at a later stage in its course, Buridihing acts as a divider between Dibrugarh and Sivasagar districts. The region is flat with a gradual slope from the East Arunachal hills to the west. It is the gateway to the three tea-producing districts of Tinsukia, Dibrugarh, and Sivasagar. These three areas account for approximately 50% of India's Assam tea crop and this gives Dibrugarh its rightly earned sobriquet as the "Tea City of India". Oil and Timber are the other two big industries in and around Dibrugarh. It is a broad plain and rises to the foothills of the Arunachal Pradesh in the south. Apart from an outlying spur of the Naga Hills stretches from the Disang river through the south of the Joypur and the Tipling ranges and a few isolated hills in the Buri Dihing mauzas, there is nothing to break the even level of the plain. The extensible plain of the district which is fairly high and fertile is covered with fields of waving paddy which changes from vivid green luster into a rich gold as the harvest time draws near or with stiff bushy tea bushes that spread over like a dark green carpet. Villages are encircled by groves of slender palms, broad-leaved plantains, feathery bamboos, and juicy fruit trees.

The soil of the district is fertile, acidic, and alluvial. Acidic phosphorous are good for tea cultivation. On the other hand, heavy clays with a high percentage of nitrogen in low lying areas of the district give a better yield of rice. Abundant rainfall and high humidity throughout the year favor the cultivation of tea and rice in the district.

Source: District Census Handbook, Dibrugarh District

The details of soil sample collection are given in **Table 20** and **Figure 6**.

Table 20: Soil sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates	
				Latitude	Longitude
1	18-Jan-2020	Moranhat Town	15m/ North	27.192552	94.925491
2	18-Jan-2020	Deroi Alikinor	60m/ West	27.201296	95.027693
3	18-Jan-2020	No. 8 Darkhastor	80m/ West	27.180973	95.034821

Source: Environmental Baseline Monitoring

Figure 6: Soil sampling locations along the project road

The soil quality along the project road is given in the below **Table 21**. The soil map of India showing the project road is shown in **Figure 10**.

Table 21: Soil Quality along the Project road

Sr. No.	Parameters	Test Method	Unit	Moranhat Town	Deroi Alikinor	No. 8 Darkhastor	Standards/Permissible Limits (Handbook of Agriculture, ICAR, New Delhi)
1.	pH (1:5 suspension)	IS:2720 (Part-26)	-	6.42	6.56	6.66	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 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 8.51-9.00 Strongly alkaline >9.00 Very strongly alkaline
2.	Electrical Conductivity at 25OC (1:5 suspension.)	IS:2720 (Part-21)	µmhos/cm	53	57	52	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 Harmful to crops (sensitive to salts)
3.	Porosity	STP/SOIL	% by mass	24.28	21.24	24.27	-
4.	Texture	STP/SOIL	-	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	-
5.	Sand	STP/SOIL	% by mass	48.91	48.32	49.25	-
6.	Clay	STP/SOIL	% by mass	43.74	43.36	42.56	-
7.	Silt	STP/SOIL	% by mass	7.35	8.32	8.19	-
8.	Nitrogen	STP/SOIL	mg/1000g	1790	1860	1870	Upto 50 Very less 51-100 Less 101-150 Good 151-300 Better >300 Sufficient
9.	Potassium (as K)	STP/SOIL	mg/1000g	85.82	82.35	84.29	Upto 15 Very less 16-30 Less 31-50 Medium, 51-65 On an avg. sufficient 66-80 Sufficient >80 More than sufficient
10.	Phosphorus	STP/SOIL	mg/1000g	<5.0	<5.0	<5.0	0 -120 Very less 120-180 Less 181-240 Medium 241-300 Average 301-360 Better >360 More than sufficient
11.	Organic Matter	IS:2720 (Part-22)	% by mass	0.84	0.87	0.74	Upto 0.20: Very less 0.21-0.40: Less 0.41-0.50: Medium, 0.51-0.80: On an avg. sufficient 0.81-1.00: Sufficient >1.00 : More than sufficient
12.	Moisture Retention	STP/SOIL	% by mass	36.2	35.32	35.2	-

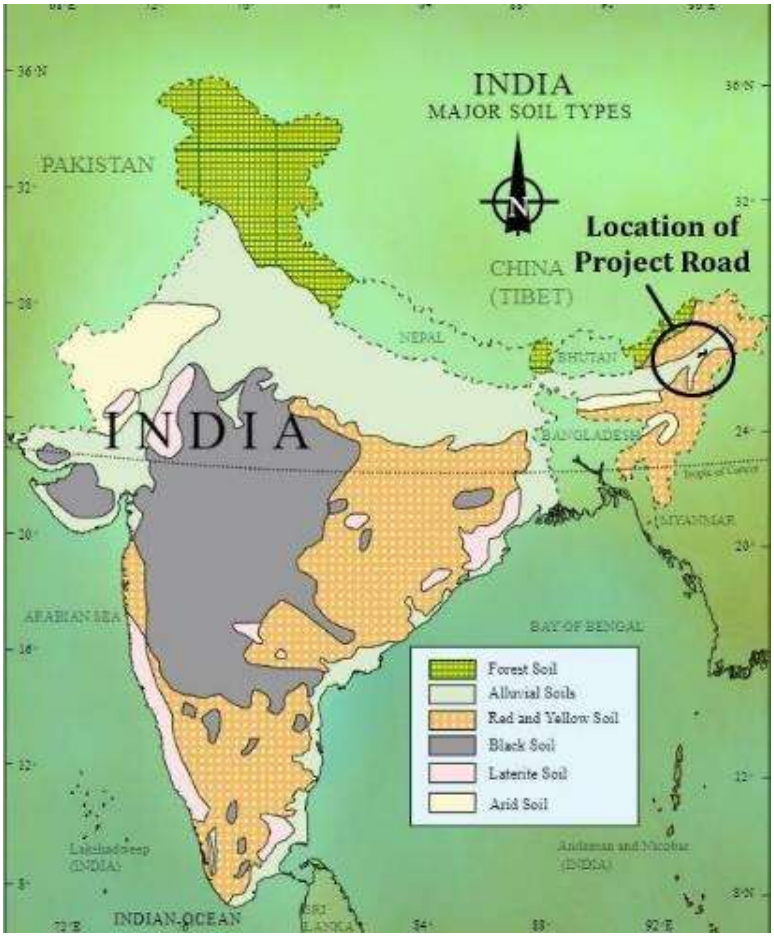
Sr. No.	Parameters	Test Method	Unit	Moranhat Town	Deroi Alikinor	No. 8 Darkhastor	Standards/Permissible Limits (Handbook of Agriculture, ICAR, New Delhi)
	capacity						
13.	Infiltration Rate	STP/SOIL	mm/hr	241	241	249	-
14.	Sulphates	STP/SOIL	mg/100gm	23.25	23.48	22.14	-
15.	Sodium Sulphates	STP/SOIL	mg/1000g	13.85	13.54	13.24	-
16.	Calcium Sulphates	STP/SOIL	mg/1000g	8.74	8.45	9.36	-
17.	Bulk Density	STP/SOIL	gm/cm3	1.25	1.17	1.17	-

Source: Environmental Baseline Monitoring

Figure 7: Soil Sample Collection at Moranhat Town

Figure 8: Soil Sample Collection at Deroi Alikinor

Figure 9: Soil Sample Collection at No. 8 Darkhastor



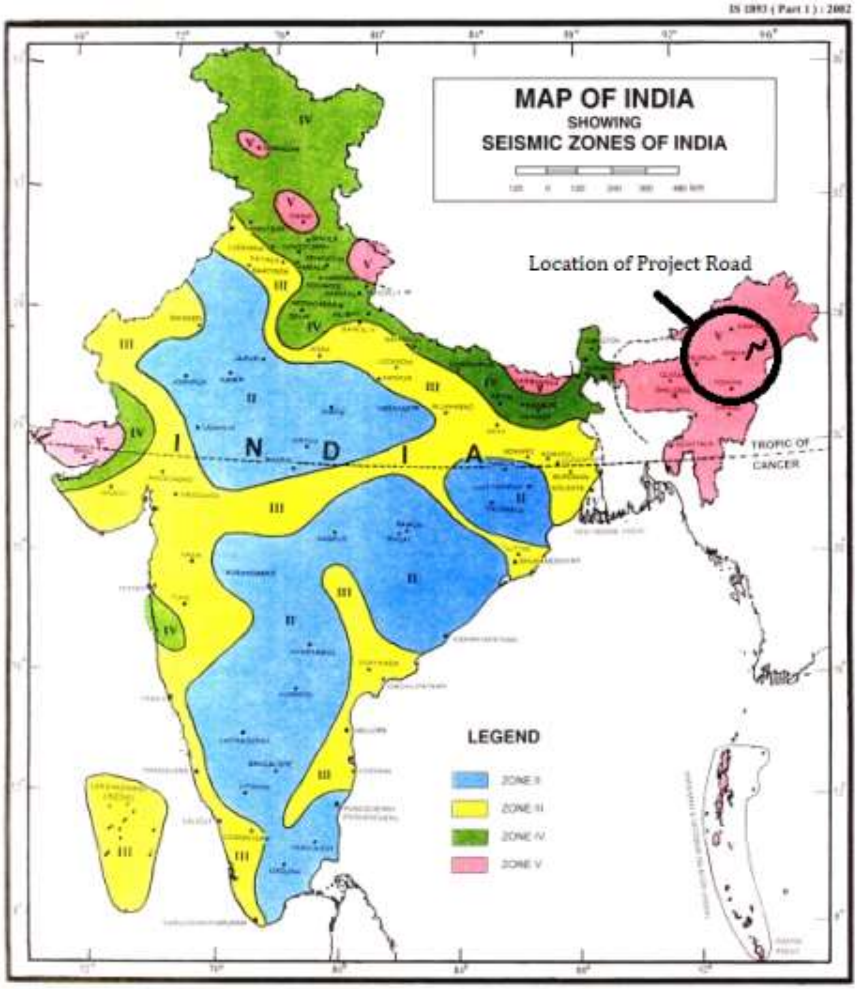
Source: Website of National Repository of Open Educational Resources

Figure 10: Soil Map of India showing the project road

As per the soil map of India, the soil found in the state of Assam is Alluvial soil. Soil is mostly found as sandy clay loam soil in the sampling locations and it is loaded with a sand percentage varying from 48.32% to 49.25% at Deroi Alikinor and No. 8 Darkhastor respectively. Nitrogen content varies from 1790 mg/1000g to 1870 mg/1000g at Moranhat town and No. 8 Darkhastor respectively. The soil is poor in organic carbon content. Chemically soil along the project road has a neutral pH in the range of 6.42 to 6.66. The soil has less water holding capacity.

4.2.2 Seismicity

Geomorphologically, NE India is located in an earthquake-prone zone (zone V) of the Indian subcontinent. In this region, an earthquake comes with land sliding flood and along with a series of smaller magnitude earthquakes. In the project district earthquakes of up to MM intensity IX can be expected. According to a hazard map by the Global Seismic Hazard Assessment Programme, the state can expect to have a peak gravitational acceleration (PGA) of 0.24g to 0.48g. The region where the highest PGA can be expected is along the state's border with Meghalaya, the site of the Great Indian earthquake of 1897. The seismic zone map of India showing the project road is shown in the below **Figure 11**.



Source: IS1893 (Part1) 2002

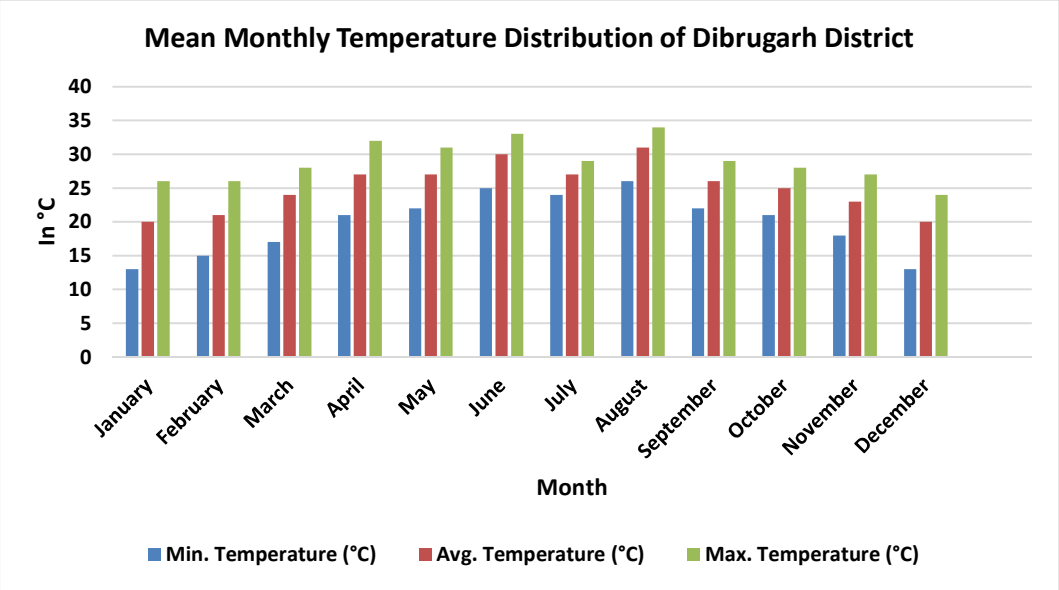
Figure 11: Seismic Zone Map of India showing the project road

4.2.3 Climate

As the entire road stretch passes through Dibrugarh district, information related to climate is studied for Dibrugarh district.

4.2.3.1 Annual Temperature

The coldest month is January, with an average high-temperature of 22.8°C (73°F) and an average low-temperature of 9.2°C (48.6°F). The warmest month in Dibrugarh is August, with an average high-temperature of 31.8°C (89.2°F) and an average low-temperature of 24.9°C (76.8°F). November is the month with the least rainfall. Rain falls for 1.8 days and accumulates 16.4mm (0.6") of precipitation. **Figure 12** represents the Mean monthly Temperature Distribution in the Dibrugarh district for 2019.

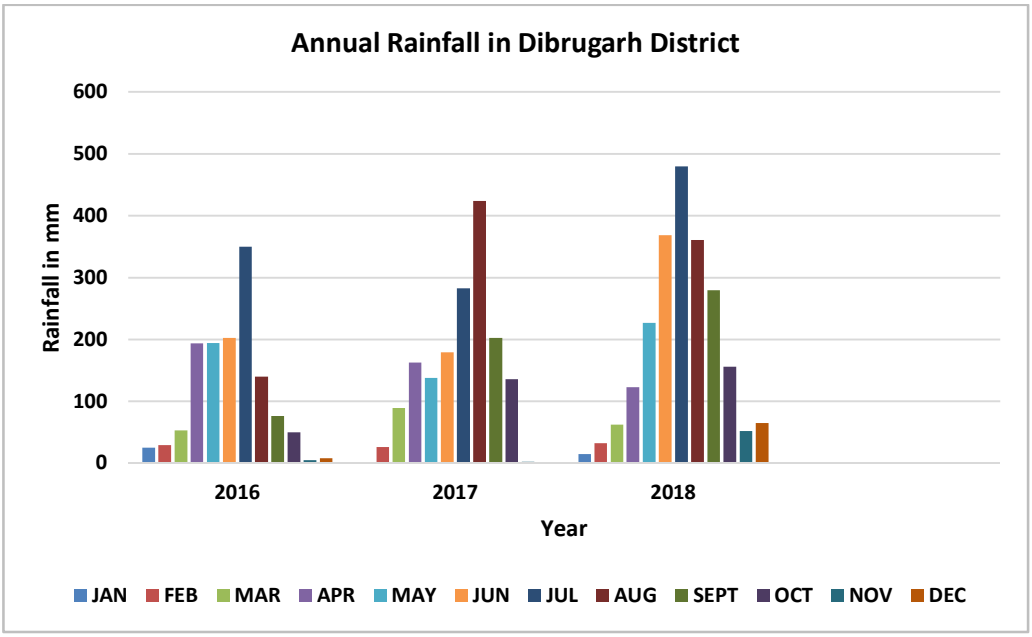


Source: www.worldweatheronline.com

Figure 12: Mean Monthly Temperature Distribution details

4.2.3.2 Annual Rainfall

The rainfall is recorded as 3603.5 mm as against the state total rainfall of 2296.3 mm. The highest rainfall 463.4 mm is recorded in April and July 2011 in the district. The lowest rainfall of 20 is recorded in December. **Figure 13** depicts the details related to the Annual Mean Rainfall received by Dibrugarh district from 2016 to 2018.



*Source: India Meteorological Department website (*www.imd.gov.in*)*

Figure 13: Annual Rainfall details

4.2.4 Wind speed/Direction

Generally, light to moderate winds prevails throughout the year with speed ranging from 1 to 19 kmph. Winds were light and moderate particularly during the morning hours, while during the afternoon hours the winds were stronger. The wind rose diagram developed during January 2020 is shown in **Figure 14** which reveals that pre-dominant wind direction occurs mostly blowing from the North-East direction in Dibrugarh IMD station (Nearest IMD from the project road) and the average wind speed is 2.4 m/s. **Table 22** shows the Meteorological Data Parameters at Dibrugarh IMD station, Nearest IMD from the project road (during January 2020).

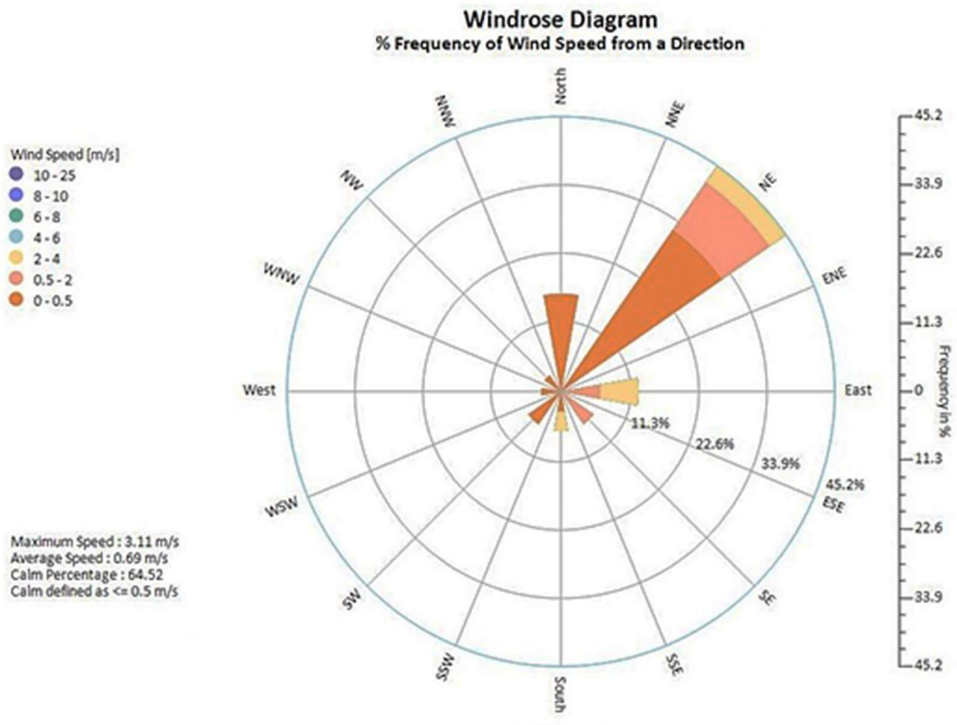


Figure 14: Wind rose diagram of Dibrugarh district (Nearest IMD station from the project road)

Table 22: Meteorological Data Parameters at Dibrugarh (Nearest IMD from the project road)

Month	Temperature, deg C			Humidity, %			Pressure, hPa			Wind Speed, km/Hr	Predominant Wind Direction	Rainfall mm
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Avg		
January	6.4	26.9	16.2	72	83	77.2	1002.3	1006.5	1004.2	2.4	NE	28.1

Source: www.imd.gov.in; Met Station: Dibrugarh

4.2.5 Hydrogeology

Hydrogeologically the project state can be divided into three units namely consolidated formation, semi consolidated formation, and unconsolidated formation. More than 75% of the project state is underlain by unconsolidated formation comprising of clay, silt, sand, gravel, pebble, and boulders. The Bhabar belt is about 11 to 15 km wide; the tube wells yield 27 to 59 m^3/hr in this zone. The Tarai zone follows immediately downslope of the Bhabar zone where the yield of the well's ranges between 80-240 m^3/hr. The flood plains follow the Tarai in Brahmaputra valley where the shallow tube wells yield between 20-50 m3/hr and deep tube wells between 150-240 m^3/hr. In the semi consolidated formations of the Cachar

district, the yield of the tube well ranges between 50 to 100 m^3/hr. The details of the hydrogeology have been presented in **Table 23** below.

Table 23: Details of Hydrogeology in project state

Dynamic Ground Water Resources	
Annual Replenishable Groundwater Resource	27.23 BCM
Net Annual Ground-Water Availability	24.89 BCM
Annual Ground Water Draft	5.44 BCM
Stage of Ground Water Development	22%
Ground Water Development & Management	
Over Exploited	NIL
Critical	NIL
Semi-critical	NIL
Artificial Recharge to Ground Water (AR)	• Feasible AR structures 250 Check Dams. 500 weirs, 1000 Gabion structures, 250 development of springs 600 RWH in Urban Areas
Ground Water Quality Problems	
Contaminants	**Districts affected (in part)**
Fluoride (>1.5 mg/l)	Goalpapra, Kamrup, Karbi Anglong, Nagaon
Iron (>1.0 mg/l)	Cachar, Darrang, Dhemaji, Dhubri, Goalpapra, Golaghat, Hailakandi, Jorhat, Kamrup, Karbi Anglong, Karunganj, Kokrajhar, Lakhimipur, Morigaon, Nagaon, Nalbari, Sibsagar, Sonitpur.
Arsenic (>0.05 mg/l	Dhemaji

Source: http://cgwb.gov.in

4.2.6 Water Quality

The objectives behind the monitoring are to develop an overall picture of the ground and surface water quality of the project district. The sampling of ground and surface water was carried out in January 2020 (winter period). The water samples after collection were immediately subjected to the analysis of various parameters in the NABL Accredited laboratory. The parameters analyzed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO_3), and Fluoride (F). The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods given in the manual of the American Public Health Association for the Examination of Water and Wastewater (APHA). The groundwater quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks.

In the study area, two surface and three ground water samples were collected for winter season (January 2020). These samples were taken as grab samples and were analyzed for various parameters to compare with the standards. The details of sample collection for Groundwater and Surface water are given in **Table 24** and **Table 25** respectively**.** The ground

and surface water quality result of the project road is given in the following **Table 26** and **Table 27**.

Table 24: Groundwater sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Source of Sample Collection	Coordinates	
					Latitude	Longitude
1	18-Jan-2020	Moranhat Town	15m/ North	Hand pump	27.192552	94.925491
2	18-Jan-2020	Dighali No. 2	60m/ West	Hand pump	27.242930	95.165861
3	18-Jan-2020	No. 8 Darkhastor	300m/ West	Hand pump	27.180973	95.034821

Source: Environmental Baseline Monitoring

Figure 15: Groundwater sampling locations along the project road

Table 25: Surface water sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Source of Sample Collection	Coordinates	
					Latitude	Longitude
1	18-Jan-2020	Deroi Alikinor	35m/ West	Stream	27.201296	95.027693
2	18-Jan-2020	Disang Kinar Bangali	680m/ East	Stream	27.257356	95.257373

Source: Environmental Baseline Monitoring

Figure 16: Surface water sampling locations along the project road

Table 26: Ground Water quality result of the project road

Sr. No.	Parameters	Unit	Limit (as per IS:10500-2012)		WHO Drinking Water Standard (Fourth Edition 2011)	Result		
			Desirable Limit	Permissible Limit		Moranhat Town	Dighali No. 2	No. 8 Darkhastor
1	pH	-	6.5-8.5	No Relaxation	8.2-8.8	7.4	6.4	7.3
2	Colour	Hazen	5	25	Not Exceeding 5 hazen Unit	<5.0	<5.0	<5.0
3	Odour	-	Agreeable	Agreeable	Unobjectionable	Agreeable	Agreeable	Agreeable
4	Turbidity	NTU	1	5	Not Exceeding 1.5 NTU	<1.0	<1.0	<1.0
5	Total Hardness (as $CaCO_3$)	mg/l	200	600	-	106.38	86.38	80.70
6	Chloride (as Cl)	mg/l	250	1000	-	42.23	13.47	23.58
7	Fluoride (as F)	mg/l	1	1.5	1.5	0.36	0.15	0.74
8	Phenol Content	mg/l	<0.001	-	-	<0.001	<0.001	<0.001
9	Calcium (as $CaCO_3$)	mg/l	75	200	-	33.53	22.58	21.29
10	Magnesium (as $CaCO_3$)	mg/l	30	100	-	5.5	7.3	6.7
11	Sulphate (as SO_4)	mg/l	200	400	-	25.17	21.47	24.5
12	Nitrate (as NO_3)	mg/l	45	No Relaxation	50	0.18	0.27	1.00
13	Selenium (as Se)	mg/l	0.01	No Relaxation	0.04 (P)	<0.01	<0.01	<0.01
14	Alkalinity as ($CaCO_3$)	mg/l	200	600	-	137.85	140.14	130.21

Sr. No.	Parameters	Unit	Limit (as per IS:10500-2012)		WHO Drinking Water Standard (Fourth Edition 2011)	Result		
			Desirable Limit	Permissible Limit		Moranhat Town	Dighali No. 2	No. 8 Darkhastor
15	TDS	mg/l	500	2000	-	230.07	189.46	190.90
16	TSS	Mg/l	-	-	-	<1.0	<1.0	<1.0
17	Phosphates	mg/l	-	-	-	<0.05	<0.05	<0.05
18	Ammonia	mg/l	0.5	No Relaxation	-	<0.1	<0.1	<0.1
19	Electrical Conductivity	Micromhos/cm	-	-	-	353.95	291.48	293.69
20	Sodium (as Na)	mg/l	-	-	40	25.89	27.58	26.25
21	Potassium (as K)	mg/l	-	-	-	14.86	12.71	9.45
22	Iron (as Fe)	mg/l	0.3	No Relaxation	Not exceeding 0.1 mg/L	0.08	0.07	0.09
23	TKN	mg/l	-	-		<0.1	<0.1	<0.1
24	Total Coliform	mg/l	Nil	Nil	Absent	Nil	Nil	Nil
25	Fecal Coliform	mg/l	Nil	Nil	Absent	Nil	Nil	Nil

Source: Environmental Baseline Monitoring

Figure 17: Groundwater Sample collection at Moranhat Town

Figure 18: Groundwater Sample collection at Dighali No. 2

Figure 19: Groundwater Sample collection at No. 8 Darkhastor

The samples were collected from bore well at all locations. It can be seen from **Table 26** that; the pH of the drinking water varies from 6.4 to 7.4. Total hardness as $CaCO_3$ varies from 80.70 mg/l to 106.38 mg/l. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. It can be seen from the results that the groundwater quality meets the standards of IS: 10500-2012 standards for drinking water and CPCB standards for groundwater.

Table 27: Surface Water quality result of the project road

Microbiological Requirement

Sr. No.	Parameter	Test Method	Result		Standards/ Permissible Limits	CPCB Surface Water Standard	
			Deroi Alikinor	Disang Kinar Bangali	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
1	Total Faecal Coliform Bacteria (MPN/100ML)	IS-1622	476	472	Nil	Nil	Nil

Organoleptic & Physical Parameters

Sr. No.	Parameter	Test method	Unit	Result		Standards/Permissible Limits		
				Deroi Alikinor	Disang Kinar Bangali	WHO	Inland Surface water Tolerance Limits for Class-B	Inland Surface water tolerance limits for class D
2	Colour	IS-3025 (P-04)	Hazen Unit	<5.0	<5.0	-	-	-
3	Odour	IS-3025 (P-04)	-	Agreeable	Agreeable	-	-	-
4	Turbidity	IS-3025 (P-04)	NTU	2.4	2.4	-	-	-
5	pH value	IS-3025 (P-04)	-	7.20	7.14	6-9	6.5-8.5	6.5-8.5
6	Total Dissolved Solid (TDS)	IS-3025 (P-04)	mg/l	153.23	150.07	-	-	-
7	Electrical Conductivity	IS-3025 (P-04)	µs/cm	235.74	230.87	-	-	1000
8	Total Suspended Solid	IS-3025 (P-04)	mg/l	1.6	1.5	-	-	-
9	Total Dissolve Oxygen	IS-3025 (P-04)	mg/l	4.4	4.6	-	5	4
10	Biological Oxygen Demand	IS-3025 (P-04)	mg/l	3.2	3.6	30	3	-
11	Phosphate Content	IS-3025 (P-04)	mg/l	0.048	0.075	-	-	2

Concerning Substances Undesirable in Excessive Amounts

Sr. No.	Parameter	Test method	Unit	Result	
				Deroi Alikinor	Disang Kinar Bangali
12	Total Ammonia	IS: 3025 (P- 34)	mg/l	<0.1	<0.1
13	TKN	IS: 3025 (P- 34)	mg/l	0.52	0.41
14	Boron (as B)	IS: 3025 (P- 57)	mg/l	BDL	BDL
15	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	17.23	15.47
16	Chloride (as Cl)	IS: 3025 (P- 32)	mg/l	23.24	23.17
17	Copper (as Cu)	IS: 3025 (P-42)	mg/l	<0.05	<0.05
18	Fluoride (as F)	IS: 3025 (P-60)	mg/l	0.27	0.29
19	Phenol Content	IS: 3025 (P-43)	mg/l	<0.001	<0.001
20	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.025	0.034
21	Magnesium (as mg)	IS: 3025 (P-46)	mg/l	12.45	12.47
22	Nitrate (as NO_3)	IS: 3025 (P- 34)	mg/l	4.46	4.27
23	Selenium (as Se)	IS: 3025 (P- 56)	mg/l	<0.01	<0.01
24	Sulphate (as SO_4)	IS: 3025 (P- 24)	mg/l	21.25	23.56
25	Alkalinity (as Ca CO_3)	IS: 3025 (P- 23)	mg/l	91.36	94.23
26	Total hardness (as $CaCO_3$)	IS: 3025 (P- 21)	mg/l	94.12	89.80
27	Zinc (as Zn)	IS: 3025 (P- 49)	mg/l	0.25	0.28
28	Sodium (as Na)	IS-3025(P-45)	mg/l	12.21	13.24
29	Potassium (as K)	IS-3025(P-45)	mg/l	4.41	4.51

Source: Environmental Baseline Monitoring

Figure 20: Surface Water Sample collection at Deroi Alikinor

Figure 21: Surface Water Sample collection at Disang Kinar Bangali

As seen from the results, the pH of the drinking water in the region is well within permissible limits (6.5-7.5). The total dissolved solids in the samples collected vary from 150.07 mg/l to 153.23 mg/l which is well within the permissible standards. Total hardness as $CaCO_3$ in the water sample varies from 89.80 mg/l to 94.12 mg/l which is within the standard limits. Other

parameters analyzed like chloride, sulphate, fluorides are found well within standards. The surface water quality in the region is reported to be well within the permissible limits and also found by visual identifications. There are no reports of any water-borne decease in the region. People are using this water for various domestic purposes.

4.2.7 Ambient Air Quality

The ambient air quality with respect to the study area forms the baseline information. The prime objective of the baseline air quality study was to assess the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the construction and operation phase.

This section describes the selection of sampling locations, methodology adopted for sampling, analytical techniques and frequency of sampling. The ambient air quality monitoring was conducted during winter season in the month of January 2020.

4.2.7.1 Methodology Adopted for Air Quality Survey

Selection of Sampling Locations:

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Representatives of likely impact areas.

Ambient Air Quality Monitoring (AAQM) stations were set up at three locations with due consideration to the above-mentioned points.

4.2.7.2 Frequency and Parameters for Sampling

Ambient air quality monitoring was carried out for 24hrs representing winter season. The baseline data of air environment was monitored for parameters mentioned below:

- Particulate Matter ($PM_{2.5}$);
- Particulate Matter (PM_{10});
- Sulphur dioxide (SO_2);
- Oxides of Nitrogen (NO_x);
- Carbon Monoxide (CO)

The AAQ sampling is carried out as the present revised standards mentioned in the latest Gazette notification of the Central Pollution Control Board (CPCB) (November, 2009).

The baseline status of the ambient air quality has been checked through ambient air quality monitoring at selected points along the project road. The ambient air quality has been monitored at 3 locations as shown in **Table 29** and **Figure 22** along the project road for particulate matter ($PM_{2.5}$ and PM_{10}), sulphur dioxide (SO_2), oxides of nitrogen (NO_X); and carbon monoxides (CO) using standard analysis technique is shown in **Table 28**.

Table 28: Techniques Used for Ambient Air Quality Monitoring

Sr. No.	Parameter	Technique	Minimum Detectable Limit (µg/m^3)
1.	Particulate Matter ($PM_{2.5}$)	Gravimetric Method	120.0
2.	Particulate Matter (PM_{10})	Gravimetric Method	100.0
3.	Sulphur dioxide	Modified West and Gaeke	5.0
4.	Nitrogen Oxide	Modified Jacob & Hochheiser	5.0
5.	Carbon Monoxide	Non-Dispersive Infrared Spectroscopy (NDIR)	1 (in mg/m^3)

Table 29: Air Quality Monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates		Land use	Zone
				Latitude	Longitude		
1	18-Jan-2020	Moranhat Town	15m/ North	27.192552	94.925491	Semi built-up	Residential
2	18-Jan-2020	Bailungbheti	60m/ West	27.242930	95.165861	Agricultural	Residential
3	18-Jan-2020	No. 8 Darkhastor	300m/ West	27.180973	95.034821	Agricultural	Residential

Source: Environmental Baseline Monitoring

Figure 22: Air Quality Monitoring locations along the project road

Ambient air quality monitoring results for $PM_{2.5}$, PM_{10}, SO_2, NO_X, and CO concentrations are given in **Table 30** and summarized below. The monitored values are compared with National Ambient Air Quality Standards prescribed by Central Pollution Control Board (CPCB) for residential areas and WBG EHS Standards. The Ambient air quality levels meet the National air quality standards for the rural, residential area and WBG EHS standards all along the project road.

- $PM_{2.5}$: The mean $PM_{2.5}$ concentration at ambient air quality monitoring locations varies from 17.3 to 17.8 µg/m^3. The values are within the permissible limit at all the stations.
- PM_{10}: The mean PM_{10} concentration at ambient air quality monitoring locations varies from 47.4 to 48.3 µg/m^3. The values are within the permissible limit at all the stations.
- SO_2: The mean concentrations of SO_2 at all ambient air quality monitoring locations vary from 6.1 to 6.6 µg/m^3. The values are within the permissible limit at all the stations.
- NO_X: The mean concentrations of NO_X at all AAQM locations range from 12.3 to 13.2 µg/m^3. The values are within the permissible limit at all the stations.
- CO: The mean concentrations of CO at all AAQM locations range from 0.410 to 0.440 mg/m^3. The values are within the permissible limit at all the Stations.

Table 30: Ambient Air Quality along the Project Road

Sr. No.	Parameter	Method	Unit	National Ambient Air Quality Standard (CPCB) Permissible Limits	WHO Ambient Air Quality Guidelines	Results		
						Moranhat Town	Bailungbheti	No. 8 Darkhastor
1	Particulate Matter (PM_{10})	IS:5182 Part-XXIII	µg /m^3	100	50	47.4	48.3	47.9
2	Particulate Matter ($PM_{2.5}$)	CPCB Volume–Grav	µg /m^3	60	25	17.8	17.3	17.5
3	Sulphur Dioxide	IS:5182 Part-II	µg /m^3	80	20	6.6	6.1	6.6
4	Nitrogen Dioxide	IS:5182 Part-VI	µg /m^3	80	200 – 1 Hourly	12.3	13.2	12.9
5	Carbon Monoxide	IS:5182 Part-X	mg/m^3	4	-	0.410	0.420	0.440

Source: Environmental Baseline Monitoring

Figure 23: Air Quality Monitoring at Moranhat Town

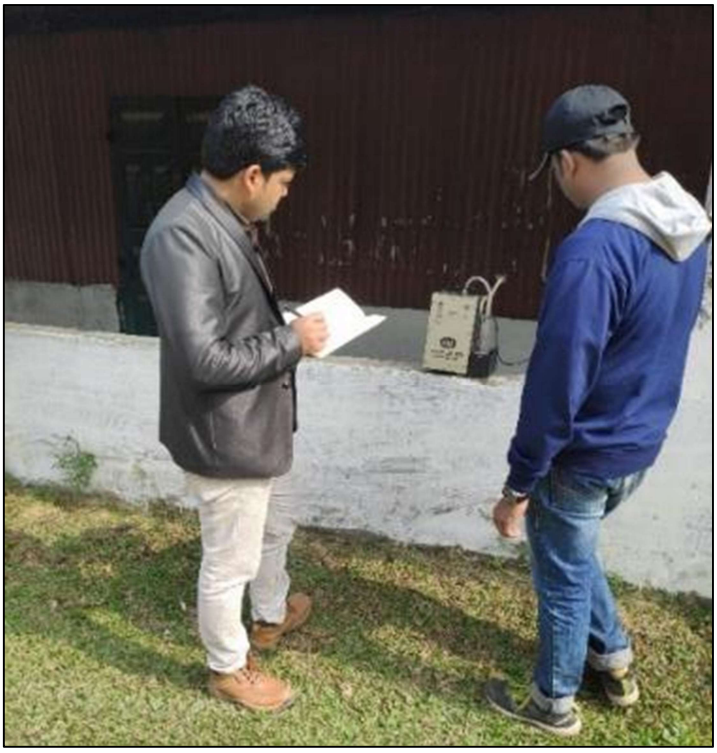


Figure 24: Air Quality Monitoring at Bailungbheti

Figure 25: Air Quality Monitoring at No. 8 Darkhastor

4.2.8 Noise Measurements

Noise in general is sound which is composed of many frequency components of various types of loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to complex sound made up of various frequencies at different loudness levels. The noise is measured as dB (A).

This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and
- The location of the noise source, with respect to noise sensitive land-use, which determines the loudness and period of exposure.

The main objective of noise monitoring in the study area is to establish the baseline noise levels, and assess the impact of the total noise generated by the construction work and movement of vehicles during operations phase

Identification of Sampling Locations

A preliminary reconnaissance survey was done to identify the major noise generating sources in the area. The noise at different noise generating sources has been identified based on industrial, commercial, and residential activities, traffic, and noise at sensitive areas. Sound Pressure Level (SPL) measurements were undertaken at all locations, with an interval of about 5 seconds over 10 minutes per hour for 24 hr. The day noise level has been

monitored from 7 AM to 10 PM and night levels from 10 P.M. to 7 AM at 3 locations. The Details of the monitoring locations are given in **Table 31** and **Figure 26.** Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards. **Table 32** gives the day and night-time Leq noise levels. Measured Leq noise levels are within the prescribed limits.

Table 31: Noise Monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates		Land Use	Zone
				Latitude	Longitude		
1	18-Jan-2020	Moranhat Town	15m/ North	27.192552	94.925491	Semi built-up	Residential
2	18-Jan-2020	Bailungbheti	60m/ West	27.242930	95.165861	Agricultural	Residential
3	18-Jan-2020	No. 8 Darkhastor	300m/ West	27.180973	95.034821	Agricultural	Residential

Source: Environmental Baseline Monitoring

Figure 26: Noise Monitoring locations along the project road

Table 32: Day and Night Time Leq in the Project Area

Sr. No.	Name of the Location	Units	Result		CPCB Ambient Air Quality Standards in respect of Noise (Residential Area)		Guidelines for Community Noise, World Health Organization (WHO) 1999		Approx. Distance from Road Edge (m)	Land Use
			Equivalent Noise Level (7 Am To 10 Pm)	Equivalent Noise Level (10 Pm To 7 Am)	Day	Night	Day	Night		
1	Moranhat Town	dB(A)	44.8	34.5	55	45	55	45	15	Semi built-up
2	Bailungbheti	dB(A)	45.2	33.4					10	Agricultural
3	No. 8 Darkhastor	dB(A)	44.3	32.2					20	Agricultural

Source: Environmental Baseline Monitoring

It can be seen from **Table 32** that at all the monitoring locations, the ambient noise levels are well within the permissible limits for residential areas prescribed by CPCB and also by World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively. The maximum recorded day time noise level is 45.2 dB(A) and night time noise level is 34.5 dB(A) at Bailungbheti and Moranhat Town respectively. Average day time noise level along the subproject road varies from 44.3 dB(A) to 45.2 dB(A) whereas average night time noise levels vary from 32.2 dB(A) to 34.5 dB(A).

Figure 27: Noise Level Monitoring at Moranhat Town

Figure 28: Noise Level Monitoring at Bailungbheti

Figure 29: Noise Level Monitoring at No. 8 Darkhastor

4.2.9 Land Use

The land-use pattern in the project section has major share of settlements which is semi built-up areas and agricultural area. The abutting land use patterns observed along the project road is as given in **Table 33**. The land use map of the project district is shown in **Figure 30** below.

Table 33: Land Use Pattern Abutting Project Road

Type of Land	Length (Km)	Percentage (%)
Agricultural	10.80	23.18%
Open Area	3.60	7.73%
Built Up	4.80	10.30%
Forest	-	-
Semi Built Up	27.41	58.80%
Total	**46.61**	**100**

Source: Road Inventory Survey

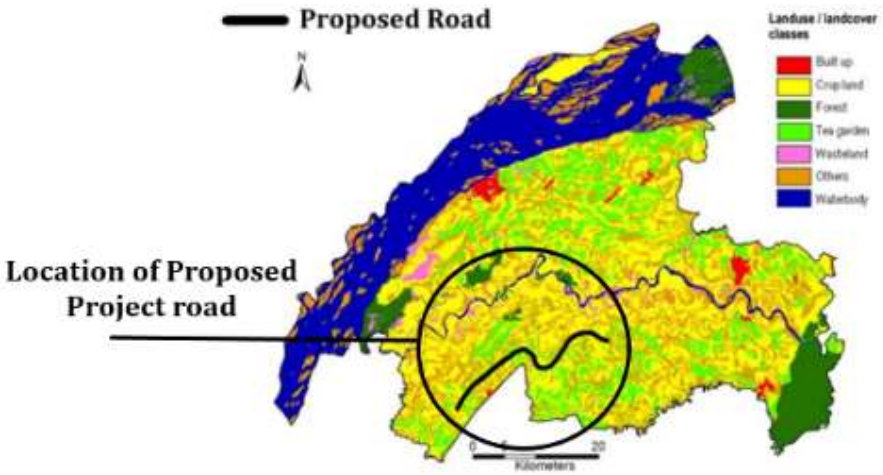


Figure 30: Land use map of the project district

4.3 Biological Environment

4.3.1 Forests

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.

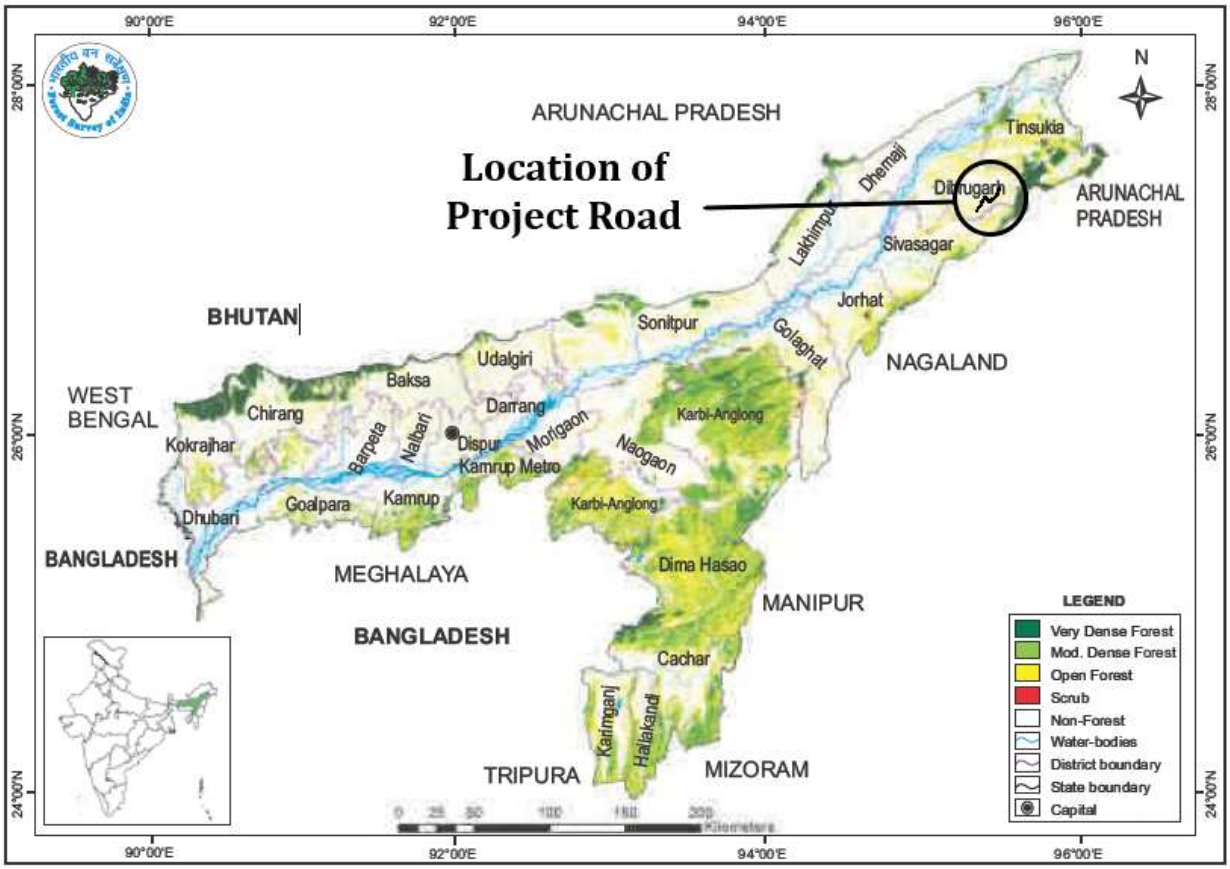


Figure 31: Forest Cover Map of Assam

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.

4.3.2 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 34: Present Species in Evergreen forests of Assam

Sr. No.	Dominant Families
1	Dilleniaceae

Sr. No.	Dominant Families
2	Anonaceae
3	Clusiaceae
4	Magnoliaceae
5	Fabaceae
6	Myrtaceae
7	Styraceae
8	Ebenaceae
9	Myristicaceae
10	Lauraceae
11	Euphorbiaceae
12	Fagaceae
13	Myrtaceae
14	Styraceae
15	Ebenaceae
16	Myristicaceae
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 35: 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
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 36: Present Species in Swamp forests of Assam

Sr. No.	Dominant Families
1	Crataeva lophosperma
2	Eugenia species

Sr. No.	Dominant Families
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
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 37: Present Species in Grasslands of Assam

Sr. No.	Dominant Families
1	Saccharum
2	Anthistena
3	Erianthus
4	Arundo
5	Phragmities
6	Imperata arundinaceae
7	Aptuda varia
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 38: 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.

Sr. No.	Scientific Name	Common Name	Uses
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.

4.3.3 Flora and Fauna of Dibrugarh District

Dibrugarh has a rich flora and fauna in the surrounding wildlife sanctuaries and rainforest. In 1999 Dibrugarh district became home to Dibru-Saikhowa National Park, which has an area of 340 km² (131.3 sq km.) The Dibru Saikhowa National Park is the fourth National Park of Assam that lies partly in Dibrugarh district and partly in Tinsukia district. The national park is about 13 kms from Tinsukia Town, which is 483 kms from Guwahati. This national park covers an area of about 340 square kms. Of the seven parts of the park one part is wet land and the rest is mainly grassland and dense forest. The main attractions of this park are its semi-wild horse and White winged Wood Duck. Besides this, other animals like Leopard, Clouded Leopard, elephant, Sambar, Slow Loris, Indian wild water Buffalo, Capped Langur,

Gangetic River Dolphin, Indian Wild Dog can be seen in this park. Various reptiles are found in the district including King- Cobra and Python. More than 250 varieties of local and migratory birds are also found in this park. The best season to visit this park is from November to March. The main marketable species are Outenga, Hillikha, Morhal, Jululi etc. The open area of the forest is covered with grasses, weeds, sorat, digholoti, etc. And low-lying areas are full of patidoi, reeds, nal, cane etc.

4.3.4 Wild Life and Protected Areas

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, Manas, and Nameri. Kaziranga National Park and Manas National Park are on the list of World Heritage sites. The List of National Park and Wildlife declared protected the Wildlife (Protection), Act -1972 located in the State of Assam and Project district is discussed in **Table 39.**

Table 39: List of National Park & Wildlife Sanctuary in the State of Assam

Sr. No.	Name	Location	Area (km^2)	Year
List of National Park in Assam				
1	Kaziranga National Park	Golaghat, Nagaon district and Karbi Anglong	858.98	1905
2	Manas National Park	Kokrajhar, Chirang, Baksa, Bajali, Udalguri, and Darrang	950	1985
3	Nameri National Park	Sonitpur	200	1978
4	Dibru-Saikhowa National Park	Dibrugarh and Tinsukia district	340	1978
5	Orang National Park	Darrang, Udalguri and Sonitpur district	78.81	1999
6	Dehing Patkai National park	Dibrugarh and Tinsukia	111.19	2020
Wildlife Sanctuary in Assam				
1	Hoollongapar Gibbon Sanctuary	Jorhat	20.98	
2	Garampani Wildlife Sanctuary	Karbi Anglong	6.05	
3	Bura Chapori Wildlife Sanctuary	Sonitpur	44.06	
4	Bornadi Wildlife Sanctuary	Darrang	26.22	1980
5	Sonai Rupai Wildlife Sanctuary	Sonitpur	220	
6	Pobitora Wildlife Sanctuary	Marigaon	38.8	1987
7	Panidihing Bird Sanctuary	Sibsagar	33.99	

Sr. No.	Name	Location	Area (km^2)	Year
8	Bherjan-Borajan-Padumoni Wildlife Sanctuary	Tinsukia	7.22	
9	Nambor Wildlife Sanctuary	Karbi Anglong	37	
10	East Karbi-Anglong Wildlife Sanctuary	Karbi Anglong	222.81	
11	Laokhowa Wildlife Sanctuary	Nagaon	70.13	
12	Chakrashila Wildlife Sanctuary	Dhubri and Kokrajhar	45.57	
13	Marat Longri Wildlife Sanctuary	Karbi Anglong	451	
14	Nambor-Doigrung Wildlife Sanctuary	Golaghat	97.15	
15	Borail Wildlife Sanctuary	Cachar and Dima Hasao	326.25	
16	Amsang Wildlife Sanctuary	Guwahati	78.64	
17	Dipor Bil Wildlife Sanctuary [4]	Kamrup	4.14	

As per the approved protected areas map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (Annexure 22) during the initial survey, the project road does not pass through any protected area such as Wildlife Sanctuary, National park, or bio-reserve. There is no wildlife sanctuary, National park, or bio –reserve within 10 km of the project road.

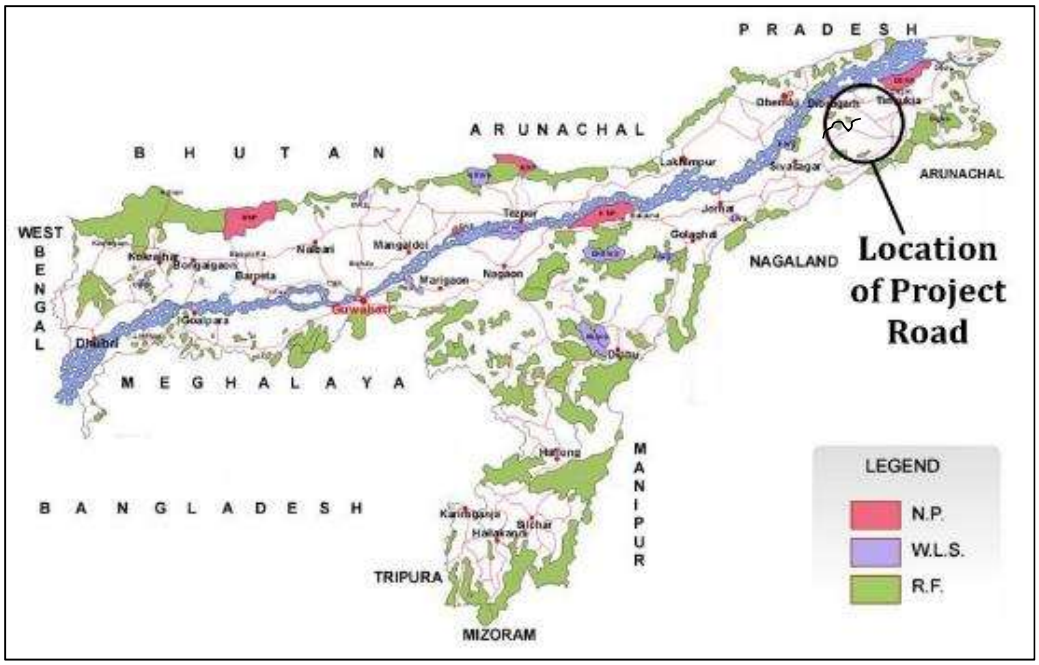


Figure 32: Protected Areas in Assam

Figure 33: Nearest protected area from project road

4.3.5 Biodiversity in Dibrugarh District

Dibrugarh is situated in the eastern part of Assam. The district is surrounded by Dhemaji district in the north, part of Sivasagar and Arunachal Pradesh in the south, Tinsukia district in the east and Sivsagar district and a part of Jorhat district in the west. The biodiversity hotspots located in Dibrugarh district are as follow:

Dibru-Saikhowa National Park

Dibru-Saikhowa is a National Park as well as a Biosphere Reserve situated in the south bank of the river Brahmaputra in the extreme east of Assam state in India. Dibru-Saikhowa, with an area of 340 sq km, situated in the flood plain of Brahmaputra is a safe haven for many extremely rare and endangered species of Wildlife.

The forest type of Dibru-Saikhowa comprises of semi-evergreen forests, deciduous forests, littoral and swamp forests and patches of wet evergreen forests. Famed for Ferral horses, a total 36 species of mammals and above 400 species of birds have so far been recorded from the Dibru-Saikhowa National Park.

6 species of mammals have so far been recorded – Tiger, Elephant, Leopard, Jungle Cat, Bears, Small Indian Civet, Squirrels, Gangetic Dolphin, Slow Loris, Assamese Macague, Rhesus Macaque, Capped Langur, Hoolock Gibbon, Wild Pigs, Sambar, Barking Deer, Water Buffalo, Feral Horses etc.

It is an identified Important Bird Area (IBA) having more than 382 species of Birds, some of which are Greater Adjutant Stork, Lesser Adjutant Stork, and Greater Crested Grebe. Large Cormorant, Open bill Stork, Black necked Stork, Large Whistling Teal. Grey leg Goose, Grey-headed Fishing Eagle, Griffon Vulture, Osprey, Crested Serpent Eagle, Spot Billed Pelican, White Winged Wood Duck, Baer's Pochard, Greater Spotted Eagle, Pale Capped Pigeon, Great Pied Hornbill, Marsh Babbler, Jerdon's Babbler, Black Breasted Parrot bill, etc. The Park is renowned for natural regeneration of Salix trees.

Dehing Patkai National Park

Dihing Patkai Wildlife Sanctuary is located in the Dibrugarh and Tinsukia Districts of Assam and covers an area of 111.19 km2 (42.93 sq mi) rainforest. It is part of the Assam valley tropical wet evergreen forest and consists of three parts: Jeypore, Upper Dihing River and Dirok rainforest. It was declared a sanctuary on 13 June 2004. This sanctuary is also a part of the Dihing-Patkai Elephant Reserve. The rainforest stretches for more than 575 km2 (222 sq mi) in the districts of Dibrugarh, Tinsukia and Sivasagar. A part of the forest was declared as a wildlife sanctuary by the Government of Assam, while another part falls under the Dibru-Deomali Elephant Reserve. The forest further spreads over in the Tirap and Changlang districts of Arunachal Pradesh. The Dihing Patkai forms the largest stretch of tropical lowland rainforests in India. The forest is often referred to as "The Amazon of the east" owing to its large area and thick forests.

Being a completely virgin rainforest, this sanctuary is very rich in biodiversity. It is an ideal habitat for non-human primates. Till date, 47 mammal species, 47 reptile species and 30 butterfly species have been recorded. The most common mammal species of this sanctuary are hoolock gibbon, slow loris, pig-tailed macaque, stump-tailed macaque, capped langur, Asian elephant, Bengal tiger, Indian leopard, gaur, Chinese pangolin, Himalayan black bear, Himalayan squirrel, leopard cat, clouded leopard, porcupine, crab-eating mongoose, sambar, sun bear, binturong, barking deer, golden cat and marbled cat.

Dihing Patkai rainforest harbors about 293 bird species, belonging to 174 genera and 51 families. The majority is resident (63.7%), some are winter visitors (23.1%), and very few are summer visitors (2.5%). About 10.7% are altitudinal migrants, coming mainly from the higher reaches of the western, central and eastern Himalayas. The avifauna includes slender-billed vulture, white-winged duck, greater adjutant, lesser adjutant greater spotted eagle, beautiful nuthatch, marsh babbler, tawny-breasted wren-babbler, yellow-vented warbler, broad-billed warbler, white-naped yuhina, white-cheeked partridge, great hornbill, brown hornbill, Oriental darter and painted stork, osprey, kalij pheasant, grey peacock pheasant, besra, black baza and hill myna.

4.3.6 Biodiversity of the Project Area

The project road from Moran to Disang Kinar Bangali traverses through settlements of Moran Town, Teloikinar Bongali, Rajgarh, Sapkait no.1, Paniyabbura Pathar No.1, and ends at Disang Kinar Bangali. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and Joypur connect the proposed project road.

There are no major rivers along the project road. The project road crossed the Dickson River at Ch. 15+096. There are a few small fish ponds along the project road. The Fish species found are Rahu, Bahu, Mirika, Pithila, Kurhi, Bhangon, Barali, Kaoi, Magur, Singee, Pabha, Eleng, etc. There is no forest area along the project road. The project road does not lie within 10 km radius of protected areas in the state. The Dehing Patkai National Park is at a distance of approx. 15 km from the project road. There are no animals observed in the vicinity of the project road except for domestic animals. The project road does not lie in near vicinity of any of the IBAs. There are several tea estates located along the project road.

4.3.7 Trees

During primary survey of the proposed road, tree species were reported beyond the earthen shoulder of the existing road. The species of trees reported during primary survey and based on the tree inventory done during tree numeration. The details of tree inventory are attached as **Annexure – 11.**

The main tree species observed in Dibrugarh district are Outenga (Dillenia Indica), Hillikha (Terminalia chebula), Morhal (Vatica lancafolia), Jululi, weeds, sorat (Laportea crenulate), digholoti (Litsea salicifolia), patidoi (Schumannianthus dichotomus), reeds (Phragmites australis), nal, cane (Arundinaria) etc.

Source: District Census Handbook, Dibrugarh District

Based on the Joint inception, tree numeration done with ranger and forest officers of Dibrugarh forest division about **2553** nos. of trees are felling will be involved in widening and realignment work.

Based on the tree felling permission and in discussion with the DFO during site visit no Tree species identified along the PROW are Critical/endangered/protected species list as per IUCN Red list.

Figure 34: Trees along the project road

4.3.8 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 26 trees of cultural significance have been identified along the road. The locations of such identified heritage trees are given in **Table 40**.

Table 40: Location of Heritage Trees along the Project Road

Sr. No.	Chainage	Location	Side of the Road
1	0+100	Moran	Left
2	0+120	Moran	Left
3	0+300	Moran	Left
4	1+450	Avyaouri Moran	Right
5	1+550	Avyaouri Moran	Left
6	6+275	Teloijan	Left
7	6+825	Teloijan	Left
8	6+900	Teloijan	Left
9	7+400	Bamunbari	Left
10	8+600	Bamunbari	Right
11	14+140	Diksam Tinali	Right
12	19+500	Pithaguti	Left
13	24+450	Rajghar	Right
14	25+075	Rajghar	Left
15	25+700	Rajghar	Right
16	28+300	Sarojini Bagan	Right
17	32+525	Tingkhong	Right
18	32+900	Tingkhong 3 No.	Right
19	39+900	Naharkatia	Right

Sr. No.	Chainage	Location	Side of the Road
20	39+900	Naharkatia	Left
21	41+180	2 No. Ghuraniya	Right
22	44+270	Nahorani	Right
23	44+600	Nahorani	Right
24	45+180	Nahorani	Right
25	45+620	Disang Kinar	Left
26	45+980	Disang kinar	Right

Figure 35: Photographs of Heritage Trees along the Project Road

4.3.9 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.

4.3.10 Sericulture

Sericulture is the major agro-based industry generating large number of employments 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 Assam. 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 locations were identified where sericulture is been carried out.

4.3.11 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 a 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, No such location have been identified along the project road.

4.3.12 Tea Estates

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. 12 tea estates are located along the project road.

Table 41: Tea Estates along the Project Road

Sr. No.	Chainage	Location	Side of the Road
1	16+050	Dirai T.E.	Right
2	16+050	Kendugiri T.E.	Left
3	17+800	Dirai T.E.	Both
4	19+400	Dirai T.E.	Left
5	20+125	Dirai T.E.	Both
6	23+875	Longboi T.E.	Left
7	26+550	Karongini T.E.	Right
8	27+480	Azizbagh T.E.	Left
9	27+480	Karongini T.E.	Right
10	28+650	Nilmoni T.E.	Right
11	29+150	Sarojini T.E.	Left
12	32+125	Tingkhong T.E.	Left

Figure 36: Photographs of Tea Estates along the Project Road

4.3.13 Aquatic Ecology and Fisheries

The project road crosses the Dickson river at Ch. 15+096 and some nallahs are also observed crossing the alignment.

In the Dibrugarh district, fishes of various kinds are found in the beels and rivers. The most popular among the large verities of fishes are Rahu, Bahu, Mirika, Pithila, Kurhi, Bhangon, Barali etc. The smaller variety of fishes Kaoi, Magur, Singee, Pabha, Eleng, Bariala are common.

Source: District Census Handbook, Dibrugarh district

Figure 37: Dickson River along the Project Road

4.3.14 Rare or Endangered Species

The local forest department was consulted to know the presence of any endangered and protected species of flora within the formation width. It is confirmed by the forest department officials that there are no endangered species that are likely to be affected by the current project.

Joint inspection is being carried out with field officials from the local forest department to prepare the detailed inventory and marking of the trees to be cut. During the joint inspection, if any endangered and or protected species of flora are found within the formation width of the subproject road, necessary mitigation measures will be adapted to protect such species. Also based on the joint inspection, a suitable compensatory afforestation plan will be prepared to mitigate the loss of vegetative cover due to the subproject activities (refer Annexure 23 - Biodiversity Assessment Report).

4.3.15 Fauna and Wildlife

Based on the primary survey within the Corridor of impact (COI) and secondary information obtained for buffer zone by public interaction, forest working plan, interaction with DFO during site inspection, etc., it can be concluded that no wildlife habitat for mammals are reported within the COI. Domestic animals mainly cow (Bos taurus), goat (Capra aegagrus hircus), pig (Sus), dogs (Canis lupus familiaris) and buffalos (Bubalus bubalis) were observed in study area. (refer Annexure 23 - Biodiversity Assessment Report).

4.4 Socio-economic Environment

The primary purpose of the socio-economic analysis is to provide an overview of the State's socioeconomic status and the relative status of the Project Influence Area (PIA) within the State. The proposed project passes through one district of Assam i.e. Dibrugarh. The demographic profile and socioeconomic status of the people in the project affected district and state as per census 2011 are as follows. The demographic details of the project area are listed in **Table 42.**

Table 42: Demographic details of Dibrugarh district

	Assam	Dibrugarh
Total Population	31,205,576	1,326,335
Rural Population	26,807,034	1082605
Urban Population	4,398,542	243730
Male	15,939,443	676,434
Female	15,266,133	649,901
Gender Ratio	958	961
SC Population	2,231,321	58,876
% SC	7.15	4.44

	Assam	Dibrugarh
ST Population	3,884,371	102,871
% ST	12.45	7.76
Density of Population (per sq. km.)	398	392

4.4.1 Road Network

Roads are considered the most important component of infrastructure, to which national economy either directly or indirectly connected. Constructing high-quality roads of international standards has come to reality in the soil of Assam because of the potential will of the Government of Assam. The state is connected to other neighboring states like Nagaland, Arunachal Pradesh, Meghalaya, Mizoram, and Tripura through all-weather high standard roads. The approaching roads to the main roads have qualitatively improved. In recent years the internal roads connecting villages, hamlets have become R.C.C roads. The roads connecting to Gram Panchayats Road and Taluka (Block) Road have also been constructed through R.C.C. In recent days attempts have been made for constructing roads through Public-Private Partnership (PPP). The road map of the Dibrugarh district has been shown in the following **Figure 38**.

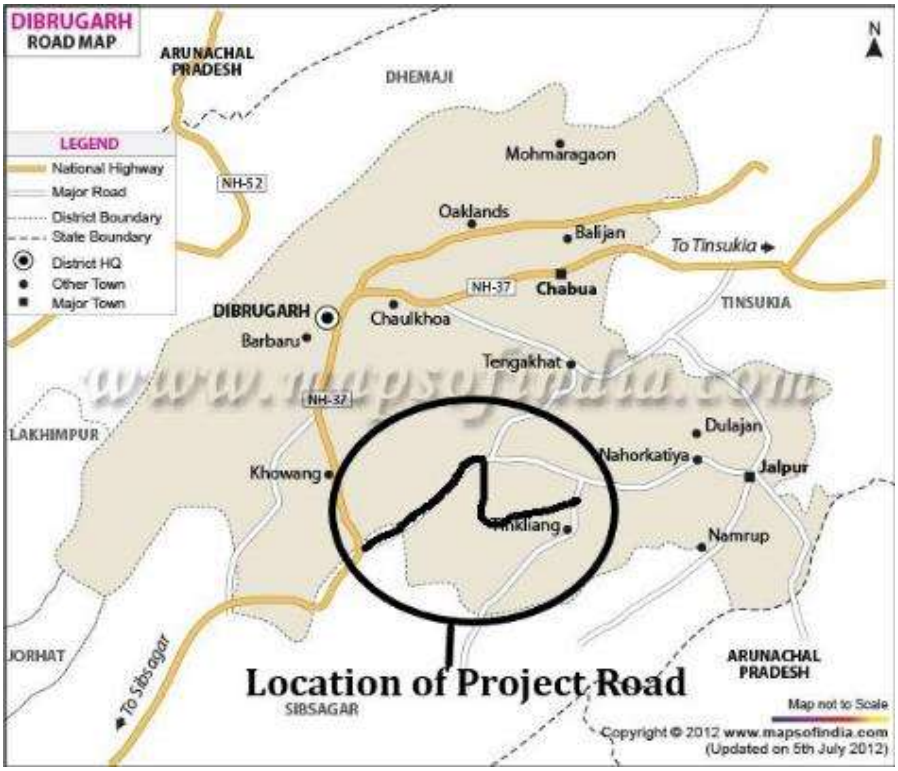


Figure 38: Road Map of Dibrugarh district

4.4.2 Settlements along the Sub-project

The list of villages and towns on the sides of the project highway, identified during the Reconnaissance Survey and Road Inventory of project road is presented in **Table 43**.

Table 43: Important Settlements Abutting Project Highway

Sr. No.	Design Chainage (Km)		Length (m)	Name of Settlement
	From	To		
1	0+000	1+800	1800	Moran
2	5+300	8+500	3200	Bamunbari
3	12+000	16+500	4500	Ouphulia
4	26+400	29+600	3200	Rajgarh
5	32+900	35+200	2300	Tingkhong 3 No.
6	35+200	38+900	3700	Tingkhong
7	45+800	46+500	700	Disang Kinar Bangali

Source: Road Invetory

4.4.3 Existing Economy & Employment Base

Agriculture and Tea farming is the mainstay of the people of the region. It plays a significant role with respect to both generations of employment and share in the GDP. Agriculture is closely followed by livestock rearing. Many families in the project region mainly depend on Agriculture, Allied Agriculture & commercial works. There are some small-scale industry units where people are employed to work as laborers.

4.4.4 Cultural/Religious resources

The language spoken by the majority of the people is Assamese and Bengali. English is widely used for official purpose and Assamese and Bengali is used as a regional language. The state has a very opulent cultural heritage, one of the richest in India. The capital city of Assam is Dispur. No protected or unprotected ASI monument exists along the project road. As per the field survey, the following **Table 44** are the religious structures observed along the project road.

Table 44: List of religious structures along the project road

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	Mosque	Right	0+500	15
2	Temple	Left	14+775	20
3	Temple	Right	25+725	20
4	Church	Left	29+800	60
5	Temple	Right	31+050	20
6	Mosque	Left	31+700	10

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
7	Religious Center	Left	33+200	25

Source: Environmental Baseline Survey

4.4.5 Archaeological and Historical Monuments

No archaeological sites or historical monuments are located along the project road section.

4.4.6 Sensitive Receptors

During the environmental and social screening survey, several sensitive receptors such as religious places, schools, colleges, hospitals, etc. are located within the existing RoW. However, no structure is going to be affected by the proposed road improvement works. The list of these structures is presented in **Table 45** below.

Table 45: Sensitive receptors along the project road

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	School	Left	0+150	15
2	School	Left	0+950	40
3	Training Institute	Left	1+525	10
4	School	Right	2+350	60
5	School	Left	2+875	10
6	School	Left	4+875	55
7	School	Left	5+425	10
8	School	Left	13+325	40
9	Health Center	Left	36+425	50
10	School	Left	41+625	25
11	Health Center	Left	44+850	25

Source: Environmental Baseline Survey

4.4.7 Demography of Displaced families

The total number of Displaced Persons is 8445 with 51.02 % (4309) males and 48.97% (4136) females. The age-wise distribution of Displaced Persons is presented in **Table 46**. Almost 40% of the Displaced Persons are in the age group of 21 to 40 years.

Table 46: Age wise Distribution of Total Displaced Persons

Age Category	Total Males	Total Females	Total Persons	Percentage
0 to 6 Years	369	363	732	8.67%

Age Category	Total Males	Total Females	Total Persons	Percentage
7 to 14 Years	522	477	999	11.83%
15 to 20 Years	400	472	872	10.33%
21 to 30 Years	871	920	1791	21.21%
31 to 40 Years	816	742	1558	18.45%
41 to 50 Years	582	524	1106	13.10%
51 to 60 Years	384	372	756	8.95%
Above 60 Years	365	266	631	7.47%
Total	**4309**	**4136**	**8445**	**100%**

Source: Social Impact Assessment Report

4.4.8 Social Stratification

The social fabric of the project area predominantly comprises of four social groups, a) Scheduled Tribes (ST) b) Scheduled Castes (SC) comprising, the Other Backward Class (OBC) and d) General Castes. The main indigenous Assamese communities inhabiting the district include Ahoms, Chutia, Sonowal Kacharis, Muttock, Moran people, Tea Tribes etc. There are also some indigenous Assamese Tai Buddhist communities like Tai Phake, Khamti and Khamyang. The Scheduled Tribes population in the project affected villages is only 9.54% (162) of the total population in these villages. Of the total 1699 families displaced by the project, 1012 i.e., 59.56% are OBC's, followed by the General Category at 27.13%ie. 461 and lastly Scheduled Caste at 64 ie 3.77% (refer **Table 47**).

Table 47: Social Category of the Displaced Families

Social Category	Total No. of Families	Percentage
Schedule Tribe	162	9.54%
Schedule Caste	64	3.77%
Other Backward Class	1012	59.56%
General	461	27.13%
Total	1699	100%

Source: Social Impact Assessment Report

4.4.9 Educational Profile

The educational status of the Displaced Persons is presented in **Table 48**. The total number of Displaced Persons, of more than school going age of 6 years, is 7713. Out of which 3.09% reported to be illiterate, 1.58% reported that they are only literate as they can both read and write in the local language but never had any formal schooling, 14.78% of the Displaced Persons have education up to primary level, 72.06% up to secondary, 8.13% upto /higher secondary and only 0.0.36 % (28 persons) have had some form of technical education.

Table 48: Educational Status

Educational Status	Male	Female	No. of Affected Persons	Percentage
Illiterate	88	150	238	3.09
Literate	48	74	122	1.58
Primary	549	591	1140	14.78
Secondary	2910	2648	5558	72.06
Higher Secondary	322	305	627	8.13
Technical	23	5	28	0.36
Vocational	0	0	0	0.00
Total	**3940**	**3773**	**7713**	**100**

Source: Social Impact Assessment Report

4.4.10 Occupational Profile

The social impact of the project may be also assessed in terms of viewing the occupation pattern in the project area. The occupational status of the Displaced Persons is presented in **Table 49**. It is reported that out of the total displaced population of 8845 children below 14 years (1731 in number) have not been included in the analysis of occupation. Out of the total remaining 6714 Displaced Persons, 4236 reported to be unemployed (including housewives and persons above the age of 60 years). The total working population is 2478 taking the workforce participation rate to 36.91%. Overall, the contribution of females in the workforce is 6.70% and that of males is 30.21%. Analysis of work force data also points to the fact that the primary sector occupation is dominated by business/trade (70.82), the secondary and tertiary sectors i.e., Private Services (8.07%) and Govt. Services (4.36%). Of the total workforce of 2478 only 268 are engaged in agriculture and as agricultural laborer making overall dependency on agriculture at 10.82%.

Table 49: Occupation Pattern

Employment Status	Male	Female	Total	Percentage

Employment Status	Male	Female	Total	Percentage
Agriculture	91	18	109	1.62%
Agriculture Labourer	120	39	159	2.37%
Non-Agriculture Labourer	66	8	74	1.10%
Business/ Trade	1472	283	1755	26.14%
Govt. Service	77	31	108	1.61%
Private Services	153	47	200	2.98%
Maid Servant	8	8	16	0.24%
Others	41	16	57	0.85%
Unemployed	1390	2846	4236	63.09%
Total	**3418**	**3296**	**6714**	**100%**

Source: Social Impact Assessment Report

5. Anticipated Environmental and Social Impacts and Mitigation Measures

5.1 Introduction

This chapter presents key environmental issues associated with various aspects of the proposed subproject. The environmental impacts caused due to the development of the subproject road sections can be categorized as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the subproject 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 subproject activities with environmental attributes is presented as Activity- Impact matrix in **Table 50**.

The immediate benefits of road construction and improvement will come in the form of direct employment opportunities during construction for the roadside communities and especially those who are engaged as wage laborers, petty contractors, and suppliers of raw materials.

During the operation stage, road-side economic activities supporting transport like Petrol pumps, automotive repair shops, lodging, and restaurants will increase due to the increased number of vehicles. An increase in agro-industrial activities is also expected to take advantage of improved access to urban centers where there are higher demands and better prices for agricultural products. The project will accelerate the industrial activities and induced development significantly. One important project-specific benefit is the avoidance of flooding or waterlogging by increasing the waterway of bridges and the provision of side drains. Other generic benefits of road improvement projects are: (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care, educational and other infrastructural facilities (iv)improved quality of life of rural tribal population (v) reduced accident events and (vi) better investment climate for industries creating more employment opportunities to local people.

The identification of potential effect requires identifying the components of the physical, biological, and human environments that are at risk of being impacted in the upgrading of state roads in Assam. It involved an integration grid between the valued environmental components and project activities. The valued environmental components for this project were drawn from the environmental baseline and are as follow:

- Physical environment – air quality and greenhouse gas emissions, land and soil, surface water quality and quantity, and groundwater quality and quantity,
- Biological environment – terrestrial vegetation
- Human environment – private land and buildings, public infrastructures, sound
- Environment, aesthetic and visual, and community and occupational health and safety.

The assessment of potential environmental impacts requires the definition of the effects associated with the MDR upgrading in terms of intensity, duration, and scope as follow:

- Nature of the effect: The nature of the effect refers to the kind of effect on the environment. Two levels have been defined:
  - Positive: The work would have a good impact on the environment or stakeholders.
  - Negative: The work will have a bad impact on the environment or stakeholder.
- Duration of the effect: Duration means the time dimension of the effect. The term short term and long term are used to describe the period:
  - Short-term: the effect disappears promptly once the source is eliminated;
  - Long Term: the effect is felt for a while even after the source is eliminated;
- Scope of the effect: The scope describes the spatial dimension of the effect caused by an action in the environment. It refers to the distance or area covered by the disruption. The terms regional, local, and limited are used to describe the scope:
  - Limited: the scope is limited when the action affects only one environmental element located near the project;
  - Local: the scope is local when the action affects the study area;
  - Regional: the scope is regional when the action affects areas beyond the study area

Assessment of the potential effect: The potential effect considering the above parameters come into one of three categories:

- Major (MAJ): signifies an effect that is permanent and that affects the integrity, diversity, and sustainability of the element. Such an effect substantially or irremediably alters the quality of the environment.
- Medium (MED): signifies a perceptible, temporary, and/or low- return effect that has little impact on the environmental component and is not irreversible. Such an effect is short-lived and/or limited in scope.
- Minor (MIN): signifies that the effect is non-existent or virtually non-existent, that it does not affect the environmental component in any observable or quantifiable way and that it is related to a randomly occurring natural effect.

Table 50: Activity Impact Identification Matrix

Activity	Severity of Impact	Degree of impacts		Duration of Impact		Scope of Impact		
		Positive	Negative	Short term	Long Term	Local	Regional	Limited
PRE-CONSTRUCTION PHASE								
Road alignment and design considerations	MED	×			×	×		
Utility shifting: removal and transfer of electrical and other utilities, tree cutting	MED		×	×			×	
CONSTRUCTION PHASE								
Site Clearance	MIN		×	×			×	
Generation of Debris	MIN		×	×		×		
Non-bituminous waste	MIN		×	×		×		
Bituminous waste	MIN		×	×		×		
Traffic diversion	MED		×	×			×	
Borrow areas	MIN		×	×			×	
Quarries	MIN		×	×			×	
Water extraction	MED		×	×		×		
Haul vehicles	MED		×	×		×		
Material storage	MED		×	×		×		
Excavation	MED		×	×		×		
Natural drainage	MIN		×	×		×		
ENVIRONMENTAL AND SOCIAL ATTRIBUTES								
Air	MED		×	×		×		
Water	MIN		×	×		×		
Noise	MED		×	×		×		
Soil	MIN		×	×		×		
Flora	MED		×		×	×		
Social Environment	MAJ	×			×		×	

Activity	Severity of Impact	Degree of impacts		Duration of Impact		Scope of Impact		
		Positive	Negative	Short term	Long Term	Local	Regional	Limited
OPERATION PHASE								
Environmental Attribute								
Air	MIN		×		×	×		
Water	MIN	-	-	-	-	×		
Noise	MIN		×		×	×		
Soil	MIN	-		-		×		
Social Environment								
Increase in ue	MED	×			×		×	
Transportation Development	MAJ	×			×		×	
Road User								
Safety and Better Connectivity	MAJ	×			×		×	
Road Users Safety	MAJ	×			×	×		

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; and
- 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

5.2 Positive Environmental impacts due to the improvement of sub-project road

The positive impacts expected from the improvement of the project road section includes:

- The consequences of soil erosions are far wider than the repair and maintenance of the road. Along the project road, the inflow of water into ponds during rains causes erosion of the embankment besides seepage of water into the embankment and

sub-grade resulting in softening of the subgrade. This may also increase siltation in water bodies. The project design includes provisions of retaining walls for protection. Regular checks will be made to check its effectiveness.

- Improvements to the road drainage will result in improved stormwater flows and reduce the tendency of blockages to occur in roadside drains. Risks to the public health caused by such stagnant water bodies by acting as disease vector breeding places will be reduced. By designing the drains to withstand appropriate storm events and regular maintenance will further reduce the chances of drainage system failure. Accidental oil spillage, washing of vehicles, used engine oils, paints used in maintenance can contaminate the water bodies. Proper handling of such chemicals under strict supervision will help to minimize the water pollution during the maintenance period. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted.
- Improved quality of life for the rural population in the projects influence area, 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, reduced road accidents, reduced vehicle operating and maintenance costs, and reduced transportation costs for goods;
- Interstate connectivity to neighboring districts; and
- Better connectivity to the State Highway and National Highway network.

5.3 Adverse Environmental impacts due to the improvement of sub-project road

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

- Cutting of roadside trees that fall within formation width may reduce the ecological balance of the area and also increase soil erosion problems.
- Noise, air and water pollution and disposal of construction waste, during construction, will adversely impact the 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.
- Improvement on the existing road although limited, may increase 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.
- 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 afterward during operation.

5.4 Impacts Related to Sub- Project Location, Preliminary Planning and Design

5.4.1 Natural Hazard

The entire Assam falls under zone V (very high-risk zone) as per the seismic map of India and therefore the risk of damage to the subproject road due to an earthquake is critical. Relevant IS codes shall be adopted in the design of civil structures.

5.4.2 Road Widening, Utilities shifting, and Safety Planning

The entire road section has enough available ROW to accommodate the proposed road improvement works and will be undertaken along the existing alignment with minimal land acquisition required at some locations. Road widening will result in the shifting of utilities and encroaching structures. Poor coordination with local authorities and communities will increase the risk of accidental damage to drainage channels and temporary disruption of water and electricity supplies along active construction fronts. The further contraction of the useable carriageway during construction will exacerbate traffic and will hinder direct access across the road by residents along the road. Temporary detention of drain water on depressed areas during the reconstruction of drainage canals may occur.

Road formation widening will be made based on minimizing tree cutting, utility shifting, and damage to community properties. Road design has incorporated the drainage system to avoid the accumulation of drainage water and surface run-off. Temporary pits will be constructed at side-and cross drains to collect drainage water from demolished or damage drainage channels which will be hauled for off-site treatment.

Adequate safety provisions like crash barriers on accident prone areas rumble strips in community areas to regulate speed, retro-reflective warning sign boards near school, hospital, and religious places are incorporated in the design. All utilities requiring shifting shall be largely made before the start of construction. Before shifting, the Contractor will coordinate with the concerned agencies regarding the time and extent of shifting and community affected will be informed of a potential service disruption at least 1 week earlier.

5.4.3 Impact on Land

The total land to be acquired is 176.71 acre, out of which 100.22 acre (56.71%) is government land; 68.15 acre (38.57%) is private land, while ownership status of remaining 8.33 acre (4.71%) land is yet to be established, as the revenue records are not available for these stretches. **Table 51** shows the land to be acquired for the proposed project.

Table 51: Proposed Land Acquisition

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Moran Town	Revenue Circle: Mohmora & District: Charaideo	0.61	0.00	1.88	2.49
2 No. Horu Pathar		0.00	0.00	1.58	1.58
Amguri Gaon		0.00	0.10	0.03	0.13
Dumar Dolong Gaon		2.34	0.00	0.00	2.34
Majpathar Gaon		0.00	0.00	3.55	3.55
Moran Nagar	Revenue Circle: Moran & District: Dibrugarh	0.05	0.00	0.77	0.81
Abhoipuria Bongali		0.00	0.00	2.46	2.46
Phatkachowa Nepali		0.53	0.00	3.41	3.94
Raidonga Gaon		0.34	0.00	2.45	2.78
Raidangia sheet Grazing		0.00	0.54	4.22	4.76
Domradalang No. 4		0.26	0.00	0.34	0.59
Domradalang No. 1		0.58	0.00	0.23	0.81
Teloijan Gaon 2nd Khanda		0.47	1.03	0.03	1.53
Teloijan Darkhsta No. 25		3.01	0.00	0.02	3.03
Teloijan Darkhasta No 26		0.00	0.00	1.39	1.39
Bamunbari T. E. 323 No. NLR Grant		1.12	0.00	0.01	1.13
Kaowimari No 2	Revenue Circle: Tingkhong & District: Dibrugarh	0.60	0.00	2.63	3.23
Kekuri Bangali		2.79	0.10	1.55	4.44
Kekuri Sonowal		2.50	0.00	2.06	4.57
2 No. Kekuri		0.02	0.00	1.44	1.46
2 No. Dighalia		2.03	0.00	4.70	6.73
Diroi Ali Kinar Gaon		0.09	0.00	1.66	1.74

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
Ouphulia		1.41	0.00	2.15	3.56
Diksam Block		0.61	0.00	2.30	2.90
Diksom Kinar		0.00	0.00	2.73	2.73
Deroi T.E 3 No. Darkhasta		0.00	0.00	1.82	1.82
Deroi T.E. 8 No. Darkhasta		6.61	0.05	1.35	8.01
Deroi T.E. 5 No. Darkhasta		1.76	4.70	0.55	7.01
2 Line NH Test Map		1.67	1.22	9.54	12.43
Longboi T.E.24 No. Darkhasta		1.21	0.10	1.57	2.88
Rajgarh T. E. 332 NLR Grant		0.00	0.00	0.99	0.99
Nabhakatia Gaon		0.43	0.00	3.23	3.67
RajgarhT.E.22 No. Darkhasta		0.98	0.01	3.72	4.70
Karangani T. E. 18 No.	**Revenue Circle: Tingkhong & District: Dibrugarh**	0.23	0.00	0.24	0.47
Karangani T. E. 340 No.		2.08	0.06	0.00	2.14
Sorujoni T.E.19 Darkhasta		2.66	0.00	2.21	4.87
Nilomoni T.E 15-55-79 Grant		0.04	0.00	3.68	3.73
1 No. Sapkait		0.47	0.00	5.07	5.55
Nilomoni T.E 84 No.		0.20	0.00	1.05	1.25
2 No. Sapkait		0.25	0.00	0.05	0.30
Tingkhong T.E No. 3 RR Grant		12.57	0.00	0.10	12.68

Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where ownership could not be ascertained (in acre)*	Govt. Land (in acre)	Total Land to be acquired (in acre)
96 No. Kachalu Pathar		0.00	0.00	0.09	0.09
Purani Sripuria		0.79	0.21	1.75	2.75
Latumoni Gaon		3.76	0.00	1.51	5.27
Bailung bheti gaon		0.00	0.00	0.07	0.07
Teenali T.E 275-299 Grant		3.49	0.00	0.02	3.52
Teenali T.E 19-11,15-16 grant		2.94	0.00	3.60	6.53
Sukan Pathar		0.90	0.00	3.51	4.41
Pulungoni		0.42	0.05	0.07	0.54
Purani Konwari		0.60	0.00	3.00	3.60
Borpathar No.1		0.00	0.00	0.75	0.75
2 No. Ghuronia	**Revenue Circle: Naharkatiy & District: Dibrugarh**	0.00	0.00	1.20	1.20
Jamguri Konwari Gaon		0.26	0.00	2.27	2.53
Naharani		1.53	0.00	3.34	4.87
Desam T.E 184 grant		0.32	0.16	0.00	0.49
Achabam T.E		0.00	0.00	0.11	0.11
Disang Kinar Bangali		2.62	0.00	0.16	2.79
Total		**68.15**	**8.33**	**100.22**	**176.71**

Source: Social Impact Assessment Report

5.4.4 Impact on Structure

The break-up of the identified impacted structures (1880 numbers) is presented in given in **Table 52**.

Table 52: Impact on Structures

Impact	Residential	Commercial	Resi. & Com	Others	Total	% of Total
Less than 10%	4	52	2	8	66	3.51%

Impact	Residential	Commercial	Resi. & Com	Others	Total	% of Total
10-20%	7	78	1	5	91	4.84%
20-30%	6	65	5	2	78	4.15%
30-40%	3	82	2	6	93	4.95%
40% & above	101	946	40	465	1552	82.55%
Total	**121**	**1223**	**50**	**486**	**1880**	**100%**

Source: Social Impact Assessment Report

5.4.5 Terrestrial Ecology

There is no national park, wildlife sanctuaries, or any other similar eco-sensitive areas within 10 km distance of the project area. The nearest protected area from the project road is the Dihing Patkai National Park which is at a distance of 15 km (approx.) from the project road. However, 2553 no. trees are likely to be affected. The impact and mitigation due to tree cutting have been discussed in the following paragraphs. The road has a direct bearing on tree resources. Road widening option is made is such a way as to minimize the cutting of trees. However, efforts have been made in the design to reduce the tree cutting to only eight meters from the central line of the existing road. Compensatory plantation in 1:10 ratio with preference to fast-growing local species has been proposed under the project to address this impact.

5.5 Environmental Impacts - Construction Stage

5.5.1 Air Quality

The potential sources of air emission during the construction phase of the project are (i) dust re-suspension from earthworks including materials loading and unloading; (ii) quarrying and rock crushing; (iii) operation of construction equipment's and machines; (iv) fugitive emissions from unpaved travel on road; and (v) combustion of fuels in equipment, machinery, and vehicles. Particulate matter, comprising the majority from road construction, Particle size distribution from road construction is dominantly large, with 85.5% > 10µm and 55% > 20 µm which can settle within proximity of the source. Hot mix plant will generate carbon monoxide (CO), un-burnt hydrocarbon, sulphur dioxide, particulate matters, and nitrogen oxides (NO_x). These may affect the air quality of nearby areas especially due to emission from low height stack. The deterioration of the air quality within the immediate vicinity of the road construction activities will be significant but temporary.

Mitigation Measures: Following measures are proposed to minimize the dust and emission generation:

- Vehicles delivering loose and fine materials like sand and aggregates shall be covered.
- Loading and unloading of construction materials in the project area or provisions of water logging around these locations.
- Storage areas should be located downwind of the habitation area.

- Water shall be sprayed on earthworks and unpaved haulage roads regularly.
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- Explore the potential for using readymade asphalt and crushed rocks to avoid or minimize the use of hot mix and rock crushing plants.
- Mixing plants and asphalt (hot mix) plants shall be located at least 1 km downwind of the human settlements. The asphalt plants, crushers, and the batching plants shall be sited at least 500m in the downwind direction from the nearest settlement and after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plants shall be fitted with a stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
- Only crushers licensed by PCB shall be used.
- LPG should be used as a fuel source in construction camps instead of wood. Tree cutting shall be restricted.
- Mask and other PPE shall be provided to the construction workers.
- Diesel Generating (DG) sets shall be fitted with adequate height as per regulations
- Low sulphur diesel shall be used in DG sets as well as machinery.
- Air quality monitoring should be carried out during the construction phase. If monitored parameters are above the prescribed limit, suitable control measures must be taken.
- Dust Control Measures – Contractor shall sprinkle water to suppress dust along the entire project length using three water tankers. However, settlement areas, schools, markets shall be given preference. Contractor shall cover material by tarpaulin during transportation.
- Contractor shall install wet scrubber or any other suitable pollution control mechanism for Hot Mix Plant and ensure that flue gas passes through the wet scrubber before releasing into ambient air. Contractor shall also ensure that wet scrubber or other filter is always in operational stage when HMP is in operation.
- Contractor shall install water sprinkler at different point of crusher operation such before feeding into hopper, transportation at conveyor belt and before screening so that emission of dust is minimized.
- Debris Handling – contractor shall sprinkle water before handling debris to minimize generation of dust as per requirement of the site.
- Maintenance of the existing road and haul road – Contractor shall maintain existing road and haul road so that vehicle can pass easily and ensure that generation of dust is minimized.
- Storage sites of top soils shall be covered with grass and separated with bund. Water should be sprinkled to facilitate growing of grass.
- Storage area should be located downwind of the habitation area.
- Hot mix plant should be located at least 1.5 km from the nearest habitation, school, hospital, river, streams, lakes, 500m from ponds, and national highways, 250m from state highways. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure dispersion of exit gases.
- LPG should be used as fuel source in construction camps instead for woods.

- Vehicles and machinery shall be maintained regularly and PUC certificate shall be obtained by the Contractor regularly
- Ambient air quality shall be monitored by Contractor as per Environmental Monitoring Plan to ensure that air quality parameter is within permissible limit.

5.5.2 Noise

The scale of the construction necessary to upgrade the road and the corresponding slight increase in traffic is not expected to generate adverse impacts. Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops, and vehicles and earthmoving equipment. These construction activities are expected to generate noise levels in the range of 80 – 95 dB (A) at a distance of about 5 m from the source.

Although this level of noise is higher than the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporarily. This noise level will attenuate with an increase in distance from the noise source, decreasing by 10dB at a distance of about 55m and 20 dB at 180 meters. Impact due to noise during construction activities will be minimal near communities as construction camps are located at least 50 meters away from community areas.

Along the project road, noise-sensitive places have been located which includes schools and hospitals. Noise impacts during project construction will be significant on these but temporary. The details of the Sensitive location along the project road are mentioned in **Table 53**.

Table 53: Sensitive Structures along the project road

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	School	Left	0+150	15
2	School	Left	0+950	40
3	Training Institute	Left	1+525	10
4	School	Right	2+350	60
5	School	Left	2+875	10
6	School	Left	4+875	55
7	School	Left	5+425	10
8	School	Left	13+325	40
9	Health Center	Left	36+425	50
10	School	Left	41+625	25
11	Health Center	Left	44+850	25

The major source of noise and vibration pollution are use of vehicle for material transport, equipment used for cutting, leveling, dumping, pressing, concrete mixing, welding etc. These

vehicles/equipment's when operated by the operator generate noise level which is discussed in This will also have impact on the sensitive receptors if located nearby, resulting in hearing loss, loss in sleep, and other health related problems to the local nearby.

Table 54: Typical noise levels of principal construction equipment (Noise Level in dB (A) at 50 Feet)

Activities/ Operation of Equipment	Noise Level dB(A)	Activities/ Operation of Equipment	Noise Level dB(A)
CLEARING AND GRUBBING		**STRUCTURE CONSTRUCTION**	
Bulldozer	80	Welding generator	71-82
Front end loader	72-84	Concrete mixer	74-88
Jack hammer	81-98	Concrete pump	81-84
		Concrete vibrator	76
EXCAVATION & EARTH MOVING		Air compressor	74-87
Bulldozer	80		
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
GRADING AND COMPACTING		**LANDSCAPING AND CLEAN-UP**	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
PAVING		Front end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94

Source:

- ***U.S. Environmental Protection Agency. Noise from Construction Equipment and Operations. Building Equipment and Home Appliances. NJID. 300.1. December 31. 1971,***

Based on the standards prescribed by Occupational Safety and Health Administration (OSHA-USA) which in-turn are being enforced by Government of India through Model rules framed under the Factories Act. The acceptable limits for each shift being of 8-hour duration, the equivalent noise level exposure during the shift is 90 dB(A).

Hence noise generated due to various activities in the construction camps may affect workers, if equivalent 8-hour exposure is more than the safety limit. ACGIH (American Conference of Government Industrial Hygienists) proposed an 8-hour Leq limit of 85 dB(A). Exposure to impulses or impact noise should not exceed 140 dB(A). The workers in general are likely to be exposed to an equivalent noise level of 80-90 dB(A) in an 8-hour shift for

which all statutory precautions as per laws should be taken into consideration. Noise limits for different working environment are provided in **Table 55**.

Table 55: Noise Limits for different working Environment

Location/ Activity	Equivalent Level LAeq,8h	Maximum LA max, fast.
Heavy Industry (no demand for oral communication)	85dB (A)	110dB (A)
Light industry (decreasing demand for oral communication)	50-65dB(A)	110 dB(A)
Open offices, control rooms, service contours of similar	45-50 dB(A)	
Individual offices (no disturbing noise)	40-45dB(A)	
Classrooms lecture halls	35-40 dB(A)	
Hospital	30-35 dB(A)	40 B (A)

General EHS Guidelines: Occupation Health and Safety; IFC World Bank group.

Identification of Pollution Sources

Noise sources identified are:

- Construction activities such as demolition of structures, clearing and grubbing, excavation & earth moving, grading and compacting, structure construction crushing
- Transportation of construction material/debris/spoil through heavy vehicles
- Operation of hydraulic rigs for piles

The construction activities will generate temporary noise impacts in the immediate vicinity of the construction site. These noises generated by construction activities is a temporary phenomenon and is limited to construction phase only. Based on the noise level the OSHA Daily Permissible Occupational Noise Level Exposure time prescribe the exposure time for resident, local and people engaged in construction of road is discussed in **Table 56.**

Table 56: OSHA Daily Permissible Occupational Noise Level Exposure[1]

Sr. No.	Duration per day, hours	Sound level dB(A)
1.	8	90
2.	6	92
3.	4	95
4.	3	97
5.	2	100
6.	1 and ½ or 1.5	102
7.	1	105

[1] Occupational Safety and Health Administration (OSHA).

Sr. No.	Duration per day, hours	Sound level dB(A)
8.	½	110
9.	14 or less	115

Mitigation Measures for Construction Phase

The high noise levels may cause discomfort to local residents and workers. Following mitigation measures shall be adopted to keep the noise and vibration levels under control.

- The plants and equipment used for construction will strictly conform to Central Pollution Control Board (CPCB) noise standards. Vehicles, equipment and construction machinery shall be monitored regularly with particular 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 90dB(A); the exposure time for the workers should be as per the reference in **Table 56.**
- In construction sites within 150 m of human settlements, noisy construction will be stopped between 10 PM and 6 AM except in case of laying of cement concrete pavement for which lower working temperature is a requirement;
- Hot mix plant, batching or aggregate plants shall not be located within 500 m of sensitive land use as schools and hospitals;
- Noise barriers such as brick wall or concrete panel shall be used near to the sensitive receptors given in **Table 53** such as hospitals and schools;
- Phase demolition, earthmoving and ground-impacting operations so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately
- Construction machinery will be located away from the settlements;
- Careful planning of machinery operation and scheduling of operations can reduce the noise levels. Use of equipment, emitting noise not greater than 90 dB(A) for the eight-hour operations shift and locating of construction yards at a distance of at least 500 m from any residential areas can be adhered to;
- Use of noise shields to construction machinery and provision of earplugs to the heavy machine operators are some of the mitigation measures, which should be followed by the contractors during the civil works;
- The noise control measures include limitations on allowable grades. Open-graded asphalt and avoidance of surface dressings to reduce tire noise in sensitive areas. Maintenance of proper road surface repairs also helps in reducing noise levels;
- Use of air horns should be minimized during night time. During daytime use of horns should be restricted at few sensitive locations. This can be achieved through the use of sign boards along the roadside;
- The worker should have job rotation and especially for those workers, exposed to higher noise level.

- During the operational stage, the movement of traffic will be the prime source of the noise. Traffic congestion and pedestrian interferences increase the use of horns. This may result in increased noise levels at nearby schools and religious places.

5.5.3 Impact on Land and Soil

Borrow areas may lose their productivity if the topsoil is not preserved. Similarly, land area used for locating construction camp may lose its productivity, if it is not restored to its original stage after disbanding the construction camp.

Mitigation Measures: The topsoil from the productive land shall be preserved and reused for plantation purposes. It shall also be used as a top cover of the embankment slope for growing crops and vegetation to protect soil erosion. It shall be ensured that the land taken on lease for access to the road and construction camp is restored to its original land use before handing over back to be the owner.

5.5.4 Soil Erosion

Soil erosion may take place at locations of the sharp bend near bridge construction locations, along steep and incompact embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, and drainage problem. Loss of soil due to runoff from earth stock-piles may also lead to the siltation of nearby water bodies. The intensity of soil erosion at different locations will be influenced by the lithology, topography, soil type, and climatic condition (mainly rainfall) and drainage pattern.

Mitigation measures: Following mitigation measures are proposed for the prevention of soil erosion:

- Bank protection measures shall be taken at erosion-prone areas. The protection measures may include the use of stone pitching for embankment height more than 3m.
- Provision of side drain to guide the water to natural outfalls.
- When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls.
- Side slopes of the embankment shall not be steeper than 2H: 1V.
- Shrubs shall be planted in loose soil areas.
- In rural stretches, longitudinal side drains shall be intercepted by drains serving as outlet channels to reduce the erosion
- IRC: 56 -2011 recommended practice for the treatment of embankment slopes for erosion control shall be taken into consideration.
- Soil erosion shall be visually checked on slopes and high embankment areas. In case soil erosion is found, suitable measures shall be taken to control the soil erosion further including bio-turfing.
- During excavations, the Contractor will take all adequate precautions against soil erosion as per MoRTH Specification for Road and Bridge works (5th Revision) Clause no. 306.
- The earth stockpiles to be located shall be provided with gentle slopes to prevent soil erosion and flow with water.

5.5.5 Borrow Areas and Quarries

The project area is flat terrain. Farmers are willing to provide earth from their field up to a certain depth on adequate compensation; it is recommended that borrowing from agricultural land shall be minimized to the extent possible.

Borrow areas if left un-rehabilitated may pose risk to people, particularly children and animals of accidentally falling into the pit as well as become potential breeding ground for mosquitoes of vector born disease.

Illegal quarrying may lead to unstable soil conditions; destroy the landscape of the terrain, air, and noise pollution. The opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from existing nearby quarries.

Mitigation measures: Borrow pits shall be selected from barren land/wasteland to the extent possible. Borrow areas should not be located on cultivable lands except in the situations where landowners desire to level the land. The topsoil shall be preserved and depth shall be restricted to the desired level.

Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for the selection of borrow pits and the amount of material that can be borrowed.

The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%. To the extent possible, borrow areas shall be sited away from inhabited areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. In addition, it shall be converted into fishpond in consultation with the fishery department and if desired by the landowner/community. The borrow shall be rehabilitated according to the broad guidelines.

Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval/ rehabilitation plan for a new quarry or use of existing sources will be submitted to EO, PIU. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state, and submit a copy of it for the approval to EA if new quarries are opened. The guidelines for borrow area management are given in **Annexure 6**.

5.5.6 Compaction and Contamination of Soil

The soil in the adjoining productive lands beyond the ROW, haulage roads, and construction camp area may be compacted due to the movement of construction vehicles, machinery and equipment, and due to the sitting of construction camps and workshops. Approach road either paved or unpaved is available for most of the bridge approaches. However, for some bridges approach road has to be constructed.

Soil may be contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment, and machinery. Soil may be contaminated due to the inappropriate disposal of domestic solid waste and sewage from construction camps.

Mitigation Measures: Fuel and lubricants shall be stored at the predefined storage location and away from drainage channels. The storage area shall be paved with a gentle slope to a corner and connected with a chamber to collect any spills of the oils. Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil.

All efforts shall be made to minimize waste generation. Unavoidable waste shall be stored at the designated place before disposal. To avoid soil contamination at the wash-down and re-fueling areas, oil interceptors shall be provided. Oil and grease spill and oil-soaked materials are to be collected and stored in labeled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/MoEF&CC authorized Waste Oil Recycler.

To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery, and equipment shall be restricted to the designated haulage route.

- Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land shall be reclaimed after construction activity.
- Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at the construction camp.
- Domestic solid waste at construction camp shall be segregated into biodegradable and non-biodegradable waste. The non-biodegradable and recyclable waste shall be sold off.
- Efforts shall be made that biodegradable waste shall be composted in the mechanized and movable composter by the contractor. Non bio-degradable and non-saleable waste shall be disposed of at authorized landfill site. Non-bituminous wastes to be dumped in borrow pits with the concurrence of the landowner and covered with a layer of topsoil conserved from opening the pit.
- Bituminous wastes will be disposed of in an identified dumping site approved by the State Pollution Control Board.

Construction waste constitutes debris, which is generated due to dismantling of pavement (though involved only for few kilometers in DBH Road), quarry dust, and unused iron bars or damaged support structures. Uncontrolled disposal of these wastes may affect soil and even receiving water bodies may cause contamination of soil, and landscape of the area.

Mitigation Measures: Construction waste shall be disposed of in an environmentally acceptable manner. Some of the measures are as follows:

- The existing bitumen surface can be utilized for paving of crossroads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, drains, cross drainage should be used for backfilling embankments, filling pits, and landscaping. Unusable debris material should be suitably disposed of at pre-designated disposal locations, with approval of the concerned authority.

- The bituminous wastes shall be disposed of in secure landfill sites only in an environmentally accepted manner. For removal of debris, wastes and its disposal MoRTH guidelines should be followed.
- The locations of dumping sites should be selected away from residential areas and located at least 1000 m downwind side of these locations with the following consideration.
- Dumping sites do not contaminate any water sources
- Dumping sites have adequate capacity for accommodation debris generated.
- Public perception and consent from the village Panchayats about the location of debris disposal site shall be obtained before finalizing the location.
- Unproductive/wastelands shall be selected for dumping sites.

5.5.7 Groundwater

Contamination of groundwater is not envisaged since construction camps will have toilets commode to septic tanks or mobile toilets depending on the number of workers in each camp.

Mitigation Measures: Requisite permission as applicable shall be obtained for the abstraction of groundwater. The contractor shall make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Water intensive activities shall not be undertaken during the summer season.

5.5.8 Surface Water Bodies

Temporary pollution of water bodies may occur due to spillage of chemicals and oil at construction sites. Installation of a haul road or temporary access across the river/nala maybe required while construction work is ongoing in the existing minor bridges and culverts. This may cause sedimentation and other disturbances to the water body.

Mitigation Measures: To prevent the siltation of roadside ponds, the provision of retaining wall is made along the road for the ponds located next to the road. To enhance the ponds along the road 5m width turfing and surface drains will be provided at pond located at Ch. 8+750 (L). As control measures, efforts shall be made to increase the water-holding capacity of the ponds (other than those affected) in the region by using the bed material as borrow earth. Following measures shall be followed additionally:

- Bridge construction activity including piling is recommended during non-monsoon seasons (October to End of May) period.
- Check dams must be created during construction to catch the silt or debris generated from construction activities across the water channels
- All chemicals and oil shall be stored away from water and concrete platforms with catch 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, easy to understand, and preferably written in the local language emergency response procedure, including a reporting system will be provided by the contractors.

- All wastes arising from the construction should be disposed of in an environmentally accepted manner so as not to block the flow of water in the channels. The wastes should be collected, stored, and transported to the approved disposal sites.
- No vehicles or equipment should be parked or refueled near water bodies, to avoid contamination from leakage of fuel and lubricants.
- Substructure construction should be limited to the dry season.
- Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Sewage from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies because these are used for bathing and washing purpose.
- Vehicle shall be washed at designated location and washed-out water shall be collected at oil interceptors for removal of grease and oil before disposal

5.5.9 Hydrology and Drainage

Construction material and waste may contaminate or clog the small drains if stored or disposed of close to the water body.

Mitigation Measures: Adequate cross drainage structures shall be provided. Additional balancing culverts shall be provided in flood-prone areas. The embankment height shall be designed consistent with the existing topography of the region and shall be higher than the HFL. The elaborate drainage system shall be provided to drain the stormwater from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and subsurface water of the area.

The design of the drainage system such as surface and sub-surface drainage shall be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes, and the service roads shall be discharged through longitudinal drains, designed for adequate cross-section, bed slopes, invert levels, and the outfalls. If necessary, the walls of the drains shall be designed to retain the adjoining earth.

IRC: 34-2011: Recommendations for road construction in the waterlogged area and IRC: 75 and MORT&H guidelines for the Design of High Embankments shall be referred.

No construction material will be stored or disposed near any water body except for reusing it for enhancement measures such as embankment raising.

5.5.10 Impact on Biological Environment

5.5.10.1 Terrestrial Ecology

As per the approved Protected areas map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (Annexure 22) during the initial survey, there is no national park, wildlife sanctuaries, or any other similar eco-sensitive areas within 10 km distance of the project area. The nearest protected area from the project road is the Dihing Patkai National Park which is at a distance of 15 km (approx.) from the project road. However, some trees are likely to be affected. The impact and mitigation due to tree cutting have been discussed in the following paragraphs.

One month before the construction starts, clearing and grubbing will be performed by the contractor. A total of 2553 trees are likely to be affected due to the proposed project. The cutting of trees will have a minor to negligible impact on the local environment.

Mitigation Measures: Requisite permission from the Forest Department shall be obtained for cutting of roadside trees located in forest land. In the State of Assam, as per the Assam (Control of Felling and Removal of trees from Non-forest lands) Rules, 2002, the felling of trees from the Non-forest area will require prior approval of the Forest Department.

The project envisages plantation of 25530 trees along both sides of the road as per IRC SP: 21 specifications. This will include the compensatory plantation in the 1:10 ratio as per the NGT order. The saplings shall be planted before cutting the existing trees. Besides, additional plantation shall be done on banks of water bodies near bridge sites to enhance the aesthetics and check soil erosion. All tree plantations will be carried out through the forest department, local community, or the civil works contractor. Tree species selected for plantation must be suitable for local climatic conditions and be equal to or better in sequestering carbon than the trees removed/be good for sequestering carbon (only for roads where there is no tree cutting). Necessary advice may be sought from the local Forestry office in the selection of tree species.

5.5.10.2 Aquatic Ecology

Temporary sedimentation and water quality deterioration are expected from the project during the construction stage. An accidental spill of materials, chemicals, and fuels may also deteriorate receiving water quality and hence the aquatic ecology.

Mitigation measures: It is proposed to undertake construction activities near water bodies during the summer season when most of the water bodies are practically dry. Best construction practices shall be adopted to prevent an increase in siltation level of the water. All precautionary efforts shall be made as given under the surface water section to prevent accidental damage of water quality.

5.5.11 Socio-Economic Impact

Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with the increase of traffic and induced development of the area. The improved road will provide better connectivity which will result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, access to educational and other infrastructure al facilities (iv) enhanced tourism activities in the area and state which in many time will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

Pandemic Effect of COVID -19 on Health & Safety Issues

During public consultation, care has to take that the State of Assam COVID-19 Guidelines are well practices.

During public consultation with the local people the following guideline need to be followed:

- Social Distancing measures need to be followed as per the guidelines of Assam Government circular.
- No more than 4 people should be Assemble during consultation and that to minimum distance of 6 feet need to be complied.
- During consultation if somebody is seen having cold, cough or unhealthy appearance like from the face reading it appears that he/she is sick, that person should be avoided.
- Do exchange any documents, pens, attendance sheet for signing during consultant. The consultant should enter all the consultation findings and attendance sheet on his/ her own behalf.
- Any document submitted during consultation should be left in one box with all the entries made by the document holder and signed by his/her own pens.
- The social consultant should carry face mask, hand sanitizer, hand gloves, face shield, body cover, etc.
- There should be no exchange or free distribution of face mask during consultation.
- Avoid those people who are not adopting social distancing measures or are not wearing face mask and are not adopting precautionary measures.
- Take photographs of consultation adopting social distancing measures and regular use of hand sanitizer after each consultation.
- Avoid those area, where number of COVID-19 patients are reported in large number by the state authority. The consultation can be repeated after situation improves.

Health and Safety Guideline for Workers under COVID -19 Pandemic situation.

- The labour will have to have COVID -19 induction when he joins the work site.
- The EHS officer during the tool box talk should educate the labors about the COVID -19 pandemic, usage of Mask is mandatory, frequent hand washing and provision of hand sanitizer at all the project site
- The labors coming from home time should be kept under quarantine as per the State quarantine regulations.
- At each project site there should have register maintained for recording of labors temperature at entry gate. At the active construction site all the workers should wear mask. The contractor should provide mask free of cost to all the labors.
- At the labors camps poster in local language should be paster at notice board.
- The social distance measures i.e number of labors in each room, kitchen strength, bathroom facilities and water point should be multiples.
- Each labors camp should have isolation room available to quarantine the labors in case COVID -19 is reported.
- There should be COVID-19 antigen test conducted for each labor travelling from outstations.
- There should be noticed board having number of Police Station, COVID treatment center, Hospitals, doctor on panel with the contractor in case of COVID-19 inspection.

The EHS office at project site should keep the track records of workers health, traveling scheduled and health complaint or complaint received from other workers on colleague's health.

5.5.12 Labour and Construction Camp

Construction workers expected to be about 250 per day per package are likely to be employed during construction. Most of the workers will be employed locally. However, some may be from nearby areas. This will cause an additional burden on local resources. However, this impact will be temporary and will not have the potential for changes in the demographic scenarios of the area. The outside workers will be housed at the construction camp, which is expected to one per package. Poor sitting and improper management of construction camps may lead to several adverse impacts on environment viz. (i) loss of vegetation due to use of wood as fuel source for cooking (ii) deterioration in nearby surface water bodies‟ quality (iii) compaction and contamination of soil due to uncontrolled disposal of solid waste (iv) Poor sanitation may result to the transmission of communicable diseases among the workers and the host communities. This includes the possible spread of sexually transmitted diseases, diseases from improper handling and supply of foodstuffs, poor water supply, and insect-borne diseases.

Mitigation Measures: Construction camp shall be sited at such locations to utilize the existing infrastructure. No productive land should be utilized for a construction camp. All sites must be graded, ditched, and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including a recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer. All camps should maintain a minimum distance of 1000 m from habitation and water bodies.

All construction camps shall be provided sanitary latrines and urinals with the provision of septic tanks attached with soak pits or mobile toilets fitted with the anaerobic digestion system. Stormwater drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder regularly. Garbage bins must be provided in the camp and regularly emptied and disposed of hygienically. LPG cylinders shall be provided as a fuel source for cooking to avoid any tree cutting.

The Contractor will ensure the following:

- The good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV between and among the workers and community, promote early diagnosis, and assist affected individuals.
- Activities under the program include monthly information, education, and consultation communication campaigns to workers, drivers, delivery crew, and communities on the risk, dangers, and impacts of STD and HIV/AIDS.
- The contractor will also provide first aid facilities at the camp and organize regular health check-up camps as well.
- The availability of safe drinking water and sufficient supply of suitable and hygienically prepared food at a reasonable price is available to the workers.
- Adoption of all precautions to protect the workers from insects and pests to reduce the risk to health. This includes the use of insecticides, which should comply with local regulations.

- Prohibition on supply or availability of alcoholic liquor or prohibited drugs at the camp.
- Regular health check-ups and immunization camps shall also be organized for the workers and nearby populations.
- Construction Workers shall be encouraged to clean/sanitize their hands frequently. Necessary arrangements for it like hand basins shall be made. They shall be encouraged to maintain social distancing at work sites and camp.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area as per ESMP, so that oil and lubricants that may spill on the floor does not contaminate any soil or water body. In case of any oil spills, it should be cleaned properly. There shall also be provisions for storage of used oil until it is disposed as per comprehensive waste management plan prepared by Contractor and approved by CSE.
- The temperature of the workers should be checked every morning using an Infrared Thermometer before the start of construction activities.
- Workers showing symptoms of Covid-19 shall be provided with appropriate medical assistance.
- Workers joining the construction site/labour camp after traveling from outstation shall be tested for Covid-19 before allowing them at site/labour camp.
- Workers should be encouraged to use hand gloves and face masks.
- Labour camps and construction sites shall be sanitized at regular intervals.

5.5.13 Safety

The road construction activities may create various unsafe situations. This will require attention to the following safety aspects viz.

- Safety of construction workers,
- Safety of road users including pedestrians and cyclists
- Safety to cattle;
- Safety of the local community
- Unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the design and construction stage and
- Conduct safety audits.

Mitigation measures: During the construction phase, contractors shall be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during (i) road works (ii) handling of large construction equipment and machinery, (iii) handling of chemicals and hazardous materials, and inflammable substances (iv) welding and (v) electrical works. The contractor shall also arrange required PPEs for workers, first aid, and firefighting equipment at construction sites. The contractor will also prepare an emergency preparedness plan, which shall be duly approved by EA to respond to any emergency and unsafe conditions. To avoid disruption of the existing traffic due to construction activities, a comprehensive traffic management plan shall be drawn up by the contractor.

Retro-Reflector zed traffic caution signs shall be used during construction. Regular safety audit or periodic reviews shall be made to assess the effectiveness of safety measures adopted during construction.

Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable with Retro-reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety to school children. The provision of sped breakers or rumble strips shall be made near schools, health centers etc.

5.5.14 Community Health and Safety

Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures. Poor safety signage and lack of barriers at work site and trenches will create hazard to pedestrians and children.

Mitigation measures:

- Provide safety barriers near any trenches, and cover trenches with planks during non-work hours.
- Contractor's activities and movement of staff will be restricted to designated construction areas.
- Consult with local PWRD authority on the designated areas for stockpiling of soils, gravel, and other construction materials.
- If the contractor chooses to locate the work camp/ storage area on private land, he must get prior permissions.
- Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.
- A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do.
- Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environmental and social specialist attention immediately; and (iv) taking remedial action as per environmental and social specialist instruction.
- The contractor shall immediately take the necessary remedial action on any complaint/ grievance received by him and forward the details of the grievance along

with the action taken to the environmental specialist within 48 hours of receipt of such complaint/ grievance.

5.5.15 Chance Find Procedure

There is a risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. Although no such sites have been identified. For this project, excavation will occur in and around the existing RoW and specified government land so no risk is foreseen to these structures. Nevertheless, the PMU and PMC will:

- Consult Archaeological Survey of India and/or State Department of Archaeology to obtain an expert assessment of the archaeological potential of the site.
- Consider alternatives if the site is found to be of medium or high risk.
- Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available.
- Develop a protocol for use by the Contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.
- If fossils, coins, articles of value or antiquity, structures, and their remains of geologic or archaeological interest are found, local government shall be immediately informed of such discovery and excavation shall be stopped until identification of cultural relics by the authorized institution and clearance is given for proceeding with work. All the above discovered on site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
- The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing.
- He shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, waiting which all work shall be stopped.
- The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.

5.6 Environmental Impacts – Operation Phase

The subproject road passes through open agricultural land in most of the sections, which will provide adequate dispersion of gaseous emission from vehicles. Further, the proposed plantation will ameliorate/enhance the microclimate. No adverse climatic changes/impacts are anticipated during the operation stage other than GHG (CO_2) emission due to increased traffic, which would be largely offset with better fuel efficiency and reduced vehicle idling due to improved road conditions.

5.6.1 Air Quality

The impacts in the operation stage for air would be less severe as compared to that in construction phase. After completion of road improvement works, smoothened new pavement and widened roads reduce fugitive dust emissions. This reduced vehicular emission is due to uniform speed and less frequent acceleration and deceleration of vehicles. With reduction in the levels of CO2, NOx, CO and HC emissions from the operating

vehicles, there will be extensive saving on fuel consumption. Air pollution can be an important concern due to increase in number of vehicles on the improved roads and poor maintenance of vehicles. To assess the likely concentrations at the critical location along the project road corridors, the prediction of the pollutant concentrations has been carried out for project using CALINE-4, a dispersion model based on Gaussian Equation. The current and projected traffic volume of A30_1 (Moran to Disang Kinar Bangali) road has been used for the prediction. CALINE-4 is a dispersion model developed by the California Department of Transportation for the prediction of concentrations of critical atmospheric pollutants (CO, NO_x and $PM_{2.5}$) along the highways. This model employs a mixing zone concept to characterize pollutant dispersion over the highway and can be used to predict the pollutant concentrations for receptors up to 500 m of the corridor. The model uses the baseline data on existing concentration of pollutants and estimates the incremental emissions due to the project.

Input Parameters:

- **Traffic Data**: The fleet wise traffic volumes for the present study has been taken from the detailed project report of the project. The annual average daily traffic (AADT) data is available for the proposed road through traffic survey. CALINE 4 model needs hour average traffic volume. The total traffic hour volume is further categorized into two-wheeler, four-wheeler, light commercial vehicles (LCV), bus, high commercial vehicles (HCVs) based on traffic survey at existing road.

Table 57: Predicted Traffic Volume Per Hour

Year	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck	PCU
2020	113	1	44	6	4	11	419
2025	152	1	59	7	5	16	561
2030	203	2	79	10	6	21	750
2035	272	2	106	13	8	28	1004
2040	364	3	142	18	12	38	1344

- **Meteorological data:** The study was conducted to predict pollutant concentration for worst-case meteorological conditions. The meteorological parameters such as wind speed, wind direction, wind direction standard deviation, temperature, mixing height and stability condition are used in model.

Table 58: Meteorological Data for CALINE 4

Sr. No.	Baseline Condition Input Data	Values
1	Altitude above Sea Level	120.874 m

Sr. No.	Baseline Condition Input Data	Values
2	Wind speed	2.22 m/s
3	Wind direction	North-East (45^{O})
4	Ambient Temperature	$25^{O}C$

- **Road Geometry:** In the CALINE-4 model the entire length of the selected road section is divided into various road links. The division of sections into links has been done in such a way, so that the link can be fairly considered straight stretch of road having homogenous geometry with uniform road width, height and alignment. The coordinates of end points of links specify the location of the links in the model. The maximum number of links in each road section can be 20. The mixing zone width calculated for selected highway corridor is 7m+ 3m + 3m = 13 m as per guideline provided in CALINE4 model.
- **Emission Factors:** Emission factor is one of the important input parameters in CALINE-4 model. In the present study, the emission factors specified by the Automotive Research Association of India (ARAI) have been used for calculation of weighted emission factors. These emission factors have been expressed in terms of type of vehicles and type of fuel used (for petrol and diesel driven passenger cars). Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas there are different categories of vehicles (viz. two wheelers, cars, bus and trucks) with different year of manufacture and fuel used, it is essential that a single value representing the equivalent or weighted emission factors for all the vehicles is input into the model. The emission factor used to estimate WEF are given below. The traffic data are not available for fuel types, therefore average emission factor is used in this study.

Table 59: Emission factors for different types of Vehicle (ARAI, 2007)

Pollutants	Unit	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck
CO	g/km	1.036	1.25	1.281	1.56	8.03	6
NOx	g/km	0.312	0.219	0.04	0.288	0.548	1.24
PM2.5	g/km	0.021	0.01	0.031	0.061	0.133	0.133

These projected vehicles would generate various air pollutants among which CO, NO_2 and Particulate matter ($PM_{2.5}$) would be modelled to predict their quantities for the year 2020, 2025, 2030, 2035 and 2040. PM_{10} and SO_2 concentration need not be modeled as sulfur content in the fuel used in vehicles is quite less to cause a significant SO_2 emission. SO_2 emission factor for vehicles is not included in the report on "Emission Factor development for Indian Vehicles" by The Automotive Research Association of India (ARAI). Similarly,

Particulate Matter in the emission factor considers only $PM_{2.5}$ as coarse fraction $PM_{2.5}$ to PM_{10} is negligible in vehicle exhaust.

The predicted results of CALINE4 has been tabulated below. Considering the predicted future traffic according to normal growth rate for the years 2020, 2025, 2030, 2035 and 2040, CO, NO_2, and $PM_{2.5}$ levels are predicted. These levels were within the limiting standards as specified in National Ambient Air Quality Standards.

Table 60: Predicted Concentrations of CO in the study location (ppm)

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	0.5	0.5	0.5	0.5	0.4
2025	0.6	0.5	0.5	0.5	0.5
2030	0.6	0.6	0.6	0.5	0.5
2035	0.7	0.7	0.6	0.6	0.5
2040	0.8	0.8	0.7	0.7	0.6
Limit	3.495	3.495	3.495	3.495	3.495

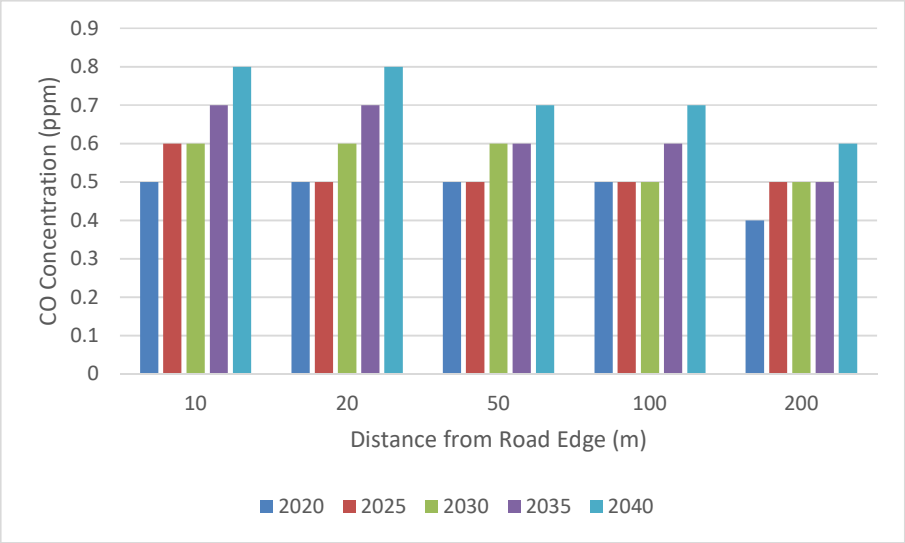


Figure 39: Graph representing Predicted Concentrations of CO in the study location (ppm)

Table 61: Predicted Concentrations of PM2.5 in the study location (µg/m3)

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	21.4	21	20.5	20.1	19.7
2025	22.6	22.1	21.4	20.9	20.3
2030	24.3	23.5	22.6	21.9	21.2
2035	26.4	25.4	24.3	23.3	22.3

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2040	29.4	28	26.5	25.2	23.8
Limit	60	60	60	60	60

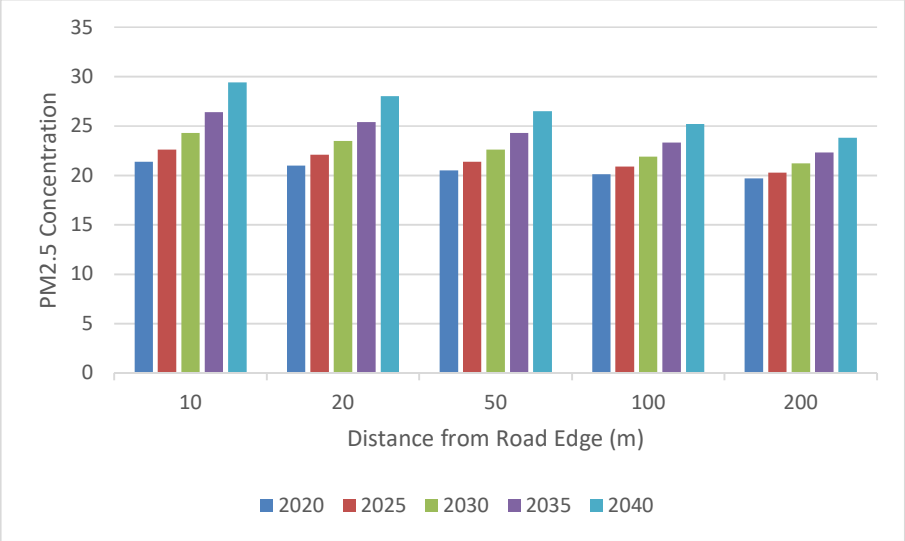


Figure 40: Graph representing Predicted Concentrations of PM2.5 in the study location (µg/m3)

Table 62: Predicted Concentrations of NO2 in the study location (ppm)

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	0.01	0.01	0.01	0.01	0.01
2025	0.01	0.01	0.01	0.01	0.01
2030	0.01	0.01	0.01	0.01	0.01
2035	0.01	0.01	0.01	0.01	0.01
2040	0.01	0.01	0.01	0.01	0.01
Limit	0.04	0.04	0.04	0.04	0.04

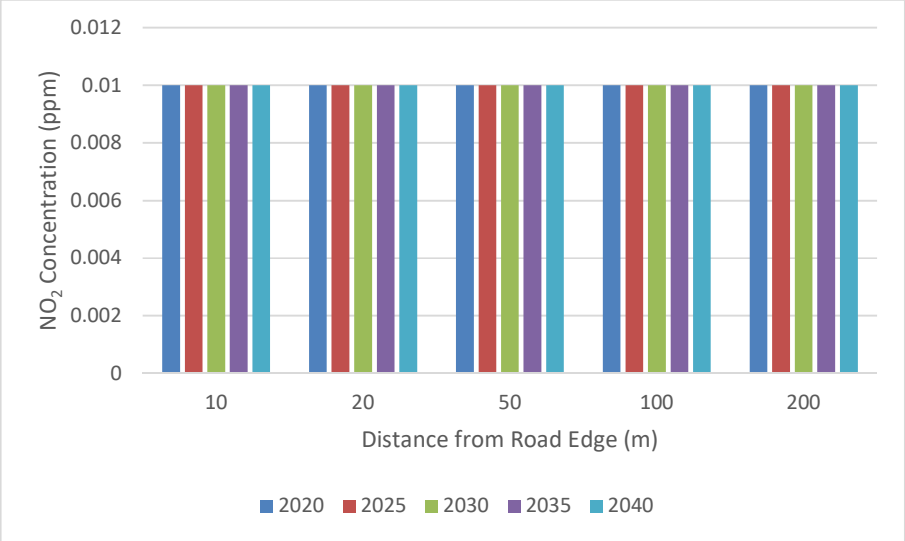


Figure 41: Graph representing Concentrations of NO2 in the study location (ppm)

Mitigation measures:

During the operation stage, vehicular emissions of pollutants (PM_{10}, $PM_{2.5}$, CO, SO_2, NO_x) shall be monitored at approved locations against National Standards. Regular monitoring is done to ensure that the air quality along the project area is within permissible limits.

Avenue and median plantation along the roadsides and medians should be done to control dust and fugitive emissions from reaching receptors. Compensatory plantation could be taken up in the available space within ROW in consultation with the local forest department. Tree plantation for attenuating pollution levels shall include pollution tolerant species with thick foliage.

5.6.2 Noise

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby villages. Cumulative noise levels of these traffic sources were computed using Federal Highway Administration (FHWA's) Traffic Noise Model (TNM). TNM computes incremental highway traffic noise at nearby receivers. As sources of noise, it includes noise emission levels for the following vehicle types:

- Automobiles: all vehicles with two axles and four tyres primarily designed to carry nine or fewer people (passenger camp, vans) or cargo (vans, light trucks), generally with gross vehicle weight less than 4500 kg.
- Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
- Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
- Buses: all vehicles designed to carry more than nine passengers
- Motorcycles: all vehicles with two or three tires and an open-air driver/passenger compartment.

The procedure for prediction of noise levels involved the following steps:

- Identification of various receivers,
- Determination of land uses and activities which may be affected by the noise generated
- Assemble input parameters
- Application of the model

Input Parameters

Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type- light, medium and heavy along with their average speed is used for predictions. The average speeds for vehicles in our project road around build-up area are considered as 30 kmph for this model.

Average Noise Level

All vehicles produce some noise, which is taken as the base and the cumulative noise at the receiver distance due to the whole traffic is estimated. The average noise levels vary depending on the type of vehicle. In order to assess the impact of noise due to the change in traffic density and speed, a small road section of each project road has been selected to develop noise projections for future years 2020, 2025, 2030, 2035, and 2040. In order to assess the impact of traffic on sensitive receptors along the road, receptor locations were set at 50 m, 100 m, 200 m, 300 m, 400 m, 500 m, 600 m, 700 m and 800 m from the center line of the road.

The outputs of the assessment are presented in table below. The **Table 63** shows the noise levels that will be generated by traffic at the respective distance from the centerline of the road. The predicted noise levels are those predicted around built-up area considering vehicle speed as 30 kmph. The permissible noise levels in residential area according to Ambient Noise Standards are 55 dB in daytime and 45 dB at nighttime. It can be seen that even without mitigation measures, noise levels in built up area are within the permissible levels except, 50m from road in the year 2040 in day time and within 50m and 100m for all years in night time. The sensitive receptors located within 50m and 100m distance of the road are not operational at night time, hence increased noise will not cause any adverse impact.

Table 63: Anticipated Noise Levels due to projected traffic

Sr. No.	Distance from Centerline (m)	2020		2025		2030		2035		2040	
		Day time	Night time	Day time	Night time	Day time	Night time	Day time	Day time	Night time	Day time
1	50	49.9	50.2	51.3	51.4	52.5	1	50	49.9	50.2	51.3
2	100	45.2	45.5	46.6	46.7	47.8	2	100	45.2	45.5	46.6
3	200	40.5	40.8	42	42	43.2	3	200	40.5	40.8	42
4	300	37.7	38	39.1	39.2	40.3	4	300	37.7	38	39.1
5	400	35.9	36.2	37.3	37.4	38.5	5	400	35.9	36.2	37.3

Sr. No.	Distance from Centerline (m)	2020		2025		2030		2035		2040	
		Day time	Night time	Day time	Night time	Day time	Night time	Day time	Day time	Night time	Day time
6	500	34.7	35	36.1	36.2	37.3	6	500	34.7	35	36.1
7	600	33.7	34	35.2	35.3	36.4	7	600	33.7	34	35.2
8	700	33	33.3	34.4	34.5	35.6	8	700	33	33.3	34.4
9	800	32.3	32.6	33.8	33.9	35	9	800	32.3	32.6	33.8

It is evident from the above table that minor increase in noise levels are anticipated due to increase in traffic intensity over the years. However, with mitigation measures like limiting the speed of vehicles around built up area, the noise levels will be maintained below the permissible limits. Most of the road alignment passes through agricultural fields and small proportion is passing through residential areas. The number of sensitive receptors within 50m and 100m distance of the road is very few. Hence, overall noise impacts on sensitive receptors will be insignificant.

Mitigation Measures

One or more rows of avenue vegetation are planted along the road to reduce the noise due to moving vehicles. Traffic management like speed restrictions and prohibition of horns shall be implemented near sensitive receptors. Regular monitoring programs should be undertaken to check any increase in noise levels due to traffic congestion.

5.6.3 Land and Soil

Better access can lead to the conversion of agriculture land for residential and commercial purposes close to roads and especially in a rural and urban area.

Mitigation Measures: The EA may explore the feasibility of restricting about 30 m area either side of the road as no development zone on the line restriction is imposed for National Highways Authority of India.

5.6.4 Soil Erosion

No impact on soil is anticipated during the operation phase of the project except bridge approaches where unexpected rainfall may erode the embankment formation and deterioration of borrow areas if not rehabilitated properly.

Mitigation measures: Embankment stabilization shall be check periodically during the operation stage and suitable stabilization measures shall be taken wherever any erosion is identified. Borrow areas will also be rehabilitated following the guidelines given in **Annexure 6.**

5.6.5 Ground Water

No impact is anticipated on groundwater due to the project during the operation phase of the project hence, no specific mitigation measure is proposed.

5.6.6 Surface Water Bodies

No major or long-term impact is anticipated during the operation phase on the surface water bodies due to the project implementation activities. Oil contaminated runoff from the road during monsoon will have minimal impacts considering their low concentration.

5.6.7 Hydrology and Drainage

Regular removal/ cleaning of deposited silt shall be done from drainage channels and outlet points before the monsoon season. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted.

5.6.8 Impact on Biological Environment

Terrestrial ecology

Positive impacts on terrestrial ecology are expected during the project operation stage due to the increase in vegetation and landscaping along the road. The project will coordinate with the local communities to maintain and enhance the trees planted along the state road. "No adverse impact is anticipated during operation stage except accidental damages or absence of proper tree management.

Mitigation Measures: Arrangement shall be made to ensure the survivability of the tree plantation. The tree survivability audit shall also be conducted at least once in a year to assess the effectiveness of the program.

Aquatic Ecology

No impact is envisaged during the operation phase of the project and hence no mitigation proposed. However, periodic surveillance shall be conducted to check erosion and siltation in major water bodies.

5.6.9 Community Health and Safety

During the operation phase, the increase in the number of motorized road users traveling at higher speeds also increases the chances of injuries and fatalities from road crashes.

Mitigation Measures: Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable of PCC with Retro-reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety to school children. The provision of speed breakers shall be made near schools and religious places.

5.7 Cumulative and Induced Environmental Impacts

Cumulative impacts are the combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project.

Induced Impacts are the adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location.

The cumulative impact is sum of the impact expected by the project discussed in this EIA report and other project which is planned or under implementation in the study area. The cumulative impact is sum off all the environmental components i.e. for e.g. total number of tree felling involve in all projects, land acquisition, total forest area effect etc. need to be addresses. The cumulative impact expected by all the project area is highlighted in **Table 64.**

Table 64: Cumulative Impact Expected Due to Project Development

Sr. No.	Features Affected	Name of Project	Cumulative Impact
1	No of tree Felling Involve	A30_2 (Disang Kinar Bangali to Kathalguri)	1515
2	Government Land Affected	A30_2 (Disang Kinar Bangali to Kathalguri)	30.02 acres
3	Forest Land Affected	A30_2 (Disang Kinar Bangali to Kathalguri)	No forest land will be affected due to the proposed project development
4	Increase in emission rate	A30_2 (Disang Kinar Bangali to Kathalguri)	The CO_2 emission rate will increase by 35,114.06 tons/year
5	Influx of labor	A30_2 (Disang Kinar Bangali to Kathalguri)	200 labors
6	Structure Affected	A30_2 (Disang Kinar Bangali to Kathalguri)	479
7	Incremental load due to NO2, SO2, PM 2.5 and CO	A30_2 (Disang Kinar Bangali to Kathalguri)	The widened road, particularly in the present more congested urban sections together with the improved road surface, will reduce congestion. This will have the impact of encouraging a more regular and uniform speed. With the same traffic flows at this increased speed, emission levels and noise levels will be reduced. However, the projected increase in traffic flows may have the impact of increasing the overall vehicle emissions and noise levels.
8	Land Acquisition	A30_2 (Disang Kinar Bangali to Kathalguri)	91.35 acres
9	Forest Area Affected	A30_2 (Disang Kinar Bangali to Kathalguri)	No forest area will be affected due to the proposed project development

Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demand and better prices for agricultural products. Further the increased industrial activities will significantly reduce migration. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in

the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

In terms of environment precaution issues the improved road surface is expected to result in less dust and noise due to traffic plying on the damaged roads. However, the increased traffic due to the improved road will generate more air pollution due to vehicle exhaust and noise. The smoother road conditions will also result in increase of traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the subproject area of Dibrugarh district.

For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees and installation of noise barriers where necessary have been included in the ESMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture includes safety related furniture, enforcing rules against encroachment of structures and sensitive structures inside the ROW and implementation of the emergency management system has been included in the ESMP for implementation during operation stage.

5.8 Potential Environmental Enhancement/ Protection Measures

5.8.1 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 work site, 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.

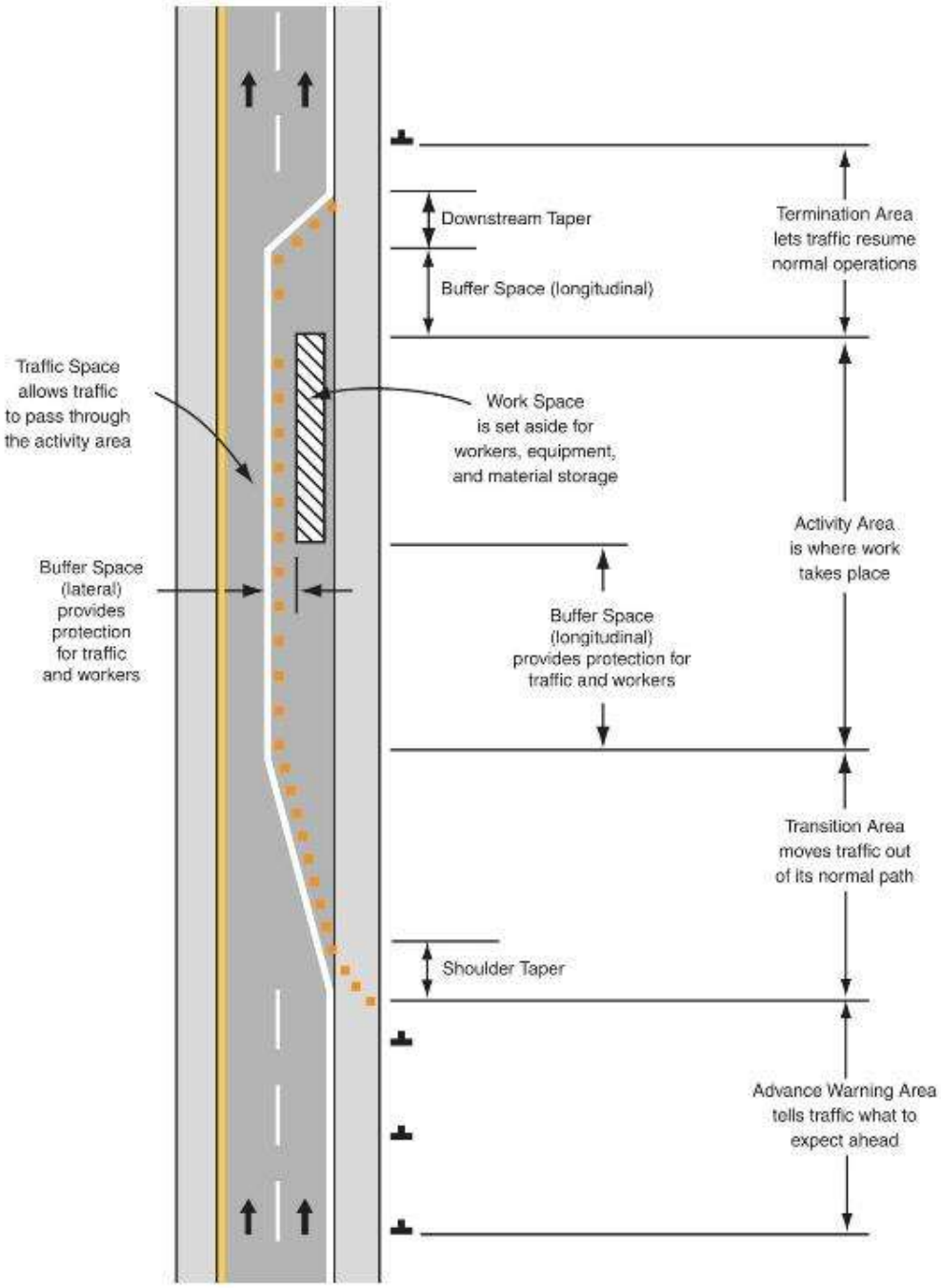


Figure 42: Traffic Management Diagram

5.8.2 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.

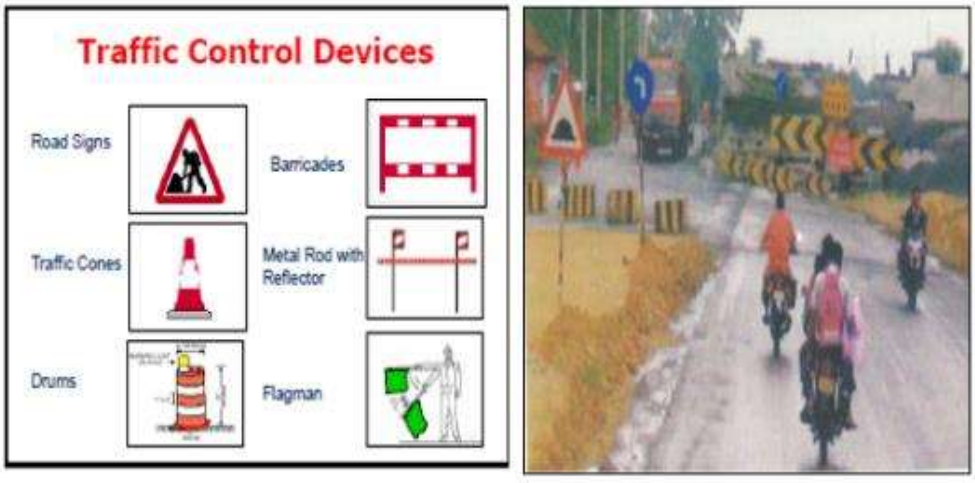


Figure 43: Traffic Control Devices at traffic diversion locations.

5.8.3 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.

5.8.4 Health and Safety Plan for COVID19 Pandemic

5.8.4.1 Introduction

- This document is intended to supplement formal Health & Safety policies, procedures and plans that the contractor has in place for its employees and staff working on Asom Mala project. Hence, this document is not intended to replace any formalized procedures currently in place for the Contractor. Where this guideline does not meet or exceed the standards put forth by the Contractor, the Contractor shall abide by the most stringent procedure available.
- This approved project-specific Health and Safety Plan (H&SP) shall be modified to require that the COVID-19 Officer2 (supervised by the contractor's environmental and health and safety officer) at the Contractor's worksite (appointed by Contractor and agreed by PIU) submit a written daily report to the Client's Representative (PIU Head). The COVID-19 Officer shall certify that the Contractor and all subcontractors are in full compliance with these guidelines.

- The COVID-19 officer (The existing safeguards officer OR health & safety officer OR supervisor of the contractor can be designated as COVID-19 officer) should be present on-site at all times by undergoing the training available at:
  - https://www.who.int/emergencies/diseases/novel-coronavirus-2019/training/online-training
  - https://openwho.org/courses/eprotect-acute-respiratory-infections,
  - https://openwho.org/courses/COVID-19-IPC-EN
- Any issue of non-compliance with these guidelines shall be a basis for the suspension of work. The Contractor will be required to submit a corrective action plan (on the next day or immediately as per the nature of issue) detailing each issue of non-conformance and a plan to rectify the issue(s). The Contractor will not be allowed to resume work until the plan is approved by the Client (PIU). Any additional issues of non-conformance may be subject to action against the Contractor's as health & safety/safeguard clauses of the contract.
- Construction sites operating during the Covid-19 pandemic need to ensure they are protecting their workforce and minimizing the risk of spread of infection.
- This guidance is intended to introduce consistent measures on sites of all sizes in line with the Government's recommendations on social distancing.
- These are exceptional circumstances and the industry must remain abreast of and comply with the latest Government advice on COVID-19 at all times.
- The health and safety requirements of any construction activity must also not be compromised at this time. If an activity cannot be undertaken safely due to a lack of suitably qualified personnel being available or social distancing being implemented, it should not take place.
- It is to be noted that emergency services are also under great pressure and may not be in a position to respond as quickly as usual.
- Sites should remind the workforce at every opportunity of the Worksite Procedures which are aimed at protecting them, their colleagues, their families and the Assam population.

If a worksite is not consistently implementing the measures as mentioned in the health & safety plan, it may be required to shut down.

5.8.4.2 Principles of Worker Protection

- Consistently practice social distancing
- Cover coughs and sneezes
- Maintain hand hygiene
- Clean surfaces frequently

5.8.4.3 Maximum Precaution for Persons/Labourers Reporting to Work

- IF SICK, STAY HOME!
- IF SICK, GO HOME!
- IF SOMEONE SICK, SEND THEM HOME!

Contractor to provide face masks (of the type approved by Government for use to protect persons from COVID-19) to all persons working in or visiting the worksite. This along with

procedures set out in this document is for maximum precaution to protect all persons/labourers at all times.

5.8.4.4 Covid-19 Typical Symptoms

- Fever
- Cough
- Shortness of Breath
- Sore Throat

All persons at the worksite should have their temperature screened by COVID-19 officer with Infrared Thermometer (handheld non-contact).

5.8.4.5 Self-Attestation by Persons/Labour Prior to Work

Prior to starting a work (on daily basis), each labour/ worker will self-attest to the supervisor:

- No signs of COVID-19 symptoms within the past 24 hours.
- No contact with an individual diagnosed with COVID-19. (contact means living with a positive person, being within 6 ft of positive person OR sharing things of positive person)
- Not undergone quarantine or isolation (in case of any labourer /worker who has been quarantined or isolated previously, the engagement shall be only after obtaining the requisite clearance)

The engagement of workers falling in the high-risk category such as workers over the age of 55 years, with underlying medical conditions or health issues, etc. should be done only after obtaining the requisite clearance from trained and registered medical practitioners.

The self-attestation would be verified in collaboration with trained and registered medical practitioners deployed at site through discussions with laborers /workers and/or preliminary checks such as temperature checks, etc. prior to their engagement at site.

In addition, the Contractor shall mandatorily follow all medical test requirements for the workers prior to their engagement and/or mobilization at site as per the guidelines issued by the Central and State government agencies and WHO from time to time.

Persons/Labourers showing COVID-19 symptoms or not providing self-attestation shall be directed to leave the work site and report to the fever clinic/quarantine centre immediately. Labour not to return to the work site until cleared by fever clinic/quarantine centre.

5.8.4.6 General Direction

- No 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, 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
- If you or a family member is feeling ill, stay home!
- Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.

5.8.4.7 Work-Site Prevention Practices

- 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 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 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.

5.8.4.8 Washing Facility

- All worksites should have access to toilet and hand washing facility.
- Providing hand cleaning facilities at entrances and exits. This should be soap and water wherever possible or hand sanitizer if water is not available
- Washing facility with hot water, and soap at fire hydrants or other water sources to be used for frequent handwashing for all onsite employees
- All onsite workers must help to maintain and keep stations clean
- If a worker notices soap or towels are running low or out, immediately notify supervisors. Proactively supervisor should make sure shortage situation never occurs.
- Garbage bins will be placed next to the hand wash facility for discarding of used tissues/towels with regular removal and disposal facility (end of each day)

5.8.4.9 Cleaning Procedures

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.

Each worksite should have enhanced cleaning and disinfection procedures that are posted and shared including sheds, gates, equipment, vehicles, etc. and shall be posted at all entry points to the sites, and throughout the project site. These include common areas and high touch points like

- Taps and washing facilities
- Toilet flush and seats
- Door handles and push plates
- Handrails on staircases and corridors
- Lift and hoist controls
- Machinery and equipment controls
- Food preparation and eating surfaces
- Telephone equipment / mobiles
- Keyboards, photocopiers and other office equipment

Re-usable PPE should be thoroughly cleaned after use and not shared between workers

5.8.4.10 Labour Camp

Contractor shall follow a zero-tolerance policy on wearing of masks.

Masks to be provided to all the persons/labourers for use at the camp site as well as at the worksite. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with disposable gloves, gown and face mask for each cycle of cleaning.

Toilet Facility

- Restrict the number of people using toilet facility at any one time e.g. appoint one welfare attendant among the labours.
- Wash hands before and after using the facilities
- Enhance the cleaning regimes for toilet facilities particularly door handles, locks and the toilet flush
- Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently
- Provide suitable and sufficient rubbish bins for hand towels with regular removal and disposal.

Eating/snacks Arrangements

- With eateries having been closed (restricted) across Assam, providing permanent (till society is safe from COVID-19) on-camp/ off-camp cook/ helpers can be implemented. Make sure that the “Guidelines for food handling, preparation and distribution during COVID-19” and its regular updates are being followed.
- Whilst there is a requirement for construction camps to provide a means of heating food and making hot water, these are exceptional circumstances and where it is not possible to introduce a means of keeping equipment clean between use, etc. must be removed from use.
- Contractor to arrange all daily need items and grocery at site itself and no worker is allowed to go to shops for daily need items.

- Dedicated eating areas should be identified on camp to reduce food waste and contamination
- Break times should be staggered to reduce congestion and contact at all times
- Hand cleaning facilities or hand sanitizer should be available at the entrance of any room where people eat and should be used by workers when entering and leaving the area
- Workers should sit "6 feet" apart from each other whilst eating and avoid all contact
- Where catering is provided on camp, it should provide pre-prepared and wrapped food only
- Payments should be taken by contactless options wherever possible
- Crockery, eating utensils, cups etc. should be avoided wherever possible
- Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced
- Tables should be cleaned between each use
- All rubbish should be put straight in the bin and not left for someone else to clear up; only covered pedal operated bins should be used and the bins should be cleared and cleaned regularly, with strict adherence to safety protocols for disposal and hygiene maintenance (including proper PPE's such as gloves, mask and apron worn by the waste handler/cleaner and disposal at a designated place);
- All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, etc.

Changing Facilities, Showers and Drying Areas

- Introduce staggered start and finish times to reduce congestion and contact at all times
- Introduce enhanced cleaning of all facilities throughout the day and at the end of each day
- Consider increasing the number or size of facilities available on camp if possible
- Based on the size of each facility, determine how many people can use it at any one time to maintain a distance of two meters
- Provide suitable and sufficient garbage bins in these areas with regular removal and disposal.
- Visitor log should be strictly maintained that the labour camp.

COVID-19 officer will ensure compliance with prevention issues at the labour camp(s).

5.8.4.11 Updates on Covid-19

The Contractor shall be in touch with the Department of Health & Family Welfare and Labour Department to identify any potential worksite exposures relating to COVID-19, including:

- Strictly follow the guidelines issues by Ministry of health and OSHA
- Other workers, vendors, inspectors, or visitors to the worksite with close contact to the individual
- Labour Camps / Work areas such as designated workstations or rooms/sheds
- Work tools and equipment
- Common areas such as break rooms, tables and sanitary facilities

Also refer the following websites from time to time for regular updates.
https://www.mohfw.gov.in/

https://covid19.assam.gov.in/

5.8.4.12 Training

- PIU to ensure all workers get training on above requirements before start of any construction activity
- During construction period frequent visual and verbal reminders to workers can improve compliance with hand hygiene practices and thus reduce rates of infection. Handwashing posters should also be displayed at work site and labour camps

5.8.4.13 EMERGENCY CONTACT

- Provide emergency contact number(s) at work site and labour camp for reporting COVID-19 symptoms

Ensure all staff and personal use the Aarogya Setu app, recommended by GOI for tracking COVID-19 patients.

6. Climate Change Impacts and Risks

A rapid increase in the number of motor vehicles on road in Assam has been observed over the past decade. 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 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 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.

6.1 Climate Change Mitigation

The Transport Emissions Evaluation Model for Projects (TEEMP) developed by Clean Air Asia 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 6 m/km which may deteriorate over a period but not less than 2 m/km and widening of roads from the single/intermediate lane (3.5/5.5 m) to two lanes with paved shoulder (7 m). 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 approximately 46.598 km of the Major District Road in the State of Assam.
- The road configuration will change from a single lane to two lanes with a carriageway width of 7 m with 1.5 m shoulder on both sides.
- The surface road roughness is mostly 6 m/km and will be improved to 2.0 m/km, which may further reach up to 3.5 m/km during 5 years of road operations. Resurfacing of the road would be required after 5 years.
- Construction will take place over 30 months in 2021/2022 and road operation will begin in 2023/2024.
- The design life of the road is 20 years.
- Other improvements include the repair or reconstruction and improvement of culverts, longitudinal and cross drains, and removal of irregularities on the existing vertical profile and road safety appurtenances.

Table 65: Vehicle Composition on subproject road

Vehicle Type	Traffic Composition (%)
Two Wheelers	44.80
3 Wheelers	0.31
Car/ Vans/ Jeeps	18.95
Mini Buses	0.88
Standard Buses	0.26
Tempo	6.33
LCV's (Goods)	1.97
2-Axle Trucks	4.36
3-Axle Trucks	0.74
Multi-Axle Trucks	0.91
Tractors with Trailer	0.09
Tractors Without Trailer	0.03
Cycle	20.32
Cycle Rickshaw	0
Animal Drawn	0
Others	0.06

Source: Traffic Study

Traffic forecasts were taken from the detailed project reports prepared for the road section. The volume/capacity saturation limit was taken at 0.85 for optimum travel speed and fuel consumption. Emission factors were 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 Emissions from in-Use Indian for three-wheelers rickshaw as shown in **Table 66.**

Table 66: CO_2 Emission Factors

Vehicle Type	Gasoline	Diesel
2-Wheeler	2.28	-
3-Wheeler	2.63	-
Car/Jeeps	2.59	-
LCV	-	3.21
Bus	-	3.61
HCV	-	3.5

It is seen that 2-wheelers, 3-wheelers, and animal-drawn carts have an average trip distance of 20 km of the total road length in each section, whereas all other vehicles do use the entire length as average trip distance.

Estimated carbon emissions: The proposed road upgrading resulting in lower surface roughness and road capacity improvements have implications in CO_2 emissions. Improved roughness results in higher speed and lesser emissions while increase road users result in

increased emissions from vehicles. These factors are also affected by traffic congestion i.e. the volume/capacity saturation limit.

Table 67: Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Year 2051		
	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%

Emissions from road construction were estimated by using the emission factor for rural/ urban roads, by using ADB - Carbon footprint report, which is equivalent to 48,400 kg CO_2/km of road construction

Source: http://www.adb.org/documents/reports/estimating-carbon- footprints-road-projects/default.asp

Estimated Carbon Emissions

The proposed road upgrading resulting in surface roughness and road capacity improvements have implications in CO_2 emissions. Improved roughness results in higher speed and lesser emissions while increase road users increase 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 a project, to upgrade and strengthen the road length of 46.598 km, total CO_2 emissions will be of the order of 2255.34 tons.

Table 68: Estimated Total CO2 Emissions during Road Construction

Road	Length (km)	Emission Factor (ton CO_2/km)	CO_2 Emission (tons)
A30_1	46.598	48.4	2255.34

The design life of roads is 20 years. Total CO_2 emission at the Business-As-Usual scenario was estimated at 9928.64 tons/year, with and without induced traffic is 22784.55 tons/year and 17442.56 tons/year respectively. These values are below the 100,000 tons per year threshold. Therefore, it is not necessary to implement options to reduce or offset CO_2 emissions under the project.

Table 69: CO_2 emissions prediction using TEEMP

Scenario	Length (km)	Emissions (tons CO_2/km/year)	CO_2 Emissions (tons/year)
Business as usual	46.598	213.07	9928.64
Project + Induced	46.598	488.96	22784.55
Project - Induced	46.598	374.32	17442.56

Table 70: Project CO_2 Emissions Intensity Indicators

Particulars	Business-As-Usual	Project (without Induced Traffic)	Project (with Induced Traffic)
tons/km	6,392.14	11,229.68	14,668.76
tons/year	9,931.05	17,446.80	22,789.88
tons/km/year	213.07	374.32	488.96
g/pkm	174.25	105.19	106.97
g/tkm	311.70	260.65	240.52

The with-project scenarios will be having higher CO_2 emissions. Furthermore, with project scenarios (both without and with induced traffic), there will be an 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 the 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.

Climate Change Impacts & Risks

As per the Assam State Action Plan on Climate Change, 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 in average temperatures and global warming. Sector-specific climate risk screening has been done based on secondary sources to analyze the 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 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 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/year during the same period.

Table 71: 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
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 (2015-2020)

Increased temperature and precipitation will have the 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. There would likely 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 southern part of Nagaon district in central Assam valley and adjoining parts of Karbi Anglong form a rain-shadow zone where annual rainfall is as low as 800-1200 mm. Water scarcities are a potential constraint for the people living in this rain shadow zone and the absence of effective irrigation systems or water harvesting practices adds to the vulnerability of the people. But what is of immediate concern is that rainfall in this zone is decreasing slowly as found in Lumding where rainfall is on the decline at a rate of 2.15 mm per year (Das, 2004). As a result, the water crisis might aggravate in this region in the coming years.
- **Cyclone**: It can be concluded from the analysis of past meteorological data that

cyclone; dust storms are extremely rare in the study area. The impact of the cyclone is likely to be low.

- **Flood**: This is a concern in the plains as floods devastate horticulture produce. In hilly areas flash floods due to heavy precipitation will lead to heavier soil erosion. The most recent examples of such flash floods originating from extreme rainfall are two events that occurred in the north bank of the Brahmaputra River and caused significant damage to human life and property. The first of the two events occurred during the monsoon season on June 14th, 2008 due to heavy rainfall on the hills of Arunachal Pradesh north of Lakhimpur District causing flash floods in the rivers of Ranganadi, Singara, Dikrong and Kakoi that killed at least 20 people and inundated more than 50 villages leading to the displacement of more than 10,000 people. The other that occurred in the post-monsoon season on October 26 affected a long strip of the area of northern Assam valley adjoining foothills of Bhutan and Arunachal Pradesh causing flash flooding in four major rivers (all are tributaries of the river Brahmaputra) and several smaller rivers. This episode of flash floods caused by heavy downpour originated from the Tropical Depression 'Rashmi', (a depression over the West Central Bay of Bengal adjoining Andhra coast) and affected mainly the catchments of the rivers Puthimari (Assam- Bhutan border), Jia-Bharali (Assam-Arunachal Border), Ranganadi (Assam-Arunachal Border), and the Subansiri (Assam-Arunachal Border). The study area does not have a flood problem. CWC in association with IMD and Ministry of Jal Shakti has prepared Flood Estimation Reports for small and medium catchments for each hydro meteorologically homogeneous 22 sub-zones. The project area is falling in subzones 2(a) and 2(b). All structures have been designed for a 50year return period with an anticipated risk of rarer flood generally of next higher frequency *i.e.* 100-year return period flood on the designed structures. Roadside toe drains shall be provided to receive a discharge from the embankment surface and countryside runoff and carry it safely to the nearest outfall point ensuring safety to the embankment toe, which is the area most vulnerable to erosion/failure.

  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 and iv) 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 the adaptation of the roads for future increases in precipitation. This risk screening and risk identification exercise have 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.

Source: Assam State Action Plan on Climate Change (2015-2020)

Possible Climate Events, Risks and Adaptation Measures in Road Transport Infrastructure

The design objective included ensuring that current infrastructure assets are protected from the long term and acute effects of climate change, and wherever necessary upgrading to new infrastructure systems fit for changing climate conditions have been taken into serious consideration. Those adaptive measures to counter possible risks and their likely effects on project road infrastructure as incorporated in the DPRs are summarized in **Table 72**. It must be noted that all these events either simultaneously or in isolation can generate severe disastrous impacts on road infrastructure.

Table 72: Possible Climate Events, Risks, and Adaptation Measures

Sr. No.	Climate Change Events	Risks to the Road Infrastructure	Adaptation Measures incorporated in Detailed Design of Project Roads
1	Extreme rainfall events	i. Overtopping and wash away ii. Increase of seepage and infiltration pass iii. Increase of hydrodynamic pressure of roads iv. Decreased cohesion of soil compaction v. Traffic hindrance and safety	a. Certain critical sections affected by overland flooding of the road raised (vertical alignment, embankment improvement) to be free from the onslaught of flooding events under intense precipitation. b. Road asset survey has considered certain critical road sections where the sub-grade strength and integrity were found to be compromised; the sub-grade strength specification meeting the recent-most IRC specifications has been adopted. c. The highest assessment of design discharge for sizing culverts and bridges from among the several discharge methods as outlined in recent IRC guidelines has been adopted. d. In terms of floodwater conveyance to prevent stagnation, lateral drains are proposed along the entire length of the road; closed concrete drains in settlement pockets and earthen drains in the remaining parts of the road. e. Improved cross-drainage capacities required for the quick conveyance of floodwater by replacing small diameter pipes with box culverts with higher discharge openings has been considered. f. The bottom of the sub-grade has been kept 0.6m above HFL, to avoid over topping, water-logging of the road surface.
2	Changes in seasonal and annual average rainfall	i. Impact on soil moisture levels, affecting the structural integrity of roads, culverts, bridges standing water on the road base ii. Risk of floods from runoff, landslides, slope failures and damage to roads if changes occur in the precipitation pattern	
3	Increased	i. Concerns regarding	a. An adequate binding layer thickness has been proposed to offset the wear, surface fatigue, and rutting

Sr. No.	Climate Change Events	Risks to the Road Infrastructure	Adaptation Measures incorporated in Detailed Design of Project Roads
	maximum temperature and a higher number of consecutive hot days (heat waves)	pavement integrity, e.g. softening, traffic-related rutting, cracking, fracture, etc. ii. Thermal expansion in iii. bridge expansion joints and paved surfaces Temperature break soil cohesion and increase dust volume which caused health and traffic accidents	under climate stresses. b. In terms of pavement integrity, the choice of viscosity grade VG30 has been maintained.
4	Extreme wind speed under cyclonic conditions	i. The threat to the stability of bridge decks ii. Damage to signs, lighting fixtures and supports	BAU

7. Public Consultation

Meaningful consultations were held early and will be held throughout the project development stage to allow the incorporation of relevant views of the stakeholders in the final project design, mitigation measures, implementation issues, and enhance the distribution of benefits. All the five principles of information dissemination, information solicitation, integration, coordination, and participation in the dialogue were incorporated in the consultation process. The analysis of environmental impacts likely from the project has strengthened and modified based on opinions of all those consulted, especially at the micro-level by setting up dialogues with the village people from whom information on-site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project has been proposed as part of the mitigation plan.

7.1 Objectives of the Consultation

Stakeholder's consultations held with the intent to understand their concerns, apprehensions, overall opinion, and solicit recommendations to improve project design and implementation. Informal meetings, interviews were organized covering the entire project design stage. Consultations provide affected people a platform to ensure incorporation of their concerns in the decision-making process and foster co-operation among officers of PWRD, the community, and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

The discussions held were designed to receive maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the sub-project. They were given a brief outline of the project to which their opinions were required particularly in identifying and mitigating any potential adverse impact.

7.2 Methodology for Consultations

Consultation with the stakeholders, beneficiaries, and community leaders had been carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire surveys/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. Besides, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders, and experts. Besides, personal discussions with officials, on-site discussions with affected stakeholders, and reconnaissance visits have also been made to the project area. Public consultations have been done at nine locations during initial surveys as shown in **Table 73**. The total numbers of participants in the consultations were 46.

Table 73: List of Public consultation and Date

Sr. No.	Village	Date	Male Participants	Female Participants	Total Participants
1	Raidongia gaon	18/01/2020	5	0	5
2	Diksom Kinar	18/01/2020	4	0	4
3	Derai T.E.	18/01/2020	4	0	4
4	Tingkhong	18/01/2020	9	0	9
5	Naharani	08/11/2020	3	2	5
6	Tingkhong Chariali	08/11/2020	5	0	5
7	Tingkhong No. 3	08/11/2020	4	0	4
8	Pithapothar	08/11/2020	4	2	6
9	Ofulia Chariali	08/11/2020	3	1	4
Total			**41**	**5**	**46**

7.3 Stakeholder Consultations

7.3.1 Project Stakeholders

All types of stakeholders were identified to ensure wide coverage as possible.

- Residents, shopkeepers and business people who live and work along the road especially the project affected persons
- All type of road users/commuters
- Executing Agency, Construction Supervision Consultant and Implementing NGOs
- Other government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Pollution Control Board (PCB), Irrigation Department, Public Health Engineering (PHED) Department
- The beneficiary community in general

Table 74: Identified Stakeholders

Level	Type	Key Participants	Response	Influence	Affected
Individual	Local Level Consultations	Persons along the road corridor	Supportive	Medium	Yes, Road users
Individual	Door to Door personal contact	People along the road corridor which are likely to be	Supportive	High	Yes, Due to Land or structure acquisition

Level	Type	Key Participants	Response	Influence	Affected
		impacted			
Settlement	Focus Group Discussion	Including women, Socially and economically vulnerable	Supportive	High	Yes, due to land or structure acquisition
Common Property Resources	FGD with Community owners/ Leaders/ Caretakers	CPR at the road stretch	Supportive	Low	Yes, by or due to land impacted
Departmental Level Consultations	Focus Group Discussion	Including Department Official & Locals	Supportive	Low	Indirectly due to road improvement

7.3.2 Consultation with Government Departments

Various Govt. Dept. officials were consulted during Environmental Impact Assessment Study including PWRD Officials, State pollution control board for Air, Noise, and Water quality information, IMD for the climatic data, the statistical officer for Population and demographic profile, Panchayat department for village level information, Survey of India for the topo sheet requirement, Revenue department for the land record information, PHQ officers for hand pump relocation and quality assessment, Assam SEB offices for electric pole shifting, etc.

These department officials helped to provide various project-related data and information which helped preparation of reports and data analysis.

Figure 44: Tree Enumeration by Moran Range Forest Officials

Figure 45: Revenue Map Collection and Consultation at Rajgarh Revenue Circle Office

7.3.3 Consultation with Local People and Beneficiaries

The informal consultation was generally started with explaining the project, followed by an explanation of potential impacts. Participant's views were gathered concerning all aspects of the environment which may have a direct or indirect impact on local people. Key Issues discussed are:

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- Labour availability in the project area or requirement of outside labour involvement;
- Local disturbances due to project construction work;
- The necessity of tree felling etc. at project sites;
- Impact on water bodies, water-logging and drainage problem if any;
- Environment and health
- Flora and fauna of the project area
- Socio-economic standing of the local people.

The project has immense acceptability among the local people. They perceive that in addition to providing all-weather connectivity, the subproject road will bring positive socioeconomic changes in the area. Local people mainly discussed the issues related to improvement activities, rehabilitation, resettlement, and road safety issues.

The Details of Participants and Public Consultation photographs are attached in Annexure 4. Also, information on the GRM procedures and formats in local language i.e. Assamese was shared with the local people as provided in Annexure 5.

Table 75: Details of Public Consultation at Diksom Kinar

Date	Issues Discussed	Response	Participant
18/01/2020	➢ People questioned about the effect of road on the adjacent tea estates and will any compensation be provided to the land owners if road passes through them ➢ People question about accident prevention on critical curve locations ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate and some tea estates are present adjacent to the road. ➢ No Wild animals crossing are observed along the project road. Domestic animals can be sighted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The road improvement work will take place on the existing road and as per requirement land acquisition will take place and appropriate compensation will be provided ➢ After improvement of road there will be a considerable reduction in the number of accidents as road safety will be an important consideration while designing the road.	Total = 4 Male = 4

Figure 46: Public Consultation at Diksom Kinar

Table 76: Details of Public Consultation at Raidongia Gaon

Date	Issues Discussed	Response	Participant
18/01/2020	➢ People are facing problem due to poor condition of road as the road is a major connectivity to important places such as Duliajan, Naharkatia and Digboi. ➢ People question about safety provisions to avoid accidents. ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate and tea estate are present along the road ➢ No Wild animals crossing are observed along the project road. Domestic and farm animals can be sighted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ Proposed widening and strengthening of the road will provide a better level of services in terms of improved riding quality and smooth traffic flow. ➢ After improvement of road there will be a considerable reduction in the number of accidents and the level of pollution.	Total = 5 Male = 5

Figure 47: Public Consultation at Raidangia Gaon

Table 77: Details of Public Consultation at Derai T.E.

Date	Issues Discussed	Response	Participant
18/01/2020	➢ People are facing problem due to poor condition of road ➢ People are concerned about tree cutting and road passing through adjacent tea estates. ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The Proposed widening and improvement of the road will provide a better level of services in terms of improved riding quality and smooth traffic flow. ➢ Ten times plantation will be done for each tree cut and for road widening in adjacent tea estates if required compensation will be provided.	Total = 4 Male = 4

Figure 48: Public Consultation at Deroi T.E.

Table 78: Details of Public Consultation at Tingkhong

Date	Issues Discussed	Response	Participant
18/01/2020	➢ People questioned about road diversion during construction phase of the project ➢ People question about provision of bus stops along the project road. ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted. A lot of people pet pig to sell pork later replied an individual. ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ Traffic management plan will be prepared to manage the traffic and avoid causing congestion on the road. ➢ Bus stops at dedicated locations will be provided along the project road.	Total = 9 Male = 0

Figure 49: Public Consultation at Tingkhong

Table 79: Details of Public Consultation at Naharani

Date	Issues Discussed	Response	Participant
08/11/2020	➢ Shopowners questioned about compensation to them as they may lose their source of income ➢ People question about provision of speed brakers and signage near schools ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The road improvement work will take place on the existing road and as per requirement land acquisition will take place and appropriate compensation will be provided to the beneficiaries. ➢ Speed control measures in road passing through settlements and near schools and hospitals will be taken by providing speed brakers	Total = 5 Male = 3 Female = 2

Figure 50: Public Consultation at Naharani

Table 80: Details of Public Consultation at Tingkhong Chariali

Date	Issues Discussed	Response	Participant
08/11/2020	➢ People questioned about employment opportunities ➢ People questioned about road maintenance activities in future ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate and farms are present along the road ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ During construction phase contractor will give preference to the locals to keep size of construction camps small ➢ Road maintenance will take place after certain years to maintain the quality of the road.	Total = 5 Male = 5

Figure 51: Public Consultation at Tingkhong Chariali

Table 81: Details of Public Consultation at Tingkhong No. 3

Date	Issues Discussed	Response	Participant
08/11/2020	➢ People questioned about road improvement and how many lanes will be constructed and in how many years ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day-to-day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The road to be constructed will be a two-lane road and will be constructed in 2-3 years.	Total = 4 Male = 4

Figure 52: Public Consultation at Tingkhong No. 3

Table 82: Details of Public Consultation at Pithapothar

Date	Issues Discussed	Response	Participant
08/11/2020	➢ People suggested that existing alignment shall also be improved and maintained properly. ➢ Suggestion viz., Minimal loss of structures, Adequate rehabilitation, and resettlement, measures ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The road improvement work will take place on the existing road and will be maintained in future. ➢ Speed control measures in road passing through settlements and near schools and hospitals will be taken by providing speed brakers	Total = 6 Male = 4 Female = 2

Figure 53: Public Consultation at Pithapathor

Table 83: Details of Public Consultation at Ofulia Chariali

Date	Issues Discussed	Response	Participant
08/11/2020	➢ People suggested where the road passes through the settlements there should be the provision of Speed breakers ➢ Suggestion viz. (i) design shall take into hydrological aspects into consideration (ii) minimal loss of structures (iii) adequate settlement and rehabilitation measures including provision of jobs to land losers ➢ People reported that the air and noise quality at the location is good. ➢ Water quality is also good and used for day to day purpose by the residents ➢ Tree cover in the project area is moderate ➢ No Wild animals crossing are observed along the project road. Domestic animals and farm animals can be spotted ➢ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted	➢ The stretch passing through settlements will have speed breakers and sign boards as well. ➢ Appropriate compensation will be provided to the beneficiaries for the loss they will incur.	Total = 4 Male = 3 Female = 1

Figure 54: Public Consultation at Ofulia Chariali

Most of the people interviewed strongly supported the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development, and thereby provide direct, or indirect, benefits to them.

7.4 Public Opinion/ Views Survey

To access the existing environment and likely impacts on the surrounding population, an interview was carried out. A sample of the population was interviewed through a designed questionnaire. Precaution has been exercised during the survey to ensure that the sample interviewed is truly representative of the affected groups and the questions are worded so as not to generate a bias response.

Public Consultation Questionnaire

Name of Project:			
Name of Project Road:			
Project package no.:			
Chainage:		**Date:**	
Place:		**District:**	
No of Participants			

Questions to be Asked?

1. **How is the Water quality of rivers, ponds, wells, and canals?**
   Positive: **Negative:** **No Response:**
2. **Status of Noise quality in the area?**
   Positive: **Negative:** **No Response:**
3. **How is the Air quality in the area?**
   Positive: **Negative:** **No Response:**
4. **Are there any Archaeological sites in the vicinity?**
   Positive: **Negative:** **No Response:**
5. **Any history of Natural disasters?**
   Positive: **Negative:** **No Response:**
6. **Any Rare species of animals and birds found in the area?**
   Positive: **Negative:** **No Response:**
7. **Are there any Cultural sites in vicinity?**
   Positive: **Negative:** **No Response:**

Figure 55: Public Consultation Questionnaire

It is observed from the interview survey that there is increased environmental awareness among the people. It can also be seen from **Table 84** that about most of the people are in

the opinion that the environmental condition of the area is good. Poor road condition and vehicular emissions are the major sources they feel responsible for this. People are unaware of the presence of archaeological, historical, and cultural sites. There is no major history of natural disasters in the region and local people have mixed responses about natural disasters. Overall, the general environmental conditions in the region are good and people have increased environmental awareness. **Table 84** shows the result of the public opinion survey carried out in the region.

Table 84: Peoples' Perception of Environmental Scenario

Sr. No.	Question Asked About	No. of People Interviewed	Positive Response	Negative Response	No Response
1	Water quality of rivers, ponds, wells, and canals	46	35	6	5
2	Noise quality of the area	46	46	0	0
3	Air quality of the area	46	46	0	0
4	Archaeological sites	46	0	46	0
5	Natural disaster	46	0	46	0
6	Rare species of animals and birds found	46	0	46	0
7	Cultural sites, market, melas etc.	46	38	5	3

Source: From Public Consultation Response

Overall, most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development, and thereby provide direct, or indirect benefits to them. Construction camps may however put stress on local resources and infrastructure nearby especially on water resources. The construction camps that will be installed during construction will exert more demand on the existing water source and would pose a threat to the quality of water bodies and groundwater resources. To prevent such problems contractor needs to provide camps with proper drinking water and sanitation facility.

The following are the consultants' initial findings regarding likely positive and negative impacts.

Positive Impacts:

- Improved road conditions will reduce travel time, fuel consumption, and emissions from base traffic volumes.
- Economic development and access will be stimulated.
- Access to Health, agriculture, and education facility will be improved.

Negative Impacts:

- Disturbance to existing traffic during the construction phase.
- Fugitive dust emissions during the construction stage thus harming the air quality. Similarly, noise quality can be affected during construction as well as operation stage.

Based on available information, field visits throughout the project, discussions with project authorities, and other discussions amongst project team and local officials it has been concluded that overall, the project will be beneficial, all negative impacts during and post-construction can be properly mitigated.

7.5 Disclosure

7.5.1 State Level

PMU and the PIUs shall disclose this entire EIA Report and all Safeguards related documents and mitigation plans at their website.

7.5.2 District Level

PMU will also arrange to disclose the final versions of the EIA and ESMP in English and Executive Summary in Assamese in all the District Collectors Offices, PIUs and the local offices of the implementing agencies. These would be in place once the final versions are ready. When this document is updated, then the copies in the different locations would also be updated.

7.5.3 Disclosure requirements of AIIB

The Bank requires the Client to disclose: (a) draft environmental and social assessment reports, ESMPs, ESMPFs, resettlement plans, RPFs, Indigenous Peoples plans and IPPFs, or other approved forms of documentation; and (b) other documents described above, as soon as they become available. The Bank also requires the Client to disclose any material changes to the disclosed environmental and social information for the Project as soon as they become available.

7.5.4 Disclosure by AIIB

The AIIB will disclose the EIA and ESMP for reference to interested parties. During the implementation phase, the EIA report shall be disclosed by PMU and the PIUs both at the local level and at the state level.

8. Grievance Redress Mechanism

A project-specific Grievance Redress Mechanism (GRM) will be established to receive, acknowledge, evaluate and facilitate the resolution to the complainant with corrective actions proposed using understandable and transparent processes on the social and environmental aspects that are gender responsive, culturally appropriate and readily accessible to all segments of the affected people. The GRM 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. 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 56**. 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 Redressal Process

The Grievance Redress Process is presented in **Figure 56**.

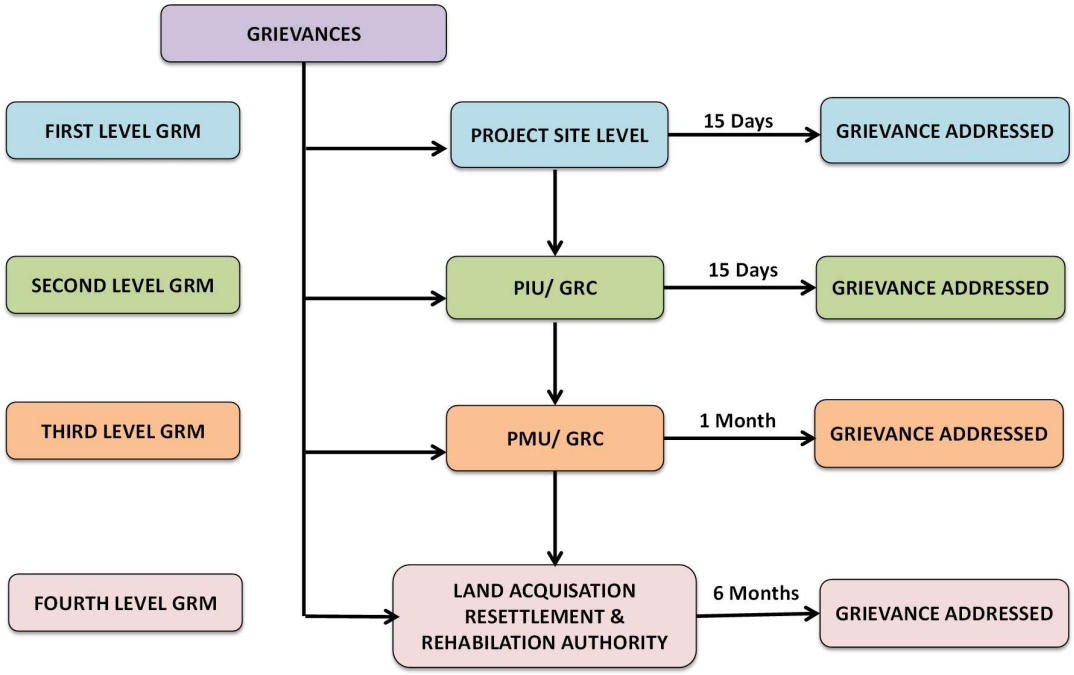


Figure 56: Environmental and Social Grievance Redressal Process

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 and Social Management Plan

9.1 Introduction

The environmental impacts associated with any development project are eliminated or minimized to an acceptable level through the development of appropriate mitigation measures based on the most suitable techno-economic options. The Environmental and Social Management Plan (ESMP) is a well-established tool to ensure effective implementation of the recommended mitigations measures throughout the project development stages. The ESMP also ensures that the positive impacts are conserved and enhanced. An ESMP provides location and time-specific actions to be taken with defined responsibility. It also provides measures for institutional strengthening and effectiveness assessment through a defined monitoring plan, reporting corrective & preventive action planning.

9.2 Objectives of Environmental and Social Management Plan

A sub-project road-specific Environment Management Plan has been formulated which consists of a set of mitigation; monitoring and institutional measures applicable to the design, construction, and operation stages of the project. The components of this ESMP includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iv) compliance to statutory requirements (v) integration of ESMP with project planning, design, construction, and operation.

9.3 Impacts and Mitigation Measures

The identified environmental, social, health & safety issues and recommended mitigation measures with institutional arrangements for implementation, supervision, and monitoring have been provided in **Table 85.** The Environmental Monitoring plan is given in **Table 86** below.

Table 85: Environmental, Social, Health and Safety Management Plan

1. Environment

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 (2553) with preference to fast growing species as per the orders of Forest department. •Additional Plantation of 25530 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 project authority or by the site 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 ESMP 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 PIU/PMU for approval.	RoW / CoI / Project influence areas	Contractor; Environmental Officer of CSC
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,	Crushers, Hotmix plants & Batching Plants	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	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.		
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 PIU for verification whenever required. • Ambient Air Quality monitoring has to be performed by the Contractor as per the Environmental Monitoring Program and in accordance with the general and specific condition of CTO.	Through out the project area	Contractor
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.	Built-up-Stretches are: Built-up-Stretches are: Moran, Teloikinar Bongali, Rajgarh, Sapkait No. 1,	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	• 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	Paniyabura Pathar No. 1, Disang Kinar Bongali Sensitive Receptors in close vicinity are: Educational Institutions (0+150, 0+950, 1+525, 2+350, 2+875, 4+875, 5+425, 13+325, 41+625) Healthcare Institutions (36+425, 44+850)	
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 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 CSE	Borrow site location as identified in DPR or any selected borrow area	Contractor
4.4. Quarry Operations	• No quarry and/or crusher units shall be established, which is within 1000m from the	Location specified as per DPR or another	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	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 CSE who shall inspect and approve the same.	quarry source selected.	
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 refueled in such a fashion that oil/diesel spillage does not contaminate the soil. • Fuel storage and refueling 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 refueling areas. • Waste oil and oil-soaked cotton/ cloth shall be stored in 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	Fueling station, construction sites, construction camps and disposal location	Contractor
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 refueled in such a fashion that oil/diesel spillage does not contaminate the soil • Fuel storage and refueling 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 refueling areas	Parking area, haulage roads and construction yards	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	• 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.		
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
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	Pond located at Ch. 8+750 (Left)	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	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.		
5.5. Deterioration in surface water quality due to leakage from vehicles and equipment and wastes from construction camps.	• No vehicles or equipment should be parked or refueled near water bodies to avoid contamination from fuel and lubricants. • Oil and grease traps and fueling platforms to be provided at re-fueling 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.	Pond located at Ch. 8+750 (Left)	Contractor
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 25530 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	Construction camps	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	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 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 CSE 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-	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	designated disposal locations, with approval of the concerned authority. • The bituminous wastes shall be disposed in secure landfill sites 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 • The effectiveness of the measures should be monitored and if need be, solid noise barrier shall be placed. • Ambient Noise Quality monitoring.	Sensitive receptors	Operation and Maintenance Agency
3. Land and Soil			
3.1 Soil erosion at embankment during	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures	At embankment slopes and other probable soil erosion	Operation and Maintenance

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
heavy rainfall.	• Necessary measures to be followed wherever there are failures	areas	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

2. Social

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
A. Pre-Construction and Design Stage			
1. Loss of Land and Assets			
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 • 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.	Land Acquisition involved along the project road. Details to be provided in Social Assessment report	PWRD, ASSAM
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/	Throughout project corridor, if any	Civil Construction Contractor

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
	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.		
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, 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.	Crushers, Hotmix plants & Batching Plants	Contractor
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

3. Health

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
A. Construction Stage			

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
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 twice a day using minimum four tankers a day, during construction period. • Provision of PPEs to workers.	Throughout the project corridor	Contractor
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: Built-up-Stretches are: Moran, Teloikinar Bongali, Rajgarh, Sapkait No. 1, Paniyabura Pathar No. 1, Disang Kinar Bongali Sensitive Receptors in close vicinity are: Educational Institutions (0+150, 0+950, 1+525, 2+350, 2+875, 4+875, 5+425, 13+325, 41+625) Healthcare Institutions (36+425, 44+850)	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, it shall be converted into fish pond to prevent it	Borrow site location as identified in DPR or any selected borrow area	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	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 CSE 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 the satisfaction of the „ Engineer".	All construction camp	Contractor
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	All construction camp	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	• 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, 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		

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	/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 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	All construction camp	Contractor

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	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 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.		

4. 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	• 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	Geometric improvement of curves 55 CD structures proposed for improvement Covered drain = 5.096 km	DPR Consultant during preliminary and detailed design

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
provisions in habitat area	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		
1.2. Safety along the proposed alignment	• Horizontal and vertical profile to be improved as per MORTH/IRC specifications considering land availability. • 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	Built-up-Stretches are: Built-up-Stretches are: Moran, Teloikinar Bongali, Rajgarh, Sapkait No. 1, Paniyabura Pathar No. 1, Disang Kinar Bongali Sensitive Receptors in close vicinity are: Educational Institutions (0+150, 0+950, 1+525, 2+350, 2+875, 4+875, 5+425, 13+325, 41+625) Healthcare Institutions (36+425, 44+850)	DPR Consultant during preliminary and detailed 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 • 55 CD structures to be reconstructed/ improved	No Anticipated water logging location as per TCS. Covered drain = 5.096 km	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 relevant utility service agencies to allow quick shifting and	Throughout project corridor	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	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.		
3.2. Road Safety Audit / Inspection at Design Stage	• Road Safety Audit (Design Stage) shall be conducted as per IRC SP 88 and all safety interventions shall be complied	Design Elements of the project roads	Design Consultant with Safety Expert
B. Construction Stage			
1. General			
1.1. Safety Procedures	The Contractor shall: • Comply with all applicable safety regulations, • Take care of the safety of all personnel who are entitled to be on the Site • Use reasonable efforts to keep the site and works clear of unnecessary obstructions so as to avoid danger to personnel, • Fencing, lighting, guarding and supervision of the works shall be carried out and provided until completion and taking over. It is necessary to provide any temporary works (including roadways, footways, guards and fences) as necessary, since the execution of these works, shall not raise a concern for the purpose of use and protection of the	All Construction Sites	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	public and of owners as well as occupiers of adjacent land. • A construction safety checklist to be prepared and implemented		
1.2. Care and supply of Documents	• The contractor shall prepare, submit and obtain approval from the Engineer for construction of the Safety Management Plan, and the same shall be prepared 14 days prior to commencement of construction works at site.		Contractor
1.3. Contractors general obligations	• All design calculations and fabrication drawings for temporary works (such as form-work, staging, centring, scaffolding, specialized construction, handling and launching equipment and the like) material lists for structural fabrication as well as detailed drawings for templates, and anchorage and temporary support details for pre stressing cables as well as bar bending and cutting schedules for reinforcement, etc shall be prepared by the contractor at his own cost and forwarded to the Engineer at least six weeks in advance of the actual constructional requirements. The Engineer will check the same for the contractor's use with amendments.		Contractor
1.4. Personal Safety Measures for Labour, Material handling , Painting etc	Construction Safety Plan shall be prepared by the Contractor as per Factory Act, 1948, Factories (Amendment) Act, 1987 (Chapter -5 Safety) Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996. The safety plan shall be prepared during mobilization and approved by Engineer and shall be adhered to by the Contractor throughout the construction period, and shall include provision of: • Protective footwear and protective goggles to all workers employed in mixing asphalt materials, cement, lime mortars, concrete etc. • Welders protective eye-shields to the workers engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals • The contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and	All Construction Sites	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	safe means of entry and egress. • The contractor shall ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. • Contractor shall provide facemasks to the workers when paint is applied in the form of spray or a surface having dry lead paint when it is rubbed and scrapped. • The Contractor shall mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance.		
1.5. Health and Safety	• The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the contractor's personnel. In collaboration with local health authorities, the contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site. • The contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the works, the contractor shall provide whatever is required by this person to exercise this responsibility and authority. • The contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. • The contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require	All construction sites and labor camps	Contractor
1.6. Risk from Electrical Equipment(s)	• No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to	All construction equipment	Contractor

<table>
<tr><th>Safety Issues</th><th>Measures to be adopted</th><th>Locations</th><th>Implementation Responsibility</th></tr>
<tr><td></td><td>the satisfaction of the Engineer</td><td></td><td></td></tr>
<tr><td>1.7. Deployment of Personnel and Safety compliance</td><td>The flagmen or flaggers shall be deployed (Ref : IRC SP 55) where:
• Workers or equipment intermittently block an unprotected traffic lane
• One lane is used for two direction of traffic
• Guidance, warning and control of traffic is considered necessary
• Hand flashers are tough and durable working on normal or rechargeable batteries with LED bulbs.
• To provide warning signal for impending hazard or danger on construction work zone, repair sites, trenches, digging of road tunnels etc.
Reflective Clothing
• The reflective clothing shall meet the requirements of standards set up in IS: 15809-2008 or EN 471:2003.
<table>
<tr><th>User</th><th>Colour of fluorescent jacket</th></tr>
<tr><td>Workers exposed to traffic</td><td>Red, Orange</td></tr>
<tr><td>Operators of road construction machineries</td><td>Orange</td></tr>
<tr><td>Supervising engineer and visiting higher officials</td><td>Yellow</td></tr>
</table>
Roll up Signs
• Mounting of the roll up sign on the portable stand
• Mounting of the roll up sign on construction or maintenance vehicles
• Mounting of the roll up sign on barricades
Protective Gear to the workers
• All the workers, exposed to moving roadway traffic or equipment in road construction zones shall wear high-visibility safety apparel, headgear, boots, gloves and protective gears for their protection.</td><td>All the construction sites</td><td>Contractor</td></tr>
<tr><td>1.8. Accessibility</td><td>• The Contractor shall provide safe and convenient passage for vehicles; pedestrians and livestock to and from roadsides and property accesses by providing temporary connecting road, as necessary.</td><td>Through the project corridor</td><td>Contractor</td></tr>
</table>

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Construction activities that shall affect the use of side roads and existing accesses to individual properties, whether public or private, shall not be undertaken without providing adequate provisions to ensure uninterrupted access, as approved by the Engineer. • The Contractor shall take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up in a manner that traffic movement in any given area does not get affected.		
1.9. Planning for Traffic diversions and detours	• As per Clause 112 of MoRTH • Detailed traffic control plans shall be prepared by the contractor and the same shall be submitted to the Engineer. • The Contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The Contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • The Contractor shall inform local community of changes in traffic routes and pedestrian access arrangements with assistance from Engineer and PIU.	All along the project corridor, access roads, bridges	Contractor
1.10. First Aid	• First aid measures shall be provided in the construction zones and labour camps.	All the construction sites and labor camps	Contractor
1.11. Sensitive Receptors	• Sensitive receptors like schools, hospitals are provided with permanent noise barriers prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement (during / post construction). Their effectiveness needs to be checked during operation phase. • Construction activities shall be confined within the present available CoI, regular strict monitoring/ supervision shall be done to minimize/control air-noise pollution and abatement of dust particles at minimum level possible using well maintained modern machineries	Built up areas and public amenities	Contractor
2. Noise			
2.1. Noise from construction vehicles, equipment and	• PPEs to workers	Built-up-Stretches are: Built-up-Stretches are: Moran, Teloikinar Bongali,	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
machinery.		Rajgarh, Sapkait No. 1, Paniyabura Pathar No. 1, Disang Kinar Bongali Sensitive Receptors in close vicinity are: Educational Institutions (0+150, 0+950, 1+525, 2+350, 2+875, 4+875, 5+425, 13+325, 41+625) Healthcare Institutions (36+425, 44+850)	
3. Traffic Management and Safety			
3.1. 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 from "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	Throughout the project corridor	Contractor
3.2. Safety during road works	• The contractor shall provide adequate signage and markings as per the instruction of the Engineer in the construction zones. The Clauses 112.4. of MoRTH (Traffic safety)	All along the project corridor and haul roads	contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Clause 112.5. of MoRTH (Maintenance and Diversions) • IRC:SP:55 (Road signage and markings) shall be referred to for preparation of the relevant signage.		
3.3. Traffic Safety and Pedestrian Safety	• Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated prior to start & unsafe areas shall be cordoned off. Ref Clause 112. of MoRTH (Arrangement for traffic during construction)	All along the project corridor	Contractor
3.4. 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
3.5. 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.	Throughout the project corridor, construction sites	Contractor

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Alternate access facility to common properties near construction zones • Speed limitation wherever animal movement is anticipated.		
3.6. 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
3.7. Road Safety Audit / Inspections at Construction stage	• Work zone safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied as per IRC SP 55. • The work zone safety audits shall be conducted on quarterly basis	All along the project corridor, access roads and junctions	Contractor with Safety Expert
3.8. Road Safety Audit / Inspection at Pre opening Stage	• Road safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied before pre-opening.	All along the project corridor, access roads and junctions	Contractor with Safety Expert
C. Operation Stage			
1. Noise and Pollution			
1.1. Noise due to movement of traffic	• Speed limitation and honking restrictions near sensitive receptors locations.	Sensitive receptors	Operation and Maintenance Agency
1.2. Pollution Monitoring	• The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination are to be continued at pre-designated locations as identified in the Environmental Monitoring Plan and if necessary, at additional locations for comparative study of pre and post operation data in order to ensure further improvement/modification in similar future works	All along the project corridor	Operation and Maintenance Agency
1.3. Atmospheric Pollution	• Ambient air concentrations of various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre designated locations to compare the levels with the preconstruction data.	All along the project corridor	Operation and Maintenance Agency

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	• Additional data at other location may be collected as per any site specific requirement		
1.4. Soil Erosion and Monitoring of Borrow Areas	• Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, shall be carried to record and monitor the effectiveness of such structures after the completion of project, so as to evaluate the beneficial effects of each type of activity together with the cost involved.	Borrow areas	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 for accident reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.	Throughout the Project route	Operation and Maintenance Agency
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
2.4. Road Safety and Maintenance of Assets	• No advertisement/hoardings shall be allowed within the Right of Way limits of the project road. • Regular maintenance and cleaning of assets such as sign boards, bus stops,	All along the project corridor	Operation and Maintenance Agency

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	drains etc. shall be undertaken.		
2.5. Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures	• The PIU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as part of the project. Monitoring and performance indicators have been indicated in Environmental Monitoring Plan	All along the project corridor	Operation and Maintenance Agency
2.6. Maintenance of Drainage	• PIU shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the spurs and check dams erected to stabilize the course and flow of all such drainage channels. • PIU shall ensure that all the sediment/oil and grease traps set up at the water bodies are cleared once in every three months	At locations where bridge works, culvert works and side drains (built up areas) proposed	Operation and Maintenance Agency
2.7. Road Safety Audits / Inspections at O&M Stage	• O&M stage safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied as per IRC SP 55. • The O&M stage safety audits shall be conducted on quarterly basis for the first year followed by half yearly in subsequent years.	All along the project corridor, access roads and junctions	O&M agency with Safety Expert

Table 86: Environmental Monitoring Plan

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 (48 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	National Ambient	24 hr. continuou	At equipment yards/ Hot mix	Contractor through

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
			adopted by CPCB for identified study area CPCB/IS:4954-1968 Using Noise Level Meter	Noise Standard specified in EPA,1986	s (once in a month) for three seasons in a year for 2.5 years	plants/ Construction Camps & Sensitive areas (48 Samples)	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 (40 Samples) Discharge Water Quality (As per suggestion in monitoring plan)	Contractor through approved monitoring agency
	Operation				Once in a Season for three seasons in a year for 1 year	(15 Samples)	
Soil Quality	Construction	NPK (ICAR Standards)	As approved by CSE	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 (40 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 (15 Samples)	
Drainage Congestion	Construction	As approved by CSE	Visual Checks	None Specific	Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	Contractor
	Operation			None Specific		Once in a year before rainy season	Contractor
Borrow	Constructi	IRC	Visual	IRC	Borrow	Once in a month	Contractor

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
Areas	on	guidelines	Checks	guidelines + Compliance conditions of SEIAA	areas to be operated		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 CSE	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. 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 CSE	As approved by CSE	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

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
							support from local police

9.4 Chance Find Procedure

The Contractor shall immediately upon discovery of a chance find of archaeological Property/ remains stop the work and inform PWRD of such discovery and carry out the PWRD instructions for dealing with the same, awaiting which all work will be stopped The PWRD shall seek direction from the Archaeologist at the Department of Archaeology before instructing the Contractor to recommence work on the site. The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing.

9.5 Environmental and Social Monitoring and Reporting Program

The purpose of the environmental monitoring program is to ensure that the envisaged objectives of the project are achieved and result in desired benefits. To ensure the effective implementation of the mitigation measures and the Environmental and Social Management Plan (ESMP), an effective monitoring programme must be designed and carried out. The broke objectives of environmental monitoring plan are:

- To evaluate the performance of mitigation measure proposed in the ESMP,
- To evaluate the adequacy of EIA
- To suggest improvements in the management plan, if required,
- To assess change in environmental quality,

A comprehensive monitoring plan has been prepared for all stages of the project. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost, and responsibility for implementation and supervision. The monitoring program is designed for monitoring during construction and operation stages with details on budget and responsible agencies:

- Construction Stage: (30 months of construction period)
- Monitoring shall be carried out by the Contractor.
- Six Monthly monitoring by the external agency shall be arranged by PIU from the Project cost budget. The monitoring report will be submitted by the agency to PWRD.
- Monitoring Programme and schedule for Key Performance Indicators (Physical, biological, and environmental management components identified as of its significance) are given in the following section:

9.5.1 Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters recommended for monitoring road development projects are $PM_{2.5}$, PM_{10}, Carbon Monoxide (CO), Oxides of Nitrogen (NO_x), and Sulphur Dioxide (SO_2). These are to be monitored, right from the commencement of construction activity at selected locations of plants and machinery, crushers on sites, excavation works, etc. Data should be generated once in a season for 3 seasons in a year excluding monsoon at the monitoring locations in accordance with the revised National Ambient Air Quality Standards formulated by MoEF&CC. (Annexure 1).

9.5.2 Water Quality Monitoring

The physical and chemical parameters recommended for analysis of water quality relevant to road development project are pH, total solids, total dissolved solids, total suspended solids, and oil & grease. The monitoring of the water quality is to be carried out at all identified locations in accordance with the Indian Standard Drinking Water Specification – IS 10500: 2012 (Annexure 3). The locations, duration, and pollution parameters to be monitored are detailed in the Environmental Monitoring Plan.

9.5.3 Noise Levels Monitoring

The measurements for monitoring noise levels would be carried out at designated locations in accordance with the ambient Noise Standards formulated by the Ministry of Environment Forests and Climate Change (MoEF&CC) as given (Annexure 2). The noise level would be monitored on a twenty-four hours basis. Noise should be recorded at "A" weighted frequency using a slow time response mode of the measuring instrument. The measurement location, duration, and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

9.5.4 Tree Plantation

The survival of tree-plantation shall be monitored for three years of the operation phase. If the survival rate is found below 75%, additional compensatory plantation shall be done by the agency responsible for plantation and its maintenance. The survival rate monitoring shall be again taken up after 1 year. This cycle should continue until the 75% survival rate is achieved. Tree plantation would be done through the forest department, monitoring shall be carried out by PWRD.

9.5.5 Soil Erosion and Drainage Congestion

No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during the construction and operation phase, the corrective action shall be initiated and the frequency of check be increased to assess the tendency of occurrence.

9.5.6 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.

9.6 Environmental and Social Reporting System

The monitoring plan covering various performance indicators, frequency, and institutional arrangements of the project in the construction and operation stages, along with the estimated cost, is summarized in the Environmental Monitoring Plan.

The reporting system will operate linearly with the contractor who is at the lowest rank of the implementation system reporting to the CSC's Engineer, who in turn shall report to the PIU of PWRD, Assam. All reporting by the contractor and CSC's Engineer shall be quarterly. The PIU shall be responsible for preparing targets for each of the identified ESMP activities.

The environmental compliance monitoring and the progress reports on environmental components may be clubbed together and submitted to the PIU quarterly during the implementation period. The operation stage monitoring reports may be annual or biannual provided the Project Environmental Completion Report shows that the implementation was satisfactory. Otherwise, the operation stage monitoring reports will have to be prepared as specified in the said Project Environmental Completion Report.

Responsibilities for overseeing ESMP implementation will rest with the CSC's Engineer staff reporting to the PIU. Capacity to quantitatively monitor relevant ecological parameters would be an advantage but monitoring will primarily involve ensuring that actions taken are in accordance with contract and specification clauses, and specified mitigation measures as per the ESMP.

During the implementation period, a compliance report may include a description of the items of ESMP, which were not complied with by any of the responsible agencies. It would also report to the management about actions taken to enforce compliance. It may, however, be noted that certain items of the ESMP might not be possibly complied with for a variety of reasons. The intention of the compliance report is not to suppress these issues but to bring out the circumstances and reasons for which compliance was not possible (such as jurisdictional issues). This would help in reinforcing the implementation of the ESMP.

Photographic records will also be established to provide useful environmental monitoring tools. A full record will be kept as part of normal contract monitoring. Reporting and Monitoring Systems for various stages of construction and related activities have been proposed to ensure timely and effective implementation of the ESMP.

The reporting system has been prepared for each of the stages of road construction namely:

- Preconstruction stage
- Construction Stage
- Operation Stage

This reporting shall be done through:

- Reporting by the Contractor to the CSC's Engineer
- Reporting by CSC's Engineer to PIU.
- Reporting by PIU to PMU.
- Reporting by the PMU to AIIB

Table 87: Detailed stage-wise reporting system

Format No.	Item	Contractor	Construction Supervision Engineer		PWRD, Assam PIU	
		Implementation and Reporting to Construction Supervision Engineer	Supervision	Reporting to PIU	Oversee/ Field Compliance Monitoring	Reporting to Environment Officer of PIU
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 water bodies	-	Monthly	Quarterly	Quarterly	Bi-Annual
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 Construction Supervision Engineer to the contractor.

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.

9.7 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 57** shows the implementation arrangement for Asom Mala Program.

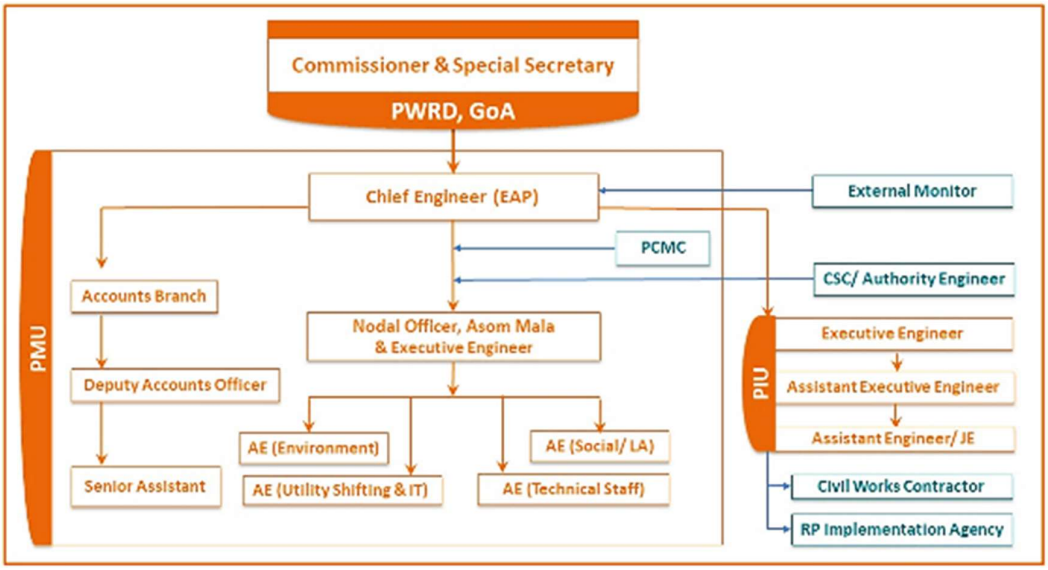


Figure 57: Implementation Arrangement for Environmental and Social Safeguards

9.7.1 Responsibilities of the Program Management Unit (PMU)

The PMU will oversee overall execution and technical supervision, monitoring, and financial control of the project. The PMU shall be assisted by Program Coordination and Management Consultant (PCMC). The PMU will be responsible for the following:

- 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;

- Liaising with district administration for direct purchase or land acquisition
- Preparation of ESMPF, Resettlement Planning Framework (RPF), Indigenous Peoples Planning Framework (IPPF) for ASRIP projects of Asom Mala program;
- Review and approving of Resettlement Plan (RP), Environmental and Social Management Plan (ESMP) and all other social and environmental safeguards documents and reports;
- Ensuring timely disbursement of compensation and assistance to the displaced persons in close coordination with the concerned line departments;
- Monitoring of implementation and monitoring of RP and ESMP;
- Proactive and timely measures to address all social and environment safeguards including measures and clearances;
- monitoring, addressing and resolving grievances;
- ensuring availability of budget for implementation activities; and
- 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.

9.7.2 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.

9.7.3 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.

9.7.4 Responsibilities of 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:

- Review the environmental and social reports and management plans to understand the background issues of the respective project corridor
- 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
- Conduct regular site inspections and monitor implementation of the ESMP and EMOP by the contractor
- Provide on-site training and technical guidance to the contractor workers as necessary
- Review the monthly reports prepared and submitted by the contractor
- Where necessary identify the need for corrective actions and issue official notices to the contractor to implement the corrective actions with clear timeline
- 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
- 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
- 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

9.7.5 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.

9.8 Capacity Building and Training

The Environmental and Social officer of the PMC will provide the basic training required for environmental and social awareness. Specific modules customized for the available skill set will be devised after assessing the capabilities of the members of the Training Programme and the requirements of the project. The entire training would cover basic principles of environmental and social assessment and management; mitigation plans, implementation techniques, monitoring methods and tools. The proposed training program along with the frequency of sessions is presented in **Table 88**.

Table 88: Environmental and Social Training Modules

Sr. No.	Training Program	Duration	Target Group	Responsibility
1	Workshop on: ➢ Introduction to Environment and Society: ➢ Basic Concept of surrounding ➢ Environment and Society ➢ Environmental and Social Regulations and Statutory requirements as per Govt. of India and AIIB	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
2	Environmental and Social management, environmental provisions, implementation arrangements, methodology of assessment, good engineering practices to be integrated into contract/ bid documents	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
3	Roles and Responsibilities of officials/contractors/consultants towards protection of environment	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
4	Monitoring and reporting system to the target audience such as Engineers and staff of implementing agencies (PWRD, Assam)	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
5	Orientation of contractors at the time of issuing work orders on the	¼ Working	PWRD & Contractor	Environmental and Social officer

Sr. No.	Training Program	Duration	Target Group	Responsibility
	implementation of SMF	Day		of the PMC
6	Overview of Land Securing and Entitlement Provisions ➢ Direct Acquisition ➢ Gift Deed / MoU ➢ Relocation of Common Property Resources ➢ Avoidance of encroachments during the post-construction scenario	¼ Working Day	PWRD, Contractor & Revenue officials	Environmental and Social officer of the PMC

9.9 Environmental and Social Management Budget

An environmental and social management budget of **INR 57,909,182** has been estimated for the implementation of the environmental and social management plan. This budget also includes the cost of environmental monitoring and associated training. A detail of the environmental and social management budget is given in **Table 89** (Civil Cost) and **Table 90** (Non-Civil Cost).

Table 89: Environment and Social Management Costs (Civil 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	24	2,500	60,000

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			Construction sites near sensitive locations	No. of Samples	24	2,500	60,000
			At 2 location during operation stage where monitoring had been done during construction stage	No. of Samples	12	2,500	30,000
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	24	1,000	24,000
			Near known nesting sites - as directed by the Engineer	No. of Samples	24	1,000	24,000
			During Operation Stage as directed by the Engineer	No. of Samples	12	1,000	12,000
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	40	4,000	160,000
			Discharge Water Quality testing during Operation Stage	No. of Samples	15	4,000	60,000
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	40	4,200	168,000

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			During Operation stage At accident/spill locations involving bulk transport carrying hazardous material.	No. of Samples	15	4,200	63,000
	Total monitoring Cost						**661,000**
2			**Mitigation / Enhancement Cost**				
2.1			***Enhancement of Road side ponds***				
	3.22	307	Turfing with Sods (Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of rods and watering)				
			5 m width turfing on outer side of ponds located at chainage 8+750 (L)	sqm	1100	31	34,100
	3.24	309	Surface Drains in Soil (Construction of unlined surface drains of average cross sectional area 0.40 sqm in soil to specified lines, grades, levels and dimensions to the requirement of clause 301 and 309. Excavated material to be used in embankment within a lead of 50m (Average lead 25m)				
			Construction of surface drains on outer side of ponds located at chainage 8+750 (L)	Meter	240	81	19,440
2.2			***Oil Interceptors***				
			Oil interceptors at parking/ servicing of	No.	1	60,000	60,000

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			construction vehicles				
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: 2+875 (LHS) and 5+425 (RHS)	Rm	100	4,000	400,000
	Total Mitigation / Enhancement Cost during Construction phase						**513,540**
	Total Environmental Management Cost						**1,174,540**
	Total Environmental Management Cost (Including GST @ 12%)						**1,315,485**

Table 90: Environment and Social Management Costs (Non-Civil Cost)

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/ GC/ 87/ R.S.T.-A30: A/ Genl/2020/5785 dated 13/12/2020]	m3	1,656.32		18,947,397
			Sub Head No-2 Compensatory Plantation				
3	11.9	307	Planting of Trees and their Maintenance for one Year (Planting of trees by the road side (Avenue trees) in 0.60 m dia holes, 1 m deep dug in the ground, mixing the soil with decayed farm yard/sludge mannure, planting the saplings, backfilling the trenches, watering, fixing the tree guatrd and maintaining the plants for one year.	No.	25530	831	21,215,430
4	11.13		Making Tree Guard 53 cm dia and 1.3 m high as per design from empty bitumen drum (Making tree guard 53 cm dia and 1.3 m high as per design	No.	25530	359	9,165,270

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			from empty bitumen drum, slit suitably to permit sun and air, (supplied by the department at stock issue rate) including providing and fixing 2 nos MS sheet rings 50mmX0.5mm with rivets, complete in all respects.				
			Sub Head No-3 Administrative Charges including logistics				
5			Data processing, administrative support, stationery etc.	LS			699,500
			Digital Camera for the Environment Cell	No.	1	35,990	35,990
			Sub Head No-5 Environmental Awareness and Training				
6			Providing Environmental awareness and training during first 5 years of project implementation	Past Project Experience			466,500
Total Cost							**50,530,087**
Total Cost @ 12% GST							**56,593,697**

10. Conclusions and Recommendations

The proposed project **A30_1 (Moran to Disang Kinar Bangali)** falls under Category B as per AIIB's ESP and ESS. The project road corridor is neither a new State Highway nor a State Highway expansion project in hilly areas (above 1000 AMSL) and not located within any eco-sensitive area or eco-sensitive zone. Hence, Environmental Clearance from MOEF&CC is not required as per EIA Notification 2006 (amended to date) and NOC from the Standing Committee of National Board for Wildlife is also not required. The project is unlikely to cause any major significant environmental impacts, few impacts are identified, all of which are localized, temporary, and easy to mitigate. Most of the impacts are short term and limited to the construction stage. Key conclusions on the environmental implications of the project are given in the paras below.

Environmental Gains Due to Proposed Work Justifying Implementation

The project entails various impacts on the project setting. There are many positive impacts bearing benefits to the area against the limited number and magnitude of negative impacts. These include (i) The project will substantially improve the transport efficiency on the roads. (ii) The project once implemented will improve the overall environmental conditions with better roads, fuel efficiency, and environmental protection measures (iii) will reduce traffic congestion particularly at junctions hence, air pollution due to the idling of the vehicles.

Potential Impacts and Mitigation

The finding of EIA indicates that the project is unlikely to cause any significant adverse environmental impacts. While some of the minor impacts are negative, there are many bearing benefits to the area. Most of the impacts are likely to occur during the construction stage and are temporary. Anticipated minor impacts will be mitigated through the implementation of mitigation measures summarized in the Environmental and Social Management Plan.

Factors contributing to minimal impacts include widening of the project road confined within the available RoW, presence of no sensitive environmental issue like a wildlife sanctuary, national park, bio reserve, within 10 km from the project road. However, some of the impacts are unavoidable. These impacts with mitigation measures are indicated below:

- **2553** trees will need to be cut with the prior permission of forest authorities. Compensatory Tree plantation of **25530** trees in non-residential areas along the project road on both sides as per the direction of the forest department will be made to compensate for this loss. Preventive measures shall be taken during the construction phase especially in rainy months, to prevent soil erosion because of tree cutting and alteration of ground flora.
- There are 26 identified trees of cultural importance along the road which may be required to be felled due to constraints in geometric improvement of the alignment.
- Air pollution due to construction activities and operation of hot mix plants will be controlled through the adoption of dust suppression measures and provision of a high stack for good dispersion of gaseous emission from hot mix plants.
- Noise levels may increase during the construction phase due to the operation of

construction machinery. All the construction equipment and DG set will be well maintained and fitted with silencers.

- Waste materials generated during the construction phase may contaminate soil, surface, and groundwater resources. Waste shall be segregated and reused or disposed of in an environmentally safe manner.
- Along the project stretch, few schools and religious structures are located. Appropriate design options are exercised to minimize the loss of such structures.
- The social issues are addressed through Social Safeguards Due Diligence reports prepared as per AIIB's Environmental and Social Framework.

Application of these measures in parallel with MoRTH environmentally friendly road construction practices will reduce significantly any potential environmental impact. Impacts remaining on the physical environment (air and water pollution) are temporary and often occur away from the presence of people.

Irreplaceable Resources

The project road does not pass through any protected areas or eco-sensitive areas. The construction material will also be sourced from identified and approved sources. As such, there are no environmentally sensitive resources found in the project area, which is likely to be affected due to the project.

Post EIA Study Surveillance and Monitoring

While an EIA is meant to provide a comprehensive understanding of the environment status of the area under the study, post surveillance is the means to ensure that the significant impacts identified are adequately mitigated as per the proposed mitigation plan. A detailed monitoring plan has been provided as part of the Environmental and Social Management Plan. Air, water quality, noise, soil erosion, and tree survival rate monitoring and reporting along with the follow-up actions in case of deviation from the norms have been detailed out. The frequency has been set in consideration of the likely impacts.

Recommendations

Adequate mitigations shall be taken up both during the construction and operation stage of the project road to avoid/minimize adverse environmental impacts due to this event and any such event in the future as suggested in the EIA.

Effective ESMP implementation is essential for the elimination or minimization of the identified impacts. The PWRD shall ensure that ESMP and EMoP are included in the Bill of Quantity (BOQ) and forms part of the bid document and civil works contract. The same shall be revised if necessary, during project implementation, or if there is any change in the project design.

PWRD needs capacity building and practical exposure. Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned EA officials.

Annexure 1: Ambient Air Quality Standards

National Ambient Air Quality Standards

Pollutant	Concentration in ambient Air			
	Average	Industrial, Residential and other rural area	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
SO_2 ug/m^3	Annual* 24 hours**	50 80	20 80	- Improved West and Geake - Ultraviolet Fluorescence
NOx ug/m^3	Annual* 24 hours**	40 80	30 80	- Modified Jacob and Hochheiser - Chemiluminescence
PM10 ug/m^3	Annual* 24 hours**	60 100	60 100	- Gravimetric - TEOM - Beta Attenuation
PM2.5 ug/m^3	Annual* 24 hours**	40 60	40 60	- Gravimetric - TEOM - Beta Attenuation
Ozone (O_3) ug/m^3	8 Hours** 1 Hour**	100 180	100 180	- UV Photometric - Chemiluminescence - Chemical Method
Lead ug/m^3	Annual* 24 hours**	0.50 1.0	0.50 1.0	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
CO ug/m^3	8 Hours** 1 Hour**	2000 4000	2000 4000	- Non-Dispersive Infra-Red Spectroscopy
NH_3 ug/m^3	Annual* 24 hours**	100 400	100 400	- Chemiluminescence - Indophenol blue method
Benzene (C_6H_6) ug/m^3	Annual*	05	05	- Gas Chromatography based Continuous Analyzer - Adsorption followed by GC Analysis
Benzo Pyrene-Particulate Phase only ug/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic ng/m^3	Annual*	06	06	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel ng/m^3	Annual*	20	20	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

Source: Gazette of India, Part II-Section -3-Subsection (i)

* Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

** 24-hourly / 8-hourly values or 0.1 hourly monitored values will be complied with 98% of the time in the year. However, 2% of the time, it may exceed but not on two consecutive days.

WHO Ambient Air Quality Guidelines

Sulphur dioxide (SO2)	24-hour 10 minute	125 (Interim target-1) 50(Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM10	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM2.5	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 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 2: Ambient Noise Level Standards

Govt. of India Ambient Noise level standards

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

The maximum permissible sound level (LAeq) according to the receiving zones (WHO)

Category	Noise level, Leq dBA	
	Day Time	Night time
Noise sensitive area, low density residential, institutional (School, Hospital), workship areas	50	40
Suburban residential, Medium density areas, public spaces, parks, recreational areas	55	45
Urban residential, high density areas, designated mixed development areas (commercial)	60	50
Commercial business zones	65	55
Designated industrial zones	70	60

Annexure 3: Indian Standard Drinking Water Specification IS: 10500-2012

Sr. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	15
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	1	5
5.	pH	6.5-8.5	No relaxation
6.	Total Coliforms (MPN/100 mL)	nil	-
7.	Pathogenic Organisms or Virus	nil	-
8.	TDS (mg/L)	500	2000
9.	Mineral Oil (mg/L)	0.5	No relaxation
10.	Free Residual Chlorine (mg/L)	0.2	1
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C_6H_5OH)	0.001	0.002
13.	Total Hardness (mg/L as $CaCO_3$)	200	600
14.	Total Alkalinity (mg/L as $CaCO_3$)	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO_4)	200	400
17.	Nitrate (mg/L as NO_3)	45	No relaxation
18.	Fluoride (mg/L as F)	1	1.5
19.	Calcium (mg/L as Ca)	75	200
20.	Magnesium (mg/L as Mg)	30	100
21.	Copper (mg/L as Cu)	0.05	1.5
22.	Iron (mg/L as Fe)	0.3	No relaxation
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	0.5	1
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.01	0.05
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.01	No relaxation
30.	Cadmium (mg/L as Cd)	0.003	No relaxation
31.	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32.	Selenium (mg/L as Se)	0.01	No relaxation
33.	Anionic Detergents (mg/L MBAS)	0.2	1
34.	PAH (mg/L)	0.0001	No relaxation
35.	Pesticides (µg/L)	Absent	0.001
36.	Alpha Emitters (Bq/L)	0.1	No relaxation
37.	Beta Emitters (Bq/L)	1.0	No relaxation

Annexure 4: Record of Public Consultation

Environmental Assessment Study

Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A 30_1		
Project package no.:	Group 3		
Chainage:		**Date:**	8/11/2020
Location:	Naharani 27.256841 95.271578	**District:**	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Jayanta Buragohain	Naharani	Shopowner	8011365516.	Jayanta Buragohain.
2.	Amio Buragohain	—11—	—11—	—11—	Amio Buragohain
3.	Jitu Buragohain	—11—	Business	9957821582	Jitu Buragohain
4.	Lila Gogoi	—11—	Labourer	7636950094	
5.	Karuna Gogoi	—11—	Shop owner	—	Karuna Gogoi

(9)

Environmental Assessment Study

Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30_1.		
Project package no.:	Group 3.		
Chainage:		**Date:**	8/11/2020
Location:	Tinsukhia 27. 232358 Chanida 95. 169429	**District:**	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Lohit Gogoi	Bailungbheti	Shopowner	9954453599	Lohit Gogoi
2.	Rakkim Gogoi	—11—	—11—	9365031104	
3.	Shewpujan Jaiswal	Bordumsa pattey	Hardware shop owner	7896743333	
4.	Chandra Gogoi	Ashokapur	Business	9957288994	Chandra Gogoi
5.	Sri Ajit Borah	Ratanpur	T.P.	8723868429	

(10)

Environmental Assessment Study

Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30-1		
Project package no.:	Group 3		
Chainage:		**Date:**	8/11/2020
Location:	Ting Phong No-3 27.213582 95.171935	**District:**	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1	Haren Malwai	Tinglahung.	Shop owner	8011261100	Haritham Halwai
2.	Sunil Munda	—11—	Tea Garden worker	—	
3.	Arup Deb	Polaypathar	shopowner	8876041320	Arup Deb
4.	Manoj Dey	Tinglung.	Shopowner	—	Manoj Dey

(11)

Environmental Assessment Study

Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30_1		
Project package no.:	Group 3		
Chainage:		**Date:**	8/11/2020.
Location:	Pimapamer 27.176749 95.061209	**District:**	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Biju Dey	Pimapamer	Driver	7575967858	Biju Dey
2.	Rekha Hembrom	—11—	Shopowner	7896268739.	Rekha Hembrom
3.	Jiban Tanti	—11—	—11—	9365310805	জীবন তাঁতী
4.	Sajan Das	—11—	Shop owner	8135833400.	Sajal Das.
5.	Kisan Munda	—11—	Working.	8133056112	Kisan Munda
6.	Reena Tanti	—11—	Shopkeeper	—	রীনা তাঁতী

(12)

Environmental Assessment Study

Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30-1		
Project package no.:	Group 3		
Chainage:		**Date:**	8/11/2020
Location:	Ofwia 27.412978 Chariali 95.016709.	**District:**	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Kamal Gogoi	Ofwia	Shop Owner	6901710565	
2.	Pavitra Saikia	-11-	Worker	8400243953	
3.	Dandi Bora	-11-	Farmer	7086308855	Dandi Borah
4.	Anwar B.D.	Ranjanchuara	Shopowner	7670070900	A Bel Baruah

Public Consultation Meeting Attendees List

Name of Project: Improvement of SH and MDRS under Asom Mala

Name of Project Road: A30-1

Project package no.: 1

Chainage: 3+930 Date: 18-01-2020

Place: Raidongia Gaon District: Dibrugarh

List of Stakeholders/Participants who attended public consultation meeting

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.
1	Beerna Bhegga	Raidongia Gaon	Leabar	
2	Titu Saikia	Raidongia Gaon	workers	6000638091
3	Abhigeet Munda	Raidongia Gaon	Farmer	
4	Virendra	Raidongia Gaon	Farmer	
5	Lokai	Raidongia Gaon	workers	

Public Consultation Meeting Attendees List

Name of Project: Improvement of SH and MDRs under Asom Mala

Name of Project Road: A30-1

Project package no.: 3

Chainage: 16+920 Date: 18-01-2020

Place: Disham kinar District: Dibrugarh

List of Stakeholders/Participants who attended public consultation meeting

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.
1	Swaroop Gunar	Dishamkinar	Students	
2.	Sayed Dey	Dishamkinar	workers	
3	Sanjay Dey	Dishamkinar	workers	
4	Tanka Bahadur	Dishamkinar	student	

Public Consultation Meeting Attendees List

Name of Project: Improvement of SH and MDRS under Asom Mala

Name of Project Road: A 30-1

Project package no.: 3

Chainage: 18+950 Date: 18-01-2020

Place: Derai T.E District: Dibrugarh

List of Stakeholders/Participants who attended public consultation meeting

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.
1	Deepak Nag	Derai T.E	workers	2471296500
2	Gautam Bora	Derai T.E	Student	
3	Milay Kitle	Derai T.E	Student	
4	Samen Munda	Derai T.E	Farmer	

Public Consultation Meeting Attendees List

Name of Project: Improvement of SH and MDRS under Asom Mala

Name of Project Road: A30-1

Project package no.: 3

Chainage: 35+350 Date: 18-02-2020

Place: Tingkhong District: Dibrugarh

List of Stakeholders/Participants who attended public consultation meeting

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.
1	Prabled Kasti	Tingkhong	Student	8638441337
2	Binatta Kanti	Tingkhong	Leaban	
3	Alokmanju Kanti	Tingkong	weaver	
4	Biplop Kanti	Tingkong	Farmer	7637993400
5	Ajit Dev	Tingkong	Student	
6	Sarwinda Dev	Tingkong	Student	
7	Amit Dev	Tingkong	Farmer	
8	Gaurav Kanti	Tingkong	Farmare	
9	Poojon Kanti	Tingkong	Leaban	

Public Consultation at Raidangia Gaon

Public Consultation at Diksom Kinar

Public Consultation at Deroi T.E.

Public Consultation at Tingkhong

Public Consultation at Naharani

Public Consultation at Naharani

Public Consultation at Tingkhong Chariali

Public Consultation at Tingkhong No. 3

Public Consultation at Pithapathor

Public Consultation at Ofulia Chariali

Public Consultation at Ofulia Chariali

Details of Public Consultation

The Consultant has explained to the Community about the scope and purpose of consultation, the Asom Mala initiative of Govt. of Assam. Participants were encouraged to tell about the problems faced due to the existing condition of the roads.

Majority of the villagers who participated in the consultation were farmers. People were very positive about the road works being carried out. They believed the road helped them in accessing urban areas and market places on the project road where modern-day facilities are easily available. The Community also requested for minimum loss of their properties and adequate rehabilitation and resettlement measures.

Key Issues/ Perception of Community	Response from Consultant
People facing problems due to the poor condition of the roads	The Consultant explained the proposed widening and strengthening of the road which provide a better level of services in terms of improved riding quality and smooth traffic flow.
People asked about provision of speed breakers in areas where project road passes through settlements	Adequate safety measures that will be implemented to prevent accidents such as provision of speed breakers, crash barriers, and sign boards were explained.

Key Issues/ Perception of Community	Response from Consultant
The road section passes by many tea estates	Appropriate measures will be taken into consideration to improve the road geometry and achieve safe travel at desired design speed and provide any harm to the tea estates
Safety provisions particularly at locations where project road passes by schools, hospitals etc.	Appropriate measures such as provision of speed breakers, sign boards will be provided as safety measures.
Green belt development	The compensatory plantation will be done as per the orders of the state forest department and following National policies.

Community Perception about the Project road:

- The project will not only help in economic development of the region, it will provide better access to education and health facilities
- The road improvements will result in reduced traffic congestion, savings in travel time and enhancing the value of the land
- The road project should provide employment opportunities to the local people.
- The villagers are willing to part with their land and structures for road improvement provided adequate compensation is paid.

Annexure 5: GRM Information Sheet

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Hindi, Assamese or any other local languages, if any)

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 পঞ্জীয়ন প্ৰ-পত্ৰৰ নমুনা

প্ৰকল্প ৰূপায়ণ সম্পৰ্কত অসম চৰকাৰৰ গড়কাপ্তানী বিভাগে অভিযোগ, পৰামৰ্শ, অনুসন্ধান, মন্তব্য বিচাৰে। স্পষ্টীকৰন আৰু প্ৰতিক্ৰিয়াৰ 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	পঞ্জীয়নৰ স্থানঃ	
যোগাযোগৰ তথ্য/ব্যক্তিগত তথ্যঃ		
নামঃ	লিঙ্গঃ	বয়সঃ
ঠিকনাঃ		
গাওঁ/চহৰঃ		
জিলাঃ		
ফোন নং		
ই-মেইলঃ		
অভিযোগ/পৰামৰ্শ/মন্তব্য/প্ৰশ্ন - আপোনাৰ অভিযোগৰ সবিশেষ (কোন, কি, ক'ত আৰু কেনেকৈ) তলত দিবঃ		
যদি সংযোজন/চিঠি/টোকা আদি গাথি দিয়া হৈছে, তেনেহলে ইয়াত টিক চিন্হ দিবঃ		
প্ৰতিক্ৰিয়া অথবা আপোনাৰ অভিযোগ/মন্তব্য সংক্ৰান্তত 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 6: Guidelines for Borrow Area Management

A. Selection of Borrow Areas

The location of borrow areas shall be finalized as per IRC: 10-1961 guidelines. The finalization of locations in case of borrows areas identified in private land shall depend upon the formal agreement between landowners and contractors. If the agreement is not reached between the contractor and landowners for the identified borrow areas sites, arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environment requirements in respect of excavation and borrow areas as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor. The contractor in addition to the established practices, rules, and regulations will also consider the following criteria before finalizing the locations.

- The borrow area should not be located in the agriculture field unless unavoidable i.e. barren land is not available.
- The borrow pits preferably should not be located along the roads.
- The loss of productive and agricultural soil should be minimum.
- The loss of vegetation is almost nil or minimum.
- The Contractor will ensure that suitable earth is available.

B. Contractor's Responsibility

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing program approved by the Engineer. It shall be ensured that the sub-grade material when compacted to the density requirements shall yield the design CBR value of the sub-grade. Contractor shall begin operations keeping in mind following;

- Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plants are operating at the place of deposition.
- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. The contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then shall make a consequent deficit of material arising therefrom.
- Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, excavate in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, the use of plants is siting of temporary buildings or structures.

C. Borrowing from Different Land-Forms

Areas located in Agricultural Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of the earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of the earth will not be done continuously throughout the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

Borrow Areas located in Elevated Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At the location where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields

Borrow Areas near River Side

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is maximum.

Borrow Areas near Settlements

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm, and drains will be cut to facilitate drainage.
- Borrow pits located in such locations will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with layers of stockpiled topsoil in accordance with compliance requirements with respect to MOEF&CC/SPCB guidelines.

Borrow Pits along the Road

Borrow pits along the road shall be discouraged and if deemed necessary and permitted by the Engineer; following precautions are recommended

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitating drainage.
- The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontals projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.

Rehabilitation of Borrow Areas

- The objective of the rehabilitation program is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is the fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level.
- Re-development plan shall be prepared by the Contractor before the start of work in line with the owners will require and to the satisfaction of the owner. The Borrow Areas shall be rehabilitated as per following;
- Borrow pits shall be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then excavation sloped will be smoothed and depression will be filled in such a way that it looks more or less like the original round surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such a borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.

The Contractor will keep records of photographs of various stages i.e., before using materials from the location (pre-project), for the period borrowing activities (construction Phase) and after rehabilitation (post-development), to ascertain the pre and post borrowing status of the area.

Annexure 7: Guidelines for Emergency Management System

Many emergencies can occur in construction sites and will need to be effectively handled. The environmental and occupational health and safety aspects and related emergency can include incidences such as subsidence of soil / Fire / Explosion / Gas Leak, Collapse of Building / Equipment, and other Occupational Accidents. Onsite and off-site emergency management plans will be developed to effectively handle them. The following guidelines will be used to develop these plans.

Guidelines:

Availability of 'On-Site Emergency Management Plan'

- The contractor will have a written-on site emergency management plan. The contractor should submit a copy of this plan to PWRD, Assam, and the Supervision Consultant before the start of the work.
- The contractor will develop an onsite emergency plan considering the potential environmental, occupational health, and safety emergency at the site.
- The contractor will include a list of potential emergencies in the emergency management plan including potential Environmental and Occupational Health and Safety Emergency Situations during construction, operation, and maintenance stages.

Examples of potential emergencies have been defined below for guidance purposes.
The contractors may follow refer to this for developing site-specific on-site emergency preparedness plans.

Emergency conditions/ situations	Sources
Collapse/subsidence of soil and structures	• Civil structures • Heavy construction machinery
Bulk spillage	• Hazardous substance / inflammable liquid storage • Vehicular movement on Highway
Fire and explosion	• Inflammable Storage Areas • Gas Cylinder Storage Areas • Electrical Circuits • Isolated Gas Cylinders (LPG/DA) Welding / Gas Cutting Activity
Flooding	• Heavy Monsoons • Upstream activities of irrigation and damming • Glacial lake outburst Flood at the source of the river

Emergency conditions/ situations	Sources
Electrical Shocks	• HT line • LT distribution • Electrically operated machines/ equipment's/ Hand tools/ Electric cables
Gaseous leakage	• Gas cylinder storage areas • Gas cylinder used in Gas cutting / Welding purposes
Accidents due to Vehicles	• Heavy earth moving machinery • Cranes • Fork lifts • Trucks • Workman Transport Vehicles (cars/ scooters/ motorcycles/ cycles) • Collapse, toppling or collision of transport equipment
Slips & Falls (Man & Material)	• Work at Height (Roof works, Steek Erection, Scaffold, Repair & Maintenance, Erection of equipment, Excavation etc.) • Slips (Watery surface due to rain) • Lifting tools & Tackles (Electric hoist & Forklifts)
Collision with stationary or moving objects	• Vehicular movement on highway
Other Hazards	• Cuts & Wounds • Confined Space (under & inside machinery etc) • Hot burns • Pressure impacts (Plant contains several pressure vessels & pipefittings containing C02, air, water, product & steams, which can cause accident & injuries to person)

Design of 'On-Site Emergency Plan'

The 'On-site emergency plan' to be prepared by the contractor will include a minimum of the following information:

- Name & Address of Contractor
- Updation sheet
- Project Location
- Name, Designation & Contact Numbers of the organization, nearby hospitals, fire agencies etc. and key personnel including their assigned responsibilities in case of an emergency.
- The roles and responsibilities of executing personnel

- Site Layout Diagram
- Identification of Potential Emergencies Situations/ preventive measures / control & response measures
- Location of Emergency Control Centre (or designated area for emergency control / coordination) with requisite facilities.
- Medical services / first aid
- List of emergency equipment including fire extinguishers, fire suits, etc.

Emergency Control Centre

The emergency control center will be equipped with the following facilities:

- Copy of current on-site emergency plan
- Display of the name of site emergency controller
- Appropriate numbers of artificial respiratory sets
- Appropriate numbers of Stretchers
- Vehicle/ambulances on each construction site for 24 hours
- Adequate and reliable communication facilities (phone, handset, etc.)
- Site layout diagram with entry and exit routes / Assembly points
- Directory of internal/external emergency phone Numbers
- Fire extinguishers (DCP type / Foam Type / CO2) on all construction camps and yards
- List of fire extinguishers installed in the construction sites and yards including maintenance records
- A set of personal protective equipment (PPE) for every member of the construction team
- First-aid boxes with prescribed first-aid medicines in every construction campsite and yard
- List of competent first-aiders
- List of fire trained personnel
- Appropriate numbers of blankets, rescue ropes, and high beam torches
- Drinking water
- Gas leak detectors
- Lifeboats & jackets

Records:

The following records will be maintained:

- Record of emergency preparedness plan with emergency contact numbers
- Mock drill/emergency preparedness exercise records
- Corrective preventive action record after the emergency occurs

Reporting:

The accident and incident records and emergency preparedness drill reports will form part of the quarterly report to PWRD, Assam, and the Supervision Consultant.

Responsibility:

- Prime Responsibility: Contractor will be responsible for implementing the Emergency plan and reporting
- Supervisory Responsibility: The Supervision Consultant will check compliance of the contractor with the above guidelines

Annexure 8: Guidelines for Waste Disposal and Management

Waste disposal and management plan will be prepared by the contractor before the start of construction works and submitted to PWRD, Assam, and the Supervision Consultant for their review and approval. The management plan will follow the guidelines as given below:

- The debris disposal site should be identified which are preferably barren or low-lying areas away from settlements.
- Prior concurrence will be taken from concerned Govt. Authorities or landowner
- Due care should be taken during site clearance and disposal of debris so that public/ private properties are not damaged or affected, no traffic is interrupted.
- All efforts should be made to use debris in road construction or any other public utilities.
- The debris should be stored at the site ensuring that existing water bodies and drains within or adjacent to the site are kept safe and free and no blocking of drains occurs.
- All dust prone material should be transported in a covered truck.
- All liquid waste like oils and paint waste should be stored at identified locations and preferably on a cemented floor. The provision of a spill collection pit will be made on the floor to collect the spilled oil or paint. These should be sold off to authorized recyclers.
- All domestic waste generated at construction camp preferably be composted in a portable mechanized composter. The composted material will be used as manure.
- In case composting is not feasible, the material will either be disposed of through a waste disposal system or disposed of through land burial. The dumpsite must be covered up with at least a six-inch thick layer of soil.
- Only appropriately design, engineered and compliant landfills will be used for disposing of waste. Engineered dump sites mean clay or other non-permeable liners to prevent water and soil contamination.
- All efforts should be made that no chemical/ oily waste spill over to ground or water bodies.
- All precautions should be followed for emergency preparedness and occupational health & safety during construction and handling waste.
- Provision of fire extinguishers will be made at the storage area
- Adequate traffic control signals and barriers should be used in case traffic is to be diverted during debris disposal. All efforts should be made to ensure avoidance of traffic jams, which otherwise results in air pollution, noise pollution, and public unrest.
- Hazardous waste and chemicals should be stored in a dedicated storage area that has: 1) weather protection, 2) solid impermeable surface and drainage to the treatment system, 3) security fence/lock, 4) primary and secondary containment with 110% volume for liquids.

Records: The following records will be maintained

- Generation and disposal quantity with the location of disposal
- Recyclables waste generation and disposal
- Domestic waste disposal locations details

Reporting:

- The waste generation and disposal details will form part of the quarterly report to PWRD Assam.

Responsibility:

- Prime Responsibility: Contractor will be responsible for waste management and reporting
- Supervisory Responsibility: Supervision Consultant will check the contractor's adherence to the above guidelines

Annexure 9: Outline of an Environmental Monitoring Report

1. Introduction

(Report Purpose, Brief project background including organizational setup, list of roads, planned project schedule, etc., Details on Project Implementation Progress with details on current site works, location, earthworks, vegetation clearing, spoils disposal, the establishment of construction camp and other construction-related facilities (e.g., concrete mixing plant, asphalt batching plant, crushing plant, etc.), establishment and operation of quarry/borrow areas, etc., including locations, schedules, dates, etc., Schedule of construction activities for the subsequent months).

2. Compliance on Environment Safeguards Requirements

(Status of compliance with AIIB loan covenants: provide a list of environmental loan covenants and specify the level of compliance).

Status of compliance with government environmental requirements: provide a list of government environmental requirements (permits, etc.) for the project as well as construction-related facilities/ activities and specify the level of compliance, indicate any required environmental permit/license/consent obtained to date and to be obtained (including the schedule) for the project and construction-related facilities/activities).

3. Changes in project scope

(Such as a change in alignment or footprint in case of horizontal infrastructure, implementation of additional Project component/s, etc. (with reference to the Project scope identified in the AIIB cleared environmental impact assessment report, i.e. EIA) and corresponding safeguard measures are undertaken, if applicable).

4. Implementation of Environmental and Social Management Plan

Indicate how ESMP requirements are incorporated into contractual arrangements, such as with contractors or other parties.

Summary of Environmental Mitigations and Compensation Measures Implemented.

Based on ESMP; it may include measures related to air quality, water quality, noise quality, pollution prevention, biodiversity, and natural resources, health and safety, physical cultural resources, capacity building, and others. Provide a table/matrix showing a summary of each environmental mitigation measure specified in the ESMP.

ESMP Requirement (list all mitigation measures specified in the EMP)	Compliance Attained (Yes, No, Partial)	Comment on Reasons for Partial or Non-Compliance	Issues for Further Action and Target Dates
1			
2			
3			

ESMP Requirement (list all mitigation measures specified in the EMP)	Compliance Attained (Yes, No, Partial)	Comment on Reasons for Partial or Non-Compliance	Issues for Further Action and Target Dates
4			
5			
etc.			

5. Environmental Monitoring Activities

(Compliance Inspections, Summary of Inspection Activities, Mitigation Compliance Mitigation Effectiveness. Findings of Environmental Monitoring Plan (EMOP) on quality of air, noise, water, etc. and Results Assessment)

6. Key Environmental Issues

(Key Issues Identified (e.g., non-compliance to loan covenants, ESMP and/or government environmental requirements, insufficient mitigation measures to address Project impacts, incidents, accidents, etc.) Actions Taken and Corrective Action Plan (specify actions taken and corrective action plans to be implemented to address non-compliance and other identified issues. Such an action plan should provide details of specific actions to be undertaken to resolve identified issues, responsible persons who will carry out such actions and timeframe/target date to carry out and complete required actions. The action plan could be presented in a tabular/matrix form (see below). Timeframe and responsibilities for reporting to AIIB on the progress of implementation of the corrective action plan should also be specified under this section.)

Issue	Cause	Required Action	Responsibility	Timing (Target Dates)	Description of Resolution and Timing (Actual)
Old Issues from Previous Reports					
1					
2					
New Issues from this Report					
1					
2					

Complaints: Details of Complaint/s (Provide details of any complaints that have been raised by the local population and other stakeholders regarding environmental performance and Overall compliance with mitigation implementation requirements could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (all required mitigations implemented)
- Good (the majority of required mitigations implemented)
- Fair (some mitigations implemented)
- Poor (few mitigations implemented)
- Very Poor (very few or no mitigations implemented)

Additional explanatory comments should be provided as necessary.

Effectiveness of mitigation implementation could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (mitigations are fully effective)
- Good (mitigations are generally effective)
- Fair (mitigations are partially effective)
- Poor (mitigations are generally ineffective)
- Very Poor (mitigations are completely ineffective)

Additional explanatory comments should be provided as necessary.

Discharge levels should be compared to the relevant discharge standards and/or performance indicators noted in the ESMP. Any accidents should be highlighted for attention and follow-up. Besides, discharge levels could be compared to baseline conditions (if baseline data is available) and described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (overall conditions are generally improved)
- Good (conditions are maintained or slightly improved)
- Fair (conditions are unchanged)
- Poor (conditions are moderately degraded)
- Very Poor (conditions are significantly degraded)

Additional explanatory comments should be provided as necessary.

Environmental impacts (complainant, nature of the complaint, date complaint was filed, which office received the complaint, etc.)

Action Taken (Document how the complaints were addressed or will be addressed by indicating the following:

- Names and designation of specific staff or officials within the Grievance Redress Committee, executing agency, project management unit, local government, contractor, and/or supervision consultant involved in receiving, documenting, and resolving the complaint (s).
- Specific actions are taken to be taken to resolve the complaint and corresponding timeframe

7. Conclusion and Recommendation

- Overall Progress of Implementation of Environmental Management Measures
- Problems Identified and Actions Recommended
- Monitoring adjustment (recommended monitoring modifications based on monitoring experience/trends and stakeholder's response)

8. Appendices

- Site Inspection / Monitoring Reports
- Source and Ambient Monitoring Results (Laboratory Analysis)
- Photographs
- Location Map of Sampling Stations
- Copies of Environmental Permits/Approvals
- Other relevant information/documents

Overall sector environmental management progress could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good
- Good
- Fair
- Poor
- Very Poor

Additional explanatory comments should be provided as necessary.

Annexure 10: 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 numbers and Introduce tracks for non-motorized transport along existing roads, 10 major cities	2	State Govt./Central Govt.	H	Department of 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 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/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 11: Tree Inventory

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
1	Gohora	45	450	9.50	1	Bokul	32	320	11.00
2	Neem	50	500	10.00	2	Poma	250	2500	13.00
3	Himolu	190	1900	10.00	3	Thal podum	43	430	11.00
4	Guwal	130	1300	10.00	4	Ashoka	193	1930	9.50
5	Hunaru	110	1100	10.00	5	Bail	108	1080	7.00
6	Himolu	300	3000	13.00	6	Gomari	160	1600	2.40
7	Guwal	60	600	12.00	7	Shirish	96	960	8.00
9	Aahote	500	5000	12.50	8	Shirish	107	1070	5.90
10	Aahote	180	1800	13.00	9	Shirish	123	1230	6.70
11	Dile	40	400	8.50	10	Shirish	109	1090	6.00
12	Aahote	500	5000	9.00	11	Koros	69	690	10.00
13	Sirish	190	1900	7.00	12	Krishnosura	45	450	7.00
14	Sirish	140	1400	8.00	13	Krishnosura	58	580	7.00
15	Sirish	210	2100	8.00	14	Shirish	83	830	8.00
16	Sohinu	45	450	8.00	15	Krishnosura	43	430	7.00
17	Krishnasura	53	530	6.00	16	Krishnosura	38	380	7.00
18	Hasi	60	600	6.50	17	Krishnosura	43	430	8.00
19	Hasi	60	600	7.00	18	Krishnosura	43	430	8.00
20	Krishnasura	45	450	6.70	19	Krishnosura	47	470	7.60
21	Krishnasura	40	400	7.00	20	Krishnosura	51	510	7.70
22	Krishnasura	47	470	7.00	21	Krishnosura	45	450	7.40
23	Sirish	85	850	6.80	22	Krishnosura	38	380	7.50
24	Sirish	50	500	7.00	23	Krishnosura	43	430	7.50
25	Sirish	240	2400	7.00	24	Krishnosura	43	430	7.50
26	Krishnasura	55	550	6.80	25	Bogori	34	340	7.30
27	Aager	160	1600	7.40	26	Gorikhasali	55	550	7.40
28	Sirish	60	600	5.30	27	Krishnosura	43	430	7.40
29	Krishnasura	33	330	6.70	28	Krishnosura	62	620	7.40
30	Krishnasura	65	650	6.70	29	Krishnosura	37	370	8.00
31	Krishnasura	60	600	7.00	30	Krishnosura	47	470	7.50
32	Hasi	65	650	6.00	31	Krishnosura	50	500	7.50
33	Hasi	83	830	6.30	32	Krishnosura	27	270	6.90
34	Mango	250	2500	8.00	33	Hasi	67	670	7.00
35	Krishnasura	50	500	7.60	34	Koros	40	400	6.00
36	Helikha	115	1150	7.20	35	Shirish	98	980	5.50
37	Krishnasura	38	380	7.00	36	Bhumura	53	530	7.00
38	Mouchs	70	700	7.00	37	Sotiana	55	550	5.50
39	Hunaru	90	900	6.20	38	Shirish	104	1040	5.00
40	Krishnasura	60	600	7.00	39	Shirish	104	1040	6.40
41	Hunaru	53	530	7.60	40	Shirish	154	1540	6.40
42	Sotina	55	550	8.00	41	Shirish	104	1040	6.40
43	Krishnasura	50	500	7.00	42	Bandardewa	45	450	6.50
44	Krishnasura	50	500	5.20	43	Mango	85	850	7.90
45	Amora	100	1000	5.80	44	Mango	96	960	7.90
46	Sirish	50	500	6.30	45	Mango	220	2200	7.90
47	Sirish	45	450	7.80	46	Mango	110	1100	7.90
48	Mouchs	40	400	7.50	47	Shirish	63	630	7.40

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
49	Mouchs	40	400	7.50	48	Hasi	80	800	7.80
50	Mouchs	36	360	7.60	49	Sotiana	310	3100	7.80
51	Mouchs	40	400	8.00	50	Shirish	100	1000	7.80
52	Mouchs	41	410	7.70	51	Katkora	80	800	7.00
53	Mouchs	60	600	7.90	52	Sotiana	52	520	8.00
54	Sirish	45	450	8.00	53	Shirish	67	670	8.00
55	Bokul	43	430	7.50	54	Krishnosura	48	480	6.00
56	Sirish	33	330	7.60	55	Gomari	180	1800	7.20
57	Sirish	50	500	7.80	56	Shirish	50	500	7.20
58	Sirish	40	400	7.90	57	Krishnosura	45	450	6.00
59	Madhuri	43	430	5.80	58	Krishnosura	40	400	6.00
60	Madhuri	50	500	5.90	59	Gomari	110	1100	5.00
61	Arjun	55	550	5.70	60	Krishnosura	60	600	6.80
62	Amora	43	430	6.30	61	Shirish	110	1100	8.00
63	Krishnasura	72	720	7.60	62	Shirish	120	1200	6.00
64	Bhoklo	40	400	6.90	63	Shirish	50	500	6.30
65	Gomare	130	1300	6.50	64	Shirish	48	480	5.00
66	Gomare	145	1450	6.50	65	Shirish	60	600	5.50
67	Dhuma	110	1100	6.00	66	Shirish	80	800	7.00
68	Gomare	136	1360	6.30	67	Shirish	78	780	6.00
69	Bhoklo	43	430	7.00	68	Shirish	40	400	8.00
70	Gomare	90	900	6.50	69	Shirish	68	680	6.00
71	Gomare	85	850	6.40	70	Shirish	80	800	6.00
72	Gomare	115	1150	5.80	71	Shirish	85	850	7.80
73	Kothal	40	400	5.60	72	Amora	124	1240	8.00
74	Gomare	125	1250	6.00	73	Hilikha	162	1620	8.00
75	Mango	34	340	6.50	74	Aahotgos	80	800	7.50
76	Kothal	36	360	6.00	75	Thal podum	56	560	8.00
77	Kothal	36	360	5.90	76	Shirish	47	470	7.00
78	Kothal	145	1450	6.00	77	Hasi	40	400	7.50
79	Mango	35	350	5.70	78	Krishnosura	100	1000	7.50
80	Bhoklo	73	730	6.60	79	Ghura neem	80	800	6.30
81	Krishnasura	280	2800	7.80	80	Krishnosura	100	1000	7.00
82	Krishnasura	185	1850	8.00	81	Krishnosura	110	1100	7.10
83	Madhuri	36	360	8.00	82	Medeluwa	105	1050	6.80
84	Krishnasura	70	700	8.00	83	Bahot	40	400	6.60
85	Gomare	80	800	8.00	84	Himolu	165	1650	6.60
86	Gomare	75	750	8.00	85	Rabab tenga	36	360	6.00
87	Katkora	120	1200	8.00	86	Hunaru	120	1200	6.00
88	Hunaru	40	400	5.70	87	Shirish	150	1500	5.30
89	Krishnasura	70	700	8.00	88	Shirish	48	480	6.30
90	Moah	65	650	7.90	89	Myfuek	56	560	6.00
91	Hasi	40	400	8.00	90	Shirish	310	3100	6.00
92	Mouchs	60	600	6.80	91	Shirish	220	2200	6.00
93	Mouchs	200	2000	5.70	92	Shirish	220	2200	6.70
94	Sirish	70	700	6.50	93	Koros	90	900	7.20
95	Gomare	120	1200	6.40	94	Shirish	64	640	6.10
96	Flower	35	350	6.60	100	Shirish	129	1290	6.60
97	Gomare	135	1350	5.30	101	Arjun	58	580	7.80
98	Sirish	90	900	6.50	102	Bogori	50	500	6.80

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
99	Gomare	200	2000	6.10	103	Shirish	57	570	6.80
100	Sirish	60	600	6.60	104	Krishnosura	36	360	5.90
101	Sirish	70	700	6.80	105	Krishnosura	130	1300	7.80
102	Valko	40	400	7.30	106	Shirish	42	420	7.60
103	Valko	44	440	6.70	107	Krishnosura	133	1330	8.00
104	Valko	43	430	6.90	108	Bogori	55	550	8.00
105	Mouchs	42	420	6.30	109	Shirish	57	570	6.90
106	Mouchs	50	500	7.80	110	Krishnosura	183	1830	7.60
107	Mouchs	120	1200	7.30	111	Shirish	35	350	5.70
108	Bhoklo	40	400	6.60	112	Shirish	98	980	8.00
109	Krishnasura	55	550	6.40	113	Shirish	78	780	6.70
110	Demoru	31	310	6.50	114	Sotiana	101	1010	6.20
111	Bhoklo	36	360	7.30	115	Sotiana	82	820	6.10
112	Gomare	50	500	6.50	116	Shirish	91	910	7.30
113	Sirish	34	340	6.50	117	Bogori	79	790	5.70
114	Sirish	60	600	6.60	118	Bogori	78	780	5.40
115	Mouchs	60	600	7.00	119	Krishnosura	35	350	5.40
116	Sirish	55	550	6.70	120	Krishnosura	47	470	5.40
117	Mouchs	130	1300	7.20	121	Shirish	59	590	6.40
118	Mouchs	125	1250	6.40	122	Azhar	56	560	7.00
119	Mouchs	75	750	5.20	123	Gomari	65	650	5.70
120	Mouchs	90	900	5.50	124	Gorikhasali	80	800	5.80
121	Bhoklo	40	400	6.60	125	Gorikhasali	83	830	5.80
122	Bhoklo	35	350	6.60	126	Krishnosura	75	750	6.50
123	Bhoklo	115	1150	6.50	127	Krishnosura	106	1060	7.90
124	Bhoklo	55	550	6.80	128	Arjun	101	1010	5.40
125	Mouchs	60	600	6.80	129	Koros	50	500	6.00
126	Mouchs	70	700	7.50	130	Azhar	76	760	7.50
127	Bhoklo	60	600	6.90	131	Koros	119	1190	7.60
128	Bhoklo	55	550	7.00	132	Shirish	70	700	7.80
129	Bogore	33	330	5.30	133	Borgos	48	480	7.80
130	Aager	115	1150	7.80	134	Aahotgos	246	2460	6.00
131	Bhoklo	110	1100	6.00	135	Koros	52	520	7.60
132	Flower	100	1000	6.10	136	Arjun	32	320	7.70
133	Flower	90	900	7.00	137	Koros	77	770	6.90
134	Bogore	40	400	5.40	138	Aahotgos	53	530	8.00
135	Sirish	35	350	5.70	139	Teteli	195	1950	6.70
136	Sirish	150	1500	6.30	140	Koros	88	880	7.20
137	Krishnasura	60	600	6.40	141	Thal podum	106	1060	7.20
138	Himolu	110	1100	6.50	142	Gohora	53	530	6.80
139	Himolu	113	1130	5.80	143	Thal podum	142	1420	7.30
140	Krishnasura	40	400	5.50	144	Thal podum	66	660	6.00
141	Himolu	55	550	5.90	145	Thal podum	78	780	5.80
142	Flower	85	850	7.00	146	Borgos	320	3200	7.30
143	Himolu	135	1350	7.00	147	Krishnosura	54	540	6.80
144	Flower	130	1300	8.00	148	Shirish	58	580	7.70
145	Flower	55	550	7.80	149	Azhar	72	720	8.00
146	Krishnasura	130	1300	7.90	150	Krishnosura	39	390	7.00
147	Krishnasura	80	800	7.60	151	Aahotgos	510	5100	6.60
148	Hasi	40	400	8.00	152	Thal podum	113	1130	7.80

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
149	Hasi	35	350	7.90	153	Satiana	220	2200	7.00
150	Keselo	60	600	6.50	154	Katkora	100	1000	5.80
151	Moadhs	65	650	6.60	155	Peepal	300	3000	7.20
152	Krishnasura	55	550	6.00	156	Shirish	72	720	6.70
153	Moadhs	35	350	6.20	157	Krishnosura	56	560	8.00
154	Bor Peepal	210	2100	5.50	158	Mango	250	2500	7.80
155	Sirish	140	1400	5.30	160	Shirish	40	400	7.60
156	Bor Peepal	600	6000	8.00	161	Moder	35	350	7.00
157	Flower	65	650	6.10	162	Katkora	118	1180	7.60
158	Krishnasura	80	800	8.00	163	Thal podum	35	350	7.40
159	Mango	70	700	8.00	164	Thal podum	64	640	7.30
160	Krishnasura	90	900	8.00	165	Thal podum	53	530	7.40
161	Jamuk	140	1400	5.80	166	Thal podum	53	530	7.90
162	Mango	235	2350	5.20	167	Thal podum	97	970	7.80
163	Gomare	50	500	7.00	168	Thal podum	98	980	7.70
164	Katkora	135	1350	7.70	169	Bogori	87	870	8.00
165	Mango	300	3000	6.70	170	Satiana	400	4000	7.70
166	Potkona	90	900	8.00	171	Thekera	250	2500	7.10
167	Sirish	100	1000	6.50	172	Bogori	80	800	7.50
168	Potkona	60	600	7.30	173	Azhar	48	480	5.50
169	Gurpat	90	900	8.00	174	Katkora	132	1320	7.20
170	Jori	500	5000	8.00	175	Thal podum	47	470	7.00
171	Demoru	50	500	7.00	176	Shirish	49	490	5.50
172	Demoru	40	400	7.00	177	Shirish	53	530	6.10
173	Demoru	50	500	7.20	178	Hilikha	110	1100	6.10
174	Sationa	74	740	6.40	181	Satiana	68	680	6.00
175	Demoru	60	600	6.30	182	Peepal	423	4230	6.90
176	Sationa	32	320	7.90	183	Bandardewa	80	800	5.80
177	Outenga	250	2500	7.60	184	Azhar	36	360	6.30
178	Amora	55	550	8.00	185	Katkora	175	1750	7.00
179	Azhar	40	400	8.00	186	Shirish	60	600	6.80
180	Sirish	120	1200	6.00	187	Satiana	170	1700	7.00
181	Amora	70	700	6.00	188	Borgos	600	6000	8.00
182	Sirish	135	1350	7.00	189	Azhar	36	360	7.20
183	Sirish	90	900	7.00	190	Shirish	40	400	7.20
184	Valko	30	300	5.20	191	Shirish	35	350	6.00
185	Sationa	34	340	5.60	192	Shirish	31	310	5.20
186	Sirish	50	500	6.50	193	Azhar	56	560	5.00
187	Sirish	45	450	6.50	194	Shirish	31	310	5.60
188	Sirish	115	1150	5.00	195	Shirish	35	350	6.60
189	Sationa	50	500	7.30	196	Shirish	34	340	5.40
190	Sirish	300	3000	7.40	197	Shirish	105	1050	7.20
191	Sirish	34	340	7.40	198	Dimaru	40	400	7.90
192	Sationa	200	2000	8.00	199	Moder	56	560	7.00
193	Azhar	65	650	7.70	200	Shirish	49	490	6.80
194	Sationa	50	500	6.60	201	Moder	66	660	5.50
195	Sirish	35	350	6.00	202	Shirish	149	1490	6.50
196	Sirish	40	400	5.00	203	Amora	129	1290	5.00
197	Sirish	40	400	5.40	204	Himolu	35	350	7.00
198	Valko	150	1500	5.20	205	Kothal	63	630	8.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
199	Aahote	400	4000	7.60	206	Selong	47	470	7.30
200	Demoru	75	750	6.00	207	Keselu	35	350	7.30
201	Jamuk	85	850	6.50	208	Sopa	55	550	7.20
202	Demoru	75	750	6.60	209	Aahotgos	156	1560	7.70
203	Outenga	95	950	6.60	210	Shirish	97	970	6.90
204	Amora	55	550	5.70	211	Shirish	453	4530	7.30
205	Sirish	45	450	5.70	212	Shirish	47	470	7.80
206	Jori	700	7000	6.50	213	Shirish	37	370	6.60
207	Kothal	50	500	7.50	214	Shirish	38	380	6.60
208	Kothal	50	500	7.50	215	Shirish	75	750	7.50
209	Jamuk	55	550	7.40	216	Satiana	125	1250	7.60
210	Jamuk	55	550	7.40	217	Shirish	115	1150	8.00
211	Gurpat	45	450	8.00	218	Shirish	95	950	8.00
212	Moj	110	1100	6.00	219	Amora	35	350	7.80
213	Koinar	85	850	6.70	220	Shirish	47	470	6.30
214	Koinar	45	450	6.60	221	Pethali	71	710	7.00
215	Koinar	45	450	6.60	222	Simolu	380	3800	8.00
216	Koinar	68	680	6.40	224	Shirish	35	350	5.00
217	Putkol	120	1200	7.60	225	Shirish	43	430	5.00
220	Koronj	75	750	7.10	226	Shirish	31	310	4.50
221	Aahote	500	5000	7.50	227	Shirish	41	410	4.70
222	Aahote	70	700	6.60	228	Shirish	107	1070	5.00
223	Mango	55	550	7.00	229	Krishnosura	58	580	6.90
224	Sojina	65	650	7.40	230	Shirish	57	570	6.50
225	Sirish	45	450	6.50	231	Aahotgos	550	5500	7.40
226	Neem	55	550	6.60	232	Aahotgos	560	5600	8.00
227	Sirish	57	570	6.90	233	Kadom	202	2020	7.90
228	Jamuk	40	400	5.80	234	Kadom	45	450	7.40
229	Sationa	90	900	6.50	235	Aahotgos	220	2200	4.30
230	Azhar	45	450	7.30	236	Neem	40	400	5.00
231	Sirish	30	300	6.30	237	Satiana	87	870	8.00
232	Sirish	31	310	4.50	238	Satiana	88	880	8.00
233	Sationa	40	400	7.30	239	Krishnosura	38	380	8.00
234	Krishnasura	51	510	6.60	240	Krishnosura	85	850	8.00
235	Valko	75	750	6.50	241	Krishnosura	60	600	4.50
236	Sirish	50	500	6.30	242	Shirish	40	400	4.90
237	Valko	52	520	7.10	243	Krishnosura	51	510	4.60
238	Bogore	80	800	6.50	244	Korai	31	310	4.60
239	Koinar	120	1200	7.70	245	Moder	100	1000	4.60
240	Koinar	130	1300	7.70	246	Krishnosura	43	430	4.40
241	Valko	110	1100	8.00	247	Krishnosura	31	310	4.50
242	Madhuri	45	450	8.00	248	Krishnosura	40	400	4.20
243	Jamuk	55	550	7.40	249	Satiana	31	310	6.30
244	Jamuk	30	300	7.40	250	Satiana	40	400	6.60
245	Jamuk	60	600	7.40	251	Krishnosura	58	580	5.80
246	Valko	30	300	7.80	252	Satiana	30	300	6.00
247	Sirish	30	300	6.00	253	Krishnosura	36	360	5.20
248	Sirish	35	350	8.00	254	Krishnosura	56	560	5.80
249	Jolphi	50	500	6.00	255	Krishnosura	46	460	5.80
250	Valko	110	1100	6.70	256	Krishnosura	36	360	5.20

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
251	Krishnasura	70	700	6.50	257	Krishnosura	52	520	7.60
252	Mango	270	2700	6.10	258	Satiana	77	770	8.00
253	Krishnasura	90	900	7.80	259	Krishnosura	33	330	5.20
254	Krishnasura	50	500	6.20	260	Sopa	48	480	7.70
255	Bogore	60	600	6.10	261	Krishnosura	39	390	5.20
256	Krishnasura	35	350	5.30	262	Krishnosura	42	420	5.10
257	Krishnasura	50	500	5.30	263	Satiana	92	920	5.60
258	Krishnasura	45	450	5.30	264	Satiana	85	850	5.10
259	Krishnasura	45	450	5.30	265	Shirish	45	450	6.00
260	Krishnasura	55	550	5.30	266	Krishnosura	38	380	5.10
261	Krishnasura	55	550	5.40	267	Krishnosura	34	340	4.90
262	Krishnasura	50	500	6.00	268	Krishnosura	80	800	6.50
263	Valko	55	550	5.60	269	Krishnosura	54	540	4.80
264	Krishnasura	40	400	5.50	270	Krishnosura	39	390	5.10
265	Krishnasura	43	430	5.40	271	Krishnosura	36	360	5.10
266	Sirish	120	1200	6.70	272	Krishnosura	35	350	5.00
267	Krishnasura	38	380	5.30	273	Krishnosura	39	390	5.20
268	Krishnasura	70	700	6.00	274	Shirish	46	460	6.40
269	Krishnasura	55	550	5.60	275	Hilikha	36	360	5.40
270	Krishnasura	55	550	5.50	276	Arjun	66	660	6.50
271	Krishnasura	68	680	5.80	277	Arjun	66	660	8.00
272	Krishnasura	50	500	5.90	278	Thekera	76	760	7.90
273	Jori	355	3550	5.80	279	Mango	120	1200	8.00
274	Valko	40	400	5.60	280	Gorikhasali	40	400	6.00
275	Sationa	50	500	6.30	281	Gorikhasali	51	510	5.90
276	Krishnasura	32	320	5.20	282	Krishnosura	87	870	5.50
277	Valko	35	350	5.00	283	Bogori	93	930	8.00
278	Krishnasura	35	350	5.00	284	Shirish	41	410	4.70
279	Krishnasura	50	500	4.90	285	Arjun	85	850	5.10
280	Azhar	350	3500	6.20	286	Arjun	86	860	5.10
281	Kothal	200	2000	5.80	287	Arjun	48	480	7.50
282	Kothal	300	3000	5.90	288	Arjun	109	1090	7.60
284	Kothal	150	1500	6.60	289	Arjun	109	1090	7.60
286	Sationa	30	300	7.00	290	Katkora	31	310	4.50
290	Khajur	200	2000	6.00	291	Satiana	95	950	6.80
292	Bail	60	600	6.80	292	Gorikhasali	35	350	6.00
293	Bokul	52	520	7.40	293	Krishnosura	32	320	5.60
298	Krishnasura	50	500	4.90	294	Koros	38	380	5.70
299	Krishnasura	40	400	5.60	295	Azhar	48	480	6.50
300	Krishnasura	40	400	5.60	296	Shirish	36	360	6.50
301	Khajur	150	1500	6.80	297	Shirish	34	340	5.40
302	Khajur	150	1500	6.80	298	Shirish	73	730	6.40
303	Krishnasura	47	470	5.00	299	Shirish	62	620	6.10
304	Sirish	150	1500	5.70	300	Shirish	35	350	4.90
310	Himolu	120	1200	5.90	301	Krishnosura	51	510	4.50
311	Krishnasura	30	300	7.90	302	Krishnosura	50	500	4.00
312	Kodom	110	1100	7.90	303	Krishnosura	31	310	4.40
313	Sationa	30	300	6.40	304	Krishnosura	45	450	4.40
314	Krishnasura	42	420	5.90	305	Krishnosura	40	400	4.40
315	Sationa	40	400	6.60	306	Azhar	51	510	6.10

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
317	Valko	120	1200	7.80	307	Azhar	32	320	6.50
318	Valko	39	390	7.60	308	Hilikha	31	310	6.40
321	Jamuk	90	900	8.00	309	Satiana	35	350	7.30
322	Krishnasura	34	340	5.90	310	Krishnosura	46	460	7.20
323	Krishnasura	50	500	5.70	311	Azhar	36	360	7.80
324	Jolphi	30	300	6.00	312	Azhar	42	420	8.00
325	Krishnasura	40	400	6.00	313	Koros	56	560	5.40
326	Krishnasura	40	400	6.00	314	Bokul	60	600	7.50
327	Sirish	35	350	5.80	315	Bokul	56	560	7.80
328	Arjun	50	500	6.60	316	Shirish	38	380	4.50
329	Bawal	100	1000	5.40	317	Peepal	420	4200	6.30
330	Helikha	45	450	5.50	318	Peepal	380	3800	4.50
331	Amora	50	500	6.90	319	Shirish	36	360	4.80
332	Jamuk	35	350	6.90	320	Peepal	380	3800	4.50
333	Amora	32	320	6.10	321	Gohora	142	1420	6.30
334	Sirish	30	300	6.00	322	Shirish	129	1290	6.50
335	Krishnasura	40	400	5.20	323	Shirish	84	840	6.60
336	Krishnasura	35	350	5.80	324	Bogori	86	860	6.60
337	Krishnasura	35	350	6.00	325	Shirish	110	1100	5.40
338	Krishnasura	35	350	6.20	326	Azhar	35	350	5.50
339	Nahor	35	350	5.10	327	Bogori	112	1120	4.30
340	Tetali	95	950	6.80	328	Krishnosura	31	310	6.20
341	Azhar	52	520	5.20	329	Krishnosura	32	320	6.00
342	Valko	30	300	7.50	330	Bogori	83	830	5.50
343	Valko	35	350	7.40	331	Krishnosura	36	360	5.60
344	Mahoti	30	300	7.50	332	Krishnosura	54	540	5.60
345	Mahoti	35	350	7.00	333	Krishnosura	39	390	5.60
346	Mahoti	35	350	7.60	334	Krishnosura	44	440	5.60
347	Mahoti	35	350	7.90	335	Krishnosura	49	490	5.50
348	Mahoti	35	350	7.90	336	Bokul	79	790	6.40
349	Mahoti	30	300	7.80	337	Bogori	48	480	6.00
350	Mahoti	55	550	8.00	338	Gorikhasali	97	970	8.00
351	Mahoti	40	400	6.90	339	Rogapet	35	350	7.50
352	Mahoti	77	770	5.80	340	Krishnosura	55	550	5.30
353	Mahoti	45	450	6.40	341	Krishnosura	35	350	5.30
354	Mahoti	48	480	6.40	342	Gorikhasali	32	320	6.80
355	Mahoti	35	350	6.40	343	Krishnosura	35	350	4.80
356	Azhar	32	320	7.50	344	Bokul	36	360	6.30
357	Valko	42	420	5.90	345	Krishnosura	41	410	5.10
358	Sationa	32	320	7.00	346	Krishnosura	50	500	5.60
359	Mango	250	2500	7.00	347	Krishnosura	43	430	5.20
360	Halali	35	350	5.80	348	Shirish	52	520	5.60
361	Kothal	96	960	7.40	349	Shirish	108	1080	5.30
362	Kothal	168	1680	7.00	350	Koros	81	810	5.20
363	Krishnasura	70	700	6.80	351	Shirish	50	500	7.20
364	Krishnasura	45	450	5.70	352	Koros	43	430	8.00
365	Krishnasura	60	600	6.40	353	Dimaru	42	420	7.20
366	Moadhs	40	400	7.20	354	Moder	34	340	6.80
367	Moadhs	45	450	7.20	355	Dimaru	32	320	6.70
368	Moadhs	35	350	5.80	356	Dimaru	105	1050	6.30

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
369	Hasi	42	420	5.90	357	Hasi	86	860	6.90
370	Krishnasura	41	410	6.30	358	Thal podum	69	690	6.90
371	Krishnasura	41	410	6.40	359	Hasi	110	1100	6.80
372	Krishnasura	36	360	6.90	360	Neem	60	600	6.90
373	Moadhs	40	400	7.10	361	Hasi	100	1000	6.90
374	Moadhs	36	360	6.50	362	Hewali	80	800	6.90
375	Bhoklo	75	750	6.90	363	Semolu	300	3000	6.90
376	Moadhs	56	560	6.60	364	Koros	90	900	7.00
377	Moadhs	35	350	7.30	365	Kothal	140	1400	7.00
378	Moadhs	33	330	7.80	366	Koros	76	760	6.70
379	Sase	35	350	7.80	367	Koros	105	1050	6.70
380	Sase	35	350	7.50	368	Koros	63	630	6.70
381	Krishnasura	45	450	6.30	369	Krishnosura	36	360	6.60
382	Krishnasura	40	400	6.30	370	Shirish	44	440	6.40
383	Krishnasura	35	350	6.40	371	Krishnosura	56	560	6.40
384	Sationa	35	350	7.00	372	Koros	60	600	7.60
385	Krishnasura	39	390	5.00	373	Gorikhasali	158	1580	6.00
386	Sationa	33	330	6.40	374	Koros	47	470	6.30
387	Bhoklo	38	380	5.00	375	Koros	80	800	6.30
388	Sationa	147	1470	6.50	376	Koros	91	910	6.30
389	Bhatgela	80	800	8.00	377	Koros	70	700	6.40
390	Krishnasura	50	500	5.70	378	Koros	40	400	6.50
391	Moadhs	30	300	5.90	379	Koros	63	630	6.40
392	Krishnasura	38	380	6.00	380	Koros	77	770	6.50
393	Moadhs	35	350	5.00	381	Koros	102	1020	5.70
394	Bogore	120	1200	6.70	382	Koros	77	770	5.70
395	Kothal	165	1650	7.60	383	Koros	83	830	5.80
396	Mango	160	1600	7.30	384	Koros	92	920	5.80
397	Sationa	115	1150	5.70	385	Koros	95	950	4.50
398	Gomare	118	1180	5.20	386	Koros	53	530	7.40
399	Mango	110	1100	7.40	387	Thal podum	53	530	7.00
400	Krishnasura	37	370	5.50	388	Batghula	103	1030	5.90
401	Krishnasura	39	390	4.80	389	Krishnosura	50	500	6.10
402	Aager	40	400	5.40	390	Bandardewa	37	370	6.00
403	Moadhs	50	500	7.10	391	Satiana	33	330	6.00
404	Moadhs	60	600	6.30	392	Azhar	30	300	6.40
405	Moadhs	50	500	6.50	393	Batghula	37	370	5.00
406	Moadhs	48	480	7.80	394	Satiana	36	360	5.00
407	Bhoklo	55	550	7.80	395	Mango	95	950	6.70
408	Bhoklo	44	440	7.80	397	Gohora	86	860	6.80
409	Bhoklo	43	430	7.70	398	Gorikhasali	79	790	7.30
410	Bhoklo	40	400	7.80	399	Koros	34	340	6.00
411	Bhoklo	46	460	7.50	400	Koros	37	370	6.00
412	Bhoklo	32	320	7.00	401	Satiana	30	300	7.20
413	Bhoklo	47	470	7.70	403	Krishnosura	99	990	6.80
414	Moadhs	40	400	7.70	404	Krishnosura	54	540	6.10
415	Moadhs	35	350	7.80	405	Krishnosura	74	740	6.10
416	Moadhs	40	400	7.30	406	Satiana	450	4500	5.20
417	Bhoklo	38	380	7.40	407	Moder	40	400	5.70
418	Gohora	70	700	7.00	408	Shirish	34	340	5.60

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
419	Hengalu	95	950	6.30	409	Thal podum	49	490	7.90
420	Hunaru	42	420	5.60	410	Thal podum	69	690	7.90
421	Sirish	60	600	7.00	411	Thal podum	65	650	7.90
422	Keselo	35	350	5.90	412	Bogori	68	680	7.00
423	Gohora	40	400	5.90	413	Thal podum	101	1010	8.00
424	Krishnasura	47	470	6.20	414	Thal podum	100	1000	5.80
425	Krishnasura	35	350	6.70	415	Peepal	330	3300	7.20
426	Sationa	135	1350	7.00	416	Peepal	410	4100	5.80
427	Krishnasura	63	630	6.50	417	Azhar	49	490	5.30
428	Krishnasura	124	1240	6.20	418	Shirish	60	600	5.20
429	Flower	80	800	6.40	419	Amora	35	350	6.00
430	Flower	80	800	7.80	420	Krishnosura	38	380	5.80
431	Neem	50	500	6.40	421	Koros	31	310	5.80
432	Flower	37	370	6.50	422	Koros	33	330	5.80
433	Moadhs	50	500	6.30	423	Gorikhasali	61	610	6.40
434	Krishnasura	37	370	5.20	424	Shirish	50	500	6.40
435	Flower	35	350	6.30	425	Amora	38	380	6.40
436	Krishnasura	37	370	5.60	426	Thal podum	67	670	6.50
437	Bhoklo	90	900	5.00	427	Thal podum	67	670	6.70
438	Bhoklo	80	800	5.00	428	Satiana	108	1080	6.50
439	Krishnasura	40	400	5.20	429	Khorika	35	350	6.90
440	Bhoklo	65	650	7.10	430	Supere	38	380	7.10
441	Bhoklo	80	800	4.00	431	Supere	38	380	7.10
442	Krishnasura	100	1000	4.00	432	Supere	38	380	7.10
443	Krishnasura	70	700	5.40	433	Supere	38	380	7.10
444	Neem	75	750	5.30	434	Supere	36	360	7.10
445	Neem	70	700	5.50	435	Satiana	56	560	7.00
446	Krishnasura	60	600	5.50	436	Supere	37	370	7.10
447	Krishnasura	40	400	5.80	437	Supere	35	350	7.10
448	Krishnasura	151	1510	5.10	438	Supere	35	350	7.10
449	Krishnasura	150	1500	5.40	439	Supere	57	570	6.60
450	Krishnasura	150	1500	7.60	440	Krishnosura	49	490	6.60
451	Krishnasura	140	1400	5.20	441	Krishnosura	30	300	6.50
452	Krishnasura	170	1700	6.00	442	Krishnosura	41	410	6.50
453	Krishnasura	45	450	5.60	443	Krishnosura	31	310	6.40
454	Sirish	130	1300	7.20	444	Shirish	51	510	6.40
455	Kothal	170	1700	6.40	445	Neem	48	480	5.60
456	Moadhs	70	700	6.70	446	Aahotgos	70	700	6.30
457	Moadhs	220	2200	7.50	447	Krishnosura	51	510	6.30
458	Moadhs	180	1800	7.00	448	Krishnosura	45	450	6.30
459	Moadhs	160	1600	6.80	449	Shirish	46	460	6.30
460	Moadhs	140	1400	7.00	450	Krishnosura	35	350	5.70
461	Gohora	40	400	7.00	451	Aahotgos	350	3500	5.60
462	Moadhs	60	600	7.00	452	Krishnosura	91	910	5.40
463	Moadhs	100	1000	7.80	453	Shirish	79	790	7.10
464	Krishnasura	60	600	5.80	454	Krishnosura	60	600	5.10
465	Krishnasura	65	650	5.80	455	Krishnosura	35	350	5.00
466	Kothal	170	1700	5.40	456	Krishnosura	57	570	4.80
467	Aahote	400	4000	5.60	457	Krishnosura	39	390	5.30
468	Krishnasura	68	680	5.60	458	Krishnosura	30	300	5.30

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
469	Krishnasura	60	600	6.00	459	Krishnosura	44	440	6.10
470	Bhoklo	55	550	6.00	460	Krishnosura	44	440	5.30
471	Aahote	350	3500	5.30	461	Krishnosura	59	590	5.30
472	Krishnasura	60	600	5.30	462	Krishnosura	64	640	5.80
473	Madhuri	45	450	6.60	463	Krishnosura	72	720	5.80
474	Kothal	240	2400	6.90	464	Dimaru	59	590	7.30
476	Krishnasura	50	500	7.00	467	Shirish	50	500	5.90
477	Krishnasura	62	620	6.00	468	Shirish	52	520	7.60
478	Krishnasura	65	650	6.30	469	Satiana	67	670	7.30
479	Flower	75	750	7.00	470	Moder	65	650	6.20
480	Krishnasura	45	450	5.50	471	Satiana	54	540	6.10
481	Krishnasura	45	450	5.30	472	Shirish	60	600	6.50
482	Bokul	30	300	5.40	473	Azhar	151	1510	4.00
483	Krishnasura	50	500	5.00	474	Gomari	80	800	6.90
484	Neem	135	1350	7.70	475	Gomari	98	980	5.90
487	Aamlokhi	78	780	7.60	476	Gorikhasali	42	420	8.00
493	Sationa	115	1150	5.80	477	Moder	60	600	6.80
495	Moadhs	50	500	6.00	478	Shirish	61	610	6.80
496	Gomare	100	1000	7.00	479	Peepal	500	5000	8.00
497	Madhuri	50	500	7.00	480	Krishnosura	115	1150	5.50
498	Sationa	75	750	7.40	481	Kadom	69	690	7.80
500	Gohora	130	1300	6.80	482	Kadom	52	520	7.80
501	Moadhs	33	330	6.90	483	Amora	57	570	7.80
502	Moadhs	31	310	7.00	484	Guwal	34	340	7.50
503	Moadhs	43	430	6.90	485	Guwal	32	320	7.50
504	Moadhs	40	400	6.80	486	Kadom	63	630	7.50
505	Moadhs	36	360	7.00	487	Kadom	40	400	7.50
506	Moadhs	40	400	7.00	488	Kadom	57	570	7.50
507	Bhoklo	60	600	7.00	489	Kadom	49	490	7.10
508	Bhoklo	40	400	7.00	490	Kadom	60	600	7.10
509	Gomare	70	700	6.30	491	Kadom	45	450	7.10
510	Flower	45	450	6.70	492	Kadom	70	700	7.10
511	Flower	45	450	7.60	493	Koros	30	300	6.60
512	Arjun	65	650	8.00	494	Neem	65	650	5.70
513	Modor	35	350	6.30	495	Guwal	61	610	5.60
514	Modor	35	350	6.50	496	Akaseri	78	780	6.30
515	Sirish	60	600	7.20	497	Shirish	98	980	6.30
516	Sationa	50	500	7.40	498	Shirish	65	650	6.60
517	Sirish	60	600	7.40	499	Shirish	75	750	6.60
518	Sirish	60	600	7.30	500	Shirish	78	780	6.50
519	Krishnasura	70	700	7.40	501	Krishnosura	79	790	5.80
520	Bhoklo	70	700	7.20	502	Kadom	96	960	7.80
521	Neem	40	400	7.90	503	Neem	80	800	7.60
522	Sirish	50	500	7.80	504	Shirish	36	360	7.60
523	Sirish	45	450	8.00	505	Gomari	31	310	4.70
524	Bhoklo	40	400	7.70	506	Guwal	36	360	7.50
525	Madhuri	38	380	7.30	507	Guwal	46	460	7.50
526	Guwal	40	400	7.50	508	Shirish	108	1080	5.20
527	Guwal	39	390	7.20	509	Modhure	31	310	5.30
528	Moadhs	55	550	7.20	510	Shirish	81	810	5.80

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
529	Sirish	37	370	7.20	511	Shirish	79	790	5.80
530	Krishnasura	63	630	7.20	512	Modhure	35	350	5.80
531	Sirish	33	330	7.20	513	Shirish	71	710	5.60
532	Sirish	36	360	7.60	514	Shirish	68	680	5.60
533	Moadhs	60	600	7.50	515	Shirish	158	1580	5.60
534	Moadhs	95	950	6.60	516	Shirish	62	620	5.60
535	Flower	62	620	5.60	517	Shirish	70	700	5.50
536	Flower	85	850	5.50	518	Shirish	108	1080	5.30
537	Mango	114	1140	7.90	519	Krishnosura	96	960	5.50
539	Sationa	36	360	6.50	520	Shirish	50	500	5.90
540	Sationa	40	400	7.10	521	Guwal	42	420	5.80
541	Sationa	36	360	7.20	522	Guwal	41	410	5.60
542	Moadhs	33	330	4.60	523	Guwal	38	380	5.60
543	Kodom	35	350	5.00	524	Guwal	36	360	5.60
544	Amora	90	900	4.30	525	Guwal	82	820	5.60
545	Moadhs	65	650	4.30	526	Shirish	35	350	5.60
546	Moadhs	60	600	4.20	527	Modhure	32	320	5.40
547	Bogore	60	600	4.90	528	Guwal	42	420	5.40
548	Moadhs	35	350	5.30	529	Shirish	45	450	5.30
549	Krishnasura	35	350	6.80	530	Sopa	51	510	5.30
550	Sationa	180	1800	6.90	531	Hilikha	78	780	5.30
551	Sationa	119	1190	5.70	532	Neem	66	660	5.40
552	Amora	35	350	6.80	533	Modhure	34	340	5.40
553	Bor Peepal	300	3000	8.00	534	Neem	58	580	5.30
554	Gomare	35	350	4.70	535	Shirish	101	1010	5.30
555	Gomare	35	350	4.70	536	Shirish	47	470	5.30
556	Neem	80	800	4.90	537	Shirish	32	320	5.30
559	Aager	40	400	7.00	538	Shirish	63	630	5.30
560	Kodom	75	750	7.80	539	Gohora	43	430	5.30
561	Kodom	80	800	7.80	540	Gohora	58	580	5.40
562	Kodom	70	700	7.80	541	Neem	51	510	5.40
563	Kodom	90	900	7.80	542	Neem	53	530	5.30
564	Krishnasura	35	350	7.20	543	Krishnosura	97	970	5.30
565	Modor	45	450	7.80	544	Krishnosura	89	890	5.30
566	Neem	85	850	4.50	545	Neem	37	370	5.80
567	Neem	84	840	4.50	546	Neem	39	390	5.80
568	Modor	35	350	4.30	547	Krishnosura	89	890	5.80
569	Krishnasura	70	700	4.40	548	Kadom	71	710	5.80
570	Moadhs	70	700	4.30	549	Krishnosura	62	620	5.40
571	Neem	65	650	4.40	550	Neem	38	380	5.50
572	Krishnasura	60	600	4.30	551	Guwal	61	610	5.40
573	Neem	50	500	4.40	552	Neem	38	380	5.50
574	Neem	95	950	4.30	553	Neem	34	340	5.40
575	Neem	80	800	4.40	554	Neem	51	510	6.00
576	Neem	100	1000	4.40	555	Neem	52	520	6.10
577	Neem	90	900	4.40	556	Neem	32	320	5.90
578	Neem	90	900	4.40	557	Shirish	68	680	5.20
579	Gomare	65	650	4.40	558	Shirish	88	880	5.80
580	Bhoklo	63	630	4.40	559	Shirish	72	720	5.50
581	Neem	90	900	4.40	560	Shirish	73	730	5.60

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
582	Sirish	87	870	4.40	561	Bogori	50	500	5.80
583	Neem	80	800	4.40	562	Aahotgos	250	2500	6.50
584	Neem	90	900	4.40	563	Aahotgos	248	2480	6.40
585	Neem	90	900	4.40	564	Satiana	310	3100	5.70
586	Neem	110	1100	4.50	565	Aahotgos	120	1200	7.80
587	Neem	35	350	4.40	566	Krishnosura	59	590	6.50
588	Neem	80	800	4.50	567	Kothal	280	2800	7.00
589	Neem	125	1250	4.60	568	Dimaru	54	540	6.40
590	Neem	60	600	4.60	569	Gomari	83	830	6.70
591	Gohora	35	350	5.00	570	Jobaful	55	550	6.90
592	Bogore	45	450	6.20	571	Tilengaful	51	510	6.90
593	Sirish	40	400	6.20	572	Supere	50	500	7.80
594	Sationa	37	370	7.90	573	Modhure	59	590	7.80
595	Moadhs	35	350	6.40	574	Aamlakhi	45	450	7.00
596	Sationa	37	370	7.00	575	Peepal	430	4300	10.00
597	Bhoklo	35	350	7.00	576	Thal podum	50	500	6.90
598	Moadhs	70	700	6.40	577	Batghula	214	2140	8.00
599	Aager	50	500	6.40	578	Bogori	114	1140	5.00
600	Krishnasura	65	650	6.40	579	Borgos	430	4300	6.90
601	Bor Peepal	250	2500	7.30	580	Krishnosura	59	590	4.60
602	Flower	39	390	6.10	581	Modhure	64	640	6.10
603	Arjun	54	540	5.00	582	Gohora	53	530	6.50
604	Arjun	50	500	6.10	583	Simolu	600	6000	6.40
605	Arjun	50	500	5.60	584	Peepal	820	8200	6.20
606	Arjun	45	450	5.70	585	Khorika	38	380	5.40
607	Arjun	48	480	5.80	586	Supere	46	460	6.50
608	Arjun	50	500	5.40	587	Shirish	54	540	6.90
609	Modor	70	700	7.70	588	Shirish	51	510	6.90
610	Sirish	65	650	7.00	589	Moder	82	820	6.20
611	Sirish	55	550	6.50	590	Bogori	45	450	5.80
612	Bor Peepal	110	1100	7.40	591	Thal podum	110	1100	5.80
613	Arjun	40	400	5.40	592	Arjun	74	740	4.80
614	Krishnasura	45	450	5.50	593	Krishnosura	38	380	4.70
615	Krishnasura	33	330	5.00	594	Krishnosura	33	330	4.70
616	Krishnasura	35	350	5.00	595	Arjun	52	520	5.00
617	Sirish	60	600	7.10	596	Arjun	53	530	5.00
618	Mango	40	400	6.10	597	Arjun	56	560	5.00
619	Jamuk	40	400	6.20	598	Arjun	40	400	5.00
620	Sirish	60	600	7.30	599	Arjun	60	600	5.40
621	Sirish	35	350	7.30	600	Arjun	59	590	5.40
622	Krishnasura	60	600	5.30	601	Arjun	55	550	5.40
623	Moadhs	60	600	4.30	602	Krishnosura	57	570	6.40
624	Krishnasura	125	1250	4.00	603	Satiana	58	580	6.40
625	Krishnasura	50	500	4.70	604	Arjun	43	430	5.00
626	Krishnasura	62	620	4.90	605	Arjun	52	520	4.90
627	Krishnasura	62	620	5.40	606	Arjun	36	360	4.90
628	Krishnasura	100	1000	5.40	607	Arjun	36	360	4.90
629	Sirish	60	600	6.00	608	Thal podum	100	1000	8.00
630	Krishnasura	35	350	7.00	609	Aamlakhi	41	410	7.60
631	Neem	35	350	6.70	610	Simolu	248	2480	5.40

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
632	Aamlokhi	40	400	6.50	611	Mango	250	2500	5.40
633	Krishnasura	110	1100	5.00	612	Mango	160	1600	6.40
634	Madhuri	43	430	7.50	613	Krishnosura	51	510	6.00
635	Arjun	40	400	5.20	614	Krishnosura	39	390	6.00
636	Aamlokhi	50	500	7.00	615	Krishnosura	31	310	5.20
637	Arjun	60	600	5.60	616	Arjun	56	560	5.10
638	Arjun	35	350	5.80	617	Krishnosura	58	580	5.10
639	Krishnasura	170	1700	4.90	618	Krishnosura	60	600	5.70
640	Krishnasura	150	1500	4.90	619	Arjun	50	500	5.20
641	Krishnasura	40	400	5.20	620	Arjun	42	420	5.00
642	Flower	65	650	6.30	621	Krishnosura	65	650	6.00
643	Krishnasura	35	350	6.30	622	Krishnosura	44	440	5.60
644	Krishnasura	70	700	5.20	623	Satiana	67	670	5.80
645	Krishnasura	110	1100	5.60	624	Krishnosura	151	1510	5.60
646	Arjun	88	880	5.40	625	Krishnosura	53	530	5.40
647	Moadhs	40	400	5.80	626	Arjun	48	480	5.80
648	Sirish	65	650	5.30	627	Krishnosura	53	530	5.60
649	Krishnasura	151	1510	4.40	628	Satiana	70	700	8.00
650	Krishnasura	100	1000	4.40	629	Arjun	58	580	5.00
651	Flower	100	1000	4.40	630	Shirish	53	530	6.20
652	Krishnasura	210	2100	4.40	631	Shirish	41	410	6.40
653	Krishnasura	300	3000	4.40	632	Arjun	67	670	5.40
654	Flower	60	600	5.90	633	Arjun	53	530	5.40
655	Bogore	60	600	6.50	634	Arjun	41	410	5.40
656	Sationa	190	1900	5.10	635	Arjun	35	350	5.40
657	Moadhs	50	500	5.20	636	Arjun	40	400	5.30
658	Moadhs	60	600	5.20	637	Arjun	45	450	5.20
659	Bokul	209	2090	4.20	638	Arjun	37	370	5.20
660	Bokul	225	2250	4.20	639	Arjun	60	600	5.50
661	Bogore	70	700	5.50	640	Krishnosura	47	470	5.50
662	Mango	35	350	6.30	641	Arjun	78	780	5.10
663	Flower	70	700	6.40	642	Krishnosura	30	300	5.30
664	Aahote	180	1800	4.70	643	Arjun	53	530	5.50
665	Krishnasura	40	400	5.20	644	Shirish	92	920	5.60
666	Krishnasura	40	400	5.20	645	Shirish	34	340	6.40
667	Bhoklo	60	600	6.20	646	Hunaru	46	460	5.50
668	Krishnasura	60	600	5.30	647	Krishnosura	52	520	5.60
669	Krishnasura	55	550	5.40	648	Hunaru	31	310	5.30
670	Bhoklo	43	430	6.50	649	Shirish	44	440	6.60
671	Sirish	60	600	5.40	650	Krishnosura	31	310	5.20
672	Arjun	40	400	5.40	651	Shirish	64	640	6.60
673	Arjun	43	430	5.40	652	Thal podum	105	1050	7.10
674	Arjun	40	400	5.50	653	Sopa	120	1200	7.10
675	Arjun	38	380	5.50	654	Thal podum	92	920	6.60
676	Krishnasura	93	930	6.80	655	Supere	41	410	6.10
677	Krishnasura	100	1000	6.80	656	Azhar	150	1500	6.60
678	Kodom	70	700	6.90	657	Khorika	55	550	7.00
679	Kodom	35	350	6.90	658	Kothal	130	1300	7.00
680	Aamlokhi	31	310	6.80	659	Dimaru	34	340	7.00
681	Gomare	40	400	7.00	660	Mango	36	360	7.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
682	Arjun	40	400	4.50	661	Kothal	152	1520	6.50
683	Kodom	43	430	7.00	662	Koros	42	420	6.30
684	Arjun	30	300	4.30	663	Koros	39	390	6.20
685	Kodom	65	650	7.00	664	Mango	51	510	6.60
686	Kodom	34	340	7.00	665	Mango	162	1620	6.50
687	Kodom	40	400	7.00	666	Kothal	145	1450	6.70
688	Sationa	115	1150	4.50	667	Mango	205	2050	6.90
689	Gomare	34	340	7.50	668	Supere	43	430	7.20
690	Krishnasura	40	400	5.20	669	Mango	34	340	6.90
691	Krishnasura	40	400	5.20	670	Satiana	153	1530	7.20
692	Krishnasura	45	450	5.30	671	Mango	148	1480	7.00
693	Arjun	40	400	5.50	672	Modhure	56	560	6.90
694	Arjun	41	410	5.50	673	Supere	51	510	6.80
695	Krishnasura	41	410	5.40	674	Parole	130	1300	6.40
696	Krishnasura	130	1300	4.80	675	Satiana	150	1500	6.60
697	Arjun	80	800	5.40	676	Supere	49	490	6.60
698	Arjun	37	370	5.60	677	Supere	49	490	6.50
699	Arjun	40	400	5.50	678	Krishnosura	31	310	5.10
700	Moadhs	40	400	5.40	679	Supere	48	480	6.50
701	Moadhs	33	330	5.30	680	Arjun	54	540	5.30
702	Arjun	33	330	5.10	681	Arjun	42	420	5.50
703	Demoru	35	350	5.50	682	Krishnosura	35	350	5.10
704	Krishnasura	37	370	5.00	683	Krishnosura	53	530	5.20
705	Moadhs	35	350	4.70	684	Krishnosura	30	300	5.10
706	Arjun	37	370	5.10	685	Arjun	38	380	4.80
707	Moadhs	70	700	6.30	686	Bokul	190	1900	5.30
708	Krishnasura	40	400	6.30	687	Krishnosura	58	580	5.30
709	Moadhs	32	320	6.00	688	Krishnosura	47	470	5.20
710	Bogore	50	500	6.60	689	Krishnosura	49	490	5.30
711	Sirish	40	400	6.80	690	Arjun	65	650	5.20
712	Sirish	40	400	6.40	691	Krishnosura	77	770	5.30
713	Sirish	36	360	6.00	692	Krishnosura	121	1210	6.00
714	Sirish	50	500	6.60	693	Krishnosura	103	1030	5.90
715	Sirish	45	450	6.60	694	Krishnosura	46	460	5.80
716	Sirish	40	400	6.50	695	Shirish	51	510	7.70
717	Moadhs	43	430	6.60	696	Katkora	43	430	7.60
718	Krishnasura	46	460	5.60	697	Aahotgos	135	1350	5.00
719	Aahote	270	2700	5.50	698	Koros	45	450	7.00
720	Krishnasura	60	600	5.60	699	Shirish	69	690	5.00
721	Krishnasura	40	400	5.80	700	Krishnosura	30	300	5.20
722	Krishnasura	35	350	5.80	701	Azhar	41	410	6.70
723	Bhoklo	40	400	5.70	702	Krishnosura	43	430	5.80
724	Krishnasura	65	650	5.20	703	Arjun	56	560	5.70
725	Moadhs	40	400	6.20	704	Koros	100	1000	6.50
726	Flower	60	600	6.40	705	Krishnosura	35	350	5.80
727	Krishnasura	130	1300	6.60	706	Shirish	43	430	5.50
728	Krishnasura	100	1000	5.70	707	Shirish	101	1010	5.50
729	Krishnasura	70	700	5.40	708	Shirish	42	420	5.50
730	Moadhs	55	550	5.30	709	Shirish	63	630	5.50
731	Moadhs	35	350	5.70	710	Peepal	320	3200	5.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
732	Moadhs	65	650	6.60	711	Peepal	310	3100	5.00
733	Sirish	60	600	6.80	712	Shirish	46	460	7.10
734	Bogore	80	800	5.80	713	Koros	45	450	7.10
735	Sirish	35	350	5.80	714	Sopa	36	360	5.70
736	Sirish	70	700	6.50	715	Koros	69	690	6.00
737	Sirish	36	360	6.40	716	Azhar	40	400	6.60
738	Sirish	36	360	6.50	717	Thal podum	110	1100	6.50
739	Arjun	70	700	5.40	718	Shirish	35	350	6.50
740	Sirish	33	330	6.40	719	Koros	55	550	7.70
741	Sirish	40	400	7.00	720	Thal podum	95	950	6.10
742	Bogore	100	1000	4.80	721	Koros	80	800	6.30
743	Sirish	32	320	6.90	722	Krishnosura	46	460	5.60
744	Sirish	30	300	6.00	723	Krishnosura	48	480	5.60
745	Krishnasura	35	350	5.20	724	Aamlakhi	120	1200	8.00
746	Krishnasura	50	500	4.60	725	Thal podum	95	950	5.70
747	Arjun	45	450	4.60	726	Thal podum	96	960	5.60
748	Bogore	35	350	4.70	727	Thal podum	60	600	5.60
749	Sirish	50	500	4.70	728	Thal podum	120	1200	6.80
750	Krishnasura	32	320	5.10	729	Neem	92	920	6.00
751	Krishnasura	40	400	5.10	730	Krishnosura	74	740	5.40
752	Krishnasura	35	350	4.80	731	Koros	61	610	5.40
753	Krishnasura	35	350	5.00	732	Thal podum	107	1070	8.00
754	Sirish	40	400	5.00	733	Thal podum	108	1080	6.60
755	Krishnasura	33	330	4.50	734	Supere	44	440	8.00
756	Krishnasura	35	350	4.90	735	Supere	44	440	5.50
757	Krishnasura	40	400	4.90	736	Supere	42	420	7.70
758	Guwal	35	350	5.50	737	Supere	43	430	7.70
759	Guwal	37	370	7.50	738	Thal podum	78	780	7.70
760	Sirish	35	350	6.60	739	Thal podum	75	750	7.80
761	Guwal	36	360	7.30	740	Dimaru	45	450	7.00
762	Bogore	40	400	4.80	741	Azhar	73	730	7.00
763	Guwal	50	500	6.20	742	Shirish	328	3280	7.30
764	Krishnasura	35	350	8.00	743	Shirish	100	1000	6.30
765	Sirish	36	360	7.00	744	Shirish	71	710	6.30
766	Krishnasura	88	880	4.90	745	Thal podum	65	650	5.90
767	Krishnasura	70	700	4.90	746	Thal podum	71	710	6.10
768	Krishnasura	70	700	4.90	747	Shirish	39	390	5.70
769	Krishnasura	49	490	7.10	748	Kadom	51	510	5.40
770	Krishnasura	96	960	7.10	749	Thal podum	35	350	5.40
771	Aahote	400	4000	7.60	750	Dimaru	40	400	4.50
772	Sirish	300	3000	9.60	751	Thal podum	32	320	4.50
773	Krishnasura	52	520	5.20	752	Shirish	34	340	5.60
774	Aamlokhi	60	600	8.60	753	Krishnosura	36	360	5.00
775	Moadhs	45	450	8.00	754	Krishnosura	41	410	4.70
776	Modor	300	3000	6.60	755	Krishnosura	30	300	4.70
777	Aahote	60	600	5.40	756	Peepal	482	4820	6.10
778	Krishnasura	60	600	6.60	757	Krishnosura	49	490	5.50
779	Flower	100	1000	7.20	758	Krishnosura	46	460	5.50
780	Aamlokhi	75	750	7.20	759	Krishnosura	51	510	5.40
781	Krishnasura	60	600	6.60	760	Gohora	42	420	5.50

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
782	Aahote	180	1800	5.00	761	Krishnosura	84	840	5.40
783	Krishnasura	94	940	7.20	762	Krishnosura	50	500	5.40
784	Kodom	65	650	7.20	763	Thekera	57	570	5.40
785	Krishnasura	100	1000	7.20	764	Bogori	38	380	4.60
786	Sirish	140	1400	7.40	765	Krishnosura	61	610	4.60
787	Krishnasura	65	650	7.30	766	Krishnosura	63	630	4.60
788	Krishnasura	60	600	7.30	767	Cham	126	1260	7.20
789	Krishnasura	65	650	6.30	768	Krishnosura	40	400	5.40
790	Krishnasura	175	1750	6.50	769	Dimaru	48	480	7.50
791	Moadhs	50	500	6.90	770	Neem	310	3100	7.60
792	Arjun	30	300	7.00	771	Thal podum	45	450	7.60
793	Krishnasura	100	1000	6.40	772	Bogori	50	500	5.50
794	Krishnasura	100	1000	6.40	773	Bogori	54	540	5.50
795	Krishnasura	50	500	6.20	774	Krishnosura	58	580	5.40
796	Aamlokhi	45	450	6.30	775	Shirish	305	3050	5.80
797	Aamlokhi	50	500	6.20	776	Shirish	49	490	5.80
798	Arjun	95	950	5.80	777	Neem	260	2600	5.80
799	Krishnasura	50	500	5.80	778	Neem	310	3100	7.20
800	Krishnasura	50	500	5.90	779	Aamlakhi	95	950	5.90
801	Powak tenga	42	420	7.00	780	Shirish	130	1300	5.80
802	Krishnasura	50	500	6.90	781	Neem	132	1320	5.70
803	Arjun	50	500	6.90	782	Moder	130	1300	5.70
804	Krishnasura	35	350	7.00	783	Peepal	480	4800	5.80
805	Gomare	35	350	6.40	784	Thal podum	54	540	7.30
806	Sirish	50	500	4.90	785	Neem	40	400	4.90
807	Gomare	73	730	5.00	786	Kadom	109	1090	6.70
808	Moadhs	35	350	4.80	787	Aamlakhi	71	710	11.00
809	Neem	50	500	5.90	788	Koros	48	480	12.00
810	Flower	50	500	7.30	789	Koros	84	840	12.00
811	Krishnasura	35	350	5.20	790	Neem	69	690	12.00
812	Krishnasura	40	400	4.60	791	Krishnosura	100	1000	5.50
813	Krishnasura	55	550	6.50	792	Krishnosura	39	390	6.40
814	Krishnasura	40	400	4.80	793	Krishnosura	50	500	6.40
815	Krishnasura	56	560	5.20	794	Krishnosura	57	570	6.40
816	Krishnasura	40	400	4.40	795	Shirish	60	600	5.60
817	Moadhs	35	350	6.00	796	Krishnosura	56	560	5.40
818	Moadhs	40	400	6.30	797	Krishnosura	62	620	5.40
819	Gomare	60	600	4.20	798	Shirish	79	790	5.40
820	Gomare	62	620	4.50	799	Krishnosura	41	410	8.00
821	Bhoklo	40	400	4.50	800	Krishnosura	63	630	8.00
822	Bogore	60	600	6.20	801	Krishnosura	73	730	7.90
823	Arjun	33	330	6.00	802	Arjun	57	570	7.90
824	Sirish	50	500	7.20	803	Satiana	77	770	7.90
825	Sirish	70	700	5.70	804	Krishnosura	42	420	8.00
826	Aahote	60	600	4.90	805	Krishnosura	65	650	8.00
827	Modor	40	400	7.80	806	Krishnosura	51	510	8.00
828	Guwal	35	350	7.60	807	Krishnosura	64	640	7.50
829	Demoru	35	350	5.20	808	Arjun	76	760	7.50
830	Guwal	32	320	5.30	809	Bokul	86	860	8.00
831	Krishnasura	37	370	7.20	810	Bokul	64	640	8.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
832	Bogore	40	400	5.50	811	Krishnosura	50	500	7.30
833	Moadhs	40	400	6.70	812	Koros	80	800	7.20
834	Guwal	34	340	7.00	813	Bokul	49	490	5.60
835	Moadhs	43	430	5.30	814	Aamlakhi	95	950	5.60
836	Aamlokhi	40	400	4.80	815	Aamlakhi	41	410	5.60
837	Arjun	60	600	4.90	816	Krishnosura	100	1000	7.40
838	Moadhs	35	350	5.00	817	Krishnosura	41	410	7.60
839	Aamlokhi	44	440	5.00	818	Krishnosura	46	460	4.90
840	Arjun	59	590	7.30	819	Krishnosura	40	400	4.90
841	Moadhs	33	330	5.60	820	Dimaru	48	480	6.00
842	Moadhs	35	350	5.30	821	Dimaru	35	350	6.00
843	Demoru	37	370	6.10	822	Sopa	315	3150	7.00
844	Sirish	30	300	5.60	823	Thal podum	129	1290	5.10
845	Madhuri	33	330	5.70	824	Thal podum	109	1090	5.00
846	Flower	30	300	5.80	825	Shirish	58	580	5.70
847	Sirish	30	300	5.40	826	Dimaru	36	360	5.60
848	Sirish	32	320	5.40	827	Bogori	74	740	4.60
849	Sirish	30	300	6.80	828	Satiana	50	500	4.90
850	Arjun	60	600	5.20	829	Satiana	47	470	4.20
851	Arjun	55	550	5.20	830	Krishnosura	40	400	5.10
852	Arjun	53	530	5.20	831	Arjun	54	540	5.10
853	Arjun	40	400	5.20	832	Batghula	46	460	7.00
854	Arjun	35	350	5.20	833	Haal	52	520	5.50
855	Arjun	35	350	5.20	834	Krishnosura	55	550	5.80
856	Arjun	40	400	5.20	835	Bogori	76	760	5.80
857	Guwal	35	350	4.80	836	Gomari	49	490	5.80
858	Aahote	350	3500	5.80	837	Shirish	45	450	6.10
859	Aamlokhi	32	320	5.50	838	Supere	40	400	7.90
860	Aamlokhi	33	330	5.50	839	Mango	60	600	7.90
861	Arjun	35	350	4.40	840	Supere	41	410	7.90
862	Aamlokhi	33	330	4.80	841	Outenga	35	350	6.00
863	Aamlokhi	35	350	4.90	842	Outenga	40	400	6.00
864	Krishnasura	40	400	5.10	843	Outenga	38	380	7.00
865	Moadhs	35	350	5.00	844	Koros	36	360	6.70
866	Flower	65	650	4.80	845	Koros	34	340	6.70
867	Arjun	55	550	5.30	846	Amora	37	370	6.70
868	Arjun	37	370	5.30	847	Kadom	87	870	7.00
869	Arjun	40	400	5.40	848	Modhure	41	410	6.80
870	Krishnasura	35	350	6.80	849	Kadom	31	310	7.00
871	Arjun	55	550	6.20	850	Neem	33	330	7.70
872	Arjun	55	550	5.00	851	Gohora	31	310	5.50
873	Arjun	40	400	5.20	853	Hewali	45	450	4.90
874	Arjun	65	650	5.20	854	Koros	40	400	4.90
875	Flower	40	400	6.30	855	Koros	75	750	4.90
876	Flower	45	450	6.30	856	Guwal	36	360	5.00
877	Arjun	40	400	6.00	857	Koros	35	350	4.70
878	Arjun	55	550	6.00	858	Gomari	41	410	5.20
879	Bogore	85	850	6.40	859	Gohora	41	410	7.00
880	Arjun	55	550	5.60	860	Koros	50	500	7.00
881	Arjun	60	600	5.60	861	Koros	45	450	7.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
882	Guwal	60	600	5.50	862	Koros	40	400	7.00
883	Guwal	40	400	5.70	863	Koros	41	410	7.00
884	Arjun	65	650	5.60	864	Koros	42	420	7.00
885	Arjun	36	360	5.00	865	Koros	38	380	7.00
886	Arjun	35	350	5.00	866	Koros	40	400	7.70
887	Arjun	50	500	4.50	867	Koros	35	350	7.60
888	Guwal	45	450	4.50	868	Shirish	51	510	7.60
889	Krishnasura	70	700	5.40	869	Koros	31	310	7.60
890	Bhoklo	90	900	5.40	870	Koros	39	390	7.60
891	Arjun	55	550	5.40	871	Koros	30	300	7.60
892	Arjun	55	550	5.30	872	Koros	35	350	7.60
893	Arjun	40	400	5.00	873	Koros	37	370	7.70
894	Kodom	35	350	5.90	874	Koros	46	460	7.20
895	Guwal	35	350	5.90	875	Koros	45	450	7.70
896	Arjun	50	500	5.00	876	Koros	65	650	5.80
897	Arjun	35	350	5.40	877	Koros	40	400	4.90
898	Arjun	35	350	5.00	878	Modhure	45	450	4.90
899	Arjun	60	600	5.00	879	Koros	38	380	5.30
900	Arjun	35	350	5.20	880	Gohora	44	440	5.10
901	Krishnasura	35	350	5.00	881	Koros	55	550	5.20
902	Neem	40	400	5.00	882	Gohora	32	320	6.00
903	Mango	40	400	6.00	883	Koros	40	400	5.80
904	Modor	43	430	5.00	884	Bogori	110	1100	5.60
905	Krishnasura	35	350	5.00	885	Thal podum	53	530	6.40
906	Arjun	65	650	4.70	886	Bogori	50	500	5.10
907	Outenga	150	1500	7.50	887	Krishnosura	39	390	6.10
908	Sirish	33	330	5.50	888	Shirish	38	380	6.10
909	Sirish	60	600	5.50	889	Arjun	51	510	6.00
910	Sirish	40	400	5.50	890	Shirish	32	320	7.50
911	Sirish	30	300	5.50	891	Azhar	52	520	5.80
912	Sirish	36	360	5.40	892	Arjun	56	560	5.80
913	Flower	55	550	4.80	893	Arjun	52	520	5.80
914	Krishnasura	60	600	5.00	894	Arjun	61	610	5.80
915	Flower	60	600	5.30	895	Arjun	68	680	5.70
916	Krishnasura	70	700	6.70	896	Arjun	64	640	5.60
917	Sirish	40	400	6.70	897	Arjun	56	560	5.60
918	Sirish	65	650	6.80	898	Arjun	52	520	5.50
919	Aager	30	300	7.00	899	Arjun	51	510	5.40
920	Aager	30	300	7.20	900	Arjun	58	580	5.40
921	Guwal	55	550	5.20	901	Arjun	65	650	5.40
922	Sirish	50	500	6.70	902	Koros	36	360	5.40
923	Sirish	35	350	6.70	903	Arjun	56	560	4.90
924	Joregos	380	3800	7.80	904	Arjun	66	660	4.90
925	Sirish	33	330	4.80	905	Koros	48	480	4.90
926	Sirish	60	600	6.50	906	Arjun	56	560	4.90
927	Helikha	47	470	4.70	907	Arjun	58	580	5.30
928	Sirish	90	900	4.70	908	Arjun	48	480	5.30
929	Sirish	65	650	5.60	909	Kadom	74	740	6.40
930	Sirish	55	550	5.60	910	Koros	45	450	4.80
931	Guwal	30	300	5.60	911	Thal podum	52	520	5.20

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
932	Sirish	85	850	6.90	912	Peepal	352	3520	5.20
933	Sirish	50	500	6.30	913	Satiana	280	2800	6.20
934	Helikha	145	1450	5.40	914	Arjun	39	390	6.20
935	Sirish	40	400	6.40	915	Krishnosura	41	410	6.20
936	Sirish	45	450	5.10	916	Koros	30	300	6.20
937	Sirish	40	400	5.00	917	Krishnosura	70	700	5.10
938	Sirish	40	400	5.50	918	Krishnosura	81	810	5.10
939	Sirish	45	450	6.70	919	Jamuk	92	920	5.40
940	Krishnasura	33	330	5.00	920	Krishnosura	117	1170	5.30
941	Sirish	70	700	4.50	921	Borgos	46	460	4.90
942	Sirish	50	500	6.10	922	Guwal	39	390	4.80
943	Sirish	55	550	6.40	923	Arjun	41	410	5.50
944	Sirish	42	420	5.70	924	Krishnosura	50	500	5.80
945	Sirish	85	850	6.00	925	Koros	30	300	5.80
946	Sirish	30	300	5.00	926	Krishnosura	36	360	5.70
947	Guwal	35	350	6.20	927	Krishnosura	48	480	5.30
948	Flower	63	630	4.70	928	Chmeli	32	320	5.40
949	Flower	45	450	5.10	929	Cham	620	6200	6.40
950	Flower	53	530	5.50	930	Krishnosura	39	390	4.80
951	Mokonda	35	350	5.00	931	Shirish	104	1040	5.70
952	Arjun	43	430	5.00	932	Arjun	102	1020	5.50
953	Mokonda	35	350	5.00	933	Krishnosura	38	380	5.60
954	Sirish	33	330	5.80	934	Batghula	54	540	5.20
955	Sirish	33	330	5.50	935	Arjun	56	560	5.20
956	Flower	60	600	5.70	936	Krishnosura	45	450	5.20
957	Krishnasura	33	330	4.80	937	Arjun	48	480	5.00
958	Flower	60	600	5.40	938	Shirish	51	510	5.00
959	Sopa	340	3400	7.60	939	Arjun	49	490	5.10
960	Krishnasura	52	520	4.70	940	Bhomlote	41	410	5.40
961	Homoge	30	300	5.00	941	Shirish	42	420	5.70
962	Sagone	70	700	5.40	942	Arjun	37	370	5.20
963	Krishnasura	70	700	5.20	943	Satiana	343	3430	7.00
964	Flower	60	600	4.80	944	Shirish	46	460	6.20
965	Sirish	30	300	7.10	945	Shirish	100	1000	5.10
966	Flower	30	300	6.80	946	Koros	44	440	6.20
967	Krishnasura	80	800	5.70	947	Koros	90	900	5.50
968	Bogore	44	440	5.00	948	Shirish	46	460	6.00
969	Gomare	85	850	6.20	949	Shirish	39	390	5.30
970	Gomare	70	700	4.80	950	Shirish	50	500	5.30
971	Moadhs	40	400	4.90	951	Shirish	57	570	6.40
972	Gomare	100	1000	5.20	952	Shirish	42	420	6.50
973	Gomare	141	1410	5.30	953	Gohora	53	530	7.00
974	Gomare	137	1370	6.70	954	Koros	68	680	5.20
975	Himolu	70	700	7.70	955	Peepal	410	4100	6.50
976	Sirish	75	750	7.80	956	Shirish	66	660	6.50
977	Gomare	150	1500	5.50	957	Shirish	33	330	5.50
978	Guwal	70	700	7.40	958	Shirish	31	310	5.50
979	Gomare	140	1400	7.20	959	Shirish	93	930	5.50
980	Aahote	500	5000	7.00	960	Bogori	71	710	7.70
981	Krishnasura	35	350	6.00	961	Krishnosura	49	490	5.10

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
982	Guwal	33	330	5.30	962	Guwal	92	920	5.20
983	Sirish	33	330	5.60	963	Krishnosura	130	1300	7.30
984	Sationa	245	2450	5.60	964	Krishnosura	87	870	7.30
985	Petha	37	370	7.00	965	Shirish	38	380	6.00
986	Mokonda	50	500	7.80	966	Krishnosura	37	370	5.50
987	Neem	75	750	7.80	967	Shirish	60	600	5.50
988	Mokonda	33	330	5.80	968	Shirish	47	470	5.50
989	Mokonda	50	500	5.80	969	Krishnosura	44	440	5.40
990	Krishnasura	33	330	5.50	970	Bokul	110	1100	6.10
991	Krishnasura	50	500	5.10	971	Thal podum	93	930	6.70
992	Sirish	30	300	5.60	972	Krishnosura	133	1330	7.10
993	Guwal	120	1200	7.00	973	Krishnosura	160	1600	7.10
994	Tenga	44	440	7.30	974	Arjun	58	580	4.60
995	Jamuk	60	600	7.60	975	Satiana	120	1200	7.70
997	Mango	140	1400	7.80	976	Krishnosura	110	1100	6.60
998	Jamuk	50	500	7.60	977	Krishnosura	51	510	6.00
999	Krishnasura	50	500	6.20	978	Krishnosura	50	500	5.80
1	Sirish	33	330	6.60	979	Krishnosura	35	350	4.30
2	Sirish	32	320	5.90	980	Moder	72	720	5.00
3	Mokonda	30	300	6.10	981	Shirish	50	500	8.00
5	Krishnasura	60	600	5.40	982	Shirish	39	390	5.20
8	Hewak	30	300	6.90	983	Supere	40	400	7.40
9	Moadhs	60	600	7.00	984	Supere	38	380	7.40
10	Arjun	50	500	5.20	985	Neem	56	560	7.00
11	Sirish	40	400	5.60	986	Supere	46	460	7.40
12	Sirish	35	350	6.20	987	Arjun	57	570	5.50
13	Krishnasura	80	800	6.20	988	Koros	38	380	7.40
14	Bogore	43	430	7.60	989	Gomari	51	510	5.60
15	Krishnasura	60	600	6.70	990	Gomari	44	440	7.80
16	Sirish	35	350	6.70	991	Gomari	102	1020	6.90
17	Krishnasura	65	650	5.80	992	Gomari	138	1380	6.70
18	Sirish	40	400	7.40	993	Gomari	67	670	7.00
19	Sirish	35	350	7.10	994	Gomari	115	1150	7.60
20	Sirish	32	320	5.50	995	Gomari	128	1280	7.60
21	Aahote	300	3000	7.90	996	Gomari	116	1160	7.60
22	Arjun	30	300	5.60	997	Gomari	59	590	7.00
23	Sirish	30	300	4.80	998	Gomari	155	1550	7.00
24	Sationa	40	400	5.20	999	Gomari	48	480	5.20
25	Sationa	45	450	5.20	1	Gomari	117	1170	4.80
26	Sirish	36	360	7.60	2	Gomari	145	1450	5.60
27	Sirish	33	330	7.00	3	Koros	39	390	7.70
28	Sirish	35	350	5.40	4	Shirish	58	580	6.30
29	Moadhs	35	350	8.00	5	Koros	37	370	6.30
30	Sirish	65	650	8.00	6	Shirish	51	510	5.70
31	Sirish	66	660	8.00	7	Amora	34	340	5.70
32	Kodom	96	960	7.90	8	Koros	32	320	5.70
33	Sirish	75	750	5.40	9	Koros	42	420	5.70
34	Sirish	50	500	5.00	10	Koros	63	630	5.70
35	Sirish	45	450	5.50	12	Flower	34	340	5.60
36	Sirish	35	350	5.20	13	Supere	45	450	7.80

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
37	Madhuri	30	300	7.70	14	Supere	45	450	7.80
38	Sirish	30	300	7.70	15	Koros	32	320	6.10
39	Krishnasura	100	1000	7.40	16	Supere	51	510	7.80
40	Nomone	55	550	5.50	17	Supere	49	490	7.80
41	Sirish	60	600	5.40	18	Supere	53	530	7.80
42	Sirish	34	340	6.90	19	Supere	45	450	7.80
43	Sirish	55	550	5.60	20	Supere	45	450	7.70
44	Sirish	53	530	7.00	21	Supere	46	460	6.20
45	Gomare	140	1400	8.00	22	Supere	44	440	6.20
46	Gomare	57	570	8.00	23	Supere	45	450	7.90
47	Sirish	40	400	6.90	24	Koros	38	380	6.10
48	Sirish	110	1100	8.00	25	Koros	37	370	6.20
49	Gomare	130	1300	8.00	26	Supere	45	450	6.80
50	Moadhs	132	1320	8.00	27	Supere	46	460	6.80
51	Gomare	113	1130	8.00	28	Flower	34	340	6.50
52	Sirish	48	480	6.60	29	Koros	75	750	6.20
53	Modor	35	350	6.50	30	Flower	39	390	5.50
54	Gomare	94	940	8.00	31	Supere	50	500	6.20
55	Sirish	92	920	8.00	32	Koros	51	510	5.80
56	Sirish	98	980	8.00	33	Supere	48	480	5.80
57	Sirish	100	1000	8.00	34	Shirish	53	530	5.50
58	Sirish	74	740	8.00	35	Moder	104	1040	5.40
59	Sirish	75	750	8.00	36	Jobaful	41	410	6.10
60	Sirish	80	800	8.00	37	Peepal	612	6120	5.40
61	Sirish	84	840	8.00	38	Outenga	67	670	6.40
62	Sirish	100	1000	8.00	39	Hunaru	52	520	6.40
63	Sirish	79	790	8.00	40	Aahotgos	122	1220	6.40
64	Sirish	91	910	8.00	41	Supere	43	430	7.00
65	Sirish	92	920	8.00	42	Mango	98	980	7.00
66	Sirish	85	850	8.00	43	Supere	46	460	8.00
67	Sirish	100	1000	8.00	44	Supere	45	450	8.00
68	Sirish	90	900	8.00	45	Modhure	35	350	8.00
69	Sirish	80	800	8.00	46	Flower	34	340	7.40
70	Sirish	85	850	8.00	47	Supere	46	460	8.00
71	Sirish	64	640	8.00	48	Mango	130	1300	7.40
72	Sirish	63	630	8.00	49	Satiana	280	2800	7.90
73	Sirish	75	750	6.40	50	Shirish	82	820	8.00
74	Moadhs	35	350	6.50	51	Gohora	40	400	8.00
75	Guwal	55	550	5.00	52	Jamuk	54	540	7.40
76	Neem	65	650	5.50	53	Flower	32	320	7.40
77	Neem	70	700	5.50	54	Borgos	380	3800	4.00
78	Hunaru	40	400	4.30	55	Azhar	42	420	7.70
79	Bogore	40	400	4.60	56	Moder	53	530	6.00
80	Bhoklo	33	330	4.70	57	Moder	32	320	6.00
81	Bhoklo	34	340	4.70	58	Moder	52	520	6.00
82	Bhoklo	30	300	4.50	59	Moder	32	320	5.40
83	Bhoklo	30	300	4.80	60	Neem	31	310	5.80
84	Sirish	50	500	5.40	61	Moder	72	720	5.80
85	Sirish	31	310	5.70	62	Moder	34	340	5.80
86	Neem	50	500	8.00	63	Supere	48	480	6.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
87	Neem	40	400	8.00	64	Jamuk	68	680	6.00
88	Sirish	31	310	5.90	65	Supere	30	300	6.00
89	Neem	80	800	8.00	66	Thal podum	44	440	5.80
90	Neem	50	500	8.00	67	Kothal	320	3200	6.10
91	Sirish	30	300	5.90	68	Krishnosura	78	780	6.00
92	Sirish	35	350	6.00	69	Kothal	280	2800	6.80
93	Sirish	33	330	5.70	70	Kothal	290	2900	6.80
94	Moadhs	40	400	5.30	71	Thal podum	38	380	5.90
95	Moadhs	34	340	5.40	72	Shirish	57	570	6.80
96	Bhoklo	50	500	5.30	73	Bokul	55	550	7.10
97	Sirish	50	500	6.20	74	Koros	70	700	8.00
98	Flower	40	400	7.60	75	Koros	45	450	8.00
99	Flower	40	400	7.00	76	Koros	55	550	8.00
100	Kodom	45	450	7.00	77	Satiana	310	3100	7.00
101	Kodom	50	500	7.00	78	Shirish	65	650	5.50
102	Kodom	48	480	7.00	79	Koros	95	950	6.70
103	Madhuri	40	400	7.00	80	Shirish	40	400	5.90
104	Aahote	170	1700	6.30	81	Flower	150	1500	6.10
105	Aahote	119	1190	6.40	82	Shirish	60	600	6.10
106	Gomare	60	600	6.50	83	Koros	55	550	5.00
107	Sirish	35	350	6.70	84	Satiana	260	2600	5.50
108	Himolu	140	1400	4.60	85	Koros	54	540	5.00
109	Sirish	35	350	6.50	86	Koros	65	650	5.40
110	Sirish	31	310	5.90	87	Koros	69	690	5.50
111	Sirish	40	400	6.50	88	Krishnosura	99	990	6.30
112	Sirish	55	550	6.50	89	Krishnosura	200	2000	5.80
113	Krishnasura	60	600	4.50	90	Aahotgos	240	2400	6.50
114	Sirish	30	300	4.50	91	Krishnosura	110	1100	5.60
115	Sirish	33	330	8.00	92	Koros	42	420	5.60
116	Sirish	34	340	8.00	93	Koros	38	380	5.60
117	Myfuek	30	300	8.00	94	Shirish	125	1250	6.00
118	Sirish	43	430	8.00	95	Shirish	79	790	6.00
119	Sirish	53	530	8.00	96	Shirish	125	1250	6.00
120	Krishnasura	71	710	6.10	97	Bhaklo	89	890	6.70
121	Sirish	40	400	6.90	98	Bhaklo	78	780	5.20
122	Arjun	32	320	6.60	99	Shirish	49	490	4.90
123	Bogore	33	330	5.30	100	Shirish	65	650	5.00
124	Krishnasura	40	400	6.60	101	Shirish	64	640	4.90
125	Guwal	34	340	8.00	102	Shirish	50	500	4.90
126	Sationa	40	400	5.50	103	Shirish	64	640	4.80
127	Sationa	220	2200	5.10	104	Shirish	65	650	5.20
128	Krishnasura	35	350	5.50	105	Shirish	59	590	4.90
129	Sirish	34	340	5.00	106	Shirish	55	550	5.50
130	Sirish	33	330	7.00	107	Shirish	49	490	5.60
131	Sirish	31	310	6.50	108	Shirish	69	690	6.00
132	Sirish	50	500	6.60	109	Shirish	69	690	6.40
133	Sirish	60	600	6.50	110	Shirish	60	600	5.90
134	Sirish	33	330	6.20	111	Shirish	90	900	6.00
135	Sirish	34	340	7.70	112	Shirish	55	550	6.80
136	Gomare	120	1200	6.00	113	Krishnosura	150	1500	4.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
137	Sirish	50	500	6.00	114	Krishnosura	129	1290	4.40
138	Sirish	35	350	6.40	115	Satiana	335	3350	6.00
139	Sirish	35	350	6.90	116	Dimaru	43	430	7.00
140	Madhuri	60	600	8.00	117	Rabab tenga	78	780	7.40
141	Jamuk	130	1300	4.90	118	Nunetenga	45	450	7.40
142	Gomare	70	700	7.50	119	Mango	350	3500	4.60
143	Sirish	31	310	5.60	120	Dimaru	50	500	7.70
144	Sirish	50	500	6.00	121	Thal podum	105	1050	7.50
145	Guwal	30	300	6.30	122	Shirish	65	650	6.20
146	Guwal	31	310	6.70	123	Moder	115	1150	6.20
147	Sirish	33	330	5.60	124	Krishnosura	39	390	5.00
148	Sirish	34	340	5.60	125	Moder	39	390	5.60
149	Sirish	85	850	5.80	126	Moder	45	450	5.40
150	Sirish	100	1000	5.60	127	Moder	35	350	5.40
151	Sirish	40	400	5.70	128	Jamuk	170	1700	5.20
152	Sirish	33	330	5.90	129	Amora	79	790	7.40
153	Sirish	55	550	5.90	130	Shirish	49	490	7.40
154	Sirish	60	600	5.90	131	Amora	84	840	7.40
155	Sirish	34	340	5.50	132	Modhure	59	590	7.40
156	Sirish	75	750	8.00	133	Koros	50	500	7.40
157	Sirish	36	360	5.10	134	Modhure	65	650	7.10
158	Sirish	140	1400	7.50	135	Shirish	64	640	6.40
159	Sirish	30	300	5.00	136	Shirish	288	2880	8.00
160	Sirish	40	400	6.00	137	Shirish	43	430	5.10
161	Sirish	140	1400	7.60	138	Shirish	65	650	5.50
162	Sirish	138	1380	7.50	139	Shirish	63	630	5.50
163	Sirish	200	2000	7.20	140	Shirish	40	400	5.60
164	Sirish	37	370	6.20	141	Shirish	40	400	5.70
165	Sirish	38	380	6.20	142	Shirish	42	420	5.70
166	Sirish	30	300	7.00	143	Shirish	47	470	5.70
167	Sirish	65	650	7.00	144	Azhar	50	500	6.80
168	Sirish	40	400	7.00	145	Krishnosura	46	460	6.40
169	Sirish	30	300	6.10	146	Moder	98	980	7.30
170	Sirish	30	300	6.10	147	Shirish	34	340	5.30
171	Sirish	30	300	6.20	148	Shirish	35	350	5.30
172	Sirish	30	300	6.30	149	Shirish	48	480	5.10
173	Rain Tree	50	500	6.30	150	Krishnosura	41	410	5.10
174	Modor	33	330	6.30	151	Shirish	45	450	6.20
175	Daikgos	34	340	6.30	152	Koros	52	520	5.00
176	Katkora	110	1100	7.00	153	Koros	56	560	5.00
177	Kothal	270	2700	7.50	154	Koros	72	720	5.00
178	Rain Tree	130	1300	7.50	155	Azhar	70	700	6.40
179	Sationa	41	410	6.30	156	Koros	60	600	6.40
180	Mango	160	1600	7.50	157	Koros	48	480	5.60
181	Krishnasura	60	600	7.90	158	Mango	150	1500	5.60
182	Krishnasura	60	600	6.70	159	Hunaru	110	1100	7.10
183	Kodom	65	650	7.90	160	Satiana	319	3190	4.90
184	Modor	53	530	7.50	161	Shirish	310	3100	5.70
186	Flower	60	600	6.80	162	Shirish	420	4200	7.70
187	Flower	70	700	6.80	163	Satiana	330	3300	6.10

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
188	Flower	70	700	6.20	164	Krishnosura	85	850	5.60
189	Gomare	60	600	6.20	165	Azhar	195	1950	4.60
190	Modor	140	1400	8.00	166	Azhar	110	1100	5.40
191	Aahote	140	1400	8.00	167	Koros	55	550	5.20
192	Madhuri	138	1380	8.00	168	Azhar	270	2700	7.70
193	Demoru	60	600	8.00	169	Azhar	130	1300	5.20
194	Katkora	70	700	8.00	170	Azhar	210	2100	6.70
195	Flower	65	650	8.00	171	Azhar	190	1900	6.70
196	Flower	60	600	6.00	172	Debodaru	75	750	7.70
197	Rain Tree	70	700	7.30	173	Aamlakhi	76	760	7.70
198	Sopa	130	1300	8.00	174	Krishnosura	90	900	5.80
199	Krishnasura	60	600	7.40	175	Aamlakhi	70	700	5.50
200	Hunaru	130	1300	7.50	176	Krishnosura	190	1900	6.20
201	Bhoklo	131	1310	7.50	177	Krishnosura	120	1200	6.20
202	Bhoklo	170	1700	7.80	178	Shirish	58	580	5.60
203	Hunaru	85	850	7.00	179	Shirish	105	1050	8.00
204	Rain Tree	80	800	7.30	180	Shirish	70	700	7.30
205	Sopa	70	700	6.60	181	Gomari	135	1350	5.20
206	Rain Tree	33	330	5.90	182	Krishnosura	120	1200	7.70
207	Neem	30	300	6.00	183	Shirish	57	570	6.30
208	Rain Tree	60	600	7.00	184	Krishnosura	110	1100	7.10
209	Bhoklo	35	350	7.00	185	Krishnosura	55	550	7.20
210	Sationa	170	1700	5.20	186	Krishnosura	58	580	7.20
211	Demoru	60	600	5.40	187	Krishnosura	65	650	7.00
212	Kothal	140	1400	6.50	188	Krishnosura	50	500	6.00
213	Mango	140	1400	6.50	189	Koros	63	630	6.00
214	Neem	41	410	7.20	190	Shirish	75	750	6.30
215	Neem	47	470	7.20	191	Koros	85	850	7.10
216	Demoru	60	600	7.20	192	Krishnosura	52	520	5.40
218	Modor	125	1250	7.10	193	Dimaru	55	550	8.00
219	Rain Tree	35	350	6.60	194	Krishnosura	45	450	7.00
220	Modor	40	400	6.70	195	Krishnosura	38	380	7.00
221	Mango	115	1150	8.00	196	Shirish	80	800	7.00
222	Mango	160	1600	7.70	197	Krishnosura	48	480	6.00
223	Hewali	40	400	6.90	198	Koros	68	680	7.40
224	Jamuk	221	2210	7.90	199	Krishnosura	37	370	7.40
225	Krishnasura	35	350	7.00	200	Borgos	420	4200	4.90
226	Kodom	60	600	7.30	201	Krishnosura	45	450	6.70
227	Amora	65	650	8.00	202	Krishnosura	64	640	6.70
228	Moadhs	64	640	8.00	203	Krishnosura	40	400	6.90
229	Rain Tree	30	300	6.60	204	Krishnosura	35	350	6.70
230	Krishnasura	64	640	6.70	205	Krishnosura	50	500	6.70
231	Krishnasura	34	340	7.70	206	Shirish	75	750	6.70
232	Neem	36	360	6.40	207	Krishnosura	43	430	6.40
233	Rain Tree	32	320	6.50	208	Krishnosura	90	900	7.20
237	Mango	60	600	7.50	209	Krishnosura	45	450	6.00
238	Modor	80	800	7.40	210	Satiana	450	4500	7.40
239	Rain Tree	60	600	7.50	211	Batghula	75	750	7.40
240	Rain Tree	30	300	6.10	212	Shirish	70	700	7.40
241	Kordi	30	300	5.50	213	Shirish	55	550	7.30

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
242	Nahor	55	550	6.30	214	Himolu	350	3500	7.30
243	Hunaru	31	310	5.50	215	Satiana	200	2000	7.00
244	Hunaru	40	400	6.80	216	Moder	180	1800	6.90
245	Neem	125	1250	7.50	217	Shirish	35	350	6.70
246	Aager	45	450	7.60	218	Krishnosura	58	580	6.70
247	Guwal	30	300	7.60	219	Shirish	36	360	6.70
248	Sationa	47	470	7.50	220	Satiana	150	1500	7.30
249	Neem	52	520	6.00	221	Shirish	50	500	7.20
250	Hunaru	50	500	7.90	222	Shirish	60	600	7.20
251	Guwal	30	300	6.10	223	Shirish	65	650	6.40
252	Krishnasura	70	700	5.50	224	Shirish	40	400	6.40
253	Mango	35	350	7.90	225	Shirish	85	850	6.40
254	Kothal	70	700	7.10	226	Shirish	100	1000	6.40
255	Sationa	80	800	7,.1	227	Shirish	40	400	6.40
256	Mango	42	420	8.00	228	Shirish	60	600	6.40
257	Kodom	66	660	8.00	229	Shirish	65	650	6.70
258	Gomare	64	640	7.10	230	Shirish	55	550	6.70
259	Kodom	70	700	7.60	231	Shirish	165	1650	6.70
260	Koros	60	600	7.60	232	Shirish	160	1600	6.80
261	Mango	70	700	7.20	233	Shirish	40	400	6.50
262	Neem	33	330	7.20	234	Shirish	41	410	6.50
264	Bhoklo	55	550	7.00	235	Satiana	390	3900	5.80
266	Guwal	30	300	7.00	236	Shirish	35	350	7.30
269	Chandan	50	500	7.40	237	Shirish	50	500	7.30
270	Guwal	60	600	7.90	238	Shirish	80	800	7.30
271	Amora	130	1300	7.90	239	Shirish	32	320	7.30
273	Neem	40	400	7.30	240	Holong	33	330	7.30
274	Neem	41	410	7.30	241	Shirish	72	720	7.30
277	Neem	55	550	7.50	242	Shirish	78	780	7.30
278	Neem	65	650	7.20	243	Shirish	63	630	7.30
280	Bhoklo	35	350	7.20	244	Shirish	46	460	7.30
281	Sationa	65	650	7.10	245	Shirish	52	520	7.30
282	Modor	70	700	7.20	246	Shirish	49	490	7.30
283	Modor	100	1000	7.20	247	Koros	33	330	7.30
284	Guwal	35	350	7.40	248	Shirish	40	400	7.30
285	Guwal	35	350	7.40	249	Shirish	62	620	7.30
286	Guwal	50	500	7.40	250	Shirish	68	680	7.30
288	Moadhs	33	330	7.00	251	Shirish	34	340	6.40
290	Moadhs	80	800	6.50	252	Shirish	34	340	6.40
293	Sopa	115	1150	6.40	253	Shirish	38	380	6.40
296	Neem	36	360	7.80	254	Shirish	41	410	6.40
300	Joregos	290	2900	7.00	255	Shirish	59	590	6.70
301	Mango	122	1220	7.70	256	Shirish	40	400	6.60
302	Rain Tree	35	350	6.30	257	Shirish	50	500	6.50
304	Leso	65	650	7.00	258	Shirish	40	400	6.50
305	Amora	90	900	6.40	259	Shirish	50	500	6.50
306	Sationa	30	300	6.40	260	Shirish	33	330	6.50
308	Amora	105	1050	8.00	261	Shirish	60	600	6.50
309	Sationa	93	930	7.00	262	Shirish	45	450	6.50
310	Mango	66	660	7.50	263	Shirish	87	870	6.50

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
311	Mango	45	450	7.50	264	Shirish	350	3500	7.30
312	Mango	95	950	7.50	265	Peepal	310	3100	7.40
314	Rain Tree	65	650	6.80	266	Mango	91	910	7.40
315	Bor Peepal	300	3000	8.00	267	Shirish	85	850	5.90
317	Koros	30	300	5.50	268	Shirish	65	650	5.90
318	Bhoklo	170	1700	7.70	269	Shirish	48	480	5.90
324	Hewali	110	1100	7.80	270	Shirish	45	450	5.90
325	Rain Tree	180	1800	8.00	271	Shirish	57	570	5.90
326	Joregos	140	1400	7.00	272	Shirish	40	400	5.80
328	Bhoklo	50	500	7.40	273	Shirish	65	650	6.40
330	Mango	80	800	7.80	274	Shirish	60	600	6.40
339	Mokonda	60	600	6.00	275	Shirish	36	360	6.60
340	Neem	70	700	6.00	276	Shirish	45	450	6.50
347	Krishnasura	50	500	5.90	277	Shirish	63	630	7.10
348	Pode tenga	43	430	7.00	278	Shirish	32	320	6.40
349	Pode tenga	35	350	7.00	279	Shirish	60	600	6.40
350	Pode tenga	36	360	7.00	280	Shirish	38	380	6.40
351	Sum	95	950	6.90	281	Shirish	38	380	5.80
352	Bhoklo	85	850	7.30	282	Neem	190	1900	7.70
353	Rain Tree	67	670	6.40	283	Shirish	38	380	5.80
356	Outenga	130	1300	6.10	284	Shirish	100	1000	7.80
359	Modor	50	500	6.40	285	Satiana	55	550	7.80
360	Arjun	35	350	6.40	286	Satiana	55	550	7.80
363	Bhoklo	55	550	6.30	287	Guwal	47	470	7.80
364	Kodom	110	1100	4.70	288	Shirish	55	550	5.40
365	Kodom	60	600	6.30	289	Shirish	50	500	5.40
366	Kodom	55	550	4.70	290	Shirish	65	650	5.40
367	Kodom	68	680	5.00	291	Shirish	100	1000	5.40
368	Kodom	84	840	5.00	292	Shirish	101	1010	7.90
369	Kodom	74	740	5.00	293	Shirish	120	1200	8.00
370	Rain Tree	70	700	5.70	294	Shirish	125	1250	8.00
371	Rain Tree	50	500	5.90	295	Shirish	130	1300	7.90
372	Kothal	75	750	6.50	296	Shirish	54	540	6.30
373	Amora	50	500	6.60	297	Shirish	40	400	5.80
374	Amora	74	740	6.40	298	Shirish	81	810	7.20
375	Neem	34	340	5.80	299	Bogori	93	930	5.00
376	Krishnasura	60	600	5.30	300	Hunaru	47	470	6.00
377	Krishnasura	50	500	5.60	301	Shirish	40	400	5.60
381	Sationa	85	850	7.00	302	Guwal	57	570	6.20
382	Krishnasura	48	480	5.30	303	Hunaru	38	380	5.00
383	Bhoklo	32	320	5.30	304	Krishnosura	58	580	5.40
384	Madhuri	33	330	7.20	305	Krishnosura	30	300	5.40
385	Neem	35	350	6.50	306	Krishnosura	42	420	5.40
386	Bogore	40	400	7.20	307	Kadom	33	330	6.00
387	Krishnasura	33	330	5.20	308	Gomari	63	630	5.30
388	Krishnasura	34	340	6.50	309	Guwal	39	390	6.20
389	Krishnasura	45	450	5.70	310	Krishnosura	35	350	5.30
390	Rain Tree	44	440	5.60	311	Shirish	40	400	5.30
391	Krishnasura	50	500	6.00	312	Shirish	48	480	5.20
392	Krishnasura	43	430	5.50	313	Krishnosura	40	400	5.70

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
393	Rain Tree	40	400	5.70	314	Bogori	75	750	5,8
394	Rain Tree	30	300	5.00	315	Koros	34	340	7.00
395	Rain Tree	33	330	5.60	316	Gomari	48	480	5.70
396	Rain Tree	34	340	7.60	317	Krishnosura	60	600	6.60
397	Krishnasura	40	400	5.50	318	Amora	68	680	5.20
398	Krishnasura	40	400	5.70	319	Azhar	48	480	6.50
399	Krishnasura	40	400	5.70	320	Modhure	35	350	6.50
400	Krishnasura	45	450	6.10	321	Krishnosura	47	470	5.80
401	Krishnasura	44	440	6.20	322	Shirish	38	380	6.00
402	Krishnasura	40	400	6.00	323	Krishnosura	57	570	6.00
403	Krishnasura	30	300	6.40	324	Krishnosura	43	430	6.00
404	Krishnasura	32	320	6.30	325	Krishnosura	79	790	6.00
405	Krishnasura	36	360	6.10	326	Bogori	62	620	5.00
406	Krishnasura	34	340	5.30	327	Krishnosura	40	400	6.40
407	Krishnasura	30	300	5.60	328	Neem	45	450	7.90
408	Krishnasura	31	310	5.20	332	Krishnosura	44	440	5.90
409	Krishnasura	40	400	6.20	333	Shirish	69	690	7.00
410	Krishnasura	32	320	5.90	334	Shirish	64	640	7.00
411	Krishnasura	31	310	5.90	335	Krishnosura	48	480	7.80
412	Krishnasura	33	330	5.60	336	Krishnosura	55	550	6.80
413	Krishnasura	30	300	5.60	337	Satiana	81	810	8.00
414	Krishnasura	34	340	5.60	338	Bandardewa	56	560	7.90
415	Krishnasura	40	400	6.40	339	Shirish	58	580	7.90
416	Krishnasura	40	400	6.10	340	Moder	84	840	6.00
417	Bogore	65	650	6.90	341	Amora	80	800	6.10
418	Krishnasura	35	350	6.10	342	Shirish	59	590	7.50
419	Krishnasura	37	370	6.10	343	Amora	48	480	7.50
420	Krishnasura	50	500	5.80	344	Peepal	820	8200	5.50
421	Krishnasura	40	400	5.40	345	Kothal	140	1400	4.90
422	Krishnasura	30	300	6.40	346	Mango	195	1950	4.90
423	Rain Tree	33	330	6.20	347	Krishnosura	55	550	5.00
424	Rain Tree	50	500	6.70	348	Krishnosura	40	400	5.00
425	Krishnasura	50	500	6.70	349	Krishnosura	43	430	6.50
426	Gomare	53	530	6.60	350	Koros	90	900	6.50
427	Flower	66	660	7.90	351	Flower	62	620	5.80
428	Kordi	40	400	8.00	352	Krishnosura	40	400	7.00
429	Rain Tree	37	370	7.70	353	Krishnosura	52	520	6.50
431	Joba Flower	36	360	7.60	354	Modhure	51	510	7.00
432	Gomare	32	320	6.80	355	Koros	95	950	6.40
433	Hunaru	30	300	5.90	356	Shirish	51	510	7.60
434	Neem	100	1000	7.90	357	Krishnosura	37	370	6.00
435	Rain Tree	33	330	7.60	358	Shirish	67	670	6.00
436	Rain Tree	60	600	7.90	359	Gomari	61	610	5.70
437	Rain Tree	58	580	8.00	360	Shirish	50	500	6.90
438	Bhoklo	70	700	8.00	364	Borgos	350	3500	7.00
439	Bhoklo	60	600	8.00	365	Azhar	100	1000	7.00
440	Rain Tree	40	400	6.70	366	Koros	115	1150	4.80
441	Helikha	120	1200	4.70	367	Koros	115	1150	7.00
442	Hunaru	80	800	5.20	368	Koros	117	1170	5.60
443	Krishnasura	210	2100	5.10	369	Shirish	43	430	5.60

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
444	Gomare	80	800	5.00	370	Shirish	41	410	6.00
445	Gomare	50	500	6.20	371	Shirish	54	540	5.40
446	Gomare	100	1000	5.30	372	Shirish	42	420	5.40
447	Gomare	163	1630	5.30	373	Guwal	52	520	5.30
448	Gomare	130	1300	6.40	374	Azhar	40	400	4.50
449	Gomare	122	1220	5.30	376	Supere	50	500	8.00
450	Gomare	186	1860	5.10	377	Supere	40	400	6.40
451	Gomare	100	1000	5.10	378	Supere	44	440	6.70
452	Gomare	140	1400	6.40	379	Mango	250	2500	7.70
453	Gomare	115	1150	5.20	380	Gomari	180	1800	6.30
454	Gomare	170	1700	5.00	381	Dimaru	90	900	7.60
455	Gomare	124	1240	5.20	382	Dimaru	75	750	7.60
456	Gomare	200	2000	5.00	383	Gomari	55	550	6.00
457	Krishnasura	60	600	6.00	384	Borgos	392	3920	6.00
458	Gomare	185	1850	5.30	385	Gomari	190	1900	4.80
459	Krishnasura	50	500	5.50	386	Aahotgos	214	2140	6.20
460	Krishnasura	30	300	6.00	387	Azhar	55	550	8.00
466	Krishnasura	70	700	6.60	388	Krishnosura	66	660	7.50
468	Madhuri	48	480	6.40	389	Gomari	215	2150	6.10
469	Krishnasura	47	470	6.00	390	Gomari	169	1690	6.30
470	Gomare	60	600	7.30	391	Gomari	79	790	5.60
472	Modor	30	300	8.00	392	Gomari	145	1450	8.00
473	Rain Tree	55	550	8.00	393	Shirish	311	3110	5.50
474	Krishnasura	33	330	6.00	394	Gomari	75	750	5.50
475	Krishnasura	31	310	5.80	395	Gomari	84	840	5.10
476	Neem	57	570	6.30	396	Gomari	149	1490	6.40
477	Madhuri	30	300	6.50	397	Gomari	132	1320	6.40
478	Bhatgela	30	300	5.60	398	Gomari	90	900	6.60
479	Rain Tree	170	1700	5.60	399	Gomari	155	1550	7.90
480	Rain Tree	175	1750	6.80	400	Gomari	154	1540	5.90
481	Krishnasura	160	1600	7.00	401	Gomari	100	1000	6.40
482	Krishnasura	30	300	6.20	402	Shirish	117	1170	4.80
483	Bhoklo	34	340	7.00	403	Gomari	119	1190	6.00
484	Krishnasura	40	400	7.00	404	Gomari	169	1690	6.00
485	Aamlokhi	35	350	6.80	405	Gomari	195	1950	6.00
486	Krishnasura	36	360	7.00	406	Krishnosura	48	480	6.50
487	Neem	33	330	5.70	407	Krishnosura	49	490	6.50
488	Rain Tree	200	2000	7.00	408	Gomari	200	2000	4.70
489	Rain Tree	33	330	7.60	409	Krishnosura	39	390	6.80
490	Bogore	30	300	5.30	410	Gomari	128	1280	6.50
491	Guwal	90	900	7.90	411	Gomari	116	1160	6.30
493	Krishnasura	40	400	6.50	412	Gomari	152	1520	6.00
494	Rain Tree	30	300	6.50	413	Krishnosura	40	400	5.30
495	Gomare	60	600	8.00	414	Shirish	140	1400	5.50
496	Rain Tree	37	370	6.50	415	Hewali	37	370	5.80
497	Bogore	30	300	7.10	416	Amora	34	340	5.50
498	Guwal	60	600	6.40	417	Shirish	55	550	5.10
499	Guwal	64	640	5.40	418	Krishnosura	36	360	6.60
500	Guwal	83	830	7.70	420	Supere	43	430	7.70
501	Krishnasura	34	340	6.80	421	Krishnosura	56	560	8.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
502	Krishnasura	40	400	7.40	422	Myfuek	67	670	8.00
503	Bogore	50	500	6.80	423	Shirish	203	2030	4.60
504	Krishnasura	77	770	5.50	424	Himolu	305	3050	7.40
505	Krishnasura	55	550	6.10	427	Gomari	90	900	8.00
506	Krishnasura	30	300	6.20	428	Shirish	55	550	6.50
507	Rain Tree	246	2460	5.00	429	Gomari	125	1250	6.50
508	Rain Tree	50	500	5.70	430	Sopa	52	520	6.30
509	Gomare	150	1500	5.40	431	Gomari	295	2950	6.00
510	Rain Tree	250	2500	5.20	432	Krishnosura	50	500	6.00
511	Amora	50	500	5.60	433	Bandardewa	43	430	7.40
512	Jamuk	35	350	7.00	434	Amora	70	700	6.60
513	Krishnasura	67	670	6.20	435	Krishnosura	35	350	7.00
514	Krishnasura	50	500	6.40	436	Krishnosura	47	470	7.00
515	Krishnasura	50	500	6.20	437	Supere	34	340	7.00
516	Krishnasura	30	300	6.20	438	Gohora	89	890	8.00
517	Krishnasura	35	350	6.30	441	Hunaru	55	550	7.00
518	Neem	40	400	6.30	442	Supere	51	510	7.00
519	Krishnasura	30	300	6.20	443	Supere	48	480	7.00
520	Aager	30	300	6.50	445	Supere	46	460	7.00
521	Gomare	40	400	6.40	446	Myfuek	84	840	6.80
522	Gomare	40	400	6.40	447	Supere	44	440	6.80
523	Gomare	37	370	5.70	448	Supere	41	410	6.90
524	Gomare	33	330	7.90	449	Shirish	312	3120	6.70
525	Katkora	31	310	6.70	450	Supere	47	470	7.00
526	Gomare	37	370	6.70	451	Supere	49	490	6.80
527	Krishnasura	35	350	5.50	452	Supere	47	470	6.80
528	Gomare	74	740	4.80	453	Supere	34	340	7.00
529	Krishnasura	35	350	5.60	454	Supere	48	480	6.70
530	Rain Tree	60	600	6.00	455	Supere	51	510	6.70
531	Krishnasura	37	370	5.80	456	Supere	38	380	6.70
532	Gomare	47	470	5.60	457	Neem	68	680	6.70
533	Gomare	44	440	7.00	458	Supere	48	480	7.70
534	Krishnasura	83	830	5.90	459	Supere	46	460	7.70
535	Flower	31	310	7.30	461	Supere	48	480	7.70
536	Flower	31	310	6.40	462	Supere	47	470	7.70
537	Krishnasura	32	320	5.30	463	Shirish	317	3170	6.90
538	Krishnasura	53	530	5.60	464	Neem	72	720	7.10
539	Gomare	45	450	6.70	465	Holong	180	1800	7.80
540	Gomare	40	400	6.30	466	Bandardewa	100	1000	7.80
541	Aamlokhi	35	350	6.50	467	Neem	98	980	7.80
542	Gomare	35	350	5.70	468	Dimaru	42	420	8.00
543	Gomare	36	360	5.70	470	Myfuek	108	1080	8.00
544	Gomare	40	400	5.70	471	Korai	110	1100	6.30
545	Gomare	40	400	5.10	472	Keselu	45	450	7.30
546	Gomare	40	400	5.90	473	Keselu	70	700	7.30
547	Gomare	35	350	6.00	474	Keselu	60	600	7.00
548	Gomare	50	500	5.90	475	Hilikha	160	1600	8.00
549	Krishnasura	30	300	6.00	476	Bokul	72	720	6.50
550	Krishnasura	45	450	5.60	477	Bokul	88	880	6.50
551	Krishnasura	30	300	5.80	478	Bokul	72	720	6.50

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
552	Krishnasura	30	300	6.00	479	Bokul	97	970	6.50
553	Krishnasura	35	350	6.00	480	Bokul	128	1280	6.50
554	Krishnasura	40	400	5.80	481	Bokul	110	1100	6.90
555	Krishnasura	37	370	5.80	482	Bokul	103	1030	6.90
556	Krishnasura	38	380	5.80	483	Neem	56	560	6.90
557	Rain Tree	70	700	7.40	484	Jolphoy	123	1230	6.90
558	Gomare	44	440	8.00	485	Gomari	82	820	7.40
559	Krishnasura	30	300	5.60	486	Gomari	80	800	6.70
560	Krishnasura	30	300	5.60	487	Krishnosura	85	850	7.40
561	Rain Tree	215	2150	5.00	488	Krishnosura	40	400	7.40
562	Rain Tree	240	2400	5.50	489	Krishnosura	33	330	7.40
563	Gomare	48	480	7.30	490	Neem	100	1000	7.60
564	Rain Tree	215	2150	5.20	491	Guwal	62	620	7.40
565	Amora	53	530	7.80	492	Guwal	58	580	7.40
566	Madhuri	35	350	7.80	493	Mango	39	390	8.00
567	Krishnasura	54	540	6.10	494	Debodaru	53	530	8.00
568	Gomare	220	2200	4.80	495	Modhure	40	400	7.40
569	Krishnasura	78	780	7.00	496	Debodaru	30	300	7.20
570	Krishnasura	33	330	5.50	497	Guwal	105	1050	7.00
571	Krishnasura	79	790	5.20	498	Shirish	110	1100	7.00
572	Krishnasura	65	650	5.70	499	Shirish	48	480	5.90
573	Krishnasura	70	700	6.70	500	Shirish	60	600	5.70
574	Rain Tree	35	350	5.80	501	Krishnosura	80	800	4.90
575	Gomare	33	330	7.10	502	Krishnosura	75	750	5.70
576	Krishnasura	34	340	6.20	503	Krishnosura	34	340	5.70
577	Gomare	35	350	7.70	504	Krishnosura	48	480	7.30
578	Gomare	34	340	8.00	505	Krishnosura	30	300	7.00
579	Gomare	38	380	7.40	506	Myfuek	114	1140	7.30
580	Gomare	50	500	7.40	508	Shirish	225	2250	5.60
581	Gomare	46	460	8.00	509	Guwal	75	750	5.70
583	Neem	38	380	8.00	510	Shirish	145	1450	5.60
585	Gomare	70	700	7.80	511	Shirish	165	1650	5.60
586	Krishnasura	50	500	6.80	512	Shirish	140	1400	5.70
587	Gomare	38	380	6.00	513	Shirish	195	1950	5.70
588	Amora	50	500	8.00	514	Krishnosura	31	310	5.70
589	Amora	48	480	8.00	515	Amora	52	520	5.70
590	Amora	40	400	7.80	516	Jamuk	58	580	7.90
591	Amora	35	350	7.80	517	Bandardewa	78	780	7.90
592	Sotina	45	450	7.80	518	Bandardewa	62	620	7.90
593	Aager	33	330	7.40	519	Supere	45	450	8.00
594	Amora	35	350	7.40	520	Amora	53	530	7.90
595	Amora	40	400	7.40	521	Amora	55	550	6.30
596	Guwal	100	1000	7.30	522	Amora	53	530	6.30
597	Rabab tenga	78	780	7.30	523	Amora	60	600	6.30
598	Gomare	37	370	6.50	524	Supere	46	460	6.40
599	Hewak	30	300	6.70	525	Amora	53	530	6.40
600	Leso	120	1200	6.90	526	Amora	54	540	6.40
601	Krishnasura	30	300	6.80	527	Amora	55	550	6.40
602	Flower	95	950	7.30	528	Krishnosura	34	340	6.00
603	Rabab tenga	60	600	5.90	529	Amora	33	330	6.40

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
605	Amora	30	300	6.60	530	Amora	37	370	6.40
608	Gomare	48	480	7.20	531	Amora	44	440	6.40
609	Krishnasura	65	650	5.30	532	Bandardewa	98	980	5.50
610	Gomare	30	300	5.90	533	Krishnosura	47	470	5.50
611	Gomare	40	400	6.70	534	Neem	64	640	6.00
612	Krishnasura	40	400	6.30	535	Krishnosura	50	500	6.10
613	Gomare	30	300	5.70	536	Krishnosura	48	480	6.10
614	Gomare	30	300	6.30	537	Krishnosura	48	480	6.10
615	Gomare	30	300	7.10	538	Jobaful	40	400	6.20
616	Madhuri	30	300	6.20	539	Supere	40	400	6.50
617	Gomare	33	330	6.60	540	Koros	35	350	7.00
618	Gomare	34	340	7.20	541	Supere	44	440	7.80
619	Gomare	33	330	6.50	542	Guwal	44	440	5.80
621	Aager	31	310	7.70	543	Modhure	33	330	5.90
622	Petha	40	400	6.90	544	Leesu	83	830	7.10
623	Krishnasura	32	320	6.80	545	Krishnosura	42	420	6.30
625	Krishnasura	73	730	5.50	546	Shirish	375	3750	5.50
626	Hewak	60	600	7.40	547	Shirish	220	2200	5.50
627	Amora	50	500	6.80	548	Krishnosura	54	540	5.40
628	Amora	55	550	6.80	549	Gomari	45	450	6.00
629	Amora	45	450	6.80	550	Gomari	32	320	6.00
630	Amora	50	500	7.50	551	Amora	59	590	5.80
632	Rain Tree	50	500	7.10	552	Krishnosura	38	380	6.00
636	Guwal	90	900	7.30	553	Aahotgos	260	2600	7.20
638	Peepal	350	3500	5.80	554	Gomari	45	450	7.30
639	Krishnasura	30	300	5.80	555	Krishnosura	49	490	6.30
640	Krishnasura	33	330	5.80	556	Gomari	32	320	6.30
641	Krishnasura	35	350	6.10	557	Krishnosura	32	320	6.30
642	Gomare	70	700	5.80	558	Krishnosura	43	430	6.30
643	Himolu	230	2300	7.40	559	Krishnosura	210	2100	5.10
644	Sationa	120	1200	8.00	560	Gomari	155	1550	5.10
645	Gomare	137	1370	8.00	561	Gomari	140	1400	5.30
646	Sationa	125	1250	7.80	562	Gomari	170	1700	5.20
647	Gomare	33	330	5.80	563	Gomari	168	1680	5.10
648	Gomare	45	450	7.30	564	Gomari	175	1750	5.10
649	Krishnasura	35	350	6.30	565	Hunaru	65	650	5.20
650	Gomare	68	680	7.90	566	Rain tree	144	1440	7.40
652	Guwal	115	1150	6.30	567	Satiana	50	500	5.10
656	Kothal	110	1100	7.90	568	Peepal	360	3600	6.50
658	Gomare	30	300	6.80	569	Gomari	198	1980	7.00
659	Krishnasura	50	500	6.00	570	Gomari	150	1500	6.60
660	Krishnasura	55	550	7.10	571	Hunaru	105	1050	5.50
665	Krishnasura	50	500	5.50	572	Hunaru	63	630	7.40
666	Gomare	40	400	5.50	573	Gomari	91	910	5.50
667	Gomare	200	2000	5.80	574	Gomari	177	1770	7.40
668	Krishnasura	60	600	6.00	575	Gomari	163	1630	7.40
669	Krishnasura	60	600	7.80	576	Gomari	83	830	7.40
670	Gomare	32	320	6.60	577	Gomari	115	1150	5.40
671	Gomare	115	1150	6.30	578	Gomari	175	1750	7.40
672	Krishnasura	50	500	5.60	579	Gomari	270	2700	7.30

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
674	Madhuri	34	340	6.40	580	Hunaru	50	500	5.50
677	Madhuri	34	340	7.20	581	Gomari	140	1400	7.30
679	Amora	60	600	7.20	582	Gomari	130	1300	5.80
680	Gomare	63	630	7.10	583	Hunaru	95	950	5.30
681	Gomare	31	310	6.90	584	Krishnosura	78	780	5.90
683	Krishnasura	37	370	5.10	585	Aahotgos	69	690	5.90
684	Amora	130	1300	6.20	586	Krishnosura	50	500	5.80
685	Amora	110	1100	6.20	587	Krishnosura	190	1900	6.60
686	Rain Tree	40	400	5.80	588	Krishnosura	160	1600	6.60
687	Rain Tree	50	500	6.00	589	Krishnosura	60	600	5.70
688	Amora	54	540	6.30	590	Peepal	200	2000	6.50
689	Gomare	60	600	6.60	591	Gomari	103	1030	5.50
690	Krishnasura	75	750	6.30	592	Gomari	120	1200	6.60
691	Krishnasura	50	500	5.10	593	Gomari	130	1300	6.60
692	Rain Tree	60	600	6.20	594	Gomari	210	2100	6.60
693	Aamlokhi	30	300	6.50	595	Gomari	230	2300	5.80
694	Bokul	70	700	7.00	596	Gomari	180	1800	7.70
695	Himolu	420	4200	3.50	597	Gomari	135	1350	7.70
696	Krishnasura	35	350	6.50	598	Gomari	170	1700	7.20
697	Krishnasura	40	400	7.20	599	Gomari	190	1900	6.40
698	Krishnasura	105	1050	5.70	600	Gomari	187	1870	6.40
699	Krishnasura	140	1400	6.70	601	Satiana	135	1350	7.30
700	Mango	140	1400	7.80	602	Gomari	160	1600	5.10
701	Mango	40	400	7.80	603	Gomari	270	2700	5.60
702	Amora	70	700	7.40	604	Gomari	190	1900	6.90
703	Mango	120	1200	7.40	605	Gomari	180	1800	7.00
704	Amora	85	850	7.40	606	Gomari	135	1350	5.60
705	Petha	40	400	7.50	607	Gomari	102	1020	4.80
708	Krishnasura	36	360	5.70	608	Gomari	110	1100	4.80
712	Gomare	77	770	6.40	609	Gomari	210	2100	6.80
716	Guwal	65	650	8.00	610	Gomari	212	2120	5.40
717	Krishnasura	30	300	5.40	611	Gomari	85	850	6.50
718	Demoru	40	400	6.90	612	Gomari	40	400	6.50
719	Krishnasura	33	330	5.30	613	Gomari	102	1020	6.50
721	Rain Tree	32	320	7.80	614	Gomari	37	370	6.40
722	Krishnasura	50	500	5.30	615	Gomari	38	380	4.10
723	Neem	120	1200	7.50	616	Gomari	50	500	4.60
724	Arjun	60	600	7.50	617	Gomari	75	750	6.20
725	Bogore	55	550	7.50	618	Gomari	118	1180	6.20
726	Neem	35	350	6.60	619	Gomari	31	310	6.70
727	Krishnasura	90	900	7.40	620	Krishnosura	43	430	6.70
728	Neem	31	310	7.20	621	Bogori	73	730	5.10
729	Bhoklo	95	950	7.50	622	Azhar	52	520	7.00
730	Sopa	35	350	7.20	623	Azhar	59	590	7.00
731	Guwal	37	370	7.30	624	Azhar	40	400	7.00
732	Moadhs	90	900	7.30	625	Azhar	35	350	7.10
733	Rain Tree	70	700	6.40	626	Azhar	50	500	7.10
734	Peepal	300	3000	6.20	627	Azhar	49	490	7.10
735	Guwal	35	350	6.70	628	Azhar	60	600	7.30
736	Neem	34	340	7.00	629	Bogori	34	340	5.00

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
737	Keselo	55	550	6.30	630	Gomari	108	1080	7.40
738	Neem	80	800	6.60	631	Gomari	53	530	6.30
741	Myfuek	65	650	7.80	632	Gomari	165	1650	7.00
743	Guwal	50	500	6.90	633	Gomari	110	1100	7.10
744	Rain Tree	155	1550	6.90	634	Krishnosura	41	410	8.00
745	Rain Tree	33	330	6.60	635	Gomari	60	600	8.00
746	Jamuk	160	1600	6.90	636	Gomari	280	2800	5.60
747	Rain Tree	60	600	7.80	637	Krishnosura	37	370	5.70
748	Myfuek	160	1600	7.70	638	Guwal	89	890	5.50
749	Aager	34	340	7.30	639	Bandardewa	78	780	6.10
751	Neem	60	600	6.30	640	Krishnosura	36	360	8.00
752	Gomare	64	640	6.40	641	Gomari	40	400	5.30
753	Demoru	35	350	6.40	642	Gomari	32	320	4.00
755	Rain Tree	38	380	6.40	643	Krishnosura	36	360	7.10
757	Guwal	43	430	6.70	644	Gomari	50	500	4.00
758	Mango	110	1100	7.30	645	Krishnosura	57	570	5.70
760	Kothal	34	340	6.00	646	Aamlakhi	78	780	7.70
764	Krishnasura	50	500	5.20	647	Mango	58	580	7.60
766	Guwal	33	330	6.50	648	Amora	40	400	7.40
769	Myfuek	85	850	5.30	649	Krishnosura	30	300	6.00
771	Krishnasura	50	500	6.60	650	Peepal	340	3400	5.20
775	Guwal	115	1150	6.30	651	Krishnosura	40	400	5.00
779	Rain Tree	75	750	7.90	652	Gomari	238	2380	4.50
780	Himolu	270	2700	5.20	653	Gomari	250	2500	6.30
781	Aamlokhi	37	370	7.60	654	Rain tree	234	2340	5.50
782	Krishnasura	46	460	6.70	655	Arjun	40	400	8.00
784	Rain Tree	40	400	6.50	656	Rain tree	310	3100	6.10
785	Bogore	60	600	5.40	657	Rain tree	153	1530	6.10
786	Gomare	37	370	7.80	658	Rain tree	270	2700	6.20
787	Gomare	35	350	8.00	659	Amora	178	1780	4.70
788	Bogore	30	300	5.10	660	Rain tree	180	1800	6.00
789	Gomare	42	420	4.20	661	Amora	116	1160	5.00
790	Gomare	55	550	4.30	662	Gomari	225	2250	4.90
791	Gomare	70	700	4.40	663	Gomari	153	1530	5.40
792	Rain Tree	43	430	6.00	664	Gomari	198	1980	4.60
793	Demoru	60	600	6.60	665	Gomari	132	1320	4.60
794	Koros	34	340	7.40	666	Gomari	139	1390	5.20
795	Koros	33	330	7.40	667	Rain tree	225	2250	5.20
796	Rain Tree	40	400	6.60	668	Gomari	295	2950	4.50
797	Rain Tree	70	700	6.00	669	Gomari	205	2050	4.50
798	Gomare	100	1000	7.30	670	Rain tree	200	2000	4.50
799	Rain Tree	35	350	6.30	671	Rain tree	180	1800	5.80
801	Koros	37	370	7.90	672	Gomari	180	1800	5.00
802	Bhoklo	40	400	8.00	673	Gomari	160	1600	7.40
806	Bhoklo	90	900	7.40	674	Gomari	158	1580	6.40
807	Modor	38	380	6.30	675	Gomari	120	1200	5.50
810	Helikha	70	700	7.00	676	Gomari	155	1550	4.90
811	Neem	45	450	8.00	677	Gomari	140	1400	4.60
812	Mango	110	1100	7.10	678	Gomari	116	1160	7.90
817	Sationa	43	430	6.20	679	Gomari	130	1300	5.50

Left side					Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
826	Guwal	50	500	7.80	680	Gomari	170	1700	5.50
827	Guwal	60	600	7.80	681	Gomari	162	1620	7.90
828	Demoru	35	350	7.80	682	Rain tree	135	1350	7.80
829	Madhuri	50	500	7.90	683	Gomari	155	1550	6.50
830	Krishnasura	50	500	7.10	684	Amora	40	400	5.50
831	Krishnasura	40	400	7.10	685	Amora	48	480	5.50
836	Bogore	30	300	6.50	686	Gomari	215	2150	6.00
839	Kothal	90	900	7.90	687	Gomari	250	2500	7.90
841	Sationa	34	340	7.00	688	Gomari	165	1650	8.00
845	Kothal	80	800	7.80	689	Gomari	205	2050	6.40
847	Helikha	170	1700	7.00	690	Gomari	35	350	5.50
849	Kothal	140	1400	7.40	691	Krishnosura	38	380	5.70
853	Krishnasura	34	340	7.00	692	Krishnosura	30	300	5.60
857	Krishnasura	66	660	6.80	693	Rain tree	50	500	5.70
863	Kothal	80	800	6.50	694	Gomari	64	640	6.80
865	Guwal	90	900	6.80	695	Rain tree	34	340	6.50
866	Bhatgela	105	1050	6.50	696	Uklitas	108	1080	6.20
868	Amora	60	600	6.80	697	Krishnosura	38	380	5.10
872	Amora	60	600	6.60	698	Azhar	41	410	6.20

Right side				
Tree No.	Tree Name	Girth in cm	Girth in mm	Distance from C/L in m
699	Uklitas	280	2800	7.90
700	Rain tree	288	2880	7.90
701	Uklitas	310	3100	7.80
702	Uklitas	312	3120	7.80
703	Himolu	318	3180	6.60
704	Uklitas	302	3020	7.20
705	Uklitas	303	3030	7.10
706	Uklitas	307	3070	7.10
707	Uklitas	293	2930	7.10
708	Uklitas	308	3080	7.10
709	Supere	35	350	6.50
710	Rain tree	42	420	6.50
711	Rain tree	95	950	6.50
712	Guwal	55	550	6.50
713	Rain tree	48	480	7.90
714	Rain tree	35	350	7.70
715	Guwal	60	600	7.70
716	Krishnosura	38	380	6.40
717	Krishnosura	53	530	7.40
718	Supere	33	330	7.90
719	Supere	33	330	7.90
720	Amora	45	450	6.80
721	Amora	32	320	6.80
722	Krishnosura	41	410	7.10
723	Hilikha	44	440	7.20
724	Amora	32	320	6.80
725	Amora	40	400	6.80

Right side				
Tree No.	**Tree Name**	**Girth in cm**	**Girth in mm**	**Distance from C/L in m**
726	Amora	43	430	7.00
727	Amora	101	1010	6.80
728	Amora	45	450	8.00
729	Krishnosura	43	430	8.00
730	Krishnosura	47	470	8.00
731	Koros	57	570	6.20
732	Koros	70	700	5.50
733	Koros	33	330	6.00
734	Rain tree	35	350	5.00
735	Koros	41	410	4.60
736	Koros	35	350	6.00
737	Koros	45	450	5.40
738	Koros	31	310	7.60
739	Koros	33	330	7.60
740	Koros	43	430	7.80
741	Koros	34	340	7.80
742	Rain tree	32	320	6.50
743	Koros	40	400	7.50
744	Rain tree	45	450	5.50
745	Rain tree	57	570	7.50
747	Rain tree	77	770	8.00
748	Neem	60	600	8.00
749	Gohora	57	570	8.00
750	Supere	45	450	8.00
751	Dimaru	72	720	8.00
752	Rain tree	35	350	8.00
753	Myfuek	73	730	8.00
754	Rain tree	76	760	8.00
755	Jobaful	34	340	8.00
756	Rain tree	71	710	8.00
757	Amora	49	490	5.50
758	Rain tree	35	350	7.00
759	Rain tree	33	330	7.00
760	Rain tree	32	320	7.00
761	Rain tree	41	410	7.00
763	Neem	61	610	7.80
764	Rain tree	154	1540	7.80
765	Rain tree	31	310	7.80
767	Neem	50	500	7.80
769	Batghula	70	700	7.50
773	Supere	36	360	7.40
774	Supere	35	350	7.40
775	Outenga	300	3000	8.00
776	Aahotgos	290	2900	6.50

Annexure 12: For Workers Health & Safety in Common Operation and During Construction

House Keeping Practices

- Maintain washrooms and canteens clean
- Keep all walkways clear and unobstructed at all times
- Ensure that spillages of oil and grease does not take place and cleaned immediately, if any spillage take place.
- Stack raw materials and finished products clear of walkways or inside roads
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fitting clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water ponding
- Use metal bins for oily and greasy rags and store all flammable materials in appropriate bins, racks or cabinets. Ensure that the meal bins for storing oily and grease rags should be covered with lids.
- Ensure that protruding nails in boards or walls are moved or bent over so that they do not constitute a hazard to people
- 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 fire risks, e.g. paint stores, wood working area and others

Safe Layout in the construction plant, camp and quarry areas

- Arrange border to perimeter fencing
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit where necessary
- Provide adequate space/area for loading and unloading, storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous location
- Consider welfare facilities required
- Provide areas for dumping garbage and other waste materials, and also arrange for their regular clearance.
- Arrange storage, transport and use of fuel, other flammable materials and explosives in line with the license requirements to be obtained from appropriate authorities
- Plan emergency assembly points, fire escape routes and locate fire-fighting equipment
- Provide access roads and plant movement areas within the site.
- Ensure the availability of first aid facilities and display notices at the various works to show the location of these facilities
- Provide proper drainage and sewage & drainage facilities

Tree Felling

- Use hard hats during tree felling

- Ensure tools such as the axes are in good condition
- Determine proper foot and body position when using the axe. Do not cut above your head
- Wear appropriate foot protection
- Carry a first aid kit to the site
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines
- Prior to felling, determine the safest direction for the fall
- Determine the proper hinge size before directing the tree fall.

Noise Hazards and its control

- Note that indications of noise levels are:
  - You have to shout to be heard;
  - Your hearing is dulled just after work;
  - You get head noises or ringing in the ears after work;
  - You have difficulty hearing people while others are talking
- Use sound level meters to measure. If the sound level exceeds 85 dB(A), then preventive measures should be taken
- Make personnel aware of noisy areas by using suitable warning signs and insisting that ear protectors should necessarily be worn.
- Reduce noise at source by improved maintenance, replacing noisy machines, screening with noise absorbing material, making changes to the process/equipment, controlling machine speeds, ensuring that two noise-generating machines are not running at the same time, using cutting oils and hydraulic breakers.
- Appoint a competent person to carry out a detailed noise assessment of the site, designate ear protection zone, and give instructions on the necessary precautionary measures to be observed by site personnel, including the use of suitable type of ear protections.
- Wear and maintain ear muffs and ear plug as required
- In construction or repair work, noise should be kept to a low-level bearing in mind the disturbance to local residents.

Road Works

- The use of signage is most important to caution the road users of possible unsafe conditions due to the road works.
- Use the appropriate signage devices as required by the site conditions/situation. The devices include regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights.
- In using signs, make sure that they are (i) simple, easy-to-understand and convey only one message, (ii) luminescent and with reflective properties, and)iii) broad, prominent and of appropriate size.
- In using barricades, make sure that you keep traffic away from work areas and you guide the drivers to keep along a safe, alternative path.
- Ensure that proper personal protective equipment (PPE) is provided to all the workers.
- Cover existing road signs and install new ones at appropriate locations taking into account the distances that would be required and reaction times.

- Plan layout and traffic management so that hazard are not created.
- Deploy flagmen, who control traffic at the work areas. The flag should be 600mm x 600mm fastened to a 1m length staff.
- Flagmen should wear reflective safety vests along with hard hats
- If required, use wireless devices for flagmen to co-ordinate from either ends of the road, where works are being carried out.

Electrical hazards in construction areas

- Treat all wires as live wires
- Never touch dangling wires, but report them to your manager
- Unless you are a qualified electrician, do not attempt electrical repairs
- Never use electrical equipment if you hands are wet or you are standing in water
- If electrical equipment is sparking or smoking, turn the power off and report the condition to your supervisor
- Never use electrical wires that have physical damage
- Never allow equipment or traffic to run over electrical wires.

Use and Storage of Gas/LPG

- Store filled gas/LPG cylinder in the open area, i.e. outside of the building
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level in locations where gas/LPG is in use
- Avoid physical damage to the cylinders
- Never weld or cut on or near the cylinders
- 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
- Never use destenched gas/LPG on site.
- Make sure that there is no other unrelated fire in the vicinity of the cylinder

Operation of Excavators

- Ensure that excavators are operated by authorized persons who have been adequately trained.
- Prevent unauthorized movement or use of the excavators
- Check regularly and maintain the machine thoroughly
- Ensure that all relevant information, including those related to instruction, training, supervision and safe system of work are provided to the operators.
- 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 during operation
- Avoid operating the machine too close to an overhang, deep ditch or hope and be alter to potential carving edges, falling rocks and slides, rough terrain and obstacles.
- Locate and identify underground services by checking with all utility companies before excavations.
- Ensure that all excavations are supervised by experienced and competent persons.

- When reversing or in caste the operator's view is restricted, adequate supervision and signaling should 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.
- Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use improper linkage pins.
- Never dismount or mount a moving machine
- Work only with adequate ventilation and lighting
- Ensure that the protective front screen of the driving cabin is fixed in position during excavations to avoid eye injury to the operator.
- Ensure switch-off of the unattended vehicle.

Operation of trucks and dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles
- Enlist the help of another worker before reversing the vehicle
- Switch-off the engine of an unattended vehicle
- 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.
- Wear safety boots or shoes to avoid injuries during loading and unloading.
- Carryout periodic servicing to the manufacturer's requirements. All records of maintenance and repairs should be in writing or kept on site.
- Keep the vehicle tidy and the cabin free from tools and material, which might obstruct the controls.
- Keep to speed limits.
- No passenger should be carried on a dumper except the driver
- Never drive the vehicle across a slope
- Provide stop blocks when the vehicle is tipping into or running alongside excavations
- Do not overload the vehicle.
- Carry only well secured loads
- Park only on level ground, in neutral with the parking brake applied
- Never mount of dismount from a moving vehicle

Gas Welding

- Use the following personal protective equipment during welding
  - Face or hand shield fitted with filters
  - Goggles, particularly when chipping slag
  - Gloves long enough to protect wrists and forearms against heats, sparks, molten metal and radiation
  - High-top boots to prevent sparks from entering footwear.
- Screen of the work area with sturdy opaque or translucent materials because glare can cause eye injury.
- Key for opening the acetylene cylinder valve must be one the valve stem while the cylinder is in use so that the cylinder valve may be immediately shut-off in an emergency.

- Ventilate the workplace using air blowers and exhaust fans to remove poisonous fumes and gases that are given off during welding
- Take precautions against flying sparks and hot slag where welding is beign done near flammable materials and check the area before leaving.
- Do not weld material degreased with solvents until completely dry.
- Do not use gas cylinders for supporting work or as rollers
- Do not use oil grease on oxygen cylinder fittings
- Do not use cylinders with damaged valves.
- Do not use too much force if valves are stuck.
- Replace valve caps after use
- Search for leaks in equipment by using a solution of soapy water.
- Shut the cylinder valve if acetylene from a cylinder catches fire at the valve or regulator due to leakage at a connection.
- Treat all gas cylinders as "full" unless you are sure otherwise.
- Never attempt to transfer acetylene from one cylinder to another or attempt to refill an acetylene cylinder.
- Place portable fire extinguishers near the welding area
- Secure all cylinders against accidental displacement.
- Always lift gas cylinders. Do not slide them along the ground or drop them from trucks.
- Keep gas cylinders in vertical position both in storage and when in use
- Keep the work place dry, secure, free from combustible materials and obstruction.
- Store the acetylene and oxygen cylinders separately, and in a proper store.
- Keep the gas cylinders from source of heat, flammable materials, corrosive chemicals and fumes.

Manual Handling and Lifting

- Use mechanical equipment in lace of manual handling as far as possible.
- Assess the manpower required to handle or life the load safety and arrange the manpower accordingly.
- In handling hazardous materials, the workers shall be informed of the hazards and safety precautions.
- All relevant persons shall be trained in the proper methods of lifting and carrying.
- Where team work is required, select the persons whose ages and physical builds are compatible for teaming up. Coordinate the actions of the team members by giving necessary instructions.
- Always lighten or suitably shape the load for manual handling as far as possible Keep a look out for splinters, sharp edges, loose banding and nails.
- Clear path or obstruction and tripping hazards.
- Stack and secure goods safety on trucks, otherwise they fall off and injure passers-by.
- Use personal protective equipment such as gloves, safety shoes, etc.
- Adopt the following procedure when you lift a load:
- Stand close to the object. Have a firm footing with feet spread on either side of the road.
- Bend the knees and keep your back as straight as you can

- Grasp object firmly. Be sure grip will not slip
- Breath in and throw the shoulder back wards.
- Straighten the legs, continuing to keep the back as straight as you can.
- Hold object firmly close to the body
- Always lift smoothly. Avoid jerky motions. Turn with feet instead of twisting the back.

Handling chemicals and hazardous substances

- Always substitute hazardous chemicals with harmless or less hazardous ones wherever possible.
- Enclose the process using chemicals or provide other engineering controls such as local exhaust ventilation, a fume cupboard or a safety cabinet.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically
- Store chemicals classified as dangerous goods in a properly constructed and approved goods store. Keep proper records of all chemicals and hazardous substances delivered, stored and used on site.
- Consider unknown substances and liquids as dangerous until proven otherwise.
- All containers should be clearly labeled to indicate contents. Never use a wrongly labeled container for chemicals.
- Prohibit smoking in the vicinity of dangerous chemicals
- Ensure that you are wearing the correct personal protective equipment before you handle chemicals
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- When opening containers, hold a rag over the cap or lid, as some volatile liquids tend to spurt up when released.
- Wash before you eat and do not eat at the work place.
- If the skin is splashed with a chemical, rinse it immediately with plenty of clean water. Eye should be flushed thoroughly with water followed by immediate medical attention.
- Eye fountain, emergency shower and breathing apparatus should be available in the vicinity of the workplace.
- Safety instructions for handling emergency situations should be displayed prominently at both the storage and use locations.

First Aid

- Provide first aid boxes at every site
- Ensure that training on the use of the first aid box is provided to a handful of staff working in the site.
- Display the list of persons who are trained on providing first aid.
- Ensure that every first aid box is marked plainly “First Aid” in English and local language.
- The responsible person or first aider should replenish the contents of the first aid box as necessary.

Personal protective Equipment

- Consider the provision of personal protective equipment only after all measures for removing or controlling safety hazards have been provided reasonably impractical.
- Ensure that sufficient personal protective equipment are provided and that they are readily available for every person who may need to use them.
- The management should ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction and training in the proper use and care of any specific protective equipment where necessary
- Do not willfully misuse, interfere with or ill-treat any protective clothing and equipment provided.
- Ensure that the personal protective equipment are in good condition. Report immediately any damage to the management for replacement. Always keep the personal protective equipment as clean as possible.

Eye Protection

- Issue eye protection equipment where there is a foreseeable risk of eye injury
- Ensure an adequate supply of goggles/shields is available.
- Keep the goggles clean and make sure they are good fit.
- Do not watch welding operations unless your eyes are protected from the damaging effect of flash.

Head Protection

- No person shall enter a construction site unless he is wearing a suitable safety helmet
- Wear a safety helmet:
  - When there is the risk of being hit by falling objects
  - While on or near a construction site
  - During adverse weather conditions
  - When in any area designated as a “hard hat” area.
- Provide identification labels to all helmets in some way to prevent random exchange among wearers, with one helmet exclusive to each person.
- Inspect helmets for cracks of sign of impact or rough treatment before each usage. Destroy, remove and replace all worn, defective or damaged helmets.

Hearing Protection

- Provide ear plugs or ear muffs as required. Use re-usable ear plugs when the reduction required (15-25 dBA) is not excessive. Use ear muffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it cannot provide any.
- Provide disposable ear plugs for infrequent visitors and ensure that they are never re-used.
- Provide re-usable ear plugs for those who need to work continuously for a long period in a high noise area.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.

- Provide ear muffs for those who may need to get in and out of a high noise area frequently.

Respiratory Protective Equipment

- Wear suitable respirable for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags.
- Ensure that he explanators can provide adequate protection.
- Provide training to all persons using the 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
- Use safety footwear on site or in other dangerous areas
- 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.
- Keep shoe lace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding & cutting and manual handling of materials & 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, eating or smoking. Wash hands immediately after each operation on site when the situation warrants.

Fire Prevention, Fighting and Equipment

Before fire breaks cut

- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Train selected personnel to use these fire extinguishers
- Inspect fire extinguishers regularly and replace as necessary
- Fire escape route should be kept clear at all times and clearly indicated.
- Know the escape route and assembly point.
- Display escape route maps prominently on each floor
- Carryout fire drill regularly. Designate fire officers
- Install fire alarm wherever required and test regularly.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.

When fire breaks out.

- Alert all persons

- 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
- Fire officers to carryout head count at the assembly point.

Incident and accident investigations

- Carryout the investigation as quickly as possible.
- Conduct interviews with as many witnesses as necessary
- Do not rely on any one sole source of evidence
- Use the following tools:
- Checklists for obtaining basic and typical information for accidents
    - Notebook
    - Tape records
    - Camera
    - Measuring tape
    - Special equipment for the particular investigation
- Obtain answers to the following questions:
    - When did the accident occur?
    - Where did it occur?
    - Who was injured and what was damaged?
    - What caused the accident?
    - Why did it occur?
    - How could it have been prevented?
    - How can a recurrence be prevented?
- Prepare a short but sufficient investigation report that contains the following:
    - A summary of what had happened
    - A summary of events prior to the accident
    - Information gathered during the investigation
    - Details of witnesses
    - Information on injury or loss sustained
    - Conclusions and possible causes of the accident
    - Recommendations to prevent recurrence
    - Supporting materials (photos, diagrams, etc.)

Annexure 13: Guidelines for Siting, Management and Redevelopment of Construction Camps

Introduction

Construction camp accommodates a mix of activities, which are highly polluting in nature causing considerable environmental impact and its proper siting, management and redevelopment is crucial to avoid, minimize and mitigate those impacts. The ESMP clearly distinguishes between various impacts that may occur at various stages of the camp like (i) siting, (ii) setting up, (iii) operation and (iv) closure / redevelopment and provide respective mitigation measures to some extent. In addition to that, this guideline has been prepared to provide the Contractor with comprehensive and systematic information on various steps to be undertaken during these four stages, so that s/he can execute his/her role in an environmentally sound manner. Various mitigation measures have been synthesized into this guideline so that it serves as a single and standalone document for the Contractor.

Criteria for Siting the Camp

To the extent, possible barren land or wastelands shall be preferred during site selection and fertile land and agricultural land shall be avoided. All such sites must be above the HFL with adequate drainage facility. In areas prone to floods, cyclones, cloudbursts or heavy rainfall, selection of the site should be made keeping in mind the safety of the camp and the workers. In addition, the Contractor should take care of the following criteria for locating the site:

- A minimum of 250 m away from any major settlement or village in downwind direction.
- A minimum of 200 m of any major surface water course or body
- Not within 500 m from ecologically sensitive areas like wild life sanctuary, mangroves etc.
- Sufficiently wide access roads (at least 5.5 m Wide) for heavy vehicle movements

After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the CSE without which any activity shouldn't be started on the site

Finalization 0f Selected Site

After identification of the site, the Contractor should fill up the prescribed reporting format provided in ESMP and submit the same for approval to the CSE. Environmental Officer of CSE shall approve the selected site/s, 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 CSE. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost. After obtaining a written approval from the CSE for the selected site, the Contractor has to enter into an

agreement with the landowner to obtain his/her consent before commencing any operation / activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

Designing of Camp / Preparation of Layout Plan

The Contractor should design a layout plan of the camp with adequate space for (i) site office along with store room, rest area and sanitary facilities, (ii) plants, machineries, (iii) workshops, (iv) vehicle washing area, (v) fuel handling area, (vi) room for raw material unloading and stocking, (vii) space for storage and handling of solid wastes (viii) security cabin etc. The laying out of these should be undertaken in such a manner that it facilitates smooth functioning of both man and machine. Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be provided inside the camp, but at a safe distance from office. Electric safety practices shall be integrated/ incorporated during the lay-out plan preparation. Prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities. Cutting of trees should be minimum and the existing ones need to be integrated into the lay-out plan with proper planning. The roads within the camp should be well planned with adequate space for movement of vehicles and their parking.

Setting Up Of Construction Camp

Site preparation:

The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity should be allowed prior to the satisfactory completion of this activity as per guidelines in ESMP. Thereafter, the site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. A compound wall of 2.0 m height should be constructed all around the camp to prevent the trespassing of humans and animals. Green belt should be provided along the boundary and as detailed in the ESMP, it should be integrated with storm water drain and sedimentation trenches as given in annexure in ESMP. No. of trees planted should not be less than three times the number of trees cut. The approved layout plan should be strictly adhered to while setting up the camp.

Setting up of plants and machineries:

Adequate arrangements should be made for avoiding fu gitive emissions from plants and camp premises. This will include (i) control of air pollution through provision of in-built dust extraction systems like bag filter, damper and cyclone filter for bitumen hot mix plant, (ii) a chimney of appropriate height (as per SPCB guideline) from ground level attached with dust extraction system and scrubber for the hot mix plant, (iii) a chimney of appropriate height for the DG set (iv) water sprinkling facilities for the concrete batching plant, wet mix macadam plant as well as in the camp premises and (v) garden net to prevent fugitive emissions from storage place of cement and aggregates.. It has to be also ensured that

effluent from the sludge tank of the scrubber is recycled and reused and the sludge is used for land filling with top soil spread on it.

To ensure that noise levels are within the limit, all plants and machineries should have their own silencers or any other noise control devices. All pollution control devices should be provided with back-up power. Following conditions should be complied regarding the sound level conditions:

- The sound level (Leq) measured at a distance of 1 m from the boundary of the site shall not exceed 55dB (A) during day time (6am - 6pm) and 45 dB(A) during night time (6 pm - 6am).
- The total sound power level of the DG set shall be less than 96+10 log 10(KVA) dB(A) where KVA is the nominal power rating of DG set.
- The DG set shall be provided with acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A).
- The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area as per ESMP, so that oil and lubricants that may spill on the floor does not contaminate any soil or water body. In case of any oil spills, it should be cleaned properly. There shall also be provisions for storage of used oil until it is disposed as per comprehensive waste management plan prepared by Contractor and approved by CSE.

Sanitation Facilities:

Adequate no. of toilets shall be provided separately for males and females (depending on their strength), screened from those of men and provided with markings in vernacular language. All such facilities must have adequate water supply with proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75 cm. thick, 2 mm 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. 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. In the construction camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site.

Waste Disposal:

While preparing the layout plan, the Contractor should allocate adequate space for storage and handling of various wastes generated until they are disposed off in pre-identified disposal sites. The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and domestic 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.

First aid / safety facilities:

At every camp site, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Workplaces which are remote and far away from regular hospitals should have indoor health units with one bed for every 250 workers. Details of nearest clinics as well as major hospitals like their location, distance from camp, phone nos. facilities offered by the hospital should be displayed in the camp office at clearly visible location in a legible manner. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and firefighting equipments as detailed out in ESMP should be made available in the camp and provided to the staff / workers. Operation manuals and training should be provided to machine operators. Warning signs should be placed at accident prone areas as well as at the entrance of the site.

Training to workers:

Workers shall be trained in smooth operation of plants and machines, the irregular maintenance and various safety measures to be followed as well as about the need for adherence to these measures.

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 signboards 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 at those respective places. Once the construction camp is set up, the date of commissioning of the camp should be intimated to the Head Office and concerned District Office of the SPCB.

Operation of Construction Camp

During the operation phase of the camp it is important to ensure that all vehicles and machineries are maintained regularly and their PUC certificates are renewed at regular intervals. All pollution control devices should be monitored and maintained properly at

regular intervals. In case of process disturbance/ failure of pollution control equipment's, the respective units should be shut down and should not be restarted until the control measures are rectified to achieve the desired efficiency. All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter. Oil and grease waste generated from garages in construction camps should be drained out through oil interceptors and they should be maintained properly. Necessary arrangements should be made for regular sprinkling of water for dust suppression. Raw materials and products should be transported with proper cover to prevent spreading of dust.

Hygienic environment must be ensured by (i) provision of safe drinking water, (ii) proper maintenance of toilets including daily cleaning and disinfection using proper disinfectants, (iii) regular cleaning of drains by removing the silt and solid waste, (if any) and iv) appropriate waste management practices. While it is of utmost importance to ensure that firefighting equipment's like fire extinguishers are in working condition, it should also be monitored that construction workers use the personal protective equipment's provided to them and they are replaced when necessary. All these facilities should be inspected on a weekly basis to achieve the desired levels of safety and hygiene standards.

Environmental monitoring should be undertaken by the Contractor as stipulated in the ESMP. If any standard is set by SPCB for hot mix plant emissions, the Contractor should collect samples of emission from all the chimneys and analyse for the parameters at least once in a month. The CTE certificate from SPCB should be renewed at regular intervals and the same should be intimated to CSE. A register should be maintained at the site office which provides (i) a one page format for each migrant labourer which will give their personal profile (including name, age, sex, educational qualification, address, blood group and any major illness), along with a copy of any ID proof and an original photograph, (ii) a copy of the ID card of local labourers. A copy of the details of the migrant labourers should be submitted to the local police station.

Demobilization and Redevelopment 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. All the areas within the camp site should be levelled and spread over with stored top soil. Residual topsoil, if any will be distributed or spread evenly in plantation sites, on adjoining/near-by barren land or affected agricultural Jhum land adjacent to the RoW that has been impacted on account of any accidental spillage. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and CSE.

These activities should be completed by the Contractor prior to demobilization. Once the Contractor finishes his job, he needs to obtain a certificate from the owner, stating that the site has been redeveloped to his/her satisfaction and in tune with the agreement. Then following documents needs to be submitted to the CSE by the Contractor:

- Copy of approved site identification report

- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site. CSE shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the works completion' certificate is issued/recommended. The EO shall ensure through site inspection that the Contractor and CSE have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be. 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 PD office.

Annexure 14: Site Selection, Layout Plan and Basic Amenities at Labour Camp

Construction camps include, but may not be limited to, office space; laboratory; vehicle repair and maintenance workshop/s; fuel pumps and associated areas; parking spaces; accommodation or quarters for engineers, workers and labour; basic amenities such as mess, kitchen, potable water supply, first aid room, garbage collection and disposal facility, sanitation (toilets, bathrooms, washing areas and water supply for such needs), material stack yards or storage areas, circulation areas, hot-mix plants, batching plants, crushers and any other space/area associated with similar activities.

Site Selection Criteria

- No construction camp, including batching plant, hot mix plant, material stock yards and storage facility will be proposed within 500 m from a) a settlement/habitation b) water source c) reserved or protected forest limits d) migratory corridor of the wildlife to avoid conflicts and stress on local infrastructures facilities and natural resources.
- To the extent possible prime agricultural land shall be avoided.
- The location should have proper drainage facilities.
- Location criteria should finally confirm with the stipulated conditions with the Contract Agreement.
- Location of plants at down wind direction of settlement or dense forest area shall be avoided.

The selected site/s shall be approved by Environmental Officer of SC and PWD/PIU after considering the compliance with the ESMP clauses including the activities proposed for such a site. Contractor shall enclose copy of the agreement with the land owner and permission of the local authorities as may be applicable.

Layout

The lay-out of a construction camp site has to be carefully planned and prepared keeping in view the various activities proposed for a particular site. The lay-out plan will contain details pertaining to, but not limited to, the cardinal points, wind direction, dimensions, surrounding features and proposed activities. This shall be submitted with complete details provided in the prescribed reporting format to the SC for written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site.

The SC will carefully examine the proposals in light of the various ESMP and regulatory provisions and provide suggestions, as necessary. Both the Resident Engineer and the Environmental Officer shall be responsible for satisfactory and timely completion of this ESMP requirement.

Some of the principles governing a lay-out plan have been listed below:

- The prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities.
- Tree felling shall be avoided and it should be tried to integrate the existing ones into the lay-out plan with proper planning.
- The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity shall be allowed prior to the satisfactory completion of this activity.
- The proposed top soil stacking areas along with the quantity shall be clearly depicted on the lay-out plan.
- Proper circulation paths and parking spaces need to be provided.
- Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be screened at safe distance from office, mess and residential areas inside the camp.
- Proper fire safety precautions including safe exits, warning signs need to be provided at all locations including vulnerable areas like plant sites, kitchen, workshops, fuel pumps, stores etc.
- Electric safety practices shall be integrated/incorporated during the lay-out plan preparation.
- All sites must be graded and rendered free from depressions such that water does not get stagnant
- Appropriate drainage shall be provided. Typical layout plan is given in Figure-1.
- Camp site shall be fenced at direction with a security at the entry gate
- Contractor is encouraged to take up plantation along the boundaries of the camp with indigenous species.
- Contractor shall obtain permission from the concerned authority to fell tree(s) which is unavoidable.

BASIC AMENITIES/FACILITIES

Accommodation for Labours

The height of the workers and labour accommodation shall not be less than 3 m from floor level to lowest part of the roof. Sheds shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of 3.5 sq.m per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-cautions shall be adhered to. Cooking, sanitation and washing areas shall be provided separately as per the ESMP clauses.

Drinking Water

- Effective arrangements shall be made to provide and maintain at suitable points conveniently situated for all workers employed therein a sufficient supply of wholesome drinking water.
- All such points shall be legibly marked "drinking water" in a language understood by majority of the workers
- and no such point shall be situated within six meters of any washing place, urinal, latrine, spittoon, open drain carrying sludge or effluent or any other source of contamination.

- An adequate and convenient water supply, approved by the appropriate health authority, must be provided in each camp for drinking, cooking, bathing and laundry purposes.
- The drinking water system must be monitored in accordance with IS:10500 or the water quality parameters as prescribed by State Pollution Control Board. The water supply system used for cooking purposes that is drained seasonally must be cleaned, flushed, and disinfected prior to use. Furthermore, a water sample of satisfactory bacteriologic quality

First Aid

- Contractor shall provide and maintain First Aid facility so as to be readily accessible during all working hours. First-Aid boxes or cupboards equipped with the prescribed contents, and the number of such boxes or cupboards to be provided and maintained shall not be less than one for every one hundred and fifty workers ordinarily employed
- Nothing except the prescribed contents shall be kept in a first-aid box or cupboard
- Each first-aid box or cupboard shall be kept in the charge of a separate responsible person who holds a certificate in first-aid treatment recognised by the Government of Assam /Govt of India and who shall always be readily available during the working hours

Canteen Facilities

A cooked food canteen on a moderate scale shall be provided by the Contractor for the benefit of workers wherever it is considered necessary.

Sanitation Facilities

- There shall be adequate supply of water, close to latrines and urinals.
- Within the precincts of every workplace, latrines and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water - flushed latrines connected with a water borne sewage system, all latrines shall be provided with dry - earth system (receptacles) which shall be cleaned at least two times daily kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year
- Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located so as to be accessible, without any individual passing through any sleeping room
- Where the toilet rooms are shared, such as in multifamily shelters and in barracks type facilities, separated toilet rooms must be provided for each sex. These rooms must be distinctly marked “for men” and “for women” by signs printed in English and in the native language of the persons occupying the camp, or marked with easily understood pictures or symbols. If the facilities for each sex are in the same building, they must be separated by solid walls or partitions extending from the floor to the roof or ceiling

- The floor from the wall and for a distance not less than 15 inches measured from the outward edge of the urinals must be constructed of materials impervious to moisture where
- water under pressure is available, urinals must be provided with an adequate water flush
- Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit

Scale of Accommodation in latrines and Urinals[2]

There shall be provided within the precincts of every work place, latrines and urinals in an accessible place, and the accommodation, separately each for this, shall not be less than at the following scale:

No. Of seats

- 2 – where number of persons does not exceed 50
- 3 – where number of persons exceed 50 but does not exceed 100
- 3 – additional each 100 persons or part thereof

In particular cases, the Engineer shall have the power to increase the requirement, wherever necessary.

Anti-malarial Precautions

Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer, including filing up any pits which may have been dug by him. Contractor shall supply mosquito repellent to his labours, drivers, operators and labours through contract agency.

Child Labour Provision

The Contractor shall not emply Child Labour for any works or in any manner under the execution of the construction of the project road at any time.

Awareness and Education of HiV/AIDS and Malaria

The Contractor shall provide/carry out HIV/AIDS and Malaria awareness through fixing appropriate poster in local language with sketch and training programme to its labour and management, at least twice per year during the construction period.

Waste Disposal

The sewage system for the camp must be designed, built and operated to the satisfaction of the concerned State Govt. Department so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place. Compliance with the relevant legislation must be strictly adhered to.

[2] Source: Civil Works Contract for Widening & Strengrhing of existing carriageway to 2-lane road from Jagatpur to Duhuria (km 0/0 to km 49/0 of MDR), OWD, Government of Odisha.

- Garbage bins must be provided in the camps and regularly emptied and the garbage disposed off in a hygienic manner to the satisfaction of relevant norms.
- Septic system shall be constructed for collection and treatment of sanitary sewage. It should be installed in areas of stable soils that nearly level, well drained and permeable, with enough separation between the drained field and the ground water table or other receiving areas. Discharge of septic tank, if any, shall confirm to standard3.
- Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta by incineration at the workplace shall be made by means of a suitable incinerator approved by the local medical health or municipal authorities. Alternatively, excreta may be disposed off by putting a layer of night soils at the bottom of permanent tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (by then it will turn into manure).
- On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the the Engineer.

Annexure 15: Generic Guidelines for Environment Friendly Construction Methodology

The contractor shall be deemed to have acquainted himself with the requirements of all the current statutes, ordinances, by-laws, rules and regulations or their instruments having the force of law including without limitation those relating to protection of the environment, health and safety, importation of labour, demolition of houses, protection of environment and procurement, transportation, storage and use of explosives, etc.

Protection of Environment

- The contractor will take all necessary measures and precautions and ensure that the execution of the works and all associated operations on site or offsite are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in ESMP.
- The contractor will take all measures and precautions to avoid any nuisance or disturbance to inhabitants arising from the execution of works.
- All liquid waste products arising on the sites will be collected and disposed of at a location on or off the sites and in a manner that will not cause either nuisance or pollution.
- The contractor will at all times ensure that all existing water courses and drains within and adjacent to the site are kept safe and free from any contamination.
- The contractor will submit details of his temporary drainage work system (including all surface channels, sediment traps, washing basins and discharge pits) to the Project Implementation Unit / Supervising Engineer for approval prior to commencing work on its construction.
- The contractor will arrange all the equipment in good condition to minimize dust, gaseous or other air-borne emissions and carry out the works in such a manner as to minimize adverse impact on air.
- Any vehicle with an open load-carrying area used for transporting potentially dust-producing material will have properly fitted side and tailboards. Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a clean tarpaulin in good condition.
- The contractor will take all necessary measures to ensure that the operation of all mechanical equipment and condition processes on and off the site will not cause any unnecessary or excessive noise, taking into account applicable environmental requirements.
- The contractor will take necessary measures to maintain all plant and equipment in good condition.
- Where the execution of the works requires temporary closure of road to traffic, the contractor will provide and maintain temporary traffic diversions subject to the approval of the CSE.
- Where the execution of the works requires single-lane operation on public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the CSE.

- Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them to the satisfaction of CSE prior to commencing the work, in that area.
- Contractor will install asphalt plants and other machineries away from the populated areas as per laid down regulations.
- Permit for felling of trees will be obtained from the forest department before the execution of any work.
- Trees and plants going to be uprooted by Contractor's own requirement will be duly compensated and maintained up to 3 years.
- Mist sprays should be provided at appropriate places for preventing dust pollution during handling and stockpiling of stones and loose earth.
- Over Burden (OB) waste dumps shall be sprayed with water, as they are the major source of air borne particulate matter.
- OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion. The frequency of sprinkling should be fixed as per the seasonal requirement and in consultation with engineer.
- Regular water spraying on haulage roads during transportation of construction material by water sprinklers. The frequency of sprinkling should be fixed as per the seasonal requirements in consultation with engineer.
- Transfer point for transporting construction material shall be provided with appropriate hoods/ chutes to prevent dust emissions.
- Dumping of construction material should be from an optimum height (preferably not too high), so as to reduce the dust blow.
- Innovative approaches of using improvised machinery designs, with in-built mechanism to reduce sound emission.
- Procurement of drill loaders, dumbers and other equipment with noise proof system in operator's cabin.
- Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.
- Regular and proper maintenance of noise generating machinery including the transport vehicles to maintain noise levels.
- Provisions should be made for noise absorbing pads at foundations of vibrating equipments to reduce noise emissions.

Quarry Operations

The Contractor shall obtain materials from quarries only after the consent of the Forest Department or other concerned authorities and in consultation with the supervision Engineer. The quarry operations shall be undertaken within the purview of the rules and regulations in force.

Prevention of Water Courses from Soil Erosion and Sedimentation / Siltation

The Contractor shall apply following mitigation measures to prevent sedimentation and pollution of watercourses.

- To prevent increased siltation, if need be existing bridges maybe widened downstream side of the water body;

- Cement and coal ash should be stacked together, fenced by bricks or earth wall, and kept away from water, to prevent leachate formation and contamination of surface and ground water;
- If need be, slope of the embankments leading to water bodies should be modified and rechannelised to prevent entry of contaminants into the water body;
- During construction silt fencing could be used along the road at all canals and rivers to prevent sediments from the construction site to enter into the watercourses.

Pollution from Hot-Mix Plants and Batching Plants

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations. The Contractor shall take every precaution to reduce the levels of noise, vibration, dust and emissions from his plants and shall be fully responsible for any claims for damages caused to the owners of property, fields and residents in the vicinity.

Arrangement for Traffic During Construction

The Contractor shall at all times carry out work on the road in a 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 SE, 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 SE regarding traffic arrangements during construction.

Traffic Safety and Control

- Where subject to the approval of the Engineer the execution of the works requires temporary closure of road to traffic use, the Contractor shall provide and maintain temporary traffic diversions. The diversion shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.
- Where the execution of the works requires single-lane operation on public road, the Contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.
- With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the Contractor shall submit details of his proposals to the Engineer for approval not less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon as possible after the date of the Letter of Acceptance.
- The color, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the CSE.
- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the

information and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the CSE.

- 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 shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the SE. At night, the passage shall 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 shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the SE 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 shall be of design and of reflectory type, if so directed by the SE.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall 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, as directed by the Engineer.

Health and Safety

The contractor shall take all measures and precautions necessary to ensure the health, safety and welfare of all persons entitled to be on the site. Such precautions shall include those that, in the opinion of the Engineer, are reasonable to prevent unauthorized entry upon the site and to protect members of the public from any activities under the control of the contractor. The contractor's responsibilities shall include but not be limited to:

- The provision and maintenance of the Contractor's Equipment in a safe working condition and the adoption of methods of work that are safe and without risks to the health of any person entitled to be on the site.
- The execution of suitable arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage, transport and disposal of articles and substances,
- The provision of lighting, including standby facilities in the event of failure, that, in the opinion of the Engineer, is adequate to ensure the safe execution of any works that are to be carried out at right.
- The provision of protective clothing and safety equipment, with such personnel and equipment and such information, instruction, training and supervision as are necessary to ensure the health and safety at work of all persons employed on or entering on the site in connection with the works, including the Engineer's supervisory staff, all in accordance with the laws.
- Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced provided with proper caution signs and marked with lights at night

to avoid accidents. Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

- The contractor shall not use or generate any materials in the works, which are hazardous to the health of persons, animals or vegetation. Where it is necessary to use some substances, which can cause injury to the health of workers, the Contractor shall provide protective clothing or appliances to his workers.
- The contractor will take all measures necessary to safeguard the health; safety and welfare of all persons entitled to be on site and will ensure that works are carried out in a safe and efficient manner.
- The contractor will provide, and ensure the utilization of appropriate safety equipment for all workmen and staff employed directly or indirectly by the contractor. Such safety equipment will include but not be limited to the safety helmets, goggles and other eye protectors, hearing protectors, safety harnesses, safety equipment for working over water, rescue equipment, fire extinguishers and first-aid equipment. The personnel working at vulnerable locations at site will wear safety helmets and strong footwear.
- The contractor will provide an adequate number of latrines and other sanitary arrangements at areas of the site where work is in progress and ensure that they are regularly cleaned and maintained in a hygienic condition.
- Provision should be made to provide OHS orientation training[4] to all new employees to ensure they are apprised of basic site rules or work at / on site and of personal protection and preventing injury to fellow employees.
- OHS training should consist of basic hard awareness, site specific hazards, safe work practices and emergency procedures for file, evacuation and natural disaster as appropriate.

First Aid

- The provision and maintenance of suitably equipped and staffed first aid stations throughout the extent of the works to the satisfaction of the Engineer. The contractor shall allow in his prices and the responsible for the costs of all such site welfare arrangements and requirements.
- Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers. At construction camps and at all workplaces first aid equipment and nursing staff must be provided. Since many of the workplaces may be far away from regular hospitals, an indoor health unit having one bed facility every 250 workers needs to be provided.
- Adequate transport facilities for moving the injured persons to the nearest hospital must also be provided in ready to move condition.
- The first-aid units apart from an adequate supply of sterilized dressing material should contain other necessary appliances as per the factory rules.

Maintenance

- All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition and be protected from rubbish accumulation.

[4] IFC's EHS Guidelines 2007

- Each structure made available for occupancy shall be of sound construction, shall assure adequate protection against weather, and shall include essential facilities to permit maintenance in a clean and operable condition. Comfort and safety of occupants shall be provided for by adequate heating, lighting, ventilation or insulation when necessary to reduce excessive heat.
- Each structure made available for occupancy shall comply with the requirements of the Uniform Building Code. This shall not apply to tent camps.

Maintenance of Diversions and Traffic Control Devices

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the SE. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary.

Community Health and Safety

Hazards posed to the public while accessing project facilities may include:

- Physical trauma associated with failure of building structures
- Burns and smoke inhalation from fires
- Injuries suffered as a consequence of falls or contact with heavy equipment
- Respiratory distress from dust, fumes, or noxious odors
- Exposure to hazardous materials

Reduction of potential hazards should be accomplished by:

- Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions
- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire. To this end, all project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads

Arrangement for transportation of hazardous material

The procedures for transportation of hazardous materials (Hazmats) should include:

- Proper labelling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
- Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labeling of the containers. The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility
- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures

Community Notification

If a local community may be at risk from a potential emergency arising at the facility, the company should implement communication measures to alert the community, such as:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advice on selecting an appropriate protection option

Annexure 16: Guidelines for Stripping, Stocking, Preservation of Top Soil[5]

When so directed by the Engineer, the topsoil from all areas of cutting and from all areas to be covered by embankment foundation shall be stripped to specified depths not exceeding 150 mm and stored in stockpiles of height not exceeding 2 m for covering embankment slopes, cut slopes and other disturbed areas where re-vegetation is desired. Topsoil shall not be unnecessarily subjected to traffic either before stripping or when in a stockpile. At least 10% of the temporary acquired area shall be earmarked for storing top soil. The stockpile shall be designated such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the stockpile is restricted to 2 m. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

Prior to stripping the topsoil, all trees, shrubs etc. shall be removed along with their roots, with approval of the Engineer. Where directed, the topsoil removed and conserved shall be spread over cut slopes, shoulders and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of topsoil, in order to provide satisfactory bond. The depth of topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 100 mm.

Topsoil generated during excavation of the borrow area shall be stockpiled at a certain location within the borrow area and the same shall be used for rehabilitation/reinstatement of the borrow area, when operation of the borrow area is over.

[5] Clauses 301.3.2 and 305.3.3 of MoRTH Specifications for Roads and Bridges Works (Fifth Edition) 2013

Annexure 17: Baseline Monitoring Results

Air Quality Monitoring Results

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.
☎ +91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-02	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	18/01/2020
Sample Drawn By	:	Mr. Kashmir Singh Pal
Sample description	:	Ambient Air
Sampling Location	:	Moranhat Town
Sampling Plan &Procedure	:	SOP-AAQ/08
Analysis Duration	:	24/01/2020 TO 29/01/2020
Ambient Temperature (°C)	:	16
Average Flow Rate of SPM (m^3/min)	:	1.10
Average Flow Rate of Gases (lpm)	:	1.0
Sampling Instrument Used	:	Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler
Weather Condition	:	Clear

TEST RESULT

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM_{10})	IS:5182 Part-XXIII	47.4	µg /m^3	100.0
2.	Particulate Matter ($PM_{2.5}$)	CPCB Volume – 1 / Grav	17.8	µg /m^3	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.6	µg /m^3	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	12.3	µg /m^3	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.410	mg/m^3	4.0

Notes:
1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

CHECKED BY **AUTHORIZED SIGNATORY**

Laboratory : GT-20, Sector-117, Noida, Gautam Budh Nagar - 201301
E. : noida.laboratory@gmail.com, info@noidalabs.com W.: www. noidalabs.com

NOIDA TESTING LABORATORIES

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-03	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	18/01/2020
Sample Drawn By	:	Mr. Mayur Dhadwad
Sample description	:	Ambient Air
Sampling Location	:	No 8 Darkhastor
Sampling Plan &Procedure	:	SOP-AAQ/08
Analysis Duration	:	24/01/2020 TO 29/01/2020
Ambient Temperature (°C)	:	20
Average Flow Rate of SPM (m^3/min.)	:	1.10
Average Flow Rate of Gases (lpm)	:	1.0
Sampling Instrument Used	:	Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler
Weather Condition	:	Clear

TEST RESULT

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM_{10})	IS:5182 Part-XXIII	47.9	µg /m^3	100.0
2.	Particulate Matter ($PM_{2.5}$)	CPCB Volume – 1 / Grav	17.5	µg /m^3	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.6	µg /m^3	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	12.9	µg /m^3	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.440	mg/m^3	4.0

Notes:

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-04	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	19/01/2020
Sample Drawn By	:	Mr. Bhuban Chetry
Sample description	:	Ambient Air
Sampling Location	:	Bailungbheti
Sampling Plan &Procedure	:	SOP-AAQ/08
Analysis Duration	:	24/01/2020 TO 29/01/2020
Ambient Temperature (°C)	:	22
Average Flow Rate of SPM (m^3/min.)	:	1.10
Average Flow Rate of Gases (lpm)	:	1.0
Sampling Instrument Used	:	Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler
Weather Condition	:	Clear

TEST RESULT

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM_{10})	IS:5182 Part-XXIII	48.3	µg /m^3	100.0
2.	Particulate Matter ($PM_{2.5}$)	CPCB Volume – 1 / Grav	17.3	µg /m^3	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.1	µg /m^3	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	13.2	µg /m^3	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.420	mg/m^3	4.0

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
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CHECKED BY

AUTHORIZED SIGNATORY

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Noise Level Monitoring Results

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+91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Noise	N-240120-02	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAL

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	18/01/2020
Sample Drawn By	:	Mr. Kashmir Singh Pal
Sample Received On	:	24/01/2020
Sample description	:	Ambient Noise
Sampling Location	:	Moranhat Town
Sampling Time	:	24 hrs
Analysis Duration	:	24/01/2020 TO 29/01/2020

TEST RESULT

S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	44.8	dB(A)	Industrial Area	75	70
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	34.5	dB(A)	Commercial Area	65	55
				***Residential Area**	**55**	**45**
				Silence Zone	50	40

Notes:

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Noise	N-240120-03	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	18/01/2020
Sample Drawn By	:	Mr. Tejas Dwivedi
Sample Received On	:	24/01/2020
Sample description	:	Ambient Noise
Sampling Location	:	No 8 Darkhastor
Sampling Time	:	24 hrs
Analysis Duration	:	24/01/2020 TO 29/01/2020

TEST RESULT

S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	44.3	dB(A)	Industrial Area	75	70
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	32.2	dB(A)	Commercial Area	65	55
				***Residential Area**	**55**	**45**
				Silence Zone	50	40

Notes:

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Analysing for an Assured Future

TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Noise	N-240120-04	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample Drawn On	:	19/01/2020
Sample Drawn By	:	Mr. Kashmir Singh Pal
Sample Received On	:	24/01/2020
Sample description	:	Ambient Noise
Sampling Location	:	Bailungbheti
Sampling Time	:	24 hrs
Analysis Duration	:	24/01/2020 TO 29/01/2020

TEST RESULT

S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	45.2	dB(A)	Industrial Area	75	70
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	33.4	dB(A)	Commercial Area	65	55
				***Residential Area**	**55**	**45**
				Silence Zone	50	40

Notes:

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Groundwater Quality Testing Results

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
GROUND WATER	W-240120-02	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Asom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample received on	:	24/01/2020
Sample Drawn By	:	Mr. Kashmir Singh Pal
Sample Quantity	:	2.0 Lt.
Analysis Duration	:	24/01/2020 TO 29/01/2020
Sample Description	:	Ground Water (Hand Pump)
Sample Location	:	Moranhat

BACTERIOLOGICAL PARAMETERS

S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	7.4	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS-3025(P-10), 1984
5.	Total Hardness (as $CaCO_3$)	mg/l	200	600	106.38	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	42.23	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.36	APHA 22nd Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as $CaCO_3$)	mg/l	75	200	33.53	IS:3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as $CaCO_3$)	mg/l	30	100	5.5	APHA 22nd Ed., 3500-Mg(B)

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11.	Sulphate (as SO_4)	mg/l	200	400	25.17	IS:3025(Pt-24) 1986, Reaff. 2003
12.	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.18	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No Relaxation	<0.01	IS: 3025 (P- 56)
14.	Alkalinity as ($CaCO_3$)	mg/l	200	600	137.85	IS:3025(Pt-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	230.07	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.2	3025(P-38), 1989
18.	BOD (at 27°C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Microm/hos/cm	-	-	353.95	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	25.89	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	14.86	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.08	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

PARAMETERS CONCERNING TOXIC SUBSTANCES

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
GROUND WATER	W-240120-03	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample received on : 24/01/2020
Sample Drawn By : Mr. Tejas Dwivedi
Sample Quantity : 2.0 Lt.
Analysis Duration : 24/01/2020 TO 29/01/2020
Sample Description : Ground Water (Hand Pump)
Sample Location : No.8 Darkhastor

BACTERIOLOGICAL PARAMETERS

S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	7.3	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS:3025(P-10), 1984
5.	Total Hardness (as $CaCO_3$)	mg/l	200	600	80.70	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	23.58	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.74	APHA 22nd Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as $CaCO_3$)	mg/l	75	200	21.29	IS:3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as $CaCO_3$)	mg/l	30	100	6.7	APHA 22nd Ed., 3500-Mg(B)
11.	Sulphate (as SO_4)	mg/l	200	400	24.5	IS:3025(Pt-24) 1986, Reaff. 2003
12.	Nitrate (as NO_3)	mg/l	45	No Relaxation	1.00	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No	<0.01	IS: 3025 (P- 56)

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				Relaxation		
14.	Alkalinity as ($CaCO_3$)	mg/l	200	600	130.21	IS:3025(Pt-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	190.90	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.2	3025(P-38), 1989
18.	BOD (at 27°C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Microm/hos/ cm	-	-	293.69	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	26.25	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	9.45	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.09	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

PARAMETERS CONCERNING TOXIC SUBSTANCES						
S. No.	**Parameters**	**Unit**	**Limit (as per IS:10500-2012)**		**Result**	**Test Method**
			Desirable Limit	**Permissible Limit**		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
GROUND WATER	W-240120-04	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAL

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample received on	:	24/01/2020
Sample Drawn By	:	Mr. Mayur Dhadwad
Sample Quantity	:	2.0 Lt.
Analysis Duration	:	24/01/2020 TO 29/01/2020
Sample Description	:	Ground Water (Hand Pump)
Sample Location	:	Dighalia No.2

BACTERIOLOGICAL PARAMETERS

S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	6.4	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS:3025(P-10), 1984
5.	Total Hardness (as $CaCO_3$)	mg/l	200	600	86.38	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	13.47	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.15	APHA 22nd Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as $CaCO_3$)	mg/l	75	200	22.58	IS:3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as $CaCO_3$)	mg/l	30	100	7.3	APHA 22nd Ed., 3500-Mg(B)
11.	Sulphate (as SO_4)	mg/l	200	400	21.47	IS:3025(Pt-24) 1986, Reaff. 2003
12.	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.27	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No	<0.01	IS: 3025 (P- 56)

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				Relaxation		
14.	Alkalinity as ($CaCO_3$)	mg/l	200	600	140.14	IS.3025(Pt-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	189.46	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.2	3025(P-38), 1989
18.	BOD (at 27°C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Microm/hos/cm	-	-	291.48	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	27.58	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	12.71	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.07	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

PARAMETERS CONCERNING TOXIC SUBSTANCES						
S. No.	**Parameters**	**Unit**	**Limit (as per IS:10500-2012)**		**Result**	**Test Method**
			Desirable Limit	**Permissible Limit**		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

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5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

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Surface Water Quality Testing Results

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Test Report of	Report Code	Date of Issue
SURFACE WATER	W-240120-08	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample received on	:	24/01/2020
Sample Drawn By	:	Mr. Mayur Dhadwad
Sample Quantity	:	2.0 Lt.
Analysis Duration	:	24/01/2020 TO 29/01/2020
Sample Description	:	Surface Water (River)
Sample Location	:	Deroi Alikinor

MICROBIOLOGICAL REQUIREMENT

RESULTS			
S.No.	Parameter	Test Method	Results
1.	*Total Faecal Coliform Bacteria(MPN/100ML)*	IS-1622	476

ORGANOLEPTIC & PHYSICAL PARAMETERS

S.NO.	Parameter	Test method	Result	Unit
2.	Colour	IS-3025(P-04)	<5.0	Hazen Unit
3.	Odour	IS-3025(P-05)	Agreeable	-
4.	Turbidity	IS-3025(P-10)	2.4	NTU
5.	pH value	IS-3025(P-11)	7.20	-
6.	Total dissolve solid (TDS)	IS-3025(P-16)	153.23	mg/l
7.	Electrical Conductivity	IS-3025(P-14)	235.74	µs/cm
8.	Total Suspended Solid	IS-3025(P-17)	1.6	mg/l
9.	Total Dissolve Oxygen	IS-3025(P-38)	4.4	mg/l
10.	Biological Oxygen Demand	IS-3025(P-44)	3.2	mg/l
11.	Phosphate Content	IS-3025(P-31)	0.048	mg/l

GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS

S.NO.	Parameter	Test method	Result	Unit
12.	Total Ammonia	IS: 3025 (P- 34)	<0.1	mg/l
13.	TKN	IS: 3025 (P- 34)	0.41	mg/l
14.	Boron (as B)	IS: 3025 (P- 57)	BDL	mg/l
15.	Calcium (as Ca)	IS: 3025 (P- 40)	15.47	mg/l
16.	Chloride (as Cl)	IS: 3025 (P- 32)	23.17	mg/l
17.	Copper (as Cu)	IS : 3025 (P-42)	<0.05	mg/l
18.	Fluoride (as F)	IS: 3025 (P-60)	0.29	mg/l
19.	Phenol Content	IS: 3025 (P-43)	<0.001	mg/l
20.	Iron (as Fe)	IS: 3025(P-53)	0.034	mg/l
21.	Magnesium (as mg)	IS: 3025 (P-46)	12.47	mg/l

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22.	Nitrate (as NO_3)	IS: 3025 (P- 34)	4.27	mg/l
23.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
24.	Sulphate (as SO_4)	IS: 3025 (P- 24)	23.56	mg/l
25.	Alkalinity (as Ca CO_3)	IS: 3025 (P- 23)	94.23	mg/l
26.	Total hardness (as $CaCO_3$)	IS: 3025 (P- 21)	89.80	mg/l
27.	Zinc (as Zn)	IS: 3025 (P- 49)	0.28	mg/l
28.	Sodium (as Na)	IS-3.25(P-45)	13.24	mg/l
29.	Potassium (as K)	IS-3.25(P-45)	4.51	mg/l

Parameters Concerning Toxic Substances:

S.NO.	Parameter	Test method	Result	Unit
30.	Cadmium (as Cd)	IS-3025(P-41)	<0.001	mg/l
31.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
32.	Lead (as Pb)	IS-3025(P-47)	<0.01	mg/l
33.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
34.	Total Chromium (Cr)	IS-3025 (P-52)	<0.05	mg/l
35.	Mercury (as Hg)	IS-3025 (P-48)	<0.0001	mg/l

Notes:

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
SURFACE WATER	W-240120-09	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sample received on	:	24/01/2020
Sample Drawn By	:	Mr. Tejas Dwivedi
Sample Quantity	:	2.0 Lt.
Analysis Duration	:	24/01/2020 TO 29/01/2020
Sample Description	:	Surface Water (River)
Sample Location	:	Disng Kinar Bongali

MICROBIOLOGICAL REQUIREMENT

RESULTS			
S.No.	**Parameter**	**Test Method**	**Results**
1.	*Total Faecal Coliform Bacteria(MPN/100ML)*	IS-1622	472

ORGANOLEPTIC & PHYSICAL PARAMETERS

S.NO.	Parameter	Test method	Result	Unit
2.	Colour	IS-3025(P-04)	<5.0	Hazen Unit
3.	Odour	IS-3025(P-05)	Agreeable	-
4.	Turbidity	IS-3025(P-10)	2.4	NTU
5.	pH value	IS-3025(P-11)	7.14	-
6.	Total dissolve solid (TDS)	IS-3025(P-16)	150.07	mg/l
7.	Electrical Conductivity	IS-3025(P-14)	230.87	µs/cm
8.	Total Suspended Solid	IS-3025(P-17)	1.5	mg/l
9.	Total Dissolve Oxygen	IS-3025(P-38)	4.6	mg/l
10.	Biological Oxygen Demand	IS-3025(P-44)	3.6	mg/l
11.	Phosphate Content	IS-3025(P-31)	0.075	mg/l

GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS

S.NO.	Parameter	Test method	Result	Unit
12.	Total Ammonia	IS: 3025 (P- 34)	<0.1	mg/l
13.	TKN	IS: 3025 (P- 34)	0.52	mg/l
14.	Boron (as B)	IS: 3025 (P- 57)	BDL	mg/l
15.	Calcium (as Ca)	IS: 3025 (P- 40)	17.23	mg/l
16.	Chloride (as Cl)	IS: 3025 (P- 32)	23.24	mg/l
17.	Copper (as Cu)	IS : 3025 (P-42)	<0.05	mg/l
18.	Fluoride (as F)	IS: 3025 (P-60)	0.27	mg/l

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19.	Phenol Content	IS: 3025 (P-43)	<0.001	mg/l
20.	Iron (as Fe)	IS: 3025(P-53)	0.025	mg/l
21.	Magnesium (as mg)	IS: 3025 (P-46)	12.45	mg/l
22.	Nitrate (as NO_3)	IS: 3025 (P- 34)	4.46	mg/l
23.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
24.	Sulphate (as SO_4)	IS: 3025 (P- 24)	21.25	mg/l
25.	Alkalinity (as Ca CO_3)	IS: 3025 (P- 23)	91.36	mg/l
26.	Total hardness (as $CaCO_3$)	IS: 3025 (P- 21)	94.12	mg/l
27.	Zinc (as Zn)	IS: 3025 (P- 49)	0.25	mg/l
28.	Sodium (as Na)	IS-3.25(P-45)	12.21	mg/l
29.	Potassium (as K)	IS-3.25(P-45)	4.41	mg/l

Parameters Concerning Toxic Substances:

S.NO.	Parameter	Test method	Result	Unit
30.	Cadmium (as Cd)	IS-3025(P-41)	<0.001	mg/l
31.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
32.	Lead (as Pb)	IS-3025(P-47)	<0.01	mg/l
33.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
34.	Total Chromium (Cr)	IS-3025 (P-52)	<0.05	mg/l
35.	Mercury (as Hg)	IS-3025 (P-48)	<0.0001	mg/l

Notes:

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Soil Quality Testing Results

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Quality Analysis	S-240120-02	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sampling Location	:	Moranhat Town
Sample Received On	:	24/01/2020
Sample Drawn by	:	Mr. Bhuban Chetry
Sample Description	:	Soil
Sample Drawn On	:	18/01/2020
Sample Quantity	:	1.0 Kg
Weather Conditions	:	Normal
Analysis Duration	:	24/01/2020 TO 29/01/2020

S.No.	PARAMETERTS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.42	-
2.	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	53	µmhos/cm
3.	Porosity	STP/SOIL	24.28	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	48.91	% by mass
6.	Clay	STP/SOIL	43.74	% by mass
7.	Silt	STP/SOIL	7.35	% by mass
8.	Nitrogen	STP/SOIL	1790	mg/1000g
9.	Potassium (as K)	STP/SOIL	85.82	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.84	% by mass
12.	Moisture Retention capacity	STP/SOIL	36.2	% by mass
13.	Infiltration Rate	STP/SOIL	241	mm/hr
14.	Sulphates	STP/SOIL	23.25	mg/100gm
15.	Sodium Sulphates	STP/SOIL	13.85	mg/1000g
16.	Calcium Sulphates	STP/SOIL	8.74	mg/1000g
17.	Bulk Density	STP/SOIL	1.25	gm/cm³

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Quality Analysis	S-240120-03	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sampling Location	:	No.8 Darkhastor
Sample Received On	:	24/01/2020
Sample Drawn by	:	Mr. Kashmir Singh Pal
Sample Description	:	Soil
Sample Drawn On	:	18/01/2020
Sample Quantity	:	1.0 Kg
Weather Conditions	:	Normal
Analysis Duration	:	24/01/2020 TO 29/01/2020

S.No.	PARAMETERTS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.66	-
2.	Electrical Conductivity at 25°C (1:5suspension)	IS:2720(Part-21)	52	µmhos/cm
3.	Porosity	STP/SOIL	24.27	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	49.25	% by mass
6.	Clay	STP/SOIL	42.56	% by mass
7.	Silt	STP/SOIL	8.19	% by mass
8.	Nitrogen	STP/SOIL	1870	mg/1000g
9.	Potassium (as K)	STP/SOIL	84.29	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.74	% by mass
12.	Moisture Retention capacity	STP/SOIL	35.2	% by mass
13.	Infiltration Rate	STP/SOIL	249	mm/hr
14.	Sulphates	STP/SOIL	22.14	mg/100gm
15.	Sodium Sulphates	STP/SOIL	13.24	mg/1000g
16.	Calcium Sulphates	STP/SOIL	9.36	mg/1000g
17.	Bulk Density	STP/SOIL	1.17	gm/cm^3

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Quality Analysis	S-240120-04	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name	:	Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam
Sampling Location	:	Deroi Alikinor
Sample Received On	:	24/01/2020
Sample Drawn by	:	Mr. Bhuban Chetry
Sample Description	:	Soil
Sample Drawn On	:	19/01/2020
Sample Quantity	:	1.0 Kg
Weather Conditions	:	Normal
Analysis Duration	:	24/01/2020 TO 29/01/2020

S.No.	PARAMETERTS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.56	-
2.	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	57	µmhos/cm
3.	Porosity	STP/SOIL	21.24	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	48.32	% by mass
6.	Clay	STP/SOIL	43.36	% by mass
7.	Silt	STP/SOIL	8.32	% by mass
8.	Nitrogen	STP/SOIL	1860	mg/1000g
9.	Potassium (as K)	STP/SOIL	82.35	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.87	% by mass
12.	Moisture Retention capacity	STP/SOIL	35.32	% by mass
13.	Infiltration Rate	STP/SOIL	241	mm/hr
14.	Sulphates	STP/SOIL	23.48	mg/100gm
15.	Sodium Sulphates	STP/SOIL	13.54	mg/1000g
16.	Calcium Sulphates	STP/SOIL	8.45	mg/1000g
17.	Bulk Density	STP/SOIL	1.17	gm/cm³

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Annexure 18: Prediction of Air Quality along the Project Road

The impacts in the operation stage for air would be less severe as compared to that in construction phase. After completion of road improvement works, smoothened new pavement and widened roads reduce fugitive dust emissions. This reduced vehicular emission is due to uniform speed and less frequent acceleration and deceleration of vehicles. With reduction in the levels of CO_2, NO_x, CO and HC emissions from the operating vehicles, there will be extensive saving on fuel consumption. Air pollution can be an important concern due to increase in number of vehicles on the improved roads and poor maintenance of vehicles. To assess the likely concentrations at the critical location along the project road corridors, the prediction of the pollutant concentrations has been carried out for project using CALINE-4, a dispersion model based on Gaussian Equation. The current and projected traffic volume of **A30_1 (Moran to Disang Kinar Bengali)** road has been used for the prediction. CALINE-4 is a dispersion model developed by the California Department of Transportation for the prediction of concentrations of critical atmospheric pollutants (CO, NO_x and $PM_{2.5}$) along the highways. This model employs a mixing zone concept to characterize pollutant dispersion over the highway and can be used to predict the pollutant concentrations for receptors up to 500 m of the corridor. The model uses the baseline data on existing concentration of pollutants and estimates the incremental emissions due to the project.

Modeling using Caline 4

The **Job Parameters** for Modelling are as follows:

Molecular weight: Molecular weight input to the model based on the chosen pollutant ("n/a" for Particulates).

Settling Velocity: The rate at which a particle falls with respect to its immediate surroundings. This parameter is an optional parameter for Particulates only ("n/a" for Carbon Monoxide and Nitrogen Dioxide). Only a value greater than or equal to zero can be used in the model.

Deposition Velocity: The rate at which a pollutant can be adsorbed or assimilated by a surface. This parameter may be specified for all pollutants but it is optional and only a value greater than or equal to zero can be used in the model.

Aerodynamic Roughness Coefficient: Also known as the Davenport-Wieringa roughness-length. These choices determine the amount of local air turbulence that affects plume spreading.

- Rural: Roughness Coefficient = 10 cm
- Suburban: Roughness Coefficient = 100 cm
- Central Business District: Roughness Coefficient = 400 cm
- Other: Use Table A below as guidance to select an appropriate value:

Table A: Aerodynamic Roughness Coefficient defined for various types of landscapes.

Roughness Coefficient (cm)	Landscape Type
0.002	Sea, paved areas, snow-covered flat plain, tide flat, smooth desert
0.5	Beaches, pack ice, morass, snow-covered fields
3	Grass prairie or farm fields, tundra, airports, heather
10	Cultivated areas with low crops and occasional obstacles (such as bushes)
25	High crops, crops with varied height, scattered obstacles (such as trees or hedgerows), vineyards
50	Mixed far fields and forest clumps, orchards, scattered buildings
100	Regular coverage with large obstacles, open spaces roughly equal to obstacle heights, suburban houses, villages, mature forests
≥200	Centers of large towns or cities, irregular forests with scattered clearings

Run Type: Different choices are associated with different hourly average wind angle(s) and averaging times (for CO concentrations only). (Wind angle is the angle between the roadway link and the wind direction. CALINE4 calculates the angles based on data in the Link Geometry and Run Conditions tabs.)

- Standard - Calculates 1-hr average CO, NO_2, or PM concentrations at the receptors. The user must input a wind direction on the Run Conditions tab.
- Worst-Case Wind Angle - Calculates 1-hr average CO or PM concentrations at the receptors. The model selects wind angles that produce the highest concentrations at each of the receptors. This is the most appropriate choice for most users.
- Multi-Run - Calculates 8-hr average CO concentrations at the receptors. The user must input wind angles for each hour.
- Multi-Run/Worst-Case Hybrid - Calculates 8-hr average CO concentrations at the receptors. The model selects wind angles that produce the highest CO concentrations at each of the receptors.

Altitude above sea level: The altitude above mean sea level used in the mass concentration-to volumetric (ppm) conversion. This value must be between zero and 10,000 meters (32,808 feet).

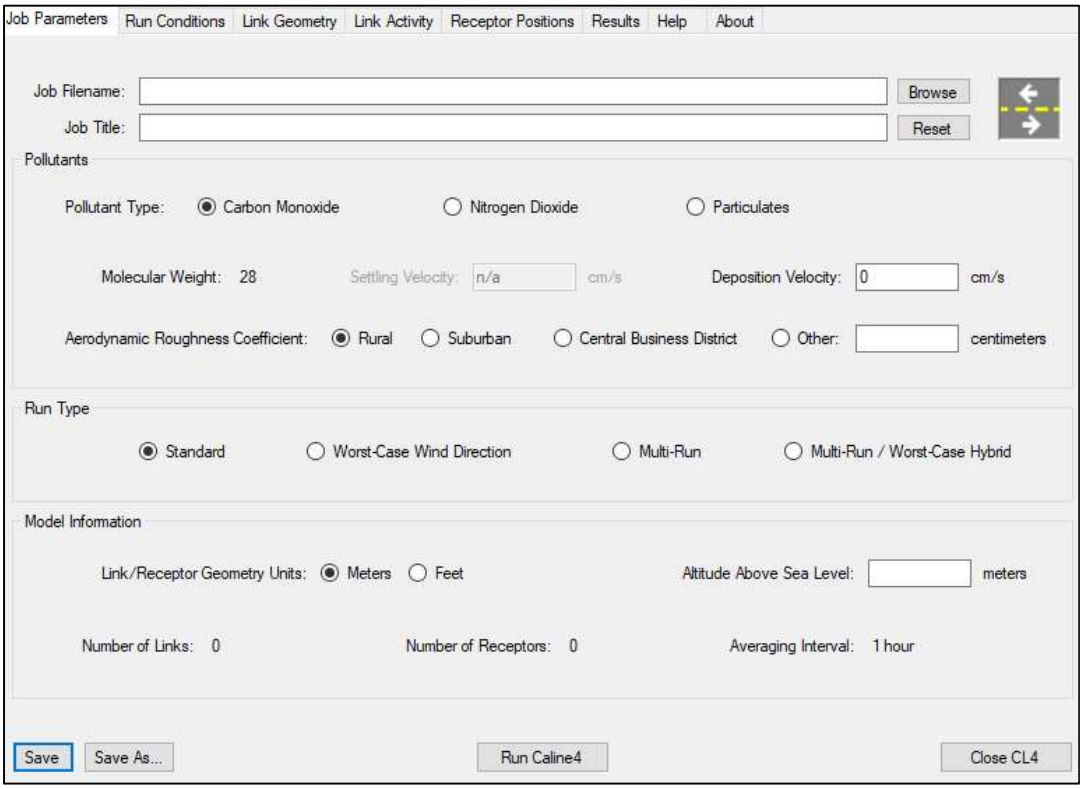


Figure A: Job Parameters Tab

The **Run Conditions** for Modelling are as follows:

Wind Speed: Expressed in meters per second (m/s). It is recommended that users input worst-case wind speeds based on observations, or that represent the minimum choice available for CALINE4 (0.5 m/s). Alternatively, EPA (1992) recommends a value of 1 m/s as the worst-case wind speed.

Wind Direction: The direction from which the wind is blowing, measured clockwise in degrees from the north (0 = north, 90 = east, 180 = south, 270 = west). Most users should opt for the "Worst-Case Wind Direction" choice on the Job Parameters tab. If "Worst-Case" is selected, CALINE4 does not use this input.

Wind Direction Standard Deviation: The statistical standard deviation of the Wind Direction, sometimes termed "sigma theta." **Table B** below provides guidance for specifying this option. CALINE4 requires this value range to be between 5 and 60 degrees.

Table B: Worst-case meteorological inputs for the estimation of 1-hr CO concentrations (Nokes and Benson, 1985).

Time Period	Geographic Location	Wind Speed (m/s)	Standard Deviation (degrees)	Stability Class	Temperature Adjustment
Morning (6-10 a.m.)	Coastal	0.5	10	G (7)	+5°F
	Coastal Valley	0.5	20	G (7)	+5°F
	Central Valley	0.5	5	G (7)	+5°F
	Mountain	0.5	30	G (7)	+5°F
Midday (10 a.m.-5 p.m.)	Coastal	1.0	25	D (4)	+10°F
	Coastal Valley	9.6	30	D (4)	+10°F
	Central Valley	0.5	20	D (4)	+10°F
	Mountain	0.9	30	D (4)	+10°F
Evening (5-9 p.m.)	Coastal	0.5	10	G (7)	+5°F
	Coastal Valley	0.5	10	G (7)	+5°F
	Central Valley	0.5	5	G (7)	+5°F
	Mountain	0.5	30	G (7)	+5°F
Nighttime (9 p.m.-6 a.m.)	Coastal	0.5	5	G (7)	+0°F
	Coastal Valley	0.5	15	G (7)	+0°F
	Central Valley	0.5	10	G (7)	+0°F
	Mountain	0.5	20	G (7)	+0°F

Atmospheric Stability Class: A measure of the turbulence of the atmosphere. Values 1 through 7 correspond to the standard definitions for stability class A through E. **Table B** above guides this choice. Stability class E (or 7) represents the most stable conditions. The stability class entered will affect permissible wind speed. A table of valid wind speeds is presented on the Run Conditions tab for reference.

Mixing Height: The altitude at which thermal turbulence occurs due to solar heating of the ground. This concept is discussed further in elementary meteorological textbooks. Reasonable values for the worst-case mixing height rarely have a significant impact on CALINE4 model results. If an extreme condition could be anticipated at the project location, the local air district should be consulted for guidance. A mixing height of greater than or equal to 5 meters must be entered.

Ambient Temperature: The ambient air temperature is needed to convert mass to volumetric concentration. A temperature that reflects wintertime conditions should be selected, expressed in degrees Celsius.

Ambient CO Concentration (Pollutant Type = Carbon Monoxide): This measure reflects the pre-existing background level of carbon monoxide, expressed in parts per million (ppm). CALINE4 adds the pre-existing and modeled CO concentrations together to determine the total impact at each receptor.

When NO_2 is selected under the pollutant type option, several additional parameters are required in the Run Conditions tab, including ambient concentrations of ozone (O_3), nitrogen monoxide (NO), and nitrogen dioxide (NO_2), NO_2 photolysis rate constant, and tailpipe NO_2 to nitrogen oxide (NO_x) emissions ratio.

Ambient O_3 Concentration (Pollutant Type = Nitrogen Dioxide): This measure reflects the pre-existing background level of O_3, expressed in parts per million.

Ambient NO Concentration (Pollutant Type = Nitrogen Dioxide): This measure reflects the pre-existing background level of NO, expressed in parts per million.

Ambient NO_2 Concentration (Pollutant Type = Nitrogen Dioxide): This measure reflects the pre-existing background level of NO_2, expressed in parts per million.

NO_2 Photolysis Rate Constant (Pollutant Type = Nitrogen Dioxide): The rate constant for the photo dissociation of NO_2, in units of 1/second. The modeled NO_2 concentrations decrease when the photolysis rate constant values increase; therefore, CALINE4 provides the most conservative estimates for NO_2 concentrations when the photolysis rate constant is set to zero through CL4.

NO_2/NO_x Ratio (Pollutant Type = Nitrogen Dioxide): The ratio of tailpipe NO_2 emissions versus NOx emissions. Note that CL4 and CALINE4 require input of g/mi NO_x emissions factors (on the Link Activity tab) when modeling NO_2 concentrations. This ratio is used to convert NOx emissions to NO_2 emissions from on-road vehicles.

Ambient PM Concentration (Pollutant Type = Particulates): This measure reflects the pre-existing background level of particulates, expressed in micrograms per cubic meter. Note that $PM_{2.5}$ and PM_{10} are not directly differentiated in the CL4 user interface or the CALINE4 model functions, but the input parameters, such as ambient concentrations and emission factors, would be different when modeling $PM_{2.5}$ and PM_{10} respectively using CL4 and CALINE4. CALINE4 adds the pre-existing and modeled $PM_{2.5}$ or PM_{10} concentrations together to determine the total impact of $PM_{2.5}$ or PM_{10} at each receptor.

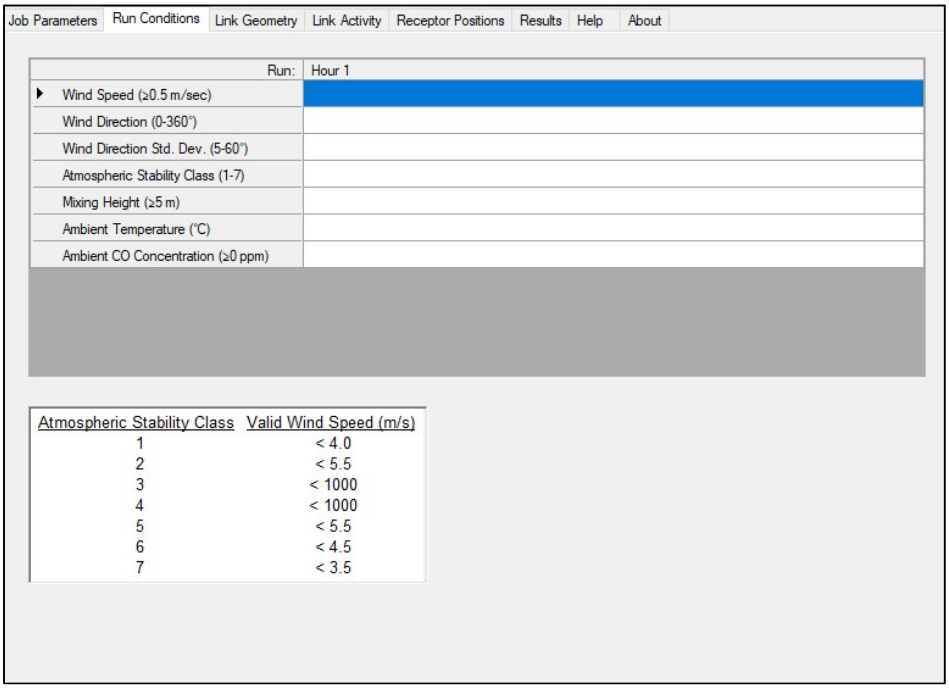


Figure B: Run Conditions Tab

The **Link Geometry** for Modelling are as follows:

The Link Geometry tab contains a matrix to define the roadway network to be modeled. Each row in the matrix defines a single link. Links are defined as straight-line segments. The distance between the centerline of the curved roadway and the straight-line link should be no greater than 3 meters.

Link Description: The user may define a 12-character description for the link. If more than 12 characters are entered, only the first 12 characters will be used.

Link Type: The user must select one of the following five choices to define the type of roadway that each link represents.

- **At-Grade:** For at-grade links, CALINE4 does not permit the plume to mix below ground level, which is assumed to be at a height of zero. The height of the link above ground level, defined in the Link Height cell, must be zero.
- **Fill:** For fill links, CALINE4 assumes that air flow follows the surface terrain, undisturbed. Link Height for fill sections must be between zero and 10 meters (32.81 feet).
- **Depressed:** For depressed links, CALINE4 increases the residence time of an air parcel in the mixing zone. The residence time increases in relation to the depth of the roadway depression. (Mixing zone = width of traffic lane(s) plus 3 meters on each side.) In such a case, estimated concentrations adjacent to the mixing zone are higher than those for an equivalent at-grade or fill section. The modeled concentrations drop more rapidly downwind of a depressed link because vertical mixing increases with residence time. Link Height for depressed links must be between zero and -10 meters (-32.81 feet).
- **Bridge:** For bridge sections, CALINE4 allows air to flow above and below the link. The plume is permitted to mix downward from the link, until it reaches the distance defined in the Link Height cell. Link Height must be between zero and 10 meters (32.81 feet).
- **Parking Lot:** Parking lot links should coincide with the parking lot access ways. The CALINE4 algorithms adjust to account for the reduced mechanical and thermal turbulence anticipated from slow-moving, cold-start vehicles. Link Height must be zero for parking lot links.

Endpoint Coordinates: Links are defined as straight-line segments. The entire length of each link should deviate no further than 3 meters from the centerline of the actual roadway. The endpoint coordinates, (X1, Y1) and (X2, Y2), define the positions of link endpoints.

- The units (meters or feet) are user-specified on the Job Parameters tab.
- The length of each link must be greater than the mixing zone width (see below).
- The user must define the link geometry and receptor positions with a consistent Cartesian coordinate system. The position of the coordinate system origin is arbitrary and at the user's discretion. The y-axis should be oriented north-south, with values increasing in the northward direction. The x-axis should be oriented east-west, with values increasing in the eastward direction. The choice of magnetic

north, true north, or some other approximation is at the user's discretion. However, the wind direction must be defined on the Run Conditions tab according to the same definition of north.

- A map of the link geometry is shown on the Receptor Positions tab.

Link Height: For all link types except bridges, Link Height represents the height of the link above the surrounding terrain. Ground level is defined at zero meters or feet. The units of measure (meters or feet) are user-specified on the Job Parameters tab.

For at-grade links, the link height may be defined as zero. For fill links, the link height must be greater than zero. However, CALINE4 always treats the link as though its height is zero; the input does not affect CALINE4 model calculations. Therefore, the positive link height value should be used for documentation purposes. For depressed links, the depth of the depression should be indicated as a negative value. For parking lots, the link height should be defined as zero. For bridges, Link Height defines the height of the bridge above the surface beneath it (a positive value).

Mixing Zone Width: Mixing Zone is defined as the width of the roadway, plus 3 meters on either side. The minimum allowable value is 10 meters, or 32.81 feet. It must also be greater than or equal to the link length.

Canyon/Bluff Mix: The Canyon/Bluff Mix feature has not been validated with field measurements. Only very rare circumstances warrant its use; use extreme caution with this feature. Users of this feature should be thoroughly familiar with dispersion modeling, the key reference (D. B. Turner, Workbook of Atmospheric Dispersion Estimates, Environmental Protection Agency, 1970), and the CALINE4 source code. All other users should leave the Canyon/Bluff input values set to zero, which disables the feature. If it is entered, Canyon/Bluff Mixing Width must be greater than one-half of the Mixing Zone Width.

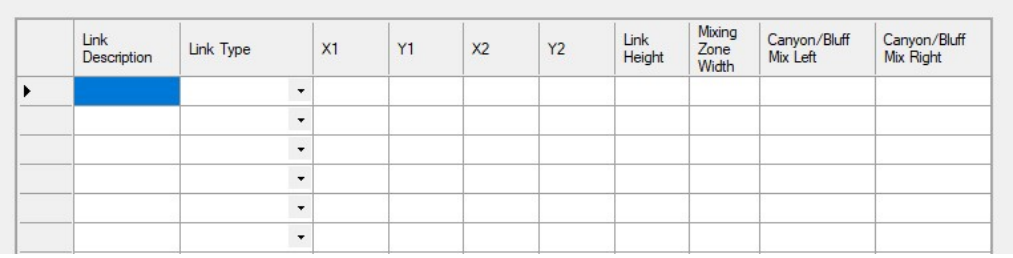


Figure C: Link Geometry Tab

The **Link Activity** for Modelling are as follows:

The Link Activity tab defines the level of traffic and auto emission rate observed at each link.

Traffic Volume: Hourly traffic volume anticipated to travel on each link, in units of vehicles per hour. If a multi-run scenario is selected for modeling CO concentrations, traffic volume must be defined for each of the eight hours.

Emission Factor: The weighted average emission rate of the local vehicle fleet, expressed in terms of grams per mile, per vehicle, for the pollutant selected. When modeling NO2

concentrations, NOx emission factors should be specified for each link. Emission rates vary by time of day. Therefore, if a multi-run scenario is selected (for modeling CO concentrations), emission factors must be defined for each of the eight hours.

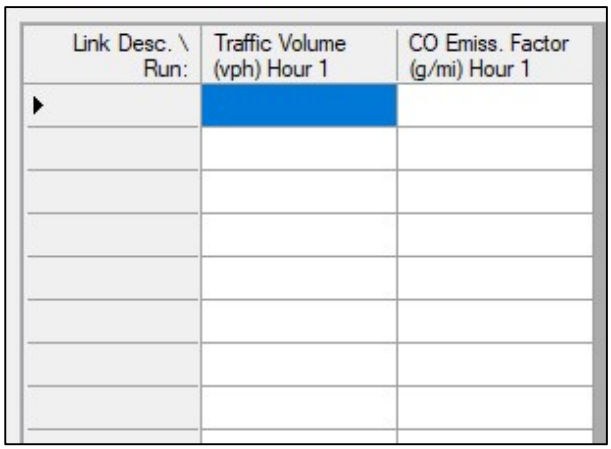


Figure D: Link Activity Tab

The **Receptor Position** for Modelling are as follows:

The Receptor Positions tab contains data inputs for all receptor positions and displays a diagram of the link geometry and receptor positions. Receptors should be defined with the same Cartesian coordinate system and units of measure as the link geometry. For each receptor, space is provided for an 8-character description, the X-coordinate, the Y-coordinate, and the height (Z). The maximum number of receptors is 20.

The links and receptors will appear on the map in their relative positions but the X and Y scales are not necessarily equal. The user may enlarge the map window by dragging the program edges or by clicking the program maximize button. Zooming in to view map details may be performed by using the mouse to drag a box around the area of interest while holding the left button. To un-zoom, click the left mouse button once

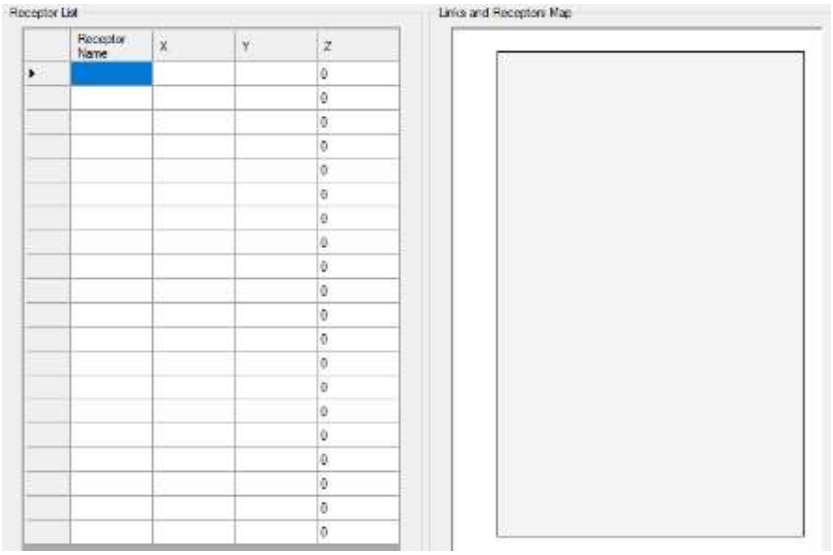


Figure C: Receptor Position Tab

Input Parameters:

- **Traffic Data**: The fleet wise traffic volumes for the present study have been taken from the detailed project report of the project. The annual average daily traffic (AADT) data is available for the proposed road through traffic survey. CALINE 4 model needs hour average traffic volume. The total traffic hour volume is further categorized into two-wheeler, four-wheeler, light commercial vehicles (LCV), bus, high commercial vehicles (HCVs) based on traffic survey at existing road.

Table C: Predicted Traffic Volume Per Hour

Year	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck	PCU
2020	113	1	44	6	4	11	419
2025	152	1	59	7	5	16	561
2030	203	2	79	10	6	21	750
2035	272	2	106	13	8	28	1004
2040	364	3	142	18	12	38	1344

- **Meteorological data:** The study was conducted to predict pollutant concentration for worst-case meteorological conditions. The meteorological parameters such as wind speed, wind direction, wind direction standard deviation, temperature, mixing height and stability condition are used in model.

Table D: Meteorological Data for CALINE 4

Sr. No.	Baseline Condition Input Data	Values
1	Altitude above Sea Level	120.874 m
2	Wind speed	2.22 m/s
3	Wind direction	North-East (45^{O})
4	Ambient Temperature	$25^{O}C$

- **Road Geometry:** In the CALINE-4 model the entire length of the selected road section is divided into various road links. The division of sections into links has been done in such a way, so that the link can be fairly considered straight stretch of road having homogenous geometry with uniform road width, height and alignment. The coordinates of end points of links specify the location of the links in the model. The maximum number of links in each road section can be 20. The mixing zone width calculated for selected highway corridor is 7m+ 3m + 3m = 13 m as per guideline provided in CALINE4 model.
- **Emission Factors:** Emission factor is one of the important input parameters in CALINE-4 model. In the present study, the emission factors specified by the Automotive Research Association of India (ARAI) have been used for calculation of

weighted emission factors. These emission factors have been expressed in terms of type of vehicles and type of fuel used (for petrol and diesel driven passenger cars). Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas there are different categories of vehicles (viz. two wheelers, cars, bus and trucks) with different year of manufacture and fuel used, it is essential that a single value representing the equivalent or weighted emission factors for all the vehicles is input into the model. The emission factor used to estimate WEF are given below. The traffic data are not available for fuel types, therefore average emission factor is used in this study.

Table E: Emission factors for different types of Vehicle (ARAI, 2007)

Pollutants	Unit	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck
CO	g/km	1.036	1.25	1.281	1.56	8.03	6
NOx	g/km	0.312	0.219	0.04	0.288	0.548	1.24
PM2.5	g/km	0.021	0.01	0.031	0.061	0.133	0.133

These projected vehicles would generate various air pollutants among which CO, NO_2 and Particulate matter ($PM_{2.5}$) would be modelled to predict their quantities for the year 2020, 2025, 2030, 2035 and 2040. PM_{10} and SO_2 concentration need not be modeled as sulfur content in the fuel used in vehicles is quite less to cause a significant SO_2 emission. SO_2 emission factor for vehicles is not included in the report on "Emission Factor development for Indian Vehicles" by The Automotive Research Association of India (ARAI). Similarly, Particulate Matter in the emission factor considers only $PM_{2.5}$ as coarse fraction $PM_{2.5}$ to PM_{10} is negligible in vehicle exhaust.

The predicted results of CALINE4 have been tabulated below. Considering the predicted future traffic according to normal growth rate for the years 2020, 2025, 2030, 2035 and 2040, CO, NO_2, and $PM_{2.5}$ levels are predicted. These levels were within the limiting standards as specified in National Ambient Air Quality Standards.

CO Modeling:

Input:

Sr. No.	Input Parameter	Value
1	Molecular weight	28
2	Aerodynamic Roughness Coefficient	Rural
3	Run Type	Worst-case Wind Direction
4	Altitude Above Sea Level	120.874 m
5	Wind Speed	2.22 m/sec
6	Wind Direction	45^O
7	Wind Direction Standard Deviation	20

Sr. No.	Input Parameter	Value
8	Atmospheric Stability Class	4
9	Mixing Height	5
10	Ambient Temperature	25^{O}C
11	Ambient CO Concentration	0.38 ppm

Output:

Table: Predicted Concentrations of CO in the study location (ppm)

Year	Distance from Road Edge (m)				
	10	**20**	**50**	**100**	**200**
2020	0.5	0.5	0.5	0.5	0.4
2025	0.6	0.5	0.5	0.5	0.5
2030	0.6	0.6	0.6	0.5	0.5
2035	0.7	0.7	0.6	0.6	0.5
2040	0.8	0.8	0.7	0.7	0.6
Limit	3.495	3.495	3.495	3.495	3.495

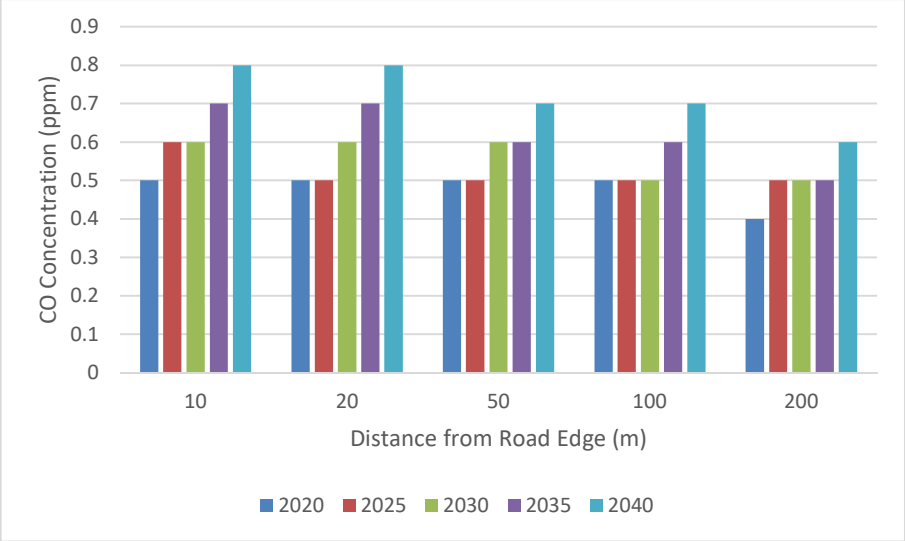


Figure: Graph representing Predicted Concentrations of CO in the study location (ppm)

Output:

For Year 2020:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=   2.2 M/S              Z0=  10. CM            ALT=   121. (M)
      BRG= WORST CASE             VD=  0.0 CM/S
     CLAS=     4 (D)              VS=  0.0 CM/S
     MIXH=    5. M               AMB=  0.4 PPM
    SIGTH=   20. DEGREES         TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-----------------------------
A. 1            *     0     0     0 10000 *  AG    419   2.1    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG    419   2.1    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG    419   2.1    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG    419   2.1    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG    419   2.1    0.0  13.0


III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X       Y       Z
-------------*--------------------
1. 1         *     10   20000   0.0
2. 2         *     20   20000   0.0
3. 3         *     50   20000   0.0
4. 4         *    100   20000   0.0
5. 5         *    200   20000   0.0
6. 6         *    -10   20000   0.0
7. 7         *    -20   20000   0.0
8. 8         *    -50   20000   0.0
9. 9         *   -100   20000   0.0
10. 10       *   -200   20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *         CONC/LINK
             *  BRG  * CONC  *           (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
-------------*-------*-------*-----------------------
 1. 1        *  182. *   0.5 *  0.0  0.1  0.0  0.0  0.0
 2. 2        *  183. *   0.5 *  0.0  0.1  0.0  0.0  0.0
 3. 3        *  184. *   0.5 *  0.0  0.1  0.0  0.0  0.0
 4. 4        *  186. *   0.5 *  0.0  0.1  0.0  0.0  0.0
 5. 5        *  189. *   0.4 *  0.0  0.1  0.0  0.0  0.0
 6. 6        *    2. *   0.5 *  0.0  0.0  0.1  0.0  0.0
 7. 7        *    3. *   0.5 *  0.0  0.0  0.1  0.0  0.0
 8. 8        *    4. *   0.5 *  0.0  0.0  0.1  0.0  0.0
 9. 9        *    6. *   0.5 *  0.0  0.0  0.1  0.0  0.0
10. 10       *    9. *   0.4 *  0.0  0.0  0.1  0.0  0.0
```

For Year 2025:

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

                JOB: A30_1 9-10-2020
                RUN: Hour 1           (WORST CASE ANGLE)
          POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M              AMB=  0.4 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


  II.  LINK VARIABLES

       LINK      *  LINK COORDINATES (M)   *             EF     H     W
    DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
-----------------*-------------------------*-----------------------------
A. 1             *    0     0     0 10000 *  AG    561   2.1    0.0  13.0
B. 2             *    0 10000     0 20000 *  AG    561   2.1    0.0  13.0
C. 3             *    0 20000     0 30000 *  AG    561   2.1    0.0  13.0
D. 4             *    0 30000     0 40000 *  AG    561   2.1    0.0  13.0
E. 5             *    0 40000     0 46598 *  AG    561   2.1    0.0  13.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X       Y       Z
-------------*---------------------
1. 1         *     10   20000   0.0
2. 2         *     20   20000   0.0
3. 3         *     50   20000   0.0
4. 4         *    100   20000   0.0
5. 5         *    200   20000   0.0
6. 6         *    -10   20000   0.0
7. 7         *    -20   20000   0.0
8. 8         *    -50   20000   0.0
9. 9         *   -100   20000   0.0
10. 10       *   -200   20000   0.0


                    CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                             JUNE 1989 VERSION
                             PAGE   2

                         JOB: A30_1 9-10-2020
                         RUN: Hour 1           (WORST CASE ANGLE)
                   POLLUTANT: Carbon Monoxide


                IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

                           *       * PRED  *         CONC/LINK
                           *  BRG  * CONC  *           (PPM)
                 RECEPTOR  * (DEG) * (PPM) *   A    B    C    D    E
                -----------*-------*-------*-----------------------------
                 1. 1      *  182. *   0.6 *  0.0  0.2  0.0  0.0  0.0
                 2. 2      *  183. *   0.5 *  0.0  0.2  0.0  0.0  0.0
                 3. 3      *  184. *   0.5 *  0.0  0.1  0.0  0.0  0.0
                 4. 4      *  186. *   0.5 *  0.0  0.1  0.0  0.0  0.0
                 5. 5      *  189. *   0.5 *  0.0  0.1  0.0  0.0  0.0
                 6. 6      *    2. *   0.6 *  0.0  0.0  0.2  0.0  0.0
                 7. 7      *    3. *   0.5 *  0.0  0.0  0.2  0.0  0.0
                 8. 8      *    4. *   0.5 *  0.0  0.0  0.1  0.0  0.0
                 9. 9      *    6. *   0.5 *  0.0  0.0  0.1  0.0  0.0
                10. 10     *    9. *   0.5 *  0.0  0.0  0.1  0.0  0.0
```

For Year 2030:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M              AMB=  0.4 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


  II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *             EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-----------------------------
A. 1            *     0     0     0 10000 *  AG    750   2.1    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG    750   2.1    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG    750   2.1    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG    750   2.1    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG    750   2.1    0.0  13.0


  III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
-------------*---------------------
 1. 1        *     10  20000   0.0
 2. 2        *     20  20000   0.0
 3. 3        *     50  20000   0.0
 4. 4        *    100  20000   0.0
 5. 5        *    200  20000   0.0
 6. 6        *    -10  20000   0.0
 7. 7        *    -20  20000   0.0
 8. 8        *    -50  20000   0.0
 9. 9        *   -100  20000   0.0
10. 10       *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *         CONC/LINK
             *  BRG  * CONC  *           (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
-------------*-------*-------*-----------------------------
 1. 1        *  182. *   0.6 *  0.0  0.2  0.0  0.0  0.0
 2. 2        *  183. *   0.6 *  0.0  0.2  0.0  0.0  0.0
 3. 3        *  184. *   0.6 *  0.0  0.2  0.0  0.0  0.0
 4. 4        *  186. *   0.5 *  0.0  0.2  0.0  0.0  0.0
 5. 5        *  189. *   0.5 *  0.0  0.1  0.0  0.0  0.0
 6. 6        *    2. *   0.6 *  0.0  0.0  0.2  0.0  0.0
 7. 7        *    3. *   0.6 *  0.0  0.0  0.2  0.0  0.0
 8. 8        *    4. *   0.6 *  0.0  0.0  0.2  0.0  0.0
 9. 9        *    6. *   0.5 *  0.0  0.0  0.2  0.0  0.0
10. 10       *    9. *   0.5 *  0.0  0.0  0.1  0.0  0.0
```

For Year 2035:

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

                JOB: A30_1 9-10-2020
                RUN: Hour 1           (WORST CASE ANGLE)
         POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M             AMB=  0.4 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-----------------------------
A. 1            *    0     0     0 10000 *  AG   1004   2.1    0.0  13.0
B. 2            *    0 10000     0 20000 *  AG   1004   2.1    0.0  13.0
C. 3            *    0 20000     0 30000 *  AG   1004   2.1    0.0  13.0
D. 4            *    0 30000     0 40000 *  AG   1004   2.1    0.0  13.0
E. 5            *    0 40000     0 46598 *  AG   1004   2.1    0.0  13.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
-------------*---------------------
1. 1         *     10  20000   0.0
2. 2         *     20  20000   0.0
3. 3         *     50  20000   0.0
4. 4         *    100  20000   0.0
5. 5         *    200  20000   0.0
6. 6         *    -10  20000   0.0
7. 7         *    -20  20000   0.0
8. 8         *    -50  20000   0.0
9. 9         *   -100  20000   0.0
10. 10       *   -200  20000   0.0


                    CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                             JUNE 1989 VERSION
                             PAGE   2

                         JOB: A30_1 9-10-2020
                         RUN: Hour 1           (WORST CASE ANGLE)
                  POLLUTANT: Carbon Monoxide


           IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

                      *       * PRED  *         CONC/LINK
                      *  BRG  * CONC  *           (PPM)
            RECEPTOR  * (DEG) * (PPM) *   A    B    C    D    E
           -----------*-------*-------*-------------------------
            1. 1      *  182. *   0.7 *  0.0  0.3  0.0  0.0  0.0
            2. 2      *  183. *   0.7 *  0.0  0.3  0.0  0.0  0.0
            3. 3      *  184. *   0.6 *  0.0  0.2  0.0  0.0  0.0
            4. 4      *  186. *   0.6 *  0.0  0.2  0.0  0.0  0.0
            5. 5      *  189. *   0.5 *  0.0  0.2  0.0  0.0  0.0
            6. 6      *    2. *   0.7 *  0.0  0.0  0.3  0.0  0.0
            7. 7      *    3. *   0.7 *  0.0  0.0  0.3  0.0  0.0
            8. 8      *    4. *   0.6 *  0.0  0.0  0.2  0.0  0.0
            9. 9      *    6. *   0.6 *  0.0  0.0  0.2  0.0  0.0
           10. 10     *    9. *   0.5 *  0.0  0.0  0.2  0.0  0.0
```

For year 2040:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=   2.2 M/S             Z0=  10. CM            ALT=   121. (M)
      BRG= WORST CASE            VD=  0.0 CM/S
     CLAS=     4 (D)             VS=  0.0 CM/S
     MIXH=    5. M              AMB=  0.4 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-----------------------------
A. 1            *     0     0     0 10000 *  AG   1344   2.1    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG   1344   2.1    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG   1344   2.1    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG   1344   2.1    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG   1344   2.1    0.0  13.0


III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
-------------*---------------------
 1. 1        *     10  20000   0.0
 2. 2        *     20  20000   0.0
 3. 3        *     50  20000   0.0
 4. 4        *    100  20000   0.0
 5. 5        *    200  20000   0.0
 6. 6        *    -10  20000   0.0
 7. 7        *    -20  20000   0.0
 8. 8        *    -50  20000   0.0
 9. 9        *   -100  20000   0.0
10. 10       *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *         CONC/LINK
             *  BRG  * CONC  *           (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
-------------*-------*-------*-------------------------
 1. 1        *  182. *   0.8 *  0.0  0.4  0.0  0.0  0.0
 2. 2        *  183. *   0.8 *  0.0  0.4  0.0  0.0  0.0
 3. 3        *  184. *   0.7 *  0.0  0.3  0.0  0.0  0.0
 4. 4        *  186. *   0.7 *  0.0  0.3  0.0  0.0  0.0
 5. 5        *  189. *   0.6 *  0.0  0.2  0.0  0.0  0.0
 6. 6        *    2. *   0.8 *  0.0  0.0  0.4  0.0  0.0
 7. 7        *    3. *   0.8 *  0.0  0.0  0.4  0.0  0.0
 8. 8        *    4. *   0.7 *  0.0  0.0  0.3  0.0  0.0
 9. 9        *    6. *   0.7 *  0.0  0.0  0.3  0.0  0.0
10. 10       *    9. *   0.6 *  0.0  0.0  0.2  0.0  0.0
```

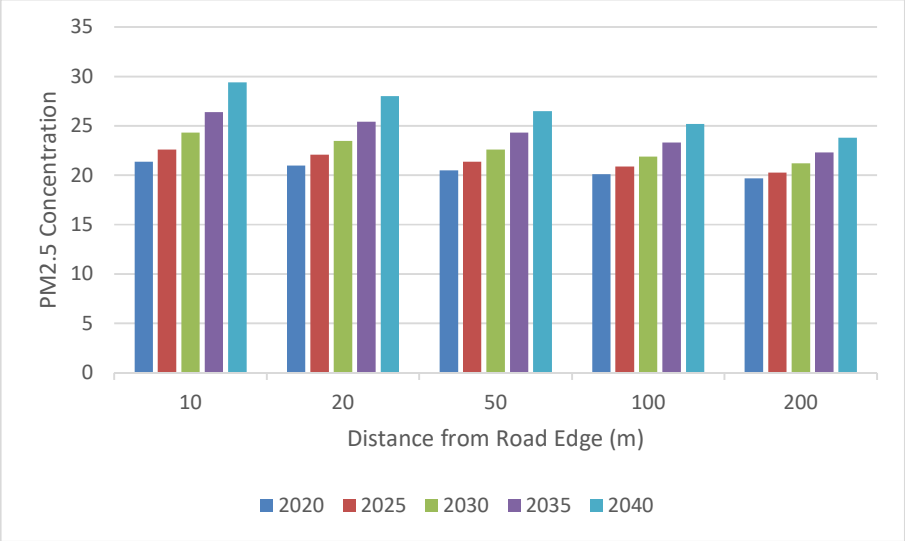
$PM_{2.5}$ Modelling:

Input:

Sr. No.	Input Parameter	Value
1	Aerodynamic Roughness Coefficient	Rural
2	Run Type	Worst-case Wind Direction
3	Altitude Above Sea Level	120.874 m
4	Wind Speed	2.22 m/sec
5	Wind Direction	45^{O}
6	Wind Direction Standard Deviation	20
7	Atmospheric Stability Class	4
8	Mixing Height	5
9	Ambient Temperature	$25^{O}C$
10	Ambient PM Concentration	17.8

Output:

Year	Distance from Road Edge (m)				
	10	**20**	**50**	**100**	**200**
2020	21.4	21	20.5	20.1	19.7
2025	22.6	22.1	21.4	20.9	20.3
2030	24.3	23.5	22.6	21.9	21.2
2035	26.4	25.4	24.3	23.3	22.3
2040	29.4	28	26.5	25.2	23.8
Limit	60	60	60	60	60



For year 2020:

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

                JOB: A30_1 9-10-2020
                RUN: Hour 1           (WORST CASE ANGLE)
         POLLUTANT: Particulates
         (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M             AMB= 17.8 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


  II.  LINK VARIABLES

       LINK      *  LINK COORDINATES (M)   *              EF     H     W
    DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
 ----------------*-------------------------*-------------------------------
 A. 1            *     0     0     0 10000 *  AG    419   0.0    0.0  13.0
 B. 2            *     0 10000     0 20000 *  AG    419   0.0    0.0  13.0
 C. 3            *     0 20000     0 30000 *  AG    419   0.0    0.0  13.0
 D. 4            *     0 30000     0 40000 *  AG    419   0.0    0.0  13.0
 E. 5            *     0 40000     0 46598 *  AG    419   0.0    0.0  13.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
 ------------*---------------------
 1. 1        *     10  20000   0.0
 2. 2        *     20  20000   0.0
 3. 3        *     50  20000   0.0
 4. 4        *    100  20000   0.0
 5. 5        *    200  20000   0.0
 6. 6        *    -10  20000   0.0
 7. 7        *    -20  20000   0.0
 8. 8        *    -50  20000   0.0
 9. 9        *   -100  20000   0.0
10. 10       *   -200  20000   0.0

                  CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                           JUNE 1989 VERSION
                           PAGE   2

                       JOB: A30_1 9-10-2020
                       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 )

                      *       * PRED  *         CONC/LINK
                      *  BRG  * CONC  *           (PPM)
           RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
          ------------*-------*-------*-------------------------
           1. 1       *  182. *  21.4 *  0.0  3.6  0.0  0.0  0.0
           2. 2       *  183. *  21.0 *  0.0  3.2  0.0  0.0  0.0
           3. 3       *  184. *  20.5 *  0.0  2.7  0.0  0.0  0.0
           4. 4       *  186. *  20.1 *  0.0  2.3  0.0  0.0  0.0
           5. 5       *  189. *  19.7 *  0.0  1.9  0.0  0.0  0.0
           6. 6       *    2. *  21.4 *  0.0  0.0  3.6  0.0  0.0
           7. 7       *    3. *  21.0 *  0.0  0.0  3.2  0.0  0.0
           8. 8       *    4. *  20.5 *  0.0  0.0  2.7  0.0  0.0
           9. 9       *    6. *  20.1 *  0.0  0.0  2.3  0.0  0.0
          10. 10      *    9. *  19.7 *  0.0  0.0  1.9  0.0  0.0
```

For Year 2025:

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

                JOB: A30_1 9-10-2020
                RUN: Hour 1           (WORST CASE ANGLE)
         POLLUTANT: Particulates
         (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M             AMB= 17.8 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-------------------------------
A. 1            *    0     0     0 10000 *  AG    561   0.0    0.0  13.0
B. 2            *    0 10000     0 20000 *  AG    561   0.0    0.0  13.0
C. 3            *    0 20000     0 30000 *  AG    561   0.0    0.0  13.0
D. 4            *    0 30000     0 40000 *  AG    561   0.0    0.0  13.0
E. 5            *    0 40000     0 46598 *  AG    561   0.0    0.0  13.0


 III.  RECEPTOR LOCATIONS

            *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
------------*---------------------
1. 1        *     10  20000   0.0
2. 2        *     20  20000   0.0
3. 3        *     50  20000   0.0
4. 4        *    100  20000   0.0
5. 5        *    200  20000   0.0
6. 6        *    -10  20000   0.0
7. 7        *    -20  20000   0.0
8. 8        *    -50  20000   0.0
9. 9        *   -100  20000   0.0
10. 10      *   -200  20000   0.0


           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   2

                JOB: A30_1 9-10-2020
                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 )

            *       * PRED  *         CONC/LINK
            *  BRG  * CONC  *           (PPM)
  RECEPTOR  * (DEG) * (PPM) *   A    B    C    D    E
------------*-------*-------*-------------------------
 1. 1       *  182. *  22.6 *  0.0  4.8  0.0  0.0  0.0
 2. 2       *  183. *  22.1 *  0.0  4.3  0.0  0.0  0.0
 3. 3       *  184. *  21.4 *  0.0  3.6  0.0  0.0  0.0
 4. 4       *  186. *  20.9 *  0.0  3.1  0.0  0.0  0.0
 5. 5       *  189. *  20.3 *  0.0  2.5  0.0  0.0  0.0
 6. 6       *    2. *  22.6 *  0.0  0.0  4.8  0.0  0.0
 7. 7       *    3. *  22.1 *  0.0  0.0  4.3  0.0  0.0
 8. 8       *    4. *  21.4 *  0.0  0.0  3.6  0.0  0.0
 9. 9       *    6. *  20.9 *  0.0  0.0  3.1  0.0  0.0
10. 10      *    9. *  20.3 *  0.0  0.0  2.5  0.0  0.0
```

For Year 2030:

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

                JOB: A30_1 9-10-2020
                RUN: Hour 1           (WORST CASE ANGLE)
          POLLUTANT: Particulates
          (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

   I.  SITE VARIABLES

         U=   2.2 M/S             Z0=  10. CM            ALT=   121. (M)
       BRG= WORST CASE            VD=  0.0 CM/S
      CLAS=     4 (D)             VS=  0.0 CM/S
      MIXH=    5. M              AMB= 17.8 PPM
     SIGTH=   20. DEGREES        TEMP= 25.0 DEGREE (C)


  II.  LINK VARIABLES

       LINK      *  LINK COORDINATES (M)   *              EF     H     W
    DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
-----------------*-------------------------*-------------------------------
A. 1             *     0     0     0 10000 *  AG    750   0.0    0.0  13.0
B. 2             *     0 10000     0 20000 *  AG    750   0.0    0.0  13.0
C. 3             *     0 20000     0 30000 *  AG    750   0.0    0.0  13.0
D. 4             *     0 30000     0 40000 *  AG    750   0.0    0.0  13.0
E. 5             *     0 40000     0 46598 *  AG    750   0.0    0.0  13.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
-------------*---------------------
1. 1         *     10  20000   0.0
2. 2         *     20  20000   0.0
3. 3         *     50  20000   0.0
4. 4         *    100  20000   0.0
5. 5         *    200  20000   0.0
6. 6         *    -10  20000   0.0
7. 7         *    -20  20000   0.0
8. 8         *    -50  20000   0.0
9. 9         *   -100  20000   0.0
10. 10       *   -200  20000   0.0


                  CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                           JUNE 1989 VERSION
                           PAGE   2

                       JOB: A30_1 9-10-2020
                       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 )

                      *       * PRED  *         CONC/LINK
                      *  BRG  * CONC  *           (PPM)
           RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
          ------------*-------*-------*-------------------------
           1. 1       *  182. *  24.3 *  0.0  6.5  0.0  0.0  0.0
           2. 2       *  183. *  23.5 *  0.0  5.7  0.0  0.0  0.0
           3. 3       *  184. *  22.6 *  0.0  4.8  0.0  0.0  0.0
           4. 4       *  186. *  21.9 *  0.0  4.1  0.0  0.0  0.0
           5. 5       *  189. *  21.2 *  0.0  3.4  0.0  0.0  0.0
           6. 6       *    2. *  24.3 *  0.0  0.0  6.5  0.0  0.0
           7. 7       *    3. *  23.5 *  0.0  0.0  5.7  0.0  0.0
           8. 8       *    4. *  22.6 *  0.0  0.0  4.8  0.0  0.0
           9. 9       *    6. *  21.9 *  0.0  0.0  4.1  0.0  0.0
          10. 10      *    9. *  21.2 *  0.0  0.0  3.4  0.0  0.0
```

For Year 2035:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Particulates
       (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M             AMB= 17.8 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *             EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*-----------------------------
A. 1            *     0     0     0 10000 *  AG   1004   0.0    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG   1004   0.0    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG   1004   0.0    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG   1004   0.0    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG   1004   0.0    0.0  13.0


 III.  RECEPTOR LOCATIONS

            *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
------------*---------------------
 1. 1       *     10  20000   0.0
 2. 2       *     20  20000   0.0
 3. 3       *     50  20000   0.0
 4. 4       *    100  20000   0.0
 5. 5       *    200  20000   0.0
 6. 6       *    -10  20000   0.0
 7. 7       *    -20  20000   0.0
 8. 8       *    -50  20000   0.0
 9. 9       *   -100  20000   0.0
10. 10      *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: A30_1 9-10-2020
              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 )

            *       * PRED  *         CONC/LINK
            *  BRG  * CONC  *           (PPM)
  RECEPTOR  * (DEG) * (PPM) *   A    B    C    D    E
------------*-------*-------*-------------------------
 1. 1       *  182. *  26.4 *  0.0  8.6  0.0  0.0  0.0
 2. 2       *  183. *  25.4 *  0.0  7.6  0.0  0.0  0.0
 3. 3       *  184. *  24.3 *  0.0  6.5  0.0  0.0  0.0
 4. 4       *  186. *  23.3 *  0.0  5.5  0.0  0.0  0.0
 5. 5       *  189. *  22.3 *  0.0  4.5  0.0  0.0  0.0
 6. 6       *    2. *  26.4 *  0.0  0.0  8.6  0.0  0.0
 7. 7       *    3. *  25.4 *  0.0  0.0  7.6  0.0  0.0
 8. 8       *    4. *  24.3 *  0.0  0.0  6.5  0.0  0.0
 9. 9       *    6. *  23.3 *  0.0  0.0  5.5  0.0  0.0
10. 10      *    9. *  22.3 *  0.0  0.0  4.5  0.0  0.0
```

For Year 2040:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: A30_1 9-10-2020
              RUN: Hour 1           (WORST CASE ANGLE)
       POLLUTANT: Particulates
       (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG= WORST CASE           VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M             AMB= 17.8 PPM
    SIGTH=   20. DEGREES       TEMP= 25.0 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2   * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-----------------------------*-------------------------------
A. 1            *     0     0     0 10000 *  AG   1344   0.0    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG   1344   0.0    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG   1344   0.0    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG   1344   0.0    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG   1344   0.0    0.0  13.0


 III.  RECEPTOR LOCATIONS

            *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
------------*---------------------
 1. 1       *     10  20000   0.0
 2. 2       *     20  20000   0.0
 3. 3       *     50  20000   0.0
 4. 4       *    100  20000   0.0
 5. 5       *    200  20000   0.0
 6. 6       *    -10  20000   0.0
 7. 7       *    -20  20000   0.0
 8. 8       *    -50  20000   0.0
 9. 9       *   -100  20000   0.0
10. 10      *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: A30_1 9-10-2020
              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 )

            *       * PRED  *         CONC/LINK
            *  BRG  * CONC  *           (PPM)
  RECEPTOR  * (DEG) * (PPM) *   A    B    C    D    E
------------*-------*-------*-------------------------
 1. 1       *  182. *  29.4 *  0.0 11.6  0.0  0.0  0.0
 2. 2       *  183. *  28.0 *  0.0 10.2  0.0  0.0  0.0
 3. 3       *  184. *  26.5 *  0.0  8.7  0.0  0.0  0.0
 4. 4       *  186. *  25.2 *  0.0  7.4  0.0  0.0  0.0
 5. 5       *  189. *  23.8 *  0.0  6.0  0.0  0.0  0.0
 6. 6       *    2. *  29.4 *  0.0  0.0 11.6  0.0  0.0
 7. 7       *    3. *  28.0 *  0.0  0.0 10.2  0.0  0.0
 8. 8       *    4. *  26.5 *  0.0  0.0  8.7  0.0  0.0
 9. 9       *    6. *  25.2 *  0.0  0.0  7.4  0.0  0.0
10. 10      *    9. *  23.8 *  0.0  0.0  6.0  0.0  0.0
```

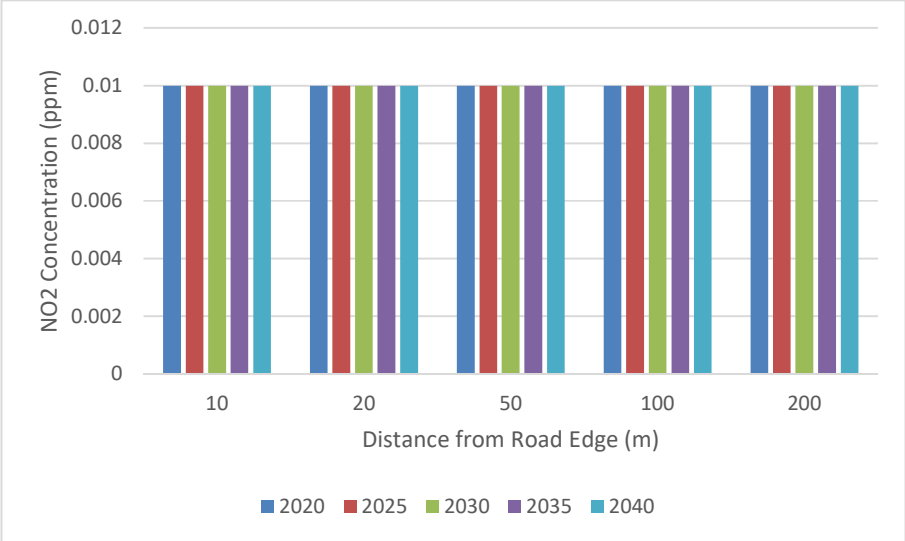
NO_x Modelling:

Input:

Sr. No.	Input Parameter	Value
1	Molecular weight	46
2	Aerodynamic Roughness Coefficient	Rural
3	Run Type	Standard
4	Altitude Above Sea Level	120.874 m
5	Wind Speed	2.22 m/sec
6	Wind Direction	45^O
7	Wind Direction Standard Deviation	20
8	Atmospheric Stability Class	4
9	Mixing Height	5
10	Ambient Temperature	25^OC
11	Ambient O_3 Concentration	0.03
12	Ambient NO Concentration	0.02
13	Ambient NO_2 Concentration	0.007
14	NO_2 Photolysis Rate Constant	0.004
15	NO_2/NO_X Ratio	0.35

Output:

Year	Distance from Road Edge (m)				
	10	**20**	**50**	**100**	**200**
2020	0.01	0.01	0.01	0.01	0.01
2025	0.01	0.01	0.01	0.01	0.01
2030	0.01	0.01	0.01	0.01	0.01
2035	0.01	0.01	0.01	0.01	0.01
2040	0.01	0.01	0.01	0.01	0.01
Limit	0.04	0.04	0.04	0.04	0.04



For Year 2020:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: A30_1 9-10-2020
               RUN: Hour 1
         POLLUTANT: Nitrogen Dioxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG=  45.0 DEGREES        VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M            TEMP= 25.0 DEGREE (C)
    SIGTH=   20. DEGREES

     NOX VARIABLES

      NO2= 0.01 PPM      NO= 0.02 PPM     O3= 0.03 PPM        KR= 0.004 1/SEC


 II.  LINK VARIABLES

     LINK      *  LINK COORDINATES (M)   *              EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
---------------*-------------------------*-------------------------------
A. 1           *     0     0     0 10000 *  AG    419  0.30    0.0  13.0
B. 2           *     0 10000     0 20000 *  AG    419  0.30    0.0  13.0
C. 3           *     0 20000     0 30000 *  AG    419  0.30    0.0  13.0
D. 4           *     0 30000     0 40000 *  AG    419  0.30    0.0  13.0
E. 5           *     0 40000     0 46598 *  AG    419  0.30    0.0  13.0


III.  RECEPTOR LOCATIONS

           *    COORDINATES (M)
  RECEPTOR *    X      Y      Z
-----------*--------------------
1. 1       *     10  20000   0.0
2. 2       *     20  20000   0.0
3. 3       *     50  20000   0.0
4. 4       *    100  20000   0.0
5. 5       *    200  20000   0.0
6. 6       *    -10  20000   0.0
7. 7       *    -20  20000   0.0
8. 8       *    -50  20000   0.0
9. 9       *   -100  20000   0.0
10. 10     *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

               JOB: A30_1 9-10-2020
               RUN: Hour 1
         POLLUTANT: Nitrogen Dioxide


  IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

           * PRED  *         CONC/LINK
           * CONC  *           (PPM)
  RECEPTOR * (PPM) *   A    B    C    D    E
-----------*-------*-------------------------
 1. 1      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 2. 2      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 3. 3      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 4. 4      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 5. 5      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 6. 6      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 7. 7      *  0.01 * 0.00 0.00 0.00 0.00 0.00
 8. 8      *  0.01 * 0.00 0.00 0.01 0.00 0.00
 9. 9      *  0.02 * 0.00 0.00 0.01 0.00 0.00
10. 10     *  0.02 * 0.00 0.00 0.01 0.00 0.00
```

For Year 2025:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: A30_1 9-10-2020
               RUN: Hour 1
         POLLUTANT: Nitrogen Dioxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG=  45.0 DEGREES        VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M            TEMP= 25.0 DEGREE (C)
    SIGTH=   20. DEGREES

     NOX VARIABLES

       NO2= 0.01 PPM      NO= 0.02 PPM     O3= 0.03 PPM        KR= 0.004 1/SEC


  II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *             EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
-----------------*---------------------------*-------------------------------
A. 1             *    0     0     0 10000 *  AG    561  0.30    0.0  13.0
B. 2             *    0 10000     0 20000 *  AG    561  0.30    0.0  13.0
C. 3             *    0 20000     0 30000 *  AG    561  0.30    0.0  13.0
D. 4             *    0 30000     0 40000 *  AG    561  0.30    0.0  13.0
E. 5             *    0 40000     0 46598 *  AG    561  0.30    0.0  13.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR   *    X      Y      Z
-------------*---------------------
 1. 1        *     10  20000   0.0
 2. 2        *     20  20000   0.0
 3. 3        *     50  20000   0.0
 4. 4        *    100  20000   0.0
 5. 5        *    200  20000   0.0
 6. 6        *    -10  20000   0.0
 7. 7        *    -20  20000   0.0
 8. 8        *    -50  20000   0.0
 9. 9        *   -100  20000   0.0
10. 10       *   -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

               JOB: A30_1 9-10-2020
               RUN: Hour 1
         POLLUTANT: Nitrogen Dioxide


  IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

             * PRED  *         CONC/LINK
             * CONC  *           (PPM)
  RECEPTOR   * (PPM) *   A    B    C    D    E
-------------*-------*-------------------------
 1. 1        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 2. 2        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 3. 3        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 4. 4        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 5. 5        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 6. 6        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 7. 7        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 8. 8        *  0.01 * 0.00 0.00 0.01 0.00 0.00
 9. 9        *  0.02 * 0.00 0.00 0.01 0.00 0.00
10. 10       *  0.02 * 0.00 0.00 0.01 0.00 0.00
```

For Year 2030:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: A30_1 9-10-2020
               RUN: Hour 1
        POLLUTANT: Nitrogen Dioxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG=  45.0 DEGREES        VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M            TEMP= 25.0 DEGREE (C)
    SIGTH=   20. DEGREES

     NOX VARIABLES

       NO2= 0.01 PPM      NO= 0.02 PPM     O3= 0.03 PPM        KR= 0.004 1/SEC


  II.  LINK VARIABLES

       LINK      *  LINK COORDINATES (M)   *              EF     H     W
    DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
-----------------*-------------------------*-----------------------------
A. 1             *    0     0     0 10000 *  AG    750  0.30    0.0  13.0
B. 2             *    0 10000     0 20000 *  AG    750  0.30    0.0  13.0
C. 3             *    0 20000     0 30000 *  AG    750  0.30    0.0  13.0
D. 4             *    0 30000     0 40000 *  AG    750  0.30    0.0  13.0
E. 5             *    0 40000     0 46598 *  AG    750  0.30    0.0  13.0


  III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
   RECEPTOR  *    X      Y      Z
-------------*---------------------
 1. 1        *    10  20000   0.0
 2. 2        *    20  20000   0.0
 3. 3        *    50  20000   0.0
 4. 4        *   100  20000   0.0
 5. 5        *   200  20000   0.0
 6. 6        *   -10  20000   0.0
 7. 7        *   -20  20000   0.0
 8. 8        *   -50  20000   0.0
 9. 9        *  -100  20000   0.0
10. 10       *  -200  20000   0.0


          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

               JOB: A30_1 9-10-2020
               RUN: Hour 1
        POLLUTANT: Nitrogen Dioxide


   IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

             * PRED  *         CONC/LINK
             * CONC  *           (PPM)
   RECEPTOR  * (PPM) *   A    B    C    D    E
-------------*-------*-------------------------
 1. 1        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 2. 2        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 3. 3        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 4. 4        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 5. 5        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 6. 6        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 7. 7        *  0.01 * 0.00 0.00 0.00 0.00 0.00
 8. 8        *  0.01 * 0.00 0.00 0.01 0.00 0.00
 9. 9        *  0.02 * 0.00 0.00 0.01 0.00 0.00
10. 10       *  0.02 * 0.00 0.00 0.01 0.00 0.00
```

For Year 2035:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: A30_1 9-10-2020
               RUN: Hour 1
        POLLUTANT: Nitrogen Dioxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG=  45.0 DEGREES        VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M            TEMP= 25.0 DEGREE (C)
    SIGTH=   20. DEGREES

     NOX VARIABLES

       NO2= 0.01 PPM      NO= 0.02 PPM     O3= 0.03 PPM        KR= 0.004 1/SEC


  II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *              EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*---------------------------*-------------------------------
A. 1            *     0     0     0 10000 *  AG   1004  0.30    0.0  13.0
B. 2            *     0 10000     0 20000 *  AG   1004  0.30    0.0  13.0
C. 3            *     0 20000     0 30000 *  AG   1004  0.30    0.0  13.0
D. 4            *     0 30000     0 40000 *  AG   1004  0.30    0.0  13.0
E. 5            *     0 40000     0 46598 *  AG   1004  0.30    0.0  13.0


 III.  RECEPTOR LOCATIONS

            *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
------------*---------------------
1. 1        *     10  20000   0.0
2. 2        *     20  20000   0.0
3. 3        *     50  20000   0.0
4. 4        *    100  20000   0.0
5. 5        *    200  20000   0.0
6. 6        *    -10  20000   0.0
7. 7        *    -20  20000   0.0
8. 8        *    -50  20000   0.0
9. 9        *   -100  20000   0.0
10. 10      *   -200  20000   0.0


                    CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                             JUNE 1989 VERSION
                             PAGE   2

                         JOB: A30_1 9-10-2020
                         RUN: Hour 1
                  POLLUTANT: Nitrogen Dioxide


           IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

                        * PRED  *          CONC/LINK
                        * CONC  *            (PPM)
                  RECEPTOR  * (PPM) *   A     B     C     D     E
                 -----------*-------*-------------------------------
                  1. 1      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  2. 2      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  3. 3      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  4. 4      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  5. 5      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  6. 6      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  7. 7      *  0.01 * 0.00  0.00  0.00  0.00  0.00
                  8. 8      *  0.01 * 0.00  0.00  0.01  0.00  0.00
                  9. 9      *  0.02 * 0.00  0.00  0.01  0.00  0.00
                 10. 10     *  0.02 * 0.00  0.00  0.01  0.00  0.00
```

For Year 2040:

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: A30_1 9-10-2020
               RUN: Hour 1
         POLLUTANT: Nitrogen Dioxide


  I.  SITE VARIABLES

        U=   2.2 M/S            Z0=  10. CM           ALT=   121. (M)
      BRG=  45.0 DEGREES        VD=  0.0 CM/S
     CLAS=     4 (D)            VS=  0.0 CM/S
     MIXH=    5. M            TEMP= 25.0 DEGREE (C)
    SIGTH=   20. DEGREES

     NOX VARIABLES

       NO2= 0.01 PPM      NO= 0.02 PPM     O3= 0.03 PPM        KR= 0.004 1/SEC


 II.  LINK VARIABLES

     LINK      *  LINK COORDINATES (M)   *              EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
---------------*-------------------------*-----------------------------
A. 1           *     0     0     0 10000 *  AG   1344  0.30    0.0  13.0
B. 2           *     0 10000     0 20000 *  AG   1344  0.30    0.0  13.0
C. 3           *     0 20000     0 30000 *  AG   1344  0.30    0.0  13.0
D. 4           *     0 30000     0 40000 *  AG   1344  0.30    0.0  13.0
E. 5           *     0 40000     0 46598 *  AG   1344  0.30    0.0  13.0


III.  RECEPTOR LOCATIONS

           *    COORDINATES (M)
  RECEPTOR *    X      Y      Z
-----------*--------------------
1. 1       *     10  20000   0.0
2. 2       *     20  20000   0.0
3. 3       *     50  20000   0.0
4. 4       *    100  20000   0.0
5. 5       *    200  20000   0.0
6. 6       *    -10  20000   0.0
7. 7       *    -20  20000   0.0
8. 8       *    -50  20000   0.0
9. 9       *   -100  20000   0.0
10. 10     *   -200  20000   0.0
```

```
                  CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                           JUNE 1989 VERSION
                           PAGE   2

                       JOB: A30_1 9-10-2020
                       RUN: Hour 1
                 POLLUTANT: Nitrogen Dioxide


        IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

                     * PRED  *         CONC/LINK
                     * CONC  *           (PPM)
          RECEPTOR   * (PPM) *   A    B    C    D    E
        -------------*-------*-------------------------
         1. 1        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         2. 2        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         3. 3        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         4. 4        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         5. 5        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         6. 6        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         7. 7        *  0.01 * 0.00 0.00 0.00 0.00 0.00
         8. 8        *  0.01 * 0.00 0.00 0.01 0.00 0.00
         9. 9        *  0.02 * 0.00 0.00 0.01 0.00 0.00
        10. 10       *  0.02 * 0.00 0.00 0.01 0.00 0.00
```

Annexure 19: Prediction of Noise Levels along the Project Road

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby villages. Cumulative noise levels of these traffic sources were computed using Federal Highway Administration (FHWA's) Traffic Noise Model (TNM). TNM computes incremental highway traffic noise at nearby receivers. As sources of noise, it includes noise emission levels for the following vehicle types:

- Automobiles: all vehicles with two axles and four tyres primarily designed to carry nine or fewer people (passenger camp, vans) or cargo (vans, light trucks), generally with gross vehicle weight less than 4500 kg.
- Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
- Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
- Buses: all vehicles designed to carry more than nine passengers
- Motorcycles: all vehicles with two or three tires and an open-air driver/passenger compartment.

The procedure for prediction of noise levels involved the following steps:

- Identification of various receivers,
- Determination of land uses and activities which may be affected by the noise generated
- Assemble input parameters
- Application of the model

Input Parameters

Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type- light, medium and heavy along with their average speed is used for predictions. The average speeds for vehicles in our project road around build-up area are considered as 30 kmph for this model.

Table A: Predicted Traffic Volume per hour during Day time

Year	Two-wheeler	Car	LCV	Bus	Truck	PCU
2020	113	44	6	4	11	**419**
2025	152	59	7	5	16	**561**
2030	203	79	10	6	21	**750**
2035	272	106	13	8	28	**1004**
2040	364	142	18	12	38	**1344**

Table B: Predicted Traffic Volume per hour during Night time

Year	Two-wheeler	Car	LCV	Bus	Truck	PCU
2020	138	58	4	2	12	**314**
2025	184	78	5	2	16	**420**
2030	247	104	7	4	21	**562**
2035	330	139	9	5	28	**752**
2040	442	186	12	6	38	**1006**

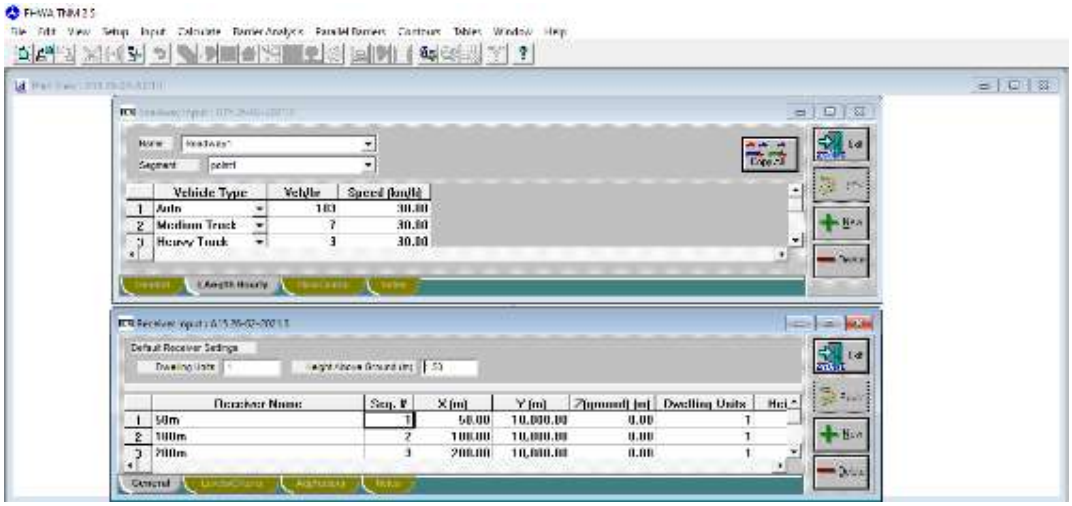


Figure A: Layout of FHWA's Traffic Noise Model

Noise Levels

As per the Baseline survey conducted on **18th January 2020**, the maximum day time noise level is **45.2 dB** and the maximum night time noise level is **34.5 dB**.

Average Noise Level

All vehicles produce some noise, which is taken as the base and the cumulative noise at the receiver distance due to the whole traffic is estimated. The average noise levels vary depending on the type of vehicle. In order to assess the impact of noise due to the change in traffic density and speed, a small road section of each project road has been selected to develop noise projections for future years 2020, 2025, 2030, 2035, and 2040. In order to assess the impact of traffic on sensitive receptors along the road, receptor locations were set at 50 m, 100 m, 200 m, 300 m, 400 m, 500 m, 600 m, 700 m and 800 m from the center line of the road.

The outputs of the assessment are presented in table below. The table shows the noise levels that will be generated by traffic at the respective distance from the centerline of the road. The predicted noise levels are those predicted around built-up area considering vehicle speed as 30 kmph. The permissible noise levels in residential area according to Ambient Noise Standards are 55 dB in daytime and 45 dB at nighttime. It can be seen that even without mitigation measures, noise levels in built up area are within the permissible levels

except, 50m from road in the year 2040 in day time and within 50m and 100m for all years in night time. The sensitive receptors located within 50m and 100m distance of the road are not operational at night time, hence increased noise will not cause any adverse impact. During day mitigation measure will be taken to prevent adverse impacts of noise pollution.

Table C: Predicted Noise Level

Sr. No.	Distance from Centerline (m)	2020		2025		2030		2035		2040	
		Day time	Night time	Day time	Night time	Day time	Night time	Day time	Night time	Day time	Night time
1	50	49.9	50.2	51.3	51.4	52.5	52.6	53.7	53.9	55.1	55.2
2	100	45.2	45.5	46.6	46.7	47.8	48	49.1	49.2	50.4	50.5
3	200	40.5	40.8	42	42	43.2	43.3	44.4	44.5	45.7	45.8
4	300	37.7	38	39.1	39.2	40.3	40.5	41.6	41.7	42.9	43
5	400	35.9	36.2	37.3	37.4	38.5	38.7	39.8	39.9	41.1	41.2
6	500	34.7	35	36.1	36.2	37.3	37.4	38.5	38.7	39.9	40
7	600	33.7	34	35.2	35.3	36.4	36.5	37.6	37.8	39	39.1
8	700	33	33.3	34.4	34.5	35.6	35.8	36.9	37	38.2	38.3
9	800	32.3	32.6	33.8	33.9	35	35.1	36.2	36.4	37.6	37.7

Output of Day time Noise Prediction:

For Year 2020:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.2	49.9	66	4.7	10	—
100m	2	1	45.2	45.2	66	0.0	10	—
200m	3	1	45.2	40.5	66	-4.7	10	—
300m	4	1	45.2	37.7	66	-7.5	10	—
400m	5	1	45.2	35.9	66	-9.3	10	—
500m	6	1	45.2	34.7	66	-10.5	10	—
600m	7	1	45.2	33.7	66	-11.5	10	—
700m	8	1	45.2	33.0	66	-12.2	10	—
800m	9	1	45.2	32.3	66	-12.9	10	—

For Year 2025:

Name	No.	#DUs	Existing LAeq1h	No Barrier				
				LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.2	51.3	66	6.1	10	—
100m	2	1	45.2	46.6	66	1.4	10	—
200m	3	1	45.2	42.0	66	-3.2	10	—
300m	4	1	45.2	39.1	66	-6.1	10	—
400m	5	1	45.2	37.3	66	-7.9	10	—
500m	6	1	45.2	36.1	66	-9.1	10	—
600m	7	1	45.2	35.2	66	-10.0	10	—
700m	8	1	45.2	34.4	66	-10.8	10	—
800m	9	1	45.2	33.8	66	-11.4	10	—

For Year 2030:

Name	No.	#DUs	Existing LAeq1h	No Barrier				
				LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.2	52.5	66	7.3	10	—
100m	2	1	45.2	47.8	66	2.6	10	—
200m	3	1	45.2	43.2	66	-2.0	10	—
300m	4	1	45.2	40.3	66	-4.9	10	—
400m	5	1	45.2	38.5	66	-6.7	10	—
500m	6	1	45.2	37.3	66	-7.9	10	—
600m	7	1	45.2	36.4	66	-8.8	10	—
700m	8	1	45.2	35.6	66	-9.6	10	—
800m	9	1	45.2	35.0	66	-10.2	10	—

For Year 2035:

Name	No.	#DUs	Existing LAeq1h	No Barrier				
				LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.2	53.7	66	8.5	10	—
100m	2	1	45.2	49.1	66	3.9	10	—
200m	3	1	45.2	44.4	66	-0.8	10	—
300m	4	1	45.2	41.6	66	-3.6	10	—
400m	5	1	45.2	39.8	66	-5.4	10	—
500m	6	1	45.2	38.5	66	-6.7	10	—
600m	7	1	45.2	37.6	66	-7.6	10	—
700m	8	1	45.2	36.9	66	-8.3	10	—
800m	9	1	45.2	36.2	66	-9.0	10	—

For Year 2040:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.2	55.1	66	9.9	10	—
100m	2	1	45.2	50.4	66	5.2	10	—
200m	3	1	45.2	45.7	66	0.5	10	—
300m	4	1	45.2	42.9	66	-2.3	10	—
400m	5	1	45.2	41.1	66	-4.1	10	—
500m	6	1	45.2	39.9	66	-5.3	10	—
600m	7	1	45.2	39.0	66	-6.2	10	—
700m	8	1	45.2	38.2	66	-7.0	10	—
800m	9	1	45.2	37.6	66	-7.6	10	—

Output of Night time Noise Prediction:

For Year 2020:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	34.5	50.2	66	15.7	10	Sub'l Inc
100m	2	1	34.5	45.5	66	11.0	10	Sub'l Inc
200m	3	1	34.5	40.8	66	6.3	10	—
300m	4	1	34.5	38.0	66	3.5	10	—
400m	5	1	34.5	36.2	66	1.7	10	—
500m	6	1	34.5	35.0	66	0.5	10	—
600m	7	1	34.5	34.0	66	-0.5	10	—
700m	8	1	34.5	33.3	66	-1.2	10	—
800m	9	1	34.5	32.6	66	-1.9	10	—

For Year 2025:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	34.5	51.4	66	16.9	10	Sub'l Inc
100m	2	1	34.5	46.7	66	12.2	10	Sub'l Inc
200m	3	1	34.5	42.0	66	7.5	10	—
300m	4	1	34.5	39.2	66	4.7	10	—
400m	5	1	34.5	37.4	66	2.9	10	—
500m	6	1	34.5	36.2	66	1.7	10	—
600m	7	1	34.5	35.3	66	0.8	10	—
700m	8	1	34.5	34.5	66	0.0	10	—
800m	9	1	34.5	33.9	66	-0.6	10	—

For Year 2030:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	34.5	52.6	66	18.1	10	Sub'l Inc
100m	2	1	34.5	48.0	66	13.5	10	Sub'l Inc
200m	3	1	34.5	43.3	66	8.8	10	—
300m	4	1	34.5	40.5	66	6.0	10	—
400m	5	1	34.5	38.7	66	4.2	10	—
500m	6	1	34.5	37.4	66	2.9	10	—
600m	7	1	34.5	36.5	66	2.0	10	—
700m	8	1	34.5	35.8	66	1.3	10	—
800m	9	1	34.5	35.1	66	0.6	10	—

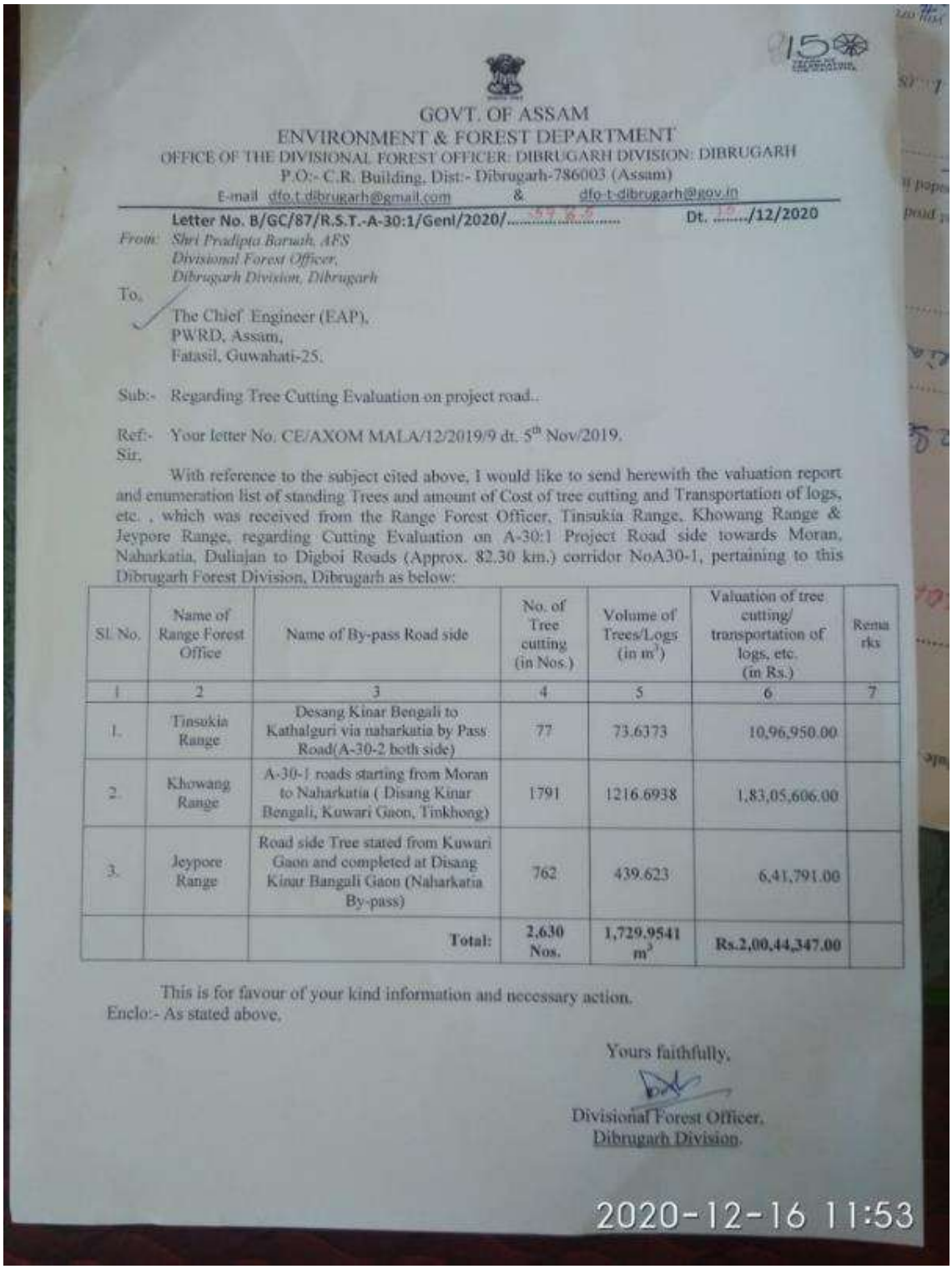
For Year 2035:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	34.5	53.9	66	19.4	10	Sub'l Inc
100m	2	1	34.5	49.2	66	14.7	10	Sub'l Inc
200m	3	1	34.5	44.5	66	10.0	10	Sub'l Inc
300m	4	1	34.5	41.7	66	7.2	10	—
400m	5	1	34.5	39.9	66	5.4	10	—
500m	6	1	34.5	38.7	66	4.2	10	—
600m	7	1	34.5	37.8	66	3.3	10	—
700m	8	1	34.5	37.0	66	2.5	10	—
800m	9	1	34.5	36.4	66	1.9	10	—

For Year 2040:

Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	34.5	55.2	66	20.7	10	Sub'l Inc
100m	2	1	34.5	50.5	66	16.0	10	Sub'l Inc
200m	3	1	34.5	45.8	66	11.3	10	Sub'l Inc
300m	4	1	34.5	43.0	66	8.5	10	—
400m	5	1	34.5	41.2	66	6.7	10	—
500m	6	1	34.5	40.0	66	5.5	10	—
600m	7	1	34.5	39.1	66	4.6	10	—
700m	8	1	34.5	38.3	66	3.8	10	—
800m	9	1	34.5	37.7	66	3.2	10	—

Annexure 20: Tree Cutting Evaluation from Forest Department



GOVT. OF ASSAM
ENVIRONMENT & FOREST DEPARTMENT
OFFICE OF THE DIVISIONAL FOREST OFFICER: DIBRUGARH DIVISION: DIBRUGARH
P.O:- C.R. Building, Dist:- Dibrugarh-786003 (Assam)
E-mail dfo.t.dibrugarh@gmail.com & dfo-t-dibrugarh@gov.in

Letter No. B/GC/87/R.S.T.-A-30:1/Genl/2020/..... Dt. ...../12/2020

From: *Shri Pradipta Baruah, AFS*
Divisional Forest Officer,
Dibrugarh Division, Dibrugarh

To,
The Chief Engineer (EAP),
PWRD, Assam,
Fatasil, Guwahati-25.

Sub:- Regarding Tree Cutting Evaluation on project road..

Ref:- Your letter No. CE/AXOM MALA/12/2019/9 dt. 5th Nov/2019.

Sir,

With reference to the subject cited above, I would like to send herewith the valuation report and enumeration list of standing Trees and amount of Cost of tree cutting and Transportation of logs, etc. , which was received from the Range Forest Officer, Tinsukia Range, Khowang Range & Jeypore Range, regarding Cutting Evaluation on A-30:1 Project Road side towards Moran, Naharkatia, Duliajan to Digboi Roads (Approx. 82.30 km.) corridor NoA30-1, pertaining to this Dibrugarh Forest Division, Dibrugarh as below:

Sl. No.	Name of Range Forest Office	Name of By-pass Road side	No. of Tree cutting (in Nos.)	Volume of Trees/Logs (in m^3)	Valuation of tree cutting/ transportation of logs, etc. (in Rs.)	Remarks
1	2	3	4	5	6	7
1.	Tinsukia Range	Desang Kinar Bengali to Kathalguri via naharkatia by Pass Road(A-30-2 both side)	77	73.6373	10,96,950.00	
2.	Khowang Range	A-30-1 roads starting from Moran to Naharkatia (Disang Kinar Bengali, Kuwari Gaon, Tinkhong)	1791	1216.6938	1,83,05,606.00	
3.	Jeypore Range	Road side Tree stated from Kuwari Gaon and completed at Disang Kinar Bangali Gaon (Naharkatia By-pass)	762	439.623	6,41,791.00	
		Total:	**2,630 Nos.**	**1,729.9541 m^3**	**Rs.2,00,44,347.00**	

This is for favour of your kind information and necessary action.

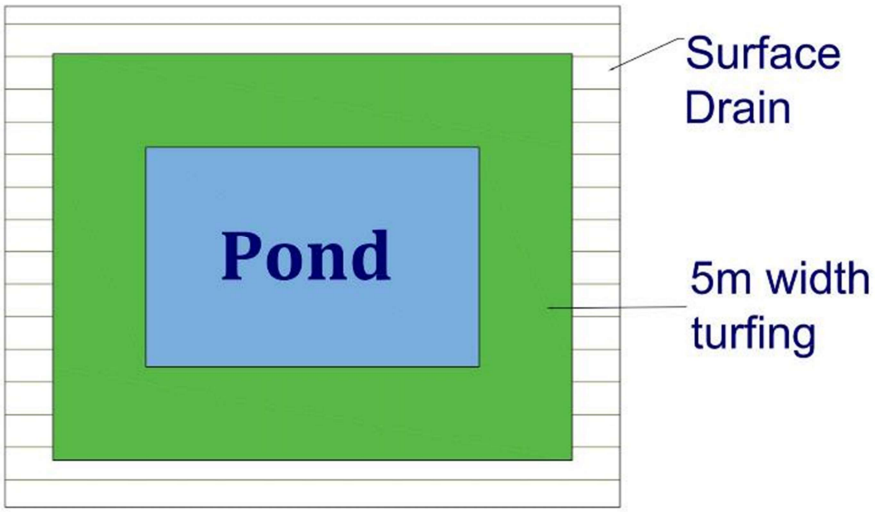
Enclo:- As stated above.

Yours faithfully,

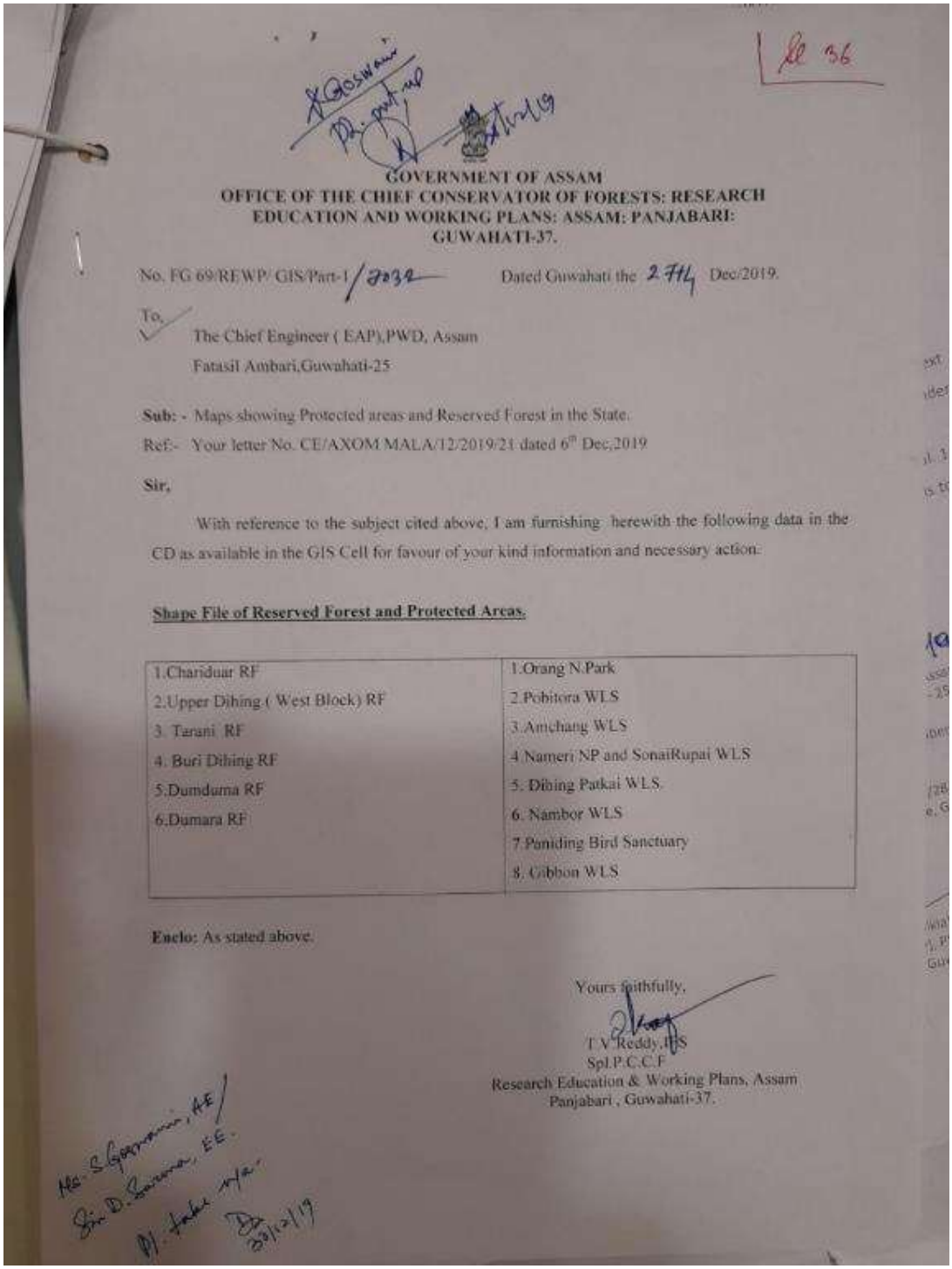
Divisional Forest Officer,
Dibrugarh Division.

2020-12-16 11:53

Annexure 21: Pond Enhancement Plan



Annexure 22: Letter from PCCF, Assam providing GIS Maps of Protected Areas and Reserve Forests



GOVERNMENT OF ASSAM
OFFICE OF THE CHIEF CONSERVATOR OF FORESTS: RESEARCH EDUCATION AND WORKING PLANS: ASSAM: PANJABARI: GUWAHATI-37.

No. FG 69/REWP/ GIS/Part-I/7032 Dated Guwahati the 27th Dec/2019.

To,
The Chief Engineer (EAP),PWD, Assam
Fatasil Ambari,Guwahati-25

Sub: - Maps showing Protected areas and Reserved Forest in the State.

Ref:- Your letter No. CE/AXOM MALA/12/2019/21 dated 6th Dec,2019

Sir,

With reference to the subject cited above, I am furnishing herewith the following data in the CD as available in the GIS Cell for favour of your kind information and necessary action.

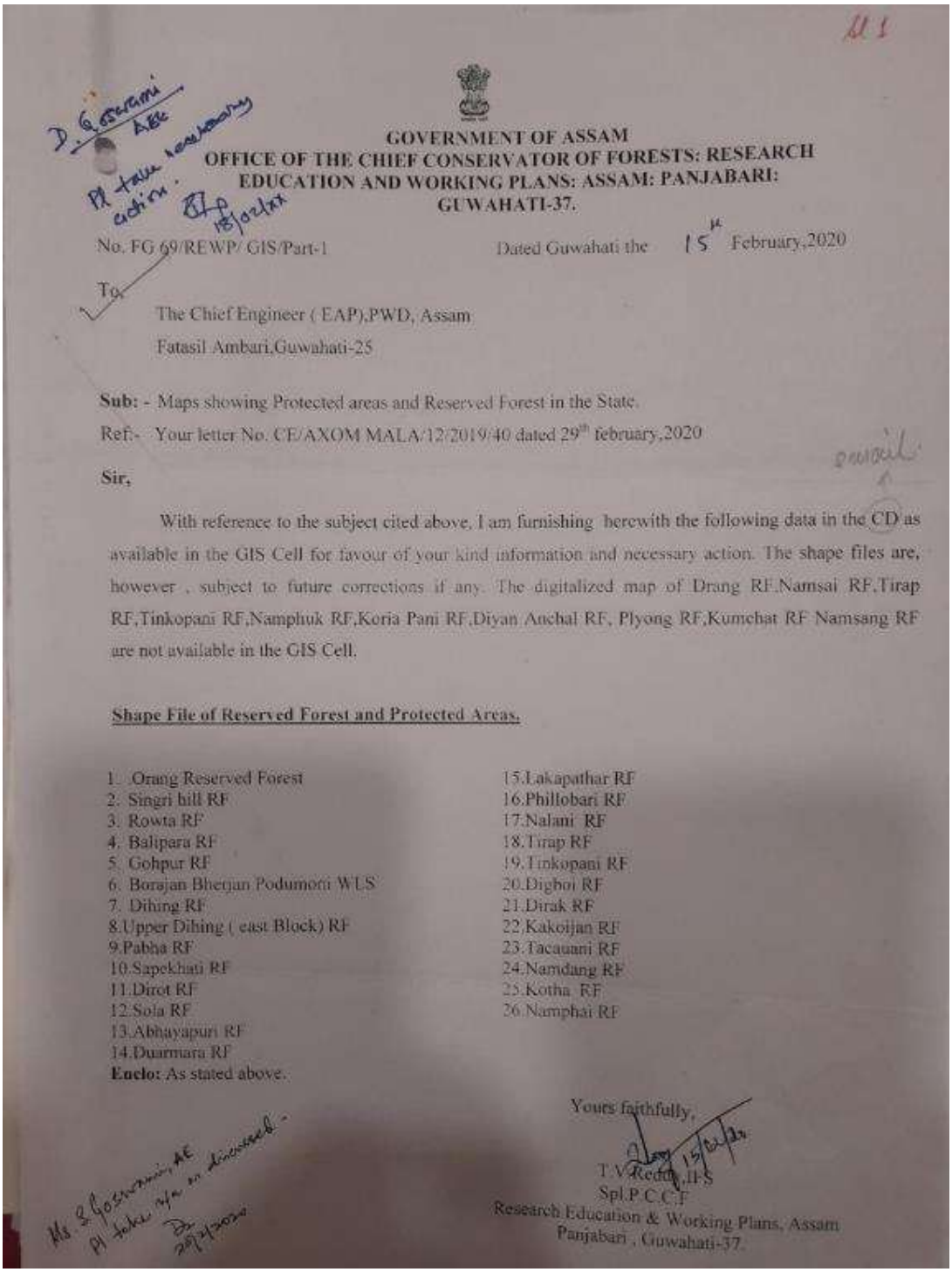
Shape File of Reserved Forest and Protected Areas.

1.Chariduar RF	1.Orang N.Park
2.Upper Dihing (West Block) RF	2.Pobitora WLS
3. Tarani RF	3.Amchang WLS
4. Buri Dihing RF	4.Nameri NP and SonaiRupai WLS
5.Dumduma RF	5. Dihing Patkai WLS
6.Dumara RF	6. Nambor WLS
	7.Paniding Bird Sanctuary
	8. Gibbon WLS

Enclo: As stated above.

Yours faithfully,

T.V.Reddy,IFS
Spl.P.C.C.F
Research Education & Working Plans, Assam
Panjabari , Guwahati-37.



GOVERNMENT OF ASSAM
OFFICE OF THE CHIEF CONSERVATOR OF FORESTS: RESEARCH EDUCATION AND WORKING PLANS: ASSAM: PANJABARI: GUWAHATI-37.

No. FG 69/REWP/ GIS/Part-1 Dated Guwahati the 15th February,2020

To,
The Chief Engineer (EAP),PWD, Assam
Fatasil Ambari,Guwahati-25

Sub: - Maps showing Protected areas and Reserved Forest in the State.

Ref:- Your letter No. CE/AXOM MALA/12/2019/40 dated 29th february,2020

Sir,

With reference to the subject cited above, I am furnishing herewith the following data in the CD as available in the GIS Cell for favour of your kind information and necessary action. The shape files are, however , subject to future corrections if any. The digitalized map of Drang RF,Namsai RF,Tirap RF,Tinkopani RF,Namphuk RF,Koria Pani RF,Diyan Anchal RF, Plyong RF,Kumchat RF Namsang RF are not available in the GIS Cell.

Shape File of Reserved Forest and Protected Areas.

1. Orang Reserved Forest
2. Singri hill RF
3. Rowta RF
4. Balipara RF
5. Gohpur RF
6. Borajan Bhetjan Podumoni WLS
7. Dihing RF
8. Upper Dihing (east Block) RF
9. Pabha RF
10. Sapekhati RF
11. Dirot RF
12. Sola RF
13. Abhayapuri RF
14. Duarmara RF
15. Lakapathar RF
16. Phillobari RF
17. Nalani RF
18. Tirap RF
19. Tinkopani RF
20. Digboi RF
21. Dirak RF
22. Kakoijan RF
23. Tacauani RF
24. Namdang RF
25. Kotha RF
26. Namphai RF

Enclo: As stated above.

Yours faithfully,

T.V.Reddy,IFS
Spl.P.C.C.F
Research Education & Working Plans, Assam
Panjabari , Guwahati-37.

Annexure 23: 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

Author
Mr. Satish Kumar Damodara
Environmental & Biodiversity Expert

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
Dr. P. C. Bhattacharjee
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.

Data collection and compilation by
Md. Rehman
Ms. Arunima Pandey
Environmental Specialist

CONTENTS

1. Introduction 1
2. Biodiversity of the State 1
3. Project Corridors 2
4. Objective 3
5. Screening of the Project Corridors for Biodiversity 3
6. Clearances 7
7. Applicable Rules and Regulations 7
8. Biodiversity Screening 8
   A. Corridor A15, A30, A20 - Applicable for Wild Fauna 8
   B. Corridor A31-Applicable for Birds 10
   C. Corridor A31-Applicable for Fisheries and Dolphin 11
9. Anticipated Impact due to the project 12
10. Biodiversity Management Plan (Corridor A15, A30 & A20) 13
   A. Budget of Biodiversity Management Plan (Corridor – A15, A30, A20) 28
11. Biodiversity Management Plan (Corridor A31) 28
   A. Project Impacts on Aquatic Ecology 29
   B. Aquatic Conservation and Management Plan 36
   C. Aquatic Ecology Monitoring Plan 46
   D. Budget of Biodiversity Management Plan (Corridor A31) 46

List of Tables

Table 1: Project Corridors 2
Table 2: Project corridors & its ecological sensitivity 4
Table 3: Threatened Wild Fauna of Protected Area 9
Table 4: Threatened Avifauna of Protected areas / WLS 10
Table 5: Significant Fishes diversity of River Subansiri 11
Table 6: Biodiversity Management Plan (A15 Dhodar Ali) 14
Table 7: Biodiversity Management Plan (A30 Moran Naharkatia Duliajan) 18
Table 8: Biodiversity Management Plan (A20 Sivasagar to Nakachari) 23
Table 9: Budget under Biodiversity Management (A15, A30 & A20) 28
Table 10: Negative impacts on Aquatic ecology 30
Table 11: Biodiversity Management Plan (Corridor - A31) Pre-Construction & Construction 38
Table 12: Detail budget for Dolphin Conservation 45
Table 13: Environmental Monitoring Plan 46
Table 14: Budget of Biodiversity Management Plan (Corridor A31) 46

List of Figures

Figure 1: Project Corridor and Eco Sensitive area 6
Figure 2: Silt Fencing.....34
Figure 3: Oil Interceptor 35
Figure 4: Proposed Organization Chart.....36

List of Annexures

Annexure 1: Corridor 31 - Majuli Biodiversity Heritage Gazette Notification by Government of Assam 47
Annexure 2: Corridor 30 – Letter from DFO, Digboi Division, Digboi 49
Annexure 3: Corridor 20 – Eco Sensitive Zone Notification of Hollongapar Gibbon WLS.....50
Annexure 4: Corridor 31 – Letter from DFO, Majuli (T) Forest Division, Majuli 58
Annexure 5: Corridor 31 – Letter from FBO, Bihpuria, Lakhimpur Forest Division, Lakhimpur 59
Annexure 6: Corridor 31 – NOC from Director, Inland Waterways Authority of India, Regional Office, Guwahati.....60
Annexure 7: Corridor 15 – NOC for Elephant Underpass.....61

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

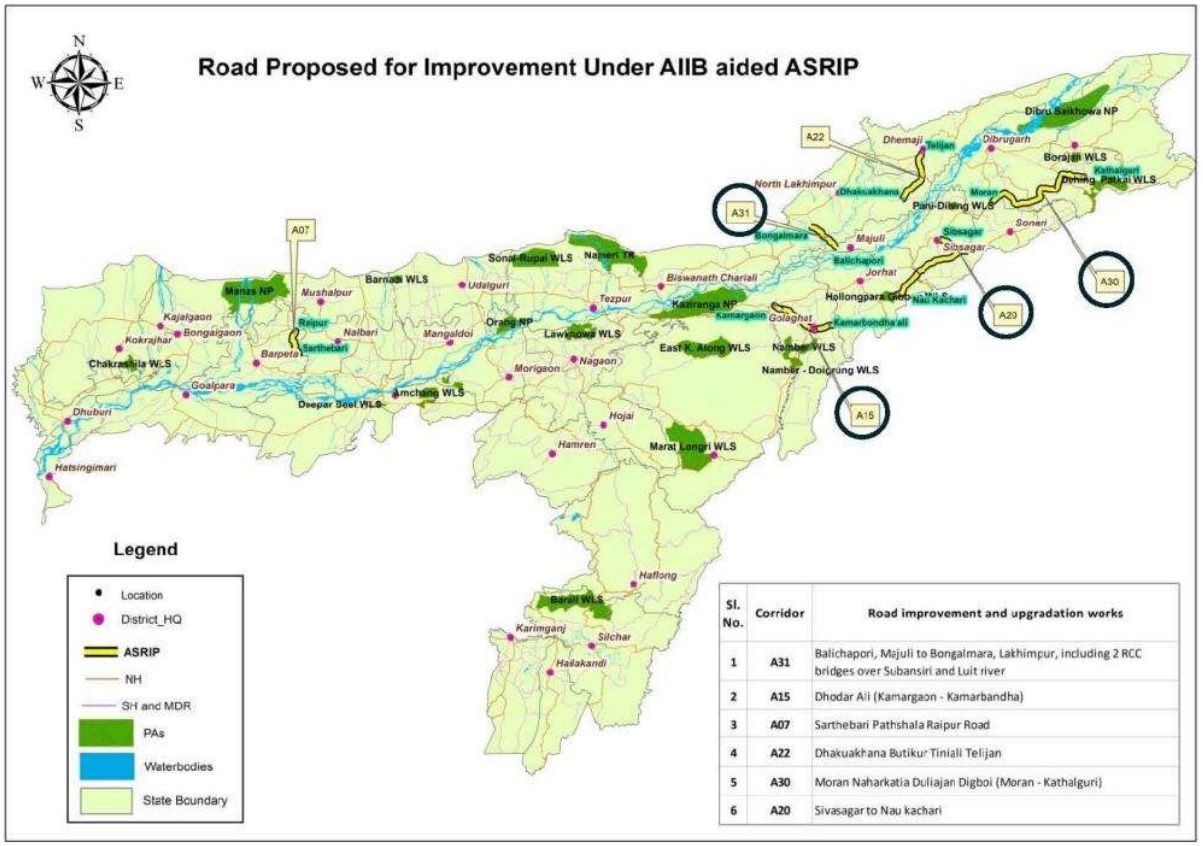
Ecological set-up, favourable geographical location and diversified topographical and climatic conditions were major factors driving the high biodiversity in the state of Assam. Different types of terrestrial and aquatic ecosystem are the ideal conditions for functioning of different types of natural 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					



Sl. No.	Corridor	Road improvement and upgradation works
1	A31	Balichapori, Majuli to Bongalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river
2	A15	Dhodar Ali (Kamargaon - Kamarbandha)
3	A07	Sarthebari Pathshala Raipur Road
4	A22	Dhakuakhana Butikur Tiniali Telijan
5	A30	Moran Naharkatia Duliajan Digboi (Moran - Kathalguri)
6	A20	Sivasagar to Nau kachari

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 locations. 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.

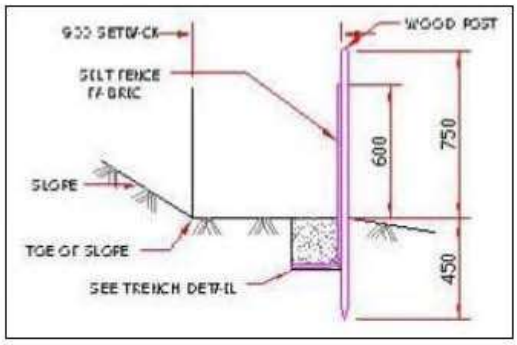


Figure 2: Silt Fencing

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.

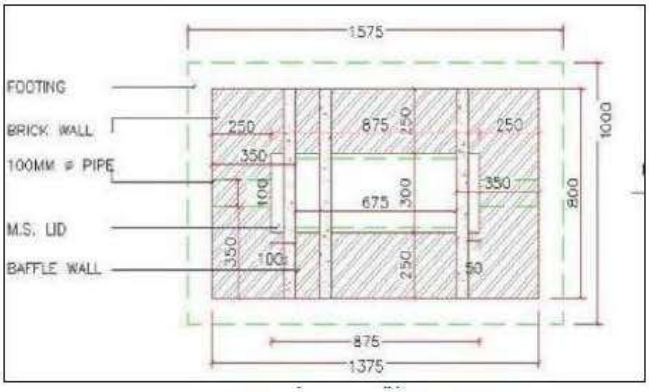


Figure 3: Oil Interceptor

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.

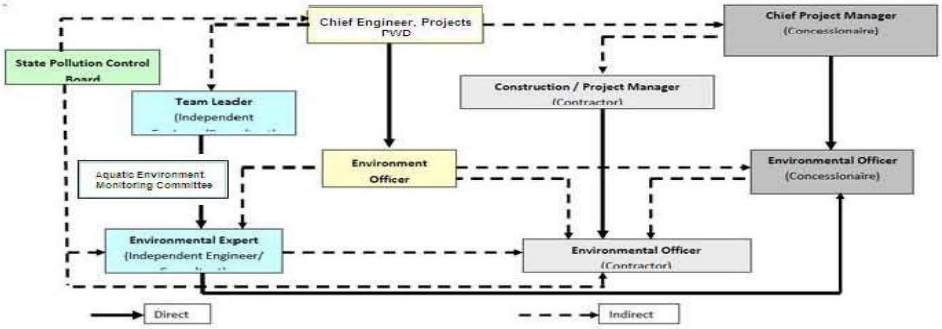


Figure 4: Proposed Organization Chart

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

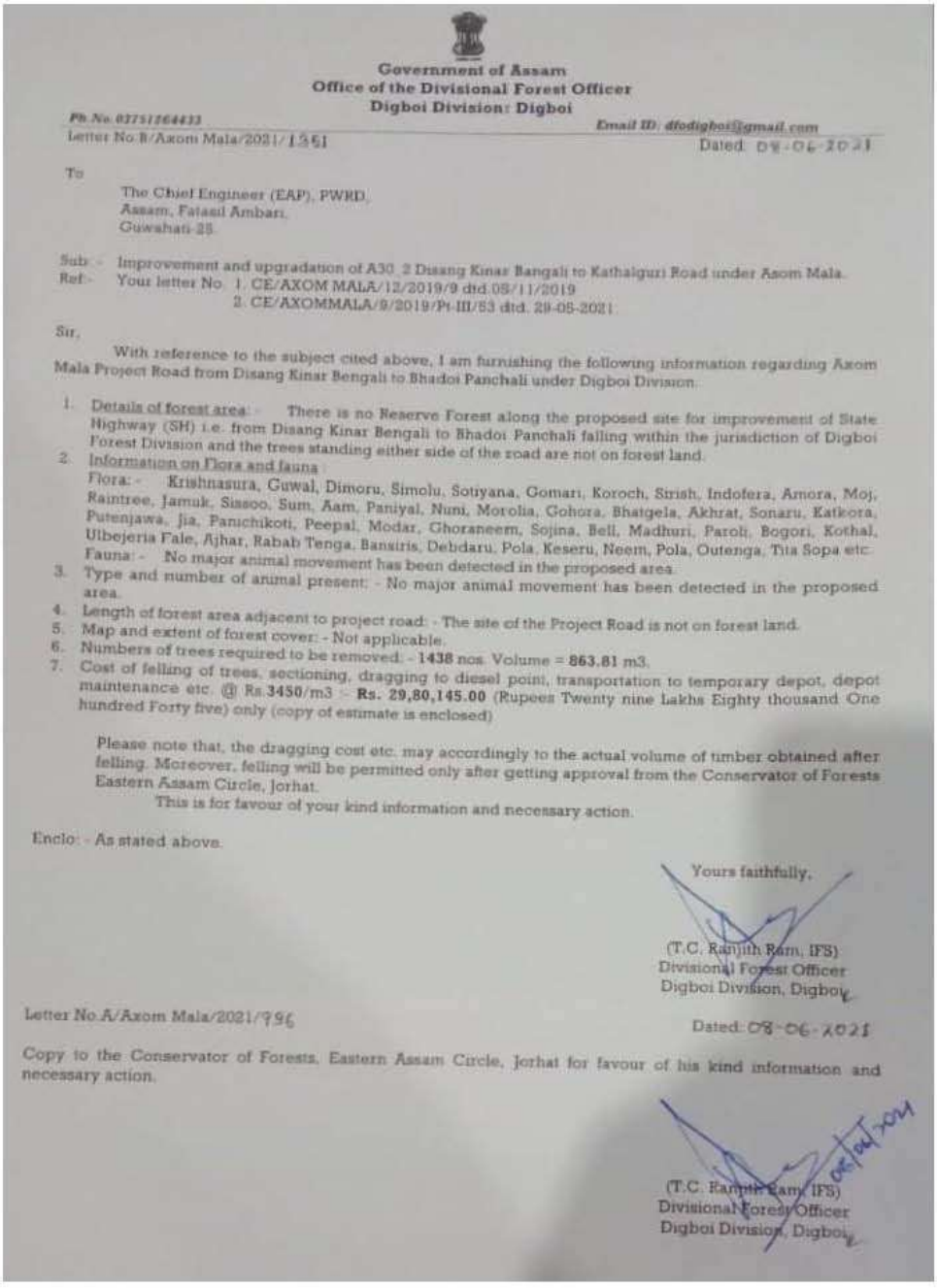
West : Sonitpur District.

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/2021/1361 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.08/11/2019
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/2021/996 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 (*Terramelos 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 kurzii*), poreng (*Elaeocarpus robustus*), sotiona (*Alostonia scholaris*), chom (*Machilus odoratissime*), chewa (*Caryota ureus*), jutuli (*Alzingia exulsa*), Jori (*Fiscus benjamine*), titasopa (*Michelia champaka*), pan chopa (*Magnolia sphenocarpa*), bohot (*Artocarpus lakoocha*), fakdema (*Triwea orientalis*), phul sopa (*Magnolia hookari*), borhomthuri (*Talauma Hodgsoni*), Bogi jamuk (*Eugenia kurzii*), Bor jamuk (*Eugenia jambulana*), bagh nola (*Litssea Sebifera*), bhatghilla (*Oroxylum Indicum*), 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 (*Ailanthus grandis*), dimaru (*Ficus Spp.*), ghora neem (*Melia indica*), hualu (*Litsaea polyantha*), Jalpai (*Elaeocarpus varunna*), kanchan (*Bauhinia purpurea*), keseru (*Heteropanax fragrans*), kotoi (*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 (*Lantana camera*), Jarmoni (*Eupatorium 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 rasirata*), Bioni Habota (*Desmodium labornifolium*), Bahok tita (*Adhatoda spp.*), Kaupat (*Phrynium spp.*), Makhioti (*Fleminzia sricia*), Mejenga (*Viburnum colebookianum*), Amoilota (*Menispermum glabrum*), Harjura lota (*Cissus quadrangularis*), Akashilota (*Trachelospermum fragrans*), Panilota (*Dilina 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 (*Elephas 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 (*Caloductyloids 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 (*Lophura leucomala*), babblers (*Timaliinae spp.*), barbets (*Capitonidae spp.*), bitterns (*Ardeidae spp.*), kingfisher (*Alcedinidae*), orioles (*Oriolidae*), bulbuls (*Pycnonotidae spp.*), owls (*Strigidae*), egrets (*Aridеidae*), 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).

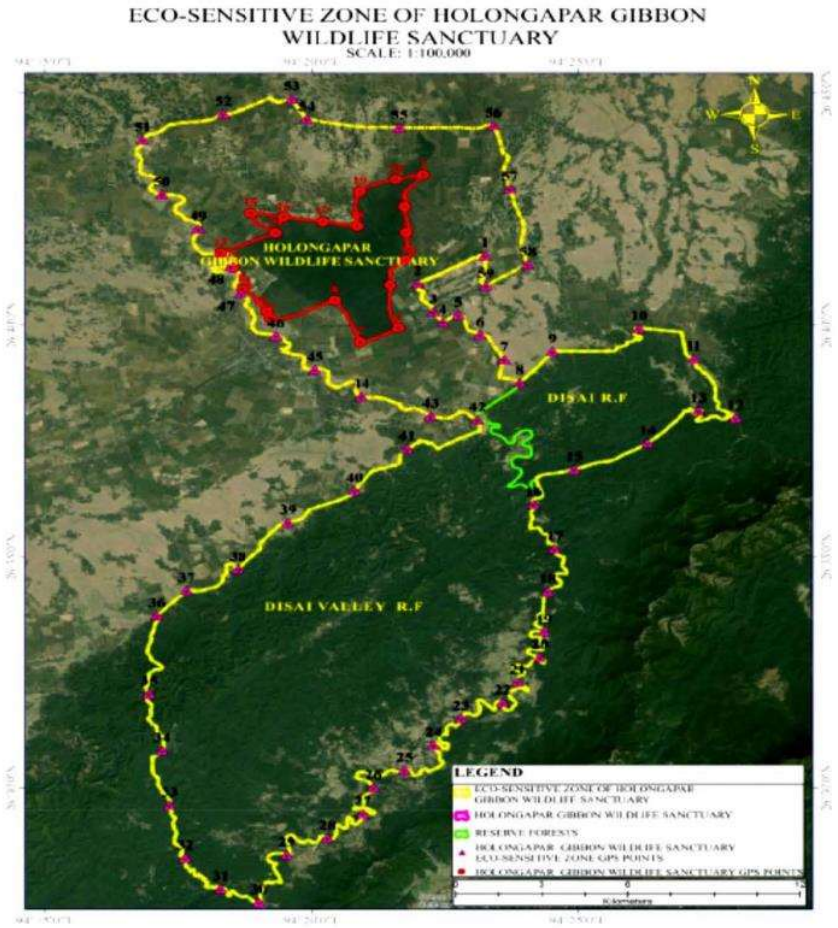
South:-From GPS Point No. 12 (94° 27' 57.392" E & 26° 38' 0.138" N) the boundary runs towards west along the reserve forest boundary of Disai & Disai Valley reserve forests (Assam Nagaland Inter-State Boundary) crossing the GPS Point No. 13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28 & 29 till it meets 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.

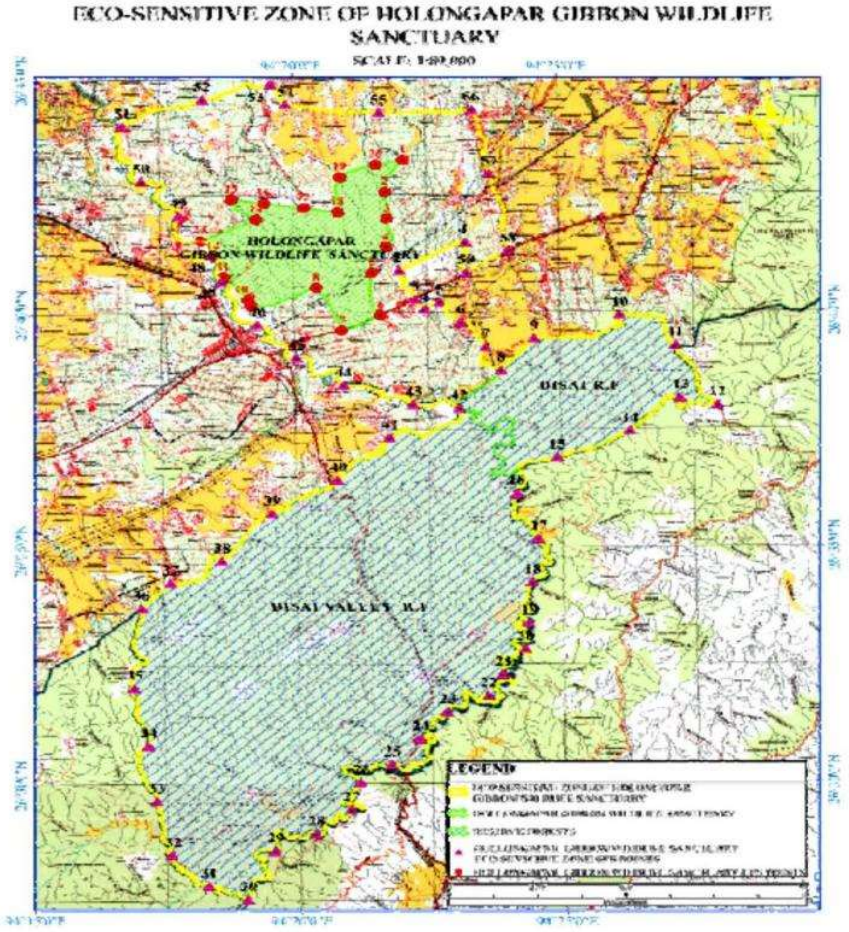
ANNEXURE- I

GOOGLE MAP OF ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS



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

36 THE GAZETTE OF INDIA : EXTRAORDINARY [PART II—SEC. 3(ii)]

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

3039
19/3/2021

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)/4401 **Date: 16-03-2021**

D. Goswami AEE
Pl. pursue
19/5/21

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

Ms. S. Goswami, AE
Pl. pursue
23/3/21

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.