

Assam State Roads Project
Environmental and Social Assessment

**Draft Environmental
Impact Assessment Report (SH-32)**

Authorized

Public Disclosure Authorized

disclo



Public Works Department
Government of Assam



LEA Associates South Asia Pvt. Ltd.,
New Delhi

June 2011

Abbreviations

AAQM	:	AMBIENT AIR QUALITY MONITORING
ASI	:	ARCHAEOLOGICAL SURVEY OF INDIA
ASRP	:	ASSAM STATE ROAD PROJECT
ASRRRP	:	ASSAM STATE ROADS RESETTLEMENT & REHABILITATION POLICY
BIS	:	BUREAU OF INDIAN STANDARD
BMC	:	BIODIVERSITY MANAGEMENT COMMITTEES
CD	:	CROSS DRAINAGE
CE	:	CHIEF ENGINEER
COI	:	CORRIDOR OF IMPACT
CPCB	:	CENTRAL POLLUTION CONTROL BOARD
CPR	:	COMMON PROPERTY RESOURCES
CSC	:	CONSTRUCTION SUPERVISION CONSULTANT
DDP	:	DESERT DEVELOPMENT PROGRAMME
EA	:	ENVIRONMENTAL ASSESSMENT
EAC	:	EXPERT APPRAISAL COMMITTEE
EIA	:	ENVIRONMENTAL IMPACT ASSESSMENT
EMP	:	ENVIRONMENTAL MANAGEMENT PLAN
GC	:	GENERAL CONDITIONS
GP	:	GRAM PANCHAYAT
GSB	:	GRANULAR SUB-BASE
ILO	:	INTERNATIONAL LABOUR ORGANISATION
INTACH	:	INDIAN NATIONAL TRUST FOR ART AND CULTURE HERITAGE
IRC	:	INDIAN ROADS CONGRESS
IS	:	INDIAN STANDARD
LASA	:	LEA ASSOCIATES SOUTH ASIA PVT. LTD.
MDR	:	MAJOR DISTRICT ROADS
MINARS	:	MONITORING OF INDIAN NATIONAL AQUATIC RESOURCES SERIES
MOEF	:	MINISTRY OF ENVIRONMENT AND FOREST
NAAQS	:	NATIONAL AMBIENT AIR QUALITY STANDARDS
NBA	:	NATIONAL BIODIVERSITY AUTHORITY
NOC	:	NO OBJECTION CERTIFICATE
OP	:	OPERATIONAL POLICY
PAPS	:	PROJECT AFFECTED PERSONS
PCB	:	POLLUTION CONTROL BOARD
PIS	:	PERFORMANCE INDICATORS
PIU	:	PROJECT IMPLEMENTATION UNIT
PPE	:	PERSONAL PROTECTIVE EQUIPMENTS
PUC	:	POLLUTION UNDER CONTROL
RAP	:	RESETTLEMENT ACTION PLAN
RMC	:	REGIONAL METEOROLOGY CENTRE
ROW	:	RIGHT OF WAY
RPM	:	RESPIRABLE PARTICULATE MATTER
SA	:	SOCIAL ASSESSMENT
SBB	:	STATE BIODIVERSITY BOARDS

SC	:	SCHEDULED CASTE
SEAC	:	STATE OR UNION TERRITORY LEVEL EXPERT APPRAISAL COMMITTEE
SEIAA	:	STATE/UNION TERRITORY ENVIRONMENT IMPACT ASSESSMENT AUTHORITY
SH	:	STATE HIGHWAYS
SOI	:	SURVEY OF INDIA
SOS	:	STRATEGIC OPTION STUDY
SPM	:	SUSPENDED PARTICULATE MATTER
ST	:	SCHEDULE TRIBE
STDS	:	SEXUALLY TRANSMITTED DISEASES
WBM	:	WATER BOUND MACADAM
WHS	:	WATER HARVESTING STRUCTURES
AIDS	:	ACQUIRED IMMUNE DEFICIENCY SYNDROME
D.O	:	DISSOLVED OXYGEN
DPR	:	DETAILED PROJECT ROAD
GOA	:	GOVERNMENT OF ASSAM
GOI	:	GOVERNMENT OF INDIA
PWD	:	PUBLIC WORKS DEPARTMENT

Table of Contents

E	EXECUTIVE SUMMARY	E-1
E.1.	BACKGROUND	E-1
E.2.	OBJECTIVES OF THE ASSIGNMENT.....	E-1
E.3.	SCOPE OF ENVIRONMENTAL ASSESSMENT (EA).....	E-1
E.4.	DESCRIPTION OF PROJECT ROAD.....	E-1
E.5.	KEY ENVIRONMENTAL LAWS AND REGULATIONS.....	E-1
E.6.	BASE LINE ENVIRONMENT	E-2
E.7.	STAKEHOLDER CONSULTATION.....	E-4
E.8.	POTENTIAL IMPACT	E-4
E.9.	ENVIRONMENTAL MANAGEMENT PLAN	E-6
E.10.	ENVIRONMENTAL MONITORING PLAN.....	E-6
E.11.	COST ESTIMATES FOR ENVIRONMENTAL MANAGEMENT	E-6
1	INTRODUCTION.....	1-1
1.1	BACKGROUND	1-1
1.2	BRIEF DESCRIPTION OF THE PROJECT ROAD	1-2
1.3	SCOPE FOR CONDUCTING EIA	1-3
1.4	STUDY APPROACH	1-3
1.5	STRUCTURE OF EIA DOCUMENT.....	1-4
2	PROJECT DESCRIPTION.....	2-1
2.1	BROADER DETAILS OF THE PROJECT AND LOCATION	2-1
2.2	SUMMARY OF PROJECT DETAILS	2-2
2.3	DESIGN PRINCIPLES.....	2-4
2.4	PROJECT BENEFITS.....	2-4
2.5	PROJECT IMPLEMENTATION SCHEDULE	2-6
3	ANALYSIS OF ALTERNATIVES.....	3-1
3.1	WITH AND WITHOUT PROJECT ALTERNATIVES	3-1
3.2	CONSIDERATION OF ALTERNATIVES	3-2
3.2.1	Nowjan (km 1/070 to 1/200).....	3-2
3.2.2	Ghillidary (km 3/300 to 3/500).....	3-2
3.2.3	Atkhaliya (6/000 to 6/200).....	3-3
3.2.4	Lunphuya (9/300 to 9/800)	3-3
3.2.5	Bankachari (10/160 to 10/300)	3-4
3.2.6	Bankachari (10/400 to 10/600)	3-4
3.2.7	Bankachari (10/800 to 10/980)	3-4
3.3	SUMMARY OF IMPACT OF EACH ALTERNATIVE.....	3-4
4	REVIEW AND ASSESSMENT OF APPLICABLE ENVIRONMENTAL REGULATIONS.....	4-1
4.1	ENVIRONMENTAL RULES AND REGULATIONS.....	4-1
4.1.1	Legal Framework.....	4-2
4.1.2	Key Environmental Laws and Regulations.....	4-2
4.1.3	Environmental Requirements of the State.....	4-6
4.1.4	Other Policies / Legislations Applicable to Road Construction Projects.....	4-7
4.1.5	World Bank Environmental Requirements.....	4-8
4.1.6	MoRTH & IRC Specifications.....	4-9
4.2	ENVIRONMENTAL CLEARANCE PROCEDURE	4-11

5	DESCRIPTION OF THE ENVIRONMENT.....	5-1
5.1	STUDY AREA	5-1
5.2	LAND ENVIRONMENT	5-1
	5.2.1 Topography	5-1
	5.2.2 Soil.....	5-1
	5.2.3 Seismicity.....	5-2
	5.2.4 Geology	5-3
	5.2.5 Flood Plains	5-3
5.3	LAND USE	5-4
5.4	WATER ENVIRONMENT.....	5-5
	5.4.1 Hydrogeology	5-5
	5.4.2 Rivers.....	5-5
	5.4.3 Ponds / Lakes.....	5-6
	5.4.4 Ground Water Aquifer.....	5-6
	5.4.5 Recharge Zones	5-7
	5.4.6 Surface Water Quality	5-7
	5.4.7 Ground Water Quality.....	5-8
5.5	AIR ENVIRONMENT.....	5-9
	5.5.1 Climate & Meteorology	5-9
	5.5.2 Ambient Air Quality.....	5-10
5.6	NOISE ENVIRONMENT.....	5-11
5.7	BIOLOGICAL ENVIRONMENT	5-12
	5.7.1 Forest	5-12
	5.7.2 Flora	5-13
	5.7.3 Fauna.....	5-14
	5.7.4 Sensitive Ecological Areas	5-15
	5.7.5 Aquatic ecosystems.....	5-17
5.8	SOCIO-ECONOMIC ENVIRONMENT.....	5-17
	5.8.1 Population Distribution.....	5-18
	5.8.2 Population Density	5-18
	5.8.3 Sex Ratio of the Influence Area	5-18
	5.8.4 Vulnerable Groups in the Influence Area	5-19
	5.8.5 Literacy Rate.....	5-19
	5.8.6 Workforce Participation	5-20
	5.8.7 Cultural Environment	5-21
6	ANALYSIS OF POTENTIAL ENVIRONMENTAL IMPACT & MITIGATION MEASURES 6-1	
6.1	PROJECT IMPACTS AND ISSUES	6-1
6.2	LAND ENVIRONMENT	6-1
	6.2.1 Anticipated Impacts	6-1
	6.2.2 Mitigation Measures	6-2
6.3	WATER ENVIRONMENT.....	6-5
	6.3.1 Anticipated Impacts	6-5
	6.3.2 Mitigation Measures	6-6
6.4	AIR ENVIRONMENT.....	6-10
	6.4.1 Anticipated Impacts	6-10
	6.4.2 Mitigation Measures	6-12
	6.4.3 Construction Stage	6-12
6.5	NOISE ENVIRONMENT.....	6-13
	6.5.1 Anticipated Impacts	6-13
	6.5.2 Mitigation Measures	6-14
6.6	BIOLOGICAL ENVIRONMENT	6-15

	Contents
6.6.1	Anticipated Impacts 6-15
6.6.2	Mitigation Measures 6-16
6.7	SOCIO-ECONOMIC AND HEALTH ENVIRONMENT..... 6-17
6.7.1	Anticipated Impacts 6-17
6.7.2	Mitigation Measures 6-18
6.8	SOLID WASTE MANAGEMENT 6-18
6.8.1	Anticipated Impacts 6-18
6.8.2	Mitigation Measures 6-19
6.8.3	Mitigation Measures 6-19
7	ENVIRONMENTAL MONITORING PROGRAMME 7-1
7.1	PERFORMANCE INDICATORS..... 7-1
7.2	MONITORING PARAMETERS AND STANDARDS 7-2
7.2.1	Ambient Air Quality Monitoring (AAQM)..... 7-2
7.2.2	Noise Quality Monitoring 7-3
7.2.3	Water Quality Monitoring..... 7-3
7.2.4	Monitoring Plans for Environment Condition 7-4
7.2.5	Reporting System 7-7
8	STAKEHOLDERS CONSULTATION..... 8-1
8.1	INTRODUCTION 8-1
8.2	IDENTIFICATION OF STAKEHOLDERS..... 8-1
8.3	CONSULTATIONS WITH PRIMARY STAKEHOLDERS..... 8-1
8.4	CONSULTATIONS WITH SECONDARY STAKEHOLDERS 8-3
9	ENVIRONMENTAL MANAGEMENT PLAN 9-1
9.1	OBJECTIVE OF EMP 9-1
9.1.1	Pre-Construction Stage 9-1
9.1.1	Construction Stage 9-1
9.1.2	Operation Stage 9-2
9.2	SUMMARY MATRIX FOR ENVIRONMENTAL MONITORING 9-44
9.3	IMPLEMENTATION OF EMP..... 9-46
9.4	GOOD ENVIRONMENTAL CONSTRUCTION GUIDELINES 9-47
9.5	COST ESTIMATES FOR ENVIRONMENTAL MANAGEMENT 9-48
10	CONCLUSION..... 10-1
10.1	CONCLUSION 10-1
11	BIBLIOGRAPHY 11-1
11.1	MANUALS 11-1
11.2	LEGAL FRAMEWORKS 11-1
11.3	PUBLICATIONS..... 11-1
11.4	WEB REFERENCES 11-1

List of Tables

Table E-1: Environmental Regulations and Legislations	E-1
Table E-2: General Impacts on Natural Environment	E-5
Table 1-1: ASRP Phase - I Roads	1-1
Table 1-2: PIU / Project Proponent Contact Details	1-1
Table 2-1: Enroute Villages of SH-32	2-2
Table 2-2: River/ Stream Crossing Location in SH-32	2-2
Table 2-3: Economic Benefits in SH-32	2-5
Table 2-4: Major Junctions in SH-32	2-6
Table 2-5: Environmental Aspects to be monitored in Project Implementation.....	2-6
Table 3-1: 'With' and 'Without' Project Scenario.....	3-1
Table 3-2: Realignment areas in SH-32	3-2
Table 4-1: Summary of Environmental Legislation Applicable for Proposed Project	4-1
Table 4-2: Applicable Laws and Regulations	4-2
Table 5-1: Surface Water Quality	5-7
Table 5-2: Groundwater Quality.....	5-8
Table 5-3: Climatology Table.....	5-9
Table 5-4: Ambient Air Quality Monitoring Analysis	5-10
Table 5-5: Noise Monitoring Observations	5-11
Table 5-6: CPCB Ambient Noise Standards	5-12
Table 5-7: Water Quality of River Dhansiri	5-17
Table 5-8: Invertebrates in River Dhansiri	5-17
Table 5-9: Population Distribution in Block along the Project Corridor, 2001	5-18
Table 5-10: Population Density in Block along Project Corridor, 2001	5-18
Table 5-11: Sex Ratio of Block along the Project Corridor, 2001.....	5-18
Table 5-12: SC & ST Population along the Project Corridor, 2001.....	5-19
Table 5-13: Literacy Rate of Block along the Project Corridor, 2001	5-19
Table 5-14: Workforce Participation Ratio along Project Corridor, 2001	5-20
Table 5-15: Religious structures along the project corridor.....	5-21
Table 6-1: water bodies along the project corridor.....	6-5
Table 6-2: List of river crossing along SH-32	6-7
Table 6-3: Predicted Pollutant Concentrations at sensitive receptors	6-11
Table 6-4: Measures to minimize air pollution during the progress of work.....	6-12
Table 6-5: Ambient Noise Standards.....	6-13
Table 6-6: Predicted Noise levels for various road sections and traffic scenarios.....	6-14
Table 6-7: Trees for Avenue Plantation	6-17
Table 6-8: Community Resources along SH-32	6-18
Table 6-9: Religious structures along the corridor SH-32	6-18
Table 7-1: Performance Indicators for Project Implementation	7-1
Table 7-2: National Ambient Air Quality Standards.....	7-2
Table 7-3: National Ambient Noise Quality Standards	7-3
Table 7-4: National Standard of Water	7-4
Table 7-5: Environmental Monitoring Plan.....	7-5
Table 7-6: Summary details of Reporting	7-7
Table 8-1: Details of the Consultations along the project corridor	8-2
Table 9-1: Environmental Management Plan.....	9-3
Table 9-2: Environmental Monitoring Plan.....	9-44
Table 9-3: Institutional Responsibilities.....	9-46
Table 9-4: Guideline for Good Environmental Practices	9-47
Table 9-5: Environmental Management Budget	9-48

List of Figures

Figure 1-1: SH – 32 (Project Road).....	1-2
Figure 2-1: Project corridor (SH – 32)	2-1
Figure 2-2: SH – 32 (Connectivity Map)	2-5
Figure 3-1: Realignment @ Nowjan.....	3-3
Figure 3-2: Realignment @ Ghillidary.....	3-3
Figure 3-3: Realignment @ Atkhaliya	3-3
Figure 3-4: Realignment @ Lunphuya	3-3
Figure 3-5: Realignment @ Bankachari (10/160 to 10/300)	3-4
Figure 3-6: Realignment @ Bankachari (10/400 to 10/600)	3-4
Figure 3-7: Realignment @ Bankachari (10/800 to 10/980)	3-4
Figure 5-1: Elevation Graph for SH-32 (Barhola to Garango).....	5-1
Figure 5-2: Topography Map of the Project Area.....	5-2
Figure 5-3: Soil Map of the Project Area.....	5-2
Figure 5-4: Seismic zone map of India.....	5-2
Figure 5-5: GSHAP – Hazard Map for Assam.....	5-2
Figure 5-6: Flood in Majuli Island.....	5-3
Figure 5-7: Assam Flood Zone Map.....	5-3
Figure 5-8: Paddy fields along the project corridor of SH-32.....	5-4
Figure 5-9: Ghillidhary Tea Estate in SH-32.....	5-4
Figure 5-10: Geology Map of Project Corridor.....	5-4
Figure 5-11: Landuse Profile of Project Corridor.....	5-4
Figure 5-12: Hydrogeology Map of the Project corridor.....	5-6
Figure 5-13: Groundwater Quality sampling location.....	5-8
Figure 5-14: Temperature variation Graph.....	5-9
Figure 5-15: Ambient Air Quality – Sampling Location Map.....	5-11
Figure 5-16: Ambient Noise Quality – Sampling Location Map.....	5-12
Figure 5-17: View of avenue trees @8/600	5-13
Figure 5-18: View of avenue trees @17/800	5-13
Figure 5-19: Forest Map of Project Site (Assam).....	5-14
Figure 5-20: Forest Type Map of Project Site (Assam).....	5-14
Figure 5-21: Wild life and Wetlands Map of Project Site (Assam).....	5-15
Figure 5-22: Nambor Wildlife Sanctuary Map.....	5-16
Figure 5-23: Population Density along Project Corridor	5-19
Figure 5-24: Sex Ratio along the Project Corridor	5-19
Figure 5-25: SC Population along the Project Corridor.....	5-20
Figure 5-26: ST Population along the Project Corridor.....	5-20
Figure 5-27: Literacy Rate along the Project Corridor	5-20
Figure 5-28: Workforce Participation Ratio along Project Corridor.....	5-20
Figure 6-1: Depth Specification for Borrow Pit Along the Road	6-3
Figure 6-2: Oil and Grease Interceptor.....	6-4
Figure 6-3: Channelised Embankment; Chute Drain.....	6-7
Figure 6-4: Cross-section of Silt Fencing	6-8
Figure 6-5: Slope Protection @ River Bank	6-10
Figure 6-6: Slope Protection @ Bridge approach (Upstream side).....	6-10
Figure 6-7: Slope Protection @ Bridge approach (Downstream side).....	6-10
Figure 6-8: Project corridor with 10 and 15Km buffer Zone.....	6-16
Figure 9-1: Organisation Setup for EMP Implementation.....	9-46

List of Annexures

ANNEXURE - 1: Construction Camp

ANNEXURE - 2: Environmental Monitoring Formats

ANNEXURE - 3: Socio – Economic Survey Questionnaires

ANNEXURE - 4: Work Programme & Construction Schedule for Improvement & Upgradation of SH-32

ANNEXURE - 5: Guidelines for Environmental Management

E Executive Summary

E.1. Background

Government of Assam has planned to improve the State road network by providing better quality and safer roads to the users in sustainable manner with loan assistance from World Bank. Improved quality of roads, better institutional operation and management system of Highway division, PWD, Assam and safe roads are important features of the project component. In this connection Govt of Assam has selected 8 corridors (cumulative length of 300 km) of high-density (traffic) roads through Strategic Option Study (SOS) to be developed.

E.2. Objectives of the Assignment

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

E.3. Scope of Environmental Assessment (EA)

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

E.4. Description of Project Road

The project corridor Barhola to Garango of SH-32, starts at Barhola chariali (km 37/300) and ends at Goranga bazar (km 49/896) connecting with another State Highway SH-1 and SH-33. Project road SH- 32 provides connectivity to District HQ Jorhat with Sub Divisional HQ Titabar. The project road mainly traverses through agricultural land and terrain is plain.

The existing Road is single lane (3.75 m) with bituminous pavement in some stretches. In some portion there is no existing pavement and in few stretches it is either earthen or gravel. Some stretches of the road does not have any pavement. It has earthen shoulder of 0.5 m to 1.5 m on both sides. Geometry of the existing road is fair to good except at few places where reverse curves or sharp curves are observed along the corridor. The existing ROW available in open area is between 10 m to 24 m and in built up area is between 9 m to 15 m. The overall condition of the pavement throughout the project corridor is poor to very poor.

E.5. Key Environmental Laws and Regulations

Table E-1 presents the environmental regulations and legislations relevant to Assam state road project (ASRP).

Table E-1: Environmental Regulations and Legislations

Sl. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
1.	Environment	To protect and improve	Yes	As all environmental	MoEF, GoI; DoE,



Sl. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
	Protection Act-1986	overall environment		notifications, rules and schedules are issued under this act.	State Gov. PCB, Assam
2.	The Land Acquisition Act 1894 & 1989	Set out rule for acquisition of land by government	Yes	This act will be applicable to as there will be acquisition of land for widening, geometric improvements and realignments.	Revenue Department State Government.
3.	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by & Transport controlling emission of air pollutants as per the prescribed standards.	Yes	This act will be applicable during construction; for obtaining NOC for establishment of hot mix plant, workers' camp, construction camp, etc.	PCB, Assam
4.	Water Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, construction camp, workers' camp, etc.	PCB, Assam
5.	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	PCB, Assam
6.	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	PCB, Assam
7.	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	For transporting and storing diesel, bitumen etc.	Chief Controller of Explosives
8.	Minor Mineral and concession Rules	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	Govt of Assam
9.	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution.	Yes	This rule will be applicable to road users and construction Machinery.	Motor Vehicle Department
10.	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregates. These will be procured through mining from riverbeds and quarries	Forest Department,

As per the new amendment dt. 6th April, 2011 to EIA notification 2006, environmental clearance has been made mandatory only for new state highways. Hence, the widening / strengthening and improvement works on existing state highways has been declared as a permissible activity.

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

E.6. Base Line Environment

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

A. Physical Environment

1. Climate & Meteorology

The project region falls in Jorhat and Golaghat districts. The climate of Jorhat district is classified as mesothermal wet climate with forest type of vegetation. January is the coldest month with temperature of 6.1°C. July and August are the hottest period with average monthly temperature of about 29°C. The average relative humidity in a year is 78.7 %. The average annual rainfall for last ten years from 1998 to 2007 has been computed to be 1,867.08 mm. The amount of rainfall increases from southwest to northeast. Golaghat district enjoys a climate, which is characterized by a highly humid atmosphere, abundant rain and general coolness. The district enjoys sub-tropical humid climate. Average annual rainfall in the district is 2,012mm. About 60 to 65% of the annual precipitation is received during south-west monsoon from June to September. The pattern of rainfall varies in the district, from south to north, the intensity of rainfall increases and the maximum rainfall is recorded in the north eastern parts of the district. Annual average temperature of the district during winter period varies from 6 to 14°C and during summer, it varies from 29 to 36°C. The relative humidity varies from 93 to 95% during morning hours and during afternoon hours it varies from 53 to 75%.

2. Ambient Air Quality

Ambient air quality was monitored at four stations viz. Ghillidary Madhya English Vidyalaya, Rupkoliya Primary School, Worsha Goranga Madhyamik Balika Vidyalaya and Goranga Chariali Bazar. Selections of Air quality monitoring stations are done as per MoEF guidelines for conducting EIA study. From the observation, the pollutant concentration levels of NO_x, SO₂, HC and CO at all the stations were very low in concentrations and comply with the NAAQS. However, RSPM exceed the limits for all the stations, AQ1 records the maximum (191.51µg/m³) followed by AQ2 (168.36 µg/m³). The higher values are attributed to the re-suspended dust from the unpaved / damaged roads in the area used by vehicles and also the commercial activities.

3. Ambient Noise Quality

To observe the noise level of the project area, noise monitoring are performed at the AAQM stations. The observed noise equivalent (Leq) was in the range of 39.1 – 43.8 dB (A) in daytime and 32.5 – 38.5 dB (A) in nighttime. The observed values are within the CPCB noise quality standards.

4. Surface water quality

From the observation, the D.O (Dissolved Oxygen) concentration is less in comparison with the standard. Likewise, the BOD concentration is high in comparison with the standard. This clearly indicates the water is polluted with organic materials. This may be due to the high nutrient value (or) algal bloom. Oil & Grease was also found to be high in comparison with the standard, this may due to the surface runoff from oil contaminated areas. Remaining parameters like Solids, Calcium, Hardness, Magnesium, Phosphate, arsenic, Iron and Chloride were found below the permissible limits of surface water prescribed by Indian Standard.

5. Ground water quality

The groundwater quality with respect to almost all the essential parameters was observed to be good and acceptable quality except for the concentration of iron which was found to be high. But still it is below the prescribed standard. There was no significant difference in total hardness in the different locations and also in the chloride concentration. Similarly, no significant differences were observed in the levels of inorganic pollutants with the location.

B. Biological Environment

1. Flora

No reserve forests and protected forests are identified within the direct influence area of the project corridor. A total of 200 trees are present on either side of the project road. These include trees in non-forest land (within existing RoW). Roadside trees in the state have not been declared as Protected Forests. The project corridor is dominated by considerable population of trees mostly Plantain (*Musa paradisiaca*); Sal (a variety of *Acacia*), Teak (*Tectona grandis*) and bamboo trees (graminaceous plant) are commonly found. However, for felling of roadside trees the District Forest Officer has to be informed. Accordingly the felling shall be organized by the DFO or he may grant permission to the road authority to undertake the felling. The proceeds shall be directed to specified timber depots by the DFO.

2. Fauna

From the reconnaissance survey it is clear that the project corridor is free from faunal populace; this is due to the commercial activities / plenty of movement and other anthropogenic activities which inturn prevents flourishing of fauna populace in the site. Wildlife and wetland information collected from Survey of India (SOI) clearly shows the project area is free of fauna. Some of the identified animal's species are Jackal - *Canis aureus*, Jungle cat - *Felis chaus*, squirrels - *Funambulus pennant*, Hare - *Lepus nigricollis nigricollis*, Common mongoose - *Harpestes edwardsi*, Common rat snake - *Ptyas mucosus*, Assam worm snake (*Typhlina bothriorhynchus*), monocellate cobra (*Naja kaothia*), Assam trinket snake (*Elaphe frenata*) and Green whip snake - *Ahaetulla nasutus*.

E.7. Stakeholder Consultation

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

E.8. Potential Impact

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

Table E-2: General Impacts on Natural Environment

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

E.9. Environmental Management Plan

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

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

E.10. Environmental Monitoring Plan

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

E.11. Cost Estimates for Environmental Management

Mitigation measures proposed in the EMP will be implemented by the Contractor. The works to be undertaken by the Contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, noise barriers, road safety features, and shrub plantation. Provisional quantities have also been included for additional measures that may be identified during construction and for silt fencing which will depend on the contractors work methods and site locations. Items and quantities have also been included for enhancement measures. More general environmental management measures to be followed by the contractor have been included in the specifications and this EMP. These cannot be quantified and are to be included in the contract rates. A total of **Rs. 0.75 Crores** has been allocated for the environmental management for the project road.

1 Introduction

1.1 Background

Assam is the most accessible state among the eight states of the north eastern region; and provides regional interconnectivity amongst the states as well as to rest of India. Traffic flows from rest of the seven north eastern states and they confluence onto the national highways in Assam through the SH and MDRs which provide interstate linkages before exiting the north eastern region. Recognizing the importance for road development of the region, Assam State Roads Project (ASRP) has been formulated.

The Government of India, on behalf of Government of Assam has applied for financing an amount of US\$ 200 Million equivalent from the World Bank for Assam State Roads Project (ASRP). The project includes improvement of about 800 km of State Highways (SH) and Major District Roads (MDR). Priority roads of about 300km from amongst the 800km have been identified and are proposed to be taken up for implementation in the first phase of ASRP. Assam PWD is in the process of preparing DPR (Detailed Project Road) for about 300 km (Stage -1) as part of 800 km in the state under the ASRP (Table 1-1).

Table 1-1: ASRP Phase - I Roads

Sl. No	Name of Road	Road No	From	To	Length (Km)
1.	Jorhat- Titabor - Goronga	SH-32	Barhola	Goronga	12.34
2.	Bongaigaon North-Salmara, Abhayapuri Langla Jania Barpeta	SH-2	Bongaigaon	Barpeta	61.0
3.	Dudhnoi Matia MornoI Goalpara Pancharatna	SH-46	Dudhnoi	Pancharatna	42.0
4.	Narengi-Chandarapur-Morigaon-Nagaon-Naltali	SH-3	Narengi	Naltali on NH-37A	37.31
5.	Soibari Itakhola Borpam PavoI Borgang NH-52	SH-45	Soibarion NH-52	Sapekhati	11.4
6.	Gogamukh Ggukanara Butikur Telijan	SH-22	Gogamukh	Ghilamara	25.4
7.	Ghilamara – Dhokukhana Machkhowa Butikur	SH-42	Ghilamara	Dhakukhana	16.0
8.	Jorhat-Marioni-Mokokchung	SH-31	Jorhat	Nagajanka	16.0
Total					221.45

A PIU headed by the Chief Engineer (CE), has been established within the PWD for the design and implementation of ASRP. The Chief engineer, on behalf of the PWD, is the project proponent for ASRP and the contact details is given in Table 1-2.

Table 1-2: PIU / Project Proponent Contact Details

PIU/ Project Proponent Contact Details	
Name of the applicant/ Proponent	The Chief Engineer, PWD
Registered Address	PWD, (ARIASP & RIDP), Guwahati, Assam
Address for correspondence:	The Chief Engineer
Name	Office of the Chief Engineer PWD,
Designation(Owner/Partner/CEO)	Government of Assam
Address	Chandmari,
Pin Code	Guwahati- 781 003, Assam
E-mail	cea.apwd@nic.in
Telephone no	+91-361-266-1879
Fax No	+91-361-266-5745

The project roads prioritized for design shall be subjected to Environmental Assessment (EA) /Social Assessment (SA) as per the requirements of Government of India (MoEF) and the World Bank. ASRP has entrusted the tasks of Environmental and Social Assessments of ASRP to M/s LEA Associates South Asia Pvt. Ltd., New Delhi (LASA). This Environmental Assessment Report is prepared in line with the Environmental Management Framework for ASRP that conforms to the GoI EIA requirements and the Environmental Safeguard Policies of the World Bank.

1.2 Brief Description of the Project Road

The project corridor Barhola to Garango of SH-32, starts at Barhola chariali (km 37/300) and ends at Goranga bazar (km 49/896) connecting with another State Highway SH-1 and SH-33. Project road SH- 32 provides connectivity to District HQ Jorhat with Sub Divisional HQ Titabar. The project road mainly traverses through agricultural land and terrain is plain.

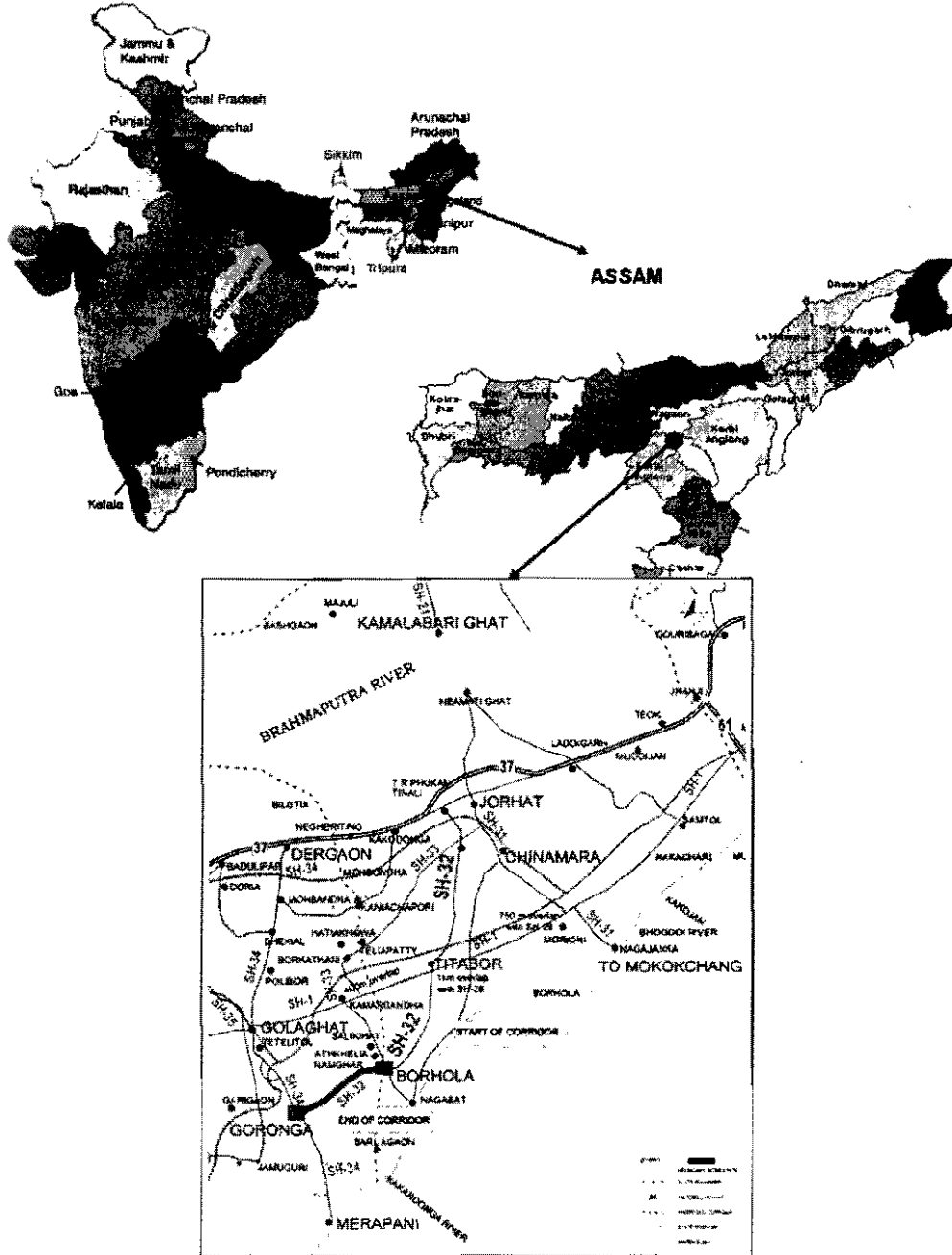


Figure 1-1: SH - 32 (Project Road)

The existing Road is single lane (3.75 m) with bituminous pavement in some stretches. In some portion there is no existing pavement and in few stretches it is either earthen or gravel. Some

stretches of the road does not have any pavement. It has earthen shoulder of 0.5 m to 1.5 m on both sides. Geometry of the existing road is fair to good except at few places where reverse curves or sharp curves are observed along the corridor. The existing ROW available in open area is between 10 m to 24 m and in built up area is between 9 m to 15 m. The overall condition of the pavement throughout the project corridor is poor to very poor.

There are 2 bridges (2 minor), one Steel Bridge single lane and the other RCC Bridge. The Steel Bridge has to be upgraded for two lane. The overall condition of the structures in the entire project corridor is fair.

1.3 Scope for Conducting EIA

Environmental Impact Assessment would address the impact due to the project on either side of the State Highways (SH) - 32 and impacts be assessed for a 100 m corridor. The broad scope of the study is

- To conduct a literature review and to collect additional data relevant to the study area;
- To undertake environmental monitoring so as to establish the baseline environmental status of the study area;
- To assess the impacts on environmental attributes due to the construction and operation of the proposed improvement works.
- To prepare an Environmental Management Plan (EMP) outlining the measures for improving the environmental quality and budgetary cost estimation for implementation;
- To identify critical environmental attributes required to be monitored subsequent to the implementation of the proposed project

1.4 Study Approach

In order to accomplish the above objectives, studies were organised in line with the guidelines stipulated by the Ministry of Environment and Forests (MoEF), Government of India, for environmental impact assessment of highway projects

Activity 1: Field Reconnaissance Survey and Review of Earlier Studies

The approach to the entire study was formulated based on a detailed field reconnaissance survey and thorough understanding of the proposed project. The reconnaissance survey was carried out for the project road to understand the salient environmental features of the project area, sensitive areas with regards to the proposed project activities, and general understanding of the proposed project.

Based on the above an environmental profile of the project area, primary and secondary data requirements for carrying out further activities of the study, environmental surveys necessary for assessing the project impacts, and the project influence area were identified.

Activity 2: Review and Assessment of Applicable Environmental Regulations

Discussions with the pollution control board authorities and review of the various regulations and guidelines for EIA were conducted to assess the sampling and analysis requirements for the project and the procedural requirements for conducting an EIA. This primarily comprised of reviewing all relevant documents and studies available for the project area.

Activity 3: Delineation of Study Area for Assessment

The above tasks identified the survey and analysis requirements for assessing the impacts of the proposed project activities. Based on which, the study area that is critical for assessing the

project impacts was identified and delineated. While the influence area varies for each of the environmental component, the study area was considered as 100 m wide corridor (50 m either side of the centre line of the road). The project influence area also considered those areas that are directly or indirectly influenced by the project activities during construction or operation of the proposed road improvement works.

Activity 4: Assessment of Base Line Environmental Conditions

This activity comprised of field surveys for assessing the baseline environmental conditions and collecting secondary information regarding physical, biological and socio-economic conditions of the study area. In addition, existing environmental quality of the study area was assessed based on the field environmental monitoring surveys. For monitoring the air, noise, surface and ground water, and soil quality, monitoring stations were set up and samples were collected and analyzed for relevant parameters.

Activity 5: Prediction of Impacts

The activity identified the likely future impacts through changes in the physical, biological or socio-economic environment based on the analysis of the base line environmental data collected in the earlier tasks. The assessment considered both positive and negative impacts due to the project and also due to the construction, and operation and maintenance of the project corridor.

Activity 6: Environment Management and Monitoring Plan

The major components of the environment management plan comprised preparation of mitigation plan for all the negative impacts identified in the earlier tasks to avoid, minimise or compensate the impacts, and the post-project monitoring plan for the measures suggested in the management plan to ensure that the impacts of the project are within the regulatory standards.

1.5 Structure of EIA Document

This EIA document has been structured as follows:

- Introduction
- Project Description
- Analysis of Alternatives
- Review and Assessment of Applicable Environmental Regulations
- Description of the Environment
- Analysis of Potential Environmental Impact & Mitigation Measures
- Environmental Monitoring Program
- Stakeholder consultations
- Environmental Management Plan
- Summary & Conclusion
- Bibliography

2 Project Description

2.1 Broader Details of the Project and Location

The project corridor Barhola to Garonga of SH-32, starts at Barhola chariali (Km 37/300) and ends at Goranga bazar (Km 49/896) connecting with another State Highway SH-1 and SH-33. Project road SH- 32 provides connectivity to District HQ Jorhat with Sub Divisional HQ Titabar. The project road mainly traverses through agricultural land and terrain is plain.

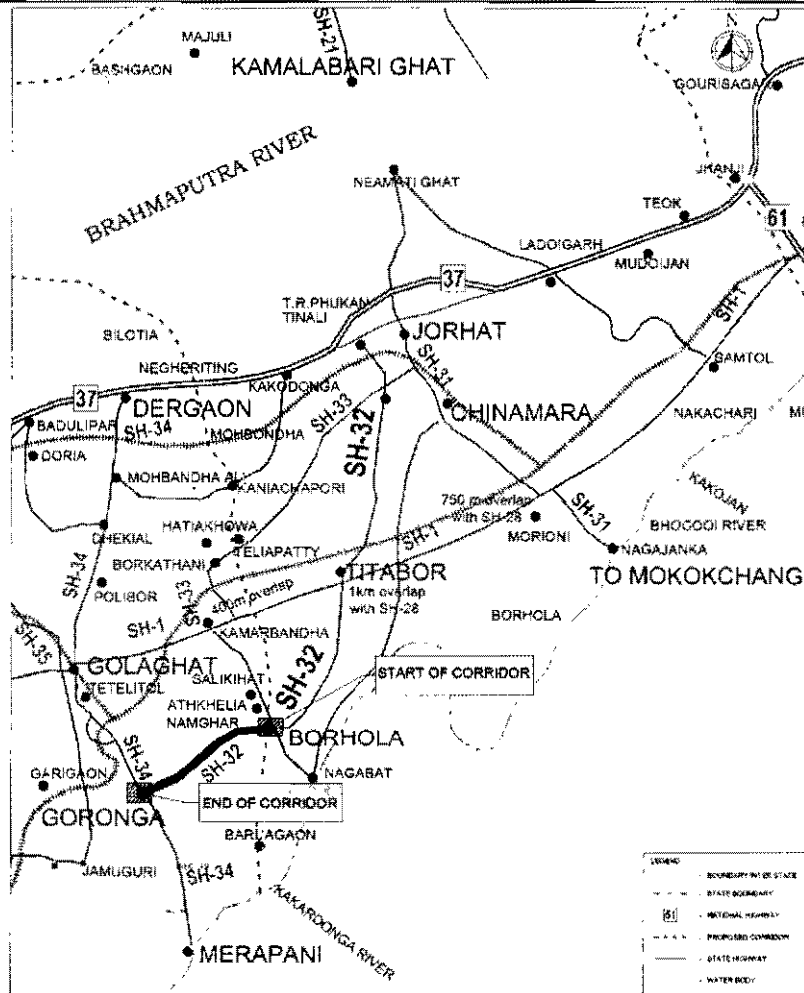


Figure 2-1: Project corridor (SH – 32)

The existing Road is single lane (3.75 m) with bituminous pavement in some stretches. In some portion there is no existing pavement and in few stretches it is either earthen or gravel. Some stretches of the road does not have any pavement. It has earthen shoulder of 0.5m to 1.5m on both sides. Geometry of the existing road is fair to good except at few places where reverse curves or sharp curves are observed along the corridor. The existing ROW available in open area is between 10m to 24m and in built up area is between 9m to 15m. The overall condition of the pavement throughout the project corridor is very poor to poor. The road passes through a number of village's enroute to Goronga (Table 2-1).

Table 2-1: Enroute Villages of SH-32

Sl. No.	Town/Village	Chainage	
		From	To
1.	Goranga Bazar	0/000	0/250
2.	Goranga	0/250	0/650
3.	Borua Gaon	0/650	1/100
4.	Nowjan	1/150	1/650
5.	Chakardhara	1/650	2/450
6.	Jerpaygaon	2/450	3/350
7.	Ghillidary	3/350	4/050
8.	Rupkoliya	4/050	4/850
9.	Rupkoliya Gaon	4/850	5/850
10.	Habichukla	5/850	6/079
11.	Atkhaliya	6/116	7/000
12.	Nowbolcha	7/000	7/700
13.	Mokram Fuloni	7/700	8/400
14.	2no Kasari	8/400	8/650
15.	2no Boisa	8/650	9/100
16.	Lunphuya	9/100	9/950
17.	Lunpuri	9/950	10/163
18.	Bankachari	10/163	11/550
19.	Atkhalia	11/550	11/970

Source: Reconnaissance survey

It is observed that quite an appreciable length of the road passes through built up area of villages, including road side habitations and urban areas of Barhola and Goronga. The land along the remaining stretches is mainly agricultural, interspersed with low lying areas and fishery ponds. The crossing location of the Rivers/ Streams in the project road is shown in Table 2-2.

Table 2-2: River/ Stream Crossing Location in SH-32

Sl. No	Stream Crossing Locations	Chainage	Status
1.	Goranga	3/900	Perennial
2.	Mokram	7/600	Perennial
3.	Kokadonga	11/800	Perennial

Source: Reconnaissance survey

2.2 Summary of Project Details

1. Name of Project	Detailed Project Report for Improvement & Upgradation of SH-32		
2. Name of Road	Jorhat - Titabor - Goronga		
3. Indicative Contract	SH-32		
Package			
4. State	Assam		
5. District	Goalghat		
6. Villages/Town	19		
7. Corridor Length	49.96 Km		
8. Design length	12.53 Km		
9. Connectivity	Project road SH 32 provides connectivity between Borhola and Goronga. This road connects interior region of Golaghat district and further leads to Kakodanga a place at Assam & Nagaland border		
10. Terrain	Plain		
11. ROW			
Existing	Open Area	= 7 m to 12 m	
	Built up Area	= 10 m to 15 m	
Proposed	Open Area	= 25 m to 30 m (normal 45m)	
	Built Up area	= 15 m to 125 m (normal 35m)	
12. Carriageway Configuration			

Existing Lane	: Single lane					
Proposed	: Two lane (7m)					
Formation Width	: Two lane with shoulder of 2.5 m on each side (12m)					
Structures (Culverts)	: Formation width 12 m					
13. Pavement						
Existing	: Flexible					
Proposals	: Flexible					
14. Subgrade CBR Value	: 6%					
proposed						
15. Design Period	: 15 years					
16. CMSA for 10 years	: 2.8					
17. CMSA for 15 years	: 5.0					
18. Reconstruction length	: 12.53 Km					
19. Pavement Composition	:					
for Widening						
	Pavement composition		Thickness of Pavement Layers			
	GSB		210 mm			
	WMM		250 mm			
	DBM		50 mm			
	SDBC		25 mm			
	Total		535 mm			
20. CD Structures						
Bridges	:	Particulars	Major Bridges		Minor Bridges	
		No. of existing Bridges	-		1	
		Bridges proposed to be retained with or without repairs	-		-	
		Bridges proposed to be reconstructed	-		1	
		Bridges under construction	-		-	
Culverts	:					
		Particulars	Slab	HP	Box	Others (Buried)
		Total Existing	45	1	3	-
		Culverts:				
		Culverts to be Abandoned:	0	0	0	-
		Culverts to be Replaced:	0	14	0	-
		Culverts Newly Proposed:	0	1	0	-
		Culverts to be retained:	35	0	0	-
21. Traffic Surveys						
AADT (Vehicles)	:					
		Type of Vehicle				AADT
		Car				236
		Auto-Rickshaw				12
		Two wheeler				1002
		Mini Bus				19
		Govt Bus				8
		Pvt. Bus				0
		LCV				200
		2-Axle truck				366
		3-Axle truck				41
		MAV				24
		Tractor				9
		Tractor with trailer				47
		Cycles				1816
		Cycle Rikshaw				94

		Hand Drawn					79
22. Traffic Projection	:	Km	2010	2015	2020	2025	2030
Jorhat Titabor		0.4	4964	7324	10758	16006	23376
Goronga (SH-32)							
23. Trees Affected	:		300				
24. Religious Structure Affected	:		Nil				
25. Project Implementation period	:		3 years				
26. Project Cost							
27. Civil Cost including 5 year maintenance cost	:		Rs. 33,40,95,549.00				
28. Total Project Cost including EIA/R&R and shifting of Utilities	:		Rs. 43,87,82,080.00				
29. Average Cost per km	:		Rs. 350.745 Lakh				

Source: Primary Survey & Records

2.3 Design Principles

The design of the project road included the following:

- Design of horizontal alignment, vertical profile, intersections and junctions and other features for upgrading the existing single lane to required lane configuration by widening, strengthening and/or reconstruction;
- Avoiding obstructions, trees, utilities and structures as far as possible;
- Designing drains and footpaths in built-up areas to minimize land acquisition;
- The geometric design is subject to available right of way (ROW) and shall conform to the standards, set out as minimum, as far as possible;
- The uniformity of design standards is maintained throughout the length of the Project roads, as far as possible;
- Wherever the existing road geometrics are deficient, due importance to improvement of these sections is provided;
- Existing horizontal curves, which are found deficient in radius and need to be corrected to meet the design requirement subject to ROW constraints have been taken care of;
- Any deficiencies in the vertical profile in respect of grades layout and sight distance are proposed to be corrected to meet the minimum standard requirements;
- Design of road side appurtenances is in accordance with relevant codes of IRC, BIS, or other international standards and shall meet minimum requirements set forth in the MORT&H Specifications for Road and Bridge Works;
- The design of cross drainage works is in accordance with the relevant IRC Codes. The roads alignment design shall take into account the location of the cross drainage (CD) works, bridges and other structures. In case of major bridges (above 60 m), the design alignment shall give precedence to the bridge location.
- The designated facility shall not become obsolescent before the design year.
- The design shall be done aiming at minimizing the life cycle cost.
- The environmental, aesthetic and landscaping aspects of the project road shall be taken into consideration in the design of project roads.

2.4 Project Benefits

The main objective of Barhola to Garango of SH-32 is to act as an important transport link connecting SH – 1 and SH – 33. All the road users, including the Project Affected People's (PAPs), will benefit from the proposed project through increased comfort and reduced travel time.

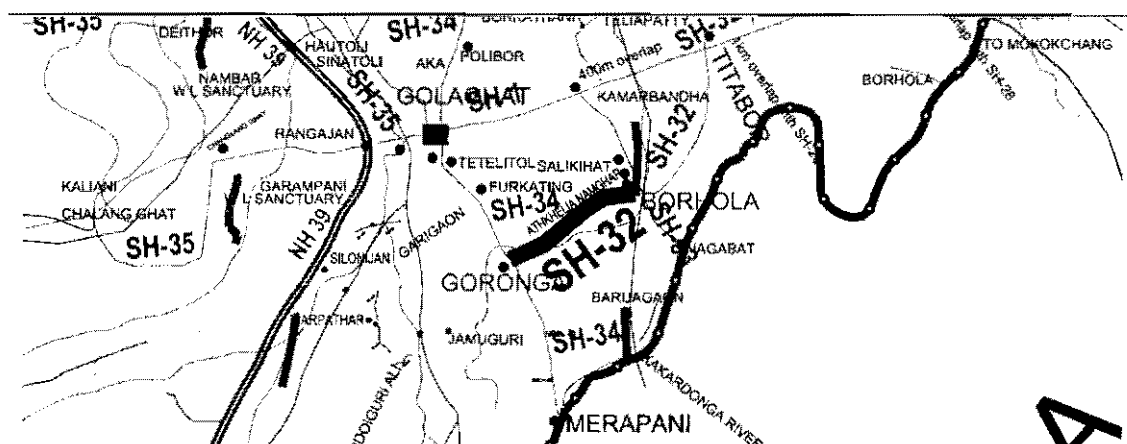


Figure 2-2: SH – 32 (Connectivity Map)

The society will benefit economically from the saving in vehicle operating costs due to enhanced speed and better geometry. A worked example for calculating the road benefits in terms of economic value is shown in the Table 2.3.

Table 2-3: Economic Benefits in SH-32

Parameters		Units
Assuming Average vehicle time saving per hour	50	Rs
Average Vehicle speed (Upgraded Road)	60	Km
Average Vehicle speed (Existing Road)	20	Km
Travel time/km (Upgraded Road)	0.02	Hr
Travel time/km (Existing Road)	0.04	Hr
Time saving	0.02	Hr
Value of savings per veh-km (Rs)	1.17	Rs
Total Saving for entire road (Rs)	21.0	Rs

Source: Reconnaissance Survey

The followings are other benefits accrued by SH-32:

- 19 villages (Error! Reference source not found.) with population of 8,823 are benefited by the project corridor.
- Increase in the local employment opportunities especially for unskilled labour is a significant and immediate economic benefit of the project
- Attracts new investment through the provision of infrastructure, which could benefit the local people and areas as a whole
- Better connectivity, increase in traffic will result in an increased economic activity in the vicinity of the proposed works
- Reduces transportation costs by 25% and will be more efficient and economically viable, the cost of public transport can also be reduced significantly, which benefits the local people
- Local communities will have greater access to public infrastructure and increased mobility through enhanced transport facilities
- A new culverts will be added to the existing 49 culverts to facilitate better drainage facility during the flooding/ monsoon period
- Slope protection measures are proposed for all water bodies along the project corridor to prevent soil erosion.
- The environment along the road will be enhanced by the inclusion of 2500 tree planting on both sides of the improved road. Provision of footpaths, bus bays and drainage facility will also help to improve the aesthetics along the road.
- As a part of the safety measures, all the junctions along the project corridor as detailed in the
- are proposed to improve. This will reduce the accident rate and will provide a safe journey for the public.

Table 2-4: Major Junctions in SH-32

Sl. No.	Location	Chainage(Km)
1	Atkhalla	0/218 to 0/330
2	Bankachari	1/830 to 2/160
3	Mokram Bagan	3/990 to 4/110
4	Socialist Pathar	5/900 to 6/510
5	Rupkollya	7/320 to 7/950
6	Ghiladhari	7/950 to 8/930
7	Ghiladhari	8/340 to 8/640
8	Chakardhara	9/870 to 10/160
9	Nowjan	10/920 to 10/950
10	Goranga	11/790 to 12/030

2.5 Project Implementation Schedule

Various stages of the project implementation viz...pre construction, construction and post construction stages are well defined with time frame. The Implementation schedules are detailed in **Annexure 4**. For an easy glance of environmental aspects (with time frame) associated with the project implementation are illustrated in the following Error! Reference source not found..

Table 2-5: Environmental Aspects to be monitored in Project Implementation

Sl. No	Environmental aspects	Responsibility	Time frame (Days)
Pre- Construction			
1.	Cutting of Trees	PIU and Forest Department	30
2.	Utility Shifting	PIU/ CSC and contractor	60
3.	Hot mix Plant erection (Including NoC from SPCB)	PIU/ CSC and contractor	90
4.	Quarry and Crusher camp	PIU/ CSC and contractor	120
Construction activities			
5.	Clearing and grubbing	PIU/ CSC and contractor	90
(i) Road Protection work			
6.	Retaining wall	PIU/ CSC and contractor	60
7.	Vetiver Plantation	PIU/ CSC and contractor	30
(ii) Culvert construction works			
8.	Pipe culvert	PIU/ CSC and contractor	60
9.	Slab culvert	PIU/ CSC and contractor	45
10.	Box culvert	PIU/ CSC and contractor	90
(iii) Road Appurtenances and Markings			
11.	Road Signage	PIU/ CSC and contractor	30
12.	Road marking	PIU/ CSC and contractor	45
13.	Rumble strip	PIU/ CSC and contractor	10

3 Analysis of Alternatives

3.1 With and Without Project Alternatives

Development of transport infrastructural facilities in the project area will result in increased revenue generation from the agricultural industry, which will lead to enhanced economic growth. The project area has significant number of road accidents. With the widening of the road, adoption of traffic calming and road safety measures, the accident rate may reduce. Keeping in view the site conditions and the scope of development of the area, the 'With' and 'Without' project scenarios have been compared as shown in Table 3-1. By looking at the table it can be concluded that "With" project scenario with positive/beneficial impacts will vastly improve the environment and enhance social and economic development of the region compared to the "Without" project scenario, which will further deteriorate the present environmental setup and quality of life. Hence the "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be definitely advantageous to achieve the all – round development of the economy and progress of the region.

Impacts on vegetation are expected during construction. Little increase in the pollution levels of the air is possible. Dust and particulate matter during construction will affect the air quality on a short-term basis. However, an important benefit which is not represented in this assessment will be major reduction in the SPM levels from vehicles using a surfaced road (with project scenario) in the build condition, compared to a continued use of dusty unsurfaced /tracks (without project scenarios).

The minor impacts due to air, noise, vegetative cover and soil erosion will be remunerated by adopting appropriate mitigative measures such as roadside plantation, arboriculture & landscaping and compensatory afforestation.

Table 3-1: 'With' and 'Without' Project Scenario

Component	"With" Project Scenario "	"Without" Project Scenario
Carriageway	The width of the carriageway of all the sections will be increased to two-lane carriageway.	Single-lane existing highway with poor geometrics.
Traffic	The widening of existing highway and construction of bridges and CD's will greatly ease the traffic congestion within the urban and rural sections.	Congestion in urban and rural areas due to mixing of local, pedestrian and through traffic.
Road Safety	Footways have been proposed to build on both sides of all the urban sections. Traffic calming measures have been proposed in major villages and towns. Road signs and road markings to be provided at appropriate locations. Zebra crossings have been marked at busy crossing points.	There are high chances of accidents in all of the section of the project Road due to absence of road safety measures like footways, traffic signage's, zebra crossing etc...
Environmental Quality	The widening of existing single lane to Two lanes will improve environmental quality within the villages and towns due to lowered pollution levels and relieving of congestion. However, short term increase in dust and noise levels during construction activities is inevitable.	Poor due to congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to increase in traffic volumes and further congestion within the towns.
Better Transportation Facilities	Lesser time and fuel consumption for easy and fast movement through the major towns and villages. Better Access to markets etc...	Increased vehicle operating costs due to reduced speeds.
Economic Development	There will be increased access to markets. Local people will be employed during construction of the project road. Better transport facilities will lead to access to new employment centers.	The economy will remain static.
Development	Higher potential for development in this region due to	Development activities will be greatly

Component	"With" Project Scenario "	Without" Project Scenario
potentials	improvement in access and consequent increase in connectivity.	hampered by the inadequacy of connectivity.

3.2 Consideration of Alternatives

There are seven locations on the project road, which are critical from geometric and land use point of view. Most of the realignments are due to geometric corrections. All the proposed realignments are minor in scale with less Impact. The details of these locations and the causes for realignment are detailed in Table 3-2.

Table 3-2: Realignment areas in SH-32

Sl. No	Location	Start Chainage	End Chainage	Position	Remarks
1.	Nowjan	1/070	1/200	Right -side Curve	• The realignment is done as a Geometric improvement to avoid sharp curve
2.	Ghillidary	3/300	3/500	Left- side Curve	• The realignment is done as a Geometric improvement to avoid sharp curve
3.	Atkhaliya	6/000	6/200	Right-side Curve	• The realignment is done as a Geometric improvement to avoid an 'S' curve
4.	Lunphuya	9/300	9/800	Left- side Curve	• The realignment is done as a Geometric improvement
5.	Bankachari	10/160	10/300	Left- side Curve	• The realignment is done as a Geometric improvement to avoid a sharp curve.
6.	Bankachari	10/400	10/600	Right-side Curve	• The realignment is done as a Geometric improvement to avoid a sharp curve
7.	Bankachari	10/800	10/980	Left -side Curve	• The realignment is done as a Geometric improvement

Source: Primary Analysis

3.2.1 Nowjan (km 1/070 to 1/200)

The proposed realignment is at Nowjan village. To induce the geometric improvement there is a need for realignment of the existing alignment. The proposed improvement has a direct impact on the existing structures, it is estimated that nearly 6 residential structures are getting affected. The realignment also has impact over land acquisition. The mitigation measures are ensured through public consultation and by providing compensation for land as well as structure (or) as per the approved entitlement framework for ASRP.

3.2.2 Ghillidary (km 3/300 to 3/500)

The purpose of the realignment is to avoid a sharp curve. The realignment has been proposed for a length of 200m in the cultivation area. The realignment has direct impact over an agriculture land and a hut. The mitigation is planned as per the R&R (or) as per the approved entitlement framework for ASRP.

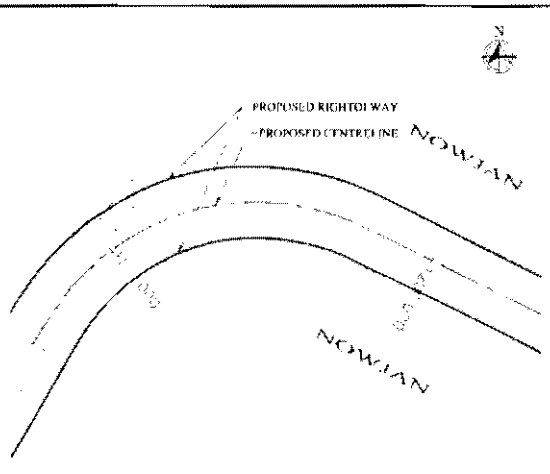


Figure 3-1: Realignment @ Nowjan

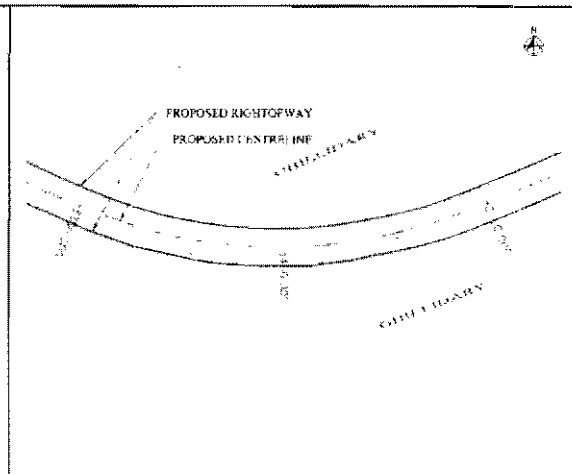


Figure 3-2: Realignment @ Ghillidary

3.2.3 Atkhaliya (6/000 to 6/200)

The proposed realignment is to avoid a sharp curve and to carry out geometric improvement. The realignment is proposed for 200m. The proposed improvement will have a direct impact over the adjacent residential plots, agriculture land and a hut. Looking at the project benefits, the impact over residential plots and agriculture land is unavoidable. The mitigation measures are through the public consultation and compensation as per R&R (or) entitlement framework as per ASRP.

3.2.4 Lunphuya (9/300 to 9/800)

To induce the geometric improvement; there is a need to realign the existing stretch at Lunphuya. The realignment is proposed for 500m, starting at Chainage 9/300 to 9/800. The improvement proposal will have a direct impact over agriculture land, 5 huts, one bus shelter, 2 semi-pucca buildings and considerable number of trees. However, the proposed activity is in very minor scale and hence the anticipated impact is also less. The mitigation measures are through the public consultation and compensation as per R&R (or) entitlement framework as per ASRP.

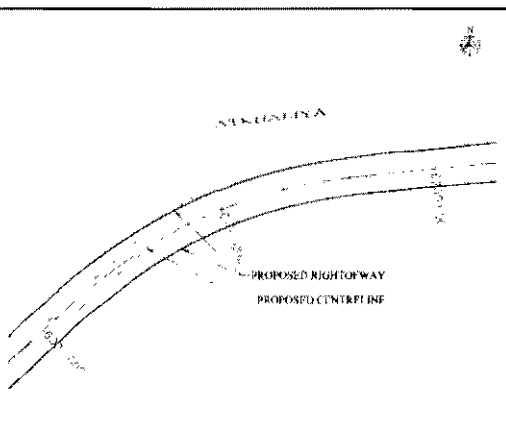


Figure 3-3: Realignment @ Atkhaliya

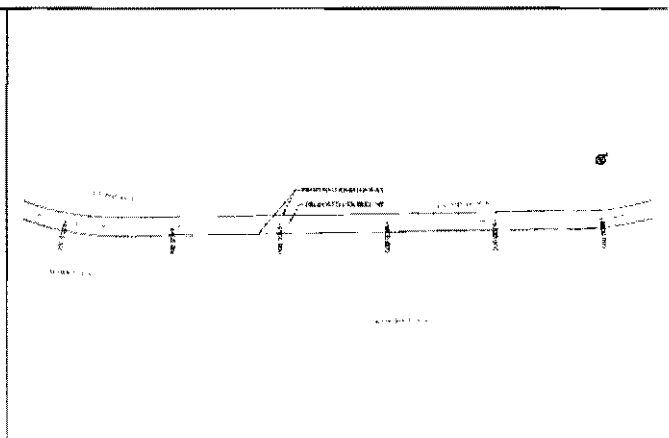


Figure 3-4: Realignment @ Lunphuya

3.2.5 Bankachari (10/160 to 10/300)

The proposed improvement at Bankachari village is a minor realignment for about 240m. The minor realignment is proposed for better geometric improvement. The realignment will have direct impact over agriculture land and 2 huts. However, the proposed activity is in very minor scale and hence the anticipated impact is also less. The mitigation is through the compensation as per the entitlement framework of ASRP.

3.2.6 Bankachari (10/400 to 10/600)

The purpose of the realignment at Bankachari (200m) is to avoid the existing curve at km 10/500. The alignment is planned to shift towards RHS to avoid the curve. However, the shifting alignment has a direct impact over the cultivation land and a hut. This is to be mitigated through the compensation as per the entitlement framework of ASRP.

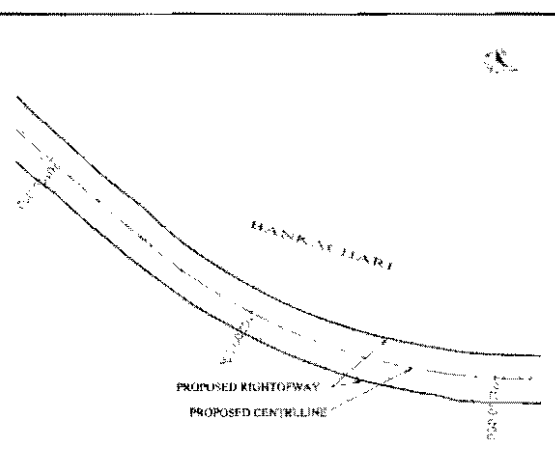


Figure 3-5: Realignment @ Bankachari (10/160 to 10/300)

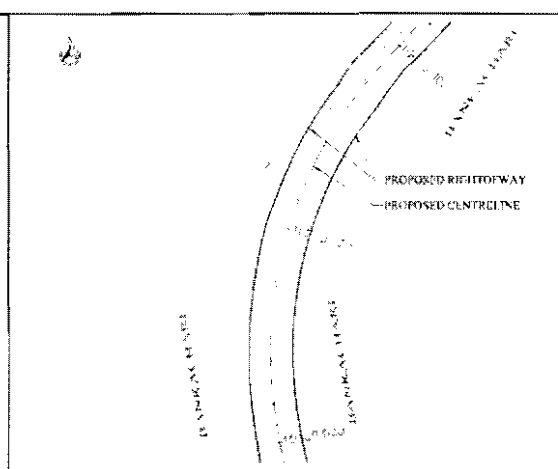


Figure 3-6: Realignment @ Bankachari (10/400 to 10/600)

3.2.7 Bankachari (10/800 to 10/980)

The proposed realignment is at a Bankachari. The purpose of the realignment is to have better geometric. The improvement doesn't have much environmental and social impact; however, acquisition of agriculture land is inevitable. The mitigation measures will be carried out through the compensation including the livelihood loss as per the entitlement framework for ASRP.

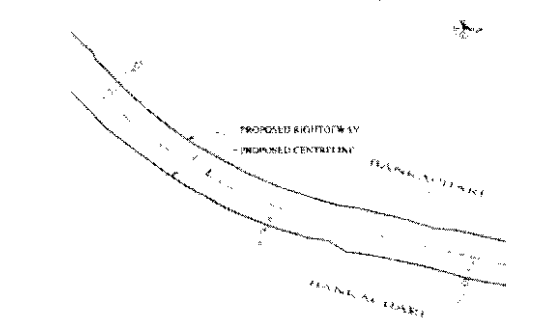


Figure 3-7: Realignment @ Bankachari (10/800 to 10/980)

3.3 Summary of Impact of each Alternative

Sl. No	Location	Start Km	End Km	Environmental / Social Impacts	Magnitude of Impact	Mitigation Measures
1	Nowjan	1/070	1/200	<ul style="list-style-type: none"> Loss of 6 residential structures Loss of agriculture land due to acquisition for realignment Tree loss 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP and avenue plantation for loss of trees

Sl. No	Location	Start Km	End Km	Environmental / Social Impacts	Magnitude of Impact	Mitigation Measures
2	Ghillidary	3/300	3/500	<ul style="list-style-type: none"> Loss of agriculture land due to acquisition for realignment Loss of structure (1 hut) Loss of residential structure and residential Plots 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP
3	Atkhaliya	6/000	6/200	<ul style="list-style-type: none"> Loss of agriculture land due to acquisition for realignment Tree loss Loss of 7 residential structures 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP and avenue plantation for loss of trees
4	Lunphuya	9/300	9/800	<ul style="list-style-type: none"> Loss of agriculture land due to acquisition for realignment Loss of a public utility (bus stop) Tree loss Loss of residential structure (1 hut) 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP, construction of new bus stand and avenue plantation for loss of trees
5	Bankachari	10/160	10/300	<ul style="list-style-type: none"> Loss of agriculture land due to acquisition for realignment 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP
6	Bankachari	10/400	10/600	<ul style="list-style-type: none"> Loss of residential structure (1 hut) Loss of agriculture land due to acquisition for realignment 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP
7	Bankachari	10/800	10/980	<ul style="list-style-type: none"> Loss of agriculture land due to acquisition for realignment 	Direct Impact and permanent	Compensation as per Entitlement framework, ASRP

4 Review and Assessment of Applicable Environmental Regulations

4.1 Environmental Rules and Regulations

In order to understand the extent of the environmental and social assessment for the proposed improvement works, applicable laws, legislation and policies were reviewed and presented in the following sections. A summary of applicable rules and regulation is furnished in Table 4-1.

Table 4-1: Summary of Environmental Legislation Applicable for Proposed Project

National Act	Year	Objective	Responsible Institution
Environment (Protection) Act.	1986	To protect and improve the overall environment	MoEF, CPCB
Notification on Environment Impact Assessment of Development projects (and amendments) (referred to as the Notification on Environmental Clearance)	2006 2009	To provide environmental clearance to new development activities following environmental impact assessment.	MoEF, CPCB
Wildlife Protection Act	1972	To protect wild animals and birds through the creation of National Parks and Sanctuaries	MoEF
Forest (Conservation) Act	1980	To protect and manage forests	MoEF
Water (Prevention and Control of Pollution) Act (and subsequent amendments)	1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	CPCB
Air (Prevention and Control of Pollution) Act (and subsequent amendments)	1981	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB and PWD
The Land Acquisition Act	1894 1984	Set out procedures for acquisition of land by government	Revenue and disaster management department, Assam
Central Motor Vehicle Act	1988	To control vehicular air and noise pollution. To regulate development of the transport sector, check and control vehicular air and noise pollution.	Transport Department, Assam
Central Motor Vehicle Rules	1989	Addressing impacts on affected persons due to all development projects	MoRD and respective state institutions undertaking the development projects
Assam Forest Regulation (Amendment) Act	1995	Guides to preserve biodiversity of north east	Department of Environment and Forest, Assam
Assam Government's Guidelines for Compensatory Afforestation	2000	Focus on mitigating environmental impact associated with any infrastructure development projects in the state	Department of Environment and Forest, Assam
Assam Forest Policy	2004	Maintenance of environmental stability through preservation and restoration	Department of Environment and Forest, Assam
Draft National Policy on Tribal's	2004	The main objective is to facilitate overall development and welfare of the tribal people	Department of Welfare of Plain Tribes and Backward Classes, Assam
Ancient Monuments and Archaeological sites and Remains Act	1958	Conservation of Cultural and historical remains found in India.	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH)

Source: GoI, MoEF & GoA

4.1.1 Legal Framework

- **Ministry of Environment and Forests (MoEF):** The primary responsibility for administration and implementation of the GoI policy with respect to environmental management, conservation, ecologically sustainable development and pollution control rests with the MoEF Established in 1985; the MoEF is the agency primarily responsible for review and approval of EIAs pursuant to GoI legislation. The MoEF has set up regional offices responsible for collecting and furnishing information relating to EIA projects, pollution control measures, enforcement of legislations and environmental protection in special conservation areas such as wetlands, mangroves and biological reserves.
- **Pollution Control Board, Assam:** The objective of PCB, Assam is to control, prevent and abate pollution in the State to protect the environment from any degradation by effective monitoring and implementation of state pollution control legislations and are also involved in Implementation, supervision and monitoring activities pertaining to Central Pollution Control Acts and Rules vests with the Central Pollution Control Board (CPCB), Government of India.

4.1.2 Key Environmental Laws and Regulations

Table 4-2: Applicable Laws and Regulations

Sl. No	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
PROJECT PREPARATION STAGE							
1	No Objection Certificate (NOC)	Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981	Pollution Control Board, Assam	Applicable	3 months	ASRP	CE, WB Projects, Project in charge PMU/CSC
2	Environment Clearance	Environment Protection Act 1986 Notification dated, 14 September 2006	Ministry of Environment and Forest, Govt. of India	Not Applicable	6 months	ASRP	CE, WB Projects, Project in charge PMU/SC
3	Wild Life Clearance	Wild Life Act 1972	Chief wildlife warden, State /National wildlife advisory board /MoEF	Not Applicable	3 months	ASRP	CE, WB Projects, Project in charge PMU/SC
4	Diversion of forest land for Non-forest use	Forest Conservation Act (1980) Forest Conservation Rules (2003) and Guidelines issued to date	Regional Office North Eastern Zone, MoEF, BBSR /MoEF, Shillong	Not Applicable	2 months	ASRP	CE, WB Projects, Project in charge PMU/SC
5	Permission for removal of tree growth within the PROW Felling conversion and removal from stump site	Assam Forest Regulation (Amendment) Act 1995, Assam Government's Guidelines for Compensatory Afforestation 2000 and Assam forest Policy 2004	Local Divisional Forest Officer	Applicable	1 month for each workout area	ASRP	CE, WB Projects, Project in charge PMU/SC
PROJECT IMPLEMENTATION STAGE							
6	Permission for Withdrawal of Ground Water	Environment Protection Act 1986	Central Ground Water Board	Applicable	2 months	Contractor	CE, WB Projects, Project in charge PMU/SC
7	Permission for Withdrawal of Surface Water from Rivers, Nala, Water harvesting structure/ Reservoirs/Ponds/ Irrigation canals	State Water Policy of Assam, 2002	Water Resource Department, Assam	Applicable (If the contractor is extracting surface water)	3 months	Contractor	CE, WB Projects, Project in charge PMU/SC

Sl. No	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
8	NOC from Archaeological Survey of India	The Ancient Monument and Archaeological sites and Remains Act, 1958	Assam State Archeology Department / Archaeological Survey of India (ASI)	Not Applicable	2 months	Contractor	CE, WB Projects, Project in charge PMU/SC
9	Permission for Sand Mining from river bed	Assam minor mineral concessions Rule, 1994	District Collector / Tahasildar / Irrigation department	Applicable	1 month	Contractor	CE, WB Projects, Project in charge PMU/SC
10	Permission for Opening of New Quarry	Assam minor mineral concessions Rule, 1994	Department of Power, Mines and Minerals, Assam	Applicable	1 month	Contractor	CE, WB Projects, Project in charge PMU/SC
11	Hot mix plant, Crushers, Cement Batching Plant	Air (Prevention and Control of Pollution) Act, 1981	Department of Power, Mines and Minerals	Applicable	3 months	Contractor	CE, WB Projects, Project in charge PMU/SC
12	Storage of Hazardous Chemicals	Hazardous Waste (Management and Handling) Rules 1989 and Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Pollution Control Board, Assam	Applicable	3 months	Contractor	CE, WB Projects, Project in charge PMU/SC
13	Disposal of Hazardous Waste	Hazardous Waste (Management and Handling) Rules 1989	Pollution Control Board, Assam	Applicable	2 months	Contractor	CE, WB Projects, Project in charge PMU/SC
14	Disposal of Construction Waste and liquid effluent from Labour camps	Water (Prevention and Control of Pollution) Act 1974	Pollution Control Board, Assam	Applicable	2 months	Contractor	CE, WB Projects, Project in charge PMU/SC
15	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Department of Transport, Govt. of Assam	Applicable	1 Month	Contractor	CE, WB Projects, Project in charge PMU/SC
16	Employing Labour	Executing Agency of Building and other construction act, 1996	District Labour Commissioner	Applicable	1 Week	Contractor	CE, WB Projects, Project in charge PMU/SC
17	Registration of Workers	Labour welfare Acts.	District Labour Commissioner	Applicable	1 Month	Contractor	CE, WB Projects, Project in charge PMU/SC

Source: Acts, Rules and Regulation from Central and State Government

The Environment (Protection) Act, 1986

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

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

Environmental Impact Assessment Notification, 2006

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

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

Environmental Impact Assessment Notification - 2006, amendment 2009

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

Environmental Impact Assessment Notification - 2006, amendment 2011

Amendment 2011 to EIA notification 2006 explains "All new state highway projects should obtain environmental clearance from SEIAA". The new amendment allows carrying out widening, strengthening and improvement works on the existing state highways.

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

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

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

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

Air (Prevention and Control of Pollution) Act 1981

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

Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

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

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

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

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

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

- The Indian Forest Act, 1927: *Section 5* states that after declaring a particular land as reserved forest, no fresh clearings for any purpose shall be made, except in accordance with such rules as made by the state government
- *Section 26* states the acts prohibited in such forests, in addition to *section 5*
- *Sections 30, 32* furnish power to the State government to regulate certain acts (clearing for cultivation, building or any other purpose) in such forests as specified in the section
- *Section 35* furnishes power to the State government to prohibit certain acts (clearing of vegetation etc) in lands not being the property of the government
- The Forest (Conservation) Act, 1980: *Section 2* of the Act restricts the state government on the de-reservation of forests or use of forestland for non-forest purposes
- The Forest (Conservation) Rules, 1981: *Rule 4* states that the procedure for state governments to make a proposal seeking prior approval to de-reserve a forest for non-forest purposes (section 2 of Forest Act, 1980), provided all proposals involving clearing of naturally grown trees in forest land or portion thereof, for the purpose of using it for afforestation, shall be sent in the form of a working plan / management plan

Wildlife Protection Act, 1972

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

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

- Destruction or damage of wildlife property in a National Park is prohibited

Biological Diversity Act, 2002

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

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

Its key provisions aimed at achieving the above are:

- Measures to conserve and sustainably use biological resources, including habitat and species protection, environmental impact assessments (EIAs) of projects, integration of biodiversity into the plans, programmes, and policies of various departments/sectors;
- Prohibition on transfer of Indian genetic material outside the country, without specific approval of the Indian Government;
- Measures for sharing of benefits from the use of biodiversity, including transfer of technology, monetary returns, joint Research & Development, joint IPR ownership, etc.;
- Protection of indigenous or traditional knowledge, through appropriate laws or other measures such as registration of such knowledge;
- Regulation of the use of genetically modified organisms;
- Setting up of National, State, and Local Biodiversity Funds, to be used to support conservation and benefit-sharing;
- Setting up of Biodiversity Management Committees (BMC) at local village level, State Biodiversity Boards (SBB) at state level, and a National Biodiversity Authority (NBA).

4.1.3 Environmental Requirements of the State

Assam Forest Regulation (Amendment) Act, 1995

This act is a regulation to amend the law relating to forest, forest produce and the duty livable on timber in Assam (similar to Forest (Conservation) Act, 1980).

Assam Forest Policy, 2004

Government of Assam has decided to adopt an environment and people's friendly State Forest Policy of Assam to focus on preservation, enhancements, maintenance, and evolution of management strategies for improved productivity, sustainable utilisation and overall quantitative improvement of stand composition and structure for enrichment of the environment. The key objectives of the policy are:

- Maintenance of environmental stability through preservation and where necessary, restoration of ecological balance that has been adversely disturbed by serious depletion of forests in the State.
- Conserving natural heritage of the state by preserving the natural forests and wetlands with vast variety of flora and fauna which represent the unique biodiversity and genetic resources of the State.
- Checking the denudation of forests and soil erosion in catchments areas of rivers and reservoirs for soil and water conservation; reducing the fury of floods and droughts; recharging of water bodies, aquifers and arresting siltation of the reservoirs.
- Promoting non-consumptive use of Protected Areas for the purpose of providing livelihood support to the fringe dwellers by encouraging sustainable eco-tourism and eco development.
- Enhancing the quality of forests/tree cover in the denuded and degraded land of the State through the involvement of people and symbiosis of traditional knowledge and modern technology.
- Increasing the forest/tree cover in forest deficient areas of State like chars, chapories permanently established along the course of the river Brahmaputra, through community afforestation and suitable agro-forestry and farm forestry models.

- Increasing forest productivity through shift of accent from major to minor forest produces; from top canopy to lower canopies and from flagship species to smaller denizens of the forest.
- Encouraging efficient utilisation of forest produce and maximising value addition to the timber and non-timber forest produce in the State. The use of non-durable secondary species as constructional timber is to be encouraged after inducing durability through wood preservation techniques.
- Encouraging conservation of genetic resources and development of traditional ethnic knowledge repository of Assam.

4.1.4 Other Policies / Legislations Applicable to Road Construction Projects

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

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

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

The Constitution (73rd Amendment) Act, Part IX of the Constitution of India, 1992

This Act enables the Participation of panchayat level institutions in decision making by broadening the village level functions and supporting implementation of development schemes.

- Article 243 B: Constitution of three-tier Panchayat System
- Article 243 C: Direct Election by the People of the Panchayat
- Article 243 D: Reservation of seats for SC, ST and women
- Article 243 G: Powers, authority and responsibilities of *Panchayats*. The state may, by law, endow the *Panchayats* with such powers and authority as may be necessary to function as institutions of self-government. This Article further enables, subject to state law, devolution of powers and responsibilities with respect to:
 - The preparation of plans for economic development and social justice; and
 - The implementation of schemes for economic development and social justice including those in relation to matters listed in the **Eleventh Schedule**—including the matters related to **roads, culverts, and bridges**.

Draft National Policy on Tribal's

This National Policy recognises that a majority of Scheduled Tribes continue to live below the poverty line, have poor literacy rates, suffer from malnutrition and diseases and are vulnerable to displacement and the policy aims at addressing each of these problems in a concrete way. It also lists out measures to be taken to preserve and promote tribals cultural heritage.

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

Assam State Roads Resettlement & Rehabilitation Policy (ASRRRP), 2004

The Government of Assam felt the need for a comprehensive R&R policy for the state as a whole for all categories of roads in order to ensure that when a road infrastructure development work takes place, no single person is adversely affected in this process of development.

The particular R&R principles to be followed in minimizing and mitigating the impacts caused by rural roads as laid down in the policy are as follows:

- *Section 2.2.1:* In the case of Rural Roads
 - To prepare a detail plan to ensure community participation through PRIs, CBOs and local administration in planning, implementation and management of the rural roads;
 - To provide for a clear programme to sensitize and train executing department towards community participation in planning & implementation of the rural roads up gradation programme;
 - To entrust Gram Panchayat (GP) to deal with the non-titleholder to facilitate the GPs to sensitize and motivate the non-titleholders to voluntarily relinquish the land;
 - To enable the GPs to play a greater role in dealing with non-titleholders, who are willing to relinquish the land required for a clear RoW of the rural roads/ODRs;
 - To develop a mechanism for community contribution to the non-titleholders voluntarily relinquishing the land and falling in the category of destitute and BPL through the GPs as decided by the community.

In addition to the above, some of the key policy guidelines as applicable to the Framework are:

- *Section 5* of the policy defines vulnerable groups as – BPL, women headed households, ST, SC, disabled, widows, divorced, single unwed mother and aged persons and those whose land becomes uneconomical.
- *Section 6.1.4 & 6.4.5:* The CPRs will be replaced as far as feasible and assistance will be provided at replacement value to the project affected communities.
- *Section 8* of the policy specifically lays down steps to be followed in cases of voluntary donation of land/assets.

Ancient Monuments and Archaeological sites and Remains Act, 1958

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

4.1.5 World Bank Environmental Requirements

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

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

OP 4.01 - Environmental Assessment

Operational Policy 4.01 (OP 4.01) is one of the ten safeguard policies of the World Bank, which provides the Environmental Assessment (EA) guidance for the lending operations. The OP 4.01 requires the borrower to screen projects upstream in the project cycle for potential impacts. Thereafter, an appropriate EA approach to assess, minimize / enhance and mitigate potentially adverse impacts is selected depending on nature and scale of project. The EA needs to be

integrated in the project development process such that timely measures can be applied to address identified impacts. The policy requires consultation with affected groups and NGOs to recognise community concerns and the need to address the same as part of EA.

OP 4.04 – Natural Habitats

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

OP 4.11 – Cultural Properties

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

OP 4.36 – Forestry

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

4.1.6 MoRTH & IRC Specifications

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

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, **Annexure A** and the contractor is to satisfy the provisions. Apart from the **Annexure A** to clause 501, there are provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. Provisions of clause 501 **Annexure A**, cover the environmental aspects as:

General	<ul style="list-style-type: none">• The contractor shall take all necessary measures and precautions to carry out the work in conformity with the statutory and regulatory environmental requirements• The contractor shall take all measures and precautions to avoid nuisance or disturbance from the work. It shall be precautionary measures than abatement measures taken after generation of nuisance• In the event of any spoil, debris, waste or any deleterious material from site being deposited on adjacent land, the same shall be removed and affected area shall be restored to its original state
Water	<ul style="list-style-type: none">• The contractor shall prevent any interference with supply/abstraction of water resources• Water used for dust suppression shall be reused after settlement of material in collected water

Air	• Liquid waste products to be disposed off such that it does not cause pollution
	• No debris is to be deposited or disposed into/adjacent to water courses
	• The contractor to devise and arrange methods to control dust, gaseous or other airborne emissions in such a way that adverse impacts on air quality is minimized
	• Dust shall be minimized from stored material and stockpiles by spraying water
	• Covering of material likely to rise dust during transport is to be covered with tarpaulin
Noise	• Spraying of water on haul roads if found necessary
	• The contractor shall use all necessary measures to reduce noise from construction equipment and maintain all silencing equipment in good condition
Control of wastes	• No uncontrolled disposal of wastes shall be permitted. The contractor shall make specific provisions for disposal of all forms of fuel and engine oil, all types of bitumen, cement, surplus aggregate, gravels, bituminous mixtures etc. conforming to local regulations and acceptance of the engineer
Emergency Response	• The contractor shall plan and provide for remedial measures in case of occurrence of emergencies as spillages of oil, bitumen or chemicals

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

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

Guidelines for Environmental Impact Assessment, IRC: 104-1988

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

Other Applicable Laws

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

- **Workmen's Compensation Act 1923:** The Act provides for compensation in case of injury by accident arising out of and during the course of employment;
- **Contract Labour (Regulation and Abolition) Act, 1970:** The Act provides for certain welfare measures to be provided by the contractor to contract labour;
- **Minimum Wages Act, 1948:** The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act;
- **Payment of Wages Act, 1936:** It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers;

- **Equal Remuneration Act, 1979:** The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees;
- **Child Labour (Prohibition and Regulation) A; 1986:** The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry;
- **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979:** The inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.;
- **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996:** All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.;
- **The Factories Act, 1948:** The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities;
- **Hazardous Wastes (Management and Handling) Rules, 1989:** Occupiers generating hazardous wastes given in the list shall take all practical steps to ensure that such wastes are properly handled, i.e. collection, reception, treatment, storage, and disposed of without any adverse effects to human health and environment (Rule 4 Such occupier shall apply for authorization in prescribed format to the State Pollution Control Board).
- **Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996:** The Rules provide for mandatory preparation of On-Site Emergency Plans by the industry and Off-Site Plans by the district collector and the constitution of four tier crisis groups at the centre, district, and local levels for the management of chemical disaster.

4.2 Environmental Clearance Procedure

As per the new amendment dated 6th April, 2011 to EIA notification 2006, environmental clearance has been made mandatory only for new state highways. Hence, the widening / strengthening and improvement works on existing state highways are not covered under the ambit of the notification and are not categorized either as Category A or Category B.

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

5 Description of the Environment

5.1 Study Area

The proposed improvement corridor (SH – 32) falls in the district of Jorhats and Golaghat. The project corridor Barhola to Garango of SH-32, starts at Barhola chariali (km 37/300) and ends at Goranga bazar (km 49/896) connecting with another State Highway SH-1 and SH-33. Project road SH- 32 provides connectivity to District HQ Jorhat with Sub Divisional HQ Titabar. The geographical location of the project corridor lies between latitude 26°27'14 to 26°25'46N and longitude 94°8'15 to 94°1'55E. The project district is bounded on the south by the Naga-Patkai range, in the west by Golaghat district and in the south east by Wokha and Mokokchung districts of Nagaland. Sibsagar district lies to its northeast.

5.2 Land Environment

5.2.1 Topography

Physiographically, the project district shows a monotonous plain topography towards north and southeast, while the south-western part of the area represents an undulating topography. The general elevation of the elevated area is around 100 meters above Mean Sea Level (MSL) and low lying areas show altitude about 80 m above MSL. Maximum height of about 128 m above MSL is observed in the southern parts of the district, where it merges with the hills of the Nagaland as well as Karbi-Anglong district of Assam. The project road elevation ranges from 94 to 107m above MSL. The elevation graph for the project corridor is depicted in **Figure 5-1**.

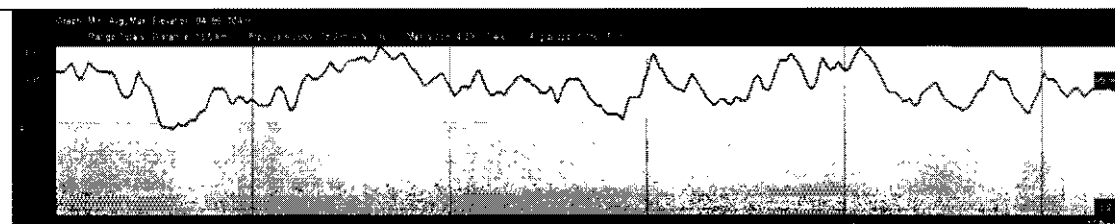


Figure 5-1: Elevation Graph for SH-32 (Barhola to Garango)

The slope of the district is towards north east from south. The proposed alignment traverses through fertile plain terrain along its entire length. The physiography of the project area is depicted in **Figure 5-2**.

5.2.2 Soil

The geological formation of the Jorhat district is of alluvial origin (**Figure 5-2**). Tipam and Surma group of rocks concentrated in the south and south eastern part. About 78 % of the soil cover in the northern part, both north and south of the river Brahmaputra occupies under soil order 'Entisols' (younger alluvial). Comparatively, northern higher slopes of about 15% cover are under 'Ultisols' (Lateritic). Extreme higher northern fringe of about 5% area is under 'Alfisols' (red Loamy). One small patch in the north-central part of about 2 % area in between antisols and Ultisols is under 'Histosols' (peaty and saline peaty).

In Golaghat district, two important soil groups are seen, namely:

- Deep reddish coloured soil developed over older geological formation and
- Light grey to dark grey coloured soil covering the major parts of the district.

Low nitrogen, low phosphate, medium to high potash, acidic characters of the soil are representative of the soil cover found in the hills. In the plain areas, the other type of the soil covers is found to be feebly alkaline. The different soil types in the project region have been depicted in Figure 5-3.

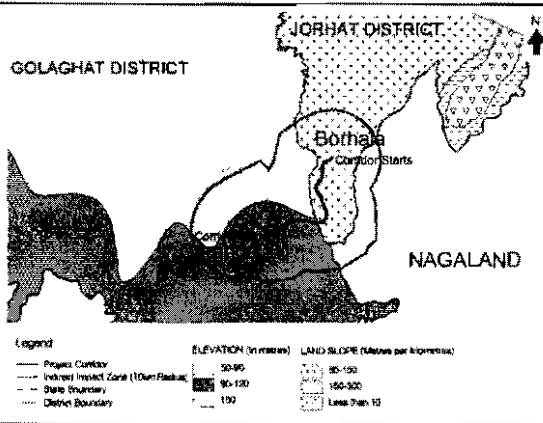


Figure 5-2: Topography Map of the Project Area

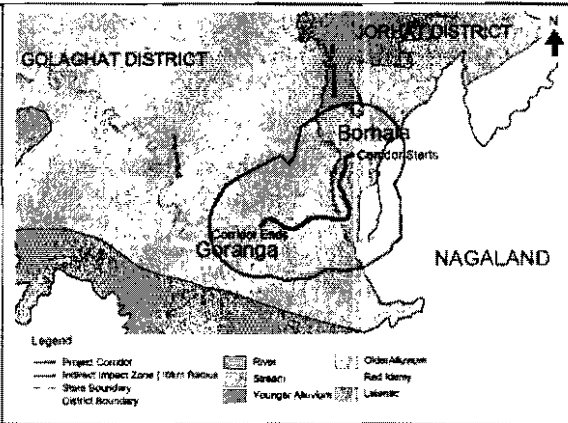


Figure 5-3: Soil Map of the Project Area

5.2.3 Seismicity

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

The proposed project corridor attracts under zone-5 (Plate boundary zone of the Shillong Plateau and Assam Valley). Seismicity in this zone is considered as the plate-boundary zone activity. Seismic activity is quite high in this zone. It was the seat of great Shillong earthquake of 1897. Besides, three large earthquakes of $M > 7$ occurred in this zone. In the Shillong plateau, the focal depth is mostly within 60 km. The prominent structural discontinuities in the plateau are Dudhnoi, Kulsi, Samin, Dauki and Dhubri faults and Dapsi and Barapani thrusts. According to GSHAP (Global Seismic Hazard Assessment Program) – Hazardous map, the project region lies with moderate to high seismic hazard.

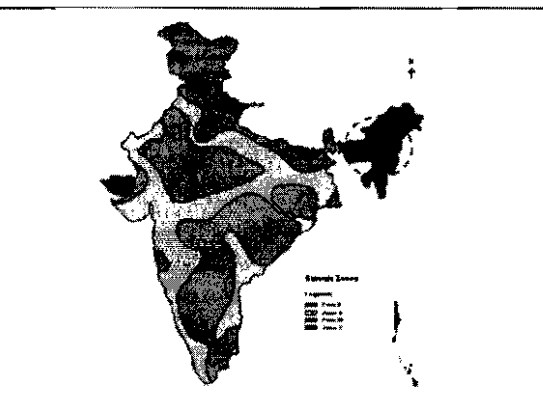


Figure 5-4: Seismic zone map of India

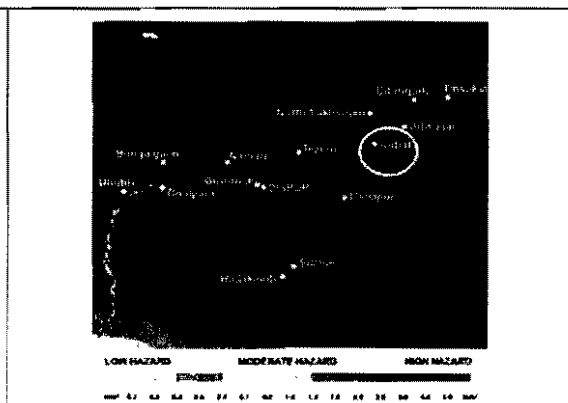


Figure 5-5: GSHAP – Hazard Map for Assam

5.2.4 Geology

The project region in the Jorhat district has five geomorphological divisions, namely,

- The flood plain of the Brahmaputra River in the north,
- The central upland area covering younger alluvial formations,
- The central upland area covering older alluvial formations,
- The southern undulating hill area running along the Naga-Patkai range covering the piedmont plain, and
- Structural hills

The general trend of the hills is NE-SW and at places to N-S. The recent alluvial soils of recent rivers are light grey to dark grey in colour and are confined to the flood plain area adjacent to the Brahmaputra River and its tributaries. The older alluvial soil is sandy loam to silty and clay-loam. It is light yellowish brown to light brown in colour. The soils of the district are characterized by organic matter and available phosphorus and low potash. The soils in the southern parts are residual in origin, derived from the semi-consolidated rocks underlying these areas.

The project region in Golaghat district is underlain by Quaternary formation followed by Archaean group of rocks. Quaternary formation comprises younger and older alluvial deposits consisting of different grades of sand, pebbles, cobbles, gravel and clay in the area. The hard crystalline of Archaean age covers extreme southern boundary of the district merging with Karbi-Anglong district. The rock types are granite, granite gneiss and quartzite. Sub-surface geology as evidenced from available data infers that the potential aquifer pertaining to Quaternary formation exist down to the explored depth of 300 m. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the southeastern parts, the thickness reverses considerably. The geology profile of the project districts is depicted in **Figure 5-10**.

5.2.5 Flood Plains

Except Majuli sub division (largest Riverine Island in the world), Jorhat district is not affected by flood (as per UNDP records). During the monsoon, the riverine island is prone for flooding due to the increase water level in River Brahmaputra and its tributaries. The other sub – divisions of the jorhat district are not affected by the flood due to their presence on the slope of the hills bordering Nagaland.



Figure 5-6:Flood in Majuli Island

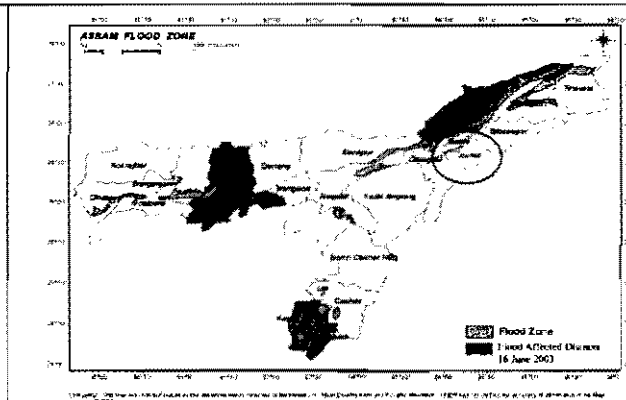


Figure 5-7: Assam Flood Zone Map

River Dhansiri, has been recorded to be flowing above the danger level in both the recording stations Numaligarh and Golaghat in Golaghat district. However, the project corridor is nearly 15km away from the flood prone area and the slope of the corridor is adequate to withstand the

flood during monsoon. The flood level information / recorded in the project area will be considered during the detail design.

5.3 Land Use

The geographical area of the two districts in the project region can be divided into three major classes:

- Arable land - that includes net sown area,
- Non-arable land - that includes forest, and
- Other cultivable land.

The alignment traverse through agriculture fields, government and private land. The proposed alignment also has direct impact over the road side shops on the government land and few settlements and structure. Land use pattern of the Golaghat district reveals that about 40% of the total district area is covered by forest, 18% by uncultivable land, 2% by fallow land and 40% by total cropped area. Principal crop grown in the district is paddy followed by pulses, mustard, sugarcane, potato, vegetables and jute. Tea plantation also is seen in the highlands covered by older alluvium. The land use on either side of the road is mostly agricultural followed by residential. The land use of the project corridor is shown in Figure 5-8 and Figure 5-9. The landuse pattern of the project district is shown in Figure 5-11.



Figure 5-8: Paddy fields along the project corridor of SH-32



Figure 5-9: Ghildihary Tea Estate in SH-32

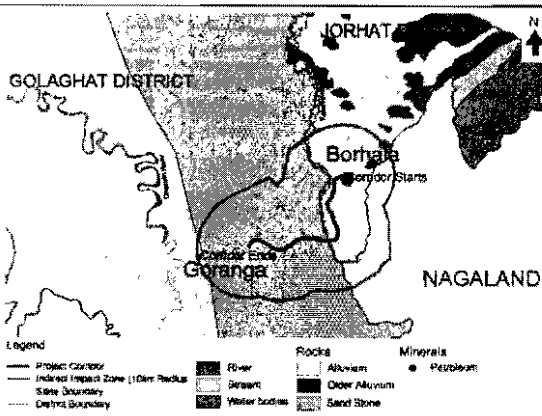


Figure 5-10: Geology Map of Project Corridor

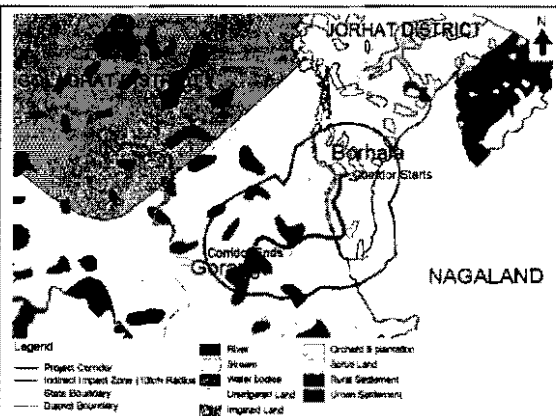


Figure 5-11: Landuse Profile of Project Corridor

5.4 Water Environment

5.4.1 Hydrogeology

The area is underlain by unconsolidated alluvial sediments of the Quaternary age, which can be differentiated into

- Older and
- Younger alluvium

Older alluvium: The Older alluvium occupies the upland areas with sediments of oxidized and relatively compact nature, while the Younger alluvium occurs along the low-lying tracts of the area along the river courses (Plate II).

Younger Alluvium: The southern part of the area, adjacent to the Naga hill range is covered by surficial blanket of clay, belonging to Younger alluvium and probably has been derived from the adjacent hills which are composed of the rocks of Tertiary age.

Ground water in the Jorhat district occurs under water table to semi-confined conditions in the near surface conditions and in the deeper horizon, under semi-confined to confined conditions. Depth to water level in the water table zone varies from 0.41 to 3.07 m bgl in the pre-monsoon period and 0.56 to 3.41 m bgl during post-monsoon period. In the vicinity of Brahmaputra River, five to six aquifer systems with limited thickness exist within the depth range of 400 m. In the southern parts, the aquifer system fades out due to mixing of finer particles of sand and clay leading to decrease in thickness of aquifer system. The geometry of the aquifer system varies widely.

In the northeastern and northwestern parts, the thickness of the aquifer increases and clear sand beds exists. Throughout the district, varied thickness of clay beds overlying and underlying the aquifer system exist. The thickness of the clay beds increases southwards i.e. towards Titabar where it attains a maximum thickness of 103 m. The predominance of clay formation in the depth of 30 to 50 m poses problem in storage of ground water in the district, however, local variation in the existence of very limited thickness of sand beds mixed with clay performing as conduits of ground water is also observed.

Hydrogeologically, Golaghat district is proved to be very potential. Ground water occurs under water table to confined conditions. Depth to water level in major parts of the district varies from 2 to 5 m. In the extreme southern and south-western parts close to hills, the water level is found to be deeper and generally rests within 5 to 7 m. The movement of ground water is from south to north. The water level trend shows that there is gradual rising of water level in the district. Central Ground Water Board has so far constructed fourteen exploratory tube wells in the district. Hydrogeological information collected from these wells indicates that three to nine prolific aquifer system exist in the district. Deep tube wells constructed down to maximum depth of 250 m give variable discharge from 26 to 216 m³/hr for drawdown within 13 m. Transmissivity and permeability value varies from 415 to 500 m²/d and 7 to 82 m²/day respectively.

5.4.2 Rivers

The project road section in Jorhat district does not cross any major river or its tributaries all along the stretch of the road. However, the project district is influenced by the mighty River Brahmaputra and its important tributaries like south Dhansiri, Bhogdoi and Kakodonga drain the district. The tributaries originate in Naga-Patkai range and flow northward to join the Brahmaputra River almost at right angles which give rise to sub-parallel type of drainage. These tributaries retain only meager base flow during the dry winter months. The rivers and streams are

highly meandering in nature and sudden changes in courses of these rivers possibly due to heavy siltation and epigenetic movements cause the flood havocs.

The project road section in Golaghat district crosses three rivers namely... Kokadonga (11/800), Mokram (7/600) and Goranga (3/900). These rivers are perennial at the time of site investigation. However, the information pertains to the rivers like lean flow, flood level, catchment area for the river are not available with any of the government departments. The River Brahmaputra flows in east-west direction in the extreme northern parts of the Golaghat district and its tributaries flow in northerly direction and controls the entire drainage system of the district and plays an important role in the ground water occurrence and control of the district. Important Rivers of the district are Dhansiri and Dayang. These rivers have meandering courses with abandoned channels in the form of bils and ox-bow lakes along their courses. The hydrology of the project region is depicted in Figure 5-12.

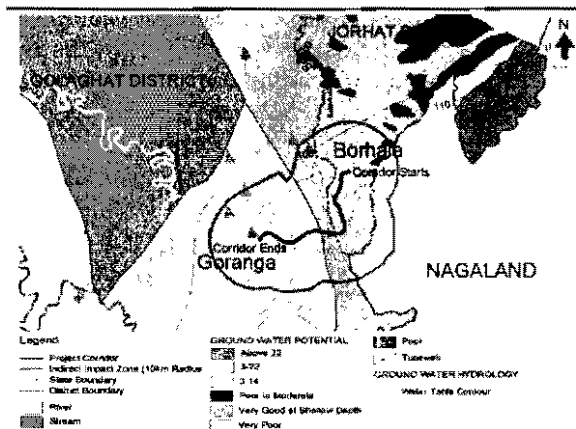


Figure 5-12: Hydrogeology Map of the Project Corridor

5.4.3 Ponds / Lakes

There are around 7 ponds identified along the project stretch, all are found to be monsoon dependent. However, at the time of observation all the ponds seem to be perennial in nature. The available water source is utilized for irrigation and aquaculture purpose.

5.4.4 Ground Water Aquifer

Jorhat district is blessed with enormous thickness of aquifer in the central and northern parts comprising medium to coarse sand within the explored depth of 450 m, which is mostly capped in the upper parts by 30 to 50 m of clay beds and varied thickness of clay intercalation in between. These water bearing formations are of moderate to high yielding nature, depending on the nature and size of the sands. In the southern parts of the district, the promising nature of the sediments slowly turns to be poor to very poor, due to mixing of finer sediments and minor thickness of water bearing beds with alternate existence of clay beds. In view of the development strategy of ground water in the district, it needs to be worked out accordingly, considering feasibility of deep tube wells, installation of proper rig and design aspects of deep tube wells.

Golaghat district possesses good promising potentiality for ground water development. The north eastern parts are more potential than that of the other parts of the district. In the southern and north-western parts, ground water potentiality decreases due to presence of semi-consolidated and consolidated formations of Pre-Cambrian and Tertiary age. Exploratory wells constructed down to the depth of 300 m show the presence of two to six prolific aquifer systems in the area. No major and medium irrigation schemes are implemented so far in the district, however minor irrigation through shallow tube wells have so far created a potential of 16, 273 ha.

5.4.5 Recharge Zones

Assam State Agricultural Department has constructed a total of 5,083 shallow tube wells in an area of 124.59 ha and developed 14% of ground water as on March 2005. The construction of shallow tube well down to 50 m depth and dug well are problematic in some parts of the district due to the presence of thick blanket of clay beds. People generally prefer to construct ponds and stores rain water, which dries up during winter period. Though, deep tube wells are feasible in the districts, construction of deep tube wells are not common within the mass, which may be due to ignorance and as well as requirement of high cost involvement. Ground water development has not been geared up in the districts, except in the Tea Gardens and in some industries.

5.4.6 Surface Water Quality

Water sample from the ponds at km 2/700, 6/500 and 10/100 was collected as per MINARS¹ and analyzed as per APHA methods. The assessment of water quality in the study area was done by comparing with the standards prescribed in the IS: 2296-1982.

Table 5-1: Surface Water Quality

Sl. No.	Parameters	Pond @ km 2/700	Pond @ km 6/500	Pond @ km 10/100	Standard (IS 2996 : 1982)
1.	Temperatures (°C)	31	29	30.5	-
2.	Total Solid (mg/L)	251.5	271.5	269	1500
3.	pH	6.9	7.05	7.225	6.5 to 8.5
4.	Colour 1/m	13.7	28.7	21.45	300
5.	Turbidity (NTU)	86	101	93.75	-
6.	Conductivity (μ Mho/cm)	195	217	206.25	NS
7.	Phenolphthalein Alkalinity (mg/L)	Nil	Nil	Nil	-
8.	Alkalinity (mg/L)	77.49	72.49	75.24	200
9.	DO (mg/L)	3.95	4.07	3.16	4
10.	BOD (mg/L)	5.13	5.28	5.21	2
11.	COD (mg/L)	17.5	15.5	13.2	-
12.	Sulfate (mg/L)	23.5	20.2	17.5	400
13.	Hardness (mg/L)	70	82	61	300
14.	Calcium (mg/L)	19	27	19	80
15.	Magnesium (mg/L)	9.5	10.5	8.0	24.28
16.	Phosphate (mg/L)	0.06	0.06	0.06	-
17.	Arsenic (mg/L)	Nil	Nil	Nil	0.2
18.	Iron (mg/L)	Nil	Nil	Nil	50
19.	Chloride (mg/L)	51.1	59.6	44.2	600
20.	Oil & Grease (mg/L)	27.3	21.8	19.6	0.1

Source: Primary Analysis

From the observation (Table 5-1), the D.O (Dissolved Oxygen) concentration is less in comparison with the standard. Likewise, the BOD concentration is high in comparison with the standard. This clearly indicates the water is polluted with organic materials. This may be due to the high nutrient value (or) algal bloom. Oil & Grease was also found to be high in comparison with the standard, this may due to the surface runoff from oil contaminated areas. Remaining parameters like Solids, Calcium, Hardness, Magnesium, Phosphate, arsenic, Iron and Chloride were found below the permissible limits of surface water prescribed by Indian Standard.

¹ Monitoring of Indian National Aquatic Resources Series

5.4.7 Ground Water Quality

Chemical analysis of ground water in the district carried out by Regional Chemical Laboratory of Central Ground Water Board, depicts that ground water of the district is potable except high iron content in scattered patches, which is a common factor in the ground water chemistry of the state of Assam.

Understanding the water quality of the project area is an integral part of Environmental Impact Assessment to identify critical issues with a view to suggest appropriate mitigation measures for implementation. Water samples were collected from the project area to represent the baseline condition. Even though impact on ground water is not envisaged in the proposed road improvement works, five groundwater samples were collected from Dudhnoi, Mornoi, Goalpara, Pancharatna and Kharmuja (Figure 5-13) were analysed for its chemical parameters. The following Table 5-2 furnishes the various physico-chemical property of the groundwater.

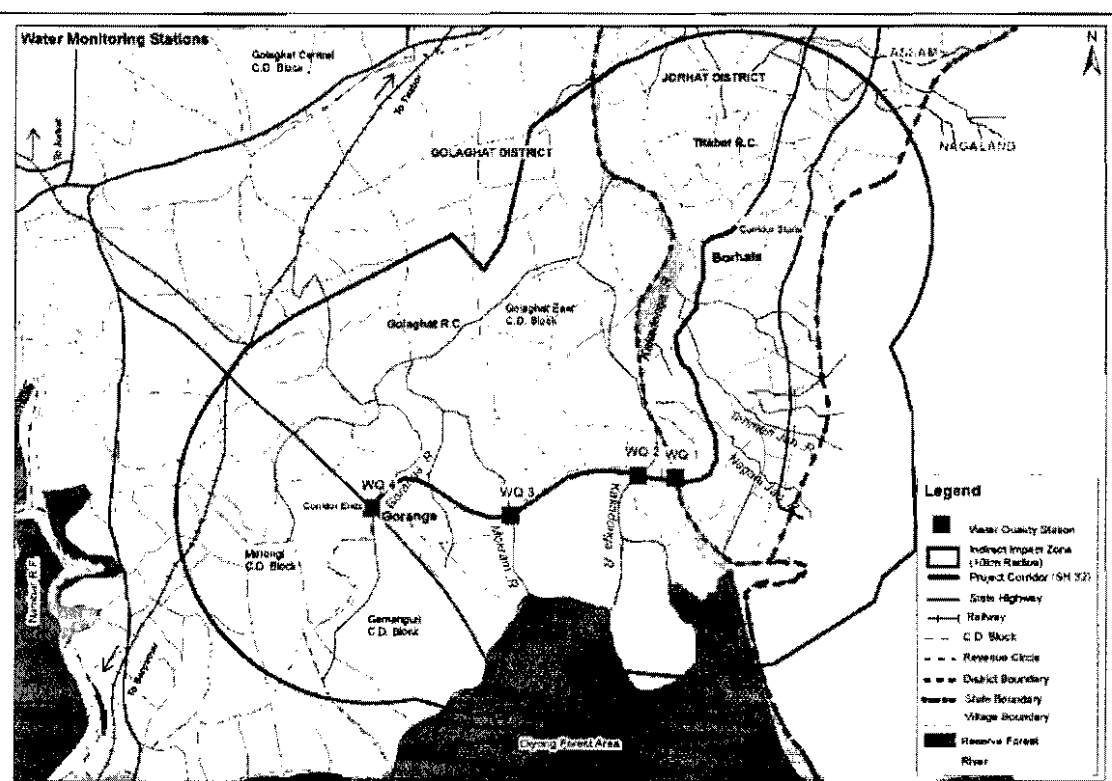


Figure 5-13: Groundwater Quality sampling location

Table 5-2: Groundwater Quality

Sl. No	Parameter	Kakadonga (WQ1)	Kakadonga (WQ2)	Mokram (WQ3)	Goranga (WQ4)	IS:10500 Norms for Drinking Waters
1	Colour		Colour Less			-
2	Odour		Odour Less			-
3	Turbidity (NTU)		None			5
4	pH(Unit)	7.7	7.3	7.5	7.4	6.5-8.5
5	Temperature (°C)	28	31	35	33	
6	Total Dissolved Solids (mg/l)	593	571	685	628	2000
7	Ether Soluble (Oil & Grease)		NIL			-
8	Total Hardness as CaCO ₃ (mg/l)	198	170	216	193	300
9	Chloride (mg/l)	124	208	195	202	1000

Sl. No	Parameter	Kakadonga (WQ1)	Kakadonga (WQ2)	Mokram (WQ3)	Goranga (WQ4)	IS:10500 Norms for Drinking Waters
10	Sulphate (mg/l)	48	61	64	63	400
11	Phosphate (mg/l)	1	2	2	2	
12	BOD (3 Days at 27° C) (mg/l)		NIL			
13	Lead (mg/l)		NIL			0.05
14	Arsenic (mg/l)		NIL			0.05
15	Iron (mg/l)	0.9	0.69	0.7	0.8	1.0
16	Total Coliforms (CFU/100 ml)		NIL			

Source: Primary analysis

The water quality with respect to almost all the essential parameters was observed to be good and acceptable quality except for the concentration of iron which was found to be high. But still it is below the prescribed standard. There was no significant difference in total hardness in the different locations and also in the chloride concentration. Similarly, no significant differences were observed in the levels of inorganic pollutants with the location.

5.5 Air Environment

5.5.1 Climate & Meteorology

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

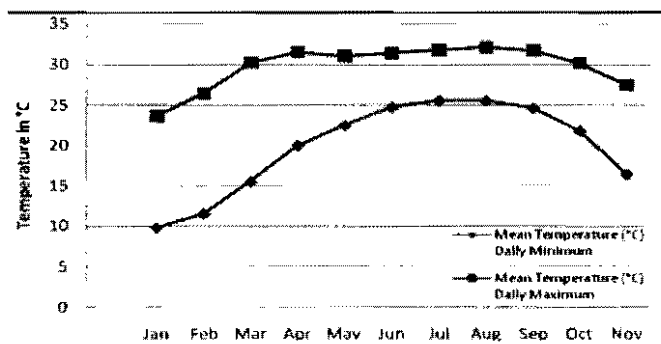


Figure 5-14: Temperature variation Graph

The post monsoon period, from October-November is a period mixed with calm conditions and winds mainly from North.

The winter months, November to February, experience frequent calm conditions. The maximum number of calm periods observed is in the month of December and January. The annual average temperature observed of maximum mean daily is 29.5°C and that of minimum mean daily temperature is 19.7°C. August is the hottest and January is the coldest month of the year. The annual average mean relative humidity is 82% in the morning and 70% in the evening. The climatic condition (Table 5-3) in the area is thus humid and tropical. The average rainfall during May to September is about 81% of the total contribution. The highest rainfall occurs in the month of July followed by June.

Table 5-3: Climatology Table

Month	Mean Temperature (°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Daily Minimum	Daily Maximum			Hail	Thunder	Fog	Squall
Jan	9.8	23.6	11.4	1.2	0	0.7	11.1	0
Feb	11.5	26.4	12.8	1.3	0.1	2.1	1.4	0.1
Mar	15.5	30.2	57.7	4.6	0.3	5.8	0.2	0.9

Month	Mean Temperature (°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Daily Minimum	Daily Maximum			Hail	Thunder	Fog	Squall
Apr	20.0	31.5	142.3	9.0	0.7	13.8	0	2.7
May	22.5	31.0	248.0	14.3	0.1	16.5	0.1	2.5
Jun	24.7	31.4	350.1	16.1	0	14.4	0	0.6
Jul	25.5	31.8	353.6	16.8	0	12.7	0	0.1
Aug	25.5	32.1	269.9	13.9	0	16.1	0	0.1
Sep	24.6	31.7	166.2	10.3	0	13.3	0.3	0.2
Oct	21.8	30.1	79.2	5.3	0	4.5	3.0	0
Nov	16.4	27.4	19.4	1.5	0	1.0	9.4	0.1

Source: Regional Meteorology Division - Guwahati

5.5.2 Ambient Air Quality

Air pollution can cause significant effects on the environment, and subsequently on humans, animals, vegetation and materials. It primarily affects the respiratory (e.g. by fine dust), circulatory (e.g. by carbon monoxide) and olfactory (e.g. by odors) systems in humans. In most of the cases, air pollution aggravates pre-existing diseases or degrades health status, making people more susceptible to other infections or the development of chronic respiratory and cardiovascular diseases. Environmental impacts from air pollution can include acidic deposition and reduction in visibility. Following the reconnaissance survey of the study area and taking into account the predominant environmental factors such as winds, topography and details of existing residential, commercial activities in the region, Ambient air quality was monitored at four stations (Figure 5-15) viz... Ghillidary Madhya English Vidyalaya, Rupkoliya Primary School, Worsha Goranga Madhyamik Balika Vidyalaya and Goranga Chariali Bazar. Selection of Air quality monitoring station was done as per MoEF/ CPCB guidelines² for conducting EIA study. High volume samplers were used to collect/measure the air pollutant concentration data at 24 hours averaging periods for all stations. The recorded observations are given in the Table 5-4.

Table 5-4: Ambient Air Quality Monitoring Analysis

Monitoring Location	Chainage (km)	Location Reference	Area Category	Pollutant Concentration (µg/m ³)					
				24 hourly mean values					
Code				RSPM	TSPM	SO ₂	NO ₂	HC	CO
AQ1	5+550	Ghillidary Madhya English Vidyalaya	Commercial	191.51	384.92	18.30	25.90	Nil	1144
AQ2	7+860	Rupkoliya Primary School	Commercial	168.36	295.93	12.02	13.83	Nil	1526
AQ3	11+970	Worsha Goranga Madhyamik Balika Vidyalaya	Residential	153.27	271.27	13.22	15.83	Nil	1526
AQ4	12+300	Goranga Chariali Bazar	Commercial	148.14	259.92	13.59	13.22	Nil	1335
NAAQ Norms* (8/24 hourly Mean)				150	500	120	120		

Source: Primary analysis

The pollutant concentration data was analyzed to evaluate the air quality in the study region. The pollutant concentration levels of NO_x, SO₂, and RPM were measured at all the stations (Figure 5-15). The pollutant concentrations were compared with the National Ambient Air Quality Standards (NAAQS) as notified by CPCB. It was observed that pollutant concentration levels of NO_x, SO₂, HC and CO at all the stations were very low in concentrations and complies with the NAAQS. However, RSPM exceed the limits for all the stations, AQ1 records the maximum

² As per CPCB, AAQ monitoring guideline, the sampling site depends on

- Size of the area to be covered
- The variability of pollutant concentration over the area to be covered
- The data requirements, which are related to the monitoring
- Pollutant to be monitored and
- Population figures which can be used as indicators of criticality both from view of likely air quality deterioration as also health implications.

(191.51µg/m³) followed by AQ2 (168.36 µg/m³). The higher values are attributed to the re-suspended dust from the unpaved / damaged roads in the area used by vehicles and also the commercial activities.

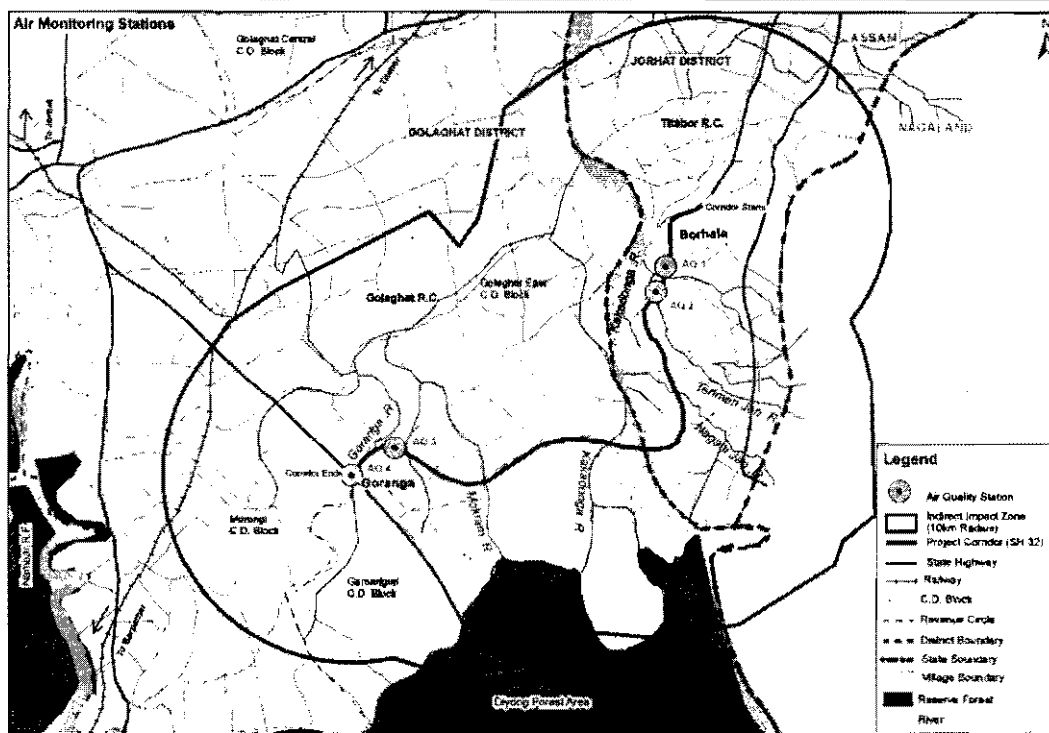


Figure 5-15: Ambient Air Quality - Sampling Location Map

5.6 Noise Environment

Noise is considered to be one of the dimensions of pollution, which also leads to the gradual degradation of environment and also poses health and communication hazards. The impact of noise pollution on humans and animals including birds is already exemplified in various studies. For measuring ambient noise levels, **Lutron SL-4030** sound level meter was used at the site (Noise monitoring locations) as shown in **Figure 5-16**. Noise monitoring has been undertaken for 24 hours at each location to capture the day-time and night-time noise levels and the noise equivalent (Leq) was calculated using the formula given below (equation -1). The monitored noise level data are furnished in **Table 5-5**.

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

Table 5-5: Noise Monitoring Observations

Sl. No.	Location	Category	Average Noise Level in dB	
			Day Time	Night Time
NQ1	Ghillidary Madhya English Vidyalaya	Commercial/ Institutional	43.3	35.9
NQ2	Rupkoliya Primary School	Commercial/ Institutional	41.8	35.9
NQ3	Worsha Goranga Madhyamik Balika Vidyalaya	Residential/ Institutional	39.1	32.5
NQ4	Goranga Chariali Bazar	Commercial	43.8	38.5

Source: Primary analysis

The Leq was found to be in the range of 39.1 – 43.8 dB (A) in daytime and 32.5 – 38.5 dB (A) in nighttimes. Though the observed values are near to the specified noise standard, but still it is within the limits set by the CPCB (Table 5-6). Maximum noise level recorded in Goranga Chariali Bazar and Ghillidary Madhya English Vidyalaya due to the presence of commercial activities. The noise levels are still higher near to the school because of considerable traffic in SH-32. Overall the Leq noise level range is 32.5 to 43.8 dB (A).

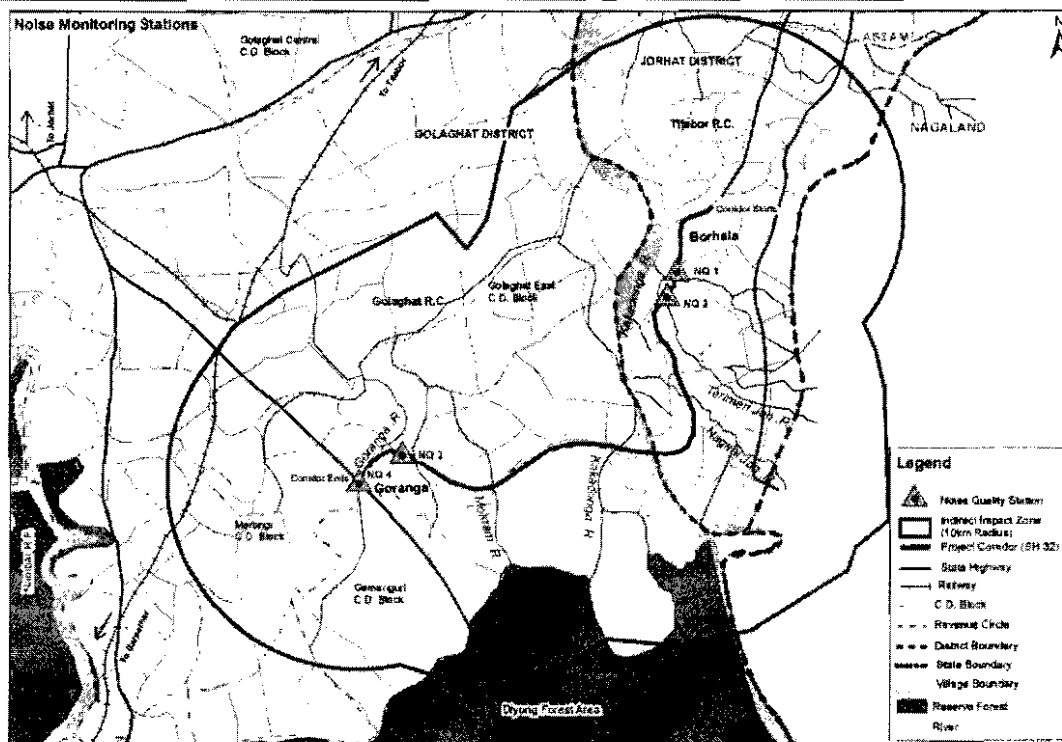


Figure 5-16: Ambient Noise Quality – Sampling Location Map

Table 5-6: CPCB Ambient Noise Standards

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

Source: CPCB

5.7 Biological Environment

5.7.1 Forest

No reserve forests and protected forests are identified within the direct influence area of the project corridor. However, in general the project districts falls under the sub-tropical zone and the prevalence of the monsoon climate. The forests in the project districts are classified into evergreen, semi-evergreen and deciduous forests (Figure 5-20). However, depending upon the intensity of precipitation, humidity and temperature, the forests are classified as wet or dry. Variation occurs in growth of different species of trees in different parts of the project district due to different soil and ground water regimes and other geographical factors. The general trend of

change in the forest type on the basis of predominant plant species from Western Assam to the East is moist deciduous, semi-evergreen, evergreen and rain forest respectively.

5.7.2 Flora

Predominant tree species found in Jorhat and Golaghat districts are Amora (*Spondias pinnata*), Ajhar (*Lagerstroemia speciosa*), Amari (*Amoora wallichii*), Bohela (*Semicarpus anacardium*), Bhelu (*Tetrameles nudiflora*), Barun (*Crotaeva nurvala*), Bonjalphai (*Castanopsis hystrix*), Bahramthuri (*Talauma hodgsonii*), Dimoru (*Ficus hispida*), Gainali (*Premna bengalensis*), Gamari (*Gmelina arborea*), Haldu (*Adina cordifolia*), Hatipoila (*Pterospermum acerifolium*), Jam (*Syzygium cumini*), Jhow (*Tamarix dioeca*), Kum (*Careya arborea*), Kathal (*Artocarpus integrifolia*) and Kuthir (*Bridelia retusa*). Predominant herbs, climbers and grass species are Abutenga (*Antidesma diandrum*), Athubhanga (*Leea* spp), Akalbih (*Clerodendron indicum*), Bogitora (*Randia dumatorum*), Bhedelilota (*Hedyotis scandens*), Dhoptita (*Clerodendron viscosum*), Eragoch (*Ricinus communis*), Patidoi (*Clinogyne dichotoma*), Titaphul (*Phlogocanthus thyrsiflours*), Kamini kanchan (*Murraya exotica*), Makhitati (*Flemingia bracteata*), Kaupat (*Phrynium imprecatum*), Own (*Leea crispa*), Barkhi lata (*Mellreureum enenillatum*), Bokul lata (*Embella ribes*), Ghilalata (*Entada phaseoloides*) etc...

From the reconnaissance survey, the flora in the project area comprises of roadside trees, fruit trees in certain villages besides the vegetables and crops grown in the agriculture lands. The flora includes Sal, Banyan, Ferns (*Angiopteris erecta*), Bamboo, Jack Fruit, Cane Bamboo and Teak. (Figure 5-17 & Figure 5-18).

Roadside Plantation: A total of 300 trees are present on either side of the project road. These include trees in non-forest land (within existing ROW). Roadside trees in the state have not been declared as Protected Forests. The project corridor is dominated by considerable population of trees mostly Plantain (*Musa paradisiaca*); Sal (a variety of Acacia), Teak (*Tectona grandis*) and bamboo trees (Graminaceous plant) are commonly found. However, for felling of roadside trees the District Forest Officer has to be informed. Accordingly the felling shall be organized by the DFO or he may grant permission to the road authority to undertake the felling. The proceeds shall be directed to specified timber depots by the DFO.



Figure 5-17: View of avenue trees @8/600



Figure 5-18: View of avenue trees @17/800

Forest map collected from Survey of India (SoI) reveals that, project corridor is free from reserved/ protected forest with no environmental sensitive area (Figure 5-19 and Figure 5-20).

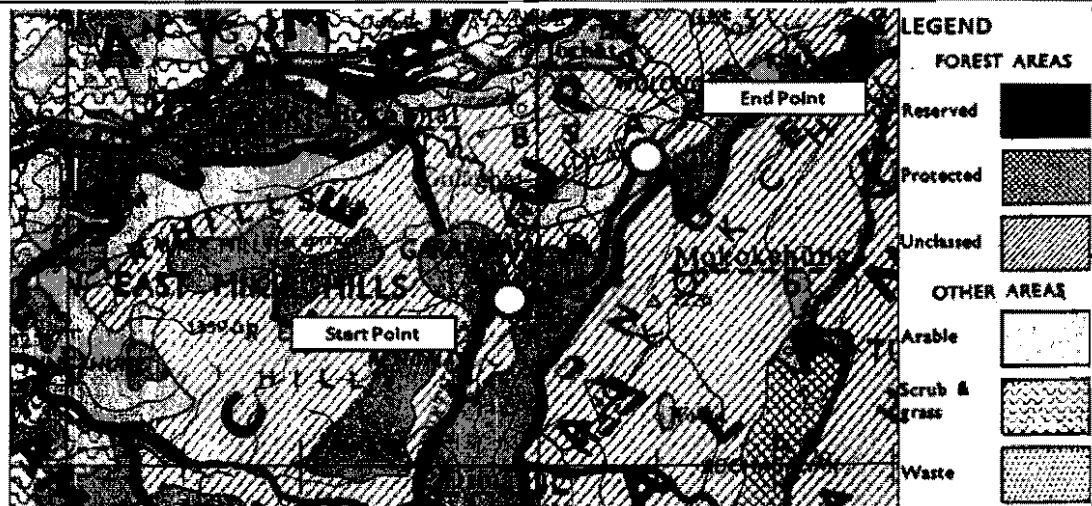


Figure 5-19: Forest Map of Project Site (Assam)

Source: Survey of India

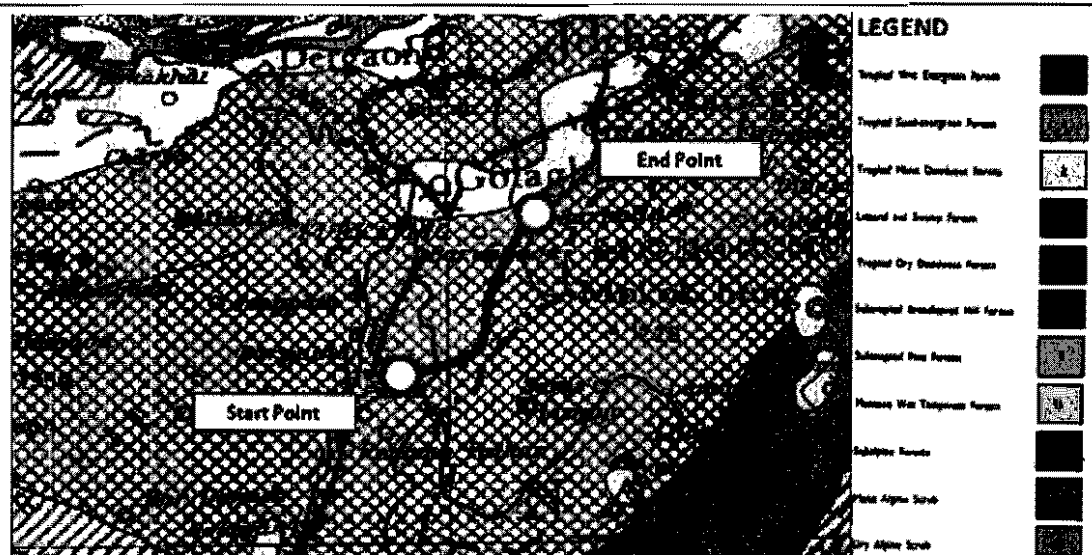


Figure 5-20: Forest Type Map of Project Site (Assam)

Source: Survey of India

5.7.3 Fauna

As a state, Assam is very rich in bio diversity with variety of faunal populace. As a part of northeast, Assam is also known as home of migratory birds. During the winter season, Bio rich wetlands and forest areas attracts more foreign and local birds and it is also known as bird watching season. Some of the species recorded around the Jorhat and Golaghat districts are listed below.

Chlidonias hybridus (Whiskered Tern), *A. grandis* (White-Vented Myna), *Podiceps cristatus* (Great Crested Grebe), *Picoides macei* (Fulvous-breasted Woodpecker) *Pelecanus philippensis* (Spot-Billed Pelican), *Nycticorax nycticorax* (Black-Crowned Night Heron), *Ixobrychus sinensis* (Yellow Bittern), *Anastomus oscitans* (Asian Openbill), *L. javanicus* (Lesser Adjutant),

Plegadisfakinellus (Glossy Ibis), *Anser anser* (Greylag Goose), *Anas crecc* (Common Teal), *Grus grns* (Common Crane), *Acridotheresginginianus* (Bank Myna) Other Specious recorded are Cattle Egret *Bubukus ibis*, Great Egret *Egretta alba*, Intermediate Egret *E. intermedia*, little Egret *E. garzetta*, Common Sandpiper *Actitis hypoleucos*, Black-winged Stilt *Himanwpus himantopus*, Common Black-headed Gull *Larus ridibundus*, Spotted Owllet *Athene brama*, Pied Kingfisher *Ceryle rudis*, Common Kingfisher *Akedo atthis*, Stork-billed Kingfisher *Pelargopsiscapensi*, House Sparrow *P. dmnesticu*. Predatory birds like Black Kite *Milvus migrans*, Brahminy Kite *Haliastur indus*, White-rumped Vulture *Gyps bengaknsis*, Long-billed Vulture *G. indkus*.

Wildlife and wetland collected from Survey of India (SOI) clearly shows the project area is free of fauna (Figure 5-21). The wildlife does not offer a wide spectrum of species in the project area. Some of the identified animal's species are Jackal - *Canis aureus*, Jungle cat - *Felis chaus*, squirrels - *Funambulus pennant*, Hare - *Lepus nigricollis nigricollis*, Common mongoose - *Harpestes edwardsi*, Common rat snake - *Ptyas mucosus*, Assam worm snake (*Typhlina bothriorhynchus*), monocellate cobra (*Naja kaothia*), Assam trinket snake (*Elaphe frenata*) and Green whip snake - *Ahaetulla nasutus*.

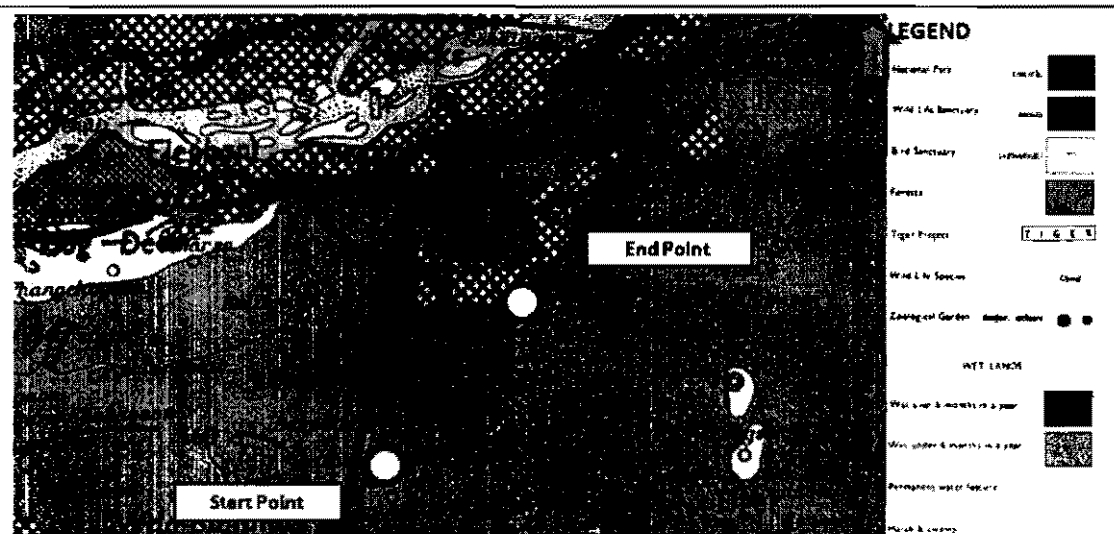


Figure 5-21: Wild life and Wetlands Map of Project Site (Assam)

Source: Survey of India

5.7.4 Sensitive Ecological Areas

No sensitive ecological habitats or ecosystems are identified within the direct influence area of the project corridor. Nambor Wildlife Sanctuary is the sensitive ecological habitat in the indirect influence area (above 10km buffer zone). The details are discussed below.

Nambor Wildlife Sanctuary: Nambor Wildlife Sanctuary is a moderately sized sanctuary that stretches across an expanse of 37 sq. km. The sanctuary is sited at a distance of 20 km from Golaghat and 65 km from the renowned Kaziranga National Park. The sanctuary is a haven for wild animals like the regal elephants and the majestic predatory Royal Bengal Tigers. Nambor Wildlife Sanctuary is also an ornithologist and a bird lover's dream destination. The sanctuary houses numerous varieties of exotic and variegated migratory as well as domestic birds. Entomologists too have a good time studying the varieties of insects, butterflies and moths that flutter about the sanctuary's premises.

Flora & Fauna of the forests: The sanctuary is dominated by Ou Tenga (*Dillenia indica*), Amari (*Aglaia spectabilis*), Gahorisopa (*Magnolia griffithii*), Borhamthuri (*Magnoliaceae hodgsonii*), Bandardima (*Dysoxylum* sp.), Titachapa (*Michelia baillonii*), Bhelekor (*Aristolochia tagala*), Chalmogra (*Hydnocarpus Kurzii*), Bheiu (*Tetramelos nudiflora*), Bon Aam (*Mangifera sylvatica*), Bonpetha (*Chrysophyllum roxburghii*), Borpat (*Ailanthus integrifolia*), Nahor (*Mesua ferrea*), Holong (*Dipterocarpus macrocarpus*), Garjan (*Dipterocarpus turbinatus*), Himolu (*Bombax ceiba*), Selleng (*Sapium baccatum*), Rudraksha (*Eleaeocarpaceae sphaericus*), Dewa Sam (*Artocarpus lacusha*), Dhuna (*Canarium bengalense*), Amora (*Spondias pinnata*), Moj (*Pithecellobium monadelphum*), Arjun (*Terminalia arjuna*), Halakh (*Terminalia myriocarpa*), Kendu (*Diospyros embryopteris*), Sationa (*Alstonia scholaris*), Sachi (*Aqualania agolacha*), Cham Kothal (*Artocarpus chama*), Kath Badam (*Mansonia dipikae*), Gamari (*Gmelia arborea*), Hingari (*Castanopsis indica*), Lemtem (*Gynocordia odorata*), Paroli (*Stereospermum chelonoides*) etc.

Some important climbers of the sanctuary are Mamoilata (*Gnetaceae montanum*), Bonjalika (*Clematis cadmia*), Hoolooklata (*Pycnarrhena pleniflora*), Tubukilata (*Cissampelos pareira*), Tikanibaruwal (*Byttneria grandifolia*) Chepatalata (*Cayratia trifolia*), Harjodralata (*Cissus quadrangularis*), Panilata (*Vitis planicaulis*) Bakaibih (*Millettia pachycarpa*) Bandor Kankora (*Mucuna pruriens*), Kalmow (*Ipomea aquatica*), Raghumola (*Cascuta reflexa*), Aaownipan (*Peperomia thomsonii*) etc.

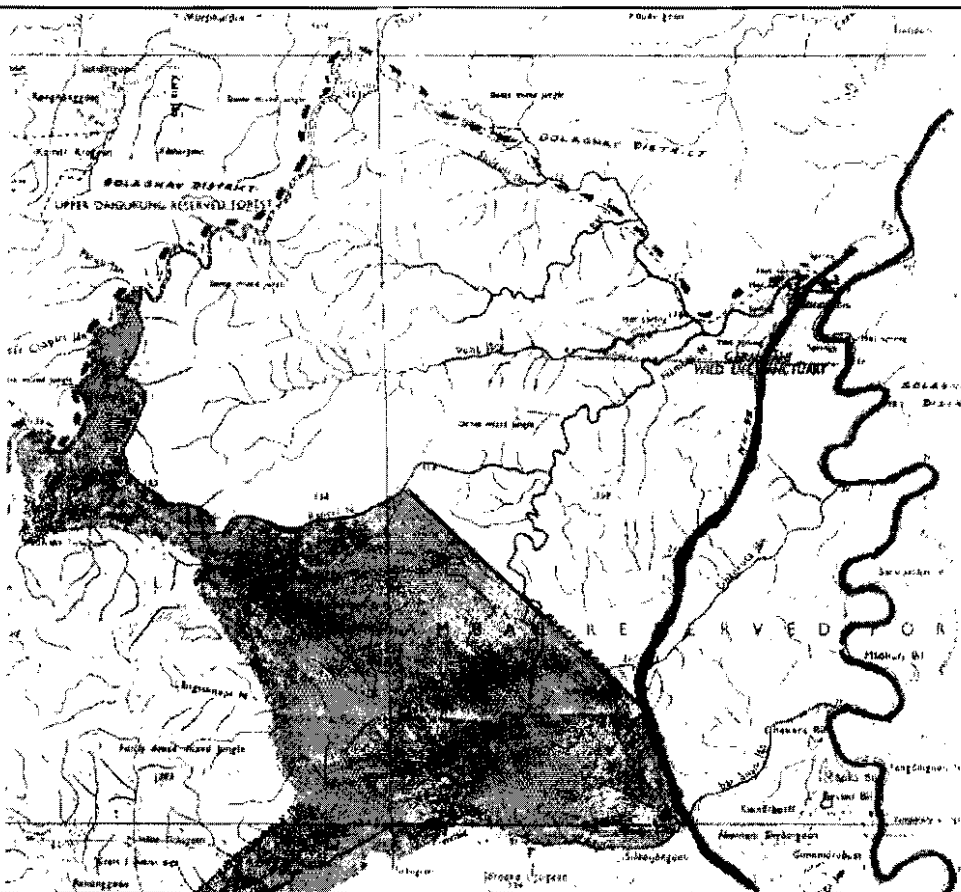


Figure 5-22: Nambor Wildlife Sanctuary Map

Several species of cane and more than hundred species of herb, shrub, under shrub, lianas, bamboo and grass proves the rich bio-diversity of the sanctuary

The main fauna of HGS includes, western hoolock gibbon (*Hoolock hoolock*), stump-tailed macaque (*Macaca arctoides*), northern pig-tailed macaque (*Macaca lenina*), eastern Assamese macaque (*Macaca assamensis*), Bengal slow loris (*Nycticebus bengalensis*) Indian Rhesus macaque (*Macaca mulatta*), orange-bellied capped leaf monkey or capped langur (*Trachypithecus pileatus durga*), hog deer (*Axis porcinus*), sambar (*Cervus unicolor*), porcupine (*Hystrix indica*), tiger (*Panthera tigris*), common leopard (*Panthera pardus*), jungle cat (*Felis chaus*), large Indian civet (*Viverra zivetha*), small Indian civet (*Viverra Indica*), common palm civet (*Paradoxurus bermaphroditus*), malayan giant squirrel (*Ratufa bicolor*), hoary-bellied squirrel (*Callosciurus pygerythrus*), Indian python (*Python molurus*), cat snake (*Boiga trigonata*), Indian cobra (*Naja naja*), common rat snake (*Pitas mucous*), Indian elephant (*Elephas maximus*), marbled cat (*Felis marmorata*), leopard cat (*Felis bengalensis*), common mongoose (*Herpestes edwardsi*), common Indian mongoose (*Herpestes auropunctatus*), Indian fox (*Vulpes bengalensis*), jackal (*Canis aureus*), wild boar (*Sus scrofa*) etc.

5.7.5 Aquatic ecosystems

The project corridor crosses three small rivers viz... Kokadonga (11/800), Mokram (7/600) and Goranga (3/900)... The rivers in the project corridor act as storm water drain and don't have a unique aquatic ecosystem. However, River Dhansiri falls in the project influence area (12km radius) and hence the water quality of the river is discussed in Table 5-7.

Table 5-7: Water Quality of River Dhansiri

Sampling location	Temperature (°C)	Dissolved Oxygen (DO) mg/l	pH	Saprobic Score	Diversity Score	Biological Water Quality Class	Biological Water Quality
River Dhansiri @ NH-39	30	6.9	6.4	5.7	0.45	C ³	Moderate pollution

Source: Water Quality of Rivers in Brahmaputra Basin-2005, CPCBENVIS

Table 5-8: Invertebrates in River Dhansiri

Sl. No	Order	Species
1	TRICHOPTERA	Hydropsychidae
2	ODONATA	Lestidae, Gomphidae, Libellulidae
3	CRUSTACEA	Atydae, Gammaridae
4	MOLLUSCA	Thioridae, Sphaeridae, Viviparidae, Unionidae, Planorbidae, Lymnaeidae,
5	HEMIPTERA	Nepidae
6	COLEOPTERA	Gyrinidae, Hydrophilidae
7	OLIGOCHAETA	Oligochoetes
8	DIPTERA	Chironomidae

Source: CPCB report on Status of Water quality in India

5.8 Socio-economic Environment

The socio-economic profile along the project corridor takes into account the socio as well as the economic aspects.

- Population Distribution
- Density of Population;
- Sex Ratio;
- Literacy Rate;
- Share of Vulnerable Groups;
- Workforce Participation Ratio;
- Sector-wise Distribution of Workers and

³ Maximum of 24 numbers of families (planktons) showed moderate pollution (Class 'C') of water quality

- Urbanization

5.8.1 Population Distribution

The project influence area comprises of 2 Blocks falling under Jorhat and Golaghat districts, namely, Titabor and Golaghat. The growth rate of population in the project influence area is 1.39% as the population of the region has slightly increased from 1991 to 2001. The highest population growth rate of 1.40% was recorded in Titabor Block followed by 1.39% in Golaghat Block. Block wise demographic characteristics in project influence area are presented in Table 5-9.

Table 5-9: Population Distribution in Block along the Project Corridor, 2001

District	Taluka	Population		AAGR (91-01)
		1991	2001	
Jorhat	Titabor	10496	12065	1.40%
Golaghat	Golaghat	36521	41936	1.39%
	Total	47017	54001	1.39%

Source: census survey of India

5.8.2 Population Density

The project influence area has a population density of 8 persons per hectare in 1991 that has increased to 9 persons per hectare in 2001. In 2001, the highest population density is observed in Golaghat Block with 13 persons per hectare whereas Titabor Block has a lower density of 4 persons per hectare. In the project influence area, the highest population according to 2001 census is 41936 persons where as in 1991 census the population of Titabor Block was 12065 persons with a decadal growth rate of 1.40% (Table 5-10).

Table 5-10: Population Density in Block along Project Corridor, 2001

District	Taluka	Area (Hect)	Population		Density (Persons/Hect)	
			1991	2001	1991	2001
Jorhat	Titabor	2808.74	10496	12065	4	4
Golaghat	Golaghat	3298.75	36521	41936	11	13
	Total	6107.49	47017	54001	8	9

Source: census survey of India

5.8.3 Sex Ratio of the Influence Area

As per the Census estimates (2001), the sex ratio (females /1000 male) of project influence area is 925. Amongst the Blocks, Titabor Block registered the highest sex ratio with an increase from 923 in 1991 to 952 in 2001. The lowest sex ratio is recorded in Golaghat Block (Figure 5-24).

Table 5-11: Sex Ratio of Block along the Project Corridor, 2001

District	Taluka	Gender Ratio	
		1991	2001
Jorhat	Titabor	923	952
Golaghat	Golaghat	853	917
	Total	868	925

Source: census survey of India

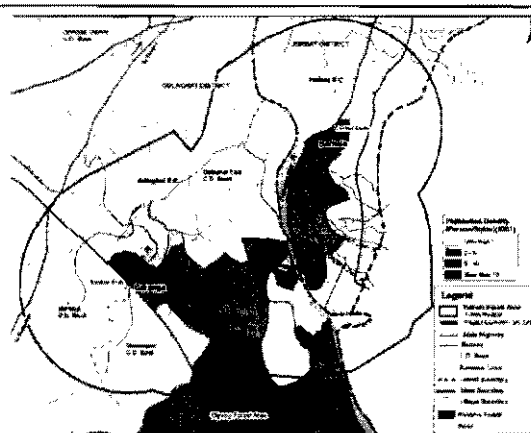


Figure 5-23: Population Density along Project Corridor

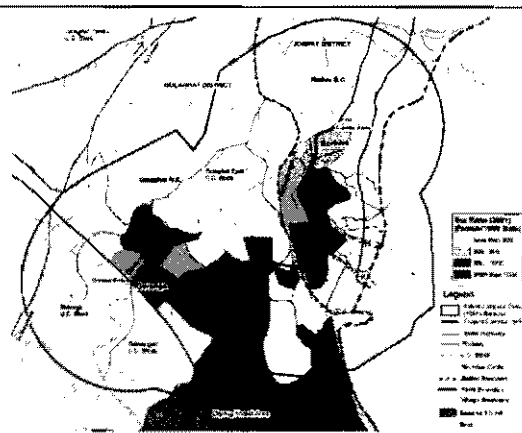


Figure 5-24: Sex Ratio along the Project Corridor

5.8.4 Vulnerable Groups in the Influence Area

Distribution of scheduled caste and scheduled tribe population is presented in Table 5-12. The percentage distribution of scheduled tribe (24%) is higher than scheduled caste (4%) for Jorhat district and vice versa for Golaghat district (SC 5% and ST 1%). However, the total SC and ST population shows very marginal difference (Figure 5-25 & Figure 5-26).

Table 5-12: SC & ST Population along the Project Corridor, 2001

District	Taluka	Population 2001		% to Total Population	
		SC	ST	SC	ST
Jorhat	Titabor	441	2913	4%	24%
Golaghat	Golaghat	1890	606	5%	1%
	Total	2331	3519	4%	7%

Source: census survey of India

5.8.5 Literacy Rate

As per the Census estimates (2001), 71% percent of the population are literate in the project influence area. Within the project influence area, Golaghat Block shares the highest literacy rate (74%) in 2001 (Table 5-13).

Table 5-13: Literacy Rate of Block along the Project Corridor, 2001

District	Taluka	Literates		Literacy Rate (%)	
		1991	2001	1991	2001
Jorhat	Titabor	5559	7523	53%	62%
Golaghat	Golaghat	24476	31006	67%	74%
	Total	30035	38529	64%	71%

Source: Census survey of India

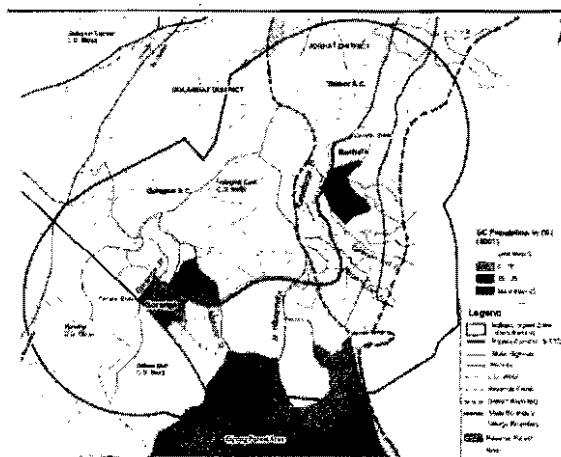


Figure 5-25: SC Population along the Project Corridor

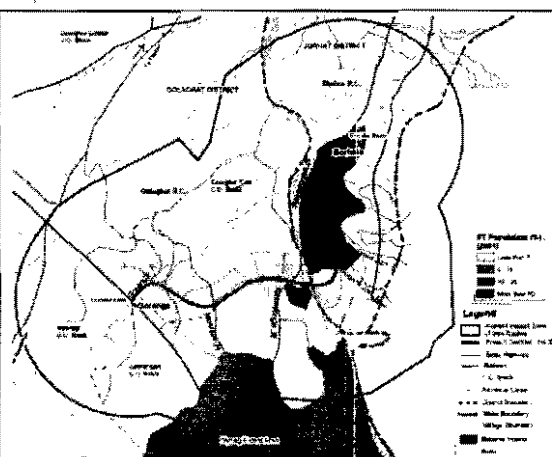


Figure 5-26: ST Population along the Project Corridor

5.8.6 Workforce Participation

The given Table 5-14 describes the average annual growth rate of workers and work participation rate at districts level (within the project influence area). The average WPR in project influence area for Jorhat is 35% and Golaghat is 34%. The main worker population rate is higher for Golaghat (89%) in comparison with Jorhat (66%). However, the total WPR shows a decline growth in the project districts.

Table 5-14: Workforce Participation Ratio along Project Corridor, 2001

District	Taluka	Total Workers		AAGR of Workers (1991-01)	WPR		Main Workers 2001		Marginal Workers 2001	
		1991	2001		1991	2001	No.	%	No.	%
Jorhat	Titabor	4731	4245	-1.08%	45%	35%	2788	66%	1457	34%
Golaghat	Golaghat	12913	14133	0.91%	35%	34%	12635	89%	1498	11%
Total		17644	18378	0.41%	38%	34%	15423	84%	2955	16%

Source: census survey of India

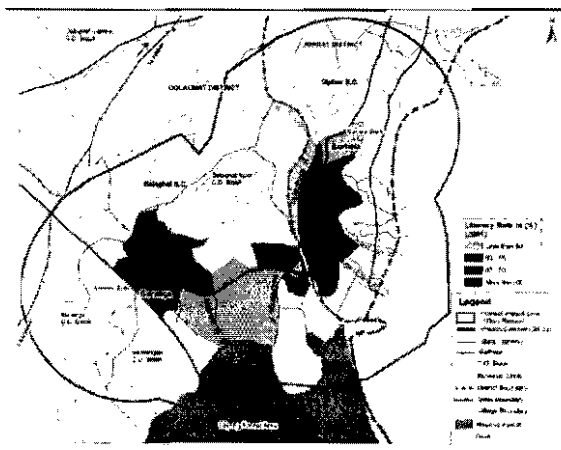


Figure 5-27: Literacy Rate along the Project Corridor

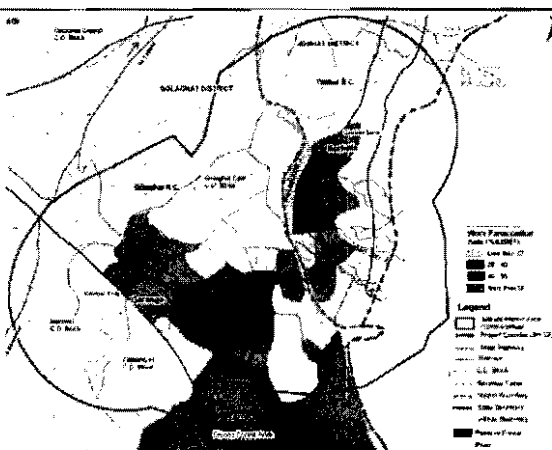


Figure 5-28: Workforce Participation Ratio along Project Corridor

5.8.7 Cultural Environment

There are about 7 religious structures that exist along the project road; most of them are temples, one mosque and one naam ghar, that lie within the ROW

Table 5-15: Religious structures along the project corridor

Sl. No	Chainage (km)	Side of the road (LHS/RHS)	Offset From CL (m)	Length along corridor	Description
1	1/770	RHS	12.10	12.15	Nam Ghar
2	2/670	RHS	7.44	8.42	Temple
3	7/650	LHS	5.72	42.39	Temple
4	8/310	LHS	6.95	40.93	Temple
5	10/020	RHS	4.30	1.53	Temple
6	10/140	RHS	19.70	5.00	Temple
7	11/310	LHS	4.51	18.23	Mosque

6 Analysis of Potential Environmental Impact & Mitigation Measures

6.1 Project Impacts and Issues

This chapter presents the mitigation and management measures to address the likely impacts on identified environmental components due to the proposed project development. The description is an overview of the specific measures provided in the EMP. The Chapter finally presents the environmental costs for mitigating adverse impacts.

The following subsections detail the mitigation measures that need to be undertaken during different project stages. They are required to minimize the negative impacts and enhance the positive impacts of the project on the surrounding environment. The mitigation measures revolve around various alternatives during the design phase, pre-construction, construction and operation phase of the road project; incorporating the following:

- The "standard design" of various road sections is arrived at based on detailed deliberations between highway design and social-environmental team.
- "General measures" to mitigate negative impacts on the natural, socio-economic and cultural environment, based on the characteristic features (existing environmental settings and assessment of probable impacts) of the project corridor.
- Specific design solutions in the section that is found to be sensitive including formulation of special provisions to ensure environmentally sensitive construction methods that take place in critical sections or areas.

6.2 Land Environment

6.2.1 Anticipated Impacts

- Widening will require additional land along the project road. Widening of road would require acquisition of 7.72 ha of agriculture land at places where the available RoW is inadequate to accommodate the proposed improvements. Acquisition of residential land of 1.36 ha for widening shall result in change in land use pattern within the proposed ROW and would cause loss of productive soil. Loss of productive land due to the road construction is a major long-term impact that results in depletion of fertile topsoil during the road construction phase.
- The road passes through fertile plain terrain along the entire stretch. No significant cutting will be involved. The cut estimate is 9,840 cu m while the fill material required would be 49,200 cu m. Thus the fill quantity is more than the quantity to be removed. Apart from cutting and filling, temporary changes in topography in the vicinity of the project site may be possible because of project related activities like construction of bridges, culverts etc.
- The excavation of quarries and borrow pits used for obtaining sand, aggregate and soil for road construction may cause direct and indirect; short and long-term adverse impacts on the environment. Spillage and dust pollution is expected during transportation of these materials.
- Erosion of the top layer takes place as a result of construction and maintenance of the project corridor. During the construction phase, clearing of trees, construction of new fill slopes for grading bridge-end fills possesses high and pervasive potential for soil erosion. During operation or maintenance phase of the state highway, erosion continues to occur in the areas not vegetated. Sites most affected during the operation phase are generally bridge end fills and over steep banks, due to the long-term exposure to water and wind.
- Impact on soil due to widening of project corridor includes: loss of topsoil, increase in soil erosion, soil instability, tipping of spoils generated from construction work and contamination of soil. Following are the measures needed to minimize the adverse impact.

6.2.2 Mitigation Measures

No major change in the topography is envisaged on the project corridor, as no construction of high embankments is proposed. However, requirement of materials shall necessitate creation of new borrow areas and quarry pits. Rehabilitation of such sites after use, by smoothing the steep slopes and covering them with vegetation or converting them into water body shall form a part of this project. Similarly, fresh embankments created at the site shall be covered with dredged earth for turfing of the slopes, in order to prevent erosion of the murrum casing, for minimizing the runoff and stabilizing the embankment.

6.2.2.1 Conservation of Topsoil

The topsoil shall be stripped up to a depth of 15 cm at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PIU. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. The stockpiles for storing the topsoil shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is restricted to 2m.

A minimum distance of 1m is required between where the topsoil has to be preserved for more than a month, the stockpile is to be stabilized within 7 days of forming. The stabilization shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control. After spreading the topsoil on disturbed areas, topsoil must be seeded, and mulched within 30 days of final grading. During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses.

Preservation of Stockpiles: The contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the engineer.

Spreading back of topsoil: The area to be covered with vegetation shall be prepared to the required levels and slope. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

Vegetative material for stockpile stabilisation...

- Must consist of grasses, legumes, herbaceous, or woody plants or a mixture thereof
- Selection & use of vegetative cover to take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth

stockpiles of different materials. In the cases

Locate stockpiles in ...

- A secure area away from
- Grade, Subsoil & Overburden materials;
- Pit activities; and
- Day-to-day operations.
- Areas that do not interfere with future pit expansion.
- Areas away from drainage paths and uphill of sediment barriers.

should be prevented from entering nearby

Preserving stockpiles – Precautions

- Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur.
- Divert runoff around stockpiles unavoidably located in drainage paths using a perimeter bank uphill.
- The stockpiles shall be covered with gunny bags or tarpaulin immediately in case they are not stored for periods longer than 1 month

6.2.2.2 Erosion Control Protection

Stabilization of High Embankment Slopes:

Slope of the road embankment shall be fixed within the range of 1:2 to 1:3, which will reduce the possibilities of slope failure. Further to stabilize the slope, vegetative cover as per Box 6-1 shall be done.

Box 6-1: Detailed specifications for Vegetative cover

Description:

The vegetative cover should be planted in the region where the soil has capacity to support plantation and at locations where meteorological conditions favour vegetative growth.

Site Preparation:

To prevent the seeds from washing away subsequent to sowing, area should be protected with surface roughening and diversions.

Soil samples should be taken from the site and analysed for fertiliser and lime requirements.

Seed Application:

The seed should be sown uniformly as soon as preparation of the seedbed has been completed.

No seed should be sown during windy weather, or when the ground surface is wet, or when not tillable.

Maintenance:

During first six weeks, the planting should be inspected by the PIU, to check if the growth is uniform and dense. Appropriate moisture levels shall be maintained. There may be requirement of watering the plantings regularly during the dry seasons. Fertiliser and pest control applications may also be needed from time to time.

In case slope is steeper than 1:2, stone pitching (Figure 6-1) will be done. Stones will be fixed on slopes by gentle hammering. A P.C.C. anchor will be provided at the base, which will prevent sliding of stones on slope. The gaps between adjacent stones allow grass to grow which will hold the soil firmly together.

To check the slope stabilization of borrow pits adjacent to the embankment, the depth of the pit will be so regulated that the bottom edge of pit shall not intersect the imaginary line of slope 1:4 drawn from the top edge of the nearest embankment (Figure 6-2). To avoid embankment slippage and erosion, borrow pits shall not be dug continuously.

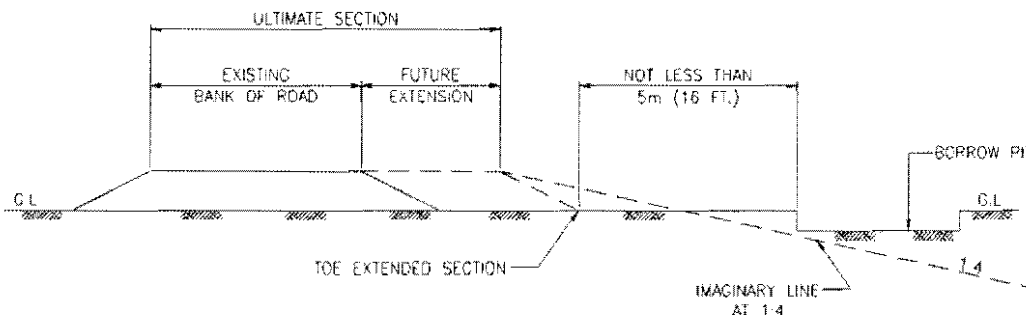


Figure 6-1: Depth Specification for Borrow Pit Along the Road

6.2.2.3 Measures to minimize Soil Contamination

Reduction and management of spoil

Construction activities may generate a lot of spoil; if the cut and fill quantities are not balanced, often the old road base is excavated and disposed off on account of its unsuitability to be used in the new fill.

Construction Stage

Cut and fill works are to be carried out strictly in accordance with the design drawings. Where extra spoil material is generated, it can be used for reclamation of borrow pits and quarries, low lying areas in barren land and in settlements along the project corridors.

Contamination of soil from fuel and lubricants

With an increase in the traffic volume, the contamination of the soil adjacent to the highway is likely, even though the effect will be much localized.

- **Construction Stage**

At the various construction sites, the vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refueling sites are kept at least 300m away from drainage channels and important water bodies. In all fuel storage and refueling areas located on agricultural lands or productive lands, the topsoil preservation shall be carried out. At the two construction sites that will be set up for the project road, "oil interceptors" should be provided. The oil interceptor works on the principle: the grease and oil being lighter in weight float on the top surface of the wastewater. Hence, oil and grease can be scum and disposed in environmentally sound fashion. The design drawing of an oil interceptor is given in the **Figure 6-2**.

Monitoring of soil is to be carried out during the construction phase at the following locations:

- at productive agricultural lands close to intersections or along sensitive land uses (2locations)
- any accident or spill locations involving bulk transport carrying hazardous materials (Budgetary provisions provide for monitoring at 2 such locations for the project during construction stage).

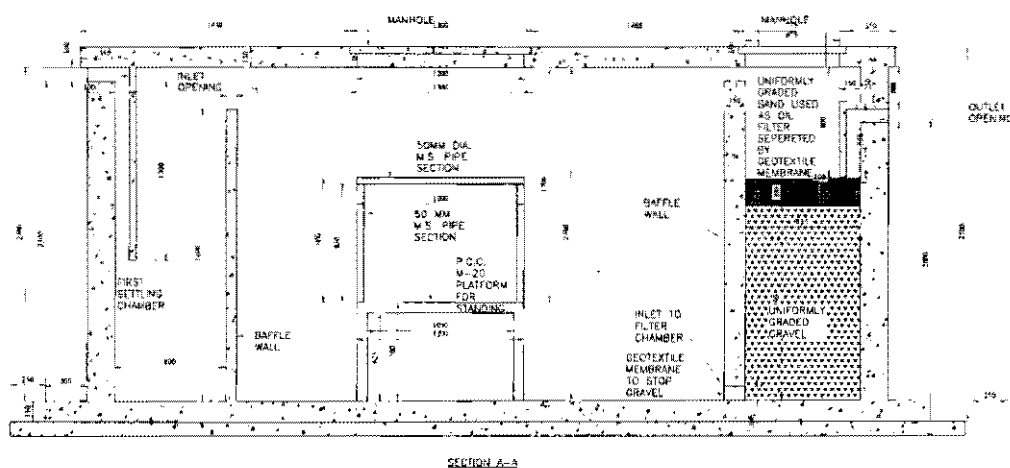


Figure 6-2: Oil and Grease Interceptor

- **Operation Stage**

Probability of contamination of soil being only from the road runoff, which is regulated by well-designed drains, no impact on the soil during operation stage except in case of accidents, is anticipated.

6.2.2.4 Contamination of soil from Construction wastes and quarry materials

Pre-construction Stage

Cut and fill areas should be designed to be balanced. Thus generation of spoil materials will be minimized. For the disposal of spoils, low-lying areas or quarries with extra storage capacity have been proposed for storage.

Construction Stage

Cut and fill works are to be carried out strictly in accordance to the design drawings. Earth, if required, is to be disposed in selected areas approved by the PIU. The spoils can be used to reclaim borrow pits and quarries, low-lying areas in barren lands and in settlements along the project corridors. All spoils are to be disposed off as desired and the site is to be fully cleaned before handing over. The construction wastes will be disposed in selected pits, developed on infertile land. Non-bituminous wastes from construction activities will be disposed in borrow pits and covered with a layer of the conserved topsoil. Bituminous wastes will be disposed off in an identified dumping site approved by the PIU.

6.3 Water Environment

6.3.1 Anticipated Impacts

Impacts envisaged on water resources due to proposed improvements are:

- Loss of existing water sources
- Loss of water storage capacity
- Increased pressure over available resources
- Deterioration of water quality and
- Drainage impact

Widening of the road width will result in partial and full filling of roadside water ditches. There are seven ponds along the project road, out of which very few would be partially affected due to widening of the project road. Most of the ditches that are likely to be impacted are non-perennial. The ditches are used for domestic purposes like washing, cleaning etc.

Table 6-1: water bodies along the project corridor

Sl.no	Water Body	Side	Chainage	Extent of Impact
1	Pond	LHS	0/520	Fully
2	Pond	LHS	2/700	Partially
3	Pond	LHS	6/550	Fully
4	Pond	RHS	6/550	Fully
5	Pond	RHS	6/550	Fully
6	Pond	LHS	10/550	Fully
7	Pond	RHS	11/000	Fully

Source: Reconnaissance Survey

Ground water recharge areas may be reduced due to an increase in impervious surface resulting from compaction. Contamination of ground water due to the runoff carrying pollutants is of major

concern because most of the domestic use is from ground water. The construction of shallow tube well down to 50m depth and dug well are problematic in some parts of the district due to the presence of thick blanket of clay beds. People generally prefer to construct ponds and store rain water, which dries up during winter period. Though, deep tube wells are feasible in the district, construction of deep tube wells are not common within the mass, which may be due to ignorance and as well as requirement of high cost involvement.

Road construction activities will lead to an increased run-off both during the construction and operation stages. During the construction stage, removal of vegetation and compaction of soil leads to increased run-off during the monsoon.

There are no tube wells, hand pumps and water taps that exist along or in the direct vicinity of the project road and thus widening will not entail any removal and/ or shifting of water supply lines

Water quality may be degraded during construction due to the disposal of solid and liquid waste from the labour camp, fuel and lubricant spills or leaks from the construction equipments, fuel storage and distribution sites and from the bitumen and asphalt storage at hot-mix plants. Major pollutants of concern due to above mentioned activities are suspended solids, oil and grease, lead and other metals. The most susceptible locations for contamination of water resources during construction are:

- Waterlogged areas that have water in them during the period of construction;
- Surface and ground water resources close to bitumen or asphalt storages at hot-mix plants, maintenance sites of construction vehicles; and
- Surface water bodies close to labour camps.

During the operation stage possible water pollution of surface and ground water bodies shall be limited to:

- Runoff and wastewater from truck parking, filling stations and automobile repair shops;
- Accidental spills from vehicles carrying hazardous chemicals; and
- Open wells adjacent to construction sites

Drainage Impacts: As per the bridge condition survey done by PWD, there are 53 cross drainage structures in the project corridor. Out of these, 4 Minor Bridges (Total Length < 60.0m) and the remaining 49 structures are culverts. Improvement measures include rehabilitation and reconstruction of existing structures. That might result in waterways getting blocked due to the haphazard dumping of the construction materials and wastes.

6.3.2 Mitigation Measures

Surface Water Body: While working around or near the water body, following measures shall be undertaken:

- Silt fencing and/or brush barrier shall be installed near all the water bodies (at 4 river crossing locations (Table 6-2) – Goranga, Mokram and Kakadonga) for collecting the sediments before letting them into the water body.
- Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be revegetated.
- Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.
- Movement of machinery, workforce shall be restricted around the water body and no waste from construction camps or sites shall be disposed into it.

• Run off Control / Drainage

To ensure efficient drainage system and to prevent water logging along the sides, adequate size and number of cross-drainage structures have been provided. All cross-drainage structures have been designed to handle a 50-year peak flood level as per IRC: 5 – 1998 (*Standard Specifications and Code of Practice for Road Bridges Section I*), IRC: SP-13 – 1973 (*Guidelines for the Design of Small Bridges and Culverts*), IRC: 78-2000, (*Standard Specifications and Code of Practice for Road Bridges Section VII*).

At locations of high embankment or bridge approaches, Chute Drains shall be provided to drain the surface runoff and prevent erosion from the slopes. Detailed specifications are mentioned in **Figure 6-3**. (Refer IRC SP: 50 – 1999, *Guidelines on Urban Drainage*; IRC SP: 42 – 1994, *Guidelines on Road Drainage* for detailed drainage design).

Table 6-2: List of river crossing along SH-32

Sl.no	Water Body	Chainage	Status
1	River	3/950	Perennial
2	Goranga River	1/100	Perennial
3	Mokrom River	7/600	Perennial
4	Kakodanga River	11/800	Perennial

Source: Reconnaissance Survey

During the progress of work, the contractor will remove obstructions that may cause any temporary flooding of local drainage channels during construction. No spoil or construction material will be stored outside the proposed RoW or at places obstructing the natural drainage system.

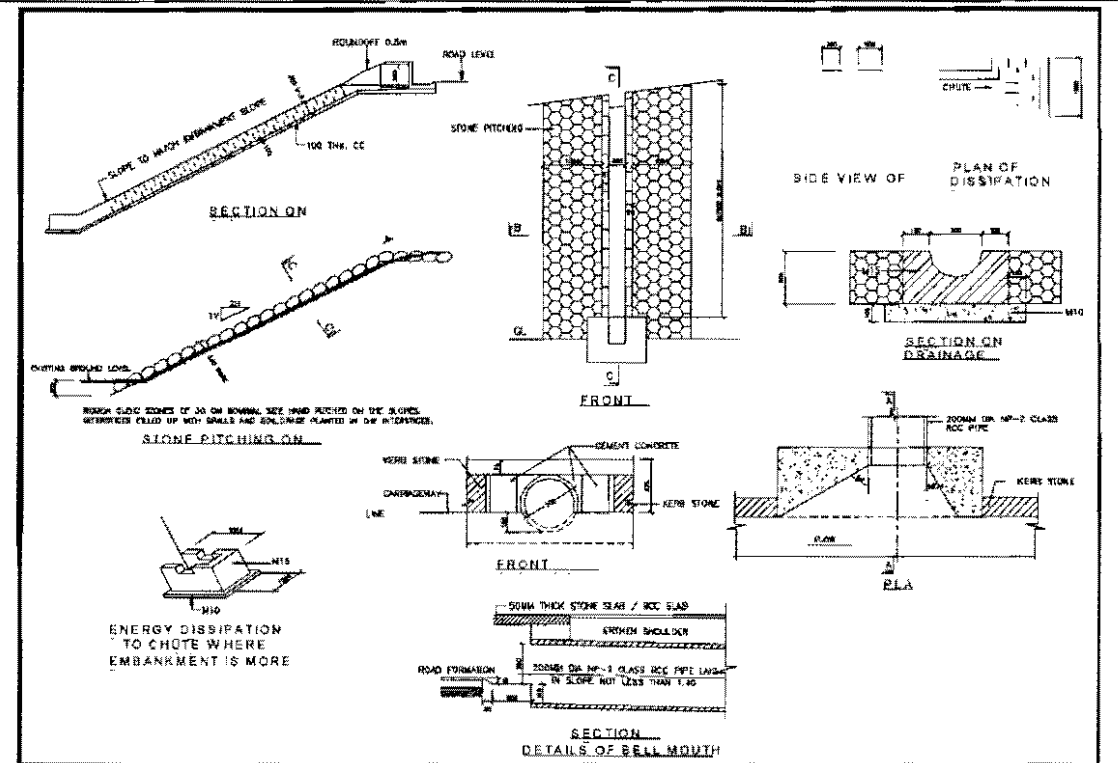


Figure 6-3: Channelised Embankment: Chute Drain

In locations close to cross-drainage channels, the contractor will ensure that earth, stone or any other construction material shall be disposed off immediately at the designated landfill site so as to avoid blocking the flow of water along those channels. Silt fencing (Error! Reference source not found.) shall be provided at the construction sites (2 construction sites considered during construction phase) in proximity to water bodies. Warning posts for notice of public against entry into the stream channels while construction shall be erected.

During the operation phase following measures need to be undertaken:

Inspection (as per IRC SP: 18-1978, Manual for Highway Bridge Maintenance Inspection) and cleaning of drains / culverts shall be done as they get choked with silt/debris and growth of vegetative cover over the accumulated debris.

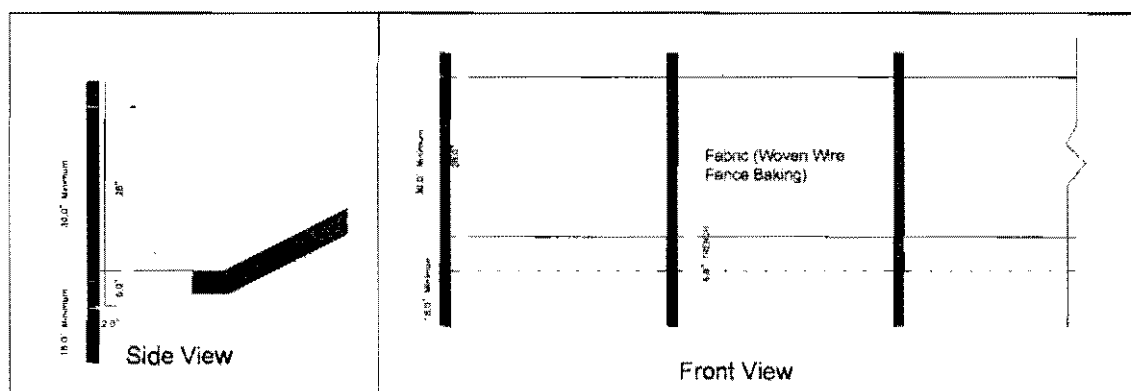


Figure 6-4: Cross-section of Silt Fencing

Box 6-2: Detailed Specifications For Silt Fencing

Description:

Silt fencing is a temporary sediment barrier made of woven, synthetic filtration fabric supported by steel or wood post. The purpose of the silt fence is to prevent sediment carried by sheet flow from leaving the site and entering to natural drainage or any other water body located near the construction site. Silt fencing encourages the sheet flow and reduces the potential for development of rills and gullies. Care should be taken that silt fences are not installed across streams, ditches, waterways or other concentrated flow areas.

Construction Specification:

- Silt fencing (Refer Figure 6-4 for Cross-section) consists of 1.0 m wide filter fabric and should be placed on the contour. In case runoff flow or velocities are very high or where slope exceed vertical height of 3.0 m, silt fencing should be wire reinforced as shown in the Figure 7.5. The contractor should purchase silt fencing in a continuous role to the length of the barrier to avoid the use of joint. In case of joints, filter cloth should be spliced together only at supporting post, with minimum 15 cm overlap and securely sealed. The pile is drive to the depth of 300 mm into the ground by pressing from the top. The frame will be installed at the edge of stockpiles and at the water bodies along which construction is in progress.

Inspection:

- The PIU will inspect location as well as efficiency of silt fencing. The inspection should be done after every 15 days and in case of storm water, within 24 hours after the end of rain.

Maintenance:

- The contractor should remove sediments, once it has accumulated to one-half the original height of the fence. Filter fabric should be replaced whenever it has deteriorated to such an extent that the effective of the fabric is reduced. Silt fence should remain in place until disturb areas have been permanently stabilized. All the sediments accumulated and properly disposed of before the fence is removed. The operation of removing and disposing have to be monitored by the PIU or Engineer In-charge.

• Prevention of Water Quality Degradation

Following are the measures that need to be undertaken to prevent contamination of water body during the progress of work and also during the operation phase of the project corridor:

- To prevent the entry of the surface run-off from fuel and other contaminants into the wells and other surface water bodies along the corridor, construction of settling ponds and the installation of oil receptors shall be undertaken.
- All the diversion and bunds shall be removed such that there is minimum amount of sediment generation.
- All wastes arising from the project shall be disposed off at identified disposal sites in environmentally sound manner.
- No vehicles or equipment shall be parked or refuelled near the water-body, so as to avoid contamination from fuel and lubricants.
- At the construction camps, the sewage system shall be designed and built so that no water pollution takes place in any water body or watercourse.

Bio engineering methods adopted for slope Protection

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

Slope Protection design

Slope Protection @ the River bank: Plantation of the vetiver system will need to be in grid pattern. The rows parallel to the flow of river will arrest land slip whereas the rows normal to the flow will reduce the energy and initiate sedimentation. The anti-erosion mattress, pegging with bamboo stakes, reed etc. are shown in **Figure 6-5**.

Slope Protection @ Bridge approach (Upstream side): This face of the approach will have grid pattern of the vetiver plantation. This is suggested as there will be flow of flood water parallel to the approach when water hits the embankment (**Figure 6-6**).

Slope Protection @ Bridge approach (Downstream side): The plantation is proposed to be only in parallel rows as shown in **Figure 6-7**.

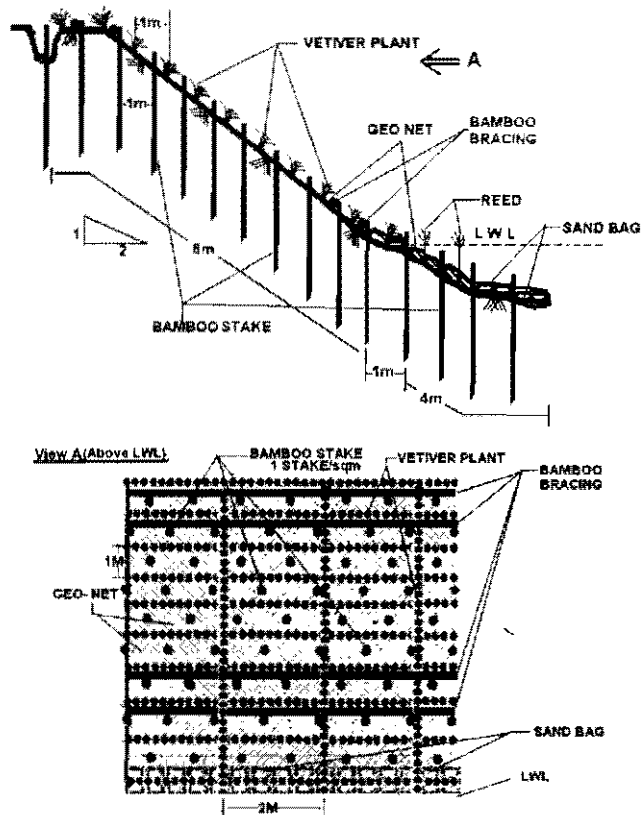


Figure 6-5: Slope Protection @ River Bank

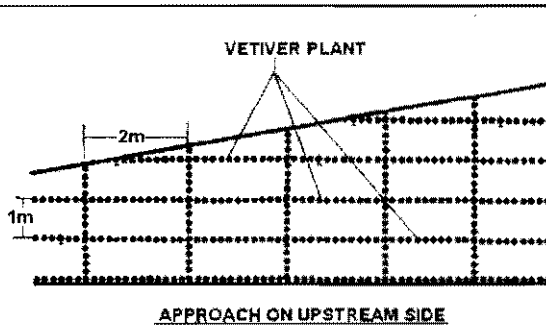


Figure 6-6: Slope Protection @ Bridge approach
 (Upstream side)

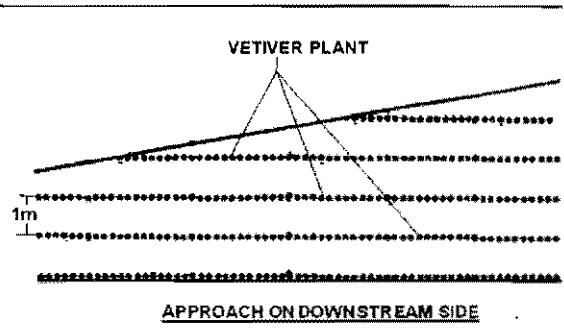


Figure 6-7: Slope Protection @ Bridge approach
 (Downstream side)

6.4 Air Environment

6.4.1 Anticipated Impacts

Various assumptions made for predicting the pollution levels along the corridor through this model are discussed below:

6.4.1.1 Construction Stage

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction equipments and ground related activities such as crushing sites, hot-mix and asphalt plants, etc. The ambient Air quality is likely to be impacted due to activities such as site clearance, stone crushing, dumping of fill materials, earthwork etc which will create dust in the construction area and its vicinity. This will affect the health of the construction workers and dwellers with in the nearby vicinity of the construction activities. The impacts anticipated on the air quality during the construction stage, though significant, will be short-term impacts.

6.4.1.2 Operation Stage

The improved road quality will lead to induced traffic on the corridor. This additional increase in the number of vehicles will result in a slow but steady increase in the air pollution levels and pollutant concentrations.

Likely contribution of the vehicular traffic to the pollutant concentrations is estimated using prediction models as the CALINE-4 for the operation period. The concentrations so worked out are presented in the **Table 6-3**. The modelling result shows, the pollution concentration of SPM steadily increases for all the identified sensitive locations from 2025 onward. The oxides of nitrogen (NO_x) show an increase level from 2030 and carbon di oxide (CO) from 2035. However, the predicted concentrations are less than the emission standards.

Table 6-3: Predicted Pollutant Concentrations at sensitive receptors

Chainage (km)	Receptor	Year	Predicted Concentration (µg/m ³)		
			NO _x	CO	SPM
5/550	Ghillidary Madhya English Vidyalaya	2011	0.03	0.5	223.9
		2016	0.03	0.5	223.9
		2021	0.04	0.6	228.9
		2026	0.04	0.7	231.0
		2031	0.05	0.7	237.0
		2036	0.06	0.8	238.6
7/860	Rupkoliya Primary School	2011	0.03	0.4	221.4
		2016	0.03	0.4	223.5
		2021	0.04	0.6	224.3
		2026	0.04	0.6	228.8
		2031	0.04	0.7	228.8
		2036	0.05	0.6	228.3
11/970	Worsha Goranga Madhyamik Balika Vidyalaya	2011	0.02	0.3	221.7
		2016	0.03	0.4	220.2
		2021	0.03	0.5	222.3
		2026	0.04	0.6	220.7
		2031	0.04	0.7	223.2
		2036	0.04	0.6	224.4
12/300	Goranga Chariali Bazar	2011	0.02	0.6	218.7
		2016	0.02	0.6	221.2
		2021	0.03	0.5	221.2
		2026	0.03	0.6	223.2
		2031	0.04	0.7	224.2
		2036	0.04	0.6	224.2

Source: CALINE Model Output

6.4.2 Mitigation Measures

Following are the measures that need to be undertaken to address air pollution during the progress of work:

6.4.3 Construction Stage

Selecting the site for plant area and parking lot for equipment's and vehicles as per **Box 6-3**.

Box 6-3: Siting of Plant Area / Parking Lot	
Avoid the following ...	Prefer the following ...
<ul style="list-style-type: none"> • Lands within 1000m of habitations • Irrigated agricultural lands • Lands within 1000m of community water bodies and water sources as rivers • Lands within 1000m of watercourses • Grazing lands and lands with tenure rights 	<ul style="list-style-type: none"> • Waste lands • Community lands not used for beneficial purposes • Lands with an existing access road

- Acquiring "No Objection Certificate (NoC)" from the Assam Pollution Control Board before setting up crusher, hot-mix plant and generator. Ensuring all vehicles must possess Pollution under Control (PUC) Certificate and shall be renewed accordingly.
- During the progress of work to minimize the dust generation, emissions as per **Table 6-4** shall be undertaken.
- Air Quality Monitoring should be carried out during the construction stage (construction period considered to be 3 years) to monitor the level of air pollutants and keep a check on the concentration. Monitoring should be carried out at the following sites for all 3 seasons except monsoons:
 - Location of Hot mix plant (to be decided by the contractor- 3 locations considered in the budget)
 - At critical locations along the project road covering various land use
 - At Ch 5/550 near Ghillidary Madhya English Vidyalaya in District Golaghat.
 - At Ch 7/860 near Rupkoliya Primary School in District Golaghat.
 - At Ch 11/970 near Worsha Goranga Madhyamik Balika Vidyalaya in District Golaghat.
 - At Ch 12/300 near congested section in Goranga Chariali in District Golaghat

The monitoring schedule has been provided in details in the Environment Management Plan (**Table 7-5**).

Table 6-4: Measures to minimize air pollution during the progress of work

Concern	Causes	Measures
Dust Generation	Vehicle Movement	Water sprinkling Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation Tail board shall be properly closed & sealed
	Crushers	Water Sprinkling
	Concrete mix Plant	Educate the workers for following good practices while material handling
Emissions	Hot-Mix Plant	Site Selection as per Clause 6.5.2, Section 6.5, IRC Manual for Construction & Supervision of Bitumen Work Regular maintenance of Dust Collector as per manufacture schedule
	Vehicles	Regular maintenance as per manufacture schedule
	Generators	Exhaust vent of long length
Noise	Heavy load vehicles	Exhaust silencer, Regular maintenance as per manufacture schedule
	Crushers	With acoustic proof
	Generators	Shall be kept in closed room and regular maintenance as per manufacture schedule

6.4.3.1 Operation Stage

During the operation stage, emissions due to vehicle movement can be effectively reduced if they conform to vehicular emission norms. However, enforcement of such measures and formulation of a regulatory framework for this purpose is beyond scope for this study.

Air quality monitoring for parameters SPM, RSPM, CO, SO₂, NO_x, at sites where monitoring has been carried out during the construction phase (except the hot mix plant site) is to be done once a year for 5 years. The monitoring schedule has been provided in the EMP Report.

Vehicular emissions of critical pollutants will be monitored with regular maintenance of roadside tree plantation. Monitoring of the effectiveness of the pollution attenuating vegetative barriers will be taken up after 5 years. Based on the results, recommendation for any changes in the mitigation measures or suggestion of additional measures shall be made.

6.5 Noise Environment

6.5.1 Anticipated Impacts

Noise is perceived as one of the most undesirable consequences of road development. Though the level of discomfort caused by noise is subjective, there is a definite increase in discomfort with an increase in noise levels. The most commonly reported impacts of increased noise levels are interference in oral communication and disturbance in sleep. Table 6-5 highlights the Ambient Noise Standards according to the Noise Pollution (Control and Regulation) Rules, 2000 under the section 6 and section 25 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 5 of the Environment (Protection) Rules, 1986.

Table 6-5: Ambient Noise Standards

Land use	Limits in dB(A) Leq *	
	Day Time	Night Time
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence Zone	50	40

*dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. Night time: 10:00 pm – 8:00 am

The impact on noise quality due to the project will be of significance in both construction as well as operation stages.

6.5.1.1 Construction Stage

Due to the various construction activities, there will be short-term noise impacts in the immediate vicinity of the project corridor. The construction activities include:

- Excavation for foundations with excavators;
- Grading and compaction of the site with graders and rollers; and
- Construction of cross drainage structures and other facilities

Though the noise levels for the construction activities far exceed the permissible standards, it is important to note that the construction noise is generally intermittent and depends on the type of operation, location and function of the equipment. Proper mitigation measures like regulation of timings of construction, employing noise protection measures etc., need to be worked out.

6.5.1.2 Operation Stage

With the increase in traffic, noise levels are expected to increase along the project corridor. However, with reduced congestion levels as a result of widening of the corridor and improvement of road surface, noise levels are going to be considerably lower in the 'with project scenario'.

Sensitive receptors like schools and colleges along the project road will be impacted due to increased traffic volume and consequently increased traffic noise on the widened road. Noise levels that are likely in the project area are estimated using screening model as the FHWA noise model. These noise levels are estimated for various design years in terms of average hourly Leq in dB (A). The noise levels are presented in the Table 6-6. It is evident that the noise levels are not likely to exceed the residential standards. However, these need to be corroborated with noise monitoring in the corresponding year.

Table 6-6: Predicted Noise levels for various road sections and traffic scenarios

Chainage (km)	Receptor	Side	Offset From CL (m)	Noise Levels (2010)		Noise Levels (2015)		Noise Levels (2020)		Noise Levels (2025)		Noise Levels (2030)		Noise Levels (2035)		Noise Levels (2040)	
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1/770	Nam Ghar	RHS	12.11	42.2	33.8	43.2	34.8	43.7	35.6	44.1	36.7	45.1	37.6	46.4	37.8	47.0	38.2
2/670	Temple	RHS	7.45	40.6	34.2	41.6	35.2	42.1	36.0	42.5	37.1	43.5	38.0	44.8	38.2	45.4	38.6
5/550	Ghillidary Madhya English Vidyalaya	RHS	6.50	37.8	31.2	38.8	32.2	39.3	33.0	39.7	34.1	40.8	35.0	42.0	35.2	42.6	35.6
7/650	Temple	LHS	5.73	42.4	36.7	43.4	37.8	43.9	38.6	44.3	39.7	45.4	40.6	46.6	40.8	47.2	41.1
7/860	Rupkoliya Primary School	LHS	7.80	41.1	32.0	42.2	33.0	42.6	33.8	43.1	34.9	44.1	35.8	45.3	36.0	45.9	36.3
8/310	Temple	LHS	6.96	40.3	33.7	41.3	34.7	41.8	35.5	42.2	36.6	43.2	37.5	44.4	37.7	45.1	38.1
10/020	Temple	RHS	4.30	36.9	37.1	37.9	38.1	38.4	38.9	38.8	40.0	39.9	40.9	41.1	41.1	41.7	41.5
10/140	Temple	RHS	19.70	47.5	35.7	48.5	36.7	48.9	37.5	49.4	38.6	50.4	39.5	51.6	39.7	52.3	40.1
11/310	Mosque	LHS	4.52	45.8	35.5	46.8	36.5	47.3	37.3	47.7	38.4	48.8	39.3	50.0	39.5	50.6	39.9
11/970	Worsha Goranga Madhyamik Balika Vidyalaya	LHS	8.30	42.5	30.6	43.5	31.6	43.9	32.4	44.4	33.5	45.4	34.4	46.6	34.6	47.3	35.0

Source: FHWA Model Output

6.5.2 Mitigation Measures

6.5.2.1 Construction Stage

The plants and equipment used for construction shall strictly conform to existing noise norms. Vehicles and equipments used shall be fitted with exhaust silencers. During routine servicing operations (as per manufacture schedule), the effectiveness of exhaust silencers shall be checked and in case of any defect, shall be replaced immediately. The noise level from any item of plants (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes, vibrators and saws shall not exceed 75 dB (A), as specified in the Environmental Protection Rules, 1986.

In construction sites within 150m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the nighttime between 10:00 p.m. and 6:00 a.m. No noisy construction activities will be permitted around the silence zones, a distance of 100m from the sensitive receptors as hospitals, educational institutions etc. Blasting will be carried out as per The Explosives Rules, 1983. Prior intimation of operational hours of the blasting will be given to the people living near such blasting sites. Blasting will not be undertaken in night hours.

To protect construction workers from severe noise impacts, noise standards of industrial enterprises will be strictly enforced, and workers shall be provided with protective devices such as earplugs.

Noise level Monitoring shall be carried out to monitor and keep a check on noise levels during construction phase. Monitoring is to be carried out for all 3 seasons a year (except monsoons) for 3 years (construction period). The sites for monitoring include:

- Equipment Yard - location to be decided by the contractor (at 3 locations within the yard)
- At critical locations along the project road covering various land use
 - At Ch 5/550 near Ghillidary Madhya English Vidyalaya in District Golaghat.
 - At Ch 7/860 near Rupkoliya Primary School in District Golaghat.
 - At Ch 11/970 near Worsha Goranga Madhyamik Balika Vidyalaya in District Golaghat.
 - At Ch 12/300 near congested section in Goranga Chariali in District Golaghat

The detailed monitoring schedule has been discussed in the Environment Management Plan (Table 7-5)

6.5.2.2 Operation Phase

Mitigation of the noise effects during the operation of the project can be effected by the following options: (i) Modifications of the characteristics of the sources of noise generation or (ii) Introduction of an obstruction between source and receptor.

As the modification of the characteristics of the vehicles / vehicle components etc., does not fall under the purview of this project, the second option of the introduction of an obstruction in the form of a noise barrier between the source of noise and the receptor along the road will be adopted. The type of noise barriers as well as their applicability is described in this section.

Noise barriers: The impacts due to high noise levels will be critical at the various urban locations, due to the larger number of receptors and their continuous exposure to high noise levels from the traffic. The shielding of the noise from the roads shall call in for the provision of barriers for the attenuation for the entire length of the settlements. Either the sound waves can be controlled near the source or the receptor can be shielded. Since safety of vehicles using the road is of paramount importance, a specific clear distance needs to be maintained from the pavement. Hence, the only viable option is to provide a shield around the receptor. The noise attenuation can be worked out by the adoption of the following types of noise barriers:

- Physical barriers in the form of walls, screens etc
- Structural modifications at receptor locations, in form of provision of double-glazing etc
- Rearrangement of the sensitive locations, through changes in internal planning
- Earthen berms between the road and the receptor and
- Vegetative barriers in the form of thick screen of vegetation etc

Selection of an appropriate barrier for a location is based on the various factors as:

- Length and height of barrier for obtaining the required attenuation at the receptor location
- Availability of land for location of barrier without obstruction to cross roads
- Alternative causing minimum disturbance to ventilation for the adjacent structures
- Structural stability and cost of construction of the proposed barrier

6.6 Biological Environment

6.6.1 Anticipated Impacts

The proposed widening and strengthening project doesn't have forest / reserved forest areas in the corridor. Hence anticipating impact on Forest area is not envisaged.

Existing road side vegetation and agriculture are likely to get impact due to the widening proposal. The portion falling within the RoW will be fully utilised for widening purpose, which leads to a permanent impact on vegetation. However, the suggested landscaping will mitigate the loss of vegetation. Trees falling within the RoW shall be cut. As per detailed assessment 300 trees, out of which 10% are fruit bearing will be affected due to the project. The tree species are mostly Plantain (*Musa paradisiaca*), coconut trees (*Cocos nucifera*), sal, Teak (*Tectona grandis*) and bamboo trees (graminaceous plant) likely to get affected.

6.6.2 Mitigation Measures

- **Highway Landscaping:** Highway landscape is an interplay of natural landscape with the cross section of the Road. The extent of landscape intervention depends essentially on the proposed cross section and the RoW is an indicator of space available for plantation. The hard landscape formed by the road medians and footpaths etc offer enough opportunities for designing a distinct landscape pattern.
- **Roadside Plantation:** IRC: SP: 21-1979 "Manual on Landscaping" shall guide the plantation of rows of trees with staggered pitch on either side of the road. The choice of the trees shall also be made as per the same code. Local, indigenous species shall be planted. A spacing of 10-15m c/c is recommended for spacing of trees parallel to the roads. Setback distance of trees needed in different situations shall be as per the IRC: SP: 21-1979 and the IRC: 66-1976.

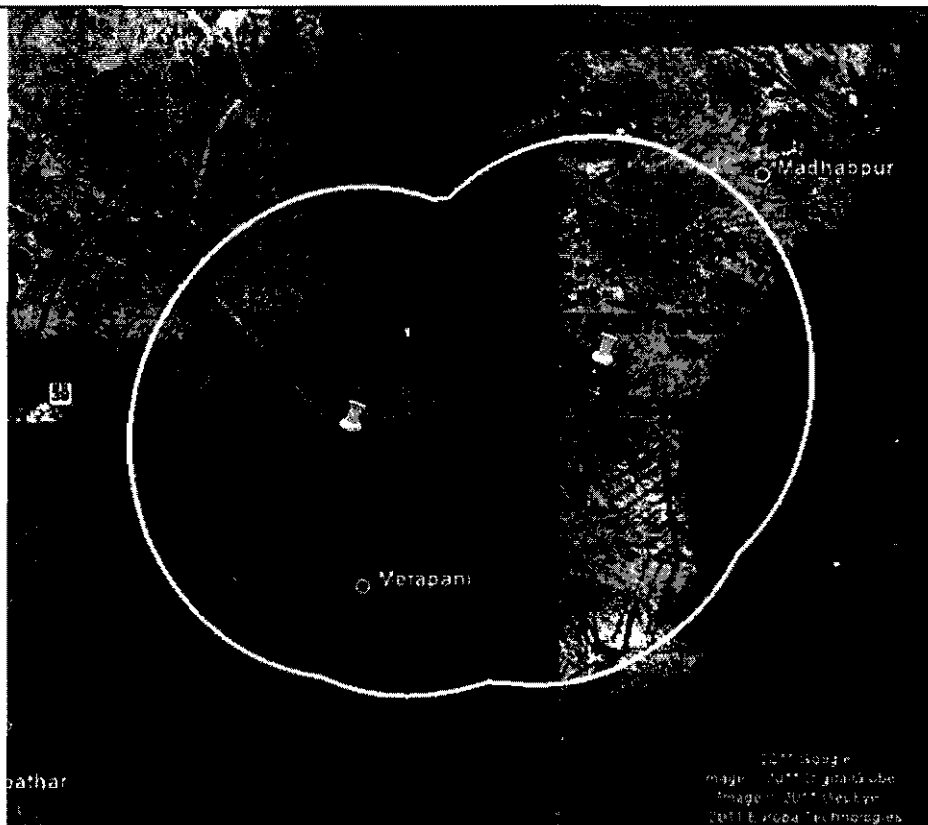


Figure 6-8: Project corridor with 10 and 15Km buffer Zone

Planting Scheme

One row of shade-giving trees with a broader crown of 7 to 10 m is suggested in the planter strips of the proposed cross section at a carriageway. A spacing of 10 m is suggested for this row of species. Tree species with a smaller crown, either shrubs that can cut the line of sight with

thick growth or ornamental are suggested for the intermediate spacing. To avoid monotony the species is to be varied after every 500m.

A study on the local flora and vegetative cover native to these sections has been carried out as part of the field surveys to enable a choice of the suitable species for that particular section. The criteria for selection of species for choice as avenue plantation are that the species is

- Indigenous and suited to the soil and rainfall of the area, and
- Hardy and needs no attention after the maintenance period

Table 6-7: Trees for Avenue Plantation

Sl. No	Scientific name	Local name	Flowering/ fruit bearing season
1	<i>Ailanthus excelsa</i>	Maharuk	January-March
2	<i>Albizia lebbek</i>	Sirish	January-March
3	<i>Albizia procera</i>	Safed Sirish	January-March
4	<i>Azadirachta indica</i>	Neem	June-July
5	<i>Bauhinia variegata</i>	Kanchan	May-June
6	<i>Butea monasperma</i>	Palash	February-April
7	<i>Cassia fistula</i>	Amaltas	March-June
8	<i>Emblica officinalis</i>	Amla	January
9	<i>Erythrina indica</i>	Dadap	July-August
10	<i>Grevillea robusta</i>	Silver oak	February-April
11	<i>Leucaena leucocephala</i>	Subabul	February-May
12	<i>Mangifera indica</i>	Aam	April-July
13	<i>Nyctanthes arbortristis</i>	Harsingar	Throughout the year
14	<i>Pongamia pinnata</i>	Karanj	February-May
15	<i>Syzygium cumini</i>	Jamun	June-July
16	<i>Terminalia arjuna</i>	Arjun	April-July

Source: Primary Analysis

6.7 Socio-Economic and Health Environment

6.7.1 Anticipated Impacts

The social environment consists of land, buildings, and other community owned assets including utilities. The proposed widening along the existing corridor will include one or more of the following impacts:

- Removal of encroachments and squatters and
- Acquisition of land and structures – residential, commercial, institutional, agricultural, etc.

This would affect livelihood and community access to the roadside communities. However, the options for the proposed widening will be finalized with a thrust to minimize the impact on structures and other properties. The likely social impacts have been analyzed based on the number of assets impacted and area to be acquired under various land uses. This has been discussed in the RAP Report.

Impact on Educational Institutes (Community Resources)

The schools are partially impacted along the project road. No hospitals are impacted along the project road. Most of the schools do not have boundary wall. Usually the playground is next to the carriageway and the school building lies behind the playground. Thus the playground is partially affected in most of the schools. There are two educational institutions along the project corridor of SH - 32 that are being partially affected. The location of schools and their extent of impact are given below in Table 6-8.

Table 6-8: Community Resources along SH-32

S.No	Chainage (km)	Side of the road (LHS/RHS)	Offset From CL (m)	Length along corridor	Description	Extent of Impact
1	5/550	LHS	8.526	21.946	Ghillidary Madhya English Vidyalaya	Partially affected
2	7/860	LHS	8.205	7.626	Rupkoliya Primary School	Partially affected
3	11/970	RHS	29.775	15.121	Worsha Goranga Madhyamik Balika Vidyalaya	Not affected

A few religious properties are present along the corridor. Along the project corridor SH-32, 1 mosque and 1 Naam Ghar and 5 temples are being partially affected and have been listed below.

Table 6-9: Religious structures along the corridor SH-32

S.No	Chainage (km)	Side of the road (LHS/RHS)	Offset From CL (m)	Length along corridor	Description	Extent of Impact
1	1/770	RHS	12.105	12.105	Nam ghar	Partially Affected
2	2/670	RHS	7.447	8.426	Temple	Partially Affected
3	7/650	LHS	5.728	42.393	Temple	Partially Affected
4	8/310	LHS	6.956	40.934	Temple	Partially Affected
5	10/020	RHS	4.302	1.539	Temple	Partially Affected
6	10/140	RHS	19.7	5.00	Temple	Not Affected
7	11/310	LHS	4.516	18.238	Mosque	Partially Affected

Utility services located along the corridor such as, electric transformers, electricity distribution lines, telephone lines etc. will be impacted during widening of road. They have to be shifted before widening.

6.7.2 Mitigation Measures

The cultural properties that will be affected due to widening will have to be relocated. Cost for relocation has been considered in the R&R Budget. In all the schools, the compound wall or the playground is partially affected. The school building is away from the road, thus remains unaffected. The compound wall is to be reconstructed beyond the proposed ROW. The costs have to be included in social costs (in **RAP report**).

The amenities like hand pumps, water tap, tube wells etc. which comes under direct impact will be compensated and relocated with community consultation and others/utility will be shifted as per Resettlement Action Plan.

6.8 Solid Waste Management

6.8.1 Anticipated Impacts

- The project road does not produce any effluent or solid waste in operation stage. However, some solid wastes will be generated due to demolition activities.
- Septic tank will be constructed at labour camps for storage of sewer and shall be collected by the municipal authority by their collection van as and when required.
- About 2,973 cu.m of spoil, overburden will be generated during the entire road construction period. But as far as possible the solid waste generated will be reused in road construction work depending upon the suitability of the material and the unused material shall be dumped to land fill site. Mine waste is not applicable.

- Municipal wastes will be generated in construction camps. Assuming a total of 280 construction workers and 70 technical staff for the project and project duration of 36 months. Approximately 100 kg per day of municipal solid waste and sludge will be generated due to the project.
- About 3,514 cu.m of construction debris will be generated during the entire road construction period.
- The wastes generated during construction do not contain any hazardous, toxic or radioactive materials. However, in case of accidents during construction and operation phase, hazardous substances can be introduced by vehicles carrying these substances. As per Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, Schedule I, Part II, the following materials would be hazardous and toxic in case of any accidents caused by the vehicles:
 - Benzene (from petrol driven vehicles)
 - Methane (from petrol driven vehicles)
- Generated Sewage from construction workers camp will be suitably disposed off. The layout for the labour camp is given in the **Annexure – 1**.

6.8.2 Mitigation Measures

- These solid wastes will be used for road construction to the extent possible depending upon its suitability of the material, rest will be disposed in dumping site and borrow areas which are located in barren land. Domestic solid waste collected from the labour camps shall be handed over to the municipal corporation for disposal. Waste oil generated due to the operation of the construction vehicle and machinery shall be used for shutter works by the Contractor and rest of the waste oil shall be disposed to secured landfill.
- Wastes generated from the road will be reused in road construction works depending upon the suitability of the material and the balance unsuitable material shall be dumped in landfill sites.
- After construction is over, these machines and equipments will be demobilized from the site and the site suitably cleared of any oil, grease and wastes.
- Necessary measures will be taken during construction to avoid soil contamination by oil from construction machineries and vehicles.

6.8.3 Mitigation Measures

Surface Water Body: While working around or near the water body, following measures shall be undertaken:

- Silt fencing and/or brush barrier shall be installed near all the water bodies (at 2 river crossing locations –Tenga Gora and Karan) for collecting the sediments before letting them into the water body.
- Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be revegetated.
- Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.
- Movement of machinery, workforce shall be restricted around the water body and no waste from construction camps or sites shall be disposed into it.

Water Required during Construction:

The project area, Dhemaji & Lakhimpur districts fall in the grey zone and not critical zone in terms of ground water development. The problem is mainly related to salinity and fluoride content in the ground water, rendering it non potable. The ground water scenario in the two project districts is discussed below.

In Dhemaji district, the average annual rainfall in the last decade is 2,600 to 3,200 mm. The estimated gross annual dynamic groundwater resource is 1,376.96 mcm while net annual ground water draft is 127.73 mcm. The stage of ground water development is 10%. Natural discharge during non-monsoon season is 68.85 mcm. Future provision for domestic and industrial use is 20.83 mcm and for Irrigation use, it is 1,172.13 mcm. Dhemaji district is very suitable locale for ground water development where shallow and deep tube well can be constructed having yield

range of 30 to 35m³/hr. and 150 to 250m³/hr. respectively for draw down within 6 meters. Based on the static water level, maximum draw down and seasonal fluctuation, length of housing pipe ranges from 30 to 40 m bgl. High concentration of iron (Fe) and arsenic (As) content in the ground water of the district is observed which is greater than permissible limit of BIS and WHO standards. Ground water is used for drinking and irrigation purpose only in the district. Drinking water is supplied in most areas from regional water supply schemes.

Two rivers have been identified as likely water sources for construction. The suitability of these identified water sources and availability of water during extraction is to be checked before incorporation of construction works as per IS 456-2000.

7 Environmental Monitoring Programme

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

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

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

7.1 Performance Indicators

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

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

The Performance Indicators and monitoring plans prepared for Project Implementation are presented in Table 7-1.

Table 7-1: Performance Indicators for Project Implementation

Sl. No.	Indicator	Details	Stage	Responsibility
A Environmental Condition Indicators and Monitoring Plan				
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 7-5)	Construction	Contractor under the monitoring of PIU
			Operation	
2	Noise Levels		Pre-Construction	PIU through approved monitoring agency
			Construction	Contractor under the monitoring of PIU
			Operation	PIU through approved monitoring agency
			Pre-Construction	PIU through approved monitoring agency
3	Water Quality		Construction	Contractor under the monitoring of PIU
			Operation	PIU through approved monitoring agency
			Pre-Construction	PIU through approved monitoring agency
4	Soil Quality		Construction	Contractor under the monitoring of PIU
			Operation	PIU through approved monitoring agency
B Environmental Management Indicators and Monitoring Plan				
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	PIU
2	Borrow Areas	Location of borrow areas have to be identified and	Pre-construction	PIU

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

7.2 Monitoring Parameters and Standards

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

7.2.1 Ambient Air Quality Monitoring (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Hydro-Carbons (HC), Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Ammonia (NH₃), Ozone (O₃), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in Table 7-2. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 7-5.

Table 7-2: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravetric -TOEM
4	Particulate Matter	Annual*	40	40	-Beta attenuation -Gravetric

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
	(size less than 2.5µm) or PM _{2.5} µg/m ³	24 hours**	60	60	-TOEM
5	Ozone (O ₃) µg/m ³	8 hours* 1 hours**	100 180	100 180	-Beta attenuation -UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m ³	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m ³	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR) spectroscopy
8	Ammonia (NH ₃) µg/m ³	Annual* 24 hours**	100 400	100 400	-Chemiluminescence
9	Benzene (C ₆ H ₆) µg/m ³	Annual*	05	05	-Indophenol blue method -Gas chromatography based continuous analyser -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, µg/m ³	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) µg/m ³	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) µg/m ³	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

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

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

7.2.2 Noise Quality Monitoring

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in Table 7-3. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 7-5.

Table 7-3: National Ambient Noise Quality Standards

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

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

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

7.2.3 Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications, presented in Table 7-4. The duration and the pollution

parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 7-5**.

Table 7-4: National Standard of Water

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27°C)	3.0	DO-Azide modification of Wrinkler's method
3	Temperature (°C)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Wrinkler's method
5	Color (Hazen)	300	Visual Comparison method
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO ₄)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthroline method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr ⁶⁺)	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method
18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

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

7.2.4 Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 7-5**. Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 7-5: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO ₂ , NO _x , RPM, SPM, O ₃ , Pb, CO, NH ₃ , C ₆ H ₆ , BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Two seasons in a year for three years		Along the road	Contractor / PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor / PIU
	Operation				Four seasons for three years			Contractor / PIU
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Three seasons per year for three years.		Along the road	Contractor / PIU
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Four seasons per year	Grab Sampling	Along the road Hot mix / batching plant	Contractor / PIU

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
	Operation				Four seasons for three years		Along the road	Contractor / PIU
Borrow area	Construction	As per Guidelines	Visual Observation		Once in a month	-	Borrow area location	Contractor
Tree plantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Contractor / PIU

7.2.5 Reporting System

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

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

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

Contractor will report to the Engineer on the progress of the implementation of environmental conditions and management measures as per the monitoring plans. The Engineer will in turn report to the PIU on a quarterly basis which will be reviewed. Along with these reports, Environmental Cell of the PIU shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer and/or the Environmental Cell as required and presented as Annexure-2.

Table 7-6: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (SC) / Concessionaire	Project Implementation Unit (PIU)	
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM1	Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
EM2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
EM3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
EM4	Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly
EM5	Tree Plantation	Construction	-	Monthly	-	-	Quarterly
EM6	Top Soil Monitoring	Construction	Quarterly	-	Continuous	Quarterly	Quarterly
EC1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
EC2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
OP1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

8 Stakeholders Consultation

8.1 Introduction

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

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

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

8.2 Identification of Stakeholders

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

1	Primary Stakeholders (Main stakeholders)	<ul style="list-style-type: none">• Potential PAPs, stakeholders and Community Leaders
2	Secondary Stakeholders (Other stakeholders)	<ul style="list-style-type: none">• Groups of affected persons;• Village representatives like Sarpanch and members, PRIs, Village level health workers, Patwaris• Tribal groups• Local voluntary organizations like CBOs and NGOs;• Field level Engineers (Asst Engineers, Junior Engineers), PWD, Government of Assam,• Other project stakeholders such as official of line Department

8.3 Consultations with Primary Stakeholders

Consultation with the community is carried out with the intention of informing and educating the Project-Affected-People (PAP's) and stakeholders about the proposed action before the finalisation of design so as to include their inputs. Consultation is also carried out to identify the problems associated with the proposed project and the needs and values of the population likely to be impacted by the project. Locations are selected which represent the predominant land uses of the project area and also included all sections of people in the project region - from agricultural labourers to land owners, shop keepers and political party representatives. Consultations are carried out at Ghiladhari Bagan LP School in Golaghat district. In each of these consultations, the villagers are briefed about the project (the RoW width, the length of the alignment, the locations where it would be crossing etc) and the potential benefits of the project. It is also informed that this is a preliminary consultation and that a detailed interactive session

would be conducted at a later stage. The minutes of the consultations carried out in respective locations is presented in the Table 8-1.

Table 8-1: Details of the Consultations along the project corridor

Date/Venue of Consultation/Participants	Issues Raised	Response given by the Consultant and PWD
<p>Date: 05/06/2010 Time: 1pm Location: Ghiladhari Bagan LP School Participants: The direct stakeholders i.e. the PAPs and local leaders formed the majority of the meeting. The indirect stakeholders included officials from the PWD and the consultants from M/S Lea Associates South Asia Pvt Ltd. Attendance sheet of the Public Consultation is enclosed as Annexure 4.1 of this document.</p> 	<p>The consultation highlighted the need of one good condition road to maximize the public benefits. Community ensured that they have no objection for land acquisition for the sake of a good road. They explained the importance of new road to improve access to socio economic service. Still numbers of PAPs raised social issues as bellow-</p> <ul style="list-style-type: none"> • Affected structure (shops) should be reconstructed as soon as possible otherwise it will effect their livelihood. • Community tells most people of this area are poor. So local labours should be employed in construction work. • The community is worried about the quality of the work. So they demand that quality of the work should be ensured by strict monitoring and construction work should be entrusted to good and efficient contractor. <p>Consultation with local communities along the proposed road needs to be carried out especially to incorporate social and environmental concerns into the design. The community expressed their social and environmental concerns as follows-</p> <ul style="list-style-type: none"> • If road is constructed with width restriction in the market area there will be less impact. • Road safety is one of the nation's most serious public health issues. To prevent this health issue community recommended as follows- • Safety measures should be provided at all sensitive locations. • Stone aggregates should not be dumped near the school and market during the time of construction 	<p>Responses given by the consultant and PWD by explaining the practical mitigation measures to issues raised by the community as follows-</p> <ul style="list-style-type: none"> • The compensation for land and building shall be provided within the ambit of the LA Act and to meet the replacement value R & R assistance will be provided. • The major widening and strengthening work planned will take place within the ROW, which will be based on IRC requirements, or as agreed with the PWD based on land availability, gradient, traffic and congestion of population along the road length. • All PAPs will be entitled to relocation and rehabilitation assistance over and above the compensation received under the LA Act. Those PAPs who are not entitled for compensation (encroachers and squatters) will get R&R benefits as per their entitlement, besides compensation as stipulated. All losses, including loss of income, will be compensated within the overall R & R package as per the broad entitlement framework. • Grievances Redress Committee will deal with grievances regarding R&R assistance. • Culverts and cross drainage structure will be provided at regular intervals. • Safety measures will be provided at sensitive locations in the consultation with the community. • The project will give preference to PAPs for employment based on skills available and project requirement. • Stone aggregates would not be dumped near the school and market in the time of construction

8.4 Consultations with Secondary Stakeholders

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

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

9 Environmental Management Plan

Environmental Management Plan (EMP) deals with the implementation procedure of the guidelines and measures recommended to avoid, minimize and mitigate environmental impacts of the project. It also includes management of measures suggested for enhancement of the environmental quality along the SH-32. The institutional arrangement made under project will look into the implementation of project as well as EMP and the various legal settings applicable to the project are briefly stated in **Chapter 4**.

The avoidance, mitigation & enhancement measures for protection of the environment along SH-32 have been discussed in detail in previous chapter. Although the social environmental impacts, its mitigation and management are an essential component of the EMP, this section excludes it for the purpose of clarity and procedural requirements. Social environmental elements have been separately dealt in separate volume namely, Resettlement and Rehabilitation Action Plan (RAP).

9.1 Objective of EMP

The EMP is a plan of action for mitigation / management / avoidance of the negative impacts of the project and enhancement of the project corridor. For each measure to be taken, its location, implementation and overseeing / supervision responsibilities are listed. A description of the various management measures during various stages of the project is provided in the **Table 9-1**.

9.1.1 Pre-Construction Stage

Pre-Construction Activities by PIU

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

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

Pre-Construction Activities by Contractor/Engineer

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

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

9.1.1 Construction Stage

Construction stage activities by the contractor

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

- Imbibing environmental principles at all stages of construction as good engineering practices
- Implementation of site-specific mitigation/management measures suggested
- Monitoring the quality of environment along the construction sites (as air, noise, water and soil)

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

Construction Stage Activities by the PIU

The construction stage involves the following activities by PIU:

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

9.1.2 Operation Stage

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

Other Activities

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

Table 9-1: Environmental Management Plan

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.0	PRE-CONSTRUCTION STAGE					
1.1	Pre-construction activities by PIU					
1.1.1	Land Acquisition: The total area of private land to be acquired is 1 Bigha, 2 Katha, and 8.2 Lessa (2 Katha 5 Lessa in the village of Bhalukmari, Kakamari and Goshal Bori, 4 Katha and 18.22 Lessa in Town Haibor and, 3 Lessa in Niz-Barpuja). The category of land to be acquired is 2 Katha and 15 Lessa of residential land, 9 Lessa of agricultural land, 4 Katha and 1.2 Lessa of commercial land and 3 Lessa of highland not fit for cultivation	The acquisition of land and properties (Govt./private) will be carried out in accordance with the LA act and the Assam State Road Resettlement and Rehabilitation Policy. ASRP has to ascertain that the environmental impacts arising due to the additional acquisition of land during project implementation shall be addressed and the same shall be integrated in the EMP and other relevant contract documents.	Corridor of Impact.	LA act, 1984 & Assam State Roads Resettlement and Rehabilitation Policy, 2004	PIU, Revenue Dept., NGOs, Collaborating Agencies	PIU/ASRP
1.1.2	Tree Cutting: The total number of trees to be cut for the project is 675	As far as possible maximum efforts shall be made to minimize the number of trees proposed to be felled by adopting suitable on the spot adjustment of engineering designs. Trees shall be removed from the Corridor of Impact and construction sites before commencement of construction. Prior Permission shall be obtained from the Forest Settlement Officer for the felling of trees.	Corridor of Impact.	Design MoRTH 201.6	Dept of Environment and Forest, Assam, Tree Felling Contractor, PIU/ ASRP	PIU/ASRP, Site Engineer/Supervision Consultant

¹ MoRTH Clause 111.1 with modifications mentioned in Appendix 3.15 shall be applicable for all the EMP Clauses

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.1.3	Utility Relocation and Common Property Resources (CPR's)	<p>The trees cut shall be disposed off through auction (inclusive of tree stumps). This disposal shall be done immediately to ensure that the traffic movement is not disrupted. Progress of tree cutting shall be reported to the PIU.</p> <p>All community utilities and common property resources such as stand posts, bore wells, wells, ponds, water supply lines, toilets, sewage lines, drainage systems, optical fiber cables, electric power supply lines, transformers, irrigation pump houses, telephone and television cables shall be relocated and restored before the commencement of the road improvement activity.</p> <p>While relocating these utilities and facilities, all concerned agencies including PIU shall take necessary pre-cautions and shall provide barricades/delineation of such sites to prevent accidents including accidental fall into bore holes, pits, drains both during demolition and construction/ relocation of such facilities. Standard safety practices shall be adopted for all such works.</p> <p>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.</p> <p>Proper placement (as per codes) of passenger</p>	Corridor of Impact.	Design MoRTH 110.7	ASRP/PIU; Concerned Agencies/Departments; Contractor	PIU/ASRP, Site Engineer/Supervision Consultant

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.1.4	Relocation of Cultural and Religious Properties 17 Cultural and Religious Properties are getting affected. In that 2 structures are fully affected and 15 structures are partially affected.	<p>shelters/bus stops shall be ensured to prevent distress to the commuters and passengers.</p> <p>Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments.</p> <p>All cultural properties within the Col, whose structure is getting affected fully, shall be relocated at suitable locations, as desired by the community; and 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.</p> <p>No cultural properties or religious structures shall be removed or relocated without the knowledge and written consent of the concerned parties or communities and local administration as the case may be. Sites for the relocation of these religious structures shall be identified in accordance with the choice of the community.</p> <p>As far as possible, the architectural elements of the structure should be conserved/reflected/translated into the design of new structures in accordance with wishes of the community</p> <p>Proper drainage and garbage disposal at such sites shall be ensured to prevent unhygienic conditions, blocking of drains etc. at/near relocated structures. Garbage collection bins, soaks pits or other appropriate measures shall</p>	Corridor of Impact. Temple - 62/100 Temple - 70/000 Mosque - 70/010 Naamghar - 71/200 Mosque - 73/720 Idga (people gather for religious reason) - 73/920 Small Shrine - 74/420 Naamghar - 75/610 Small Shrine - 76/730 Medium sized Shrine - 78/110 Small shrine - 79/180 Naamghar - 80/900 Naamghar - 82/785 Temple - 11/000 Tiosk - 22/395	Design	PIU/ASRP; NGOs; Contractor; Concerned Community	PIU/ASRP, Site Engineer/Supervision Consultant

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.1.5	Orientation of Implementing Agencies	<p>be provided apart from simple enhancement of such sites.</p> <p>The PIU shall organize orientation sessions during all stages of the project. This shall include on-site training (general as well as specific to the context of this subproject) as well.</p> <p>These sessions shall involve concerned division-level staff of the ASRP involved in the sub-project, Staff of the Site Engineer/Supervision Consultant and the implementing agencies.</p>			PIU/ASRP, Site Engineer/Supervision Consultant	PIU/ASRP
1.2	Pre-construction activities by the Contractor/Engineer of CSC					
1.2.1	Joint Field Verification	<p>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.</p> <p>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 EMP 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/ASRP for approval.</p>	Project Corridor	EMP	Contractor; Environmental Officer of SC	PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.2.2	Assessment of Impacts due to Changes/Revisions in the Project Work	<p>The PIU shall maintain proper documentation and justifications/reasons in all such cases where deviation from the original EMP is proposed.</p> <p>The Engineer - Incharge of CSC shall assess the impacts and revise/modify the EMP in consultation with the PIU/ASRP in accordance to the recommendation made by the field survey party in the event of changes /revisions (including addition or deletion) in the project's scope of work.</p>	Project Corridor	EMP	Contractor, Environmental Officer of SC	PIU/ASRP
1.2.3 1.2.3.1	Procurement of Machinery Crushers, Hot-mix Plants & Batching Plants	<p>Specifications of crushers, hot mix plants and batching plants shall comply with the requirements of the relevant current emission control legislations.</p> <p>Hot-mix and batching plants shall be located 1000m away from settlements, forests, wildlife movement areas and commercial establishments, preferably in the downwind direction. No plants can be set-up within 1000m from the residential/ settlement locations.</p> <p>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. Actions by CSC and PIU/ASRP against any non-compliance shall be borne by the Contractor at his own cost.</p> <p>Arrangements to minimize dust pollution through provision of windscreens, mist spray units, and dust encapsulation shall have to be</p>	<p>Project Corridor:</p> <p>All construction machineries (Crushers, Hot-mix Plants & Batching Plants) should be kept/stationed 1000 m away from Morigaon (66/750 to 69/180), Dalbari (69/390 to 69/780) Barhi Gaon (70/020 to 70/290), Dandua (70/170 to 71/370), Jaluguti (73/650 to 75/960), Barapujia (82/600 to 84/170), Gandhibori (85/870 to 86/070), Kuhigaon (90/170 to 90/770), Jamuguri (93/370 to 93/870) and Nagaon (100/270 to</p>	Contract, MoRTH: 111.1, Gol Air & Noise Standards, OSHA Standards	Contractor	Environmental Officer of SC ; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>provided at all such sites. Specifications of crushers, hot mix plants and batching plants shall comply with the requirements of the relevant current emission control legislations and Consent / NOC for all such plants shall be submitted to the CSC and PIU/ASRP.</p> <p>No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority and the same is submitted to the PIU/ASRP and the CSC.</p>	103/070)			
1.2.3.2	Other Construction Vehicles, Equipment and Machinery	<p>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.</p> <p>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.</p> <p>Efficient and environment friendly equipment conforming to the latest noise and effluent emission control measures available in the market shall be used in the project.</p> <p>The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced to</p>		Contract, Environment Protection Act, 1986 & MoRTH: 111.1	Contractor	Environmental Officer of SC; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
		the PIU/ASRP and the Supervision Consultant for verification whenever required.				
1.2.4	Identification & Selection of Material Sources					
1.2.4.1	Borrow Areas	<p>Arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the contractor. The environmental personnel shall be required to inspect every borrow area location prior to approval.</p> <p>Format for reporting shall be as per the Reporting Format (Format EM-3 – Annexure 2 Environmental Reporting System and Guideline -3 Borrow area management) for Borrow Area. The Engineer - Incharge of the CSC shall be required to inspect every borrow area location and evaluate such proposals in accordance to environmental requirements prior to issuing approval for use of such sites.</p> <p>No borrow areas shall be opened within 500m of wildlife movement zones and forest areas. The borrow areas shall be atleast 300m from schools and village access roads.</p> <p>The Contractor shall not borrow earth from the selected borrow area until a formal agreement is signed between land owner and Contractor and a copy of this agreement is submitted to the Engineer - In-charge of the CSC. The Supervision Consultant shall report these facts to the PIU/ASRP along with the remarks in the prescribed format with documentary proofs.</p>	Ecologically sensitive area	MORTH: 305.2.2.2	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>Planning of haul roads for accessing borrow materials shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas. In case agricultural land is disturbed, the Contractor shall rehabilitate it as per Borrow Area guideline given in the EMP or as approved by the Engineer – In-charge of CSC.</p> <p>Haul roads shall be maintained throughout the operation period of the borrow areas by undertaking the required maintenance and repair works, which may include strengthening, pot hole repairing and diversions. Improvements shall be done to reduce inconvenience to users of these roads, residents living along the haul roads and minimize air and water pollution.</p> <p>Such measures shall include, but not limited to, frequent sprinkling of water, repairing of the road, road safety provisions (warning and informatory signage, flagmen etc.), and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation with public and special precautions are required when measures are implemented near schools, health centers and settlement areas.</p> <p>All borrow areas whether in private, community or govt. land shall be restored either to the original condition or as per the approved rehabilitation plan (Format OP2 - Annexure 2 - Redevelopment of Borrow Areas) immediately upon completion of the</p>				

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.2.4.2	Quarries	<p>use of such a source.</p> <p>The Contractor shall identify materials from existing licensed quarries with the suitable materials for construction. Apart from approval of the quality of the quarry materials, the Engineer's representative shall verify the legal status of the quarry operation, as to whether approval from Assam State Government is obtained.</p> <p>No quarry and/or crusher units shall be selected or used, which is within 1000m from the forest boundary, wildlife movement path, breeding and nesting habitats and national parks/sanctuaries. No plants can be set-up within 1000m from the residential/ settlement locations</p> <p>Contractor shall also work out haul road network used for quarry transport and report to Engineer - Incharge of Supervision Consultant who shall inspect and in turn report to PIU/ASRP on the suitability of such haul roads from safety of residents, biodiversity and other environment point of views.</p>	<p>Quarry area should be located 1000m from the following locations:</p> <p>Morigaon (66/750 to 69/180), Dalbari (69/390 to 69/780) Barhi Gaon (70/020 to 70/290), Dandua (70/170 to 71/370), Jaluguti (73/650 to 75/960), Barapujia (82/600 to 84/170), Gandhibori (85/870 to 86/070), Kuhigaon (90/170 to 90/770), Jamuguri (93/370 to 93/870) and Nagaon (100/270 to 103/070)</p>	MoRTH: 111.3	Contractor	Supervision Consultant; PIU/ASRP
1.2.4.3	Arrangement for Construction Water	<p>The contractor shall source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project area. The contractor shall be allowed to pump only from the surface water bodies. Boring of any tube wells shall be prohibited. To avoid disruption/disturbance to other water users, the contractor shall extract water from fixed locations. The contractor shall consult the local people before finalizing the locations.</p>	All rivers / surface water bodies that can be used in the project	Contract	Contractor	Environmental Officer of SC; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.2.4.4	Sand (all river and stream beds used directly or indirectly for the project)	<p>Only at locations where surface water sources are not available, the contractor can contemplate extraction of ground water. Consent from the Engineer that "no surface water resource is available in the immediate area for the project" is a pre-requisite prior to extraction of ground water. The contractor shall need to comply with the requirements of Department of Irrigation, Assam and seek their approval for doing so.</p> <p>The contractor shall identify sand quarries with requisite approvals for the extraction of sand. In case of selection of new sites for sand quarrying, the Contractor shall obtain prior approval and concurrence from Competent District Authority and the Engineer – Incharge of the CSC keeping in view the objections and convenience of the local population, who may restrain such activities for their own security and safety.</p> <p>Where the supplier of sand is another party, the authentic copy of lease agreement that has been executed between the local Tahasildar and the supplier has to be submitted to CSC and PIU/ASRP of the project, before any procurement is made from such a site.</p> <p>To avoid accidents and caving in of sand banks at quarry sites, sand shall be removed layer by layer. Digging deeper than the permissible limit has to be completely avoided by the Contractor. Such quarry shall be barricaded 10m away from the periphery on all sides</p>	All riverbeds recommended for sand extraction for the project.		Contractor	Environmental Officer of SC; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.2.5	Labour Requirements	<p>except the entry point, so as to prevent accidental fall of domestic cattle, wildlife and human beings.</p> <p>The contractor shall use unskilled labour drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply, etc.)</p>	Along project corridor at construction sites	Contract	Contractor	Supervision Consultant; PIU/ASRP
1.2.6	Setting up construction sites					
1.2.6.1	Construction Camp Locations – Selection, Design & Layout	<p>Construction camps shall not be proposed:</p> <p>(i) Within 1000m of Ecologically sensitive areas</p> <p>(ii) Within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. Layout of construction camps shall be as per the conceptual design presented in Annexure 1.</p> <p>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.</p> <p>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.</p>	All Construction Workers Camps including areas in immediate vicinity.	Contract Annexure 1	Contractor	Supervision Consultant; PIU/ASRP
1.2.6.3	Arrangements for Temporary Land Requirement	<p>The contractor as per prevalent rules shall carry out negotiations with the land owners for obtaining their consent for temporary use of lands for construction sites/ hot mix plants /traffic detours /borrow areas etc.</p>	Areas temporarily acquired for construction sites / hot mix plants / borrow areas /	Contract Document	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		The Engineer shall ensure that the site is cleared prior to handing over to the owner (after construction or completion of the activity) and it is included in the contract.	diversions / detours			
2.0	CONSTRUCTION STAGE					
2.1	Construction Stage Activities by Contractor					
2.1.1	Site Clearance					
2.1.1.1	Clearing and Grubbing	Site clearance including clearance of marked trees for felling and removal has to be carried out much before the actual road construction takes place.	Corridor of Impact	Design MoRTH 201	Contractor	Supervision Consultant; PIU/ASRP
		Structures and utilities (cabins, commercial properties, hoardings, overhead power transmission lines, cable connections, telephone lines, bore wells, stand posts, wells, statues, temples etc.) shall be compensated/relocated as per RAP and EMP provisions before tree felling; clearing or grubbing activities are to be undertaken as these activities may damage structures (private and govt.) and essential facilities/utilities of public use.				
		All works shall be carried out in a manner such that the damage or disruption to flora is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from Engineer - Incharge of CSC.				
		Any tree up to 30cm girth at breast height shall be uprooted mechanically with ball of earth intact for relocation and transplantation at various degraded sites, embankment of				

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
		water body, ponds, temples, market places, schools and along road corridors for preventing complete loss of such vegetative cover.				
2.1.1.2	Dismantling of Bridgework / Culverts	<p>The Contractor, under any circumstances shall not cut or damage trees. Vegetation above 30 cm girth shall be considered as trees and shall be compensated.</p> <p>All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems.</p>	At locations where bridge works and culverts are proposed.	MoRTH 202.2	Contractor	Supervision Consultant; PIU/ASRP
2.1.1.3	Generation & disposal of Debris	<p>Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction as follows:</p> <p>Eighty percent (80%) of the sub-grade excavated from the existing road surface, excluding the scarified layer of bitumen, shall be reused in the civil works after improving the soil below the subgrade through addition of sand and suitable cementing material for qualitative up-gradation.</p> <p>The dismantled scraps of bitumen shall be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the corridor or in any other manner approved by the Engineer - Incharge of CSC.</p>	Throughout Project Corridor	MoRTH 202.5 MoRTH 517	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>At locations identified for disposal of residual bituminous wastes, the disposal shall be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water.</p> <p>The Contractor shall suitably dispose off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of the Engineer - Incharge of CSC.</p> <p>Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies or form puddles in the area.</p> <p>The pre-designated disposal locations shall be part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Engineer - Incharge of CSC and approval local competent authority.</p>				
2.1.1.4	Non-bituminous construction wastes disposal	<p>Location of disposal sites shall be finalized prior to completion of the earthworks on any particular section of the road. The Engineer shall approve these disposal sites conforming to the following</p> <p>(a) These are not located within designated forest area</p> <p>(b) The dumping does not impact natural drainage courses</p> <p>(c) No endangered/rare flora are impacted by such dumping.</p>	Disposal site locations	Contract MoRTH: 201.4 & 202.5 Section 2.1.1.3	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.1.5	Bituminous wastes disposal	<p>(d) Settlements are located at least 1.0km away from the site.</p> <p>The disposal of residual bituminous wastes shall be done by the contractor at secure land fill sites, with the requisite approvals for the same from the concerned government agencies.</p>	Throughout Project Corridor	Contract MoRTH: 201.4	Contractor	Supervision Consultant; PIU/ASRP
2.1.1.6	Stripping, stacking and preservation of top soil	<p>The top soil from all sites including road side widening and working area, cutting areas, quarry sites, borrows areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 150mm and stored in stockpiles for reuse.</p> <p>A portion of the temporarily acquired area and/or RoW edges shall be earmarked for storing top soil. The locations for stacking shall be pre-identified in consultation and with approval of Engineer - Incharge of CSC. The following precautionary measures shall be taken by the Contractor to preserve the stockpiles till they are re-used:</p> <p>Stockpile shall be arranged such that the slope does not exceed 1:2 (vertical to horizontal) and height is restricted to 2 m.</p> <p>To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing.</p> <p>Multiple handling are to be kept to a minimum to ensure that no compaction occurs.</p> <p>Such stockpiles shall be covered with empty gunny bags or shall be planted with grasses to prevent loss during rains.</p>	Throughout Project Corridor	MoRTH: 301.3.2; MoRTH: 301.7; MoRTH: 301.3.3; MoRTH: 305.3; Guideline for Borrow Areas	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>Such stockpiled topsoil shall be utilized for</p> <p>Covering reclamation sites or other disturbed areas including borrow areas (not those in barren areas)</p> <p>Top dressing of road embankment and fill slopes</p> <p>Filling up of tree pits and</p> <p>In the agricultural fields of farmers, acquired temporarily that need to be restored.</p> <p>Residual topsoil, if there is any, shall be utilized for the plantation works along the road corridor.</p> <p>The utilization as far as possible shall be in the same area/close to the same area from where the top soil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by CSC.</p>				
2.1.1.7	Accessibility	<p>The Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road by providing temporary connecting road, as necessary.</p> <p>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 provision approved by the CSC.</p> <p>The Contractor shall take care that the cross</p>	All along the project corridor, all access roads.	MORTH specifications and IRC guidelines	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.1.8	Planning for Traffic Diversions and Detours	<p>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.</p> <p>Detailed traffic control plans shall be prepared by the contractor and the same shall be submitted to the Engineer - Incharge of CSC for approval. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements including night time safety measures, details of traffic arrangement after cessation of work each day, safety measures undertaken for transport of hazardous materials and arrangement of flagmen etc. to regulate traffic congestion.</p> <p>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.</p> <p>The Contractor shall also inform local community of changes in traffic routes and pedestrian access arrangements with assistance from CSC and ASRP.</p>	<p>All along the project corridor, all access roads</p> <p>Traffic diversion and detour should be at major junctions at Morigaon Town (66/750), Barapujia (82/870), Kakamari (89/070), Jamuguri Chariali (93/370) and Nagaon Market (102.77 & 103.12); critical areas at Morigaon Sunarigaon/ Dalbari Tiniali (67/980 to 70/680), Barhigaon/Dandua (70/680 to 71/340), Dandua (71/340 to 71/610), Jaluguti (72/810 to 74/370 and 74/370 to 74/670), East Jaluguti/Purba Jaluguti (74/670 to 76/020), Purba Jaluguti (76/710 to 77/190), Barbhagia (77/790 to 78/240), Kumargaon/Jarabari</p>	MoRTH: 112; IRC SP:55	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
			(80/490 to 81/480), Jarabari/Jarabai Alokpur/Barapujia (81/480 to 82/590), Barapujia (82/870 to 82/970 & 82/970 to 83/170), Gandhibari (83/170 to 84/070 & 85/370 to 86/270), Bhalukmari (86/970 to 87/870), Kakameri (88/970 to 89/170), Kakameri/Khaloigaon (89/170 to 90/870), Khaloigaon (90/870 to 91/170), Jamuguri (93/370 to 93/570, 94/370 to 95/170, 95/670 to 96/170), Barbhèti (98/870 to 99/670, 99/670 to 100/370, 100/370 to 100/570 & 100/570 to 101/270) and Haibar Bazar (101/270 to 102/170).			
2.1.2	Construction Materials					
2.1.2.1	Earth from Borrow Areas for Construction	No borrow area shall be opened without permission of the Engineer – incharge of CSC. Borrow pits shall not be dug continuously in a stretch. The location, shape and size of the designated borrow areas shall be as approved by the Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961).	All along the project corridor, all access roads, sites temporarily acquired & all borrow areas	MoRTH: IRC 10 1961	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>The borrowing operations shall be carried out as specified in the guidelines for siting and operation of borrow areas.</p> <p>The unpaved surfaces used for the haulage of borrow materials shall be maintained dust free by the contractor. Since dust rising is the most significant impact along the hauled roads, sprinkling of water shall be carried out twice a day along such roads during their period of use.</p>				
2.1.2.2	Quarries	<p>The Contractor shall obtain materials for quarries only after the approval of Government of Assam Mines & Minerals Department and the District Administration. A copy of this consent must be submitted to ASRP/PIU through Engineer-Incharge of CSC.</p> <p>The Contractor shall develop a Comprehensive Quarry Redevelopment Plan, as per the Mining Rules of the State and submit a copy to ASRP and CSC prior to opening of the quarry site.</p>	All along the project corridor and all haul roads	Forest department as per Assam Forest Regulation, 1891	Contractor	Supervision Consultant; PIU/ASRP
2.1.2.4	Blasting	<p>The quarry operations shall be undertaken within the rules and regulations in vogue.</p> <p>Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will shall not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor shall comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land, as applicable.</p> <p>The Contractor shall at all times take every</p>	All blasting and Pre-splitting Sites.	MoRTH: 302.4	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>possible precaution and shall comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The contractor shall at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer.</p> <p>The Contractor shall at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations.</p> <p>Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed.</p> <p>Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing shall be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions. Procurement of water is to be carried out as per Section 1.2.4.3. The contractor shall minimize wastage of water during construction.</p>				
2.1.2.6	Water Extraction	<p>All vehicles delivering materials to the site shall be covered to avoid spillage of materials.</p>	All water bodies recommended to be used in the project	Section 1.2.4.3	Contractor	Supervision Consultant; PIU/ASRP
2.1.2.5	Transporting Construction Materials	<p>All existing highways and roads used by vehicles of the contractor, or any of his sub -</p>	All along the Project corridor and all haul roads	MoRTH: 111.9	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>contractor or suppliers of materials and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles</p> <p>The unloading of materials at construction sites close to settlements shall be restricted to daytime only.</p>				
2.1.3	Construction work					
2.1.3.1	Disruption to other users of Water	<p>While working across or close to any perennial water bodies, Contractor shall not obstruct/prevent the flow of water.</p> <p>Construction over and close to the non-perennial streams shall be undertaken in dry season and if such activity is likely to disrupt, constrain or impact the community use of the water body, adequate prior information (at least two weeks in advance) shall be provided to such community. Such water body may be limited to ponds, water harvesting structures (WHS), feeder channels to pond, irrigation sources etc.</p> <p>If the supply of water or access to a source is being completely cut off, then the Contractor shall make necessary arrangements to provide water in the interim period. Water quality test shall be done prior to providing / supplying water.</p> <p>Wherever excavation results in diversion of water flow shall be required as per the engineering designs, the Contractor shall ensure that such diversion channels have no</p>	Water withdrawal locations	MoRTH:304.3.2; Contractor Water Rules and Policy of the State	Supervision Consultant; PIU/ASRP	

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>stepper slopes than 1:2 (V to H). Proper slope protection measures have to be taken as approved by the Engineer - Incharge of CSC and ASRP/PIU.</p> <p>The Contractor shall take prior approval of the River Authority (Brahmaputra Board) or Irrigation Department and CSC for any such activity. The ASRP/PIU shall ensure that Contractor has served the notice to the downstream users of water well in advance where such diversion of the flow is likely to affect the downstream population subject to the condition that under no circumstances the downstream flow shall be stopped putting the wildlife, the aquatic fauna and the shore line settlement under distress.</p>				
2.1.3.2	Drainage and Flood Control	<p>Contractor shall ensure that no construction materials like earth, stone, ash or appendage disposed off so as not to block the flow of water of any water course and cross drainage channels.</p> <p>Where necessary adequate mechanical devices to bailout accumulated water from construction sites, camp sites, storage yard, excavation areas are to be pre-settled and arranged well in advance of the rainy season besides providing temporary cross drainage systems.</p> <p>The contractor shall take all adequate precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run-off of sediments is controlled. Silt fencing shall</p>	Surface water sources/ drains/ Nalahs/ Ponds etc.	MoRTH:305.3.7; Contractor MoRTH:306		Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		be installed prior to the onset of the monsoon at all the required locations, as directed by Engineer - Incharge of CSC and ASRP/PIU.				
2.1.3.3	Siltation of Water Bodies and Degradation of Water Quality	<p>The contractor shall also ensure that no material blocks the natural flow of water in any water course or cross drainage channel. Prior to monsoon, the contractor shall provide either permanent or temporary drains to prevent water accumulation in surrounding residential, commercial and agricultural areas.</p> <p>Contractor shall construct silt fencing at the base of the embankment construction near all water bodies (including wells) and around the stockpiles at the construction sites.</p> <p>Silt fencing shall be provided prior to the commencement of earthwork and shall continue till the stabilization of the embankment slopes are complete on the particular sub-section of the road.</p> <p>The contractor shall also put up sedimentation cum-grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m.</p>	Surface water sources/ drains/ Nalahs/ Ponds etc.	MoRTH: 306;	Contractor	Supervision Consultant; PIU/ASRP
2.1.3.4	Slope Protection and Control of Soil Erosion	<p>The contractor shall construct slope protection works as per design, or as directed by the Engineer - Incharge of CSC to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fiber mats, mulches, grasses, slope drains and other devices as required under specific local conditions.</p>	<p>High raise embankment and surface water bodies locations</p> <p>Plantation of vetiver grass for 80 m is proposed at 1 location</p>	MoRTH: 305.2.2.2; MoRTH: 306.2; Guideline for Slope Stability and Erosion Control	Contractor	Supervision Consultant, PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>Contractor shall ensure the following: After construction of road embankment, the side slopes of all cut and fill areas shall be graded and covered with stone pitching, grass and shrub as per design specifications. Terfing works shall be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization shall include mulching netting and seeding of batters and drains immediately on completion of earthworks with sowing of seeds of grass, shrub and bushes 30cm interval from line to line across the slope and sprinkling of water on such slopes after completion of the earth work. In borrow pits, the depth shall be regulated so that the sides of the excavation shall not be steeper than 1 vertical to 2 horizontal, from the edge of the bank. Stabilization of the embankment with appropriate technique/s shall commence soon after the embankment formation.</p>	(100/460 to 100/500) for 512 sq.m on both sides of the embankment with an average width of 6.4m			
2.1.4	Pollution Control					
2.1.4.1	Water Pollution					
2.1.4.1.1	Water Pollution from Construction Wastes	<p>The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor shall avoid construction works close to the streams or water bodies during monsoon.</p> <p>All waste arising from the project are to be</p>	Surface water sources/ drains/ Nalahs/ Ponds etc.	MoRTH: 111.4; MoRTH: 111.1; Water Act, 1974	Contractor	Supervision Consultant; PIU/ASRP, SPCB



Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.4.1.2	Water Pollution from Fuel, Lubricants and Chemicals	<p>disposed off in the manner that is acceptable to the State Pollution Control Board or as directed by Engineer – Incharge of CSC. The Engineer – Incharge shall certify that all liquid wastes disposed off from the sites meet the discharge standards.</p> <p>Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors shall be provided for vehicle parking, wash down and refueling areas as per the design provided.</p> <p>In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil shall be stripped, stockpiled and returned after cessation of such storage.</p> <p>Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites approved by the Engineer – Incharge. All spills and collected petroleum products shall be disposed off in accordance with MoEF and state PCB guidelines.</p> <p>Engineer – Incharge shall certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.</p>	Surface water sources/ drains/ Nalahs/ Ponds etc.	<p>MoRTH: 111.4; MoRTH: 111.1;</p> <p>Petroleum Act and Rules; MoEF/CPCB Notifications;</p> <p>Guideline -2 for Construction Camps</p>	Contractor	Supervision Consultant; PIU/ASRP, SPCB
2.1.4.2	Air Pollution					
2.1.4.2.1	Dust Pollution	The contractor shall take every precaution to reduce the level of dust (SPM and RSPM) from crushers, material storage yards, haul roads	Construction area/ site, Construction camps, Materials Loading /	<p>MoRTH:111.1; MoRTH:111.5; MoRTH:111.9;</p>	Contractor	Supervision Consultant; PIU/ASRP, SPCB

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		and construction sites (including earthwork, dismantling, scarification and material mixing sites) by sprinkling of water, mist spray, encapsulation of dust source and erection of screen /barriers.	unloading facilities	MoRTH:111.10; Air Act; SPCB Rules and Guidelines		
		Hot mix plant and batch mix plant shall be fitted with dust extraction units and mist spray to keep down the dust emission levels. The suspended particulate matter value at a distance of 40m from a unit located in such a cluster should be less than 500 µg/m ³ .				
		The contractor shall provide necessary certificates to confirm that all crushers used in the project conform to relevant dust emission control legislation. Air pollution monitoring shall be conducted as per the Pollution Monitoring Plan and results shall be used to strengthen/rectify problematic areas. If other existing crushers are used, such units need to have valid license from the SPCB.				
2.1.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm to the emission standards specified by the CPCB. Certification issued for such contrivances obtained from designated/approved authority shall be submitted along with the specified reporting format.	Construction camps, Materials Loading / unloading facilities	Motor Vehides Act Pollution Monitoring Format Format EC1	Contractor	Supervision Consultant; PIU/ASRP, SPCB
		The contractor shall maintain a separate file and submit PUC certificates for all vehicles/equipment/machinery used for the project. Monitoring results shall also be				

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		submitted to CSC and ASRP/PIU as per the Pollution Monitoring Plan in the specified format.				
2.1.4.3	Noise Pollution					
2.1.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipment's	<p>The Contractor shall confirm the following:</p> <p>All plants and equipment used in construction (including the NHA) aggregate crushing plant) shall strictly conform to the MoEF/ CPCB noise standards.</p> <p>All vehicles and equipment used in construction shall be fitted with exhaust silencers.</p> <p>Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced.</p> <p>Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter distance from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986.</p> <p>Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.</p> <p>Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use. (MoRTH - Section: 201.2)</p> <p>At the construction sites within 150 m of the nearest habitation, noisy construction work</p>	<p>School - 77/865, School - 98/208</p> <p>Temple - 62/100 Temple - 70/000 Mosque - 70/010 Naamghar - 71/200 Mosque - 73/720 Idga (people gather for religious reason) - 73/920 Small Shrine - 74/420 Naamghar - 75/610 Small Shrine - 76/730 Medium sized Shrine - 78/110 Small shrine - 79/180 Naamghar - 80/900 Naamghar - 82/785 Temple - 11/000 Tiosk - 22/395</p>	<p>Noise rules, 2002</p> <p>MoRTH - Section: 201.2</p> <p>MoRTH - Section 111.3</p>	<p>Contractor</p> <p>Affected Communities; PRLs; NGOs; Staff at Schools and Health Centres</p>	<p>Supervision Consultant; PIU/ASRP; SPCB,</p>

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>such as crushing, concrete mixing, batching shall be stopped during the night time between 9.00 pm to 6.00 am.</p> <p>No noisy construction activities shall be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.0 pm.</p> <p>Contractor shall provide noise barriers to the suggested locations of select schools/Temples/health centers.</p> <p>Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to Engineer-Incharge of CSC. Engineer shall be required to inspect regularly to ensure the compliance of EMP. (Refer MoRTH - Section 111.3)</p>				
2.1.4.4	Safety					
2.1.4.4.1	Personal Safety Measures for Labour, Material handling, Painting etc.	<p>Contractor shall provide all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staff.</p> <p>Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc.</p> <p>Welder's protective eye-shields to workers engaged in welding works</p> <p>Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals</p>	All construction sites	Factories Act, 1948; Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996		

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>Earplugs to workers exposed to loud noise (above 75dB (A)), and workers working in crushing, compaction, or concrete mixing operation.</p> <p>Adequate safety measures for workers during handling of materials at site are taken up.</p> <p>The contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.</p> <p>The contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed for the work of painting with products containing lead in any form.</p> <p>The contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.</p> <p>Contractor shall provide facemasks to the workers when paint is applied in the form of spray or a surface having dry lead paint is rubbed and scrapped.</p> <p>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. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by Engineer.</p>				
2.1.4.4.2	Traffic and Safety & Pedestrian Safety	The contractor shall take all necessary measures for the safety of traffic during	All along the project corridor and all haul	MoRTH - Section 112.2	Contractor	Resident Engineer; Bridge Engineers

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>construction and shall provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Engineer - Incharge for the information and protection of traffic approaching or passing through the section of any existing cross roads.</p> <p>The contractor shall ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications.</p> <p>Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated prior to start & unsafe areas shall be cordoned off</p>	roads	and IRC guidelines		PIU/ASRP
2.1.4.4.3	Risk from Electrical Equipment(s)	<p>The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that -</p> <p>No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public.</p> <p>All necessary fencing and lights shall be provided to protect the public in construction zones.</p> <p>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 the satisfaction of the Engineer - Incharge.</p>	All construction equipment		Contractor	Supervision Consultant; PIU/ASRP
2.1.4.4.4	First Aid	<p>The contractor shall arrange for -</p> <p>A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories</p>	All construction sites	Building and the other Construction Workers	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		Rules in every work zone Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital Equipment and trained nursing staff at construction camp.		(Regulation of Employment and Conditions of Service) Act, 1996		
2.1.4.5	Cultural Property					
2.1.4.5.1	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site are the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor shall take reasonable precautions 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-Incharge of such discovery and carry out the CSC's instructions for dealing with the same, waiting which all work shall be stopped. The Engineer shall seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Along the project road.	Central and State Laws	Contractor	Supervision Consultant; PIU/ASRP, State Archeological Department
2.1.4.6	Labour Camp Management					
2.1.4.6.1	Location of Construction labour camps: Accommodation	The contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities during the progress of work for labour to standards and scales approved by the Engineer-Incharge.	Along the project corridor at the location of construction labor camps	Building and the other Construction Workers (Regulation of	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labor camp.</p> <p>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. The location, layout and basic facility provision of each labour camp shall be submitted to Engineer prior to their construction.</p> <p>The construction shall commence only upon the written approval of the Engineer - Incharge.</p>		<p>Employment and Conditions of Service) Act, 1996</p>		
2.1.4.6.2	Potable Water	<p>The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing, within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996). The contractor shall also guarantee the following:</p> <p>Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities.</p> <p>If any water storage tank is provided that shall be kept such that the bottom of the tank is at least 1mt. from the surrounding ground level.</p> <p>If water is drawn from any existing well, which</p>	Construction labor camps	<p>Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996</p>	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.4.6.3	Sanitation and Sewage System	<p>is within 30mt. proximity of any toilet, drain or other source of pollution, the well shall be disinfected before water is used for drinking. All such wells shall be entirely covered and provided with a trap door, which will be dust proof and waterproof.</p> <p>A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which will be done at least once in a month.</p> <p>Testing of water shall be done every month as per parameters prescribed in IS 10500:1991.</p> <p>Compliance to EMP shall be reported to Engineer - Incharge every week. Engineer - Incharge shall inspect the labour camp periodically, to ensure compliance of the EMP.</p> <p>The contractor shall ensure that -</p> <p>The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place</p> <p>Separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women</p> <p>Adequate water supply is to be provided in all toilets and urinals</p> <p>All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition</p> <p>Night soil is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered</p>	Construction labor camps	<p>Building and the other Construction Workers</p> <p>(Regulation of Employment and Conditions of Service) Act, 1996</p>	Contractor	Supervision Consultant; PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.4.6.4	Waste Disposal	<p>with a layer of earth for a fortnight. Adequate health care is to be provided for the work force during the entire phase.</p> <p>The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer - In-charge. Unless otherwise arranged by local sanitary authority. The contractor has to make arrangements for disposal of night soils (human excreta) either by suitably approved by the local medical health or municipal authorities or as directed by Engineer - In-charge as provided by the contractor.</p>	Construction labor camps	Environment Protection Act, 1986 and Rules	Contractor	Supervision Consultant; PIU/ASRP, SPCB, Local Authorities
2.1.4.6.5	Stock-yards	<p>Location for stockyards for construction materials shall be identified at least 1000 m from water course and separated and sufficiently away from the labour camps.</p> <p>Separate enclosures shall be planned for storing construction materials containing fine particles such that sediment-laden water does not drain into nearby storm water drain & underground sewerage pipes.</p>	Construction labor camps	MoRTH - Section 306	Contractor	Supervision Consultant; PIU/ASRP, SPCB, Local Authorities
2.1.4.6.6	Fuel storage and refueling areas	<p>The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites are located at least 500 m from rivers and irrigation canal/ponds</p> <p>All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and shall be approved by the Engineer.</p>	Construction labor camps		Contractor	Supervision Consultant; PIU/ASRP, SPCB, Local Authorities

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.2	Contractor Demobilization	<p>In all fuel storage and refueling areas, if located on agriculture land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after completion of such storage and refueling activities. Fuel storage shall be provided with bunds.</p> <p>The plan for the construction camp site shall also include the process of collection and disposal of spent oil and grease. The collection and disposal methods for the spent oil and grease submitted as part of the construction camp plan should be duly approved by the Engineer - incharge.</p>				
2.2.1	Clearing of Construction of Camps & Restoration	<p>Contractor to prepare site restoration plans for approval by the Engineer. The plan has to be implemented by the contractor prior to demobilization.</p> <p>On completion of the works, all temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer.</p>	All Construction Workers' Camps		Contractor; Resident Engineer of SC; Environment Officer of SC	ASRP/PIU
2.2.2	Redevelopment of Borrow Areas	<p>Residual topsoil shall be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75mm - 150mm.</p> <p>Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Engineer.</p>	At all borrow area locations suggested for the project.		Contractor; Resident Engineer of SC; Environment Officer of	ASRP/PIU

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
3.0	Environmental enhancement and special issues					SC
3.1	Enhancement measures	Enhancement of all incidental spaces shall be planned and carried out prior to completion of construction, along the project road. Some of the enhancement measures to be considered along the project roads include Avenue tree plantation along the entire stretch of the road, Planting of shrubs in medians, rain water harvesting, adequate storm water drainage, Landscaping at junctions to improve aesthetics etc. A total of 250 trees will be cut along SH-3 for the purpose of the project and as compensatory measure 7600 trees shall be planted and protected.	At suitable locations along the project road		PIU/ASRP; DPR consultants; Forest Department; Supervision Consultant	ASRP/PIU
3.2	Road side Plantation Strategy, Tree Planting & Protection	<p>The contractor/identified agency (where specifically identified) shall do the plantation at median and/or turving at embankment slopes as per the tree plantation strategy prepared for the project.</p> <p>A total of 7600 saplings shall be planted along the Right of Way. Minimum 80 percent survival rate of the saplings shall be acceptable otherwise the contractor shall replace dead plants at his own cost. The contractor shall maintain the plantation till they handover the project site to ASRP.</p> <p>Giving due protection to the trees that fall in the shoulders /corridor of impact shall be the prime focus during Construction/post construction.</p> <p>Re-plantation of at least twice the number of trees cut should be carried out along the project road. Since the major portion of the</p>	<p>All tree plantation / greenery areas of the project;</p> <p>At locations identified along the project road</p>		PIU/ASRP; DPR consultants; Forest Department; Supervision Consultant	Project Director, PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference	Responsibility	
					Planning and Execution	Supervision and Monitoring
3.3	Transplantation	<p>project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure, which would also serve as a mechanism to delineate ROW and prevent future encroachments / squatters into the right of way, wherever possible.</p> <p>Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years. Survival status shall be reported on monthly basis to Engineer - Incharge.</p> <p>The Engineer - Incharge shall inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.</p> <p>All trees up to 45 cm girth at breast height and naturally occurring medicinal shrubs/bushes/grass clumps with in the RoW shall be uprooted mechanically with ball of earth intact for relocation and transplantation at various pre-identified locations such as degraded sites, embankments of road-side water bodies, temples, near-by market places, religious properties, schools and along road corridors for preventing loss of diverse vegetative cover and for reducing growth period.</p>	Along the project road		PIU/ASRP; Forest Dept., GoA; Tree Felling Contractor	Project Director, PIU/ASRP
3.4	Flora and Chance found Fauna	<p>The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.</p> <p>If any wild animal is found near the</p>	Along the project road		Contractor; Supervision Consultant	PIU/ASRP; Supervision Consultant; Forest Dept., GoA

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		<p>construction site at any point of time, the contractor shall immediately upon discovery thereof acquaint the Engineer - Incharge and execute the Engineer's instructions for dealing with the same.</p> <p>The Engineer-Incharge shall report to the nearby forest office (range office or divisional office) and shall take appropriate steps/ measures, if required in consultation with the forest officials.</p>				
3.5	Sensitive Areas	<p>The sensitive areas 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 to be checked during operation phase.</p> <p>Construction activities shall be confined within the present available RoW, regularly strict monitoring/supervision should be done to minimize/control air-noise pollution and abatement of dust particles at minimum level possible using well maintain modern machineries. Crushers, Hot-mix Plants and Batching Plants should be placed at least 10 km aerial distance away from the sanctuary boundary.</p>	Concerned locations			
4.0	OPERATION STAGE (Activities to be Carried Out by the ASRP/Forest Department, GoA)					
4.1	Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures provided in the Project	The ASRP/PIU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. Monitoring and performance indicators have been indicated in Chapter 7	All along the project corridor	-	PIU/ASRP	PIU/ASRP



Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		(section 7.2 Environmental Monitoring Plan).				
4.2	Maintenance of Drainage	Also, the rehabilitation works at degraded sites along nalas, streams and gullies after soil and water conservation measures has to be inspected, recorded and damages timely repaired for effective functioning and maintenance of such efforts in the field. All observations and data shall be added /updated in the Database/Information Management System developed for the project. This also covers other points given in this table. ASRP/ 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.	All along the project corridor	MoRTH specifications; IRC guidelines	PIU/ASRP	PIU/ASRP
4.3	Pollution Monitoring	ASRP/PIU shall ensure that all the sediment/oil and grease traps set up at the truck and bus lay bye are cleared once in every three months. 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 Pollution 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	Environmental Monitoring Plan (section 7.2)	PIU/ASRP; SPCB	PIU/ASRP; SPCB

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
4.3	Atmospheric Pollution	ASRP/PIU shall appoint specific pollution monitoring agency for this purpose. 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 pre-construction data.	All along the project corridor	Environmental Monitoring Plan (section 7.2)	PIU/ASRP; SPCB	PIU/ASRP; SPCB
4.4	Noise Pollution	Additional data at other location may be collected as per any site specific requirement. Noise pollution shall be monitored as per environmental monitoring plan at sensitive locations where pre-construction noise data was collected. The functioning of the noise barriers has to be specifically supervised and monitored for further improvement/replication at other affected points if necessary.	All along the project corridor	Environmental Monitoring Plan (section 7.2)	PIU/ASRP; SPCB	PIU/ASRP; SPCB
4.5	Soil Erosion and Monitoring of Borrow Areas	Signage indicating 'no horn zones' near sensitive locations shall be maintained and kept clean. Monitoring the effectiveness of the pollution attenuation barriers shall be taken up thrice in the operation period. 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 out before monsoon, during monsoon and after winter rains 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	Guideline – 3 for Borrow Area Management (EMF)	PIU/ASRP	PIU/ASRP
4.6	Road Safety and Maintenance of Assets	No advertisement/hoardings shall be allowed within the Right of Way limits of the project	All along the project corridor		PIU/ASRP	PIU/ASRP

Sl. No	Activities	Management Measure	Location	Reference ¹	Responsibility	
					Planning and Execution	Supervision and Monitoring
		road.				
		Regular maintenance and cleaning of assets such as sign boards, bus stops, drains etc. shall be undertaken.				

9.2 Summary Matrix for Environmental Monitoring

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 9-2**. Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 9-2: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO ₂ , NO _x , RPM, SPM, O ₃ , Pb, CO, NH ₃ , C ₆ H ₆ , BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation ²				Two seasons in a year for three years		Along the road	Contractor / PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982)	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor / PIU
	Operation				Four seasons for three years			Contractor / PIU
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Three seasons per		Along the	Contractor / PIU

² Parameters to be monitored for Operation stage is same as Construction stage

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	year for three years. Four seasons per year	Grab Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Four seasons for three years		Along the road	Contractor / PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor
Tree plantation	Operation stage	As per Rehabilitation Plan			Quarterly	-	Areas where plantation is being done	Contractor / PIU

9.3 Implementation of EMP

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

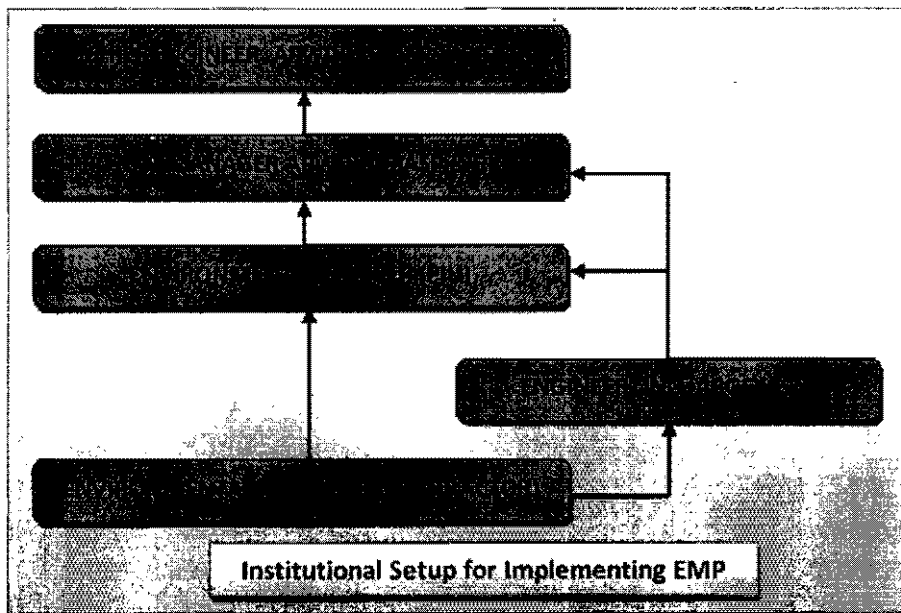


Figure 9-1: Organisation Setup for EMP Implementation

Table 9-3: Institutional Responsibilities

System	Designation	Responsibilities
Coordinating/Facilitating Agency	Chief Engineer APWD (ARIASP & RIDF)	<ul style="list-style-type: none"> • Overview of the project implementation • Ensure timely budget for the EMP • Coordination with different state level committee, to obtain Regulatory Clearances • Participate in state level meetings • Monthly review of the progress.
	Project Manager APWD (ARIASP & RIDF)	<ul style="list-style-type: none"> • Overall responsible for EMP implementation • Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Coordination with PIU Staff (Environmental officer). • Responsible for obtaining Regulatory Clearances • Review of the progress made by contractors • Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.
	Environmental Officer (PIU)	<ul style="list-style-type: none"> • Assisting Project Manager in overall implementation of EMP • Review of periodic reports on EMP implementation and advising Project Manager in taking corrective measure. • Conducting periodic field inspection of EMP implementation • Assisting Project Manager to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP

System	Designation	Responsibilities
Implementing/ Monitoring Agency	Engineer- Incharge (CSC if any)	<ul style="list-style-type: none"> Implementation • Preparing environmental training program and conducting the same for field officers and engineers of contractor • Act as an "Engineer" for supervising EMP implementation • Responsible for maintaining quality of EMP envisioned in Detail Project Report • Maintaining progress reports on EMP implementation • Periodic reporting to PIU about the status of EMP implementation • Work in close coordination with Environmental officer (PIU) and contractor
	Executing Agency	<ul style="list-style-type: none"> • Responsible for ensuring the implementation of EMP as per provision in the document. • Directly reporting to the Project Manager of the Contractor • Discussing various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly • Assisting his project manager to ensure social and environmentally sound and safe construction practices • Conducting periodic environmental and safety training for contractor's engineers, supervisors and workers along with sensitization on social issues that may be arising during the construction stage of the project • Assisting the PIU on various environmental monitoring and control activities including pollution monitoring; and • Preparing and submitting monthly/bio-monthly reports to PIU on status of implementation safeguard measures
	Environmental Manager of Contractor	

9.4 Good Environmental Construction Guidelines

Comprehensive environmental construction guidelines have been prepared to guide the planning and implementing agency in preparing the project specific environmental code of conduct for contractor. The list of good environmental practices is as follows. All guidelines listed are presented as **Annexure 5** for reference and implementation into the Environmental Management Plans for the specific projects.

Table 9-4: Guideline for Good Environmental Practices

Guidelines	Activities
Guideline-1	Site Preparation
Guideline-2	Construction and Labour Camps
Guideline-3	Borrow Areas
Guideline-4	Topsoil Salvage, Storage and Replacement
Guideline-5	Quarry Management
Guideline-6	Water for Construction
Guideline-7	Slope Stability and Erosion Control
Guideline-8	Waste Management and Debris Disposal
Guideline-9	Water Bodies
Guideline-10	Drainage
Guideline-11	Construction Plants & Equipment Management
Guideline-12	Labour and Worker's Health and Safety
Guideline-13	Cultural Properties
Guideline-14	Tree Cutting and Afforestation
Guideline-15	Forests and Other Natural Habitats
Guideline-16	Air and Noise Pollution
Guideline-17	Environmental Monitoring

9.5 Cost Estimates for Environmental Management

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

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

More general environmental management measures to be followed by the contractor have been included in the specifications and this EMP. These cannot be quantified and are to be included in the contract rates. A total of **Rs. 0.66 Crores** has been allocated for the environmental management for the Project road.

Table 9-5: Environmental Management Budget

Environmental Management - Civil Work							
S. No.	Item	Unit	Rate (Rs)	Quantity	Cost (Rs)	Responsibility	
A	CONSTRUCTION PHASE						
1	<i>Mitigation Measures</i>						
1.1	Oil interceptors	Number	5000	4	20,000.00	Contractor, PIU, CSC	
1.2	Recharge pits	Number	20000	28	560,000.00		
1.3	Silt Fencing	Length (m)	900	200	180,000.00		
1.4	Deepening of Ponds	Number	25000	7	175,000.00		
2	<i>Enhancement of Cultural Properties</i>						
2.1	Partially affected	Number	50000	6	300,000.00		
Environmental Budget During Construction Phase (Civil Works)					1,235,000.00		
Environmental Management - Enhancement and monitoring cost							
S. No.	Item	Unit	Rate (RS)	Quantity	Cost (RS)	Responsibility	
B	Construction Phase						
	<i>Tree Plantation and Protection</i>						
1.1	Trees	Number	1000	2500	2,500,000.00	Forest Department, PIU, CSC	
1.2	Barb wire fencing	Per kg	75	3250	243,750.00		
2	<i>Monitoring of Environmental Attributes during Construction Activity</i>						
2.1	<i>Air Quality</i>						
2.1.1	Monitoring of Air Quality near Hot mix plants	No. of Samples	6000	36	216,000.00	PCB, Assam, CSC, PIU	
2.1.2	Monitoring of Air Quality at Critical Locations	No. of Samples	6000	36	216,000.00		
2.2	<i>Noise Levels</i>						
2.2.1	Monitoring of Noise Level at Equipment Yards	No. of Samples	4000	36	144,000.00		
2.2.2	Monitoring of Noise Levels at Critical Locations	No. of Samples	4000	36	144,000.00		
2.3	Water Quality	No. of Samples	6000	48	288,000.00		
2.4	Soil Quality	No. of Samples	6000	36	216,000.00		
Environmental Budget During Construction Phase (Enhancement and Monitoring)					3,967,750.00		
C	OPERATION PHASE						
1	<i>Monitoring of Environmental Attributes during Construction Activity</i>						
1.1	Monitoring of Air Quality during Operation Phase					PCB Assam, CSC, PIU	
1.2	Monitoring of Air Quality at Critical Locations	No. of Samples	6000	24	144,000.00		
1.3	Monitoring at additional locations	No. of Samples	6000	24	144,000.00		

Environmental Management - Civil Work						
S. No.	Item	Unit	Rate (Rs)	Quantity	Cost (Rs)	Responsibility
2	Monitoring of Noise during Operation Phase					
2.1	Monitoring of Noise Levels at Critical Locations	No. of Samples	4000	40	160,000.00	
2.2	Monitoring at additional locations	No. of Samples	4000	40	160,000.00	
3	<i>Monitoring of Management & Operational Performance Indicators</i>					
3.1	Tree Protection (maintenance Cost - Two years)	LS	10000	24	240,000.00	
	Environmental Budget During Operation Phase (Enhancement and Monitoring)				848,000.00	
	Sub Total A+B+C				6,050,750.00	
	Grand Total INR. (Environmental Budget Exclusive of Cost of Measures Included Under Good Engineering Practices, A+B+10% contingency)				6,655,825.00	

10 Conclusion

10.1 Conclusion

The proposed project corridor SH-32 is one among the eight roads selected for road improvement under Assam state road project (ASRP). There are no environmental sensitive areas within 25 km buffer from the project corridor.

The Environmental Impact assessment Report prepared for the project corridor adheres to the rules and regulations adopted by the Ministry of Environmental and Forest (MoEF) and World Bank guidelines. The environmental impacts are expected to arise during the project implementation phase viz. Project pre construction, construction and post construction phases, the activities like tree cutting, site clearance, blasting, dismantling of structures, disposal of construction debris tends to create environmental impact on the existing environment. Considering these key impacts and other associated impacts, a comprehensive Environmental Management Plan (EMP) has been formulated and briefed in the chapter 9 – Environmental management Plan.

The specific management measures laid down in the EMP will effectively address any adverse environmental impacts raised due to the project implementation. The effective implementation of the measures proposed will be ensured through capacity building of the PMU and CSC Consultants as well as incorporating the proposed EMP and appropriate clauses covering the environmental protection requirements in the contract document. Further, the environmental monitoring plans provide adequate opportunities towards course correction to address any residual impacts during construction or operation stages.

Based on the detailed assessment the proposed strengthening and widening of SH- 32 will not generate significant environmental impacts provided that the works are designed and executed in accordance with sound engineering practice and that the mitigation and precautionary measures described in this report (Environmental Management Plan) are fully implemented.

11 Bibliography

11.1 Manuals

- Administrative Staff College of India., *EIA Guidance Manual – Highways*, Ministry of Environment and Forest, Govt of India, 2010
- Canter L, *Environmental Impact Assessment (Second Edition)*. McGraw Hill Publishing Company, New York, 1996
- World Bank, *Environmental Management Plans*. Environmental Assessment Sourcebook Update No. 25, Environment Department, World Bank, Washington D.C., 1999
- World Bank, *Analysis of Alternatives in Environmental Assessment*. Environmental Assessment Sourcebook Update No. 17, Environment Department, World Bank, Washington D.C., 1996

11.2 Legal Frameworks

- Ministry of Environment and Forest, *Environment (Protection) Act*, Govt of India, 1986
- Ministry of Environment and Forest, *Environmental Impact Notification*, Govt of India, 2006 and 2009
- Ministry of Environment and Forest, *Wildlife Protection Act*, Govt of India, 1972
- Ministry of Environment and Forest, *Forest (Conservation) Act*, Govt of India, 1980
- Ministry of Environment and Forest, *Water (Prevention and Control of Pollution) Act (and subsequent amendments)*, Govt of India, 1974
- Ministry of Environment and Forest, *Air (Prevention and Control of Pollution) Act (and subsequent amendments)*, Govt of India, 1981
- Revenue and disaster management department, Assam, *The Land Acquisition Act*, Govt of Assam, 1984
- Ministry of Rural Development, *National Resettlement and Rehabilitation Policy*, Govt of India, 2007
- Department of Environment and Forest, *Assam Forest Regulation (Amendment) Act*, Govt of Assam, 1995
- Department of Environment and Forest, *Assam Forest Policy*, Govt of Assam, 2004
- Department of Welfare of Plain Tribes and Backward Classes, *Draft National Policy on Tribals*, Govt of Assam, 2004
- Archeological Survey of India, *Ancient Monuments and Archaeological sites and Remains Act*, Govt of Assam, 1958

11.3 Publications

- NAAQM, *National Ambient Air Quality Status*, Central Pollution Control Board, 2004
- MINARS, *Status of Water Quality in India*, Central Pollution Control Board, 2004
- District Ground Water Developmental reports - District Report, Central Groundwater Board (CGWB),
- Ministry of Water resource , *Watershed Atlas of India*, Central Groundwater Board (CGWB),

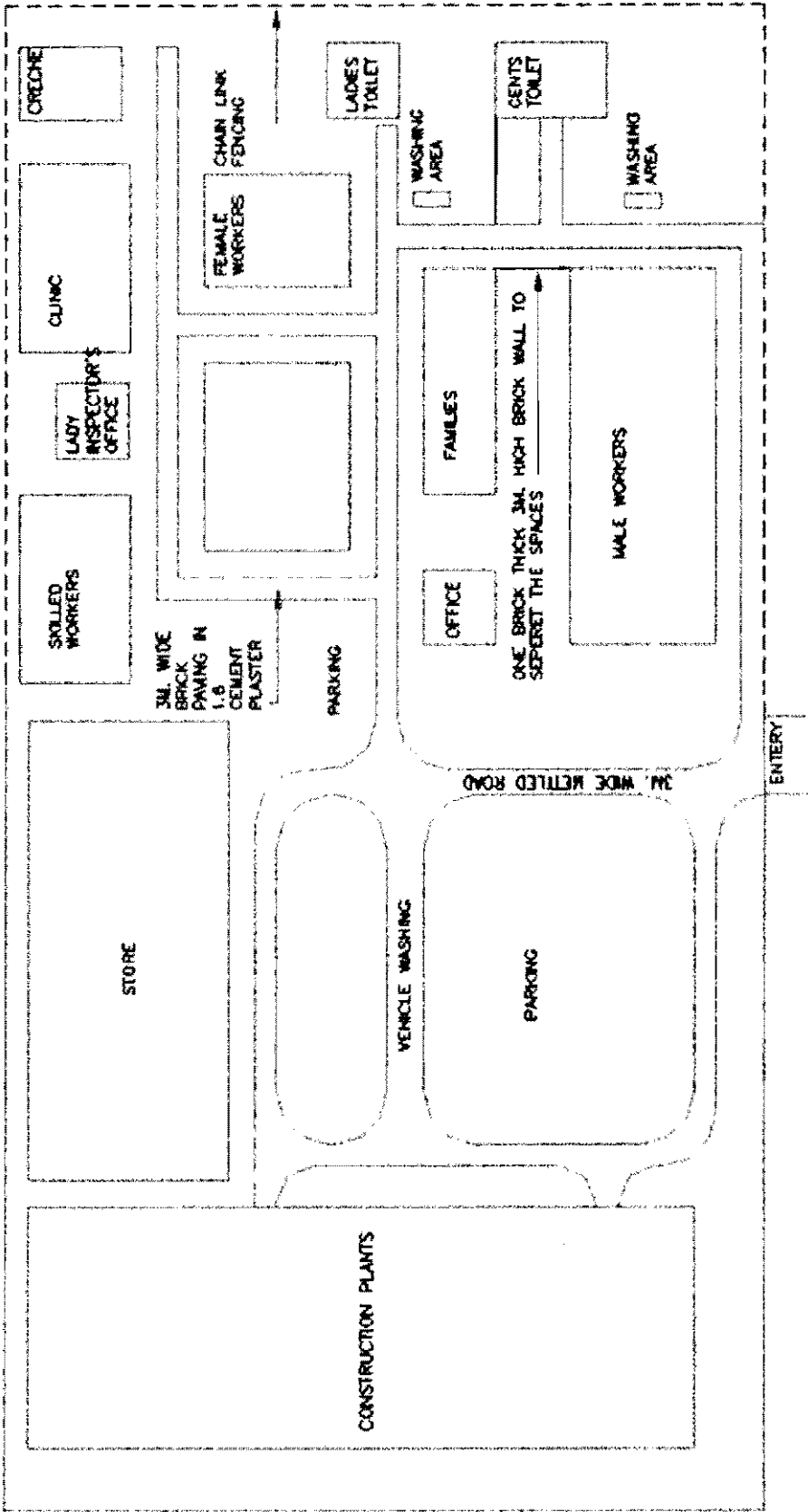
11.4 Web References

- http://cawb.gov.in/qw_profiles/st_assam.htm
- http://cawb.gov.in/District_Profile/Assam/Goalpara%20Brochure.pdf
- <http://www.cpcb.nic.in/Data%20Search/water%20quality%20data/Brahmaputra-2005.PDF>
- <http://www.imd.gov.in/section/climate/guwahati2.htm>

ANNEXURES

ANNEXURE - 1: Construction Camp

Schematic Drawing of Construction Camp



ANNEXURE - 2: Environmental Monitoring Formats

Format EM1: Selection of disposal site locations

From _____ To _____

(Give chainage and nearest settlements from both ends)

Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
Area covered (m ²)				
Total Material that can be dumped within the site (m ³)				
Depth to which disposal is feasible (m)				
Distance of nearest watercourse (m)				
Nearest Settlement (m)				
Date/s of Community Consultation/s				
Whether the community is agreeable to siting of dumping site (Y/N)				
Date of Permission from Village Council President(VCP)				
Proposed future use of the Site				

Selected Site (tick any one column only)

Certified that the above information is correct to the best of my knowledge and belief.

(Contractor / Concessionaire)

Verified:

Date:

Recommendation on the suitability of the site

Signed:

Date:

Name & Designation:

Decision Taken (tick one):

Approved/Not Approved

Signed:

Date:

Name and Designation of Deciding Authority

Enclosures

(Tick as appropriate)

- 1 Maps of each location
- 2 Photographs
- a Each disposal location
- b Each community consultation
- 3 Photocopies of permissions from VCPs

Name and Designation of Verifier:



Format EM2: Construction Camp and Storage Area

Construction Stage: Report - Date_____ Month_____ Year_____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before target date (decided by PIU) of establishing camps

Location of Camp (km_____)

Sl. No	Item	Unit	Details	Remarks
1	Detail of item camp			
a	Size of Camp	mxm		
b	Area of Camp	sq.m		
c	Distance from Nearest Settlement			
d	Distance from Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
e	Date of camp being operational dd/mm/yy			
f	Present land use			
g	No other trees with girth > 0.3m.			
h	Details of Storage area(Availability of impervious surface)	mxm		
i	Availability of separate waste disposal from storage area	Cum		
2	Details of top soil stacking			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	Describe stacking arrangement		
3	Details of workforce			
a	Total No of Labourers	nos		
b	Total no of Male Workers	nos		
c	No of Male Workers below 18 years of age	nos		
d	Total No of Female Workers	nos		
e	No of Female workers below 18 years of age	nos		
f	No of children	nos		
4	Details of dwelling units			
a	No of dwellings/huts	nos		
b	Minimum Size of Dwelling	mxm		
c	No of openings per dwelling	nos		
d	Minimum size of opening	mxm		
e	Walls	specifications		
f	Roofing	specifications		
g	Flooring	specifications		
h	Drinking Water Tank	specifications		
i	Capacity of Drinking water Tank	cum		
j	Size of Drinking Water Tank	mxmxm		
k	Total no of WC	nos		
l	No of Wcs for female workers	nos		
m	Minimum Size of WC	mxm		
n	Total No of Bathrooms for female workers	nos		
o	Size of septic tank for WC/Baths	mxmxm		
p	Capacity of Water Tank for WCs/ Bathrooms and general purpose			
q	Fencing around camp	Y/N		
5	Details of facilities			
a	Availability of security guard 24 hrs a day	Yes/No		
b	Details of First Aid Facility	Yes/No		

Annexure 2

c	Availability of Day Care Centre	Yes/No		
d	Availability of dust bins (capacity 60 ltr)	nos		

Certified that the furnished information is correct the quality of work is as per god practice and all relevant information as required is attached

Project Engineer

Format EM3: Reporting for Borrow Areas

Construction Stage Report: Date ____ Month ____ Year ____ Site Layout of Borrow Area and Proposed Borrow Area Redevelopment Plan to be attached with format Format to be submitted before target date as (decided by PIU) for establishing Borrow Areas Borrow Area No. BA _____ Location of Borrow Area (Km ____)

Sl. No	Item	Unit	Details	Remarks by CSC, if any
1	Details of Borrow Area			
a	Date of Borrow Area becoming operational			
	dd/mm/yy			
b	Current Landuse			
c	Distance from Nearest Settlement	Km		
d	No of settlements within 200m of Haul Road	No.		
e	No of settlements within 500m of Borrow Area	No.		
f	Total Capacity	cum		
g	No of Trees with girth more than 0.3 m	No.		
h	Length of Haul Road	km		
i	Width of Haul road	m		
j	Type of Haul Road	metal/dirt		
k	Size of Borrow Area	sqkm		
l	Area of Borrow Area	km x km		
m	Quantity Available	cum		
n	Distance of Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
o	Quantity of top soil removed	cum		
p	Detail of storage of topsoil			
q	Daily/occasional use of the Borrow Area by the community, if any	-		
r	Probable reuse of Borrow pit-ask community	-		
s	Drainage channels/slope/characteristics of the area	-		
2	Enhancement Elements			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	sq.m		
c	Adjoining land use/Natural elements			
d	Near by catchment for storing water			
e	Erosion Control Programme			
f	Preventive measures for			
i	Leaching			
ii	Mosquito Breeding			
iii	Water run-off/contamination			
iv	Any other environmental degradation			
3	Details of workforce			
a	Total No of Labourers	No.		
b	Total no of Male Workers	No.		
c	No of Male Workers below 18 years of age	No.		
d	Total No of Female Workers	No.		
e	No of Female workers below 18 years of age	No.		
4	Details of redevelopment, Plan to be enclosed			

Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached

Project Engineer

(Contractor / Concessionaire)



Format EM4: Tree Felling

S.No	Links	Physical Target				Completion Target			Reason for Delay if any
		Total	Target	Target Achieved	% of task completed	Target Date	Date of Completion if task completed		
		Unit							
1		nos							
2		nos							
3		nos							
4		nos							

(Signed)

PIU

Format EM5: Tree Plantation

Construction Stage: Quarterly Report -Date____ Month____ Year____

Sl. No	Activity	Physical Target				Financial Target			Completion Target			
		Target (tree/shrubs to be planted in Package) for this Quarter		Target Achieved		% of task completed	Total (lakhs)	Budget Spent	% used	Target Date	Date of Completion/% completed	Reason for Delay if any
		Km (From) / No.	Km (To) / No.	No. of Trees	Survival Rate (%)							
1	Tree Plantation along roadside											
2	Plantation at Locations identified for enhancement											

Certified that the above information is correct
PIU

EM6 Topsoil Conservation Monitoring

Contract _____

Report No. _____

Date _____

Location (Chainage)	Original Use of Topsoil removed	Measures for preventing spillage of topsoil on Haul Roads(Earthen/ Metalled)	Present Method of Storage	Anticipated period of Storage (Months)	Distance of nearest Water course (m)	Present Slope of Pile (V: H)	Whether silt fencing provided?	Is any other covering / measure provided? If yes, what is it?	Improvements required	Extent of Compliance as on date of report

Certified that the above is true.

Signed _____

(Authorised Representative of the contractor / concessionaire)

Verified

Signed _____

(Environmental Specialist of the Engineer)



Format EC1: Target Sheet for Pollution Monitoring

Construction Stage: Report - Date _____ Month _____ Year _____

(Locations at which monitoring to be conducted as per EMP)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Project Engineer

Contractor

Format EC 2: Target Sheet for Pollution Monitoring

Operation Stage: Report - Date _____ Month _____ Year _____

(Locations at which monitoring to be conducted)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Project Engineer

Format OP 1: Survival Rate of Trees

Operation Stage: Report - Date _____ Month _____ Year _____

S. No.	Landscape Section	Roadside Trees			Landscaping at Junctions			Turfing on Embankment		
	Km-Km	Total Trees Planted	Total Surviving	% Survival	Total Shrubs Planted	Total Surviving	% Survival	Total Area Turfed	Total Turfed Area Surviving	% Survival
		Nos.	Nos.	%	Nos.	Nos.	%	Sqm.	Sqm.	%

Certified that the above information is correct

PIU

Format OP2: Redevelopment of Borrow Areas

Operation Stage: Report: Date ____ Month ____ Year ____

To be monitored by PIU during operation period

Details of remarks to be appended wherever necessary.

Sl. No	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond,							
A	Details of available catchment for storing water							
B	List of Fish species that can survive in that area							
C	Economic Benefits/Utility							
11	If it has been developed as an orchard							
A	Details of suitability of soil and water.							
B	Type of Plantation							
C	Economic Benefits/Utility							
12	Any Other End use							
A	Particulars							
B	Economic Benefits/Utility							

Signed

(Environmental Specialist of EC of PIU)

ANNEXURE - 3: Socio – Economic Survey Questionnaires

English Version

Assam State Road Project (ASRP) Census & Socio Economic Survey of PAPS

Form No. _____ Date _____
Name of Investigator _____
Name of Supervisor _____

ID No. _____ Chainage _____ Distance of Structure from C/L: _____
Address: _____ Village: _____ Block: _____ District: _____
Phone No: _____ Mobile No. _____ P/S: _____ P/O: _____

1. Type of the Use:

1	Residential	2	Commercial	3	Mixed (C+R)	4	Industrial	5	Petrol Pump	6	Farm House	7	Government
8	Agricultural	9	Orchard	10	Under construction	11	Open land/Plot	12	Plantation	13	Cattle Shed	14	Religious
15	Forest	16	Jhum Land	17	Community Assets	18	Others						

2. Type of Loss due to the project:

1	Structure	2	Land	3	Land and structure	4	Livelihood	5	Others ()
---	-----------	---	------	---	--------------------	---	------------	---	------------

3. Type of Ownership:

1	Private	2	Government	3	Trust	4	Temple	5	Community	6	Others ()
---	---------	---	------------	---	-------	---	--------	---	-----------	---	------------

4. Status of Property user:

1	Owner	2	Mortgaged	3	Leased	4	Tenant	5	Encroachment	6	Squatter	7	Share Cropper	8	Others
---	-------	---	-----------	---	--------	---	--------	---	--------------	---	----------	---	---------------	---	--------

5a. Survey No. _____ 5b. Total Land Holding: Lecha _____ Katha _____ Bigha _____ Acre _____ Hectare _____

6. Extent of Impact:

1	Partial	2	Full
---	---------	---	------

7a. Age of Building _____ 7b. No. of Years Occupied _____

7c. Name of head of HH _____ 7d. Sex _____

8. If Tenant/Lessee:

Name and Address of the owner _____

8. Which Floor?

G	1
G+1	2
G+2	3

10. If the property is on rent then the amount of rent being paid per month: Rs _____

11. Assets in the Property:

S. No	Assets	Units Owned	S. No	Assets	Units Owned	S. No	Assets	Units Owned
1	Trees		7	Hand Pump		13	Temporary Shed	
2	Dug Well		8	Motor Pump		14	Washing place	
3	Tube Well		9	Boundary Wall		15	Shrine	
4	Open Well		10	Barbed Wire Fencing		16	Seating around Tree	
5	Water Tap		11	Cattle		17	Country Stove	
6	Water Tank		12	Cattle Shed		18	Bathroom	

12. Structure types Details:

Wall	Reed	Bamboo	Cane	Mud	Brick	Others	
	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	ⓕ	
Roof	Thatch	Tin	Asbestos	Tiles	RCC	Others	
	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	ⓕ	
Floor	Mud	Concrete	RCC	Tiles	Marble	Stone	Others
	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	ⓕ	ⓖ

13. Do you have:

		BPL	Other
1	Ration Card	Yes	No
2	Votes ID Card	Yes	No
3	Electricity Bill	Yes	No
4	Legal property document	Yes	No
5	Job ID Card of NREGS	Yes	No

14. Social Category:

Scheduled Caste (SC)	Scheduled Tribe (ST)	Other Backward Classes (OBC)	General (G)	Physically Challenged (PC)
1	2	3	4	5

15. Family Type:

Joint	ⓐ
Nuclear	ⓑ

16. If PAH is SC/ST Please mention the name of the community _____

17. What type of business are you doing, in case of commercial use? Any other, please specify

S. No	Category	Options							
1	Refreshments	Tea Stall	Chaba	Sweet Shop	Hotel	Restaurant	Motel	Pan Shop	
2	Service Industry	Tailoring	Hair Cutting	Cobbler	Blacksmith	Two wheeler repair	Four wheeler Repair	Cycle repair	
3	Retail Activity	Grocery	Chemist	Furniture	Petrol Pump	Electric Shop	Hardware	Electronics	
4	Warehousing	Godowns	Cold Storages						
5	Tertiary Activity	STD	PCO	Photocopy	Private offices	Weighing bridge			
6	Institutional	School	Government Offices	PHC	Veterinary Hospital				



18. Capital Investment on Business (Approximately) Rs. _____

19. Value of the property; Land Cost _____ Building cost _____

20. Codes for Relationship with Head of the Household:

1	Household	2	Spouse	3	Huband	4	Sex
5	Daughter	6	Son-in-law	7	Daughter-in-law	8	Grandfather
9	Grandmother	10	Grandson	11	Grand daughter	12	Brother
13	Sister	14	Brother-in-law	15	Sister-in-law	16	Father
17	Mother	18	Father-in-law	19	Uncle-in-law	20	Grandson-in-law
21	Grand daughter-in-law	22	Nephew	23	Niece	24	Cousin
25	Nephew	26	Niece	27	Any other (specify):	28	

Members Number	1	2	3	4	5	6	7	8	9	10	11	12	
1. Name													Write down the names of all people who live and eat together in this house add starting with head
2. Relationship													
3. Sex	Is the NAME male or female?												
	M	M	M	M	M	M	M	M	M	M	M	M	
	F	F	F	F	F	F	F	F	F	F	F	F	
4. Age	How old was NAME on the last birthday?												
													Record the age on last birthday
5. Marital Status	1	2	3	4	5	6	7	8	9	10	11	12	Married
	13	14	15	16	17	18	19	20	21	22	23	24	Unmarried
	25	26	27	28	29	30	31	32	33	34	35	36	Divorced
	37	38	39	40	41	42	43	44	45	46	47	48	Separated
	49	50	51	52	53	54	55	56	57	58	59	60	Widow/Widower
6. Education	The class till which the person has been educated.												
	1	2	3	4	5	6	7	8	9	10	11	12	Illiterate
	13	14	15	16	17	18	19	20	21	22	23	24	Primary (upto Class 3)
	25	26	27	28	29	30	31	32	33	34	35	36	High School (Class 4 - 7)
	37	38	39	40	41	42	43	44	45	46	47	48	Secondary (Class 8 - 10)
	49	50	51	52	53	54	55	56	57	58	59	60	Higher Secondary (Class 11 - 12)
6.1	Is the NAME working?												
	1	2	3	4	5	6	7	8	9	10	11	12	Yes
	13	14	15	16	17	18	19	20	21	22	23	24	No
E.2 Occupation	What is the main activity at the place of job?												
	1	2	3	4	5	6	7	8	9	10	11	12	Artisans
	13	14	15	16	17	18	19	20	21	22	23	24	Agriculture
	25	26	27	28	29	30	31	32	33	34	35	36	Agriculture Labour
	37	38	39	40	41	42	43	44	45	46	47	48	Non Agriculture Labour
	49	50	51	52	53	54	55	56	57	58	59	60	Business/Trade
	61	62	63	64	65	66	67	68	69	70	71	72	Govt. Service (Class I - III)
	73	74	75	76	77	78	79	80	81	82	83	84	Govt. Service (Class IV)
85	86	87	88	89	90	91	92	93	94	95	96	Private Service	
97	98	99	100	101	102	103	104	105	106	107	108	Cleaner	
E.3	What was the main reason for the NAME not working?												
	1	2	3	4	5	6	7	8	9	10	11	12	Persons who are not working
	13	14	15	16	17	18	19	20	21	22	23	24	No work available
	25	26	27	28	29	30	31	32	33	34	35	36	Seasonal inactivity
	37	38	39	40	41	42	43	44	45	46	47	48	Household family duties
	49	50	51	52	53	54	55	56	57	58	59	60	Old (>55 yrs) / young (<14 yrs)
61	62	63	64	65	66	67	68	69	70	71	72	Physically Challenged	
73	74	75	76	77	78	79	80	81	82	83	84	Not willing to work	
E.4 Income	How much does the NAME earn in a month?												
E.5 Skills	Any skill possessed by the person?												
	1	2	3	4	5	6	7	8	9	10	11	12	Tailoring
	13	14	15	16	17	18	19	20	21	22	23	24	Electrical
	25	26	27	28	29	30	31	32	33	34	35	36	Plumbing
	37	38	39	40	41	42	43	44	45	46	47	48	Electronic / Watch Repair
	49	50	51	52	53	54	55	56	57	58	59	60	Lathe works
	61	62	63	64	65	66	67	68	69	70	71	72	Handicraft
	73	74	75	76	77	78	79	80	81	82	83	84	Others

A21. Rehabilitation Options:

S. No.	Compensation at replacement value	Choice (✓)	Priority (1,2,3...)
1	Alternative shop/residence		
2	Employment During Project Construction		
3	Employment During Maintenance		
4	Training to improve the skill level		

S. No.	Compensation at replacement value	Choice (✓)	Priority (1,2,3...)
5	Provide land Against Land		
6	Self Relocation		
7	Others		
8			

22. Assets Owned (other than affected one):

Agricultural Properties				Other Properties				Other Assets
Irrigated/ Wet Land	Un Irrigated/ Dry Land	Orchard/Waste/ Barren/Horticulture Land	Equipment	House Plot	House	Farm House	Business Establishment	
Area	Area	Area	Nos.	Area	Area	Area	Area	Area
Value	Value	Value	Value	Value	Value	Value	Value	Value

23. Agriculture Property:

Name of Crop	No of Crops	Yield Per Acre	Total land Holding

24. Household Expenditure (Amount in Rs)

Sl. No.		(Rs.)	Sl. No.		(Rs.)
1	Food (Monthly)		6	Health (Monthly/Annual)	
2	Education (Monthly/Annual)		7	Cooking fuel (Monthly)	
3	Cloth (Monthly/Annual)		8	Social Functions (Annual)	
4	Local Travel (Monthly)		9	Vehicle Maintenance (Monthly / Annual)	
5	Leisure (Monthly)		10	Out Station travel (Monthly - Annual)	

25. Debts: (Amount in Rs)

Sl. No.		(Rs.)	Sl. No.		(Rs.)
1	Crop/Agriculture Loan		4	Loan on vehicles	
2	Loan on Assets		5	Loan for education	
3	Jewell Loan		6	Personal Loan	

26. Investments: (Amount in Rs):

Sl. No.		(Rs.)	Sl. No.		(Rs.)
1	Deposits		3	Bonds/Shares	
2	Jewellery		4	Business	

27. Health Details (If any major diseases):

Sl. No.	Name of Person	Type of Disease	Duration	Condition/ Remarks

28. Amenities and Facilities:

Sl. No.		Distance (approx. in km)	Sl. No.		Distance (approx. in km)
1	Market		7	Clinic	
2	School		8	Worship Place	
3	College		9	Agriculture Market	
4	Primary Health Center		10	Community Center/Hall	
5	District Health Center		11	Place of Work	
6	Private Hospital				

29. House Hold Items:

Sl. No.		Yes / No	
		Yes	No
1	TV	Yes	No
2	Refrigerator	Yes	No
3	Two Wheeler	Yes	No
4	Four Wheeler	Yes	No
5	Telephone/Mobile Phone	Yes	No
6	Washing Machine	Yes	No

Sl. No.		Yes / No	
		Yes	No
7	Food processor / Mixer / Grinder	Yes	No
8	Computer / Laptop	Yes	No
9	Air Conditioner	Yes	No
10	Air Cooler	Yes	No
11	Microwave Oven	Yes	No

Drawing:

LHS	Sketch of Structure	RHS
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		
:		

Note for Enumerators:

- [1] Q.No.3 Confirm the availability of Patta and mark as owned / encroachments.
- [2] Q.No.3 Squatter: No legal ownership over the land occupied.
- [3] Q.No.20: All the relationship should be specified with respect to the household head only.
- [4] Specify the distance from Centre Line to the property Boundary and Building Line. Mention all the dimensions of the building and plot boundaries in meters only.
- [5] Women Headed Household: The households not headed by husband or father.

Assamese Version

অসম ৰাজ্যিক পথ প্ৰকল্প (এ. এছ. আৰ. পি)

পি. এ. পি. এছৰ জন গণনা আৰু আৰ্থ সামাজিক সমীক্ষা

প্ৰাৰ্থনা নং তাৰিখ
 অনুসন্ধানকাৰিৰ নাম
 পৰ্যবেক্ষকৰ নাম

চিহ্নাঙ্ক নং চেইফেৰ ডেজৰ লাইনৰ পৰা অৱায় দূৰত্ব
 ঠিকনা গাও ব্লক জিলা
 ফোন নং মহিলা নং অৱস্থা চকী ডাঙৰাৰ
 ১. বাহাৰৰ প্ৰকাৰ :

১	অৱস্থান	২	বৰ্গীকৃত	৩	মিডিয়াম (কম্বাৰ্বা)	৪	উন্নয়নিক	৫	পেট্ৰিয় পাম্প	৬	পায়ল	৭	চৰকাৰী
৮	কৃষি	৯	লক্ষ্য	১০	নিৰ্মিত	১১	বালী বেৰ	১২	বুকুপাম্প	১৩	গোৱালি	১৪	পৰীয়া
১৫	আবহন	১৬	সহযোগিতা সম্পত্তি	১৭	ফুৰ বেৰ	১৮	অন্যান্য (.....)						

২. প্ৰকল্পৰ বাবে হোৱা ক্ষতিৰ প্ৰকাৰ :

১	স্বত্ব	২	মটি	৩	মাটি অক-এক্স	৪	জীৱন ক্ষতি	৫	অন্যান্য (.....)
---	--------	---	-----	---	--------------	---	------------	---	------------------

৩. সম্পত্তিৰ প্ৰকাৰ :

১	ভাৰতপত	২	চৰকাৰী	৩	শাস	৪	শ্ৰমিক	৫	স্বত্বাধাৰ	৬	অন্যান্য (.....)
---	--------	---	--------	---	-----	---	--------	---	------------	---	------------------

৪. সম্পত্তি গ্ৰহণকাৰীৰ স্থিতি :

১	পৰ্বকী	২	কোৱ	৩	জীৱ	৪	জগতীয়া	৫	বেশখৰ	৬	মুণী ছপুৰি	৭	আংশিক স্বত্বাধিকাৰী	৮	অন্যান্য
---	--------	---	-----	---	-----	---	---------	---	-------	---	------------	---	---------------------	---	----------

৫a. সন্মতিৰ নাম : ৫b. ১৫৭ মাটিৰ পৰিমাণ :
 পোতা জৰা বিলা একৰ হেটৰ

৬. প্ৰকল্পৰ প্ৰকাৰৰ পৰিসৰ :

১	আংশিক	২	সম্পূৰ্ণ
---	-------	---	----------

৭a. মূল আয়ুৰ্ণ হৰা ৭b. কলমে কৰা কিমান বছৰ হ'ল
 ৭c. মূল বুকুৰিৰ নাম ৭d. কিছৰ নাম
 ৮. যদি জগতীয়া ন'বলড, তেন্তে কলমে :
 মালিকৰ নাম
 ৯. যদি জগতীয়া ন'বলড, তেন্তে কলমে :
 মালিকৰ নাম
 ১০. যদি জগতীয়া ন'বলড, তেন্তে কলমে :
 মালিকৰ নাম
 ১১. সম্পত্তিৰ পৰিমাণ :

ক্রমিক নং	সম্পত্তি	সম্পত্তিৰ সংখ্যা	কলমে নং	সম্পত্তি	সম্পত্তিৰ সংখ্যা	ক্রমিক নং	সম্পত্তি	সম্পত্তিৰ সংখ্যা
১	১৫		১	মহাজা		১৩	আছাৰী গুৰ	
২	১৬		৮	মটি পাম্প		১৪	বেশখৰ ফল	
৩	১৭		২	সীমান বেৰ		১৫	মোসাই থকা	
৪	১৮		১০	জীৱা-তীৰ		১৬	গছৰ তলৰ স্থল	
৫	১৯		১১	জীৱ-কল		১৭	চাহৰ বোজন	
৬	২০		১২	গোৱালি		১৮	গা ধোৱা ঘৰ	

১২. নিৰ্বাচনৰ বাহাৰৰ হোৱা সামগ্ৰী :

বছৰ	ইলেক		বীজ		পেট		জীৱ		ইটা		অন্যান্য	
	(১)	(২)	(৩)	(৪)	(৫)	(৬)	(৭)	(৮)	(৯)	(১০)	(১১)	
মুঠ												
স্থিতি												

১৩. বাহাৰপ্ৰতিৰ লক্ষ্য তলত উল্লেখিত কি আছে :

ক্রমিক নং	লক্ষ্য	দৃষ্টিৰ সীমাবদ্ধতা তলত	অৱস্থা
১	জেন কাৰ্ড		নাই
২	মহাজা চিনাক্তকৰণ কাৰ্ড		আছে
৩	বিজুলী বিল		নাই
৪	বৈশ্ব সচি পত্ৰ		আছে
৫	এন. এন. ই. এছ. প্ৰকল্পৰ নাম চাকৰি চিনাক্তকৰণ কাৰ্ড		আছে

১৪. সামাজিক ক্ষেত্ৰী বিকাশ :

১	আসুৰীত ব্যক্তি	২	অসুৰীত অসুৰীত	৩	অসুৰীত অসুৰীত	৪	অসুৰীত অসুৰীত	৫	অসুৰীত অসুৰীত
	(১)	(২)	(৩)	(৪)	(৫)	(৬)	(৭)	(৮)	

১৫. যদি পি. এ. এছৰ অনুমতিত ছাতি/অন্যদৰে ভেদে সম্পত্তিৰ নামটো উল্লেখ কৰক :

১৬. বাহাৰপ্ৰতিৰ লক্ষ্য তলত উল্লেখ কৰাৰ বাবে যদিহে অন্য বাহাৰ, তেন্তে উল্লেখ কৰক :

ক্র. নং	ক্ষেত্ৰ	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
১	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
২	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
৩	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
৪	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
৫	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ
৬	অসুৰীত	বাহাৰপ্ৰতিৰ লক্ষ্য	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ	বাহাৰ



18. বাতাসায়তন বিস্তৃতিৰ কথা নুশিকিব পৰিমাণ (মেটা/ঘণ্টা) টকা ২.....

19. সামগ্ৰিক সূচক (টিকাত) ১ মানি সূচক..... যকৰ সূচক.....

20. কৰন মণ্ডলীৰ লম্বত অক্ষত বেগুৰা টিকা ১

Table with multiple rows and columns containing numerical data for environmental assessment metrics. The table is divided into sections for 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', and 'কালিমান্দৰ অক্ষত'. It includes various sub-sections like 'কালিমান্দৰ অক্ষত', 'কালিমান্দৰ অক্ষত', and 'কালিমান্দৰ অক্ষত'.



21. পূৰ্বৰ সংস্কৰণৰ প্ৰকাৰ :

ক্রমিক নং	সংশোধনৰ বস্তু	প্ৰাৰম্ভিক সংস্কৰণ (১৭)	সংশোধনৰ পিছত
১	সিদ্ধান্ত		
২	প্ৰকল্প বিৱৰ্তনৰ সময়ত কৰা সলনি		
৩	প্ৰকল্প বিৱৰ্তনৰ সময়ত কৰা সলনি		
৪	কৌশল প্ৰস্তুতকৰণৰ বাবে প্ৰকল্প		

22. কৃষি প্ৰকল্পৰ আৱিষ্কাৰৰ সন্দৰ্ভত সন্দেহিত :

কৃষিক্ষেত্ৰৰ সন্দেহিত (সন্দেহিত স্থান)				সংৰক্ষণৰ সন্দেহিত				
অনুসন্ধান কৰা কৃষি	সংৰক্ষণ কৰা কৃষি	প্ৰতিবেদন/অন্যান্য প্ৰমাণ	সংৰক্ষণ	সংৰক্ষণৰ স্থান	সংৰক্ষণৰ প্ৰকাৰ	সংৰক্ষণৰ প্ৰকাৰ	সংৰক্ষণৰ প্ৰকাৰ	সংৰক্ষণৰ প্ৰকাৰ
মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা
মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা	মহিলা

23. কৃষি সন্দেহিত :

কৃষিৰ প্ৰকাৰ	কৃষিৰ প্ৰকাৰ	কৃষিৰ প্ৰকাৰ	কৃষিৰ প্ৰকাৰ

24. কৃষিক্ষেত্ৰৰ ব্যৱস্থা (পৰিষ্কাৰ টকাৰত)

ক্রমিক নং	ব্যৱস্থা	ক্ৰমিক নং	ব্যৱস্থা
১	জল (মহিলা)	৬	জল (মহিলা/বহু-কোণীয়া)
২	জল (মহিলা/বহু-কোণীয়া)	৭	জল ইন্ধন (মহিলা)
৩	জল (মহিলা/বহু-কোণীয়া)	৮	সামগ্ৰিক অনুষ্ঠান (বহু-কোণীয়া)
৪	জলীয় অংশ (মহিলা)	৯	জলীয় অংশ (মহিলা/বহু-কোণীয়া)
৫	জলীয় অংশ (মহিলা)	১০	জলীয় অংশ (মহিলা/বহু-কোণীয়া)

25. জল (পৰিষ্কাৰ টকাৰত)

ক্রমিক নং	জল	ক্রমিক নং	জল
১	জল	৬	জল
২	জল	৭	জল
৩	জল	৮	জল

26. জল (পৰিষ্কাৰ টকাৰত)

ক্রমিক নং	জল	ক্রমিক নং	জল
১	জল	৬	জল
২	জল	৭	জল

27. জলীয় অংশ (বহু-কোণীয়া/বহু-কোণীয়া)

ক্রমিক নং	জলীয় অংশ	ক্রমিক নং	জলীয় অংশ
১	জলীয় অংশ		
২	জলীয় অংশ		
৩	জলীয় অংশ		

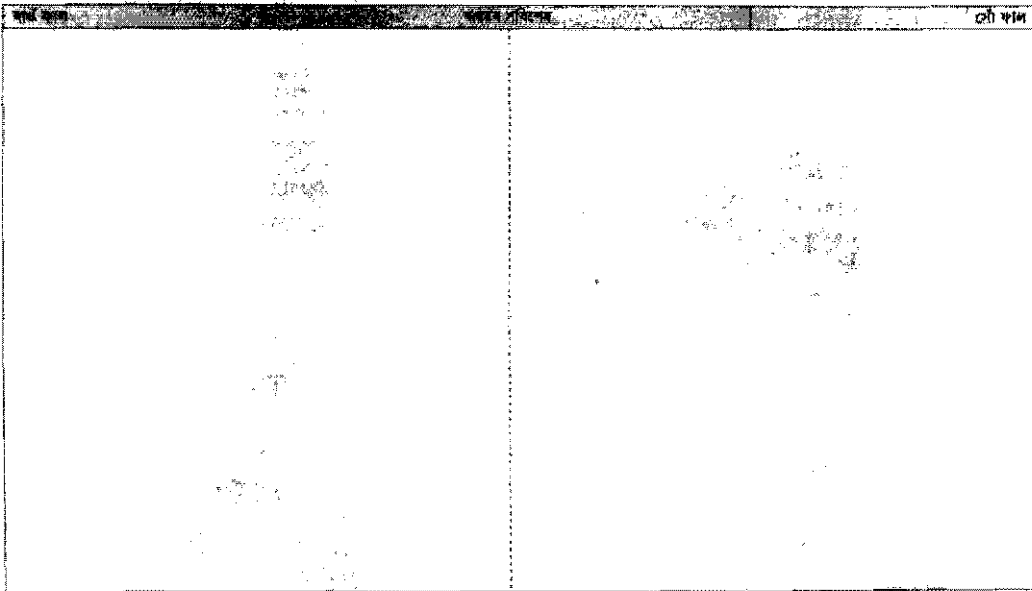
28. জলীয় অংশ (পৰিষ্কাৰ টকাৰত)

ক্রমিক নং	জলীয় অংশ	ক্রমিক নং	জলীয় অংশ
১	জলীয় অংশ	৫	জলীয় অংশ
২	জলীয় অংশ	৬	জলীয় অংশ
৩	জলীয় অংশ	৭	জলীয় অংশ
৪	জলীয় অংশ	৮	জলীয় অংশ
৫	জলীয় অংশ	৯	জলীয় অংশ
৬	জলীয় অংশ	১০	জলীয় অংশ
৭	জলীয় অংশ	১১	জলীয় অংশ

29. জলীয় অংশ (পৰিষ্কাৰ টকাৰত)

ক্রমিক নং	জলীয় অংশ	ক্রমিক নং	জলীয় অংশ
১	জলীয় অংশ	৫	জলীয় অংশ
২	জলীয় অংশ	৬	জলীয় অংশ
৩	জলীয় অংশ	৭	জলীয় অংশ
৪	জলীয় অংশ	৮	জলীয় অংশ
৫	জলীয় অংশ	৯	জলীয় অংশ
৬	জলীয় অংশ	১০	জলীয় অংশ
৭	জলীয় অংশ	১১	জলীয় অংশ

ৰেখা চিত্ৰ ১



টোকা ১ (অনুসন্ধানকাৰীক বাবে)

- (১) Q.No.3 - পত্ৰী নথৰ অৱস্থানে নাই নিশ্চিত কৰাৰ আৰু তাৰ ক্ষতিত ব্যক্তিজন জনততে সম্পৰ্কিত অধিকাৰী
সে প্ৰেৰণকাৰী উল্লেখ কৰক।
- (২) Q.No.3 - চুপী ছ'লুনি - (হাটৰ মৰীচক নথক। কৰালাকাৰী।)
- (৩) Q.No.20 ৰ সকলোকেৰে সৰ্ব্বমুঠ পৰিষ্কাৰটোৰ মুৰব্বীজনৰ লগত তথ্য ক্ৰমিত কৰি উল্লেখ কৰিব লাগিব।
- (৪) চেঞ্জৰ লাইনৰ পৰা হেৰাল্ডেৰে বাঁহা আৰু মৰু মৰু পথকে উল্লেখ কৰক। ঘৰ আৰু শীয়াৰ বৈৰ্ণা-প্ৰায়
পথকে বেৰা চিত্ৰত উল্লেখ কৰক। সকলোবোৰ ছোৰা হিটানত প্ৰকাশ কৰক।
- (৫) মহিলা মুৰব্বীৰ নামৰ : বি.বনৰ মুৰব্বী শ্ৰীমতী য় শিত্ৰ নহয়।



ANNEXURE 5: Guidelines for Environmental Management

GUIDELINE-1: SITE PREPARATION

1. GENERAL

The preparation of site for construction involves: (i) clearing of land required for construction; and (ii) management of activities such as traffic during construction. These activities have been detailed out for road construction activities separately.

2. ROAD CONSTRUCTION

2.2 Site Preparation Activities

After obtaining the consent of the community on the alignment, the Project Implementation Unit (PIU) of the Divisional Office shall be responsible to stake out the alignment by establishing working benchmarks on ground. It shall be the responsibility of the PIU to take over the possession of the proposed RoW and hand over the land width required clear of all encumbrances to the Contractor. Activities pertaining to the clearance of land and relocation of utilities need to be initiated by the PIU well in advance to avoid any delays in handing over of site to the Contractor. Assistance of the Revenue Department shall be sought in accomplishing the task. To summarize, the PIU's responsibilities before handing over the site to the contractor include:

- Clearance of encroachments within proposed RoW;
- Initiation of process for legal transfer of land title;
- Alignment modification or Relocation of common property resources in consultation with the local community;
- Alignment modification or Relocation of utilities in consultation with the various government departments; and
- Obtain clearances required from government agencies for
 - Cutting of trees; and
 - Land Diversion of forestlands, etc.

2.2 Site Preparation Activities by the Contractor

Site preparation shall involve formation of the road base wherein it is ready for construction of protective/drainage works, carriageway, shoulders, parapets and other road furniture. The PIU shall transfer the land for civil works to the Contractor after peg marking of the alignment.

The Contractor shall verify the benchmarks soon after taking possession of the site. The Contractor, prior to initiation of site preparation activities, shall highlight any deviations/discrepancies in these benchmarks to the PIU in writing. The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PIU for approval. The Contractor shall commence operations at site only after the approval of the schedules by the PIU.

The activities to be undertaken by the contractor during the clearing and grubbing of the site are as follows:

The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures: (i) Limiting the surface area of erodible earth material exposed by clearing and grubbing; (ii) Conservation of top soil and stock piling as per the measures suggested as part of **Guideline 4**, "Top Soil Salvage Storage and Replacement"; and (iii) Carry out necessary backfilling of pits resulting from uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.

Annexure 5

To minimize the adverse impact on vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed. Cutting of trees and vegetation outside the working area shall be avoided under all circumstances. In case the alignment passes through forest areas, The Forest Ranger shall be consulted for identification of presence of any rare/endangered species within the proposed road way. Protection of such species if found shall be as per the directions of the Forest Department.

The locations for disposal of grubbing waste shall be finalized prior to the start of the works on any particular section of the road. The selection of the site shall be approved by the PIU. The criteria for disposal of wastes shall be in accordance with the measures given in Guideline on, "Waste Management and Debris Disposal" (**Guideline 8**).

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

Dismantling of CD structures and culverts shall be carried out in a manner as not to damage the remaining required portion of structures and other surrounding properties. The disposal of wastes shall be in accordance with the provisions given in **Guideline 8**, "Waste Management and Debris Disposal". The following precautions shall be adopted: (i) The waste generated shall not be disposed off in watercourses, to avoid hindrance to the flow, and (ii) All necessary measures shall be taken while working close to cross drainage channels to prevent earthwork, stonework as well as the method of operation from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.

The designated sites duly approved by Implementing Agency shall be cleared of its existing cover for setting up of the construction sites, camps and related infrastructure facilities, borrow areas and other locations identified for temporary use during construction. The contractor shall comply with all safety requirements in consideration as specified in the **Guideline 12** on, "Labour & Worker's Health and Safety". Before initiation of site preparation activities along these lands to be used temporarily during construction, it shall be the responsibility of the Contractor to submit and obtain approval of the site redevelopment plan from the implementing agency. The letter/contract agreement between the owner(s) of the land parcel for temporary usage shall include site redevelopment to its original status. The guidelines for the same are furnished in the Guideline on, "Construction Plants & Equipment Management"; guideline, "Construction and Labour Camps"; and "Borrow areas".

2.2 Traffic management during construction

Traffic management during construction is an activity specific to the contractors. Contractors must ensure a reasonably smooth flow of traffic during construction. The following are the general principles to be followed for traffic management during construction:

- Partial pavement construction **over long lengths will not be permitted**. The contractor should concentrate his activities over sections such that he can complete continuous fronts of up to a maximum of 1 km before starting the adjacent front. The contractor may open more than one continuous 1 km front provided that he has the separate resources to do so. The resources working on a 1 km front may not be shifted to another front until no longer required on that front.
- The construction activities should be **staggered** over sub-sections to the extent that the use of plant and equipment is optimized to maximum efficiency and to avoid idling. For road widening operations, excavation **adjacent to the existing road shall not be permitted on both titles simultaneously**. Earthworks must be completed to the level of the existing road before excavation work on the opposite side will be permitted.
- The construction operations taking place on a particular front must be managed efficiently such that delays between successive pavement layers are minimized.
- Before the start of the monsoon season (June) the contractor shall ensure that the pavement over any front is complete, full width, at least upto Dense Bituminous Macadam, DBM level, but preferably with Asphaltic Concrete, AC wearing course. The contractor **should not start any sections of pavement that he cannot complete by the start of the monsoon season**.

Annexure 5

- In the absence of permanent facilities, temporary drainage and erosion control measures, as required by the Specifications, are to be implemented prior to the onset of the monsoon.

In cases where separate traffic diversions are not essential or cost effective the construction methodology should be in accordance with the guidelines following:

On a 1km section, the pavement construction (except new alignments) should be limited to 500m subsections with a minimum of 1 to 1.5 km between successive sub-sections to ease traffic management and safety issues. The earthworks in the widening portions are not limited in, this respect. Excavation on both sides of the existing, road over the same sub-section simultaneously shall not be permitted for reasons of safety to the traffic, particularly at night.

Sub-sections longer than 500 m may be authorized by the Engineer if two-way traffic flow can be comfortably managed and the Contractor can demonstrate his ability to maintain dust control, proper road edge delineation, proper signage and traffic control. Where single file traffic is permitted ('only applicable to final wearing course operations), the sub-sections shall be reduced to a maximum length whereby safe traffic regulation can be physically managed. Single file traffic may not be permitted at certain locations or times of the day when traffic volumes are such that excessive congestion shall occur.

GUIDELINE-2: CONSTRUCTION AND LABOUR CAMPS

1. INTRODUCTION

The scope of this guideline pertains to the siting, development, management and restoration of construction and labour camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of labourers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labour camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

2. PRE-CONSTRUCTION STAGE

Identification of site for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the PIU. Table 1 gives the lands that could be avoided for construction camps and conversely those that could be preferred.

Table 1: Selection Criterion for Construction Camps.

Avoid the following ...	Prefer the following ...
<ul style="list-style-type: none"> • Lands close to habitations. • Irrigated agricultural lands. • Lands belonging to small farmers. • Lands under village forests. Lands within 100m of community water bodies and water sources as rivers. • Lands within 100m of watercourses. • Low lying lands. • Lands supporting dense vegetation. • Grazing lands and lands with tenure rights. • Lands where there is no willingness of the landowner to permit its use. 	<ul style="list-style-type: none"> • Waste lands. • Waste Lands belonging to owners who look upon the temporary use as a source of income. • Community lands or government land not used for beneficial purposes. • Private non-irrigated lands where the owner is willing. • Lands with an existing access road.

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

- a) photograph of the proposed camp site in original condition;
- b) activities to be carried out in the site;
- c) environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;
- d) detailed layout plan for development of the construction and labour camp that shall indicate the various structures to be constructed in the camp including temporary, drainage and other facilities (Figure 1 gives a layout plan for a construction camp); and
- e) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project.

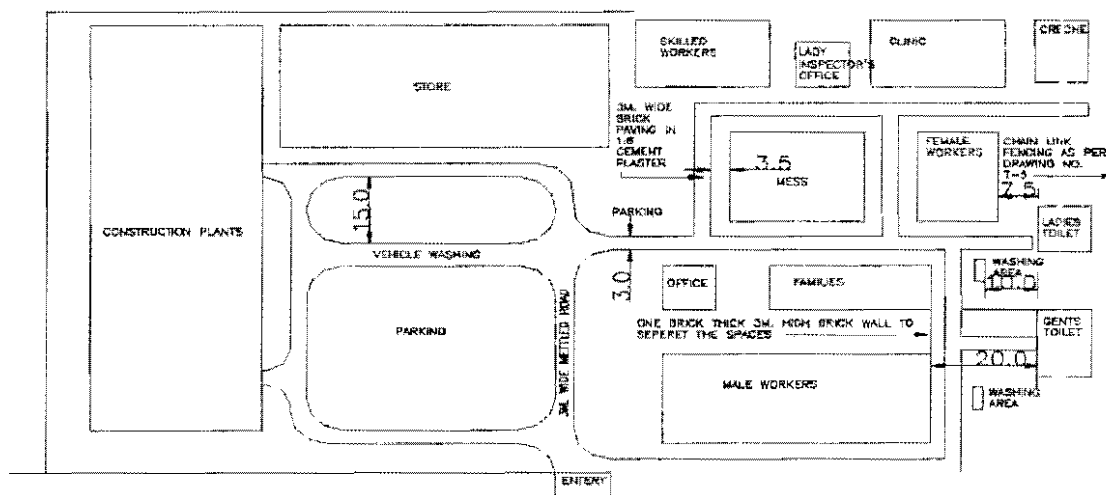


Figure 1: Layout Plan for Construction Camp

2.2 Setting up of labour camp

The contractor shall provide, free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him for complete construction/maintenance work is in progress. A minimum area of 6 sq.mts per person shall be provided. The rooms of labour shall be well lighted and ventilated. The facilities to be provided for the labour are discussed below:

a) Drinking Water

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.
- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.

b) Washing and Bathing Facilities

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

c) Toilets Facilities

Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:

- A latrine for every 15 females or part thereof (where female workers are employed).
- A latrine for every 10 males.

Annexure 5

- Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system;
- Water shall be provided in or near the latrines and urinals by storage in suitable containers.

d) Waste Disposal

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.

e) Medical and First Aid Facilities

Medical facilities shall be provided to the labour at the construction camp. Visits of doctor shall be arranged twice a month wherein routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following.
 - 6 small sterilized dressings
 - 3 medium size sterilized dressings
 - 3 large size sterilized dressings
 - 3 large sterilized burns dressings
 - 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
 - 1 (30 ml) bottle containing salvolatile
 - 1 snakebite lancet
 - 1 (30 gms) bottle of potassium permanganate crystals
 - 1 pair scissors
 - Ointment for burns
 - A bottle of suitable surgical antiseptic solution

In case, the number of labour exceeds 50, the items in the first aid box shall be doubled.

f) Provision of Shelter during Rest

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

g) Crèches

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realisation. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

2.2 Storage of Construction Material in Construction Camps

For storage of Petrol/Oil/Lubricants, brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. These should be kept away from labour residential areas. The storage of cement shall be at Damp-proof flooring, as per IS codes. All materials shall be stored in a barricaded area. In case of electrical equipments, danger signs shall be posted. The batch mix plant is to be located away from the residential area and not in the wind direction. Separate parking areas for vehicles and also workshop areas need to be provided.

2.2 Fire fighting arrangement

- The following precautions need to be taken:
- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of fire;
- Contractor shall educate the workers on usage of these equipments.

2.2 Interactions with host communities

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to labourers and residents of construction camps.

3. CONSTRUCTION STAGE

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Wastewater should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed off safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction should be kept in a designated and barricaded area.

The PIU will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the period of the contract.

4. POST CONSTRUCTION STAGE

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed off suitably (Refer **Guideline - 10** on "Waste Management and Debris Disposal").
- Ramps created should be levelled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.
- Proper documentation of rehabilitation site is necessary. This shall include the following: –Photograph of rehabilitated site;
 - Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
 - Undertaking from contractor; and

- Certification from Engineer in-charge of the PIU.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

GUIDELINE-3: BORROW AREAS

1. INTRODUCTION

Embankment fill material is to be procured from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, pre-construction, construction stage and post construction stage. Borrow areas are related only to road construction activities.

2. PROJECT PLANNING AND DESIGN STAGE

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Borrow area siting should be in compliance with IRC: 10-1961. The DPR shall contain (i) Guidelines for locating site of borrow areas (ii) The arrangements to be worked out with the land owner/community for the site and (iii) Sample designs for redevelopment of borrow areas.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the PIU. Borrowing to be avoided on the following areas:

- Lands close to toe line.
- Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. The subsequent Guidelines discuss in detail the conservation of topsoil.
- Grazing land.
- Lands within 0.8km of settlements.
- Environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands (including beel). Also, a distance of 500 m should be maintained from such areas.
- Designated protected areas / forests.
- Unstable side-hills.
- Water-bodies.
- Streams and seepage areas.
- Areas supporting rare plant/ animal species;
- Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

3.1 Arrangements for Borrow Area

The Contractor will work out arrangements for borrowing with the land owner/concerned department. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project. The Engineer of PIU shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The contractor shall commence borrowing soil only after the approval by the PIU. The contractor shall submit to the PIU the following before beginning work on the borrow areas.

- Written No-objection certificate of the owner/cultivator;
- Estimate extent of earth requires;
- Extent of land required and duration of the agreement;
- Photograph of the site in original condition; and
- Site redevelopment plan after completion.

The depth of excavation should be decided based on natural ground level of the land and the surroundings, and rehabilitation plan. In case higher depth of excavation is agreed with backfilling by

Annexure 5

unsuitable excavated soil (from roadway), then filling should be adequately compacted except topsoil, which is to be spread on the top most layer (for at least 20m thick). The guidelines for location, depth, size and shape of the borrow areas are available in the following:

- Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;
- Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989: (IRC: 104-1988);
- IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;
- IRC SP: 58-2001 guideline for use of fly ash in road construction;
- EIA manual of MoEF, 2001;
- MoEF notification on utilisation of fly ash dated 27 August, 2005.

3.2 Documentation of Borrow Pit

The contractor must ensure that following data base must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

- Chainage along with offset distance;
- Area (Sq.m);
- Photograph of the pit from all sides;
- Type of access/width/kutcha/pucca etc from the carriageway;
- Soil type;
- Slope/drainage characteristics;
- Water table of the area or identify from the nearest well, etc;
- Existing landuse, for example barren/agricultural/grazing land;
- Location/name/population of the nearest settlement from borrow area;
- Present usage of borrow area; and
- Community facility in the vicinity of borrow pit.

3.3 Redevelopment Plans for Borrow Pits

The following checklist provides guidelines in order to ensure that redevelopment of borrow areas must comply with MoRTH, clause 305.2.2.2 and EMP requirement. Borrow areas can be developed as:

- Ponds (various types) (eg: Drinking Water only; Washing and for other Domestic Chores; Only for Cattle; Mixed Uses etc.) (a large pond can be divided into two parts - each having a defined use)
- Farmland
- Water Recharging Zones
- Pastureland
- Fish Ponds (pisciculture)
- Waste disposal Sites (depending upon the location, distance from settlements, pollution risks, safety, associated environmental risks and hazards, regulations/ permissions of appropriate authority and other such factors)
- Plantation Zones
- Recreational Zones (depending upon location, size, potential of the site, willingness of the local bodies to develop it)
- Wildlife Refuge and Drinking Area (applicable only in case of sensitive environs with appropriate planning and understanding including regulation of depth for safety of animals etc.)

The rehabilitation measures for the borrow areas shall be dependent on the following factors:

- Land use objectives and agreed post-borrowing activities;
- Physical aspects (landform stability, erosion, re-establishment of drainage);
- Biological aspects (species richness, plant density,) for areas of native re vegetation;
- Water quality and soil standards; and
- Public safety issues.

Annexure 5

Rehabilitation should be simple and maintenance free. Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be: (i) Restoring the productive use of the land (ii) Development of detention ponds in barren areas.

Option I: Suitable in locations with high rainfall and productive areas

Topsoil must be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs.

Plants must be planted during the first growing season following the reclamation phase.

Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 75% survival rate.

Option II: In barren land, the borrow areas can be redeveloped into detention ponds.

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Following parameters are to be observed while setting up a detention pond:

- Pond should be located at the lowest point in the catchment area. Care should be taken that the horizontal velocity should be less than settling velocity to prevent suspension or erosion of deposited materials.
- Minimum Effective Flow Path: 5 times the effective width
- Minimum Free Board: 0.15 m
- Minimum Free Settling Depth: 0.5 m
- Minimum Sediments Storage Depth: 0.5 m
- Maximum interior slope: 2H : 1V
- Maximum exterior slope: 3H : 1V
- The inlet structure should be such that incoming flow should distribute across the width of the pond. A pre-treatment sump with a screen should provide to remove coarse sediments. Settled sediment should be removed after each storm event or when the sediment capacity has exceeded 33% of design sediment storage volume. Accumulated sediment must be disposed of in a manner, which will prevent its re-entry into the site drainage system, or into any watercourse.

4. CONSTRUCTION STAGE

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in IRC: 10-1961. In addition, the contractor should adopt precautionary measures to minimise any adverse impacts on the environment. Checklists for monitoring borrow areas operation and management has been prepared (Table 1).

Table 1: Checklist for Monitoring Borrow Area Operation and Management

Attributes	Requirements
Access Road	Access road shall be used for hauling only after approved
Top soil preservation	To soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line of the proposed embankment.

Attributes	Requirements
Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the engineer of the PIU.
Dust Suppression	Water should be sprayed on kutchā haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

5. POST CONSTRUCTION STAGE

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the PIU after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The final payment shall be made after the verification by PIU.

6. CHECKLIST FOR INSPECTION OF REHABILITATION AREA

Inspection needs to be carried out by the PIU for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the PIU is given below.

- Compliance of post-borrowing activities and land use with the restoration plan;
- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
- Levelling of the bottom of the borrow areas;
 - In case the borrow area is on private property, the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement "no responsibility of R&BD on contractor in the event of accident.
- Condition of the reclaimed area in comparison with the pre-borrowing conditions.

GUIDELINE-4: TOPSOIL SALVAGE, STORAGE AND REPLACEMENT

1. INTRODUCTION

Loss of topsoil is a long term impact along roads due to (i) site clearance and widening for road formation (ii) development of borrow areas (iii) temporary construction activities such as construction camps, material storage locations, diversion routes etc. The environmental measures for both these activities during all stages of construction activity are discussed in the subsequent sections.

2. PROJECT PLANNING & DESIGN STAGE

At the project preparation stage, the following shall be estimated: (i) Extent of loss of top soil due to widening and siting of construction activities (ii) Estimates of borrow area requirements and (iii) Area requirement for topsoil conservation. The bid document shall include provisions that necessitate the removal and conservation of topsoil at all locations opened up for construction by the Contractor.

3. PRE-CONSTRUCTION STAGE

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner/concerned department shall include the conservation / preservation of topsoil.

4. CONSTRUCTION STAGE

It shall be the responsibility of the Contractor to strip the topsoil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PIU. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. In case of hilly and desert areas, topsoil with humus wherever encountered while opening up the site for construction shall be stripped and stockpiled. The stockpiles shall be located at:

- Areas away from Grade, Subsoil & Overburden materials;
- Areas away from pit activities and day-to-day operations;
- Areas that do not interfere with future pit expansion; and
- Areas away from drainage paths and uphill of sediment barriers.

The stockpiles for storing the topsoil shall be designed such that the slope should not be less than 1:2 (Vertical to horizontal), and the height of the pile is restricted to 2m. A minimum distance of 1m is required between stockpiles of different materials.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilised within 7 days of forming. The stabilisation shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading. During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses. The Contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the Engineer.



5. POST CONSTRUCTION STAGE

The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer. The area to be covered with vegetation shall be prepared to the required levels and slope as detailed in the DPR. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material. The top soil can also be used for the following purposes:

- a. Covering the borrow areas;
- b. Embankment and turfing;
- c. Median; and
- d. Rehabilitation of construction and labour camp.

GUIDELINE-5: QUARRY MANAGEMENT

1. INTRODUCTION

This guideline pertains to the measures to be taken to address environmental concerns in quarry areas. The general practice adopted is to procure materials from existing quarries operating with the requisite permits. The measures to be taken for operation and management for quarries during all stages of construction have been discussed in this Guideline.

2. PROJECT PLANNING AND DESIGN STAGE

The PIU shall provide in the DPR / bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, the DPR shall contain the following: (i) Quantity of materials available in quarries (ii) Lead from the various existing quarries and (iii) Adequacy of materials for the project in these quarries. Table 1 and 2 give the format for preparing a list of quarries.

Table 1 Details of Sand Quarry

Sample No.	Source of Sand	Name of quarry area	Site Identification/ Location			Approximate Quantity (cum)	Approximate basic cost of the material (Rs.)	Remarks
			Nearest Chainage (Km.)	Left/Right	Offset from nearest chainage (km)			

Table 2 Details of Quarry Area for Aggregates

Sample No.	Chainages(Km.)	Left/Right	Name of Quarry Area	Name of Crusher	Lead from nearest chainage (Km.)	Basic cost of the material (Rs.)	Available land/terrian	Surrounding land Terrian	Remarks

Only in the event of non-availability of existing quarries, the Contractor shall open a new quarry in accordance with Mines and Minerals (Development & Regulation) Act, 1957. The bid document shall include the exhaust quarry reclaim plan per needs of the landowner / community.

3. PRE-CONSTRUCTION STAGE

The Contractor shall select an existing licensed quarry identified in DPR for procuring materials. The Contractor shall establish a new quarry with the prior consent of the PIU only in cases when: (i) Lead

Annexure 5

from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the PIU.

The construction schedule and operations plans to be submitted to the PIU prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

4. CONSTRUCTION STAGE

4.1 Development of Quarry Area

To minimize the adverse impact during excavation of material following measures are need to be undertaken:

- Adequate drainage system shall be provided to prevent the flooding of the excavated area
- At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
- Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
- The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
- In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

4.2 Setting up of Crushers and other equipments

The following measures shall be undertaken for setting up of crushers are other equipments.

- The contractor shall obtain "No Objection Certificate (NoC)" from the Assam State Pollution Control Board.
- All vehicles must possess Pollution Under Control (PUC) Certificate and shall be renewed accordingly
- All machinery, equipments, and vehicles shall comply with existing CPCB noise and emission norms.
- The PIU must ensure that contractor shall submit the copy of NoC and PUC Certificate before the start of work.

4.3 Quarry operations

The followings precautions shall be undertaken during quarry operations. vii) Overburden shall be removed and disposed as per **Guideline 8** "Waste Management and Debris Disposal".

- During excavation slopes shall be flatter than 20 degrees Guideline 8 on to prevent their sliding
- In case of blasting, the procedure and safety measures shall be taken as per The Explosive Rules, 1983
- The Contractor shall ensure that all workers related safety measures shall be done as per measures for, "Labour & Workers Health & Safety" (**Guideline 12**).
- The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.
- Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in **Guideline 4**, "Topsoil Salvage, Storage & Replacement."
- During transportation of the material, measures shall be taken as per **Guideline 11** "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents
- The PIU and the concerned authority shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

5. POST CONSTRUCTION STAGE

A quarry redevelopment plan shall be prepared by the Contractor. All haul roads constructed for transporting the material from the quarries to construction site shall be restored to their original state.

The PIU and the concerned authority shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.

The plan shall include:

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site
- Safety measures during quarry operation
- Design for redevelopment of exhaust site.

Two options for redevelopment of quarry areas are given below:

Option A: Revegetating the quarry to merge with surrounding landscape. This is done by conserving and reapplying the topsoil for the vegetative growth.

Option B: Developing exhausted quarries as water bodies. The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/ natural drainage slopes towards it.

GUIDELINE-6: WATER FOR CONSTRUCTION

1. INTRODUCTION

The scope of this guideline includes the procurement of water required for construction of roads. Except bituminous works, water is required during all stages of road construction such as Embankment Sub-Grade; Granular sub-base (GSB) and Water Bound Macadam (WBM). Management of water in various stages of construction is given in the following sections.

2. PROJECT PLANNING & DESIGN STAGE

- The Detailed Project Report for both road constructions shall contain the following information:
- Estimate of water requirement during different seasons based on construction schedule of various stages of construction.
- Identification of potential sources of water for construction,
- Arrangements to be worked out by the contractor with individual owners, when water is obtained from private sources, and
- Whether scarcity of water would have any impact on schedule of construction.



In water scarce regions, if water-harvesting structures are to be constructed, suitable locations and mechanism for siting these structures will be identified. These are envisaged to be permanent water tanks for collection of stream water. Detailed drawings of water harvesting structures based on site conditions will need to be worked out and presented in the DPR. No extra payment shall be generally made for these works and the Contractor has to include the cost of these items in his offer while quoting his tendered rate.

Scheduling Construction in Water Scarce Areas: As part of the project preparation, the PIU shall conduct an assessment of water requirement and availability in water scarce regions. As far as possible, schedule for construction in these water scarce areas shall be prepared such that earthwork for embankment is carried out just before monsoon, so that water requirement for subsequent construction works such as granular sub-base and water bound macadam are met in monsoon and post monsoon season. Carrying out these activities even during the monsoon is possible as the rainfall may not be high enough to disrupt construction.

3. PRE-CONSTRUCTION STAGE

Prior to commencement of extraction of water for construction, the contractor shall work out arrangements as specified in the DPR.



4. CONSTRUCTION STAGE

During construction, the Contractor shall be responsible to monitor the following:

- The arrangements worked out with the Panchayat/individual land owners for water extraction is adhered to;
- Extraction of water is restricted to construction requirement and domestic use of construction workers;
- Water requirement for curing of concrete shall be minimized by pooling of water over the concrete or by covering with wet gunny bags; and
- The potable water used for drinking purposes of construction workers shall be as per the Indian Standard for Drinking Water IS: 10500, 1991.

GUIDELINE-7: SLOPE STABILITY AND EROSION CONTROL

1. INTRODUCTION

Stability of slopes is a major concern in locations of high embankment. In cases of high embankment, water retention at the embankment base initially causes toe failure and subsequently failure of the whole embankment. Soil erosion is consequent to high runoff on hill slopes. Embankments made up of silty and sandy soils get eroded, in the absence of vegetative cover, when the slopes are steep say more than 20 Degree.

The scope of this guideline includes measures to minimize the adverse environmental impacts due to slope instability and soil erosion. The adverse environmental impact can be: (i) Damage to adjacent land, (ii) Silting of ponds and lakes disturbing the aquatic habitat (iii) Erosion of rich and top fertile top layer of soil (iv) Contamination of surface water bodies and (v) Reduction in road formation width due to erosion of shoulders/berms.

2. PROJECT PLANNING AND DESIGN STAGE

During the detailed project preparation phase, the following investigations shall be carried out prior to finalisation of alignment.

- Topographical;
- Hydrological;
- Geo-technical; and
- Geological Investigation (in case of roads in hill areas and areas of high seismic activity)

In addition to the slope stability analysis the alignment should be such that (i) steep as well as heavy cuts are avoided, (ii) Flora and fauna of the area are not disturbed and (iii) Natural drainage pattern is not obstructed.

For high embankments, geo-technical investigations (determination of C, ϕ , density etc.) of the available material need to be done to check its suitability as fill material.

In case of the CD structures, measures for preventing siltation and scouring shall be undertaken as per Guideline on, "Drainage".

Following guidelines shall be followed in desert areas while using cohesion-less soils for embankment construction.

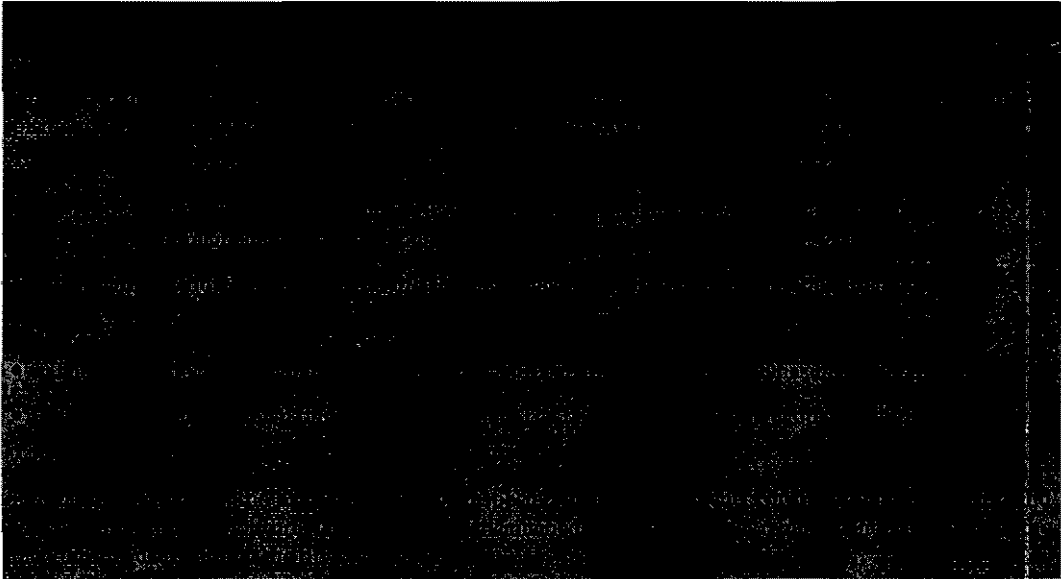
- The alignment should follow the natural ground level to the extent possible and the embankment shall be restricted to minimum to achieve ruling grades.
- Slope of the embankment should be 3 (H): 1(V) or flatter.
- The corners of the embankment should be rounded for better aerodynamic performance.

3. PRE-CONSTRUCTION STAGE

Interceptor ditches are constructed along hilly slopes or areas with high rainfall to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff. Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed. These are the structures designed to intercept and carry surface run-off away from erodible areas and slopes, thus reducing the potential surface erosion. The PIU must ensure that the layout and siting of ditches is as per specifications.

4. CONSTRUCTION STAGE

When alternative material such as fly ash is used for embankment formation, it needs to be ensured that sufficient filter bed is provided along with the top cap. All tests as per IS: 2720 (Parts: 4, 5, 8 & 40) and IRC: SP: 20-2002 are to be conducted on the embankment to keep a check on the compaction achieved. Slope stabilisation techniques and erosion control measures such as vetiver grass, stone pitching, use of geotextile and turfing.



5. POST CONSTRUCTION STAGE

All the exposed slopes shall preferably be covered with vegetation using grasses, brushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

In case of steep and barren slopes, in order to retain the seedling to the ground asphalt mulch treatment shall be given. Seedling are covered with asphalt emulsion and spread into a thin layer. The asphalt film gradually disintegrates and a carpet of green vegetation and deep-rooted species of grass and clovers, takes its place. Anchoring shall be carried out as per IRC: SP: 48-1998.

Regular inspection of check dams and repositioning/replacement of dislodged or stolen stones need to be carried out.

Repair and maintenance of eroded side drain inverts is to be done in order to arrest retrogradation of levels in side drains. Slopes of high embankment can give a fertile base for growth of vegetative cover / sodding.

In arid areas, in order to avoid the deposition of sand over or near the road surface, shrubs are to be planted at an appropriate distance from the formation. The shrubs should not be abutting the road and the distance for carrying out plantation shall be determined based on prevalent wind speeds as well as quantity of sand being carried amongst various other factors. There should be a clear gap between the roadway and shrubs to allow the wind to pick up its velocity and carry along with it any sand that is deposited.

GUIDELINE-8: WASTE MANAGEMENT AND DEBRIS DISPOSAL

1. INTRODUCTION

This guidance describes procedures for handling, reuse and disposal of waste materials during road construction. The Guideline describes waste management measures in all stages of construction. Also, the Guideline discusses the measures to be taken for debris disposal.

2. PROJECT PLANNING AND DESIGN STAGE

As part of DPR preparation, the PIU shall carry out the following measures

- Finalize road design and alignment to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible reuse
- Provide guidelines to the contractor for locating waste disposal sites for non-toxic wastes
- Identify existing landfill sites if available for disposal of toxic materials.
- In case no existing landfill sites are available, identification of landfill site as well as identification of the clearance requirements.
- Identify sites of disposal of debris.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the activities during construction, that have the potential to generate waste and work out measures for reducing, reusing and proper disposing of the generated waste in the construction schedule to be submitted to the PIU. A sequential listing of the activities during road construction and the nature of wastes together with the possible options for reuse are specified in **Table-1**. For the disposal of excess cut and unsuitable (non-toxic) materials, the contractor shall identify the location for disposal in consultation with the community / concerned department. Any toxic materials shall be disposed in existing landfill sites that comply with legislative requirements. Prior to disposal of wastes onto private/community land, it shall be the responsibility of the Contractor to obtain a No-objection Certificate (NOC) from the land owner/community. The NOC shall be submitted to the PIU prior to commencement of disposal.

Practices to avoid – waste disposal ...

- Tipping of waste into stream channels, water bodies, forests and vegetated slopes
- Non-cleaning of wastes after day's work
- Leaching of wastes
- Littering in construction camps / sites
- Storing wastes on private land

The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

4. CONSTRUCTION STAGE

The contractor shall either reuse or dispose the waste generated during construction for roads depending upon the nature of waste, as specified in **Table 1**. The reuse of waste shall be carried out by the contractor only after carrying out the specific tests and ascertaining the quality of the waste materials used, and getting the same approved by the PIU. Wastes that were not reused shall be disposed off safely by the contractor. The contractor shall adopt the following precautions while disposing wastes:

- Bituminous wastes shall be disposed off in 60mm thick clay lined pits and covered with 30cm good earth at top, so as to facilitate growth of vegetation in long run.
- In case of filling of low-lying areas with wastes, it needs to be ensured that the level matches with the surrounding areas. In this case care should be taken that these low lying areas are not used for rainwater storage

Annexure 5

- In case oil and grease are trapped for reuse in a lined pit, care shall be taken to ensure that the pit should be located at the lowest end of the site and away from the residential areas.

The waste management practices adopted by the Contractor, including the management of wastes at construction camps etc shall be reviewed by the PIU and the Pollution Control Board (PCB) during the progress of construction.

5. POST CONSTRUCTION STAGE

On decommissioning of construction sites, the Contractor shall hand over the site free of all debris/wastes to the satisfaction of PIU. In case of any temporary disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The same is to be submitted to the PIU before final payment is claimed.

Table 1: Type of wastes and scope for reuse- road construction

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
I	CONSTRUCTION WASTES			
1.	Site Clearance and grubbing	Vegetative cover and top soil	Vegetating embankment slopes	
		Unsuitable material in embankment foundation	Embankment Fill	Low lying areas Land fill sites
2.	Earthworks			
a)	Overburden of borrow areas	Vegetative cover and soil	Vegetating embankment slopes	
b)	Overburden of quarries	Vegetative cover and soil	Vegetating embankment slopes	
		Granular material	Embankment Fill, Pitching	
c)	Accidental spillages during handling	Dust		
d)	Embankment construction	Soil and Granular Material	Embankment Fill	
e)	Construction of earthen drains	Soil	Embankment Fill	
3.	Concrete structures			
a)	Storage of material	Dust, Cement, Sand	Constructing temporary structure, embankment fill	
		Metal Scrap		Scrap Yard
b)	Handling of materials	Dust		
c)	Residual wastes	Organic matter	Manure, Revegetation	
		Cement, sand	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail	
4	Reconstruction works			
a)	Dismantling of existing pavement	Bitumen Mix, granular material	sub-base	
		Concrete	Road Sub-base, reuse in concrete, fill material and as rip rap on roads	
		Guard rail sign post, guard stone	Reuse for same	
b)	Dismantling of cross drainage structures	Granular material & bricks	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail Culvert	
		Pipes	Culvert	
5	Decommissioning of sites			
a)	Dismantling of temporary structures	Granular material and bricks	Constructing temporary structure, embankment fill	

Annexure 5

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
6	Maintenance operation			
a)	Desilting of side drains	Organic matter and soil	Revegetation	
II OIL AND FLUIDS				
1	Construction machinery – maintenance and refuelling	Oil and Grease	Incineration, Cooking, Illumination	
2	Bituminous works			
a)	Storage	Bitumen	Low Grade Bitumen Mix	
b)	Mixing and handling	Bitumen	Low Grade Bitumen Mix	
		Bitumen Mix	Sub-base, Paving access & cross roads	
c)	Rejected bituminous mix	Bitumen Mix	Sub-base, Paving access & cross roads	
III DOMESTIC WASTES				
1	Construction camps	Organic waste,	Manure	
		Plastic and metal scrap		Scrap Yard
		Domestic effluent	Irrigation	

6. DISPOSAL OF DEBRIS

For the purpose of disposal of debris, dumping sites need to be selected. The criteria for selection of dumping sites include:

- No residential areas are located downwind side of these locations;
- Dumping sites are located at least 1000 m away from sensitive locations;
- Dumping sites do not contaminate any water sources, rivers etc; and
- Dumping sites have adequate capacity equal to the amount of debris generated;
- Public perception about the location of debris disposal site has to be obtained before finalizing the location;
- Permission from the Village Panchayat is to be obtained for the dumping site selected;
- Productive lands are avoided; and
- Available waste lands shall be given preference

GUIDELINE-9: WATER BODIES

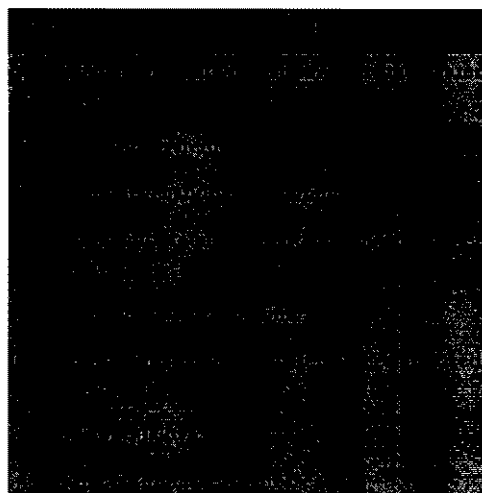
1. INTRODUCTION

Water bodies may be impacted when the road construction is adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

- Earth moving;
- Removal of vegetation;
- Vehicle/Machine operation and maintenance;
- Handling and laying of asphalt; and
- Waste disposal from construction camps.

2. PROJECT PLANNING AND DESIGN STAGE

All efforts are to be taken to avoid the alignments passing adjacent or close to water bodies. Where possible, it should be realigned away from the water body without cutting its embankment, decreasing the storage area or impairing the catchment area. Adequate drainage arrangements as per IRC guidelines have to be provided. Stream bank characteristics and hydrology of the area are to be studied before finalizing the alignment, the profile and cross-drainage structures.



Complete filling of water body with soil is not contemplated in the project. The DPR and its cost estimates have to accommodate costs of rehabilitation (to be estimated as lump sum at DPR stage) of water bodies impacted by the project. Water body rehabilitation shall be as per the Rehabilitation Plan prepared by the Contractor which should have approval of the PIU. Details of the tasks to be performed as per the sequence of activities during the project planning and design are as follows:

- Consultations with the people regarding alternate routes that were devised to avoid the pond. If alternate routes are not available, consent of the villagers is to be sought for affecting the pond and also the measures that would be taken to mitigate the impacts.
- Final design is to be prepared indicating the pond location in the alignment drawings.
- If impacting the pond, the extent of impact is to be clearly indicated on a separate drawing showing blown up portion of the pond. The drawing should aid the contractor in setting up exact lines for cutting the pond.
- All necessary measures for mitigation of impacts and precautionary measures while working close to the water body are to be incorporated into the DPR and cost estimates. The measures to be incorporated shall be as per this guideline.

PRE-CONSTRUCTION STAGE

The Contractor after an assessment of the likely impacts on the water body and review of the provisions of this guideline shall prepare a detailed work plan at the pre-construction stage. The Contractor shall prepare a Rehabilitation Plan for rectifying the likely impact to be caused and approval of PIU shall be sought prior to commencement of work. The Rehabilitation Plan should include:

- Locations of erosion protection works and silt fencing to prevent sediment laden runoff entering the water body;
- Location of side drains (temporary or otherwise) to collect runoff from the embankment before entering the water body in accordance with IRC guidelines;
- Work program in relation to the anticipated season of flooding/overflowing of the water body;

Annexure 5

- Obstructions likely to cause temporary flooding and information to seek clearance to remove the obstruction; and
- Drawings in Rehabilitation Plan should indicate the landscape details along with species to be planted in the surrounding environs of the water body.

The rehabilitation of water body should be with the objective of restoring it to its original state or to a better state with necessary enhancement of its environs. Rehabilitation Plan shall include:

- Reconstruction and stabilization of embankment in case it is impacted;
- If storage area is lost, then the water body is to be deepened to regain an equivalent volume;
- Further enhancement of the water body as a focal point with place for seating and provision of shade; and
- Costs of rehabilitation

Concurrence of the community has to be sought on the Rehabilitation Plan prepared by the Contractor. Concerns of the community have to be incorporated into the plan before submitting it for approval of the PIU.

The PIU shall scrutinize the Rehabilitation Plan, verify the implementation on site and finally approve the plan. The Rehabilitation Plan should be implemented by the Contractor immediately after completion of construction at the stretch near the water body.

When there is interruption to regular activities of villagers near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

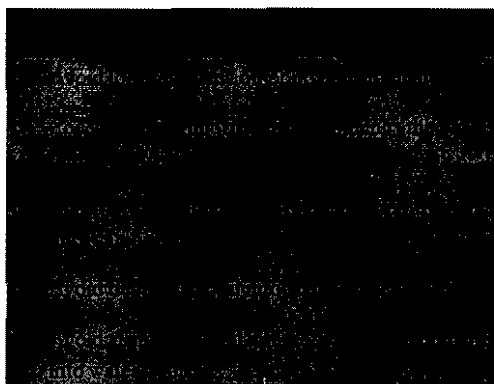
- Restriction on use of water, if any, should be intimated to the community in advance;
- Alternate access to the water body is to be provided in case there is interruption to use of exiting access. The access provided should be convenient for use of all the existing users whether community or cattle; and
- If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

3. CONSTRUCTION STAGE

It should be ensured by the contractor that the runoff entering the water body is free from sediments. Silt fencing and/or brush barrier shall be installed in the drainage channels for collecting the sediments before letting them into the water body. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be revegetated. Cutting of embankment reduces the water retention capacity and also weakens it, hence:

- The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
- Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The PIU shall monitor regularly whether safe construction practices near water bodies are being followed.

Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body. Movement of machinery and workforce shall be restricted around the water body, and no waste from construction camps or sites shall be disposed into it.



4. POST CONSTRUCTION STAGE

With the completion of construction, the PIU has to ensure implementation of rehabilitation/restoration plan for the water body, as indicated by the Contractor in the bid submission. The precincts of the water body have to be left clean and tidy with the completion of construction. Drainage channels of adequate capacity shall be provided for the water body impacted.

GUIDELINE-10: DRAINAGE

1. INTRODUCTION

Inadequate and faulty drainage arrangements during road construction result in obstruction to natural drainage pattern. The problem is further aggravated in the low-lying areas and flood plains receiving high intensity rainfall, which can lead to the instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts. The functioning of the drainage system is therefore a vital condition for a satisfactory road.

However, construction or upgradation of CD structures and longitudinal drains is likely to increase sediments, scour the banks, change water level and flow, and also affect the ecology of the surrounding area. The guideline shall address the environmental concerns related to drainage aspects during different stages of the project execution.

2. PROJECT PLANNING AND DESIGN

Drainage shall be broadly divided as (i) Cross-Drainage and (ii) Longitudinal Drainage both surface & subsurface drainage. The alignment shall be routed such that minimum drainage crossings are encountered. Also the geometric design criteria as per IRC 73, guidelines for effective surface drainage should be ensured.

All drains crossing the alignment shall be identified on site and marked on map while undertaking transect walk. Basic information on the width of channel, frequency of traffic holdup and flow would provide inputs into screening of alternate alignments as well as fixing the alignment. Consultations with the community shall provide information on the HFL in the area.

In areas of high and medium intensity rainfall (>400 mm/year), flood prone areas and hilly areas, detailed hydrological studies will need to be conducted. The studies shall be conducted as per IRC: SP-13: 1973 "Guidelines for the Design of Small Bridges & Culverts" and IRC: SP-33:1989 "Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures".

Design of cross-drainage structures shall be based on the inputs from the hydrological studies as per clause 12.2.3 and in other areas, the C-D structure design shall be as per IRC: SP-13. Design of C-D structure shall be such that:

- Normal alignment of the road is followed even if it results in a skew construction of culverts and stream bank protections are incorporated.
- Afflux generated is limited to 30 cm in plains with flat land slopes.
- It is fish friendly – fish passage is not interrupted either in upstream or downstream direction.
- Adequate scour protection measures for stream bank, roadway fill as head walls, wing walls and aprons are included.
- Reinforced road bed (of concrete or rock) for protection against overflow in case of low water crossing (floods/causeways) is included.
- The design of C-D structure (minor and major bridge) should have stairs leading to the bed of the drainage channel, for regular inspection of the sub-structure.
- Schedule of construction of C-D structures should be confined to dry months to avoid contamination of streams.

Longitudinal drains are to be designed to drain runoff from highest anticipated rainfall as per rainfall data for the past 20 years or 50 years as per hydrological analysis in high rainfall areas (annual rainfall >1000 mm) and hill areas. For design of longitudinal drains in other areas, the design shall be as per IRC: SP-20:2002.

Outfall of the roadside drains shall be into the nearby stream or culvert. The outfall should be at such a level that there would be no backflow into the roadside drain. Wherein pond/low lying areas exist in

the vicinity, the flow may be diverted into them after removal of sediment for possible ground water recharge.

In case of high embankment (>1.0m) or bridge approaches, lined channels shall be provided to drain the surface runoff, prevent erosion from the slopes and avoid damage to shoulders and berms. Detailed specifications shall be as per IRC: SP-20:2002. The type of drains that can be constructed include bricklined, pucca with RCC, covered drain with RCC slabs and piped drain.

3. PRE-CONSTRUCTION STAGE

Following measures are to be undertaken by the contractor prior to the commencement of CD/Bridge construction:

- The downstream as well as upstream user shall be informed one month in advance
- The contractor shall schedule the activities based on the nature of flow in the stream.
- The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by PIU.
- Erosion and sediment control devices are to be installed prior to the start of the civil works.
- Interceptor drains to be dug prior to slope cutting to avoid high runoff from slopes entering construction sites in case of hill roads
- Runoff from temporary drains and interceptor drains to be directed into natural drains in hill roads
- In case of up-gradation of the existing CD Structures, temporary route / traffic control shall be made for the safe passage of the traffic, depending upon the nature of the stream
- All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction of the CD structures, the contractor has to take the consent from the concerned department (refer Guideline on "Water for Construction")

4. CONSTRUCTION PHASE

Drainage structures at construction site shall be provided at the earliest to ensure proper compaction at the bridge approach and at the junction of bridge span and bridge approach. Velocity of runoff to be controlled to avoid formation of rills/gullies as per guideline, "Slope stability & erosion control"

While working on drainage channels, sediment control measures shall be provided. Silt fencing (as per the detailed specifications of guideline, "Slope Stability & Erosion Control") shall be provided across the stream that carries sediment.

The sediments collected behind the bunds shall be removed and after drying, can either be reused or disposed off as per guideline, "Waste Management and Debris Disposal". Safety devices and flood warning signs to be erected while working over streams and canals.

5. POST CONSTRUCTION

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow. HFL should be marked as per hydrological data on all drainage structure. Temporary structure constructed during construction shall be removed before handing over to ensure free flow through the channels. The piers and abutments should be examined for excessive scour and make good the same if required. The upstream and downstream areas should be cleared of all CD works.

In case of Causeway following aspect shall be taken into consideration:

- Dislocation of stones in stone set pavements, scouring of filler material due to eddy currents.
- Floating debris block the vents. In case of large amount of floating material, debris arrestor shall be provided in upstream side.
- Damage to guide stones, information board shall be inspected and replaced accordingly.

Annexure 5

Schedule of Inspection shall be drawnup for checking cracks, settlements and unusual backpressures. It must be ensured that all the rectification shall be undertaken as and when required. Following are broadly the items to be checked:

- Settlement of piers/abutments & settlement of approach slabs have to be checked;
- Cracks in C-D structures or RCC slabs;
- Drainage from shoulders to be ensured;
- Ditches & drains to be kept clean of debris or vegetation growth; and
- Repairs to parapet of culverts whenever required are to be undertaken.

GUIDELINE-11: CONSTRUCTION PLANTS & EQUIPMENT MANAGEMENT

1. GENERAL

During execution of the project, construction equipments, machinery and plants are likely to cause adverse impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. This guideline describes the activities during the project stages where pollution control measures are required.

2. PROJECT PLANNING AND DESIGN STAGE

Selection criteria for setting up a plant area and parking lot for equipments and vehicles shall be done as per siting criteria for construction camp specified in Guideline on "Construction and Labour Camps".

3. PRE-CONSTRUCTION STAGE

The Contractor must educate the workers to undertake safety precaution while working at the plant / site as well as around heavy equipments. Before setting up the crusher, hot-mix plant and generator, the Contractor shall acquire "No Objection Certificate (NOC)" from the Assam State Pollution Control Board for the same. The Contractor shall ensure all vehicles must possess Pollution under Control (PUC) Certificate, which and shall be renewed regularly. The Contractor must ensure that all machinery, equipments, and vehicles shall comply with the existing Central Pollution Control Board (CPCB) noise and emission norms. The PIU must ensure that the Contractor shall submit a copy of the NOC and PUC Certificates before the start of work. The Contractor shall design the service road with protection measures as black topping at vulnerable points as in low lying areas.

4. CONSTRUCTION STAGE

The Contractor shall undertake measures as per **Table 1** to minimize -the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.

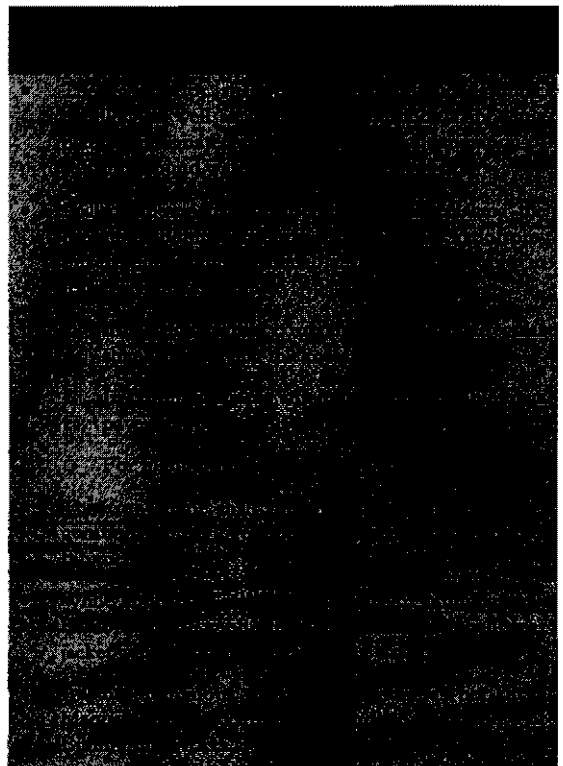
Table 1: Measures at Plant Site

Concern	Causes	Measures
Dust Generation	Vehicle Movement	<ul style="list-style-type: none"> • Water sprinkling • Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation • Tail board shall be properly closed and sealed to be spill proof
	Crushers	<ul style="list-style-type: none"> • Regular Water Sprinkling to keep the dust below visibility level
	Concrete-Mix Plant	<ul style="list-style-type: none"> • Educate the workers to follow/adopt good engineering practices while material handling
Emissions	Hot-Mix Plant	<ul style="list-style-type: none"> • Site Selection as per Clause 6.5.2, Section 6.5, IRC's Manual for Construction & Supervision of Bitumen Work • Regular maintenance of Dust Collector as per manufacture's recommendations
	Vehicles	<ul style="list-style-type: none"> • Regular maintenance as per manufacture's recommendation
	Generators	<ul style="list-style-type: none"> • Exhaust vent of long length and emission to confirm to PCB norms.
	Heavy Load Vehicles	<ul style="list-style-type: none"> • Exhaust silencer, Regular maintenance as per manufacture schedule
Noise	Crushers	<ul style="list-style-type: none"> • Siting as per guideline, "Construction and Labour Camps"
	Generators	<ul style="list-style-type: none"> • All generators should have mandatorily acoustic enclosures and confirms to PCB norms.
Oil Spills	Storage and	<ul style="list-style-type: none"> • Good practice, guideline, "Waste Management and Debris Disposal"

Concern	Causes	Measures
	Handling	
Residual waste	Dust Collector and Pits	<ul style="list-style-type: none"> Guideline, "Waste Management and Debris Disposal"
Concrete waste	Concrete-Mix plant	<ul style="list-style-type: none"> Guideline, "Waste Management and Debris Disposal"
Bitumen and bitumen mix	Hot-mix Plant	<ul style="list-style-type: none"> Guideline, "Waste Management and Debris Disposal"
Stone chips	Crushers	<ul style="list-style-type: none"> Guideline, "Waste Management and Debris Disposal"
Safety	Trajectory of Equipments	<ul style="list-style-type: none"> No worker shall be present in the vicinity of the equipments
	Movable Parts of Equipments	<ul style="list-style-type: none"> Caution Sign, awareness among workers
	Plant Area / Site	<ul style="list-style-type: none"> Caution Sign, Safety Equipments
	Accidents / Health	<ul style="list-style-type: none"> First Aid Box, Periodic Medical Checkup Break down of
	Break down of vehicles	<ul style="list-style-type: none"> Arrangement for towing and bringing it to the workshop

During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns. During excavation, water sprinkling shall be done to minimize dust generation. Frequent water sprinkling shall be done on the haul roads to minimize dust generation. In case of loose soils, compaction shall be done prior to water sprinkling. Cautionary and informatory sign shall be provided at all locations specifying the type of operation in progress. The contractor must ensure that there is minimum generation of dust and waste while unloading the materials from trucks. The construction waste generated shall be disposed as per Guideline on, "Waste Management and Debris Disposal". The equipments, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensure that the workers shall remain away from the working areas at such times. Also, equipments at construction camp should be barricaded and kept away from residential quarters of workers.

The PIU shall carry out periodic inspections to ensure that all the pollution control systems are appropriately installed and comply with existing emission and noise norms.



5. POST-CONSTRUCTION STAGE

The PIU shall ensure that all the haul roads are restored to their original state. In case any inner village road is damaged while transporting the procured material; the contractor shall restore the road to its original condition. The PIU must ensure that the decommissioning of plant shall be done in environmentally sound fashion and the area to bring its original state.

Annexure 5

Designated area refers to paved surfaces and barren parcels of land, with adequate drainage and disposal system. It must be ensure that these are away from agriculture land, water body and other sensitive areas.

GUIDELINE-12: LABOUR AND WORKER'S HEALTH AND SAFETY

1. INTRODUCTION

The safety and health concerns of the workers and the community are impacted due to the hazards created during the construction of road. **Box: 1** gives the safety concerns during construction. This Guideline describes the hazards and measures that need to be taken to mitigate the impacts.

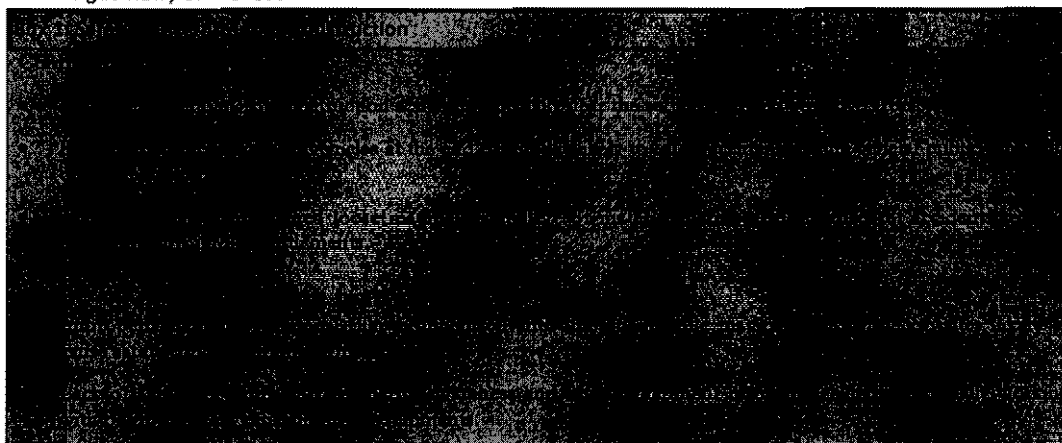
2. PROJECT PLANNING AND DESIGN STAGE

To address health and safety concerns, the DPR shall contain selection criteria for setting up:

- Construction Camps (as per guideline);
- Borrow Areas (as per guideline); and
- In case of opening new quarry areas (as per guideline).

To address the safety concerns to road user during operational phase, the DPR shall contain the following:

- Selection and location of regulatory as well as informatory signs as per IRC: 67-2001, depending upon the geometry of the road.

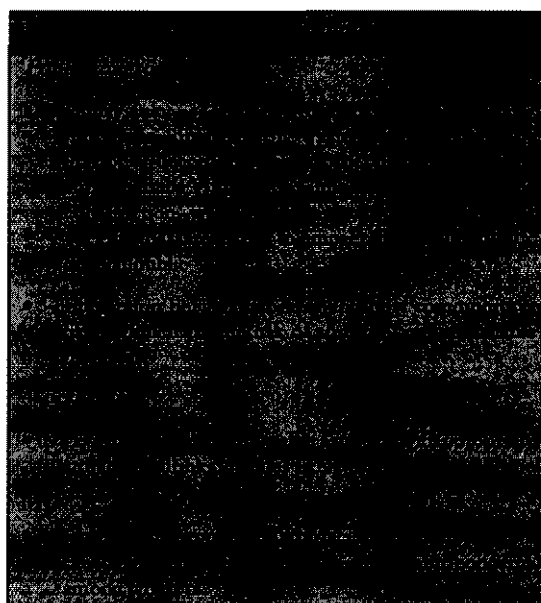


PRE-CONSTRUCTION STAGE

In order to incorporate public health and safety concerns, the PIU and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas;
- Extent of work;
- Time of construction;
- Diversions, if any;
- Precaution measures in sensitive areas;
- Involvement of local labours in the road construction;
- Health issues - water stagnation, exposure to dust, communicable disease; and
- Mechanism for grievances.

The information dissemination could be through the local newspaper, billboards, panchayats meetings, etc. The Contractor must educate the



Annexure 5

workers to undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Awareness on HIV/AIDS awareness and usage of safety measures such as condoms;
- Awareness on hygienic sanitary practices;
- Personal safety measures and location of safety devices;
- Interaction with the host community;
- Protection of environment with respect to:
 - Trampling of vegetation and cutting of trees for cooking;
 - Restriction of activities in forest areas and also on hunting;
 - Water bodies protection;
 - Storage and handling of materials;
 - Disposal of construction waste.

3. CONSTRUCTION STAGE

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal Protective Equipments (PPE) for the workers. Table 1 gives the safety gear to be used by the workers during each of the construction activities.
- All measures as per bidding document shall be strictly followed.
- Additional provisions need to be undertaken for safety at site:
 - Adequate lighting arrangement;
 - Adequate drainage system to avoid any stagnation of water;
 - Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, as well as at the location of generator (grease trap); and
 - Facilities for administering first aid.



Table 1: Worker Safety Measures

Sl. No.	Activity	Safety Requirement
1.	Setting out and levelling	<ul style="list-style-type: none"> • Luminous jackets; • Helmets; • Boots for protection against insect bite; and Dust Mask
2.	Tree cutting	<ul style="list-style-type: none"> • Helmet Boots • Luminous safety jackets
3.	Reinforced yard/ carpentry/ reinforcement cutting/ bending work.	<ul style="list-style-type: none"> • Hand gloves
4.	Shuttering work	<ul style="list-style-type: none"> • Goggles Hand gloves
5.	Plant and Machinery	<ul style="list-style-type: none"> • Hand gloves • Boots • Helmets • Dust Mask
6.	Material handling	<ul style="list-style-type: none"> • Hand gloves • Dust mask

Annexure 5

Sl. No.	Activity	Safety Requirement
7.	Batching plant	<ul style="list-style-type: none"> • Goggles • Hand gloves • Dust mask
8.	Weeding	<ul style="list-style-type: none"> • Goggles
9.	Binding reinforcement	<ul style="list-style-type: none"> • Safety belt • Boots
10.	Manual concrete laying	<ul style="list-style-type: none"> • Gum boots • Hand gloves • Helmet
11.	Piling	<ul style="list-style-type: none"> • Helmet • Hand gloves, gumboots.

The following measures need to be adopted by the contractor to address public safety concerns:

- The Contractor shall schedule the construction activities taking into consideration factors such as:
 - Sowing of crops;
 - Harvesting;
 - Local hindrances such as festivals etc.; and
 - Availability of labour during particular periods.
- All the cautionary signs as per IRC: 67-2001 and traffic control devices (such as barricades, etc) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed.
- Following case specific measures need to be followed during the progress of the activity:
 - In case of blasting, the Contractor must follow The Explosives Rules, 1983.
 - In case of construction activity adjoining the water bodies, measures shall be taken as per measures suggested in Guideline on "Water Body".
 - If construction of road is within the settlement, the contractor must ensure that there shall not be any unauthorized parking as well as storage of material, adjacent to road.
 - Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all the water logging areas

The PIU shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per the guideline.

4. POST-CONSTRUCTION STAGE

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the PIU to ensure safer roads:

- Inspection and maintenance of installed regulatory and informatory signs.
- Ensure that the location of signage does not obstruct the visibility
- In case of hill roads, maintenance of parapet wall as well as of overtaking zones.

The PIU must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per the measures given in Guideline on "Construction and labour Camp" and "Waste Management and Debris Disposal."

GUIDELINE-13: CULTURAL PROPERTIES

1. INTRODUCTION

The cultural properties located close to the road are likely to be impacted by the road construction. Most of the properties are avoided in general during finalization of alignment. This Guideline discusses the mitigation measures for cultural properties.

2. PROJECT PLANNING AND DESIGN STAGE

Measures for mitigation of impacts on cultural properties during project preparation shall be as per the following steps:

- Identification of locally significant cultural properties should be done;
- Assessment of likely impacts on each cultural property due to project implementation;
- The extent of impact on the identified culture property should be assessed and possible measures for avoidance should be devised based on the site investigation. In case impact is not avoidable, identification of alternative routes or possibility of relocation of the culture property shall be assessed in consultation with the local public, based on the economic feasibility.

In case of relocation, relocated site should be suggested by the local people and the size of relocated structure should at least be equal to the original structure. A written consent letter is to be obtained from the community regarding the relocation site of the cultural property in the form of resolution on the letter pad of the sarpanch/gram panchayat or with the signatures of community members.

A detailed design of the relocated structure and its site plan along with the necessary BoQ are to be presented DPR. The relocation and other avoidance measures should be carried out before the start of the road work

It must be ensured by the PIU that the BoQ and rates are incorporated into the contract document.

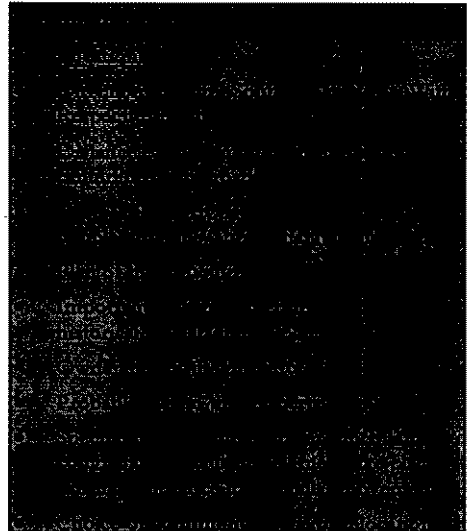
3. CONSTRUCTION STAGE

Major impacts on the properties during this stage are mainly due to movement of construction machinery as well as due to construction activity in the vicinity of the cultural property. Following are precautionary measures that need to be undertaken by the contractor while working near these structures:

- Restrict movement of heavy machinery near the structure
- Avoid disposal or tipping of earth near the structure
- Access to these properties shall be kept clear from dirt and grit

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from PIU. The State Archeological Department shall be intimated of the chance find and the Engineer shall carry out a joint inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work.

The PIU must ensure that the contractor implements the precautionary measures as suggested. Also, the PIU must conduct monitoring for the enhancement of cultural property.



GUIDELINE-14: TREE CUTTING AND AFFORESTATION

This Guideline discusses the issue of tree cutting and afforestation. Loss of trees creates adverse environmental impacts. In order to mitigate these impacts, suitable measures have been suggested as part of this Guideline. These measures have been given for each of the stages of the road construction activities.

1. PROJECT PLANNING AND DESIGN STAGE

During alignment finalisation, due consideration shall be given to minimise the loss of existing tree cover, encroachment of forest areas / protected areas etc as specified in guideline on, "Site preparation". Tree felling, if unavoidable, shall be done only after compensatory plantation of at least three saplings for every tree cut is done.

The plantation/afforestation would be carried out by the forest department. It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth. The species shall be identified giving due importance to local flora (suggested in **Table 1**). It is recommended to plant mixed species in case of both avenue or cluster plantation.

The plantation strategy shall suggest the planting of fruit bearing trees and other suitable trees. Development of cluster plantations will be encouraged in the community lands, at locations desired by the community. The choice of species will be based on the preferences of the community. The PIU shall oversee the plantation to check the following:

- Whether trees are obstructing live of right at junctions;
- Whether trees are at the inside of the junctions;
- Whether trees are within 5 mts of the proposed centerline.

2. POST-CONSTRUCTION STAGE

The maintenance of the saplings (including activities such as weeding, watering, planting of replacement saplings, etc application of manure etc) shall be the responsibility of the forest department. The PIU shall ensure the following:

- Shoulder of roads to be kept clear of weeds/undesirable undergrowth; and
- Branches of trees do not obstruct clear view of the informatory and cautions signs.

Table 1: Endemic Species of Assam

Sl. No	Tree Species Endemic species)	Sl.no	Tree Species Endemic species)
1	<i>Aphanamixis polystachya</i>	12	<i>Dillenia indica</i>
2	<i>Anthocephalus chinensis</i>	13	<i>D. pentagyna</i>
3	<i>Syzygium cumini</i>	14	<i>Careya arborea</i>
4	<i>S. formosum</i>	15	<i>Lagerstroemia parviflora</i>
5	<i>S. oblatum</i>	16	<i>L. speciosa</i>
6	<i>Bauhinia purpurea</i>	17	<i>Terminalia bellirica</i>
7	<i>Mallotus philippensis</i>	18	<i>T. chebula</i>
8	<i>Cinnamomum tamala</i>	19	<i>Trewia polycarpa</i>
9	<i>Actinodaphne obtusa</i>	20	<i>Gmelina arborea</i>
10	<i>Bombax ceiba</i>	21	<i>Oroxylum indicum</i>
11	<i>Sterculia villosa</i>	22	<i>Bridelia spp</i>

GUIDELINE-15: FORESTS AND OTHER NATURAL HABITATS

1. INTRODUCTION

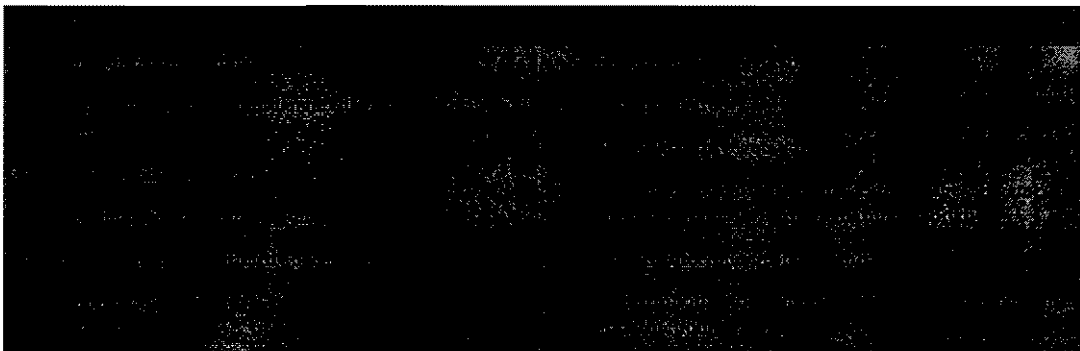
This guideline envisages measures to be undertaken during blacktopping / widening of road sections passing through natural habitats. These measures shall be undertaken in addition to the measures laid down in the other Guidelines.

Conservation of natural habitats is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.



2. PROJECT PLANNING AND DESIGN

To minimize the adverse impact on the ecology of the natural habitats, selection of alignment should be as per guideline. An officer of at least the rank of a forest ranger shall be deputed for detailed inventory of ecological features along the road. The nature and type of impact on natural habitats due to road construction shall be identified. Magnitude of the impact to the extent feasible on the ecological features shall also be assessed.



Impacts identified on the natural habitats shall be minimized to the extent required. Minimization shall be through precautionary measures or through appropriate mitigation measures. Following are the measures should be undertaken along the road passing through natural habitats:

- Constricting the road width to 6.0 m and embankment height to 0.5 m to minimize the extent of diversion of forest land and cutting of trees
- Drainage Structures shall be designed strictly in accordance with guideline on "Drainage".
- Rumble strips shall be provided at every kilometer along the length of the natural habitat and invariably at the start and end of the natural habitat
- Signage (viz. speed limit, animal crossing, switch of headlight etc) shall be provided as per IRC: 67-2001 Code of Practice for road sign (first revision)

In addition to the above measures, specific impacts identified on site shall be mitigated as per the recommendation of the forest department / officer in charge of the identified natural habitat.

In case proposed alignment falls within the catchments of a water body or a stream, a flush causeway shall be constructed without impacting the drainage system. The length of the causeway shall be as per the existing water spread. The causeway shall be strictly in compliance with IRC:SP-20:2002. In no circumstances a water body within the natural habitat shall be cut across or filled for the purpose of laying the road.

3. PRE-CONSTRUCTION STAGE

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

4. CONSTRUCTION STAGE

Procurement of any kind of construction material (as quarry or borrow material) from within the natural habitat shall be strictly prohibited. No water resources within the natural habitat shall be tapped for road construction. Use of mechanized equipment shall be kept minimum within the natural habitat. Contractor must ensure that there will be no parking of vehicles machine and equipment within the natural habitat. Disposal of construction waste within the natural habitat shall be strictly prohibited and as far as possible reuse shall be undertaken as per **Table -1** type of waste of guideline, "Waste Management and Debris Disposal".

5. POST CONSTRUCTION STAGE

The road passing through the natural habitat shall be declared as a silence zone. Compensatory tree plantation within the available Right of Way shall be done in accordance with guideline, on "Tree Cutting and Afforestation". The PIU must ensure maintenance of drainage structure shall be undertaken as per guideline, "Drainage"

GUIDELINE-16: AIR AND NOISE POLLUTION

1. INTRODUCTION

This guideline deals with the mitigation of adverse impacts due to air and noise pollution. Both of these have been discussed in the subsequent sections respectively.

2. AIR POLLUTION

The types of air pollution due to construction activities might include generation of dust, emission from hot mix plants and batching plants, odour from construction labour camps, emission from construction machinery/vehicles etc. The measures for mitigation of impacts from each of these are given below.

Generation of Dust

- All vehicles delivering materials to the site shall be covered to avoid spillage of materials.
- The Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants up to the satisfaction of the Engineer in accordance with the relevant emission norms.
- All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles or their tyres.
- Spillage shall be cleared immediately by manual sweeping and removal of debris or if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed completely. Additionally, if so directed by the Engineer, the road surfaces shall be hosed or watered using necessary equipments.
- Plants, machinery and equipment shall be so handled (including dismantling) so as to minimize generation dust.
- All earthwork shall be protected in a manner acceptable to the Engineer to minimise generation of dust.
- The hot mix plant is sited at least 1000m from the nearest habitation. The hot mix plants shall be fitted with dust extraction units in order that the exhausts comply with the requirements of the relevant current emission control legislation.
- Generation of dust should be suppressed during unloading of construction material and also during storage of the construction material.

Emission from Hot-Mix Plants and Batching Plants

- Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible such plants will be located at least 1000m away from the nearest habitation.
- The exhaust gases shall comply with the requirements of the relevant current emission control legislation. All operations at plants shall be undertaken in accordance with all current rules and regulations protecting the environment.

Odour from Construction Labour camps

- Construction labourers camp shall be located at least 500 m away from the nearest habitation.
- The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odour is generated. Compliance with the Factory Act, the construction workers (regulation of employment and conditions of service) Act, 1996 and all other relevant legislation shall be strictly adhered to.

Emission from Construction Vehicles, Equipment and Machinery

- The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment and machinery used for construction shall conform to the relevant Indian Standard (IS) norms.

Annexure 5

- All vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of SPCB & the Engineer.

Pollution from Crusher

- All crushers used in construction shall conform to relevant dust emissions control as legislated. Clearance for siting shall be obtained from the SPCB. Alternatively, only crushers already licensed by the SPCB shall be used.
- Dust screening vegetation will be planted on the edge of RoW for all existing roadside crushers.
- If crusher owned by contractor, the suspended particulate matter contribution value at a distance of 40m from a controlled isolated as well as from a unit located in a cluster should be less than 600 ug/Nm³. The monitoring is to be conducted at least twice a month for all the 12 months in a year during the crushing operation for the project.

3. NOISE POLLUTION

Noise from Vehicles, Plants and Equipment

- The plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the GoI noise standards.
- All vehicles and equipment used in construction shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site.
- Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986.
- Maintenance of vehicles, equipment and machinery shall be regular and proper, to the satisfaction of the Engineer, to keep noise from these at a minimum.
- In construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 2200 hours to 0600 hours. In silence zone (areas up to 100 m around such premises as hospitals, educational institutional and courts) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around hospitals between 21.00 hours to 06.00 hours.
- Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall wear earplugs.

Noise from Blasting (or) Pre splitting Operations.

- Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulators, rules, etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed.
- Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer. The timing should be made known to all the people within 500m (200m for pre-splitting) from the blasting site in all directions. People, except those who actually light the fuse shall be excluded from the area of 200m (50m for pre-splitting) from the blasting site in all directions at least 10m minutes before the blasting.

GUIDELINE-17: ENVIRONMENTAL MONITORING

1. ENVIRONMENTAL MONITORING PLAN

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

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

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

2. PERFORMANCE INDICATORS

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

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

The Performance Indicators and monitoring plans prepared for Project Implementation are presented in Table 1.1

Table 1.1: Performance Indicators for Project Implementation

Sl. No.	Indicator	Details	Stage	Responsibility
A Environmental Condition Indicators and Monitoring Plan				
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 1.2)	Pre Construction	PIU through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
2	Noise Levels		Pre Construction	PIU through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
3	Water Quality		Pre Construction	PIU through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
4	Soil Quality		Pre Construction	PIU through approved monitoring agency
		Construction		
		Operation	PIU through approved monitoring agency	
B Environmental Management Indicators and Monitoring Plan				
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	PIU

Annexure 5

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

3. MONITORING PARAMETERS AND STANDARDS

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

Ambient Air Quality Monitoring (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Hydro-Carbons (HC), Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Ammonia (NH₃), Ozone (O₃), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in Table 1.2. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 1.5.

Table 1.2 National Ambient Air Quality Standards

S. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation
5	Ozone (O ₃) µg/m ³	8 hours* 1 hours**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m ³	Annual*	0.50	0.50	-AAS/ICP method after

S. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
		24 hours**	1.0	1.0	sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) $\mu\text{g}/\text{m}^3$	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR)spectroscopy
8	Ammonia (NH ₃) $\mu\text{g}/\text{m}^3$	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C ₆ H ₆) $\mu\text{g}/\text{m}^3$	Annual*	05	05	-Gas chromatography based continuous analyser -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, $\mu\text{g}/\text{m}^3$	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) $\mu\text{g}/\text{m}^3$	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) $\mu\text{g}/\text{m}^3$	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

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

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

Noise Quality Monitoring

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in Table 1.3. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 1.5.

Table 1.3 National Ambient Noise Quality Standards

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

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

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

Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications, presented in Table 1.4. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 1.5.

Table 1.4: National Standard of Water

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27°C)	3.0	DO-Azide modification of Winkler's method
3	Temperature (°C)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Winkler's method
5	Color (Hazen)	300	Visual Comparison method

Annexure 5

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO ₄)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthroline method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr ⁶⁺)	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method
18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

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

4. MONITORING PLANS FOR ENVIRONMENT CONDITION

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in Table 1.5. Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 1.5: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO ₂ , NO _x , RPM, SPM, O ₃ , Pb, CO, NH ₃ , C ₆ H ₆ , BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Two seasons in a year for three years				Along the road		Contractor / PIU	
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982)	Four seasons per year	Grab Sampling	Along the roadSurface watersources	Contractor / PIU
	Operation				Four seasons for three years			Contractor / PIU
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Three seasons per year for three years.		Along the road	Contractor / PIU
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Four seasons per year	Grab Sampling	Along the road Hot mix / batching plant	Contractor / PIU
	Operation				Four seasons for three years		Along the road	Contractor / PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor
Tree plantation	Operation stage	As per Rehabilitation Plan			Quarterly	-	Areas where plantation is being done	Contractor / PIU

5. REPORTING SYSTEM

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

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

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

Contractor will report to the Engineer on the progress of the implementation of environmental conditions and management measures as per the monitoring plans. The Engineer will in turn report to the PIU on a quarterly basis which will be reviewed. Along with these reports, Environmental Cell of the PIU shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. The PIU will also send compliance report to the MoEF every six months as per the conditions of clearance granted for the project after receiving the report from the contractor and duly verified by the Engineer. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer and/or the Environmental Cell as required and presented as **Annex -6**.

Table 1.6: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (SC) / Concessionaire		Project Implementation Unit (PIU)
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM1	Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
EM2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
EM3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
EM4	Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly
EM5	Tree Plantation	Construction	-	Monthly	-	-	Quarterly
EM6	Top Soil Monitoring	Construction	Quarterly	-	Continuous	Quarterly	Quarterly
EC1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
EC2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
OP1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

