

# Environmental Assessment Report

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Initial Environmental Examination  
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February 2013

## India: North Eastern State Roads Investment Program

Tumulpur – Paneri – Udalguri Road Section in Assam (AS-02 & AS-03): Tranche 2 Subprojects

Prepared by the Ministry of Development of North Eastern Region (MDONER), Government of India for the Asian Development Bank

## **CURRENCY EQUIVALENTS**

(as of 31 January 2013)

Currency Unit = Indian Rupee (INR)

INR1.00 = US\$ 0.0185

US\$1.00 = INR 54.00

## **LIST OF ABBREVIATIONS**

ADB	-	Asian Development Bank
CPCB	-	Central Pollution Control Board
CRRI	-	Central Road Research Institute
DoE	-	Department of Environment
EA	-	Executing Agency
EFRC	-	Environment Friendly Road Construction
EIA	-	Environmental Impact Assessment
EMMP	-	Environmental Mitigation and Monitoring Plan
GDP	-	Gross Domestic Product
GoA	-	Government of Assam
GoI	-	Government of India
IEE	-	Initial Environmental Examination
IRC	-	Indian Road Congress
MDONER	-	Ministry of Development of North Eastern Region
MDRs	-	Major District Roads
MoEF	-	Ministry of Environment and Forests
MoRT&H	-	Ministry of Road Transport and Highways
MSL	-	Mean Sea Level
NEC	-	North Eastern Council
NER	-	North Eastern Region
NGO	-	Non-government Organization
NH	-	National Highway
NOx	-	Oxides of Nitrogen
NSDP	-	Net State Domestic Product
PIU	-	Project Implementation Unit
PWD	-	Public Works Department
ROW	-	Right of Way
SPM	-	Suspended Particulate Matter
SO <sub>2</sub>	-	Sulphur Dioxide
SSI	-	Small Scale Industries
SPCB	-	State Pollution Control Board
TA	-	Technical Assistance
TOR	-	Terms of Reference
WHO	-	World Health Organisation

## **NOTES**

(i) The financial year (FY) of the Government of India ends on 31 March. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2012 ends on 31 March 2012.

(ii) In this report, "\$" refers to US dollars

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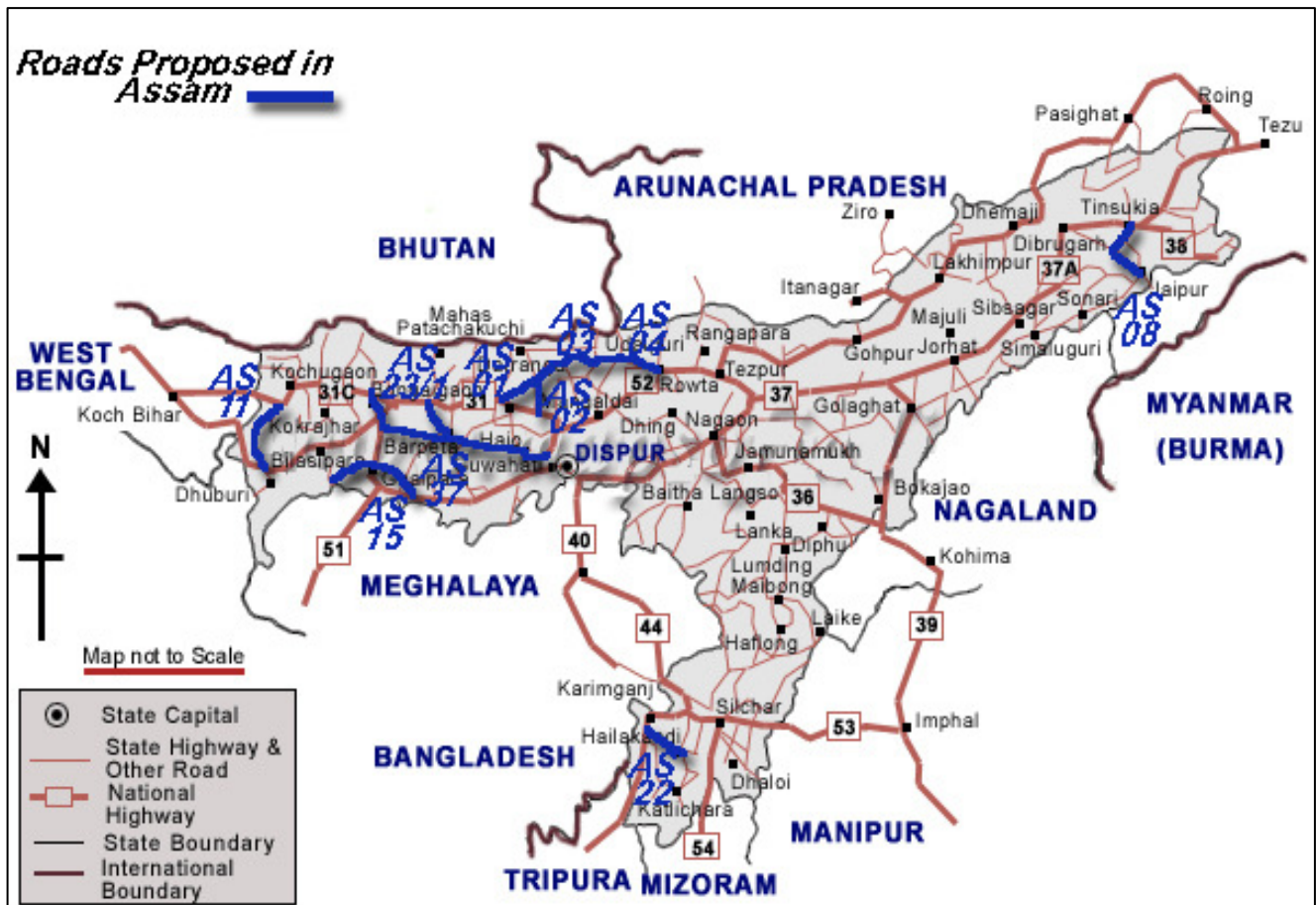


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Map showing subprojects included in Assam under NESRP





## EXECUTIVE SUMMARY

1. The environmental screening of tranche 2 subprojects in Assam i.e. AS-02: Tamulpur-Paneri (43.0km) and AS-03: Paneri-Udalguri (18.6km) road sections revealed that the proposed improvement of these road sections will not result to significant adverse environmental impacts, and all significant impacts are site-specific and can be addressed through proven mitigation measures. The tranche 2 subprojects in Assam are classified as environmental Category B and an initial environmental examination was prepared and documented in this report.
2. AS-02 and AS-03 road sections are part of tranche 2 of the ADB's multitranche financing facility approved for the North Eastern State Roads Investment Program. The proposed road improvement will cover 62.9 km of existing state roads including four major bridges. AS-02 road section starts outside Tamulpur built up area and ends at Paneri covering a total length of 43 km whereas AS-03 road section starts at Paneri and ends at Udalguri with a junction of MDR in the town covering a total length of 18.6 km. The project also includes major bridge component (four bridges – 2 in each section) covering a total length of 1.4km. The existing roads are sections of state highway with single to intermediate lane carriageway.
3. The road improvements will involve paving and widening of existing carriageway to two lanes to accommodate the increase in traffic; construction of new and strengthening of existing erosion control structures and cross drainage structures to ensure easy connectivity between Tamulpur, Paneri, Udalguri and further to NH-31 particularly during monsoon; and improvements in horizontal, vertical geometries and installation of road safety appurtenances to minimize road crashes.
4. The significant environmental impacts attributable to the upgrading of the road sections pertains to cutting about 2352 trees for the proposed widening; temporary deterioration of ambients during construction phase from land clearing, ground shaping, quarry and camp operations; and community and occupational health and safety. These impacts will be mitigated through compensatory afforestation; timing of construction activities to minimize fauna disturbance; control of noise, dust, wastewater, fuel combustion emissions, and construction debris generation through good construction practices; and implementation of road safety measures to separate road users from active construction fronts.
5. During operation stage, the main impacts are increase in mobile emissions, road safety to motorist, pedestrian and animals. Road safety measures will be implemented as per IRC guidelines. Road safety appurtenances like information, regulatory and warning signs copuled with crash barriers will reduce serious injuries to road users. Adequate cross drains and side drains and their proper maintenance will be implemented to avoid localised flooding.
6. Several consultations were organized during the project preparation to engage major stakeholder representatives and incorporate their concerns in the overall design. These consultations involved officials of executing agency, PWD, district rural development officials, forest department officials, affected persons and village heads in the project area. Most of the people interviewed strongly support the project.
7. An environmental management and monitoring plan summarising likely potential impacts, mitigation measures, institutional responsibilities and cost estimate has been developed which will be included in the contractors work specifications. Total cost of the environmental management estimated at INR 3,811,060 (or US\$ 70,575). The PWD, Government of Assam, through its Project Implementation Unit (PIU), will ensure the effective implementation of the environmental management plan. There is a need for the PIU to organize its environmental unit

to provide close support to the Project Director and ensure the contractors maintain environmental compliance. To provide regular monitoring information and technical advice to the PIU is the supervision consultant and the contractors environment and social officer.

8. This initial environmental examination (IEE) ascertains that upgrading of Tamulpur – Paneri – Udalguri (AS-02 and AS-03) road section is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subprojects, all of which are localized and temporary in nature and can be easily mitigated with minor to negligible residual impacts. No additional studies or requirement of a detailed EIA is envisaged at this stage.

## I. INTRODUCTION

### A. Project Background

9. The North Eastern Region (NER) of India is bordered by Bangladesh, Bhutan, the People's Republic of China, Myanmar, and Nepal. It represents about 8% of India's total geographic area with a population of about 54 million. The region consists of eight states, namely: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Sikkim, and Tripura. The NER is connected to the rest of the country through a narrow Siliguri Corridor in the West Bengal. Except in Assam, NER has predominantly hilly to mountainous terrain and very high rainfall (among the highest in the world), which frequently results in landslides and floods.

10. Recognizing the need for accelerated development, the Government of India places special focus on the development of NER in its five-year plans, mainly through central funding of development activities in the region. Over the last two decades the government has required 10% of the budget of central ministries and departments to be allocated for NER, and created a funding mechanism for pooling the unspent allocated central funds for further assistance to the region. However, the recent growth performance of these states has not been encouraging. The government's Eleventh Five Year Plan, 2007–2012 states that "while development efforts over the years have made some impact (as reflected in some of the human development indicators, which are comparable with the rest of the country), the region is deficit in physical infrastructure which has a multiplier effect on economic development."

11. With the limited exception of the highest class roads (mostly national highways maintained by central organizations), the NER road network needs substantial improvement, through its expansion and improvement of individual road sections. This improvement will be made by widening the existing roadway, strengthening pavements, improving road geometry, raising embankments, and providing permanent structures at river-crossings. With renewed recognition that inadequate roads and bridges supporting the road transport which is the region's single most dominant transport mode, are the major constraints on development efforts, the government started a national investment program to improve road connectivity to remote places in the region.

12. The present North Eastern State Roads Investment Program (NESRIP) is being provided by the ADB which was developed in parallel with SARDP-NE and is complementary to it. While SARDP- NE focuses on improving higher class roads, the investment program is developed to improve intrastate connectivity, mainly to district headquarters and other places of administrative and economic importance in the individual states, and to enhance capacity of state PWDs to manage its road assets.

### B. North Eastern State Roads Investment Program (NESRIP)

13. The North Eastern State Roads Investment Program is an ADB's multitranche financing facility (MFF) that will: improve about 430 kilometers (km) of priority roads in six states, namely: Assam, Manipur, Meghalaya, Mizoram, Sikkim, and Tripura in the North Eastern region (NER) of India; and provide capacity building support to the executing agencies, the Ministry of Development of North Eastern Region (MDONER) and the state public works departments (PWDs) or its equivalent in the six project states. The investment program targets the secondary road network and aim to enhance the performance of state roads sector in NER through investment project implementation and dedicated capacity building measures. The improved secondary road network will provide important linkage between the primary and tertiary road

networks in the region, for which there are ongoing national programs for improvement<sup>1</sup>. The entire MFF is structured in two tranches as detailed in Table 1.1.

**Table 1.1: Road Sections under Multitranche Financing Facility NESRIP**

Road Section Package Code	Tranche/Road Name	State	Length (km)
<b>Tranche 1</b>			
AS-11	Futkibari – Bilasipara (NH-31)	Assam	16.2
AS-37C	Barpeta – Kalitakuchi	Assam	58.5
ML-N1	Garobadha – Dalu (NH-51)	Meghalaya	93.4
SK-01	Melli (NH-31A)Km 17.10 – Nayabazar	Sikkim	14.5
SK-02	Nayabazar – Namchi	Sikkim	19.7
<b>Subtotal for Tranche 1</b>			<b>202.3</b>
<b>Tranche 2</b>			
AS-02	Tamulpur – Paneri	Assam	43.0
AS-03	Paneri – Udalguri	Assam	18.6
AS02-03	Major Bridges	Assam	1.3
MN-06	Tupul (NH53) - Kasom-Khullen	Manipur	93.2
MZ-02	Serchhip – Buarpui	Mizoram	55
TR-02	Udaiphur (NH-44) – Melaghar	Tripura	20.3
<b>Subtotal for Tranche 2</b>			<b>231.4</b>
<b>Grand Total for investment program</b>			<b>433.7</b>

14. The impact of the investment program will be improved surface-transport connectivity in NER, which is expected to contribute to NER's economic growth and poverty reduction. Improved surface-transport connectivity will facilitate delivery of various development schemes in other sectors. The outcome will be improved mobility and accessibility in the project areas in NER that will be measured in terms of traffic growth rates, cost of transport and travel time. The investment program will also contribute to improved transport connectivity to the rest of India, and eventually to neighboring countries, which will facilitate inward investment in NER.

15. This road improvement will be pursued in an environmentally congenial manner that avoids, minimizes or mitigates adverse environmental impacts. This IEE contains the approach, evaluation, findings, and recommendation of the Initial Environmental Examination for tranche 2 subprojects (AS-02 and AS-03) in the State of Assam. These road sections are components of the ADB Loan No. 2770-IND for North Eastern State Roads Project (NESRP) which aims to upgrade and improve priority state roads in the northeast region.

### **C. Background of the Present Report**

16. This Initial Environmental Examination (IEE) Report is prepared for the present assignment in order to identify the baseline environmental status of the proposed alignment, assessment of impacts due to the proposed widening of the road on various environmental parameters and preparation of environmental management plan to mitigate the negative impact on these parameters.

<sup>1</sup> "Proposed Multitranche Financing Facility and Administration of Technical Assistance Grant India: North Eastern State Roads Investment Program" Report and Recommendation of the President to the Board of Directors, June 2011.

17. The IEE study was prepared from September 2005 to January 2006 as part of feasibility study under ADB financed technical assistance to meet ADB requirements. The report was updated in 2008, and again in 2010 as part of detailed design. This is the final IEE report prepared to meet the requirements of the ADB's Safeguard Policy Statement 2009.

#### **D. Objective and Scope of the IEE Study**

18. The objective of this IEE study is to identify potential environmental impacts of the proposed road improvement measures and formulate strategies to avoid / mitigate the same. The scope of work to accomplish the above objective, comprise the following.

- understanding the baseline environmental conditions of the project area,
- identifying the potential environmental impacts of the project proposal,
- recommending appropriate mitigation measures to avoid / minimise the environmental impacts, and
- preparing an environmental management plan for implementation.

19. The IEE study has been confined to the situation around the deemed areas of direct influence caused by constructional and operational facilities along the proposed road sections. Following sections of this report discusses the methodology adopted by the consultants in conducting the IEE study and presents the results of the same.

#### **E. Methodology Adopted for IEE Study**

20. This IEE has been carried out, in accordance with the requirements of the ADB's Safeguard Policy Statement (SPS) 2009. The IEE methodology has been adopted in such a manner to ensure that environmental concerns are given adequate weightage in the selection of alignment and design of proposed road improvements. This IEE study employs an iterative approach in which potential environmental issues have been examined at successive levels in detail and specificity, at each step in the process.

21. The IEE is based on the information collected from secondary as well as primary sources on various environmental attributes. Environmental features within the ROW and significant issues were examined during field survey to determine the magnitude of significant environmental impacts.

#### **F. Structure of the Report**

22. This report has ten sections following the prescribed IEE outline of the ADB's SPS and starts with this introduction followed by:

- Policy, Legal, and Administrative Frameworks section summarizing the national and local legal and institutional frameworks that guided the conduct of the assessment
- Description of the Project Section presenting the key features and components of the proposed project

- Description of the Environment section discussing the relevant physical, biological, and socioeconomic features that may be affected by the proposed project.
- Anticipated Environmental Impacts and Mitigation Measures section presenting the environmental assessment of likely positive and adverse impacts attributed to the proposed project and concomitant mitigation measures.
- Information Disclosure, Consultation, and Participation section describing the consultation process undertaken during the environmental examination and its results, their consideration in the project design, and manner of compliance to the ADB's Publication Policy and related national laws.
- Grievance Redress Mechanism section describing the formal and informal redress procedures for registering, resolving, and reporting complaints.
- Environmental Management Plan section discussing the lessons from the impact assessment and translated into action plans to avoid, reduce, mitigate or compensate adverse impacts and reinforces beneficial impacts. This plan is divided into three sub-sections; mitigation, monitoring, and implementation arrangements.
- Conclusion and Recommendation section stating whether there is a need for further environmental assessment and highlights key findings and recommendations to be implemented by the borrower.

23. An executive summary is also prepared and presented in the beginning of the report.

## II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

### A. National (India) Environmental Legal Framework

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

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

26. These Acts and Regulations require projects to comply with the following:

- a) As per provisions of Environmental Impact Assessment Notification 2006 (amended 2009), all State Highways (construction of new roads or construction of new bypasses) and expansion of state roads in hilly terrain (above 1000 m above msl and or ecologically sensitive areas) fall under category B projects and require Environmental Clearance from State Environmental Impact Assessment Authority.
- b) Further, under the same notification, it is stated that any category B project will be treated as category A if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972; (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time; (iii) Notified Eco-sensitive areas; and (iv) interstate boundaries and international boundaries.<sup>2</sup>
- c) Forest Clearance from Department of Forests is required for diversion of forest land to non-forest purpose. Prior permission is required from Forests Department to carry out any work within the forest areas and felling of road side trees. Cutting of trees need to be compensated by compensatory afforestation as required by the Forest Department.<sup>3</sup>

<sup>2</sup> As per Government of India Regulation all road projects are categorized as "A" or "B" depending on its environmental sensitivity as **Category A -i)** New National High ways; and ii) Expansion of National High ways greater than 30 km, involving additional right of way greater than 20m involving land acquisition and passing through more than one State. And **Category B-i)** All New State Highways Projects; and ii) State Highway Expansion projects in hilly terrain (above 1000 m above mean sea level and or ecologically sensitive areas)

<sup>3</sup> In tranche 2 (AS-02 and AS-03) subprojects in Assam, permission would be required for cutting the trees in non-forest areas (road side trees) from District authorities.

- d) As per Office Memorandum issued by MOEF on 31 March 2011 and 9 September 2011, for projects requiring environmental clearance and involving diversion of forests land, the project proponent must first apply for Stage-I forestry clearance, and thereafter only submit the proposal for obtaining Terms of Reference for undertaking Environmental Impact Assessment study to the respective Expert Appraisal Committee (EAC). The Stage-I forestry clearance must be submitted to the respective EAC within 12 months, extendable upto a maximum of 18 months, of the recommendation for grant of environmental clearance. Only after submission of the stage-I forestry clearance, will the formal environmental clearance be issued. In case the stage-I forestry clearance is not submitted within the stipulated time the project proposal will stand rejected and the process for obtaining environmental clearance will have to be initiated from the beginning.
- e) Placement of hot-mix plants, quarrying and crushers, batch mixing plants, discharge of sewage from construction camps requires No Objection Certificate (Consent to Establish and Consent to Operate) from State Pollution Control Board prior to establishment.
- f) Permission from Central Ground Water Authority is required for extracting ground water for construction purposes, from areas declared as critical or semi critical from ground water potential prospective by them.

27. Specifically for the proposed subprojects, the following (Table 2.1) environmental laws and regulations are applicable:

**Table 2.1: Applicable Environmental National and State Requirements**

Sl. No.	Activity	Statute	Requirement	Competent Authority	Responsible Agency for Obtaining Clearance	Time Required
1	Cutting of road side trees	The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003) and Environmental Protection Act of 1986 and as amended	Permit from Forest Department	State Department of Forests	The PWD	3-9 months
2	Establishing stone crusher, hot mix plant, wet mix plant and Diesel Generator Sets	Water Act of 1974, Air Act of 1981, Noise Rules of 2000 and Environmental Protection Act of 1986 and as amended	Consent-for-establishment	State Pollution Control Board	The Contractor	2-3 months

Sl. No.	Activity	Statute	Requirement	Competent Authority	Responsible Agency for Obtaining Clearance	Time Required
3	Operating stone crusher, hot mix plant, wet mix plant and Diesel Generator Sets	Water Act of 1974, Air Act of 1981, Noise Rules of 2000 and Environmental Protection Act of 1986 and as amended	Consent-for-operation	State Pollution Control Board	The Contractor	2-3 months
4	Use and storage of explosive for quarry blasting work	India Explosive Act 1984	Explosive licence for use and storage	Chief Controller of Explosives	The Contractor	2-3 months
5.	Storage of fuel oil, lubricants, diesel etc. at construction camp	Manufacture storage and Import of Hazardous Chemical Rules 1989	Permission for storage of hazardous chemical	State Pollution Control Board or Local Authority (DM/DC)	The Contractor	2-3 months
6	Quarry operation	State Minor Mineral Concession Rules, The Mines Act of 1952, Indian Explosive Act of 1984, Air Act of 1981 and Water Act of 1974	Quarry Lease Deed and Quarry License	State Department of Mines and Geology	The Contractor	2-3 months
7	Extraction of ground water	Ground Water Rules of 2002	Permission for extraction of ground water for use in road construction activities	State Ground Water Board	The Contractor	2-3 months
8	Use of surface water for construction	-	Permission for use of water for construction purpose	Irrigation Department	The Contractor	2-3 months
9	Engagement of labour	Labour Act	Labour license	Labour Commissioner	The Contractor	2-3 months

28. Before the start of civil works for the any subproject the state PWD must obtain necessary clearances / permits from the regional office of the Ministry of Environment and Forests and State Pollution Control Board. Since the project road does not pass through any of the sensitive areas, the EIA notification 2006 is not applicable to this subproject hence environmental clearance from the MOEF is not required. However, for cutting of roadside trees, necessary permits from the state forest departments must be obtained by PWD prior to start of civil work on those sections.

**B. ADB's Environmental Safeguard Requirements**

29. This environmental assessment is carried out in compliance with requirements of ADB's SPS so as to ensure that potential adverse environmental impacts are identified, avoided where possible and managed or addressed.

30. As per the SPS the objective of Environmental Safeguard is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. To help achieve the desired outcomes, ADB adopts eleven policy principles for guiding the assessment of projects that trigger environmental risks and impacts. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts.

31. Based on the ADB's SPS, the proposed tranche 2 subprojects in Assam (AS-02 and AS-03) of the investment program is categorized as category B project based on the most sensitive component. Project categorization is carried out using Rapid Environmental Assessment (REA) Checklist (Appendix 1). The category of the project is confirmed during the FF mission in November 2011. Category B projects judged to have some adverse impacts, but of lesser degree and/or significance than category A. An initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Accordingly this IEE is prepared to meet the requirements of the government as well as ADB's SPS requirements.

### III. DESCRIPTION OF THE PROJECT

#### A. Type of Project

32. The present report deals with the Initial Environmental Examination of the Tamulpur-Udalguri road section in the State of Assam. This road section is included in tranche 2 of NESRIP and divided in two subprojects as AS-02: Tamulpur – Paneri (43.0 km) and AS-03: Paneri – Udalguri (18.6km). AS-02 subproject starts outside Tamulpur built up area and ends at Paneri covering a total length of 43 km whereas AS-03 subproject starts at Paneri and ends at Udalguri with a junction of MDR in the town covering a total length of 18.6km. The project also include major bridge component which include four bridges – two bridges in AS-02 and two bridges in AS-03 subproject, covering a total length of 1.4km. Total length of the project road is therefore 62.9km. The existing roads are sections of State Highway with single to intermediate lane carriageway. Average carriageway width of AS-02 is about 3.5m whereas in case of AS-03, the average carriageway width is about 4.0 to 5.5m. The road passes mostly through plain terrain with mild to straight curves. The road condition is fair to poor with some part of road are completely deteriorated. Riding quality is poor with a maximum vehicle speed of about 30km/h. Road has earthen shoulders that are in poor condition and side drainage is also very poor.

33. These sections are proposed for improvement and upgradation to two lane configuration (7.0m carriageway) with shoulders and side drains. Total formation width will be 12.0 m. Table 3.1 present information about the subproject roads.

**Table 3.1: Information of the Project Roads**

Name of the Project	Package No.	Length (km)	District	State
Tamulpur – Paneri Road Section (AS-02) in the state of Assam	NESRIP, Tranche 2	43.0	Tamulpur	Assam
Paneri – Udalguri Road Section (AS-02) in the state of Assam	NESRIP, Tranche 2	18.6	Udalguri	Assam
Major Bridges in AS-02 and AS-03 (four bridges)	NESRIP, Tranche 2	1.3	Tamulpur & Udalguri	Assam
	<b>Total</b>	<b>62.9 km</b>		

#### B. Need for the Project

34. Assam, the gateway of north eastern region is the biggest state in the region. It is located in the eastern part of the country, in the foothills of himalayas having a geographical area of about 78000 sq km. The state is bound on the north by Bhutan and Arunachal Pradesh and shares its boundary with other north-eastern states of Meghalaya, Tripura, Nagaland, Manipur and Mizoram. The population of the state stood at 26.6 million in 2001 of which about 87 percent is rural. The density of population in Assam is more than twice the average density for the NE region and is also slightly higher than the national average. Assam consists of discrete plains encompassed within hills, with a number of agro-climatic zones. It is characterized by heavy precipitation, rich bio-diversity, fragile hills and high seismicity. Currently, the area under forest cover is 22 percent – much below the 33.3 percent minimum threshold prescribed by the National Forest Policy.

35. Compared to other states of the NE region, the state is well served by all modes of transport viz railways, inland water transport, air and roads. The state is connected with the rest

of the country by West Bengal in the north through a small strip about 30 km wide called the Chicken's Neck. It also serves as a gateway to other states of the NE region. Railways account for a length of about 2400 km. The state has 6 airports (Guwahati, Tezpur, Jorhat, Dibrugarh, Lakhimpur and Silchar). As regards IWT, the Brahmaputra and the Barak are the two most important navigable rivers. Several tributaries of these rivers are also navigable by country boats. The Brahmaputra is already declared as National Waterway No.2. Two public sector organisations viz State Directorate of IWT and Central Inland Water Transport Corporation are operating transport services between Guwahati and Kolkata for movement of goods by barges. Roads and road transport is, however, the main mode of transport in the state. Today the road network stands at 41300 km including 31300 km of earth or gravel roads. Improvement and maintenance of the existing road network is an urgent need. Roads are considered to be key to the facilitation of economic development in the remote rural areas. To achieve the development objectives, it will be necessary to improve the road sector.

### C. Location and Features of the Project Road

36. Project roads AS-02 pass through Bagsa district whereas AS-03 pass through Udalguri district in the state of Assam. Figure 3.1 and Figure 3.2 shows the location map of the subprojects on state road map and on Google Earth image respectively. Existing conditions of the subproject roads are described in following paragraphs.

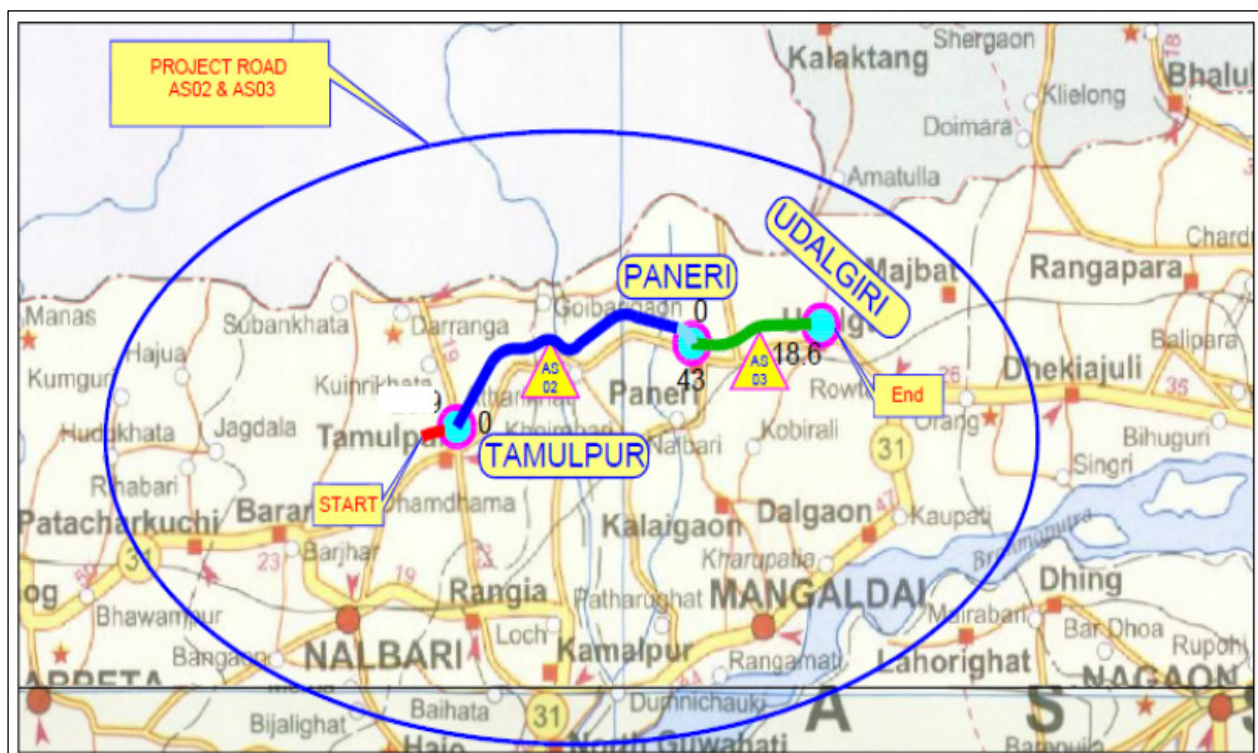
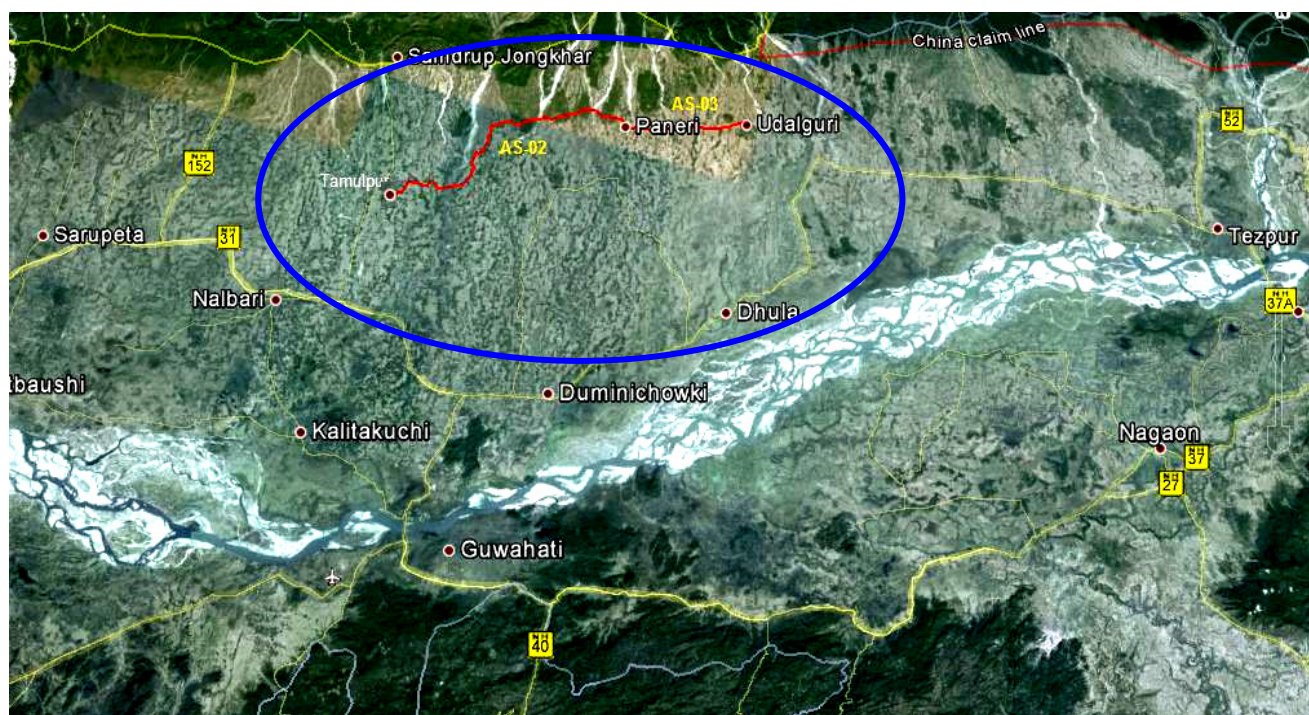


Figure 3.1: Index Map of the Project Road



**Figure 3.2: Project Roads on Google Earth Image**

37. **AS-02: Tamulpur to Paneri:** Section AS-02 starts outside Tamulpur built up area and passes through Dhanpara and Nagrihuli market areas enroute and ends at Paneri. This road crosses enroute major rivers such as Bar, Sukhlai and Karla Nonai. There are no bridge crossing at these rivers and therefore road is not passable to the traffic. The length of this road section, as per topographic survey and design is 43.0 km.

38. **AS-03: Paneri to Udalguri:** Section AS-03 starts at Paneri and passes through Paneri town and ends at Udalguri with a junction of MDR in the town. The road crosses Kalsi river, where a bridge is under construction and Barla river, where there is no bridge crossing. The length of this road section, as per topographic survey and design is 18.6 km.

39. The existing road sections are single lane configuration throughout. The formation width varies between 5.0 and 7.5 m in general. The earthen shoulder width varies between 0.75 m and 2 m. The road is generally in fill and there are high fill embankments at approaches to bridges. The shoulders are rutted and depressed in sections with embankment slopes eroded. In many sections the road is non-existent, particularly in approaches to rivers, where the bridges are yet to come up / constructed. The road carriageway varies between 2.5 m to 5 m in general. The existing roads had been constructed in flexible pavement with BT wearing course. The condition of the existing road pavement is in general, very poor. The pavement has been badly damaged / washed away, due to recurring floods.

40. Land use along the project road corridors is mainly agriculture with undulating barren and short shrubs patches. The roads are aligned along east west direction across the natural slope from north towards south i.e. across natural drainage.

41. The existing road alignment generally follows the topography of the adjoining land through plain terrain, crossing a number of rivers, streams and nallahs. The project roads have a

number of horizontal curves at various places and many of these are with sharp radii. Through built up areas, there are right angle bends and junctions. The vertical profile of the existing road is generally flat except at bridge approaches, where the approaches rise sharply onto the bridges. The existing cross-sections of the project roads are generally consistent throughout the length. The height of embankment in open and agricultural areas varies between 0.5 to 2.0 m. Besides the major junctions / intersections at Barama, Tamulpur, Paneri, Udalguri and Rowta with National Highway, State Highways and MDR's, a number of village roads and link roads join the project road sections.

42. The right of way (ROW) is not demarcated on the ground. The PWD informed that the ROW is about 24 m to 30 m but is not of uniform width throughout the length of the road sections. Through built up sections, in small stretches, the ROW is restricted and varies between 7 m to 10 m. In open areas it varies between 10 to 15 m.

43. Project road sections AS-02 and AS-03 aligned in west-east direction across the general slope of the terrain (from north to south) cross many a rivers and streams besides general surface drainage resulting in a number of existing cross drainage structures and many more yet to be added / bridged. The major rivers, which are yet to be bridged on the project roads are:

- Bar Nadi in on AS-02 (River width about 1.2 km)
- Shuklai Nadi in on AS-02 (River width about 1.0 km)
- Mara Kala in Km on AS-02 (River width about 0.5 km)
- Kala Nonoi in Km on AS-02 (River width about 1.0 km)
- Barla Nadi in Km on AS-03 (River width about 0.5 km)
- Kulsi Nadi in Km on AS-03 (River width about 0.5 km)

44. Out of these six river crossings, bridges at Mara Kala river and Kulsi river are under construction. The other crossings are yet to be bridged. Due to these unbridged crossings, the Project road sections AS-02 and AS-03 are not fit for through traffic. Long stretches of the road sections at these crossings get submerged during rainy season making it impossible for the through traffic to ply.

45. There are 46 bridges and 86 Culverts on the Project roads. 6 bridges (4 major and 2 minor) are under construction by the State PWD. There are no service roads on the Project roads. Very few vehicles are observed parking along road side without causing any traffic congestion. In fact due to road sections (AS-02 & AS-03) being not through, long distance vehicles are not plying on the road. No laybys exist on the Project roads sections. There are a very few km stones along the Project roads and these are very old and of poor condition. However, there are neither any 200 m stones nor any boundary pillars. Electric lines and other utilities and services (electric / telephone poles) have been observed existing in the shoulders of the road. In the sections outside the built up areas, the services are generally outside the formation width. At few locations, transformers are coming very close to the road edge.

46. Following critical sections exist on the road.

- Unbridged crossings
- Existing culverts where inadequate
- Junctions with NH& State highways
- Approaches to bridges;
- Narrow stretches in built up areas

- Stretches prone to submergence.
- Roadside Structures close to the road edge.

#### **D. Design Standards for the Project Road**

47. The IRC design standards have been followed in consultation with ToR, while formulating the road design standards. As the project road sections pass mainly through flat terrain, the ruling design speeds considered for the formulation of design standards are 100 km/hr. for plain sections. The purpose of formulation of design standards is to avoid any inconsistency in design during the road construction and operation.

#### **E. Engineering Surveys and Investigations**

48. Following surveys and investigations had been carried out on the Project roads for collection of data for incorporation in the DPR and evolve the design for improvement and upgradation.

- topographic surveys;
- traffic surveys;
- road and pavement condition survey and inventory;
- culverts and bridges condition survey and inventories;
- material surveys;
- hydrology studies for new bridge structures;
- Geotechnical investigations & subsoil exploration for structures; and
- existing utilities surveys.

49. These surveys had been carried out in accordance with the guidelines in IRC:SP:19 to fulfil requirement in the TOR.

#### **F. The Design**

50. The improvement proposal involving design for the Project road specifies widening and strengthening of existing road. The design of the Project road incorporates the following design components:

- analysis of present traffic and future projections,
- analysis of present pavement structure and its strength and design requirements for the new pavement and overlay over the design period for widening and strengthening,
- determination of adequacy of the hydraulic capacity and structural parameters of the existing structures,
- determination of adequacy of the road's geometry (horizontal as well as vertical); and
- ensuring road safety aspects are addressed.

51. Figure 3.2a, and Figure 3.2b, shows the typical cross sections of the proposed roads.

Figure 3.2a: Proposed cross section in Open Area

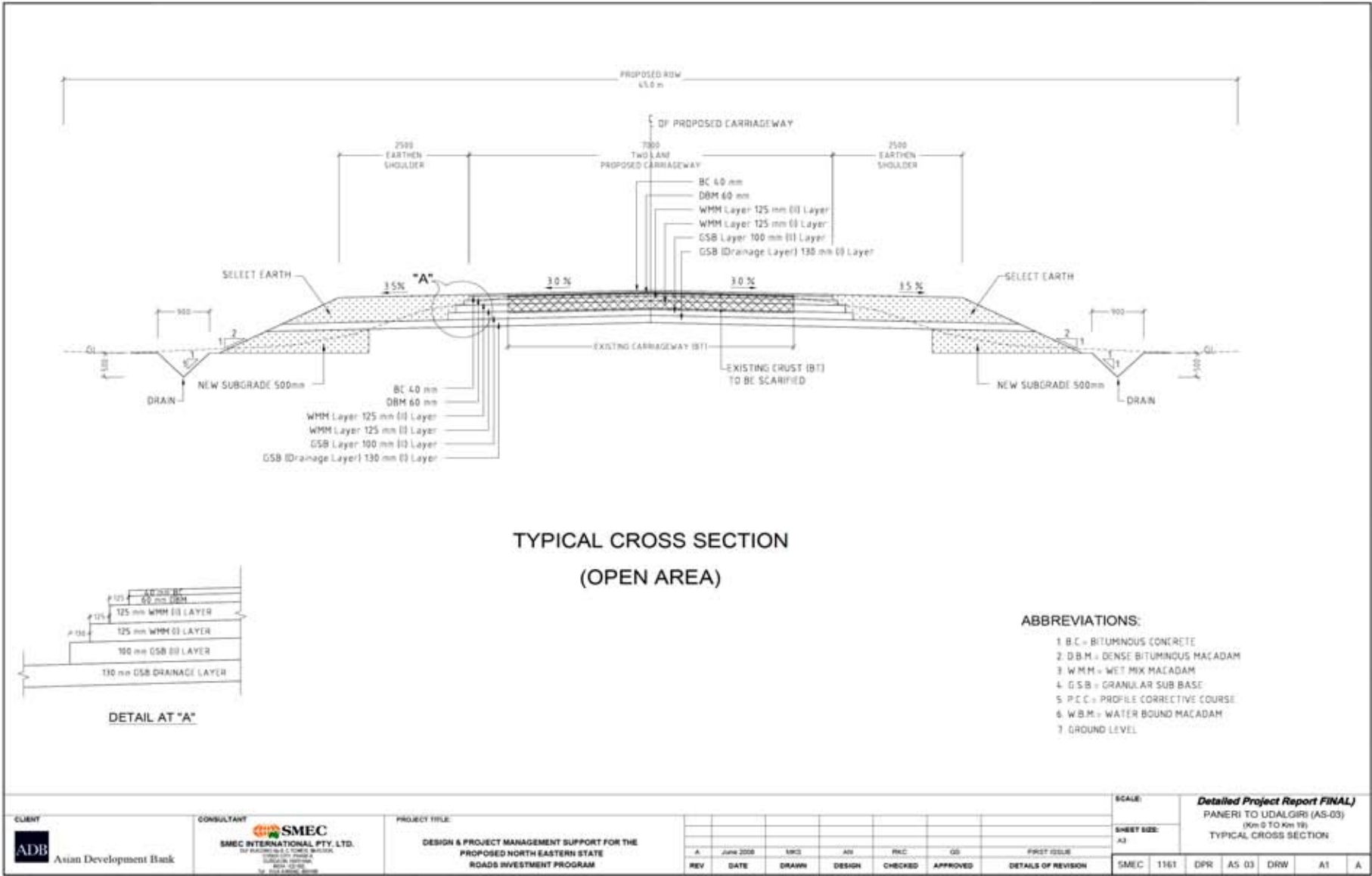
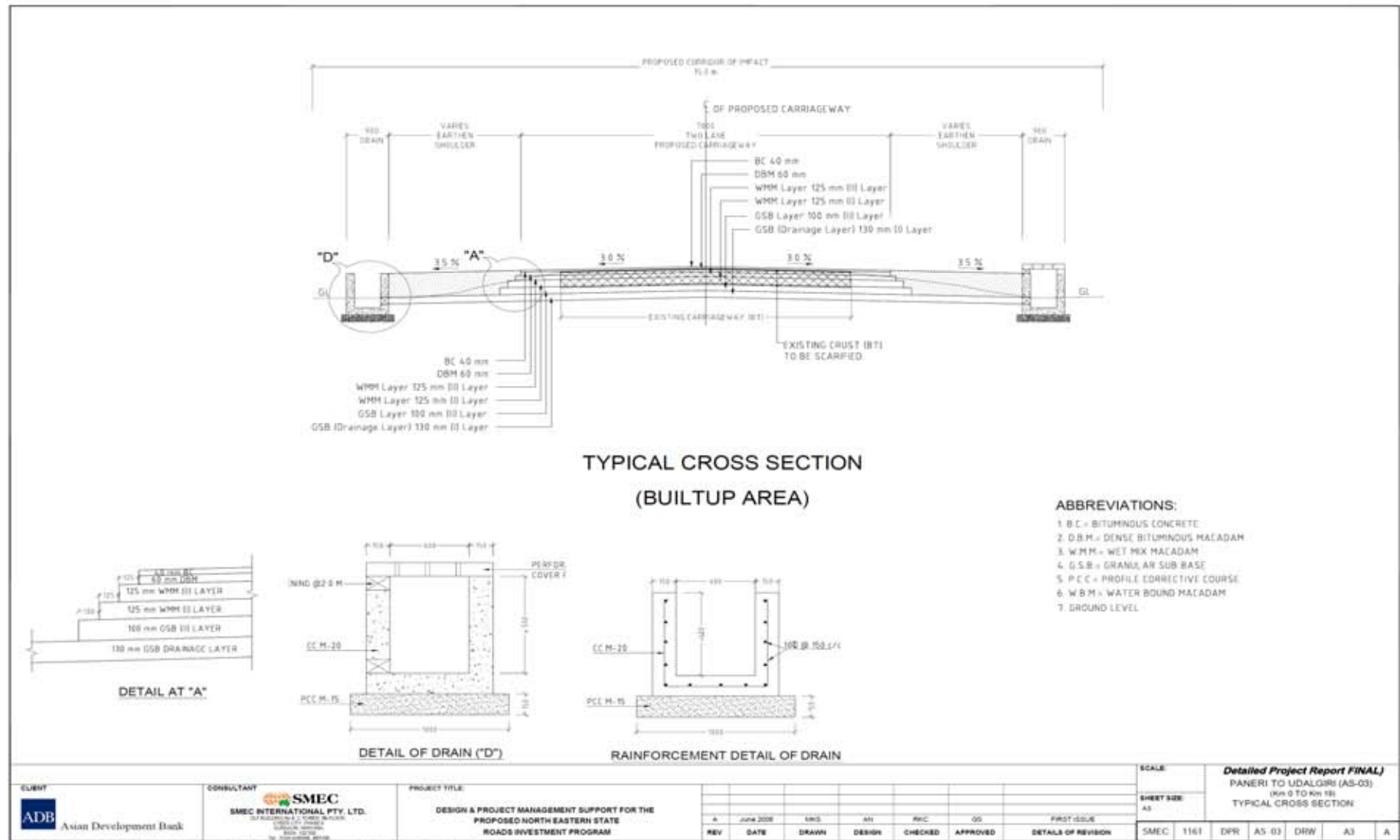


Figure 3.2b: Proposed cross section in built-up Area



52. **Lane Configuration:** As envisaged in traffic analysis, the Project roads need to be widened from single lane to 2- lane configuration over the design life.

53. **Horizontal Alignment:** Horizontal alignment for the Project roads is proposed to follow the existing alignment, this being an existing road improvement proposal by way of widening and strengthening. One side widening is proposed in some locations where available land on either side permits a design without acquisition of land or where features on one side of the road are so important that these cannot be shifted.

54. **Horizontal Geometry:** The design is based on IRC: 38-1988. In non-urban and urban stretches, the radii of curves have been limited to the absolute minimum to avoid acquisition of land and structures.

55. **Vertical Geometry:** The Project road's vertical geometry has been designed following the guidelines contained in IRC: SP: 23-1993 and conform to the draft standards. Low lying stretches are proposed to be raised and so also the approaches to bridges regraded.

56. **Formation Width:** The project road sections are proposed to be widened from single lane to 2- lane standards within the available ROW. Formation width for the proposed 2-lane configuration shall be 12 m. All new structures except bridges shall be 12 m in width. All new bridge structures shall have deck width of 7.5 m.

57. **Carriageway Width:** The width of existing carriageway varies widely from section to section and so also the formation width. The road carriageway will be designed as a 2-lane carriageway (7m).

58. **Right of Way (ROW):** The existing ROW is not demarcated on ground. As per PWD, ROW, between 24 to 30 m but is not of uniform width throughout the length of the road sections. Through built up sections, in small stretches, the ROW is restricted and varies between 7 m to 10 m. It is proposed to have minimum ROW, as per IRC:73-1980 ROW for a State Highway is 45 m in open areas and 30 m in built up areas. In some locations, in built up areas, the available ROW between properties lines on either side is as low as 7 m. In such locations, ROW shall need to be made up to accommodate improvement proposal.

59. **Bridges:** The improvement proposals of existing bridges and new construction of bridges less than 100m have been included in Road Works and bridges at major river crossings have been undertaken separately as "Major Bridges".

60. **(i) Road Work and Bridges:** There are 73 bridges on the Project roads. Existing bridges, in good condition are proposed to be retained with repairs. Weak and narrow and timber bridges are proposed to be replaced. Summary of existing bridges and improvement proposal / new construction included in Road Works is given in Table 3.2.

**Table 3.2: Existing and New Bridges under Road Work and Bridges**

Particular	Type of Bridge					
	AS-02			AS-03		
	Major	Minor	Total	Major	Minor	Total
Existing bridges	2	21	23	3	20	23
To be retained with repairs	1	16	17	0	16	16
Under construction	1	2	3	3	0	3

Particular	Type of Bridge					
	AS-02			AS-03		
	Major	Minor	Total	Major	Minor	Total
To be reconstructed	0	3	3	0	4	4
New bridges proposed	0	2	2	0	1	1

61. **(ii) Major Bridges:** There are 4 bridges included in the Major Bridges packages as detailed in Table 3.3.

**Table 3.3: Bridges proposed under Major Bridges**

Sl. No.	River Name	Existing Chainage (Km)	Proposed Chainage (Km)	Length of the Bridge (m)
<b>AS-02: Tamulpur-Paneri</b>				
1.	Bar River	17+550	17+500	400
2	Suklai River	27+800	27+850	160
3	Kala Nono River	36+425	36+375	200
<b>AS-03: Paneri-Udalguri</b>				
4.	Barla River	6+750	6+835	200

62. **Culverts:** There are 86 culverts existing on the project roads. Existing substandard HP culverts are proposed to be replaced with NP4 type culverts. Existing slab type culverts are narrow. The slab type culverts are proposed to be repaired/ replaced, depending upon condition and widened, if feasible. Similarly the Box culverts in good condition will be retained /widened. Other type of culverts like SPT, and the buried ones will be reconstructed with Box/HP, as per site conditions The proposal for existing culverts and new culverts is summarized in Table 3.4.

**Table 3.4: Existing and New Culverts Proposed for Improvement**

Particular	Type of Culvert					
	AS-02			AS-03		
	HP	Slab	Other	HP	Slab	Other
Existing culverts	24	30	0	5	25	2
To be retained	0	0	0	0	0	0
To be widened	4	7	0	0	0	0
To be reconstructed (Box)	8	21	0	2	24	1
To be reconstructed (HP)	12	0	0	3	0	1

63. **Pavement:** Pavement composition for widening / new construction / reconstruction of Project roads is given Table 3.5.

**Table 3.5: Pavement Composition for Project Road**

<b>Crust Composition</b>	<b>Thickness (mm)</b>
GSB	230
WMM	250
DBM	60
BC	40
<b>Total</b>	<b>580</b>

64. **Bus Bays / Lay byes:** Presently there are no bus bays on the Project roads. Bus bays have been proposed at appropriate locations on Project roads. Their locations are however, subject to confirmation by the State PWD with State Transport Department and the local authorities, to enable them arrange additional land for the bus bays and bus passenger shelters.

65. **Junctions and Intersections:** Existing junctions and intersections on the Project roads are generally deficient in geometrics. These are proposed to be designed for improvement as per geometrics, laid down in IRC:SP:41-1994, subject to constraints due to existing road side structures. Total 5 junctions (3 on AS-02 and 2 on AS-03) are proposed for improvement.

66. **Traffic Signs:** The Project roads are deficient in traffic signs. New traffic signs, as per guidelines, in IRC:67-2001, IRC:31-1969 and IRC:SP:31 are proposed. The traffic signs are broadly categorized as cautionary signs, mandatory signs and informatory signs.

67. **Traffic markings:** Road traffic markings with hot applied thermoplastic paint are proposed in accordance with clause 803 of MORT&H Specifications and IRC : 35-1997.

68. **Traffic Safety Features:** The project roads lack in required traffic safety features such as traffic signals, road safety barriers, delineators and footpaths etc. that should ensure safety of road users, vehicles and pedestrians as well as the road side population, through built-up areas especially near schools, educational institutions, commercial areas, religious places and other public utility locations.

## **G. Road Construction Materials**

69. Material Survey for road construction materials for the Project roads, i.e. earth, aggregates, water, bitumen etc. has been carried out in the Project corridor and the indicative lead charts have been prepared.

70. Besides, the field in-situ investigations were conducted. The materials samples collected were tested in the laboratory and results data compiled in Material Report Volume III of the DPR.

71. The lead involved for the project roads and the investigations are quite representative, but more extensive investigation shall need to be conducted by the contractors at the time of construction, for earth and aggregates available from such sources.

## **H. Road Protection Work**

72. Sections of the Project roads are submerged and overtopped during rainy seasons. In addition, the stretches of the road alignment get submerged at river crossings during the floods.

It is proposed to raise the road levels appropriately, 1 m above the HFL or the general ground level, whichever is more. The approaches to bridges over rivers / streams are subjected to erosion during high floods. It is proposed to protect the erosion of the approaches to the bridges and the embankment by providing river protection works with stone pitching and aprons in accordance with provisions contained in MORT&H Specifications and IRC:89-1985.

## **I. Safety Audit**

73. A separate safety audit has not been carried out because most of the recommendations would not be possible to be implemented as these would involve extensive land acquisition, adverse environmental issues, and rehabilitation and resettlement concerns. The designers have attempted to eliminate the most serious safety issues through a smart design, to ensure improvement within the available ROW as far as possible.

## **J. Summary of Proposed Improvement Works**

74. The salient proposals for upgradation and improvement of the existing road are classified into the following engineering aspects.

- Widening of the carriageway width to 7.0 m with shoulders and side drains. Total formation width is 12 m. The road more or less follows the existing alignment and profile. The widening will be accommodated within available land-width and there will not be any significant land acquisition either forest land or private land.
- All new structures except bridges shall be 12 m in width. All new bridge structures shall have deck width of 7.5 m.
- Horizontal alignment for the project roads is proposed to follow existing alignment. One side widening is proposed in some locations where available land on either side permits a design without acquisition of land or where features on one side of the road are so important that these cannot be shifted.
- Horizontal geometry will be based on IRC:38-1988 "Guidelines for Design of Horizontal Curves for Highways and Design Tables (First Revision)".
- Vertical geometry will be based on "IRC:SP 23-1993".
- Carriageway width will be 7.0 m in general and the formation width will be 12.0m.
- The existing ROW is not demarcated on ground. As per PWD, ROW, between 24 to 30 m but is not of uniform width throughout the length of the road sections. Through built up sections, in small stretches, the ROW is restricted and varies between 7 m to 10 m. It is proposed to have minimum ROW, as per IRC:73-1980 ROW for a State Highway is 45 m in open areas and 30 m in built up areas.
- Bridges: There are 46 bridges (5 major and 41 minor) on the project roads. A total of 33 bridges will be retained, 7 bridges will for reconstruction, and 3 will be newly constructed.
- Cross drains: There are 86 culverts existing on the project roads. Existing substandard HP culverts are proposed to be replaced with NP4 type culverts. Existing slab type culverts are narrow. The slab type culverts are proposed to be repaired/ replaced, depending upon condition and widened, if feasible. Similarly the Box culverts in good condition will be retained /widened. Other type of culverts like SPT, and the buried ones will be reconstructed with Box/HP, as per site conditions.

- Pavement profile will have a 230mm, 250mm, 60mm, and 40mm thicknesses for GSBC, WMM, DBM, and BC respectively.
- 5 junctions (3 on AS-02 and 2 on AS-02) will be improved.
- Road safety measures like road delineators, signages, crash barriers, and guide posts will be installed.

#### **K. Project Cost**

75. The cost of civil works including maintenance amounts to Rs.292.58 crores (or US\$ 54.18 million) for road works including major bridges. These costs are based on 2008 rates as per analytical rates. The cost has been indexed for escalation till mid-2011 @ 5% per annum. The maintenance component in Part D of the Cost Estimate is based on an average 3% of total cost of Civil Works for 5 years. This component shall not be undertaken as part of contract for Civil Works, but to be undertaken separately subsequent to the construction.

#### **L. Construction Packaging and Implementation Schedule**

76. It is proposed to carry out construction of the road Project under one package with a time period of 4 years (48 months) under the contract. The Project is proposed to be undertaken through International Competitive Bidding (ICB). Currently the project is at bidding stage and planned to award contract in the second quarter of 2013.

#### **M. Project Benefits**

77. The implementation of the various project items is envisaged to have the following direct benefits:

- improved quality of life for the rural population in the project influence area (Tamulpur, Udalguri, Paneri, Rawta, and connectivity to national highway number 31): this as a result of better access to markets, health, education and other facilities; and the derived stimulus for local economic activity;
- a more efficient and safe road transport system: through reduced travel times, reduced road accidents, reduced vehicle operating and maintenance costs and reduced transportation costs for goods; and
- interstate connectivity to remote areas and district headquarters of the state.

#### IV. DESCRIPTION OF THE ENVIRONMENT

78. A brief description of the existing environment, including its physical and ecological resources, economic development of the region, and issues relating to quality of life are presented in this section. Broad aspects on various environmental parameters like geology, soil, topography, climate, land use, water resources, water quality, air quality, noise quality, tourism, cultural resources which are likely to be affected by the proposed road improvement project are described herewith.

##### A. Physical Environment

##### 1. Topography, Geology, and Soil

79. The state of Assam is located in the eastern part of the country in the foothills of Himalayas having a geographical area of about 78000 sq km. The state is bounded on the north by Bhutan and Arunachal Pradesh and shares its boundary with other North-Eastern states of Meghalaya, Tripura, Nagaland, Manipur and Mizoram. The state consists of discrete plains encompassed within hills, with a number of agro-climatic zones. The state can be divided into three broad physiographic units, viz., i) the Brahmaputra Valley in the north, ii) the Barak Valley in the south, and iii) the Hills region that lies in between the two valleys.



Figure 4.1: Typical road washed away by flood

80. The Brahmaputra Valley is an alluvial plain surrounded by hills except in the western side. The Brahmaputra river has entered the plain area near Sadiya in Tinsukhiya district in the east flowing towards west through the middle of the state and then turned down towards south to enter plain area of Bangladesh. The Brahmaputra Valley has a gradual slope from east to west. At Sadiya, the easternmost point of the state, the altitude is 134 metres above MSL, at Dibrugarh it is 104 metres, at Guwahati it is 50 meters and at Dubri, the western point, the altitude is 35 metres. The Barak Valley mainly consists of flat plain areas of the Cachar, Karimganj and Hailakandi districts, which is about 190 km long, and 96 km wide surrounded by hills on the three sides. The hilly region includes Karbi-Anglong and North Cachar Hills. Map showing physical features of the state is given in Figure 4.3.



Figure 4.2: Terrain and land use along the Project road

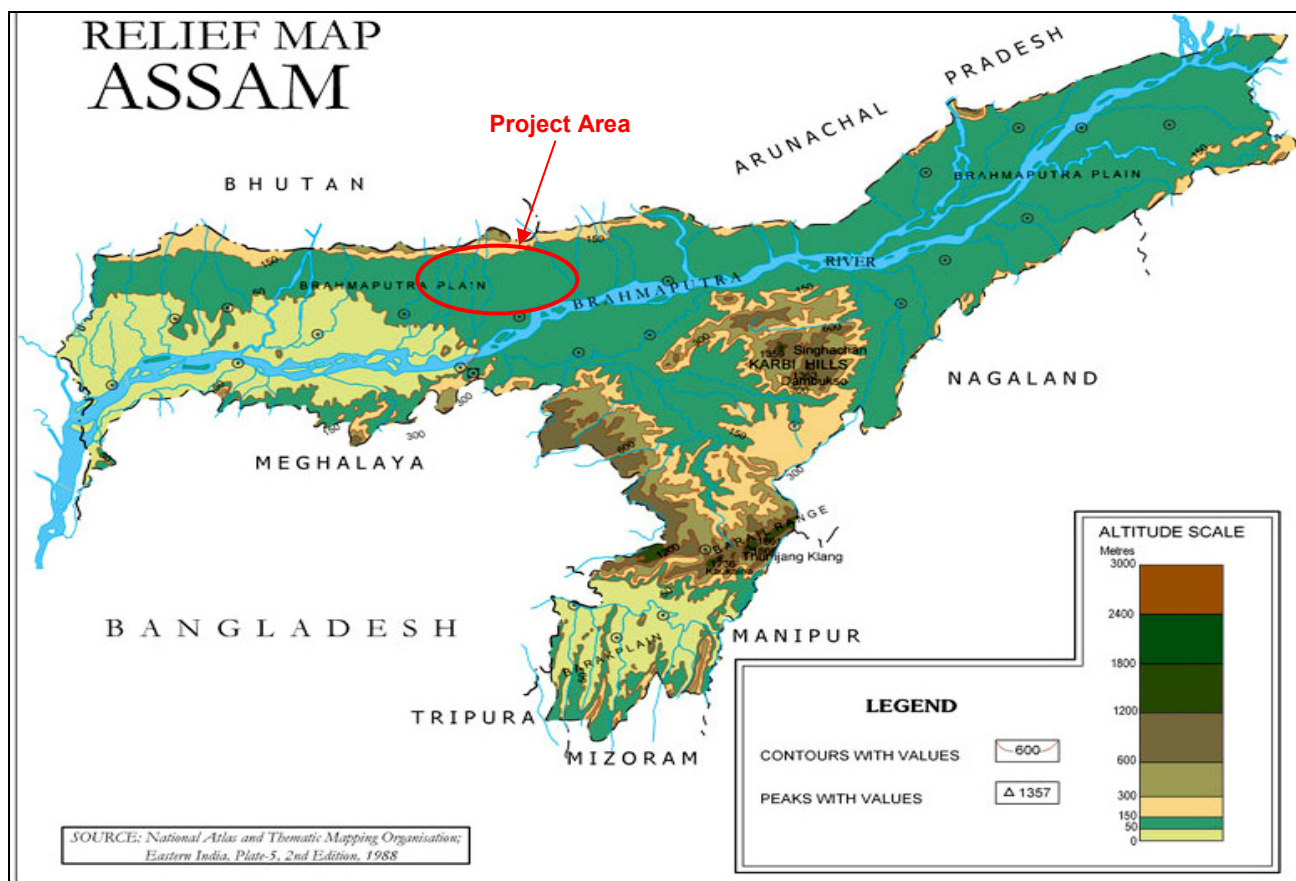
81. Geographically the state lies in the North-Eastern part of the

country between 24°30' to 28°00' North latitude and 89°00' to 96°00' East longitude, and sprawling over 78000sq.km. The state shares international boundaries with Bangladesh in the South-west and Bhutan in the North while it serves as a gateway to Myanmar through the neighbouring state of Manipur. Guwahati, the capital of Assam is the hub of all commercial activities in the North east India and a potential trade link with South-East Asian countries. Figure 4.1 shows the typical road washed out by flood whereas Figure 4.2 shows that topography and land use along the project road marked on the Google-earth image.

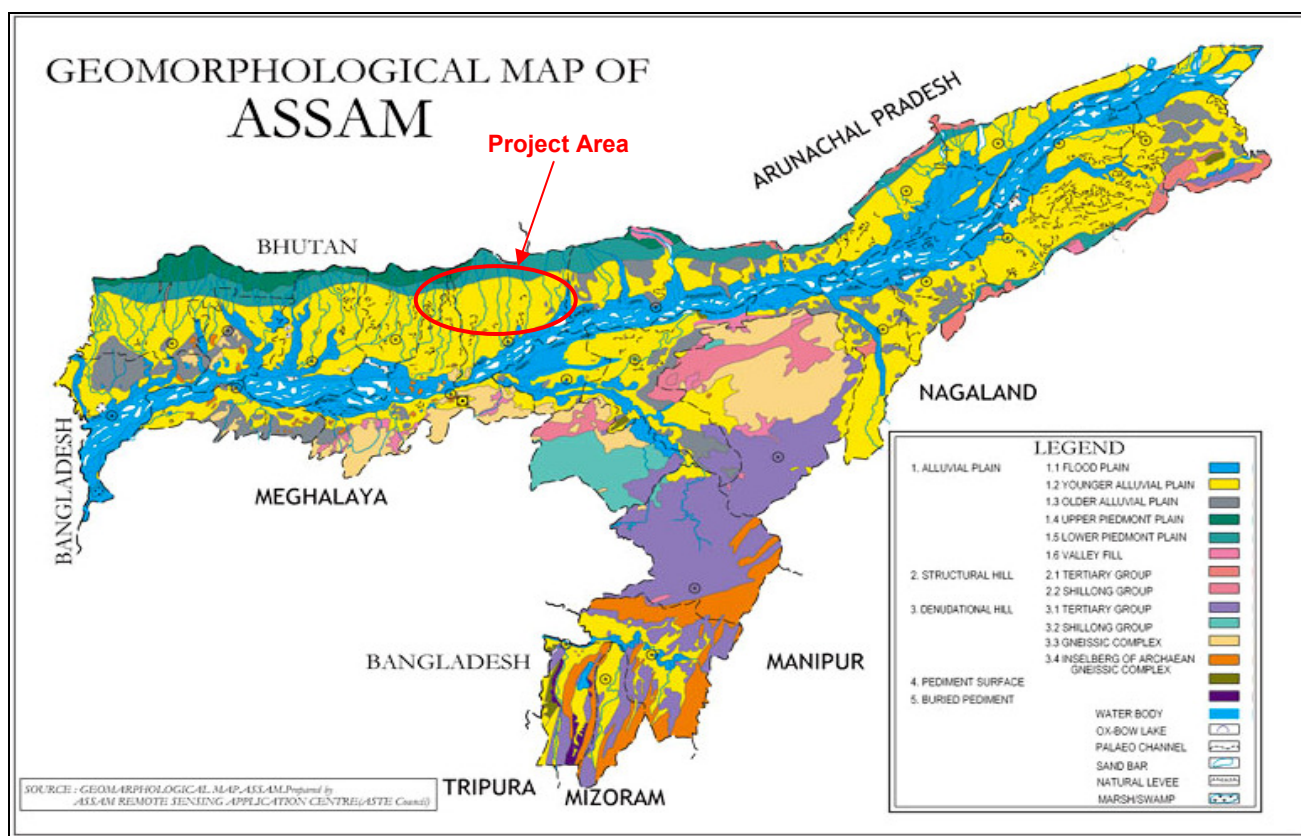
82. The soil, geology and topography of state are congenial for cultivation of paddy, which covers nearly 70 percent of the gross cropped area and more than more than 90 percent of total area under food grains. The soil of the state is acidic in reaction having pH value between 4.5 and 6.5 except the new alluvial soils, which are neutral in reaction. The soils of the foothills are also strongly acidic whereas the remaining areas are less acidic. As regards neutral status, phosphate contents are low while nitrogen and potash contents are medium. The major soil groups are i) new alluvial soil, ii) old alluvial soil, iii) old mountain valley alluvial soil, iv) non-laterised red soil, and v) laterised red soil. Geomorphological map of Assam is shown on Figure 4.4.

83. The subproject roads are located in Bagsa and Udalgiri districts of Assam. It can be seen from the relief map of Assam (Figure 4.3) that project roads are located at an altitude of 50-100 m above mean seal level.

84. Similarly it can be seen from Figure 4.4 that geomorphologically the subproject roads AS-02 and AS-03 are located in younger alluvial plan and upper and lower piedmont plants.



**Figure 4.3: Physical Feature Map of Assam State showing project roads**



**Figure 4.4: Geomorphological Map of Assam State showing project roads**

## 2. Climate

85. The project areas has a tropical climate with three seasons viz the summer months from June to August, the monsoon months from May to October, and winter/spring months from November to April. The region belongs to rainfall belt where rainfall varies from 80 mm to 1850 mm during different period of the year. Sufficient rainfall occurs mainly during the kharif season which is beneficial for growing paddy, the principal crop of the region. The project areas experience hot and humid climate as high as 85.9 percent or more in the majority of the districts including Baga and Udalgiri districts of Assam. Variation of temperature with a maximum of 30°C to 33°C, and minimum of 6°C to 12°C is also noticed in different parts of state. The salient climatic features of the project areas are as follow:

Average Annual Rainfall	-	2117 mm
Concentration of precipitation	-	May to September
Humidity	-	75 to 95%
Cloudiness	-	Mild clouded
Wind	-	Generally light except rainy season
Temperature	-	Summer 30°C to 33°C
	-	Winter 6°C to 12°C

### 3. Water Resources and Water Quality

86. The Brahmaputra river flowing through Assam carries one third of combined annual flow of all the rivers of India. Along with the river Barak, Assam has the unique advantage of 430 million acres feet of water resources which could be used to generate hydroelectric power, widen the irrigation network and used as an inland water transport network (cheapest mode of transport). There is also considerable groundwater resource in the Brahmaputra and Barak river basins, which holds good prospects for utilization. There are 22 rivers in the state, which is the largest perennial water system in the country.

87. The ground water aquifers in the region occur in sediments and fractured rocks. Springs are either seasonal or perennial and are often used for irrigation and drinking purposes. There are number of hot springs in the region which are being used by the local communities for domestic and agricultural purposes and also being used by the visiting tourists.

88. The project roads crosses two major rivers (km 28.5 and km 33.5) and other tributaries of Brahmaputra River (i.e. Chandana River, Varla River, Nonai River, Kala River, Suklai River, Baranadi River, Balti River) and many other small streams. Table 4.1 show the chainage wise detail of major rivers along the project roads.

**Table 4.1: Major Rivers along the Project Roads**

Sl. No.	River Name	Existing Chainage (Km)	Proposed Chainage (Km)	Width of the River Crossings (m)
<b>AS-02: Tamulpur-Paneri</b>				
1.	Bar River	17+550	17+500	1200
2.	Suklai River	27+800	27+850	1000
3.	Mara Kala River	32+900	32+950	500
4.	Kala Nonoi River	36+425	36+375	1000
<b>AS-03: Paneri-Udalguri</b>				
5.	Barla River	6+750	6+835	500
6.	Kulsi River	12+500	12+750	500

89. The surface water quality in the project area is reported to be well within the permissible limits and also found from the data available from Pollution Control Boards, that the surface water quality is acceptable except the turbidity and silt content which is due to frequent raining and floods. There are no reports of any water born disease in the region. People are using this water for domestic as well agricultural purposes without any treatment.

90. In case of ground water quality, it is generally good in entire state. People use ground water for domestic purposes within any treatment. Overall ground water quality is acceptable.

### 4. Air Quality

91. The ambient air quality in the state is good except some commercial centres i.e. Guwahati, Silchar where particulate concentration is higher side. There are very few industrial activities in the state. Dust arising from unpaved surfaces, forest fire, smoke created by burning of fire woods, and vehicular pollution are sources of pollution in the region. Firewood burning is major contributor in the ambient pollution load. Industrial and vehicular pollution is mainly concentrated in the major commercial areas in the state. Lack of technology and state of the art equipments are some of the factors responsible for industrial pollution.

92. Vehicular pollution is a secondary source of pollution in the state as the traffic density in the entire state is very less. Pollution from vehicles is mainly due to use of low-grade fuel, low maintenance of vehicles, and also the poor conditions of the roads. The level of pollution in rural areas is much less than that of the urban areas and also the traffic flow in rural areas is much less than that of the urban locations.

93. The stock of motorized vehicles in the state is continuously on the rise, average growth being 6 to 7 percent per annum. Currently the total number of registered vehicles is estimated at 600,000 vehicles including over 80,000 trucks and 8000 buses. With economic growth, traffic is bound to increase.

94. The air quality data obtained from the Assam State Pollution Control Board indicates that the ambient air quality in the project areas i.e. Baga and Udalgi district of Assam is well within permissible standards except respirable particulate matter which is on slight higher side.

## **5. Noise Quality**

95. Noise pollution is not a problem in the project areas. Also in future rise in the noise levels due to proposed activities is not anticipated because the smooth traffic flow resulting of improved road condition will lead to reduction in noise levels. Since the traffic flow is expected to be very low on the project roads, there will not be any rise in the noise levels. However, at few commercial locations i.e. Udalgi, Paneri, and Tamulpur, small contribution to the noise levels are anticipated, but still the ambient noise quality is expected to be well within the permissible limits.

96. During the construction period, temporary increase in the noise levels are anticipated due to movement of construction machineries and construction activities associated with proposed road development. Suitable barriers in the form of noise barriers and timely scheduling of construction activities will minimize these affects to the greater extent.

## **B. Ecological Environment**

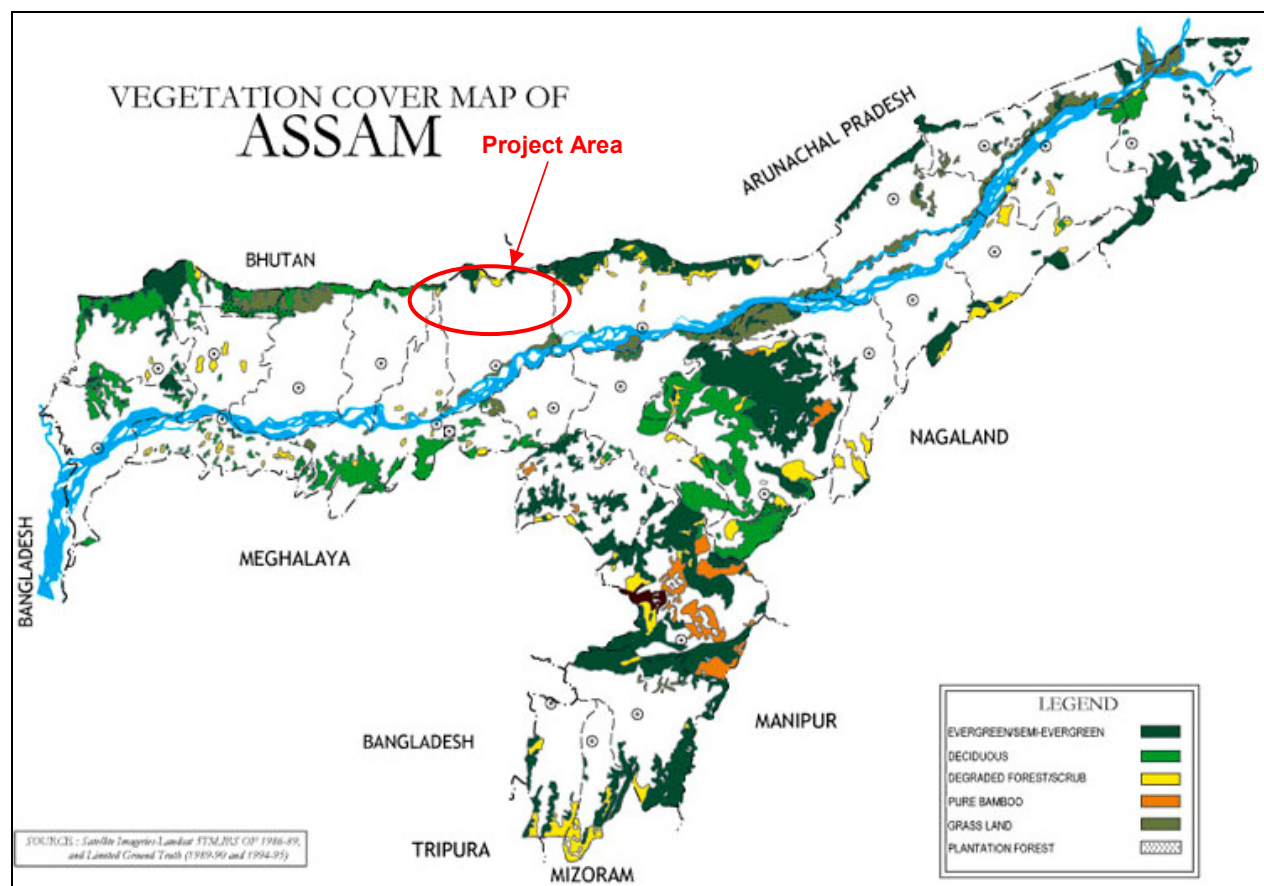
### **1. Vegetation**

97. The state is divided into three zones in describing the aspects of vegetation. These are tropical, temperate and evergreen respectively in increasing order of altitude. The favourable rainfall, temperature and high humidity existing in the area, have caused the vegetation to acquire the general characteristics of the northern tropical semi-evergreen forest.

98. The territorial area under region extends from the forest hills of eastern himalayas (Bhutan hills) to the flood plain area of Brahmaputra valley. Because of diversified configuration pattern of the ground and varied rainfall pattern throughout the region different types of forest associations are found in the region.

99. Assam is known for its extensive forests areas and availability of rich flora and faunas besides other vulnerable forest products. As per information available from the state forest department, the total area under forests in Assam is about 26781sq.km and more than 50 percent of this area is under reserved forests area. Thus the forests constitute of about 34.14 percent of the total geographical area of the state. The forests in the plain districts are managed by the state forest department. The vegetation map of the Assam state is presented in Figure 4.5.

100. It can be seen from the vegetation map of the Assam (Figure 4.5) that subproject roads in Baga and Udalgiri districts of Assam has semi-evergreen to deciduous vegetations. Some patches of degraded forests can also be seen in the project areas.



**Figure 4.5: Vegetation Map of Assam State**

101. Shifting cultivation, encroachments and unchecked felling of trees have contributed to declining areas and forest productivity. A large proportion of the forest produce is processed by a number of forest based industries such as plywood, match factories, timber treatment and seasoning plants, hard board factories, paper mills and saw mills. They depend upon good quality road network for efficient evacuation of products.

102. With its vast hills and forests, Assam is the home for a variety of medicinal herbs and plants. About 300 types of medicinal herbs and plants are known to exist in abundance in the state.

103. The major species which have commercial importance and found in the forests of the state are Badam, Amari, Cham, Tita Sopa, Nahar, Bhelu, Gomari, Poma, Bonsum, Dhuna, Myrobalans, Bhola and Bon Am etc. in the top canopy. Mixed moist deciduous forests have Haldu, Bohera, Simul, Ghogra, Azhar, odal, Outenga etc. in the top canopy. Riverain type of forest occupies the localities with alluvial soil of more recent origin in the vicinity of rivers and streams of the state. The common species of importance are Khair, Sissoo, Simul, Urium, Kokoli etc. Miscellaneous type of forest comprises of Amari, Sopa, Cham, Bonsum, Bogipoma, Gonsoroi, Dhuna and Hingori etc. Principal species of bamboos are Dendrocalamus hamiltonii (Kako) and Bambusa tulda (Jati) besides a small proportion of other bamboos. Kako and Jati bamboos are mostly harvested species. The forests are also rich in minor forest produces like Cane, Patidoi, Dhuna, Agar, Ekra, Thatches, Barks of Baghnala, Laham, Dalchini, Patihunda, Rema, Satkora and a variety of medicinal plants.

## 2. Wildlife and Protected Area Network of Assam

104. Two national parks viz. Kaziranga and Manas; ten wildlife sanctuaries and one game reserve are located in Assam. These are home to the famous one-horned rhino besides elephants, tigers and others. The potential of these parks as tourist attractions is yet to be realised to their fullest.

105. The state has rich wildlife comprising rare and endangered species and has long network of protected area. In order to protect the rich flora and fauna of Assam, the Government has established five national parks, twelve wildlife sanctuaries and three bird sanctuaries. These are home to the famous one-horned rhino besides elephants, tigers and others. The potential of these parks as tourist attractions is yet to be realised to their fullest. The details of these parks and sanctuaries are given in Table 4.2. Figure 4.6 show the protected area map of the Assam. The total area under the protected area network is 2.7 percent of total geographical area of state and that of under national parks is 1.5 percent.

**Table 4.2: Protected Area Network in the State of Assam**

Sl.	Protected Area	Location (District)	Area in sq.km
<b>A.</b>	<b>National Parks</b>		
1	Kaziranga National Park	Golaghat, Nagoan & Sonitpur	858.98
2	Manas National Park	Chirang & Baksa	500
3	Nameri National Park	Sonitpur	200
4	Dibru-Saikhowa National Park	Dibrugarh&Tinsukia	340
5	Orang National Park	Udalguri & Sonitpur	78.81
<b>B</b>	<b>Wildlife Sanctuaries</b>		
1	Gibbon Wildlife Sanctuary	Jorhat	20.98
2	Garampani Wildlife Sanctuary	Karbi Anglong	6.05
3	Burachapari Wildlife Sanctuary	Sonitpur	44.06
4	Boranadi Wildlife Sanctuary	Udalguri	26.22
5	Sonai-Rupa Wildlife Sanctuary	Sonitpur	220
6	Pabitora Wildlife Sanctuary	Morigoan	38.8
7	Panidihing Bird Sanctuary	Sibsaoar	33.93

Sl.	Protected Area	Location (District)	Area in sq.km
8	Bhejan-Borajan-Padumoni Wildlife Sanctuary	Tinsukia	7.22
9	Nambor Wildlife Sanctuary	Karbi Anglong	37
10	North Karbi-Anglong Wildlife Sanctuary	Karbi Anglong	96
11	East Karbi-Anglong Wildlife Sanctuary	Karbi Anglong	222.81
12	Laokhowa Wildlife Sanctuary	Nagoan	70.13
13	Charkrasila Wildlife Sanctuary	Kokraiher	45.57
14	Marat Longri Wildlife Sanctuary	Karbi Analong	451
15	Nambor-Doigrung Wildlife Sanctuary	Golaqhat	97.15
16	Dehing Patkai Wildlife Sanctuary	Dibrugarh & Tinsukia	111.19
17	Borail Wildlife Sanctuary	Cachar Karimgang	326.25
18	Amsang Wildlife Sanctuary	Kamruo (Metro)	78.64
<b>C</b>	<b>Proposed Wildlife Sanctuary</b>		
1	Deepar Beel Wildlife Sanctuary	Kamrup (Metro)	4.14
2	Bordoibuam-Beelmikh Wildlife Sanctuary	Lakhimpur, Dhemaji	11.25

Source: Statistical Handbook Assam 2004 and Chief Conservator of Forest (WL), Assam

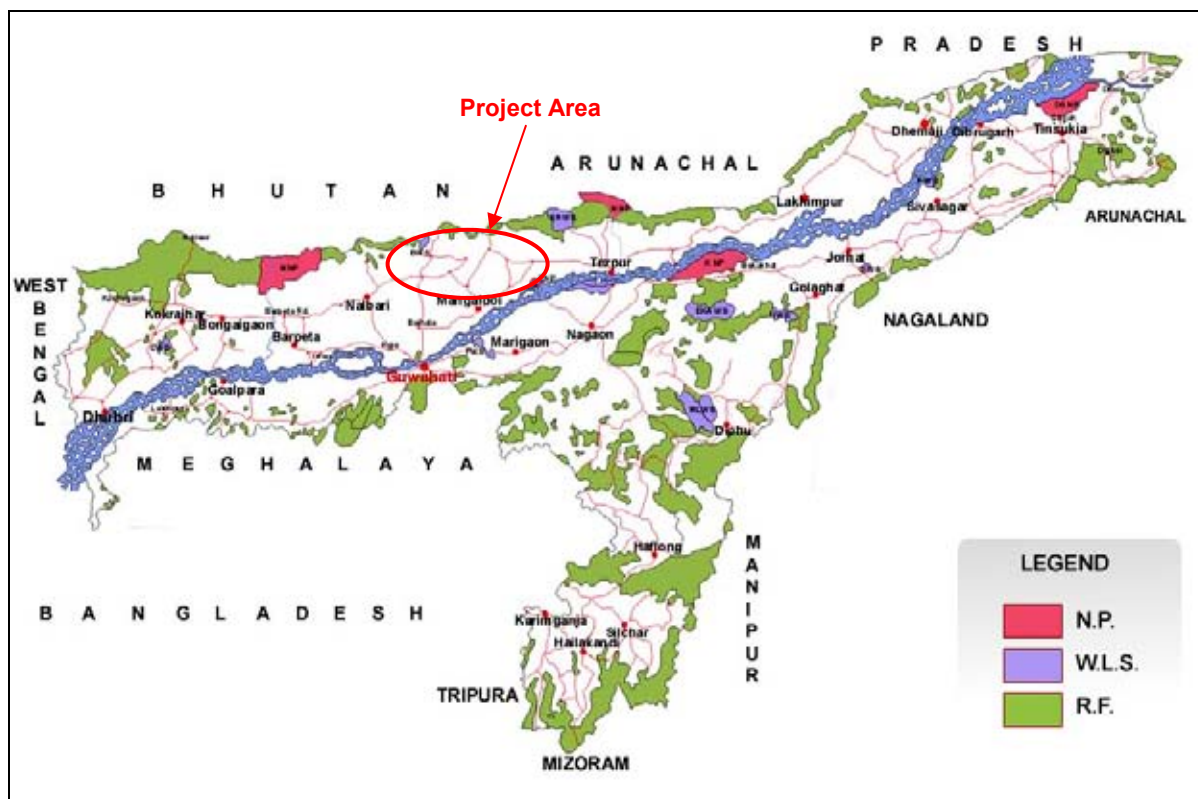


Figure 4.6: Protected Area Map of Assam State

106. It can be seen from the protected area map of the state (Figure 4.6) that the subproject roads AS-02 and AS-03 do not pass through any of the protected areas of the state.

107. One of the most attractive features of the state's forestry sector is its wildlife comprising variety of animals, reptiles, birds and fishes. Some of the species found in the state are either exclusive to her or rarely to be seen in any part of the country. Assam is famous all over the world as the home of great one-horned Rhinoceros. The highly endangered species of the world found in Assam are Hollock Gibbon, the Stump-tailed Macaque, the Capped Langour monkeys, the Pigmy Hog, the Clouded Leopard, the Golden Cat, the White Winged Wood Duck etc. Assam is one of the best destinations where tourists can encounter a great variety of wildlife.

108. The one horned rhino is largely concentrated in the Kaziranga National Park (world heritage site), where a range of about fifteen types of grass provide them ample forage. The rhino is also found in smaller number in some other wildlife sanctuaries in the state. Assam boasts of a variety of other exotic wildlife mammals as well as the multihued winged species like Swamp Deer, Sambar, Hog Deer, Hog Badger, Indian Bison, Water Buffalo, Jackal, Goose, Hornbills, Ibis, Cormorants, Egret, Heron, Fishing Eagle, Hill Partridges, Yellow Bittern, Emerald Dove and Pelican.

## C. Socio Economic Environment

### 1. Demography

109. Assam is the largest state in the north eastern region with a geographical area over 78000 sq. km with total population of 26.6 million with more than 87 percent of the population living in the rural areas. The human population density is very high i.e. 340 persons/km<sup>2</sup> compared to 149 persons/km<sup>2</sup> for the north eastern region. Sex ratio is almost that for the country i.e. 932. The demographic feature of north eastern states is unique in that there are more than 100 recognized tribes, which inhabit mostly the hill areas and each with distinct culture, ethos, and traditional knowledge systems. Assam has been the home to people of various stocks viz. Aryan, Mongoloid, Astro-Asiatic, Indo-Tibetan-Burmese, Dravidian etc. There are a number of tribal groups like Bodo, Karbi, Dimas, Missing etc that inhabit the State. The majority of the people survive on subsistence economy based mainly on the agriculture, supplemented with limited horticulture, animal husbandry, crafts/handloom, etc. Table 4.3 below presents the demographic features of the North eastern region.

**Table 4.3: Demographic Features of Assam and North Eastern Region as per 2001 census (p)**

State	Area (sq. km)	Population			Density	Sex Ratio
		Rural	Urban	Total		
Assam	78438	23248994	3389413	26638407	340	932
NE Region	262179	33008703	5809395	39041167	149	936
All India	3287263	741660293	285354954	1027015247	312	933

Source: 1) Census of India, 2001 (Provisional), 2) Statistical Abstract of State Governments, Directorate of Economics and Statistics, 3) Where do we stand in 2003, Meghalaya & North East and India & The World, Directorate of Economics & Statistics, Government of Meghalaya

110. The Net State Domestic Product (NSDP) at constant (1993-94) prices for the year 1999-2000 is Rs.155.55 billion. The contribution of primary, secondary and tertiary sector is 46

percent, 14 percent and 40 percent respectively. The per capita income in real terms is Rs.5968 in 1999-2000 which is much below the national level.

## 2. Land Resources

111. The area available for land utilization in the state is about 69852 sq.km of the total geographical area of state. This means about 54 percent of the area in the state is available under various land uses. Major portion of the land use is under gross cropped area covering about 30 percent of total land available for various uses. About 21 percent area is under net sown area. Agriculture is the major land use in state. The area under various land uses in the state and north eastern region is presented in the Table 4.4:

**Table 4.4: Land use pattern in North East Region (Figure in thousand hectare)**

State	Reporting area for land utilization	Forest area	Not available for cultivation	Other uncultivated land excluding fallow land	Fallow land	Gross cropped area	Net area sown	Area sown more than once	Total
Assam	6985.2	1845.2	2510.2	483	225.5	3940.6	2701.1	1239.5	12945.1
NE Region	21754.5	13379	3296.8	1624	913.6	5448.6	3891.1	1557.5	30110.6

Source: www.neportal.org (Directorate of Economics and Statistics, NE states and NEC, Shillong).

Statistical Abstract (2001-02), Sikkim, Directorate of Economics and Statistics, NE States.

## 3. Agriculture and Forestry

112. Agriculture occupies an important place in the economy of the state. The state is endowed with the largest perennial water system in the country with Brahmaputra and its tributaries passing through the state. The soil, topography, rainfall and climate make the land highly fertile for cultivation of a wide variety of food grains and cash crops on a commercial basis. About one-third of total land area is the net sown area. Of this roughly 45 percent area is sown more than once. During the year 1999-2000, the total production of food grains was 4.04 million tonnes, largest share being that of rice (3.86 million tonnes). Other commodities include wheat, maize, cereals, sugarcane, potato, jute. Tea plantation has constituted an important cash crop of increasing commercial value for the state. Production of tea in 1999 is reported to be 414 million kgs and it accounted for half the country's production.

113. As mentioned earlier, area under forest cover is only about 22 percent. Shifting cultivation, encroachments and unchecked felling of trees have contributed to declining areas and forest productivity. A large proportion of the forest produce is processed by a number of forest based industries such as plywood, match factories, timber treatment and seasoning plants, hard board factories, paper mills and saw mills. They depend upon good quality road network for efficient evacuation of products.

## 4. Fisheries

114. The state has great potential for the development of fisheries. There are over 25421 hectares of ponds and tanks and 26421 hectares of Swamps or Low Lying Areas which can be developed for pisciculture. The present requirement of fish in the state is estimated at about 2.73 lakh tons per year whereas production level is estimated to be 1.65 lakh tons only. Thus, there exist a gap between demand and production of fish. However, the fish production has

increased from 161450 tons in 2001-2002 to 165521 tons in 2002-2003 thereby registering an increase of 2.52 percent.

115. The important fish species commonly found in the region's plain and river basins are *Catla catla*, *Labeo rohita*, *Labeo calbase*, *Cirrihinus mirigale*, *Clarius*, *batrachus*, *Rita rita*, *Heteropneustus fonilis*, *Notopterus nontopterus*, *N. Chitala*, *Macrobrachum rosenbergii*, *M. malconsoni*, *M. Chapral*, *Channa punetatus* *C. gaehua*, *C. striatus*.

## 5. Transportation

116. Compared to other states of the NE region, the state is well served by all modes of transport viz railways, Inland Water Transport, air and roads. The state is connected with the rest of the country by West Bengal in the North through a small strip about 30 km wide called the Chicken's Neck. It also serves as a gateway to other states of the NE region. Railways account for a length of about 2400 km. The state has 6 airports (Guwahati, Tezpur, Jorhat, Dibrugarh, Lakhimpur and Silchar). As regards IWT, the Brahmaputra and the Barak are the two most important navigable rivers. Several tributaries of these rivers are also navigable by country boats. The Brahmaputra is already declared as National Waterway No.2. Two public sector organisations viz State Directorate of IWT and Central Inland Water Transport Corporation are operating transport services between Guwahati and Kolkata for movement of goods by barges. Roads and road transport is, however, the main mode of transport in the state. Today the road network stands at 41300 km including 31300 km of earth or gravel roads.

## 6. Mineral Resources

117. The state is endowed with a number of mineral resources. Besides oil and gas (5.145 MT), the state has good reserves of coal, petroleum crude and limestone. These are important for economic and industrial growth of the region. For exploiting the mineral resources, it is important to provide a good road and rail infrastructure.

## 7. Industrial Situation

118. Industrial growth has been slow mainly due to lack of infrastructure (power and transport). The annual output from industries in the state was merely Rs.75.13 billion (1997-98 data) providing employment to 187165 persons. The situation is improving as the state is giving a push to industrial growth by development of several growth centres spread throughout the state. As per 2001 data, there are 15 industrial estates, 115 large and medium industrial units and 37433 small scale units. The thrust areas identified are tea processing machinery, handloom and handicrafts, food processing, ceramic, paper, plastic and rubber etc. Opportunities need to be provided by harnessing the natural gas available and augmenting the road infrastructure.

## 8. Aesthetic and Tourism

119. The state offers 'wildlife' as its most attractive feature. The Kaziranga National Park and Manas National Park are home to one-horned rhino, golden Langour, Royal Bengal Tiger and natural habitat of various wild animals. The state government is taking several measures for development of this sector by declaration of tourism as an industry.

## 9. Cultural Resources

120. The region has great cultural value. Festivals and cultural activities are being celebrated throughout the year in the region. The region is a home to number of tribal communities which has a great cultural importance. There are number of cultural / pilgrim centers in the region. The famous Kamakhya Temple of goddess Kali at Guwahati attracts millions of pilgrims annually. Along the project road there are number of small temples /mosques exist within project corridor. Table 4.5 gives details of these cultural properties.

## 10. Energy and Electric Power Potential

121. Firewood is still a major source of energy in the region which is available in abundance in the region. The region is generating mostly hydro power which contributes to about 50 percent of installed capacity in the region and rest is by other means. The state's main power generation sources are steam and gas. The region is endowed with huge hydro power potential. The power potential needs to be harnessed for the industrial growth of the Region and for meeting the energy demand of the rest of the country. The gross generation of power in Assam is 840.41 MKWH. Other state's contribution is very less to the power sector.

## 11. International Trade & Commerce

122. There are number of agreements between India and neighbouring country to enhance the border trade across the countries. The states of North East have 5,000 Km. of International Border with 4 foreign countries viz. Bhutan, Bangladesh, China & Myanmar. The region shares 2% of its border with mainland of the country and rest 98% with other countries. This region is blessed with an abundance of natural, mineral and energy resources and an extremely beautiful landscape complemented by a highly literate population. The process of globalisation and liberalisation has opened up the economy of the N.E. as a result of which the Trade relation with the neighbouring countries is growing and diversifying.

123. The various physical features along the project road are described in Table 4.5 below.

**Table 4.5a: Physical /Sensitive Features along the project road AS-02**

Sl. No.	Name of School/ college/ hospital	Name of the village	Distance and Direction from existing road edge	Chainage (km)
1	Upen Brahma M.E. School	Bareigaon	26.0m(LHS)	0.450km
2	Tamulpur Bareigaon L.P. School	Bareigaon	61.0m(LHS)	0.450km
3	Adarsha Vidya Niketan	Kasubari	17.2m(RHS)	2.600km
4	Kasubari L.P School	Kasubari	16.0m(RHS)	2.650km
5	Ramechuburi M.E. High School	Ramechuburi	50.0m(RHS)	5.350km
6	Dongpar Sub Centre	Dongpar	32.6m(RHS)	5.475km

Sl. No.	Name of School/ college/ hospital	Name of the village	Distance and Direction from existing road edge	Chainage (km)
7	486 No. Dongapara L.P. School	Dongpar	9.7m(LHS)	5.550km
8	Nuakhat M.E. School	Nuakhat	10.7m(RHS)	7.475km
9	Nuakhat L.P. School	Nuakhat	19.0m(RHS)	7.475km
10	Laupara L.P. School	Laupara	56.0m(LHS)	9.575km
11	Anandaram Baruah Jatiya Vidyalaya	Tebitola	14.0m (RHS)	10.75km
12	Tebitola Balak Primary School	Tebitola (Gudam Basti)	30.0m (LHS)	11.025km
13	485No. Khatorbari L.P. School	Khatorbari	31.0m (RHS)	13.375 km
14	Khatorbari High School	Khatorbari	90.0m(LHS)	13.775 km
15	Nagriji Junior College	Nagriji	79.0m(RHS)	13.950 km
16	St. Jude's English Medium School	Nagriji	54.0m(LHS)	14.350 km
17	St. Mary's Health Centre	Nagriji	13.5m(LHS)	14.550 km
18	Irragdao L.P School	Dangargaon	55.0m(LHS)	18.450 km
19	Bholajhar Primary School	Bangalipara	16.0m(RHS)	18.775 km
20	Uttarnaobandha Primary School	Uttar Naobandha	25.8m(LHS)	22.600 km
21	Indira Gandhi M.E. School	Uttar Naobandha	85.0m(RHS)	22.725km
22	Uttar Naobandha Health Centre	Uttar Naobandha	8.50m(LHS)	22.850km
23	Borangajuli Primary School	Suklai (Borangajuli Khuti)	19.6m(RHS)	27.150km
24	Millenium Academy	Suklai	19.0m(RHS)	27.250km
25	Shuklai Jatiya Vidyalaya	Suklai	35.0m(LHS)	27.400km
26	Bishnurabha M.E. school	Borangajuli	13.0m(LHS)	29.225km
27	Borengajuli Kuthi L.P. School	Borangajuli	21.0m(RHS)	29.250km
28	Maharshi Vidya Niketan	Borangajuli	72.0m(RHS)	30.150km
29	Borengajuli Hospital	Borangajuli	19.0m(RHS)	30.250km
30	DAV High School	Borangajuli	21.0m(RHS)	30.625km
31	Sonajuli Sarkar Mission L.P. School	Dimakuchi	29.0m(RHS)	31.100km
32	Dimakuchi Junior College	Dimakuchi	44.3m(RHS)	31.125km
33	Sekhar Sankardev Mission H.S. School	Dimakuchi	29.0m(RHS)	31.250km

Sl. No.	Name of School/ college/ hospital	Name of the village	Distance and Direction from existing road edge	Chainage (km)
34	Himalaya Jatyiya Vidyalaya	Dimakuchi	71.8m(LHS)	31.350km
35	Uttar Dimakuchi L.P. School	Dimakuchi	41.6m(LHS)	32.050km
36	Dimakuchi Girls' M.E. School	Dimakuchi	72.0m(LHS)	32.500km
37	Dimakuchi L.P. School	Dimakuchi	70.0m(RHS)	33.400km
38	Dimakuchi M.E. School	Dimakuchi	71.5m(LHS)	33.875km
39	Gitibari Primary School	Gitibari	13.0m(RHS)	37.075km
40	Paneri Kendriya Hospital with Diagnostic Centre	Paneri	22.0m(RHS)	39.450km
41	Child Care Centre (Paneri Tea Estate)	Paneri	35.0m(RHS)	39.525km
42	Paneri Tea Estate L.P. School	Paneri	39.0m(LHS)	39.900km
43	Paneri College	Paneri (Kasubil)	30.0m(RHS)	40.975km
44	Khaling Duar Academy	Paneri	32.0m(LHS)	41.875km
45	Paneri H.S. School	Paneri	23.0m(LHS)	42.100km
46	Paneri M.E. Madrasa	Paneri Hat	37.0m (RHS)	42.425km
47	Paneri Adarsa M.E. School & Paneri L.P. School	Paneri Hat	18.0m(RHS)	42.450km
48	Paneri Jawaharlal M.E. School	Paneri Hat	10.0m(LHS)	42.975km

**Table 4.5b: Physical / Sensitive Features along the project road AS-03**

Sl. No.	Name of School/ college/ hospital	Name of the village	Distance and Direction from existing road edge	Chainage (km)
1	Panery Jabaharlal M.V.School	Panery hat	17 m (LHS)	0.025 km
2	Panery Subsidiary Health center	Panery hat	20.1 m (LHS)	0.075 km
3	Bengbari Health Sub center	Bengbari	39 m (LHS)	4.525 km
4	Bengbari L.P. School	Bengbari	15 m (RHS)	4.600 km
5	Bengbari H.E.School	Bengbari	17 m (RHS)	4.675 km
6	St. Paul's School	Bengbari	18 m (RHS)	6.100 km
7	Bengbari Natun Basti L.P. School	Bengbari Natunbasti	48 m (LHS)	6.350 km
8	Harisinga M.P Baro Girls Highschool	Deulguri (KochPara)	58 m (RHS)	7.700 km
9	Upendra National Academy	Ambagaon	16 m (RHS)	10.550 km
10	Ambagaon High School	Ambagaon	96 m (LHS)	10.650 km

Sl. No.	Name of School/ college/ hospital	Name of the village	Distance and Direction from existing road edge	Chainage (km)
11	Ulubari L.P School	Ulubari	35.5 m (LHS)	13.075 km
12	Tamulbari M.E School	Tamulbari	59 m (RHS)	13.800 km
13	Kapurpara M.E School	Kapurpara	69.8 m (LHS)	14.750 km
14	Chandana Bagan L.P School	Chandana	23 m (LHS)	16.650 km

## **V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

124. This chapter presents key environmental issues associated with various aspects of the proposed project. Identification and assessment of the potential environmental impacts are based on secondary information supplemented by field visits. Impacts on various environmental components have been assessed at four different stages, namely:

- the project location;
- design;
- construction; and
- operation stages.

125. A few short and long-term negative effects, mainly at the construction and operation stages, are, nonetheless, anticipated. These can be kept in check through proper planning and adopting environment friendly road construction methods and the appropriate regulatory measures.

### **A. Identification and Assessment of Impacts**

#### **1. Positive Impacts due to improvement of road section between Tamulpur and Udalguri in the Northern Assam**

126. The following are the anticipated:

- Better access to region and reduction in travel time and lower vehicle operating cost i.e. per kilometre vehicle operating cost from the general improvement work and an absolute saving in cost due to reduction in fuel consumption and therefore exhausts, tyre and spare parts consumption can be expected for the existing traffic.
- Better access to other parts of the state by through links to Udalguri, Rangia, Paneri and Tamulpur and further to NH-37 (which is a major route connecting state capital Guwahati with northern states of Assam). From economic point of view, proposed road will enhance the trade and commerce between northern Assam and rest of the state.
- Easier access to educational and health care facilities, urban centres etc.

#### **2. Adverse Environmental Impacts due to improvement of state highway section between Tamulpur and Udalguri in the Northern Assam**

127. The following adverse environmental impacts are expected from the improvement of Tamulpur-Udalguri road section:

- Cutting of road side trees that falls within formation width i.e. 12.0 m may reduce the ecological balance of the area and also increase problem of soil erosion.
- Noise, air and water pollution and disposal of waste, during construction, will cause adverse impacts on local residents. These effects should, however, only be temporary/reversible.

- A number of quarries and other sources will be established. However, the operation of quarries is an independent and already regulated activity. Negative impacts on water quality of rivers in the form of silt deposition and runoff during construction are expected. However, this is short term and will be taken care by controlled construction activities.
- Improvement of road sections and construction of bridges / cross drainage structures may enhance soil erosion and reduce the micro -level ecological balance of the area. The widening will also require the cutting of a large number of trees (about 2352).
- Minor impacts of noise and air quality for those now living and workings close to the project road (mainly at Tamulpur, Paneri, and Udalguri) will deteriorate during the construction period and afterwards during operation.

## **B. Impacts and Mitigation Measures Due to Project Location and Design**

### **1. Vegetation Clearing and Tree Felling**

128. Most of the project road section passes through plain areas. Since, improvement work will be largely limited to the available ROW there will not be any adverse impacts due to diversion of forest land. Nonetheless, land clearing will involve cutting of a large number of trees exist within 12 m formation width. Problem of soil erosion is expected in some locations. To minimize loss of trees, the following mitigation measures are adopted during the detailed design and construction stage of the project:

- widening proposal will consider option with minimal tree cutting.
- identify areas prone to erosion and include land stabilization measures.
- strictly enforce the environmental conditions put as part of the environmental clearance by the MoEF and SPCB.
- adopting Environmental Friendly Road Construction (EFRC) methods.

129. The improvements of the proposed road will largely be confined on the existing alignment. At some locations, improvements to the geometry may involve cutting, filling, and the need to cut vegetation along most of the project road length. This will have more significant impact and this matter is discussed in the sections which follow.

130. From the field assessment it is estimated that tentatively 1786 trees to be cleared along AS-02 (Tamulpur-Paneri) and 567 trees to be cleared along AS-03 (Paneri-Udalguri) road sections. These numbers will be further confirmed during the joint verification with forest department. As per compensatory afforestation, the tree plantation will be done three times of tree cutting (1:3 of tree cutting i.e. 7056 trees). At sensitive locations such as schools, colleges and hospitals along the project roads noise barrier shall need to be provided. Details of the trees to be cut are given in Table 5.1 for AS-02 and AS-03 road sections. Species wise detail of trees inventory is provided as Appendix 2.

**Table 5.1: Details of trees to be cleared along Tamulpur-Udalguri Road**

Chainage (Km)	AS-02: Tamulpur-Paneri Section		AS-03: Paneri-Udalguri Section	
	LHS	RHS	LHS	RHS
0+1	30	31	25	36
1+2	41	14	13	28
2+3	53	18	8	27
3+4	54	12	7	30
4+5	19	19	4	28
5+6	25	21	13	43
6+7	23	20	13	16
7+8	24	18	8	18
8+9	54	22	14	11
9+10	34	32	13	18
10+11	21	20	14	30
11+12	25	73	17	7
12+13	40	29	16	11
13+14	65	29	13	7
14+15	57	26	7	1
15+16	5	2	13	9
16+17	42	19	13	9
17+18	0	0	3	17
18+19	24	27	1	5
19+20	40	56		
20+21	4	10		
21+22	29	49		
22+23	24	34		
23+24	12	17		
24+25	2	2		
25+26	22	20		
26+27	16	6		
27+28	10	21		
28+29	2	3		
29+30	3	3		
30+31	33	2		
31+32	25	2		
32+33	0	2		
33+34	28	0		
34+35	18	10		
35+36	4	29		
36+37	0	9		
37+38	3	32		
38+39	4	4		
39+40	7	2		
40+41	14	8		
41+42	28	31		
42+43	20	18		
Total A	984	802	215	351
Total B	1786		566	
Grand Total	2352			

## 2. Borrow Pits and Quarries Operation

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

- borrow areas are not established in ecologically sensitive areas;
- villagers are consulted in regard to the design and location of all borrow areas – these should ensure the safety of local communities and, if possible, should incorporate beneficial post construction features for the villages;
- located away from the road and hill slopes as well as settlements facing the road, so as to minimise visual impacts;
- In case of reserve forest areas, construction facilities such as temporary workers camp, hot mix plants, and concrete batching plant and stone crushers should not be established in stretches that passes through reserve / protected forests. Consult forest department / village forest management committees before locating temporary project facilities such as construction camps and workers camp;
- construction camps for labourers should be located at least 500 m away from settlements;
- living accommodation and ancillary facilities should be erected and maintained to standards and scales approved by the Engineer-in-Charge; and
- toilets and urinals should be provided in accessible places away from the asphalt plant and mixing yard.

132. As part of detailed engineering design and considering above criteria, possible sources of construction materials have been identified (Appendix 3).

## 3. Cultural Heritage

133. There are no adverse impacts expected on historical places/monuments. However, there are few small shrines along the road. Care must be taken to avoid any damage to these structures. Earthworks, as associated with the road construction/ improvement works, or deriving from secondary sites such as quarries or borrow pits, may reveal sites or artifacts of cultural/ archaeological significance. In the event of such discovery, concerned authorities should be informed and the requirement to take such action should be incorporated in contract documents. Figure 5.1 show the typical shrine within formation width.



Figure 5.1: Typical shrine along the project road

## 4. Other Impacts deriving from the Project Preliminary Planning and Design Process

134. During preliminary planning and design of this project, the Consultant should take into account the need for:

- optimum siting and control of quarries;
- reduced incidence of slope failures due to inadequate drainage;
- providing adequate culverts/ drains;
- providing side-drainage structures;
- mechanised construction methods and thereby, for example, reduced use of firewood for heating bitumen;
- maximising safety and thereby reducing traffic accidents;
- reducing travel times and, thereby, fuel consumption and emissions;
- increased accessibility for residents to education and health facilities, markets etc., and for others who might come for tourist or other purposes; and
- improving the socio-economic conditions of residents in the project areas of influence.

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

Environmental Issue	Measures to be taken
Alignment	Final alignment should be determined so as to minimise land take, air pollution and the impact on people and animals and to avoid unfavourable geological condition and cultural relics.
Balancing cut and fill	The design should attempt to equalise cut and fill. The centreline should be aligned so that on all slopes below 60 degrees, half cut and half fill can be achieved.
Soil erosion	Temporary and permanent drainage systems should be designed to minimise the soil erosion.
Dust and air pollution	Borrow sites, waste disposal sites and asphalt mixing sites should be identified – keeping in mind environmental issues such as dust.
Cultural heritage	Any archaeological sites identified along the alignment should be excavated prior to construction.
Wildlife Habitat	Care should be taken in preservation of wildlife and construction workers should be educated on wildlife protection.

### C. Impacts and Mitigation Measures during Construction

136. As a requirement of the Environmental Impact Assessment Notification 2006 (amended 2009), by Government of India, any development activities should not be taken in any part of country unless it has granted clearance from the Ministry of Environment and Forests, Government of India.

137. Highways are classified as one of the project, listed in said notification, which require prior environmental clearance. Highways are classified in two categories. In **Category A** include New National Highways & Expansion of National Highways greater than 30 km, involving additional right of way greater than 20m involving land acquisition and passing through more than one State. **Category B** includes All New state highway projects and State highway expansion projects in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive areas.

Any project or activity specified in category B will be treated as category A, if located in whole or in part within 10 km from the boundary of: (i) Protected areas notified under the Wildlife (Protection) Act 1972; (ii) Critically polluted areas as identified by the Central Pollution Control Board from time to time; (iii) Eco-sensitive areas as notified under section 3 of the Environment (Protection) Act, 1986, such as, Mahabaleswar, Panchgani, Matheran, Pachmarhi, Dahanu, Doon Valley and (iv) interstate boundaries and international boundaries. Since present subprojects do not pass through any sensitive areas, hence environmental clearance from Central / State Government is not required. However, prior to applying commencement of civil works, a number of resource-specific clearances and permits have to be obtained. Table 5.2 outlines the types of clearances and permits and the authorised bodies that issue them along with the procedures involved.

**Table 5.2: Clearances and Permits Required for AS-02 and AS-03**

Sl. No.	Clearance/permit	Authorised body	Procedures involved	Time involved
1	Clearance from Forest Department	Divisional Forest Office	Project proponent will submit application to the district forest office. Joint verification and enumeration of trees to be cut shall be done by division office and after approval shall be allowed to cut.	Approximately 6 months or more
2	Clearance for quarry sites	Department of Mines and Minerals, Govt. of Assam, Guwahati	Submission of application for quarry site to mining department. Department of mines and minerals after scrutiny of application and consultation with forest department and revenue department together with site verifications will give approval with specific conditions.	Takes between 3 months and six months.
3	Clearance for blasting	State Department Mines and Minerals, Guwahati	Detailed application with blasting locations and amount of blasting shall be submitted to DoMM. Mining department may issue the conditional approval.	2 to 6 months

138. Any felling of trees requires forestry clearance and appropriate permits. The procedures necessary to obtain such permits will require liaison with local territorial forestry offices and their head office in Guwahati. No clearance is required for the use of surface sand and stone from the river banks as for commercial purposes they can only be purchased in an open auction carried out by the forestry office. It is imperative that all necessary clearances and permits be obtained before commencement of work.

## **C.1 Physical Environment**

### **1. Topography, Geology and Soil**

139. During the improvement works for the road sections micro-level topography may change due to the cutting of slope, filling, the cutting of trees, construction of bridge embankments, stone quarrying, and construction of structures. With proper planning, these topographical impacts can be kept within acceptable limits and sometimes even used to enhance local aesthetics. Any negative impacts on topography (existing or new), particularly soil erosion due to a lack of drainage facilities, will be minimised with the provision of proper drainage facilities such as culverts, causeways etc. The overall impact on topography is, therefore, anticipated to be insignificant.

140. The terrain and geological conditions of area are such that, even with reasonable care exercised during final design, during construction the interaction between proposed road features and existing land features may reveal/ result in significant land instabilities.

141. During the construction phase following restrictions should be imposed:

- existing vegetation including shrubs and grasses along the road (except within the strip directly under embankments or cuttings) should be properly maintained;
- sites for quarrying, borrowing and disposal of spoils are to be confirmed according to the applicable laws and regulations in the state and the practices followed in recent/ ongoing internationally funded road projects should be continued;
- controlled and environmentally friendly quarrying techniques should be applied to minimise erosions and landslides;
- blasting should not be carried out during busy periods; and
- cut material should be disposed of in suitable depressions;

142. It is also important to:

- maintain adequate vegetative cover above and below the road;
- maintain the natural course of water bodies (that is as far as possible) and avoid throwing debris into stream courses;
- construct proper drainage structures to avoid erosion; and
- minimise construction of hair-pin bends that are close to each other: as this often adds to instability.

143. Given the existence of flat terrain and high rainfall in almost entire project area and weak geology in some areas, it is inevitable that some sites will face problems of silt deposit and erosion, mostly debris slides.

## **2. Erosion, Silt Run-Off and Landslides**

144. All soil cutting areas should be revegetated as soon as construction activities are completed. Excavation and earthworks should be mainly undertaken during the dry season when the risks from erosion and silt run-off are least. The materials used for surface dressing will consist of aggregates and gravel, which do not contain silt. Internationally accepted best practice engineering approaches to minimise erosion risks and silt run-off will be incorporated into contract documents and monitored during construction. In order to minimise erosion, silt run off and landslides, it will also be important to:

- ensure that all embankment grades are not too steep and prone to erosion;

- waste material is not thrown into nearby rivers and cross cutting water bodies;
- temporary retention ponds, interception drains, and silt traps are installed to prevent silt laden water from entering adjacent water bodies;
- the topsoil of borrow areas is preserved and used for re-vegetation;
- borrow areas are provided with gentle side slope that are re-vegetated and connected to the nearest drainage channel to avoid the formation of cess pools during the rainy season; and
- control the disposal and ensure the vegetative stabilisation of spoil.

### **3. Climate**

145. The proposed improvement/ construction works will be localised activities and the Project will not have significant impact on climatic conditions, such as rainfall, temperature and humidity in the project area.

### **4. Surface and Ground Water, Drainage and Hydrology**

146. Given the presence of six major rivers and several streams crossing the project road, improvement of road may result in disruptions to the natural hydrology and water mismanagement and lead to further problems of soil erosion.

147. The natural courses of rivers will be maintained. Appropriate temporary diversions of streams will be made and brought back to their natural course as soon works are completed in that section. No disposal of construction debris in streams and rivers is allowed.

148. Minor impacts on water resources are expected during the construction phase. The rehabilitation of existing bridges may also cause soil erosion and turbidity in downstream water bodies. To mitigate this, river-bank slope stabilities will be monitored and, if necessary, appropriate remedial measures applied throughout the construction period. Construction work at bridges during rainy season will be minimized to avoid erosion and sedimentation.

149. The likely impacts of surface water movements are changes in the natural drainage systems, downstream scour, and erosion due to constriction in flows. If suspended solid concentrations in the water are affected, this could also affect aquatic river ecology.

150. To mitigate these impacts the following should be implemented:

- chemicals and oils are stored in secure, impermeable containers, and disposed of well away from surface waters;
- no vehicle cleaning activity is allowed within 300 m of water bodies/ drains;
- construction camps are equipped with sanitary latrines that do not pollute surface waters;
- the work on bridges and culverts is limited to dry seasons, when many of the smaller streams will have low water - water diversion works can be minimised and the original course restored immediately after the work has been completed;
- drivers are made aware of diversions and other works at bridge construction sites to avoid accidents;
- drainage structures are properly designed to accommodate forecast discharges;

- side drain waters must be discharged at every available stream crossing to minimize volume and prevent erosion at discharge point;
- provide lined drainage structures;
- where an increased discharge of surface water endangers the stability of the water outlet, erosion protection measures such as bioengineering measures, ripraps, and check dams are incorporated;
- in areas with high water tables, seepage may occur and side drains and up-slope catch drains must always been lined to avoid percolation; and
- all debris and vegetation, clogging culverts are regularly cleared.

151. Ground water pollution is not envisaged in this project.

## 5. Air Quality

152. During construction air quality may be deteriorated for short periods due to (i) the exhaust emissions from the operation of construction machinery; (ii) fugitive emissions from brick, concrete, and asphalt plants; (iii) the dust generated from the haulage of materials, exposed soils and material stockpiles; (iv) cutting and filling of hill slope; (v) cleaning of the road; (vi) material loading; (vii) unloading; and (viii) blasting activities. The impact is expected to be localised, temporary and confined to construction areas.

153. Adverse impacts on air quality during construction are likely to result from three main sources; (i) emissions from construction equipment, including delivery trucks; (ii) fugitive dust from earth-moving operations and demolition; and (iii) localised increased traffic congestion in construction areas.

154. The adverse impacts on air quality during construction stage were classified in Table 5.3. There are two types of pollution, dust pollution and pollution from harmful gases.

**Table 5.3: Impact on Air Quality during Construction Stage**

Sl.	Impact	Source
1	Generation of Dust (SPM)	<ul style="list-style-type: none"> <li>• Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;</li> <li>• Blasting operations;</li> <li>• Activation of landslides and rock falls etc.;</li> <li>• Transportation of raw materials from quarries and borrow sites;</li> <li>• Stone crushing, handling and storage of aggregates in asphalt plants;</li> <li>• Site levelling, clearing of trees, laying of asphalt, construction of bridges;</li> <li>• Concrete batching plants;</li> <li>• Asphalt mix plants – due to the mixing of aggregates with bitumen; and</li> <li>• Construction of structures and allied activities</li> </ul>
2	Generation of polluting gases including SO <sub>2</sub> , NO <sub>x</sub> and HC	<ul style="list-style-type: none"> <li>• Hot mix plants;</li> <li>• Large construction equipment, trucks and asphalt producing and paving equipment;</li> <li>• The movement of heavy machinery, oil tankers etc. on steep slopes</li> </ul>

Sl.	Impact	Source
		<p>will cause much higher emissions of gases;</p> <ul style="list-style-type: none"> <li>• Toxic gases released through the heating process during bitumen production; and</li> <li>• Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.</li> </ul>

155. On the AS-02 and AS-03 road sections, it is expected that air quality will be affected to some minor extent by dust and particulate matters generated by construction, vehicular movements, site clearance, earth filling and material loading and unloading. The impacts are expected to be localised, temporary and confined to construction areas. Care should, however, be taken at sensitive urban locations so that harmful impacts can be minimised.

156. As it is anticipated that suspended particulate matter (SPM) levels will increase during construction, certain mitigation measures are suggested in order to bring down these levels to prescribed standards. The following actions should be implemented:

- regular check-up and maintenance of construction equipment and long idling of engines are discouraged;
- mixing plants i.e. asphalt, concrete, and bricks, should be operated within the permissible limits of CPCB, and located away from settlements;
- the contractor will submit a dust suppression and control programme to the PWD prior to construction – this plan details actions to be taken to minimise dust generation and identify equipment to be used;
- vehicles delivering loose and fine materials should be covered to reduce spills;
- controlled blasting should be carried out and such only with the prior approval of the site Engineer and, if required, PWD;
- bitumen emulsion should be used wherever feasible, and
- bitumen heaters should be used and the use of wood for fuel prohibited.

## 6. Noise Levels

157. With the exception of the Tamulpur, Paneri and Udalguri urban centers, the ambient noise level along the road sections is within permissible limits prescribed by CPCB. During the construction period, noise will be generated from the operation of heavy machinery, blasting works, the haulage of construction materials to the construction yard and the general activities at the yard itself. Concrete mixing and material movements will be the primary noise generating activities and will be uniformly distributed over the entire construction period. These construction activities are expected to produce noise levels in the range of 80-95 dB(A). Piling, if necessary, will also cause vibration. Noise and vibration from this source will be unavoidable but the impact will only be temporary and affect people living or working near piling locations. In construction sites within 500 metres of a settlement, noisy operations should cease between 22:00 and 06:00 hrs. Regular maintenance of construction vehicles and machinery must also be undertaken to reduce noise. The impact and sources of noise and vibration are summarised in Table 5.4.

**Table 5.4: Likely Impact on Noise Quality in the Vicinity of Project Area**

Impact	Source
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Impact	Source
Increased Noise Levels causing discomfort to local residents, workers and local fauna	<ul style="list-style-type: none"> <li>• Mobilisation of heavy construction machinery;</li> <li>• Accelerations/decelerations/gear changes – though the extent of impact will depend on the level of congestion and smoothness of the road surface;</li> <li>• Use of blasting to cut into hill sides;</li> <li>• Excavation work for foundations and grading;</li> <li>• Construction of structures and other facilities;</li> <li>• Crushing plants, asphalt production plants; and Loading, transportation and unloading of construction materials.</li> </ul>

158. Typical noise levels associated with various construction activities and equipment are presented in Table 5.5.

**Table 5.5: Typical noise levels of principal construction equipments  
(Noise Level in db (A) at 50 Feet)**

Clearing		Structure Construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
Excavation and Earth Moving		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		Landscaping and clean-up	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94

Source: U.S. Environmental Protection Agency, noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. 300.1.December 31, 1971

159. The noise levels indicated for various construction activities/ equipments, while far exceeding permissible standards, will occur only intermittently. Still, these extremely high sound levels present real risk to the health of workers on-site.

160. Since the anticipated post-construction volumes of traffic on the project road is expected to be low, impacts from higher noise levels will have little significance even though present

noise levels in these areas are low. In these areas, the noise produced during construction will also not have a significant impact, if proper mitigation measures are taken. Mitigation measures should include:

- construction machinery should be located away from settlements;
- careful planning of machinery operation and the scheduling of such operations;
- controlled blasting should only be carried out with prior approval from the Engineer in charge;
- contractors should be required to fit noise shields on construction machinery and to provide earplugs to the operators of heavy machines;
- blasting should be conducted only during day-light hours; and
- only controlled blasting should be conducted.

## 7. Topography and Appearance

161. Construction activities of the project roads will bring permanent changes in the local-level topography and appearance of the project site. There will be loss in aesthetic beauty of the project area mainly due to the earthwork. Table 5.6 elaborates potential effects on the topography and appearance and appropriate mitigation measures.

**Table 5.6: Potential Effects on Topography by the Proposed Road Section Upgrading**

Sl.	Construction activity	Potential effect on topography and appearance	Mitigation
1	Clearing of vegetation and cutting of hillside for widening of the road	Scarring of landscape from cutting and potential landslides (short term and long term) may be caused. There may be minor permanent changes in the landscape.	Cut material should be used to widen the road or disposed off at proper disposal sites. Cut slopes should be re-vegetated immediately after widening activities.
2	Stone quarrying	Scarring of landscape and potential landslides (rock slides/falls). There may be permanent changes in the landscape.	Stone quarrying should only be undertaken in legally approved areas. Controlled and environmental friendly quarrying should be carried out to minimise landslides and erosion.
4	Earthwork from borrow areas	Scarring of landscape due to unearthing activities. Minor but permanent changes in landscape.	Borrow areas should be in legally approved locations. As soon as construction activities are complete, they should be re-vegetated and brought back as far as possible to their previous appearance.
5	Waste disposal	Disposal of cut soils and debris at improper locations such as hillside below the road will make the area look untidy and unattractive.	Cut off material should be used to widen the road or disposed of at proper disposal sites.
6	Establishment of labour camps	Disposal of waste and litter at improper locations and deforestation for fire-wood will make the area look dirty and	Provision and allocation of proper waste disposal bins and sites are required. A supply of cooking gas should be provided by the

Sl.	Construction activity	Potential effect on topography and appearance	Mitigation
		unattractive.	contractor to eliminate the use of fire wood.

## C.2 Ecological Resources

### 1. Wildlife

162. As the project road does not have presence of any wildlife, impacts on wildlife due to road construction activities is not envisaged.

### 2. Vegetation

163. The project roads do not pass through any forest areas. However, thin vegetation along the project roads exists. The density of vegetation in area is very less i.e. 0.1 to 0.2. Removal of the existing vegetative cover and the uprooting of trees (about 2352 trees) is an unfortunate activity, which will reduce the ecological balance in the areas. A total of approximately 314500 sq m (5 m strip for entire length 62.9 km) of scrub and vegetation will probably be removed for improvement of road between Tamulpur and Udalguri. The loss of vegetative cover will mostly be permanent and only some might be revived through mitigation efforts. Another impact from road construction activities and deriving from the quarrying, preparation and transfer of stone chips and other earthwork, is the accumulation of dust on the surrounding vegetation. This will lead to deterioration of the vegetative health, which in turn will affect the ecology as well as the aesthetic beauty of the area. Induced impacts may result from the following:

- increased forest harvesting for fire-wood, construction timber, forage, medicinal plants and other products;
- increased earth and rock extraction;
- construction crew demands for wood as a fuel and for building materials;
- construction crew demands for food and recreational hunting and fishing;

164. To minimise adverse impacts on vegetative cover the contract documents should specify that:

- all wood building material for workers' housing should be brought from outside the project area;
- workers should be supplied with non-wood fuels such as liquefied petroleum gas for the duration of the contract;
- all contract equipment and plants should be cleaned to the satisfaction of the project engineer in charge prior to their relocation to project sites;
- during site clearance, care should be taken to ensure that the minimum area of vegetation area is affected; and
- water sprinkling of trucks used as construction vehicles should be properly and regularly undertaken, so that dust deposition problem on vegetation are minimised.

## **C.2 Socio-economic Resources**

### **1. Human Use Values**

165. Field reconnaissance surveys of the project roads were conducted on October 2005 to assess the environmental and social conditions. It was noted that the relocation of structures will be required at few locations. These structures made of light materials i.e. compacted earth, timber and corrugated iron sheets. The widening options have been devised to minimise impacts of structures.

166. The survey also found that there is one temporary structure and one temple likely to be affected due to widening of road. A short resettlement plan is prepared to address this issue. The affected people will be compensated and rehabilitated as per the provisions of the Resettlement Plan.

167. There will be negligible land acquisition as the proposed widening will be accommodated within existing ROW i.e. 27 ft either side of the road.

168. At certain locations on the road, particularly at bridge sites, traffic will be temporarily diverted from the existing carriageway while construction is in progress and temporary traffic diversions will be managed within the ROW. In other instances, traffic may have to be diverted across adjacent private land, in which case compensation will be paid for any loss of crops or the replacement of damaged structures. In other situations, most frequently not at bridge sites, for example when bitumen surfacing is in progress, it may be required to close the road temporarily. In these circumstances, adequate radio and press releases should be made beforehand and a date/time given for the re-opening.

169. Most construction will be undertaken during the dry season when few crops are planted to so that losses can be minimised.

### **2. Sensitive Location Such as School, College and Hospital along the Project Road**

170. The sensitive location such as school, college and hospital along AS-02 and AS-03 within 100 meter from the edge of the existing road has been identified as given in Table 4.5a and Table 4.5b respectively. Impacts on these sensitive resources are minimized by keeping alignment away from these locations to the extent possible.

### **3. Health, Safety and Hygiene for Construction Workers**

171. Construction of the roads will result in the generation of waste. In isolated places, the amount of waste generated may be greater than normal because of substandard subsoil materials, which will need to be replaced.

172. The Contractor will be required to control the construction site, keep it clean and provide facilities such as dust bins and collectors for the temporary storage of all waste. This waste should be adequately stored to avoid pollution of water supplies and water sources and to avoid dust formation. The Contractor will be responsible for the safe removal and/or storage of all waste in order to prevent environmental pollution of any type that may be harmful to people or animals.

173. All necessary safeguards should be taken to ensure safety, welfare and good health of all persons entitled to be on the sites and to ensure that works are carried out in a safe and

efficient manner. All personnel working at vulnerable sites will wear safety helmets and strong footwear. It should be ensured that all workmen and staff employed on site use proper safety equipment – for example, eye protectors, ear plugs, safety helmets, the designated safety equipment when working over water - and that proper rescue equipment is available. Fire extinguishers and first-aid equipment will be kept at all sites.

174. The construction camps are anticipated to house up to 300 people for three to five years. With this concentration of people, the potential for the transmission of diseases and illnesses will increase. The main health and safety risks during construction will arise from:

- inadequate sanitation facilities in worker camps;
- introduction of sexually transmitted, and other diseases, by immigrant workers; and
- outbreaks of malaria, typhoid, cholera etc. amongst the labour force.

175. The following actions will be undertaken at construction camps and stipulated in construction contracts:

- submit and obtain approval for a health and safety plan prior to the commencement of work;
- provision of adequate health care facilities; and
- workers will be required to undergo pre-employment medical screening and treatment (if required) and periodic health checks thereafter.

176. The project will support a public health education programme for workers and villagers covering road safety, malaria, hygiene, and sexually transmitted diseases. The district health departments will be enjoined to participate in monitoring and education of communities and workers affected by the project.

#### **4. Nuisance to nearby Properties**

177. Nuisance to nearby properties is likely to result from:

- noise and vibration from mechanical devices and construction plant;
- dust during quarrying, construction and the trafficking of new surfaces prior to sealing;
- gaseous emissions from heavy equipment; and
- fumes from asphalt boiling sites.

178. Much of the project road pass through rural areas and presently air/dust pollution is not a major issue. Nonetheless, there will be regular watering of the road surfaces or the application of emulsion coats near villages, where dust is a nuisance. Noise generating equipment such as power generators and concrete mixers will be kept away from populated/ commercial areas. Provisions will be incorporated into the contractor's contract to require the use of dust suppression measures.

#### **5. Interference with Utilities and Traffic**

179. On the project road, utilities interfere with the ROW at few locations that will have to be moved prior to construction. This should not be a major problem.

180. Traffic may experience minor delays when diverted around active construction areas, but will be more severely hampered at the locations where temporary road closures are necessary. Such hazard points will have proper signs indicating the nature of the problem envisaged.

## **6. Community Impacts**

181. There will be minor widening work on entire road length - in which case the resettlement problem will be minor.

182. Construction camps may put stress on local resources and the infrastructure in nearby communities resulting to people raising grievances. This sometimes leads to aggression between residents and migrant workers. To prevent such problems, the contractor should provide the construction camps with facilities such as health care clinics, places of worship, and occasional entertainment. The use of local labourers during the construction will be promoted to minimise these problems.

## **7. Quality of Life**

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

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

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

## **8. Construction Materials**

186. The use of proper sources for stone and aggregates has become a major issue in most states. Historically, stone has been collected from the roadside or from shallow surface workings. Small quarries on steep slopes are often enlarged by blasting or excavation at the base. This is dangerous and can cause slope failures. Roadside stone collection continues in some districts despite its proven negative impacts on road safety and stability. Sand and gravel are often obtained from river deposits. Jurisdiction over stone and aggregates is shared between the Geological Survey of India and the State Forest Department. The Geological Survey of India issues licences for major mineral developments while the Forest Department issues permits for stone quarrying and for sand and gravel extraction. This is largely because these are mostly found on forest lands. Roadside quarrying is officially discouraged, but unofficially continues, invariably by petty contractors.

187. Road maintenance, repair and new construction will continue to cause large demands for construction materials. There is a clear need for a better materials supply policy in each district to minimise environmental impacts of small-scale, poorly managed operations and

improve the quality and reliability of supply. In some districts, it may be appropriate to develop centralised quarries, if an operator can be attracted. In any case, pre-designation of sources would give contractors a level playing field for bidding and minimise incentives for environmentally damaging cost cutting.

188. As a prior requirement of projects, every quarry and borrow area should be subjected to a site specific environmental investigation, work according to an approved plan; and should be left in a safe condition or restored to a productive land use. Subject to these conditions, obtaining construction materials for projects will not cause unacceptable impacts.

189. Quarry and borrow pits may be filled with rejected construction waste and afterwards should be given a vegetative cover. If this is not possible, then the excavated slopes will be filled in such a way that they resemble an original ground surface.

190. Mitigation for Quarries

- aggregates will be sourced only from licensed quarry sites that comply with environmental and other applicable regulations;
- occupational safety procedures/practices for the work force will be adhered to in all quarries;
- quarry and crushing units will be provided with adequate dust suppression measures; and
- regular monitoring of the quarries by concerned authorities to ensure compliance with environmental management and monitoring measures.

191. Mitigation of Borrow Areas

- prior approval will be obtained from concerned authorities and all local environmental regulations be complied with;
- within all identified borrow areas, the actual extent of area to be excavated will be demarcated with signs and access to the operational area controlled;
- borrow pit plant and machinery will conform to EPA noise emission regulations;
- protective gear will be provided to the workforce exposed to noise levels beyond threshold limits and there should be proper rotation of such personnel; and
- all operation areas will be water sprinkled to control dust levels to national ambient air quality standards.

192. The project will require large amounts of bitumen or bitumen emulsion usually stored in drums. These empty bitumen drums are generally recycled as steel sheeting, or used in road construction as parapets or for bank stabilisation. When supplied and used in this manner, bitumen is not regarded as a significant environmental hazard.

193. The project will require the import, transport and use of fuel and oils. Minor diesel spills are common in region, especially around fuel stations. The project provides an opportunity to assist the PWD and contractors in improving fuel handling practices so as to minimise future fuel spillage.

## **D. Impacts and Mitigation Measures during Operation**

### **1. Noise Vibration, Air Pollution, Runoff, Spoils of Hazardous Materials**

194. The current low traffic flows along the project road is expected to increase because of improved economic activities associated with better access. The larger numbers of vehicles will be an additional source of noise and gaseous emissions. Repairs to culverts and new drainage work will eliminate/reduce the soil erosion problems presently caused by poor cross drainage. Also, the situation will remain good because road sections pass through open areas and road side trees and plants have the capacity to absorb gaseous as well as noise pollutants. Bioengineering techniques may also help to absorb pollution.

195. The project road is linked to national highway NH-31 which carries a variety of goods and materials. With the road improvements including safety measures, it is envisaged that overall road safety will improve resulting to reduced risk of accidental spillages.

196. Stone & sand quarries and water sources along the Project roads are provided in the Appendix 3.

## **2. Land Use and Settlements**

197. The likely impacts on land use and settlement patterns are limited. Improved access will lead to increased migration, but this will occur gradually and over a prolonged period. There will be time for new residential areas to be established. There will be a need to control ribbon development.

## **3. Social Impacts**

198. Specific benefits to local people will include:

- easier communication;
- easier access to markets (both internally and regionally) with savings in travel times and costs;
- enhanced market efficiency through better distribution and accelerated deliveries etc.;
- improved access to health, education and other social services;
- employment generation;
- improved technical skills; and
- enhanced economic activity.

199. Likely adverse social impacts will include:

- increased chances of exposure to communicable diseases, particularly during construction;
- influxes of new settlers leading to increased pressure on natural resources causing hardship to local communities relying on local/forest resources; and
- rural-to-urban migration causing labour shortages in the depleted rural areas and other negative impacts in the urban areas.

## **E. Potential Environmental Enhancement/Protection Measures**

200. Appendix 10 of this IEE Report presents good environmental management practices and guide documents in the following aspects of road construction:

- Plant Management
- Campsite Management
- Debris Disposal Management
- Borrow Area Management
- Quarry Area Management.

## VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

201. In accordance with the ADB's environmental safeguards policy, public consultation were held as part of IEE study with beneficiaries, local /government officials, community leaders, NGO's, and other stakeholders in corridor of impact. Brief description of the project and its activities were presented, preliminary environmental screening results were discussed, and comments were solicited and noted to be considered in the engineering design and preparation of mitigation measures. The State PWD also took the opportunity to foster co-operation among officers of PWD, forest department, the community and the stakeholders to achieve a cordial working relationship for smooth implementation of the project.

202. The official consultation with the stakeholders was carried out during project preparation (third week of May 2005) and detailed design (2008) at respective offices in state head quarter Guwahati. Various officials consulted include Conservator of Forest, Wildlife Warden, Environmental Officer from pollution control board, statistical officer etc. The various issues discussed are:

- Statistics of forests cover in the State and its legal status i.e. Reserved, Protected, Unclassed;
- Requirements of Forest Department to carryout project activities within forest areas;
- Flora and Fauna and endangered species in the State;
- Scope of the proposed road development, IEE and likely impacts on flora & fauna;
- Major threats to flora & fauna in the state;
- Procedure to get clearance from forest department and NOC from pollution control board;
- Environmental Quality parameters i.e. Air, Water, Noise quality in the State and major sources of pollution;
- Instructional capacity of state authorities in pollution control and environmental management;
- Socio-economic conditions and likely impacts on due to proposed road improvement;

203. The list of officials / people contacted along with the venue, issues raised, date of consultation is presented on Appendix 4.

204. Details of the consultations through focus group discussions were carried out as detailed in Table 6.1.

**Table 6.1: Peoples' Perception about Environment Degradation**

Date	Venue / Place	Participants	Remarks
3 <sup>rd</sup> August 2005	Village - Rawta Village – Udalguri Village - Ulubari	Total – 25 participants Local villagers, affected persons, shop owners, formers, forest guards, community leaders,	Two to three persons were interviewed from each village to have representative sample
4 <sup>th</sup> August 2005	Village – Deoguri Village – Golibar Village – Dimakuchi		
5 <sup>th</sup> August 2005	Village – Rangia Village - Tamalpur		

205. Most of the people interviewed strongly support the project. People living in the entire project area expect the different project elements to facilitate transport, employment, boost economic development and thereby provide benefits to them.

206. In order to document likely impacts on affected persons, an interview survey has been carried out. A sample of PAPs was selected and interviewed through a designed questionnaire (Appendix 5). Precaution has been exercised during the survey to ensure that the sample interviewed is truly representative of the affected groups and the questions are worded so as not to generate a bias response. Figure 6.1 shows one such interview survey.



Figure 6.1: View of Pubic Consultation with PAPs road

207. It is envisaged from the interview survey that there is increased environmental awareness among the people. It can also be seen from Table 6.1 that more than 65% of the persons believes the existing environmental conditions of the area is good. Over 70 % of the people agreed that the quality of air, water and noise in the area is good; whereas, about 30% respondent feel that the environmental quality is being deteriorated. Poor road condition and vehicular emissions are the major sources they feel responsible for this. In case of presence of archaeological / historical the responses are very few. The area has great cultural significance as 72% people say that there are places of cultural significance in the region. The project areas experience frequent flooding due to lower plains of Brahmaputra river basin. It also envisaged that about 68 percent of responded reported history of natural disaster mainly due to flood. Majority of people says there is no endangered, rare species in the region, whereas about 20 percent indicates presence of rare species mainly in the forests. Overall, the general environmental conditions in the region are good and people have increased environmental awareness. Table 6.2 shows the result of public opinion survey carried out in the region.

**Table 6.2: Peoples' Perception about Environment Degradation**

Sl. No.	Question asked about	No. of people interviewed	Positive response (%)	Negative response (%)	No response (%)
1.	Water quality of rivers, ponds, wells, and canals	25	72	28	0
2.	Noise quality of the area	25	64	28	8
3.	Air quality of the area	25	56	36	8
4.	Archaeological sites	25	72	12	16
5.	Natural disaster	25	20	68	12
6.	Rare species of animals and birds	25	76	16	8
7.	Cultural sites i.e. market, melas	25	52	32	16
<i>Note: Positive response shows that the overall environmental scenario in the area is good and wise versa</i>					

208. The IEE report will be disclosed in MDONER, PWD and ADB websites. The full reports will also be available to interested parties on request from office of PWD, Assam.

## VII. GRIEVANCE AND REDRESS MECHANISM

209. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. The project-specific GRM is not intended to bypass the government's own redress process, rather it is intended to address affected people's concerns and complaints promptly, making it readily accessible to all segments of the affected people and is scaled to the risks and impacts of the project.

210. The PIUs will make the public aware of the GRM through public awareness campaigns. The contact phone number of the respective PIUs will serve as a hotline for complaints and will be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information leaflet will include information on the GRM and will be widely disseminated throughout the corridor by the R&R officers in the PIUs with support from the NGO engaged to implement the RP. Grievances can be filed in writing using the Complaint Register and Complaint Forms or by phone with any member of the PIU.

211. **First tier of GRM.** The PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Resettlement Officer in the PIU will be designated as the key officer for grievance redress. Resolution of complaints will be done within seven working (7) days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

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

212. The updated register of grievances and complaints will be available to the public at the PIU office, construction sites, and other key public offices along the project corridor (offices of the ward members, local Resident Welfare Association offices etc). Should the grievance remain unresolved it will be escalated to the second tier.

213. **Second Tier of GRM.** The Resettlement Officer in the PIU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the Grievance Redress Committee (GRC)<sup>4</sup>. The GRC will be established before commencement of site works. A

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<sup>4</sup> The GRC will consist of the following persons: (i) Project Director; (ii) representative of the affected person(s); (iv) representative of the local Deputy Commissioners office (land). The functions of the local GRC are as follows: (i) resolve problems quickly and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social and resettlement related issues such as land acquisition (temporary or permanent); asset acquisition; and

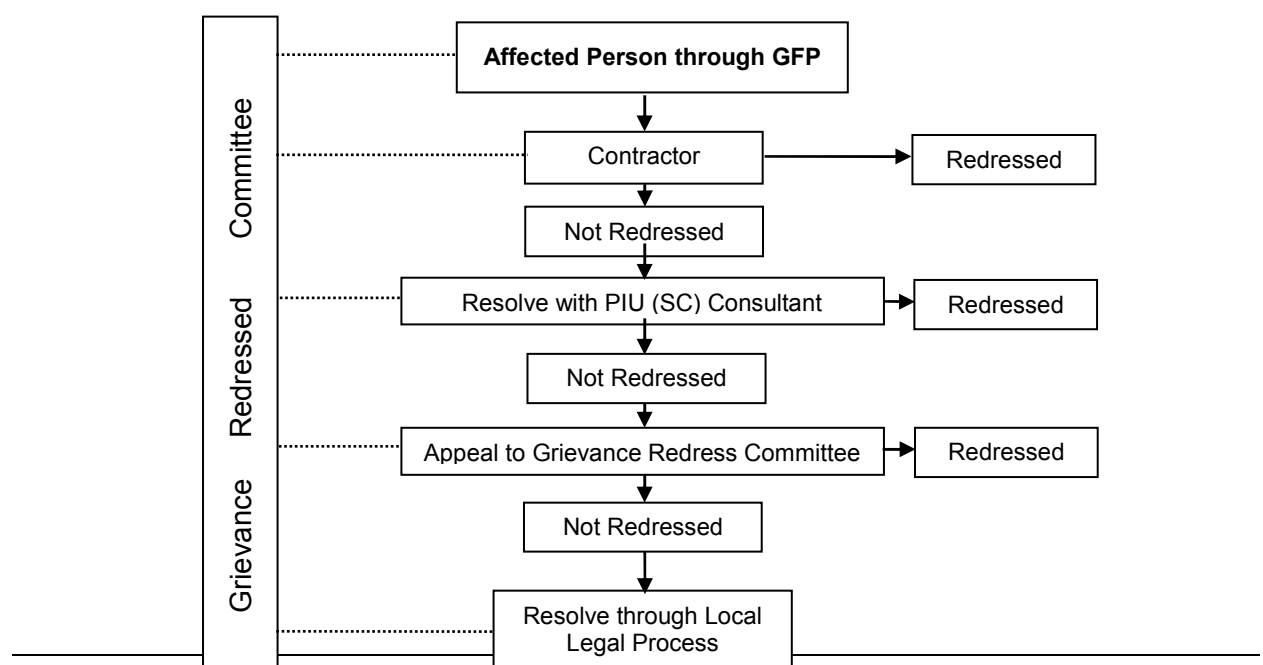
hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

214. The PIU Officers will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.1.

215. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress in the appropriate court of law. The PIUs or GRC will be kept informed by the district, municipal or national authority.

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

217. **Costs:** All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the Project.



eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

**Figure 7.1: Grievance Redress Mechanism**

## VIII. ENVIRONMENTAL MANAGEMENT PLAN

218. This Environmental Management Plan (EMP) consist of a set of mitigation, monitoring and institutional measures to avoid, minimize and mitigate adverse environmental impacts and enhance positive impacts.

219. The major components of the EMP are the mitigation of potentially adverse impacts, monitoring of EMP implementation during project implementation and operation; and institutional arrangements to implement the EMP.

### A. Summary of Impacts

220. Following are anticipated potential adverse environmental impacts:

- Impacts on surrounding area due to tree cutting for the proposed widening;
- Impacts on cultural properties and common property resources for the proposed widening;
- Temporary impact on land and air environment due to locating construction camp;
- Temporary impact on land, air and water environment due to establishing and operating construction plants (Hot Mix Plant and Diesel Generator [DG] sets);
- Impact on biophysical environment due to quarry operation;
- Impact on air quality, water quality, drainage, road users due to construction activities of project road ;
- Impact on land and water environment due to disposal of waste materials; and
- Impact on occupational health and safety due to all onsite and offsite construction works.

### B. Mitigation Measures

221. The identified environmental issues and suggested mitigation measures with institutional arrangements for implementation, supervision and monitoring have been provided in matrix format in Appendix 6. These mitigation measures will be implemented as applicable for tranche 2 subprojects in Assam i.e. AS-02 and AS-03. The specific impacts and mitigation measures to be implemented particularly during the construction phase of AS-02 and AS-03 subprojects are presented in following sections.

#### 1. Compensatory tree plantation

222. As per compensatory afforestation, the tree plantation will be done three times of tree cutting (1:3 of tree cutting). A total of 7036 trees will be planted as part of compensatory afforestation as detailed in Table 8.1.

**Table 8.1: Subproject wise details of Compensatory Afforestation**

Subproject	From	To	Tranche	Length (km)	Tree to be cut in the project road (tentative)	Proposed tree to be planted in the project area in consultation with Forest Dept. (1:3 of tree cutting)
AS-02	Tamulpur	Paneri	2	43.0	1786	5,358
AS-03	Paneri	Udalguri	2	18.6	566	1,698

Subproject	From	To	Tranche	Length (km)	Tree to be cut in the project road (tentative)	Proposed tree to be planted in the project area in consultation with Forest Dept. (1:3 of tree cutting)
<b>Total</b>				<b>61.6</b>	<b>2352</b>	<b>7056</b>

## 2. Noise Barriers at Sensitive Locations

223. Noise barriers in the form of vegetative covers and boundary walls have been proposed at sensitive locations along the project roads as detailed in Table 8.2. The budget of noise barrier has been incorporated in proposed EMP budget.

**Table 8.2: Locations of proposed Noise Barriers**

Name of School/ College	Ch (Km)	RHS/LHS	Approximate length of Noise Barrier (m)
<b>AS-02: Tamulpur – Paneri</b>			
Kasubari L.P School	2.650	RHS	25
Laupara L.P. School	9.575	LHS	20
Dimakuchi Girls' M.E. School	32.500	LHS	25
<b>Total Length AS-02</b>			<b>70</b>
<b>AS-02: Paneri – Udalguri</b>			
Bengbari Natun Basti L.P. School	6.350	LHS	25
Chandana Bagan L.P School	16.650	LHS	25
<b>Total Length AS-03</b>			<b>50</b>
<b>Gran Total</b>			<b>120</b>

## 3. Enhancement of Cultural Properties

224. The cultural properties will be enhanced during construction phase of the project road. Following items can be considered for enhancement of cultural properties.

- Provision and erection of cement concrete, standard sitting benches including clearing of the area around the benches.
- Boundary fencing with barbed wire fencing of approved make and specification including provision and erection of struts.

225. The specific cultural properties for enhancement will be identified by Contractor and Engineer jointly. The Contractor will take the approval before execution of the work.

## 4. Excavated Road Side Debris and its disposal

226. The provision has been made in cost estimate to use the roadway excavated materials as necessary for the construction of road, which are as follows.

- For all types of soil, such as ordinary rock, hard rock and
- Excavation from drain and foundation of other structures.

227. As per above description, the Contractor will use the excavated road side material for construction of road. The unsuitable material will be disposed properly. The Contractor will not dispose the excavated unsuitable material generated from hill section to other side (valley side) of the project road. Proper disposal plan will be prepared by the Contractor to dispose the unsuitable material generated from hill cutting/ road excavation.

## **5. Water Bodies to be Protected**

228. The surface water bodies in the project road require protection during construction phase of the project road. The Contractor shall not disturb/ pollute the surface water due to construction activities of the project road. The Contractor will be responsible to protect the surface water and extra payment for the same will not be given.

## **6. Re-development of Borrow Area**

229. The items for redevelopment of borrow area such as preservation of top soil and re-application of stored top soil has been considered in proposed EMP cost. The Contractor will re-develop the borrow areas before closing of same. The estimated quantities for preservation and re-application of the top soil has been considered for redevelopment of borrow area.

## **C. Environmental Monitoring**

230. Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions. To ensure the effective implementation of mitigation measures and environmental management plan during construction and operation phase of the up gradation of project road, it is essential that an effective Environmental Monitoring Plan be designed and followed. Monitoring will be undertaken on selected parameters of air, water, noise, soil and performance monitoring on tree plantation as mentioned in Appendix 7. The stipulated standards for various environmental attributes (water, air and noise) are given in Appendix 11.

## **D. Institutional Requirements**

231. The PWD, through its Project Implementing Unit (PIU), is the Executive Agency of the Project. The Project Director is overall responsible for EMP implementation. The following key players are involved in EMP implementation during construction stage:

- PIU and its environmental unit;
- Construction Supervision Consultant (SC) i.e. Engineer and his representatives; and
- Contractor.

232. There is a need to establish Environmental and Social Management Unit (ESMU) within the PIU. Since it is not envisage that significant environmental impacts will result from the road upgrading, it is recommended that one of the senior officers of PIU will be designated as Environmental and Social Officer for monitoring implementation of proposed safeguard measure. EMSU will be headed by the Project Director but coordinating and supervising implementation of safeguard measures will be undertaken by the designated Environmental and Social Officer. There is a need for capacity building of environmental unit through various trainings.

233. The Project Director of PIU with the assistance of designated Environmental and Social Officer will be overall responsible for ensuring compliance of safeguard measures and will be reporting to the regulatory bodies and ADB certifying that relevant environmental safeguard measures have been complied with during project implementation. At the field level, the Executive Engineer with his Assistant Engineer/s will supervise implementation of safeguard measures for this subproject and submit monthly reports to PIU.

234. PIU may engage independent agencies for carrying out pollution monitoring activities. The Supervision Consultant (SC) will be interacting with these agencies and facilitate them in carrying out such activities.

235. The SC will liaise with PIU environment unit to ensure that Contractor complies with the requirements of various environmental safeguard measures through supervision, monitoring and reporting. Efforts must be made by SC to ensure that environmental mitigation and good-construction-practices are implemented as integral component of each civil activity. Implementation of environmental safeguard measures needs team effort and as such the Team Leader of SC will delegate the responsibilities to each member of the supervision team with respect to their core responsibilities. The project should have a provision of part time input of Environmental Specialist within SC to supervise implementation of safeguard measures. His role would be more on advisory. He will assist the Team Leader of SC on the following:

- Advise PIU on preparing reports to ADB and other statutory bodies;
- Preparing procedures for implementing EMP;
- review Contractor's EMP, traffic management plan and safety plan and recommend for its approval / improvements, to the Team Leader;
- provide training to PIU, SC and Contractors' staff on implementing environmental safeguard measures;
- advise on obtaining various statutory environmental clearances on time;
- conduct periodic field visits to examine environmental compliances and suggest corrective actions ; and
- any other issues as will be required to ensure environmental compliance.

236. Besides, the Team Leader of SC will nominate a senior engineer from the site office responsible for day-to-day supervision of EMP implementation. He will provide guidance to the field staff of SC and Contractor for implementing each of the activities of the EMP. He will be responsible for record keeping, providing instructions through the Engineer for corrective actions, ensuring compliance of various statutory and legislative requirements and assist Engineer for submitting reports to PIU. He will maintain a close co-ordination with the Contractors and PIU for successful implementation of the environmental safeguard measures.

237. To ensure the EMP is properly implemented, Contractor shall appoint a full time qualified and experienced Environmental and Safety Officer (ESO) from the commencement to completion of the project. The qualification and responsibilities of ESO as stipulated below should be considered. The qualification of ESO will be as given below:

- Diploma or Graduate in Civil Engineering with post graduate specialization in Environmental Engineering or Environmental Science or equivalent;
- 5 to 10 years of total professional experience; and

- About 3 to 5 years of experience in similar projects i.e. management of environmental issues in design and construction of road / highway / flyover / bridge projects.

238. The responsibilities of ESO of Contractor will include the following:

- Directly reporting to the Project Manager of the Contractor;
- Discussing various environmental issues and environmental mitigation, enhancement and monitoring actions with all concerned directly or indirectly;
- Preparing Contractor's EMP, traffic management plan and safety plan as part of their Work Program;
- Ensuring contractor's compliance with the EMP stipulations and conditions of statutory bodies;
- Assisting his project manager to ensure environmentally sound and safe construction practices;
- Assisting his project manager to ensure the timely procurement of materials that are included in the Bill of Quantities relating to environmental mitigation and enhancement measures;
- Conducting periodic environmental and safety training for contractor's engineers, supervisors and workers;
- Preparing a registers for material sources, labour, pollution monitoring results, public complaint and as may be directed by the Engineer;
- Assisting the PIU on various environmental monitoring and control activities including pollution monitoring; and
- Preparing and submitting monthly reports to SC on status of implementation safeguard measures.

239. As mentioned above, there is a need for capacity building of PIU on various environmental and social aspects of the project through various environmental training. Recently, there has been change of statutory requirements for this similar projects based on new EIA Notification. This has changed the landscape of legal and administrative framework for implementing the projects. Thus, there is a need for the PIU staff to updating the information and keeping abreast with the changing legal and administrative requirement. The requirements of various statutory permits and clearances are mentioned in Table 5.2. For successful implementation of EMP, it is essential to orient engineers of PIU, SC and Contractor who would be mobilized for this project. One day environmental orientation workshop will be conducted each at Guwahati by PIU, once most of the staff has been mobilized. The training program is included in Appendix 8.

## E. Proposed Environmental Budget

240. The proposed EMP budget is **Rupees 3,811,060 (or USD 70,575)**. The environmental budget including cost of environmental training summarized in Table 8.3 and detailed cost estimate is provided Appendix 9.

**Table 8.3: Summary EMP Budget**

Sl. No.	Item	Amount in INR
A.	Tree Plantation	2716560

B.	Environmental Monitoring	214500
C.	Noise Barriers at Sensitive Locations	480000
D.	Enhancement of cultural properties	325000
E.	Environmental Training	75000
<b>Total in INR</b>		<b>38,11,060</b>
<b>Total in USD</b>		<b>70,575</b>

## IX. CONCLUSION AND RECOMMENDATION

241. The proposed improvement works for tranche 2 subprojects in Assam i.e. AS-02 (Tamulpur-Paneri) and AS-03 (Paneri-Udalguri) has been categorized as Category 'B' based on environmental screening and assessment of likely impacts. The initial environmental examination ascertains that it is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and easy to mitigate.

242. The proposed road sections does not pass through or located nearby any national park, wildlife sanctuary, reserved forests, or any other ecologically sensitive areas. No archaeological/ protected monument is located in the project vicinity. The land use pattern around the alignment is predominantly agricultural / open land.

243. The significant adverse impacts of the road section upgrading are:

- Impacts on surrounding area due to tree cutting (about 2352) for the proposed widening;
- Impacts on cultural properties and common property resources for the proposed widening;
- Temporary impact on land and air environment due to locating construction camp;
- Temporary impact on land, air and water environment due to establishing and operating construction plants (Hot Mix Plant and Diesel Generator [DG] sets);
- Impact on biophysical environment due to quarry operation;
- Impact on air quality, water quality, drainage, road users due to construction activities of project road ;
- Impact on land and water environment due to disposal of waste materials; and
- Impact on occupational health and safety due to all onsite and offsite construction works

244. Stakeholder and public consultations were undertaken and in general, the subproject received immense support from local people. The local people appreciated that besides providing an all-weather efficient connectivity to large rural populations and improving the traffic scenario in the region, it will bear out several other socio-economic positive benefits.

245. The initial environmental examination of the subprojects ascertains that the project is unlikely to cause any significant environmental impacts. No additional studies or need of undertaking detailed EIA is envisaged at this stage. The Executing Agency shall ensure that EMP and EMoP are included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design and with approval of ADB.

### Appendix 1: Rapid Environmental Assessment (REA) Checklist

**Country/Project Title:** INDIA: North Eastern State Roads Investment Program

**Sector Division:** South Asia Transport and Communication Division (SATC)

**Road Section:** AS-02: Tamulpur – Paneri) and AS-03 (Paneri – Udalguri) sections in the State of Assam – 62.9 km

Screening questions	Yes	No	Remarks
<b>A. Project siting</b>			
▪ Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Protected area		X	No specific protected areas within project corridor. Thin plantation and forests area existing along the project roads.
▪ Wetland		X	
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	
<b>B. Potential environmental impacts</b>			
▪ Will the project cause...			
▪ Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	X		Small shrines and temples exist along the road within 10 m corridor which may or may not fall within the widened area. However, it will be updated in social impact assessment report. Proper Plantation will improve the landscape of the area. Proper management plan will be required during construction to sustain the quarries.
▪ Encroachment on precious ecology (e.g. Sensitive or protected areas)?		X	
▪ Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	X		Project area is high rainfall zone and most of the rivers are tributaries of Brahmaputra river. Frequent flooding caused washing away of existing roads as observed at site. Soil erosion and sediment deposit are major concerns in the area. Controlled construction activities will ensure sediment discharge into streams.
▪ Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	X		During construction period suitable mitigation measures will be required to control the silt runoff. Adequate Sanitary facilities and drainage in the workers camps will help to avoid this possibility. As the construction activity in this project will not contain any harmful ingredients, no impact on surface water quality is anticipated.

Screening questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?</li> </ul>	X		With appropriate mitigation measures and use of most modern environment friendly equipments/machineries air pollution shall be reduced to permissible levels.
<ul style="list-style-type: none"> <li>risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?</li> </ul>	X		Possible but will be reduced with appropriate mitigation measures.
<ul style="list-style-type: none"> <li>Noise and vibration due to blasting and other civil works?</li> </ul>	X		Short term minor impact may occur during construction period. Suitable mitigation measures will be required to minimize the adverse effects.
<ul style="list-style-type: none"> <li>Dislocation or involuntary resettlement of people</li> </ul>		X	This will be updated in Social Report.
<ul style="list-style-type: none"> <li>dislocation and compulsory resettlement of people living in right-of-way?</li> </ul>	X		This will be updated in Social Report.
<ul style="list-style-type: none"> <li>disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>		X	
<ul style="list-style-type: none"> <li>Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?</li> </ul>		X	Imposing of appropriate mitigation measures in contract agreement to keep the air pollution within permissible levels will keep a check on this problem.
<ul style="list-style-type: none"> <li>Hazardous driving conditions where construction interferes with pre-existing roads?</li> </ul>		X	To minimise the impact suitable traffic management plan will be required.
<ul style="list-style-type: none"> <li>Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?</li> </ul>	X		Proper provisions for sanitation, health care and solid waste disposal facilities will be available in the contract documents to avoid such possibility. Workers will be made aware about communicable diseases.
<ul style="list-style-type: none"> <li>Creation of temporary breeding habitats for mosquito vectors of disease?</li> </ul>		X	
<ul style="list-style-type: none"> <li>Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?</li> </ul>		X	Adoption of suitable traffic signage system at sensitive places will reduce such possibility.
<ul style="list-style-type: none"> <li>Increased noise and air pollution resulting from traffic volume?</li> </ul>		X	Due to improvement in Riding Quality & Comfort in driving due to unidirectional traffic such pollution will be reduced. Mitigation measures along with monitoring plan will be required.
<ul style="list-style-type: none"> <li>Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?</li> </ul>	X		Controlled construction activities and proper drainage system will reduce this possibility.
<ul style="list-style-type: none"> <li>social conflicts if workers from other regions or countries are hired?</li> </ul>	X		Possible. Adequate measures will be adopted in contractor's specification to ensure maximum participation of local labours for construction activities.

Screening questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>		X	Possible.
<ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul>		X	Possible but controlled handling of explosives and construction material will avoid this risk.
<ul style="list-style-type: none"> <li>community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.</li> </ul>		X	Possible. Adequate health and safety measures would be included to minimize community safety risks.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	REMARKS
<ul style="list-style-type: none"> <li>Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunamis or volcanic eruptions and climate changes (see Appendix I)</li> </ul>	X		Project is vulnerable to heavy and frequent flooding.
<ul style="list-style-type: none"> <li>Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., increased erosion or landslides could increase maintenance costs, permafrost melting or increased soil moisture content could affect sub0-grade).</li> </ul>	X		Likely. Increase in rainfall will reduce lifespan of the project as this is a flood prone area.
<ul style="list-style-type: none"> <li>Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (eg., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?</li> </ul>		X	
<ul style="list-style-type: none"> <li>Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by encouraging settlement in areas that will be more affected by floods in the future, or encouraging settlement in earthquake zones)?</li> </ul>	X		Induced developed along the project road due to improvement of project roads which are prone to floods.

### Appendix 2: Species wise details of trees to be cut

**Table A: Number, Location, and Type of Trees to be cleared along AS-02: Tamulpur-Paneri**

Location (Km)	LHS	RHS
0+1	<b>30</b> (Madar-1, Bel-1, Silikha-1, Neem-1, Siris-1, Bogori-5, Kathal-2, Maj-2, Karoi-1, Velcol-6, Debbaru-3, Kurus-2, Kohimala-1, Mango-2, Kadam-1)	<b>31</b> (Mango-2, Kurus-2, Radhasura-2, Sonaru-1, Kohimala-5, Beetlenut-17, Kathal-1, Pakri-1)
1+2	<b>41</b> (Kadam-2, Maj-3, Bogori-2, Kardoi-2, Kurus-1, Kathal-2, Beetlenut-12, Siris-5, Mango-2, Velcol-1, Pakri-2, Kohimala-1, Silikha-1, Gameri-1, Dambaru-1, Sonaru-1, Ou-1, Jam-1)	<b>14</b> (Harua-1, Mango-1, Siris-5, Kathal-1, Neem-1, Kadam-2, Nahar-1, Simalu-2)
2+3	<b>53</b> (Ou-1, Krisnasura-1, Velcol-5, Arjun-1, Siris-5, Bogori-1, Poma-1, Kohimala-2, Beetlenut-9, Saitan-1, Silikha-1, Simalu-1, Kadam-1, Amara-1, Pakri-10, Samala-1, Velcol-3, Gameri-3, Mango-1, Sajna-1, Maj-1, Madar-2)	<b>18</b> (Siris-5, Poma-1, Kurus-1, Simalu-1, Pakri-2, Madar-2, Kadam-2, Mango-2, Madhuriaam-1, Gameri-1)
3+4	<b>54</b> (Pakri-16, Siris-8, Silikha-2, Radhasura-3, Maj-6, Debbaru-1, Krisnasura-2, Kadam-2, Coconut-1, Bamboo bush-4, Eucalyptus-1, Mango-1, Velcol-4, Badgas-1, Kohimala-2)	<b>12</b> (Neem-1, Kadam-1, Ou-1, Saitan-1, Kathal-1, Beetlenut-1, Kohimala-2, Pakri-1, Bakul-1, Siris-1, Eucalyptus-1)
4+5	<b>19</b> (Bogori-6, Bamboo bush-1, Siris-1, Pakri-1, Ajar-1, Velcol-1, Tetli-1, Kathal-1, Kurus-1, Sorua-4, Kohimala-1)	<b>19</b> (Kadam-1, Kohimala-2, Pakri-2, Ajar-2, Bagari-8, Harua-3, Kar-1)
5+6	<b>25</b> (Siris-4, Pakri-3, Debbaru-1, Eucalyptus-1, Bogori-3, Beetlenut-11, Sonaru-2)	<b>21</b> (Mango-3, Siris-5, Pakri-4, Bamboo bush-1, Bagari-3, Kathal-1, Sonaru-1, Kar-2, Bakul-1)
6+7	<b>23</b> (Khejur-1, Siris-3, Gameri-3, Maj-2, Kohimala-1, Beetlenut-8, Silikha-1, Sonaru-4)	<b>20</b> (Pakri-5, Bamboo bush-2, Kohimala-3, Majar-2, Sonaru-7, Bagari-1)
7+8	<b>24</b> (Pakri-4, Maj-1, Kurus-1, Sonaru-1, Amara-1, Siris-4, Bogori-7, Neem-1, Kohimala-2, Poma-1, Velcol-1)	<b>18</b> (Kathal-1, Bagari-4, Sonaru-2, Pakri-1, Harua-2, Kohimala-3, Radhasura-1, Siris-2, Krisnasura-1, Kadam-1)
8+9	<b>54</b> (Pakri-11, Kadam-1, Khejur-6, Beetlenut-15, Eucalyptus-4, Siris-8, Amlokhi-1, Jam-1, Radhasura-1, Bamboo bush-1, Neem-1, Poma-1, Bogori-1, Velcol-2)	<b>22</b> (Pakri-2, Velcol-5, Bagari-6, Khejur-1, Bel-2, Gameri-1, Harua-1, Kathal-1, Bamboo bush-1, Siris-2)
9+10	<b>34</b> (Khejur-1, Ti-1, Jam-1, Neem-1, Bel-1, Siris-1, Kathal-3, Velcol-15, Mango-1, Kurus-1, Bakul-2, Pakri-1, Ou-1, Bogori-4)	<b>32</b> (Pakri-7, Badgas-2, Poma-1, Khejur-2, Tet-1, Mango-1, Neem-3, Bagari-1, Beetlenut-7, Bakul-1, Krisnasura-2, Eucalyptus-3, Kadam-1)

Location (Km)	LHS	RHS
10+11	<b>21</b> (Bogori-6, Khejur-2, Siris-1, Eucalyptus-1, Ou-1, Pakri-2, Bel-1, Coconut-1, Bamboo bush-3, Gameri-1, Madhuri-1, Sorua-1)	<b>20</b> (Khejur-2, Bagari-6, Pakri-7, Siris-2, Kathal-2, Harua-1)
11+12	<b>25</b> (Kathal-1, Gameri-1, Siris-8, Sorua-3, Velcol-4, Madhuri-1, Bogori-3, Maj-1, Ajar-2, Samala-1)	<b>73</b> (Bamboo bush-6, Pakri-2, Bakul-1, Harua-4, Velcol-9, Kadam-1, Siris-42, Kohi-2, Majar-2, Koroi-2, Bagari-1, Eucalyptus-1)
12+13	<b>40</b> (Velcol-19, Bogori-18, Mango-1, Madhuri-1, Saitan-1)	<b>29</b> (Majar-1, Bagari-12, Eucalyptus-2, Velcol-4, Ou-1, Palash-1, Moin-8)
13+14	<b>65</b> (Bel-1, Bogori-7, Ou-1, Samala-2, Velcol-25, Amara-1, Pakri-5, Jiya-11, Mango-1, Sagun-3, Neem-1, Madhuri-1, Kohimala-2, Maj-2, Saitan-2)	<b>29</b> (Bagari-11, Moin-2, Velcol-6, Kathal-3, Kohimala-2, Madar-1, Pakri-2, Siris-1, Jam-1)
14+15	<b>57</b> (Bamboo bush-1, Siris-17, Dambaru-1, Samala-1, Gameri-2, Velcol-7, Kadam-2, Pakri-6, Madar-1, Bel-4, Khejur-1, Jiya-10, Sonaru-1, Neem-1, Radhasura-2)	<b>26</b> (Velcol-7, Siris-8, Bagari-4, Pakri-2, Sagun-2, Sonaru-2, Badgas-1)
15+16	<b>5</b> (Neem-5)	<b>2</b> (Bagari-2)
16+17	<b>42</b> (Neem-34, Dambaru-1, Madar-1, Siris-5, Simalu-1)	<b>19</b> (Badgas-2, Kar-5, Neem-1, Krisnasura-2, Arjun-1, Mango-1, Kohimala-1, Eucalyptus-1, Bagari-1, Simalu-4)
17+18	<b>0</b>	<b>0</b>
18+19	<b>24</b> (Khoira-1, Bel-1, Velcol-6, Bogori-1, Bamboo bush-1, Maj-1, Sorua-2, Kurus-1, Madar-2, Siris-2, Kohimala-1, Gameri-1, Neem-2, Beetlenut-2)	<b>27</b> (Makrisal-2, Kohimala-2, Velcol-12, Bagari-3, Moin-1, Neem-1, Kar-1, Siris-3, Bel-1, Jiya-1)
19+20	<b>40</b> (Kohimala-1, Bogori-15, Madhuri-2, Velcol-16, Neem-1, Pakri-3, Jiya-1, Mango-1)	<b>56</b> (Bagari-16, Simalu-2, Kohimala-9, Kar-1, Bamboo bush-10, Jiya-5, Velcol-5, Bel-2, Amara-1, Madar-1, Pakri-2, Krisnasura-1, Ajar-1)
20+21	<b>4</b> (Velcol-2, Samala-1, Bokul-1)	<b>10</b> (Velcol-2, Bamboo bush-2, Neem-1, Kurus-1, Pakri-3, Badgas-1)
21+22	<b>29</b> (Samala-2, Bogori-7, Madar-1, Simalu-1, Neem-2, Amara-6, Velcol-6, Bamboo bush-1, Beetlenut-2, Sisu-1)	<b>49</b> (Bamboo bush-16, Amara-2, Simalu-1, Velcol-7, Pakri-1, Neem-1, Gameri-6, Bhomora-1, Beetlenut-14)
22+23	<b>24</b> (Bogori-4, Bamboo bush-1, Mango-2, Bel-1, Neem-4, Kathal-1, Siris-3, Madhuri-1, Sonaru-1, Bakul-1, Samala-1, Velcol-1, Jiya-2, Kohimala-1)	<b>34</b> (Kohimala-8, Beetlenut-11, Neem-4, Gameri-1, Bamboo bush-1, Krisnasura-1, Kadam-1, Siris-1, Velcol-1, Kar-2, Jam-2, Badgas-1)
23+24	<b>12</b> (Kadam-1, Siris-1, Velcol-9, Jiya-1)	<b>17</b> (Bamboo bush-3, Kohimala-7, Kar-1, Badgas-1, Bagari-1, Pakri-2, Velcol-1, Siris-1)

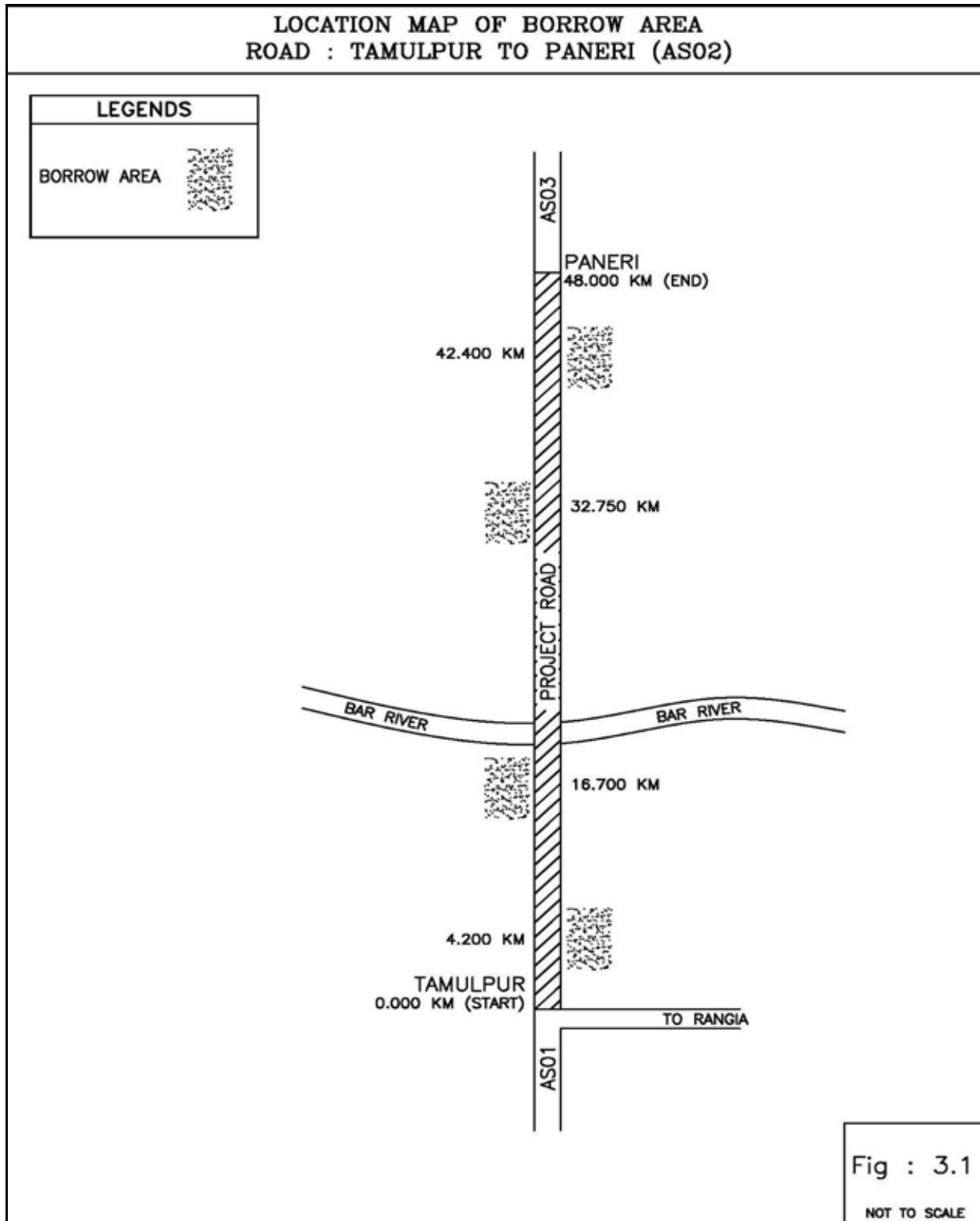
Location (Km)	LHS	RHS
24+25	<b>2</b> (Maj-1,Bogori-1)	<b>2</b> (Bagari-2)
25+26	<b>22</b> (Bogori-22)	<b>20</b> (Poma-1, Jiya-1, Bagari-16, Harua-2)
26+27	<b>16</b> (Kathal-3, Mango-2, Maj-1, Ou-1, Khejur-4, Bogori-2, Bel-2, Krisnasura-1)	<b>6</b> (Kathal-3, Mango-3)
27+28	<b>10</b> (Mango-2, Bogori-2, Velcol-2, Radhasura-3, Bakul-1)	<b>21</b> (Krisnasura-4, Bagari-3, Amara-2, Dawa-2, Kohimala-10)
28+29	<b>2</b> (Sorua-2)	<b>3</b> (Pakri-1, Badgas-1, Simalu-1)
29+30	<b>3</b> (Bamboo bush-3)	<b>3</b> (Harua-1, Jiya-2)
30+31	<b>33</b> (Pakri-1, Jiya-30, Samala-1, Kohimala-1)	<b>2</b> (Kathal-2)
31+32	<b>25</b> (Jiya-17, Kohimala-5, Khejur-2, Silikha-1)	<b>2</b> (Mango-2)
32+33	<b>0</b>	<b>2</b> (Poma-1, Badgas-1)
33+34	<b>28</b> (Bel-1, Kohimala-4, Jiya-8, Gameri-11, Velcol-4)	<b>0</b>
34+35	<b>18</b> (Gameri-5, Velcol-5, Bamboo bush-2, Bel-2, Siris-2, Bogori-2)	<b>10</b> (Gameri-5, Bagari-5)
35+36	<b>4</b> (Bogori-3, Velcol-1)	<b>29</b> (Bagari-1, Gameri-25, Jiya-2, Poma-1)
36+37	<b>0</b>	<b>9</b> (Pakri-1, Krisnasura-1, Eucalyptus-2, Nahar-3, Siris-1, Mango-1)
37+38	<b>3</b> (Sir-2, Sim-1)	<b>32</b> (Gameri-5, Radhasura-5, Krisnasura-2, Bagari-2, Siris-15, Hamara-1, Simalu-1, Velcol-1)
38+39	<b>4</b> (Eucalyptus-2, Arjun-1, Samala-1)	<b>4</b> (Kohimala-2, Bagari-1, Radhasura-1)
39+40	<b>7</b> (Sim-4, Eucalyptus-1, Kohimala-1, Siris-1)	<b>2</b> (Simalu-1, Bagari-1)
40+41	<b>14</b> (Velcol-7, Maj-1, Siris-1, Gameri-1, Simalu-1, Eucalyptus-1, Sorua-1, Ajar-1)	<b>8</b> (Siris-6, Koro-i-1, Gameri-1)
41+42	<b>28</b> (Gameri-21, Bel-2, Bogori-2, Eucalyptus-2, Mango-1)	<b>31</b> (Gameri-27, Bagari-2, Pakri-1, Eucalyptus-1)
42+43	<b>20</b> (Gameri-12, Eucalyptus-2, Velcol-2, Simalu-1, Madar-1, Jam-1, Mango-1)	<b>18</b> (Gameri-13, Poma-1, Siris-2, Moin-1, Simalu-1)
<b>Total Tree to be cut</b>	<b>984</b>	<b>802</b>
<b>Total tree to be cut for the project road AS-02</b>		<b>1786</b>

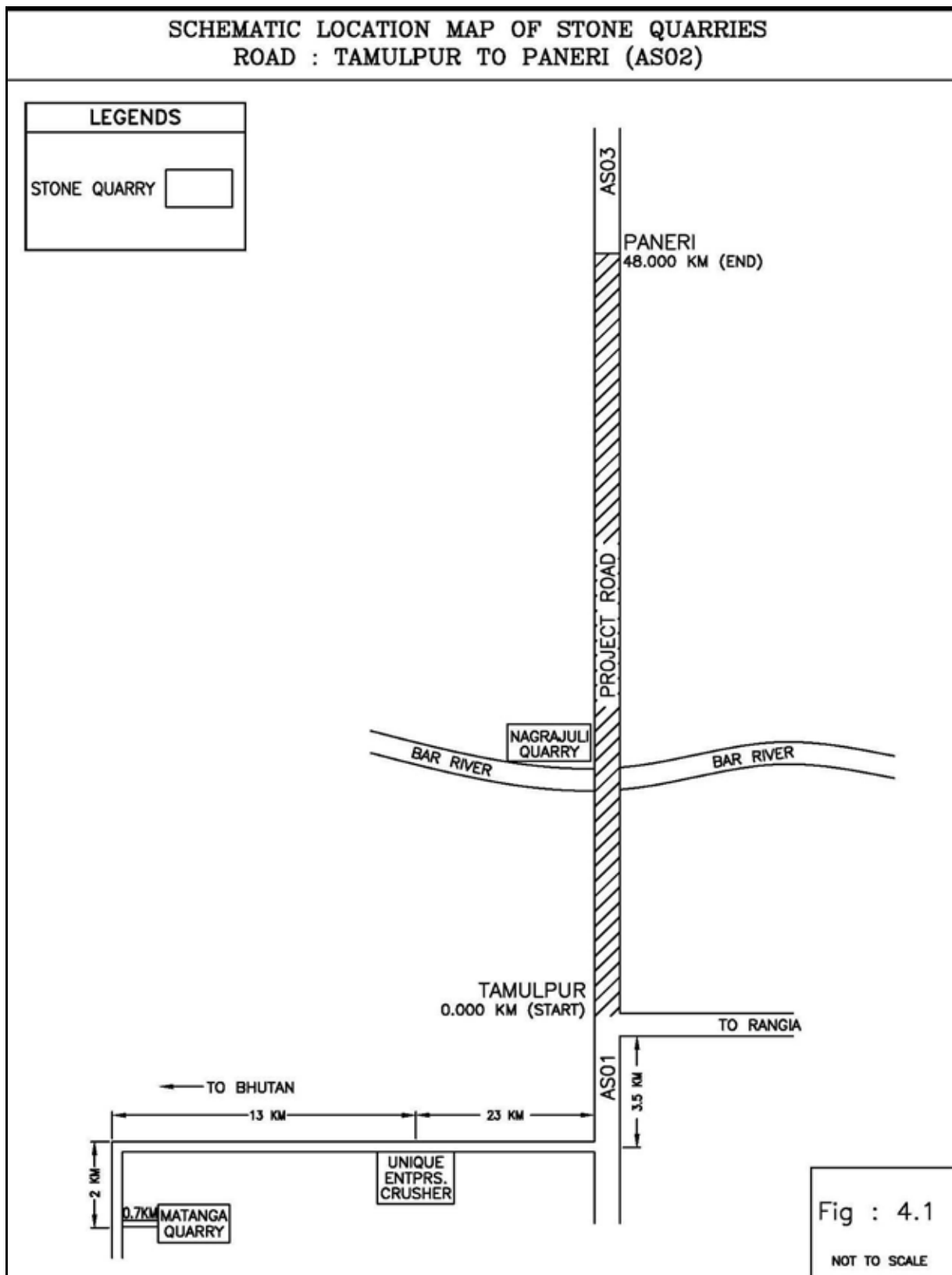
**Table B: Number, Location, and Type of Trees to be cleared along AS-03: Paneri-Udalguri**

<b>Location (Km)</b>	<b>LHS</b>	<b>RHS</b>
0+1	<b>25</b> (Mango-1, Simolu-3, Bakul-1, Gameri-9, Pakari-1, Koroi-8, Kadom-1, Neem-1)	<b>36</b> (Koroi-1, Krishnasura-1, Pakari-1, Gameri-18, Sirish-2, Khejur-2, Chetan-1, Mango-1, Kahimala-1, Bargas-1, Nahar-2, Velcol-2, Simolu-2, Debdaru-1)
1+2	<b>13</b> (Simolu-3, Madar-1, Nahar-1, Bakul-1, Sirish-2, Cocanut-1, Gameri-1, Kadom-1, Harua-1, Mango-1)	<b>28</b> (Gameri-15, Bakul-5, Amara-1, Koroi-2, Krishnasura-1, Khejur-1, Nahar-2, Sirish-1)
2+3	<b>8</b> (Sirish-2, Mango-3, Simolu-1, Khejur-1, Titachop-1)	<b>27</b> (Simolu-5, Bagari-3, Velcol-1, Gameri-10, Palash-3, Mango-5)
3+4	<b>7</b> (Velcol-1, Halfali-1, Bakul-1, Pakari-1, Radhasura-1, Bel-1, Madar-1)	<b>30</b> (Harua-2, Bagari-1, Pakari-13, Velcol-1, Khejur-1, Kahimala-1, Bamboo bush-1, Moin-1, Mango-9)
4+5	<b>4</b> (Kathal-1, Simolu-1, Chetan-1, Khejur-1)	<b>28</b> (Krishnasura-2, Pakari-5, Khejur-2, Jam-1, Kurus-4, Eucalyptus-9, Kahimala-1, Harua-1, Sirish-1, Moin-1, Chetan-1)
5+6	<b>13</b> (Kathal-1, Maj-2, Chetan-8, Khejur-1, Koroi-1)	<b>43</b> (Bamboo bush-2, Bel-1, Kahimala-8, Kathal-1, Jam-1, Khejur-2, Krishnasura-1, Beetle nut-21, Mango-1, Kadom-2, Poma-1, Maj-1, Debdaru-1)
6+7	<b>13</b> (Bagari-4, Bargas-1, Ahat-1, Simolu-2, Velcol-4, Madar-1)	<b>16</b> (Tat-1, Simolu-1, Moin-6, Kahimala-3, Velcol-5)
7+8	<b>8</b> (Amara-1, Mango-2, Krishnasura-1, Eucalyptus-1, Bakul-1, Jam-1, Sirish-1)	<b>18</b> (Gameri-1, Sishu-7, Jam-1, Mango-1, Eucalyptus-3, Kadom-2, Bagari-1, Sirish-1, Bhomora-1)
8+9	<b>14</b> (Sirish-7, Ahat-2, Mango-1, Bakul-2, Chetan-1, Kahimala-1)	<b>11</b> (Sirish-3, Bhomora-2, Pakari-2, Kahimala-1, Jam-1, Mango-1, Khilikha-1)
9+10	<b>13</b> (Bagari-1, Chetan-1, Mango-1, Dombaru-1, Kahimala-1, Ahat-1, Khilikha-1, Sirish-1, Sishu-1, Pakari-2, Simolu-1, Khejur-1)	<b>18</b> (Bagari-2, Khejur-3, Harua-1, Mango-1, Sirish-1, Jam-2, Bakul-1, Beetle nut-6, Kahimala-1)
10+11	<b>14</b> (Kurus-1, Bagari-2, Loubandha-1, Ahat-1, Radhasura-5, Moin-4)	<b>30</b> (Bargas-7, Kurus-1, Hilikha-1, Ajar-3, Bakul-1, Amara-1, Khejur-8, Moin-3, Kathal-1, Krishnasura-1, Bhomora-2, Velcol-1)
11+12	<b>17</b> (Moin-6, Bagari-3, Poma-1, Loubandha-1, Bel-1, Simalu-1, Mango-1, Jam-1, khe-2)	<b>7</b> (Moin-2, Bagari-3, Gameri-1, Pakari-1)
12+13	<b>16</b> (Bagari-14, Loubandha-1, Ademura-1)	<b>11</b> (Kurus-1, Bagari-8, Moin-2)
13+14	<b>13</b>	<b>7</b>

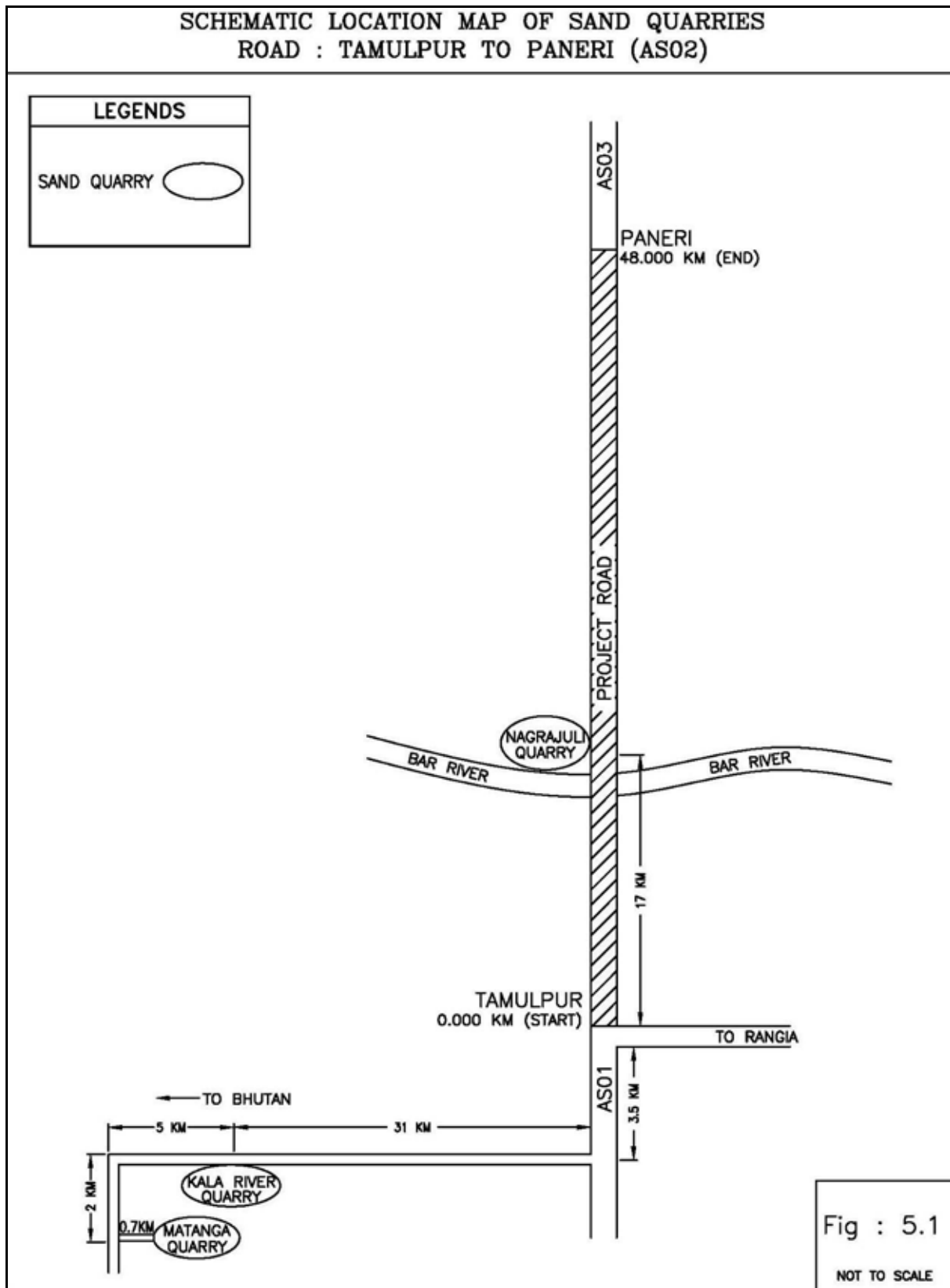
Location (Km)	LHS	RHS
	(Harua-3,Ahat-2,Krishnasura-1,Simolu-1,Bagari-1,Moin-2,Khejur-1,Kahimala-1,Kurus-1)	(Bagari-2,Khejur-2,Madar-2,Bel-1)
14+15	<b>7</b> (Bagari-3,Khejur-1,Mango-1,Krishnasura-2)	<b>1</b> (Sirish-1)
15+16	<b>13</b> (Bagari-3,Moin-1,Eucalyptus-8,Simolu-1)	<b>9</b> (Bagari-6,Eucalyptus-2,Maj-1)
16+17	<b>13</b> (Bhomora-1,Sagun-5,Bagari-2,Sirish-2,Ahat-2,Simolu-1)	<b>9</b> (Bagari-2,Gameri-3,Pakari-1,Kahimala-1,Beetle nut-2)
17+18	<b>3</b> (Simolu-1,Sirish-1,Ajar-1)	<b>17</b> (Kathal-1,Sagun-3,Mango-1,Eucalyptus-8,Sirish-2,Bagari-2)
18+End point (18.55km)	<b>1</b> (Bargas-1)	<b>5</b> (Sirish-2,Bargas-2,Guc-1)
<b>Total (Nos)</b>	<b>215</b>	<b>351</b>
<b>Total tree to be cut for the project road AS-03</b>		<b>566</b>

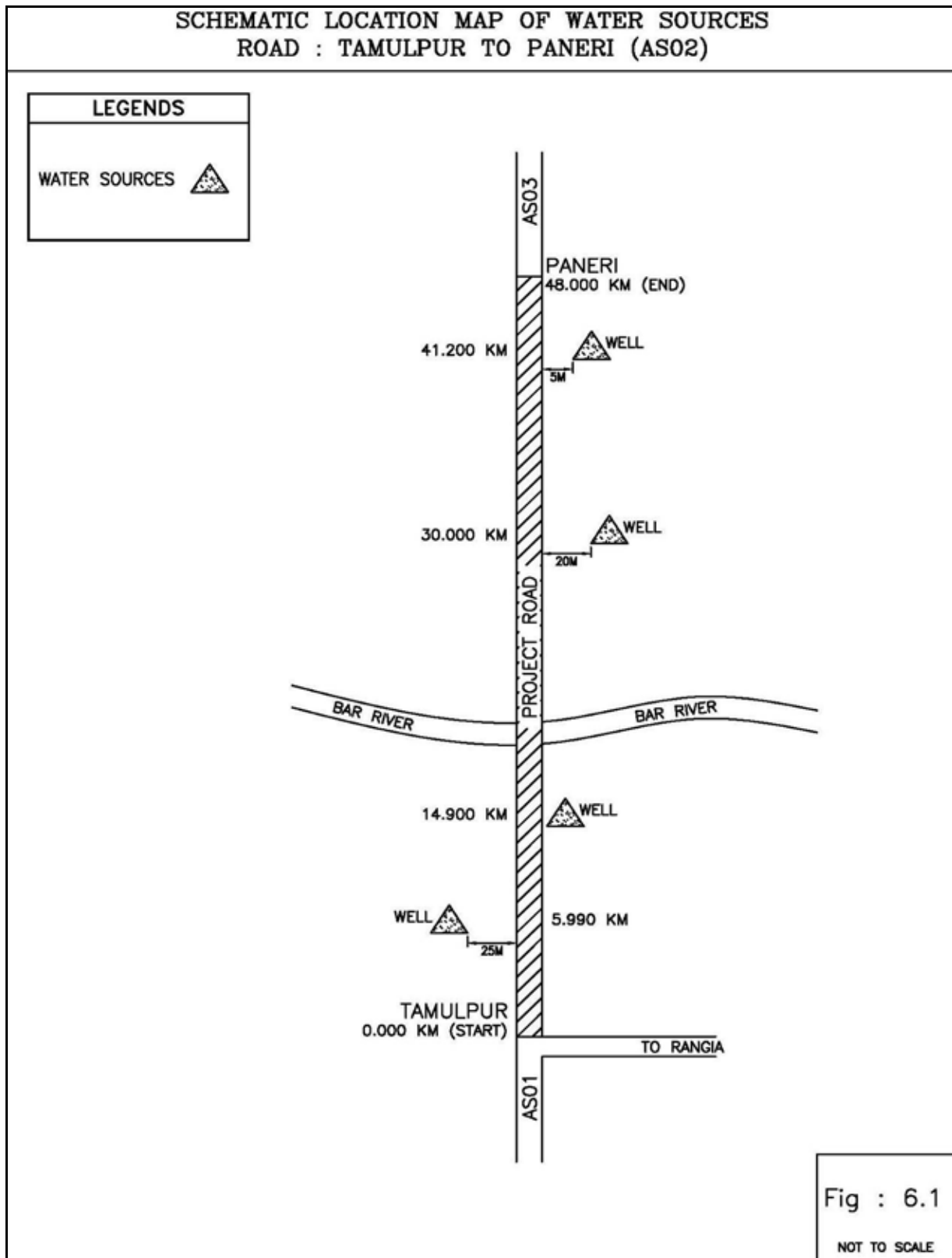
### Appendix 3: Location Map of Borrow Areas, Stone & Sand Quarries and Water Sources

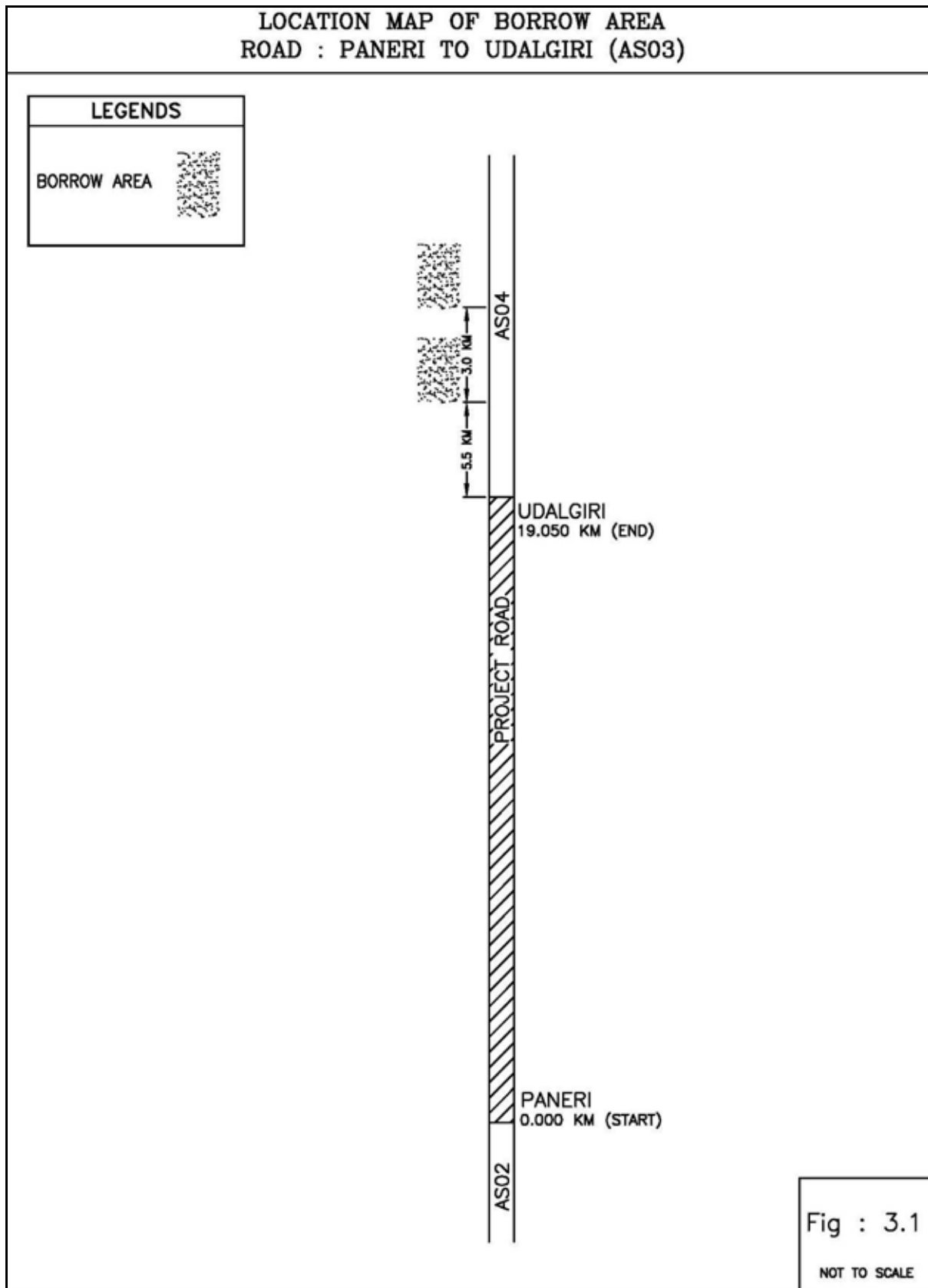


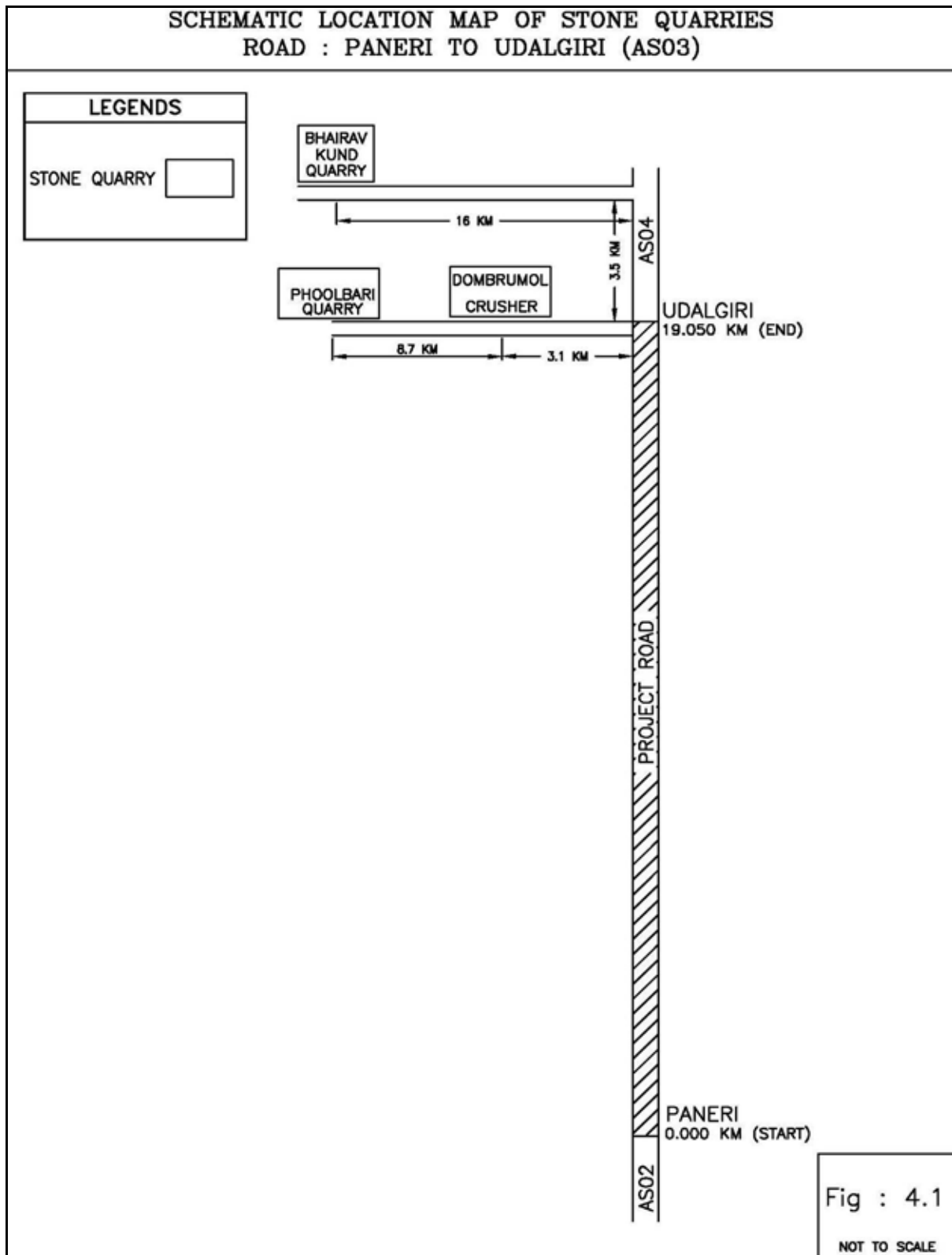


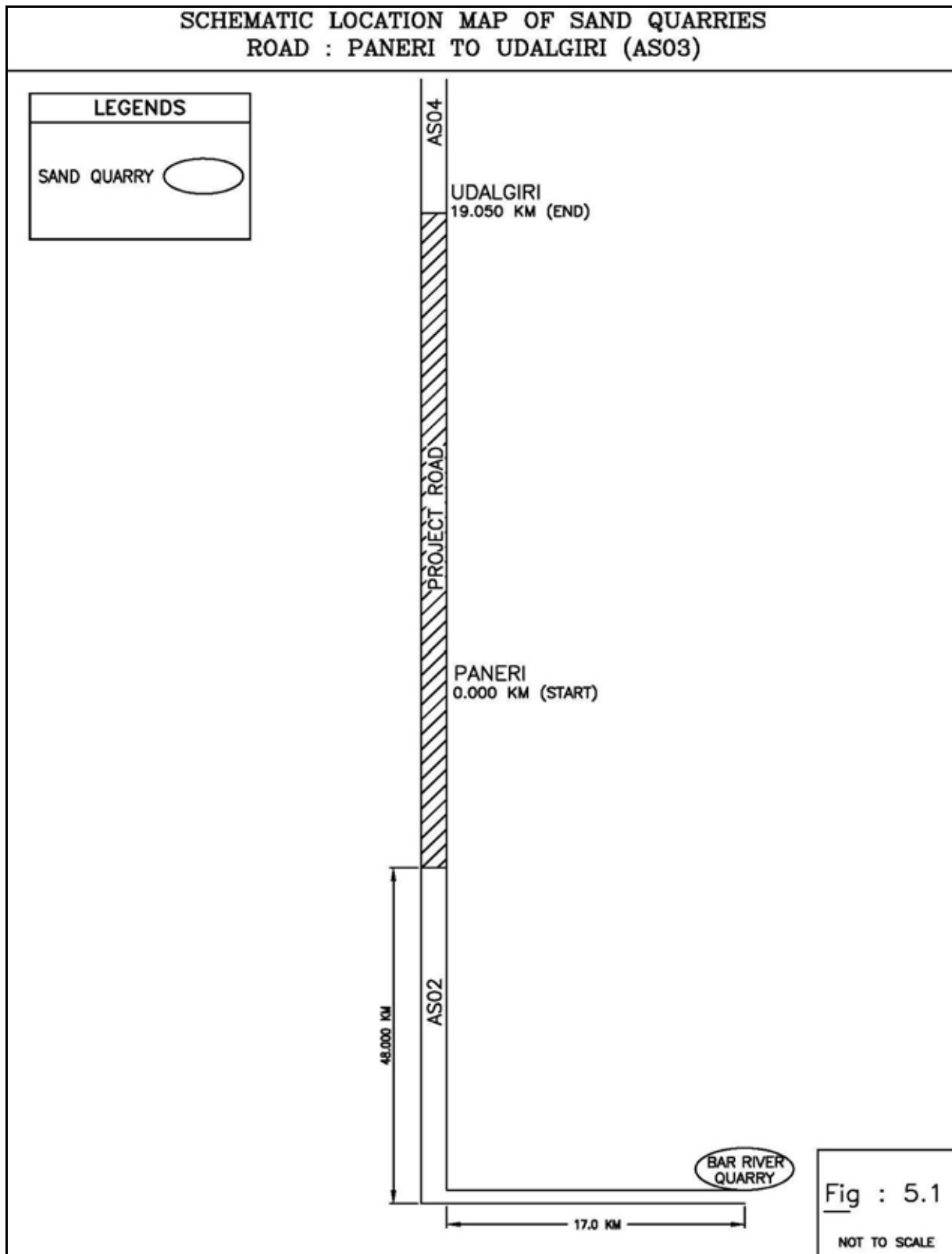


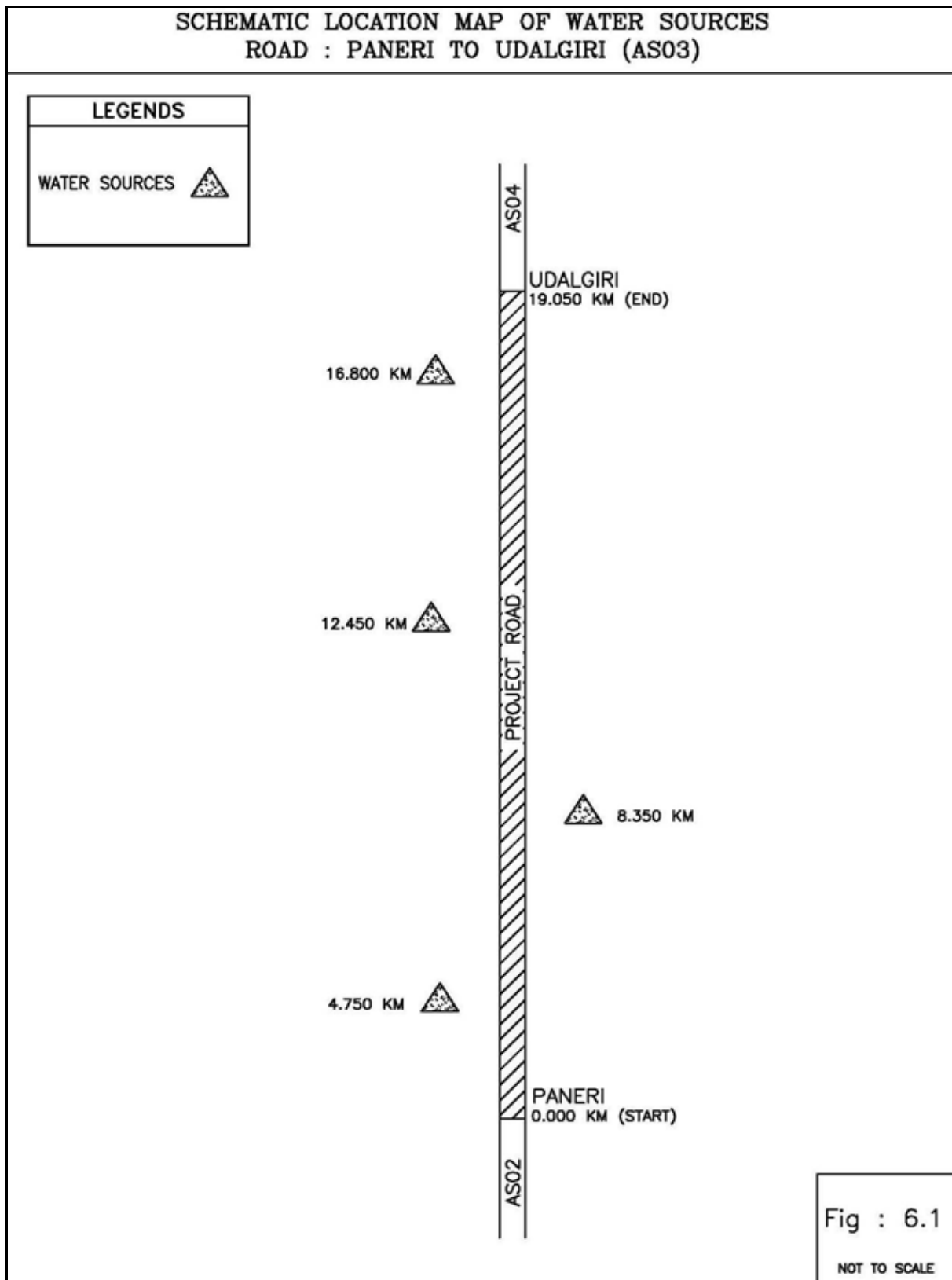












**Appendix 4: List of Officials Consulted & Issues Discussed During Field Visit**

Sl. No.	Name of Official Consulted	Department	Issue discussed	Date
1	Mr. M.C. Malakar	Chief Conservator of Forests (Wildlife), Office of PCCF, Govt. of Assam, Paltan Bazar, Guwahati	Wildlife status in state, flora & fauna species, Environmental aspects of hilly roads	20th May 2005
2	Mr. S. Ahmed	Working Plan Officer, Working Plan Office, Forest Research School, Guwahati, Assam	Status of forests in Assam, flora & fauna in Assam	21st May 2005
3	Sh. K.S. Chakraborty,	Board Analyst, Assam Pollution Control Board, Bamunimaidan, Guwahati	Environmental Quality in Tripura, Institutional capacity for environmental monitoring, Likely impacts and mitigation	21st May 2005
4	Dr. Deepak Baruah,	Dy. Analyst, Assam Pollution Control Board, Bamunimaidan, Guwahati	Environmental Quality, Environmental Issues	21st May 2005
5	Dr. M.A. Reddy	Ass. Professor, Civil Engineering Department, Indian Institute of Technology Guwahati, Assam	Environmental issues in north east, capacity at IIT Guwahati for environmental monitoring, Scope of IEE, Potential areas of concern	13th May 2005
6	Ms. Junu Neoz	Dy. Director, Directorate of Social Welfare, Govt. of Assam, Guwahati	Socio-economic conditions of the state, Welfare activities in state	21st May 2005
7	Mr. K.R. Baisya	Superintendent, Assam Institute of Research for Tribal & Schedule Caste, Guwahati, Assam	Tribal communities and activities for tribal development in the state, 2301103	21st May 2005
8	Mr. Sharma	Team Leader, North Eastern Region Urban Infrastructure Development Study	Environmental Issues of urban areas in North Eastern Region, Solid Waste Management, Water Supply, Transportation facilities, Proposed project, Scope of IEE	10th June 2005
9	Chinpal Raunier	Consultant (GDS), ADB TA Preparation of North Eastern States Trade and Investment Creation	Potential of trade & economy in the North Eastern Region, Impacts of road sector on trade & economy, factors affecting trade & economy	6th May 2005
10	Mr. Madhusudan Mitra	Consultant (GDS), ADB TA Preparation of Northeastern States Trade and Investment Creation	Potential of trade & economy in the North Eastern Region, Impacts of road sector on trade & economy, factors affecting trade & economy	6th May 2005

Sl. No.	Name of Official Consulted	Department	Issue discussed	Date
11	Mr. P.C. Mudoy	Survey Assistant, Survey of India, Guwahati	1) Archaeological sites within 10 km from project road. 2) Any anthropological site within 10 km from project road.	3rd April 2008
12	Mr. Sanjay Panda	Asst. Archaeologist, Archaeological Survey of India, Guwahati	-do-	10th April 2008
13	Mr. Kumarendra Sharma	Superintendent, Directorate of Archaeology, Guwahati, Assam	Any anthropological site within 10 km from project road.	16th April 2008
14	Mr. Nayandyuti Pathak & Mr. Anil Basumotary	Asst. Executive Engineer, Tamulpur Rural Road Sub-Division, PWD, Assam	Alignment of project road on district planning maps. 2) Water bodies near the road, which can affect project road. 3) Flood prone areas along the project road. 4) Tentative debris disposal site. 5) Prevention from flood.	17th May 2008
15	Mr. D. Chowdhury & Mr. Dipak Kr. Deka	Asst. Executive Engineer, Udalguri Rural Road Sub-Division, PWD, Assam	1) Alignment of project road on district planning maps. 2) Water bodies near the road, which can affect project road. 3) Flood affected areas along the project road. 4) Tentative debris disposal site. 5) Prevention from flood.	22nd May 2008
16	Mr. Babul Ch. Boro	Head Assistant (Accountant), DFO Office, Dhansiri Division, Udalguri. Forest Department	Ecologically sensitive areas across the project road and within 10 km radius from project road.	16th May 2008
17	Mr. Haladhar Kalita	Range Officer Paneri (Nonai Range), Forest Department	-do-	21st May 2008
18	Mr. A.K. Patwary	ACF, Dhansiri Forest Division, Udalguri, Forest Department	1) Forest Map showing project road. 2) Ecologically sensitive areas across the project road 3) Ecologically sensitive within 10 km from road edge for each side. 4) Tree plantation strategy. 5) Standing orders, circulars, notifications or any other regulatory requirements about restrictions / permission of carrying out road	23rd May 2008

Sl. No.	Name of Official Consulted	Department	Issue discussed	Date
			construction activities within these ecological sensitive areas.	
19	Mr. S. Momin	DFO, Orang Wildlife Division, Mangaldai, Wildlife Division	1) Details of Baranadi Wildlife Sanctuary. 2) Floral and Faunal details.	23rd May 2008
20	Mr. Tarun Sharma	Forester-I, Orang Wildlife Division, Mangaldai, Wildlife Division	1) Floral and Faunal details.	23rd May 2008

### Photographs Record of Stakeholders' Consultation

	
<p><b>Mr. Sanjay Panda</b> (Archaeological Survey of India)</p>	<p><b>Mr. Nayandyuti Pathak</b> (PWD)</p>
	
<p><b>Mr. Anil Basumotary</b> (PWD)</p>	<p><b>Mr. D. Chowdhury &amp; Mr. Dipak Kr. Deka</b> (PWD)</p>



**Mr. Babul Ch. Boro** (Forest Department)



**Mr. Haladhar Kalita** (Forest Department)

## Appendix 5: Questionnaire Used for Community Consultation

### ENVIRONMENTAL SURVEY

#### Practical View of the Community about Environmental Scenario

- | <b>Km:</b> | <b>From-</b>  | <b>To-</b> | <b>Team No-</b> |
|------------|---|------------|-----------------|
| Q.1-       | What do you think about the quality of water from ponds, wells, rivers or canal in your area? |            |                 |
|            | Good  |            |                 |
|            | Satisfactory  |            |                 |
|            | Polluted  |            |                 |
| Q.2-       | If the quality of water is polluted /poor then in your opinion what are its reasons?          |            |                 |
|            | Ingress of industrial effluent in the source  |            |                 |
|            | Sewage leakage/discharge in the source  |            |                 |
|            | Animal water holes  |            |                 |
|            | Rain water storage  |            |                 |
|            | Others, please specify  |            |                 |
| Q.3-       | Is the noise level in your area disturbing / irritating?                                      |            |                 |
|            | Yes   |            |                 |
|            | No  |            |                 |
| Q.4-       | If the Noise level is disturbing / irritating then in your opinion, it is due to              |            |                 |
|            | Vicinity of industry  |            |                 |
|            | Vehicular Traffic   |            |                 |
|            | Construction work   |            |                 |
|            | Work shop / scooter repair shop   |            |                 |
|            | Aviation zone   |            |                 |
|            | Others, please specify  |            |                 |
| Q.5-       | How, in your opinion, the noise level can be brought to satisfactory level in your area.      |            |                 |
| Q.6-       | Is the quality of air, which you breath is healthy and clean                                  |            |                 |
|            | Yes   |            |                 |
|            | No  |            |                 |
| Q.7-       | If not, then what are the reasons ?   |            |                 |
|            | Due to vehicular pollution  |            |                 |
|            | Due to Industrial pollution   |            |                 |
|            | Due to poor sanitation  |            |                 |
|            | Due to tanneries in the vicinity  |            |                 |

Due to domestic smoke

Others , please specify

Q.8- Are there any places of Archeological / historical importance in your vicinity, if yes, please give details

Q.9- Is there any previous history of natural disaster viz. Floods, Drought, earthquake etc. in your area, if so give details with year of occurrence and damage.

Location:

Year:

Flood Yes / No

Drought Yes / No

Earthquake Yes / No

Q.10- Are any rare species of Birds, Animals etc. visiting your area during winter, if so please give details and locations

Name of the Species

Location

Q.11- Do you have any market place, melas etc. in your areas and it is likely to be affected by proposed expansion of road, if yes then which site do you suggest for relocation the markets.

Q.12- Do you have any suggestion to improve the Environment w.r.t. Air, Water and Noise in your area.

Particular	Name	Sign/Date
Recorder		
Scrutinizer		

### Appendix 6 : Environmental Management Plan (EMP) Matrix

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
<b>PRE-CONSTRUCTION PHASE</b>						
1	Obtainment of appropriate NOC/permits (Delays in processing permits causing further delay in initiation of project construction)	All along project road and critical areas	<ul style="list-style-type: none"> <li>Processing of NOC/permits on a timely basis.</li> </ul>	Project Cost	PIU	PIU
2	Involuntary resettlement or land acquisition	All along project road	<ul style="list-style-type: none"> <li>Compensation paid for temporary/ permanent loss of productive land as per entitlement framework and its process</li> </ul>	Project Cost	Revenue Dept. / PIU	PIU
3	Tree cutting	Cutting of about 2352 nos. trees during site clearance	<ul style="list-style-type: none"> <li>Restricting tree cutting within construction limit</li> <li>Avoiding tree cutting at ancillary sites</li> <li>Providing and maintaining compensatory plantation of 7056 trees i.e. three times of cutting</li> </ul>	27,16,560	Forest Dept. / PIU	PIU
4	Removal of utilities	Work site clearance	<ul style="list-style-type: none"> <li>Necessary planning and coordination with concerned authority and local body</li> <li>Prior notice to and consultation with concerned authority, local body and public to be affected so as to ensure that work does not get affected and impact on public is minimum</li> </ul>	Project Cost	Concerned utility agencies / PIU	SC/ PIU
5	Religious places	Work site	<ul style="list-style-type: none"> <li>Suitable mitigation measures are incorporated in resettlement plan.</li> </ul>	3,25.000	PIU	SC / PIU
<b>CONSTRUCTION PHASE</b>						
1	Air Pollution	Construction plants, equipment and vehicles	Refer <b>Appendix 10-A</b> and <b>Appendix 10-B</b>	Project Cost	Contractor	SC/PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
		Temporary diversion	<ul style="list-style-type: none"> <li>Maintaining diversion and detour for road traffic in good shape and traffic regulated.</li> <li>Regular sprinkling of water, as necessary.</li> </ul>	Project Cost	Contractor	SC/PIU
		Dust during earth works or from spoil dumps	<ul style="list-style-type: none"> <li>Maintaining adequate moisture at surface of any earthwork layer completed or non-completed unless and until base course is applied, to avoid dust emission.</li> <li>Stockpiling spoil at designated areas and at least 5 m away from traffic lane.</li> <li>Refer <b>Appendix 10-C</b></li> </ul>	Project Cost	Contractor	SC/PIU
		Borrow pits and haul road	Refer <b>Appendix 10-D</b>	Project Cost	Contractor	SC/PIU
		Storage of construction materials	<ul style="list-style-type: none"> <li>Sprinkling of water as necessary.</li> </ul>	Project Cost	Contractor	SC/PIU
2	Water Pollution	Construction of Bridges or Culverts - Earthwork and marginal spillage of construction materials causing temporary turbidity and suspended solids	<ul style="list-style-type: none"> <li>Constructing and maintaining diversion channel, sedimentation basin, dykes, etc. as may be required to temporarily channelise water flow of streams / river</li> <li>Storage of construction material and excavated soil above high flood level</li> </ul>	Project Cost	Contractor	SC/PIU
		Construction vehicles	<ul style="list-style-type: none"> <li>Strictly avoiding cleaning / washing of construction vehicle in any water body</li> </ul>	Project Cost	Contractor	SC/PIU
		Soil erosion from construction site	<ul style="list-style-type: none"> <li>Proper planning of site clearing and grubbing so as not to keep the cleared site before working for long duration.</li> <li>Providing temporary side drains, catch water bank or drains, sedimentation basin, as necessary to avoid or minimize erosion and prevent sedimentation to receiving water bodies</li> </ul>	Project Cost	Contractor	SC/PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
3		Seepage from Construction Debris	<ul style="list-style-type: none"> <li>Refer <b>Appendix 10-C</b></li> </ul>	Project Cost		
		Construction camp and workers' camp	<ul style="list-style-type: none"> <li>Refer <b>Appendix 10-B</b></li> </ul>	Project Cost	Contractor	SC/PIU
	Ground water Pollution	Wastewater logging	<ul style="list-style-type: none"> <li>All wastewater will be diverted to a ditch that will be managed for the period of construction and after construction such ditches will be filled and restored to original condition.</li> </ul>	Project Cost	Contractor	SC/PIU
		Borrow pit excavation	<ul style="list-style-type: none"> <li>Excavation of borrow pit should not touch the aquifer</li> </ul>	Project Cost	Contractor	SC/PIU
		Human wastes and wastewater at construction camp	<ul style="list-style-type: none"> <li>Providing septic tanks for treating sewage from toilets before discharging through soak pits</li> <li>Locating soak pits at least 50m from any ground water sources</li> <li>Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas</li> <li>Refer <b>Appendix 10-B</b></li> </ul>	Project Cost	Contractor	SC/PIU



S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
5	Land Pollution	Spillage from plant and equipment at construction camp	<ul style="list-style-type: none"> <li>• Providing impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform</li> <li>• Collection oil and lubes drips in container during repairing construction equipment vehicles</li> <li>• Providing impervious platform and collection tank for spillage of liquid fuel and lubes at storage area</li> <li>• Providing bulk bituminous storage tank instead of drums for storage of bitumen and bitumen emulsion</li> <li>• Providing impervious base at bitumen and emulsion storage area and regular clearing of any bitumen spillage for controlled disposal</li> <li>• Reusing bitumen spillage</li> <li>• Disposing non-usable bitumen spills in a deep trench providing clay lining at the bottom and filled with soil at the top (for at least 0.5 m)</li> <li>• Refer <b>Appendix 10-A and 10-B</b></li> </ul>	Project Cost	Contractor	SC/PIU
		Domestic solid waste and liquid waste generated at camp	<ul style="list-style-type: none"> <li>• Collecting kitchen waste at separate bins and disposing of in a pit at designated area/s</li> <li>• Collecting plastics in separate bins and disposing in deep trench at designated area/s covering with soil</li> <li>• Collecting cottons, clothes etc. at separate bins and burning in a pit (with sand bed)</li> </ul>	Project Cost	Contractor	SC/PIU
		Borrow pits	<ul style="list-style-type: none"> <li>• Controlled operation and redevelopment of borrow pits to avoid water logging and land contamination</li> </ul>	Project Cost	Contractor	SC/PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
6	Loss of topsoil	All construction sites	<ul style="list-style-type: none"> <li>The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped to a specified depth of 150 mm and stored in stockpiles. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil.</li> <li>The stockpile shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile be restricted to 2m. To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing.</li> <li>Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or tarpaulin.</li> <li>It shall be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.</li> <li>Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes. Residual topsoil will be distributed on adjoining/proximate barren/rocky areas as identified by the SC in a layer of thickness of 75mm – 150mm. Top soil shall also be utilized for redevelopment of borrow areas, landscaping along slopes, medians and incidental spaces.</li> </ul>	Project Cost	Contractor	SC/PIU
7	Compaction of soil	All construction sites	<ul style="list-style-type: none"> <li>Construction vehicle, machinery and equipment shall move or be stationed in the designated area (RoW or CoI, as applicable) only. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, topsoil from agricultural land will be preserved as mentioned above.</li> </ul>	Project Cost	Contractor	SC/PIU
8	Ecology	Site clearance	<ul style="list-style-type: none"> <li>Restricting tree cutting within corridor of impact</li> </ul>	Project Cost	Contractor	SC/PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
		Ancillary sites	<ul style="list-style-type: none"> <li>Minimizing tree cutting and vegetation clearance during site selection</li> <li>Preservation of trees within ancillary sites and avoiding impact on forest resources by providing buffer area from boundary of PF, RF, national park and wildlife sanctuary of 1km for locating construction plants, construction camp, and quarry and 500 m for borrow areas</li> <li>Preservation of trees of ecological, socio-cultural importance</li> <li>Providing cooking at camp for discouraging and prohibiting use of fire-wood i.e. cutting of trees by the workers.</li> </ul>	Project Cost	Contractor	SC/PIU
9	Occupational health and safety of workers	Construction camp	<ul style="list-style-type: none"> <li>Water supply, sanitation, drainage and medical health facilities at campsite</li> <li>Providing and using PPEs</li> <li>Using working reverse horn for all construction equipment and vehicles</li> <li>Providing earth link circuit breaker (ELCB) for all electrical connections</li> <li>Maintaining first aid at construction sites</li> <li>Maintaining emergency response system</li> <li>Refer <b>Appendix 10-B</b></li> </ul>	Project Cost	Contractor	SC/PIU
10	Accidents and safety	Construction sites	<ul style="list-style-type: none"> <li>Providing and maintaining traffic management comprising diversion; warning, guiding and regulatory signage; channelisers and delineators; lighting, flagmen; dust control system etc. as specified in the contract.</li> <li>Providing adequate light at construction zone if working during night time is permitted by the Engineer</li> <li>Conducting induction and periodic training for all workers and supervisors</li> </ul>	Project Cost	Contractor	SC/PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
		Construction camp	<ul style="list-style-type: none"> <li>Conducting periodic mock drilling on critical accident prone activities</li> <li>Conducting periodic training for all personnel working at plant site</li> </ul>	75,000	Contractor	SC/PIU
<b>OPERATION PHASE</b>						
1	Air Pollution	Vehicular gaseous emission	<ul style="list-style-type: none"> <li>Periodicals monitoring of air pollutants and if values exceed the standard limits, suitable mitigation measures to be taken.</li> </ul>	Project Cost	PIU	SPCB and Traffic Police
2	Noise Pollution	Vehicular	<ul style="list-style-type: none"> <li>Periodical monitoring of noise level will be carried out. If values exceed the standard limits, suitable measures will be taken.</li> <li>Providing and maintaining signage on noise regulation at silence zones</li> </ul>	Project Cost	PIU	SPCB
3	Road Safety	Traffic and Vehicles	Maintenance of standard Highway Safety Signage and Traffic Management.	Project Cost	PIU	PIU and Traffic Police
		Lighting	Maintenance of road / flyover lighting.	Project Cost	PIU	PIU/Traffic police
4	Tree plantation	-	Roadside tree plantation three times of cutting	Project Cost	Forest Dept. / PIU	PIU
5	Contamination of Soil and Water Resources from Spills due to traffic & Accidents	Vehicular Traffic	<ul style="list-style-type: none"> <li>Contingency plans to be in place for cleaning up of spills of oil, fuel and toxic chemicals.</li> <li>Spill of oil, fuel and automobile servicing units without adequate preventive systems in place to be discouraged.</li> </ul>	Project Cost	PIU	PIU
6	Soil Erosion and Sedimentation		<ul style="list-style-type: none"> <li>Maintaining the slope protection measures provided at stretches of high embankment and protection measures for bed scouring at cross drainage locations as per maintenance manual to be prepared before operation</li> </ul>	Project Cost	PIU	PIU

S.No.	Environmental Issue	Location/sources	Mitigation Measures	Mitigation Cost (INR)	Implementing Agency	Supervising & Monitoring Agency
7	Maintenance of drainage system	-	<ul style="list-style-type: none"> <li>The drains will be periodically cleared to maintain storm water flow.</li> <li>Road drains will be cleared of debris before onset of every monsoon.</li> </ul>	Project Cost	PIU	PIU

## Appendix 7 : Environmental Monitoring Plan

Environmental Component	Project Stage	MONITORING						RESPONSIBILITY	
		Parameters	Measurement Method	Standards	Location & Frequency	Duration	Cost (INR)	Implementation	Supervision
Air Quality	Construction Stage	SPM	Gravimetric (High-Volume) Gravimetric (High-Volume with Cyclone) EPA Modified West & Gaeke method Arsenite modified Jacob & Hochheiser NDIR technique	National Ambient Quality Standards (Refer <b>Appendix 11-B)</b>	At suitable locations as and when required and as instructed by SC (for 3 years)	Continuous 24 hours/ or for 1 full working day	96,000	Contractor through approved monitoring agency	SC, PIU
		RPM							
		SO <sub>2</sub>							
	Construction Stage	NO <sub>x</sub>		National Ambient Quality Standards (Refer <b>Appendix 11-B)</b>	At suitable locations as and when required and as instructed by SC (for 3 years)	Continuous 24 hours/ or for 1 full working day	96,000	Contractor through approved monitoring agency	SC, PIU
		CO							
Air Quality	Construction Stage	SPM, RSPM, SO <sub>2</sub> , NO <sub>x</sub> , CO	Same as Above	National Ambient Quality Standards (Refer <b>Appendix 11-B)</b>	At suitable locations as and when required and as instructed by SC (for 3 years)	Continuous 24 hours/ or for 1 full working day	96,000	Contractor through approved monitoring agency	SC, PIU
	Operation Stage	SPM, RSPM, SO <sub>2</sub> , NO <sub>x</sub> , CO, HC	Same as above	National Ambient Quality Standards	half yearly for two years	Continuous 24 hours/ or for 1 full working day	Project Cost	PIU through approved monitoring agency	PIU

Environmental Component	Project Stage	MONITORING						RESPONSIBILITY	
		Parameters	Measurement Method	Standards	Location & Frequency	Duration	Cost (INR)	Implementation	Supervision
Water Quality	Construction stage (surface water)	pH, temperature, turbidity, DO, BOD, COD, TDS, TSS, Oil & Grease	Grab sample collected from source and analyzed as per IS : 2488 (Part 1-5) methods for sampling and testing of Industrial effluents	Water quality standards by CPCB (Refer <b>Appendix 11-A</b> )	At suitable locations as and when required and as instructed by SC (for 3 years)	-	84,000	Contractor through approved monitoring agency	SC, PIU
	Construction stage (ground water)	All parameters of drinking water		IS: 10500, 1991 (Refer <b>Appendix 11-A</b> )	At suitable locations as and when required and as instructed by SC (for 3 years)		22,500	Contractor through approved monitoring agency	SC, PIU
	Operation Stage (surface water)	pH, temperature, turbidity, DO, BOD, COD, TDS, TSS, Oil & Grease and Pb	Grab sample collected from source and analyzed as per IS : 2488 (Part 1-5) methods for sampling and testing of Industrial effluents	Water quality standards by CPCB	half yearly for two years	-	Project Cost	PIU through approved monitoring agency	PIU

Environmental Component	Project Stage	MONITORING						RESPONSIBILITY	
		Parameters	Measurement Method	Standards	Location & Frequency	Duration	Cost (INR)	Implementation	Supervision
Noise levels	Construction stage	Noise levels on dB scale (A)	Equivalent noise levels using an integrated noise level meter kept at a distance of 10-15 m from edge of pavement	Noise standards by CPCB (Refer <b>Appendix 11-C</b> )	At suitable locations as and when required and as instructed by SC (for 3 years)	Readings to be taken at 15 seconds interval for 15 minutes every hour and then Leq should be estimated.	12,000	Contractor through approved monitoring agency	SC, PIU
	Operation Stage	Noise levels on dB scale (A)	Equivalent noise levels using an integrated noise level meter kept at a distance of 10-15 m from edge of pavement	Noise standards by CPCB (Refer <b>Appendix 11-C</b> )	Half-yearly for first two years	Continuous 24 hours/ or for 1 full working day	Project Cost	PIU through approved monitoring agency	PIU

### Appendix 8: Details of Environmental Training Program

Module	Title	Objectives	Duration (Day)	Participants
1	Environmental Legislations and Bank's Safeguard Policies	<ul style="list-style-type: none"> <li>• Brush up latest on environmental legislations</li> <li>• Brush up safeguard policies</li> </ul>	1	PIU and SC staff
2	Environmental Supervision and Monitoring	<ul style="list-style-type: none"> <li>• EMP requirements</li> <li>• Implementation, Supervision and Monitoring Mechanism</li> <li>• Provision made in Contract Documents for Works</li> <li>• Provision made in contract Agreement for Supervision Services</li> </ul>	1	PIU and SC staff
3	Orientation Workshop on EMP Implementation	<ul style="list-style-type: none"> <li>• EMP requirements</li> <li>• Implementation, Supervision and Monitoring Mechanism</li> <li>• Roles and Responsibilities of Contractors and SCs</li> </ul>	1	PIU, Contractors and SCs
4	Focused Training on Specific Issue/s (three during course of implementation)	<ul style="list-style-type: none"> <li>• Analyzing problems, referring stipulations in Contract and EMP and agreed to feasible solution within specified timeframe</li> </ul>	0.5	PIU, Contractors and SCs

**Appendix 9: Proposed Environmental Management Plan (EMP) Cost**

SL. NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE (Rs.)	AMOUNT (Rs.)	RESPONSIBILITY
A	Tree Plantation					
A.1	Plantation of trees (Compensatory plantation i.e. Three times of total tree cut along road side) by road side in 0.6 m dia hole 1 m deep dug in the ground, mixing the soil with decayed farm yard sludge manual, planting the saplings, backfilling the trenches, watering and maintaining plants for one year.	7,056	No.	285	2,010,960	PIU through Forest Department
A.2	Providing bamboo tree guard of height 1.2 meters above ground and 0.20 meter below ground for all trees other than bamboo tree.	7,056	No.	100	705,600	
B	Environmental Monitoring					
B.1	Ambient air quality monitoring as per <b>Appendix 7</b> (2 location in the interval of 3 months for 3 Years)	24	No.	4000	96,000	PIU through Approved Monitoring Agency
B.2	Ambient noise level monitoring as per <b>Appendix 7</b> (2 location in the interval of 3 months for 3 Years)	24	No.	500	12,000	
B.3	Water quality monitoring of surface water as per <b>Appendix 7</b> (2 location in the interval of 3 months for 3 Years)	24	No.	3500	84,000	
B.4	Water quality monitoring of drinking water from construction camp as per <b>Appendix 7</b> (1 location in the interval of 6 months for 3 Years)	6	No.	3750	22,500	
C	Noise Barrier at sensitive location					
C.1	Provide the Noise barrier at sensitive areas like schools and hospitals. The noise barrier of hollow brick wall/reinforced concrete panels with height of 3.5 m. The design of the noise barrier shall be approved by the engineer in charge.	120	Rm	4000	480,000	Contractor through BOQ
D	Enhancement of cultural properties as per directed by the engineer including the following items					
D.1	Provision and erection of cement concrete, standard sitting benches including clearing of the area around the benches.	50	No.	1000	50,000	

D.2	Boundary fencing with barbed wire fencing of approved make and specification including provision and erection of struts.	500	Rm.	550	275,000	
E	<b>Environmental Training</b>					
E.1	Training at site as per <b>Appendix 8.</b>	1	Lump Sum	75000	75,000	PIU through Supervision Consultant
		<b>Grand Total (Rupees)</b>			<b>3,811,060</b>	

## **Appendix 10: General Guidelines for Environmental Management**

### **A. PLANT MANAGEMENT (Hot-Mix, Crushing and Batching)**

#### **Purpose**

- To ensure that statutory / regulatory requirements are complied with
- To ensure that safeguard measures are taken to avoid / mitigate / minimize environmental impacts

#### **Site selection criteria**

**Following criteria are to be met wherever possible for crusher and HMP:**

- 1.5 km away from settlement, school, hospital on downwind directions
- 1.5 km from any archaeological site
- 1.5 km from ecologically sensitive areas i.e. forest, national park, sanctuary etc.
- 1.5 km from rivers, streams and lakes
- 500 m from ponds
- 250 m from State and National Highway boundary
- away from agricultural land
- preference to barren land

Concrete batching plant should be located at least 200 m from the settlement, preferably on leeward side, whenever possible.

The format for submission of details to the Engineer during finalisation of plant site is given as follows (**Site identification for Plants**).

#### **Statutory Requirements**

- Obtaining Consent-for-Establishment (CFE) under Air and Water Acts from the State Pollution Control Board (SPCB) before start of installation
- Obtaining Consent-for-Operation (CFO) under Air and Water Acts from the State Pollution Control Board (SPCB) before start of commissioning and trial run
- Complying with the terms and conditions laid down in the CFE and CFO, which generally include providing metallic road inside plant campus for movement of vehicles, plantation, periodic (monthly) pollution monitoring i.e. ambient air, noise and stack emission
- The suspended particulate matter contribution value at a distance of 40 m from a controlled isolated as well as from a unit located in a cluster should be less than  $600 \mu\text{g}/\text{m}^3$  or as shall be prescribed by SPCB.
- Obtain certificates from manufacturer for Type Approval and Conformity of Production for Diesel Generator (DG) set/s.
- For DG sets of capacity up to 1000 kVA, the noise level at 1 m from the enclosure surface shall not exceed 75 dB (A).

#### **Pollution control measures**

- Dust control measures in stone crusher plant i.e. water sprinkling at primary crusher and secondary crusher, conveyor & return belts, covered conveyor system, chute at outfall of aggregates, cyclone separator, wind braking wall etc.
- For HMP, ensure adequate stack height as stipulated in CFE, install emission control devices such as bag house filters, cyclone separators, water scrubbers etc., as attached with the plant by the manufacturer or stipulated in CFE.
- Prefer bulk bitumen storage with mechanized handling facilities that storage in drums with manual operation at HMP to prevent / minimize bitumen spillage and thereby contaminating soil and ground water.

- Impervious platform for storage of bituminous and other liquid hazardous chemical
- Bag house filter / multi-cone cyclone for emission control. For bag house, cartridge filters reported to be more efficient than fabric filters
- Pollution control measures for Diesel Generator (DG) set i.e. stack height, acoustic enclosure etc.
- Greenbelt along the periphery of plant site.

### SITE IDENTIFICATION FOR PLANTS

Construction Stage Report: One Time  
Installed Capacity (tph):

Date:  
Location of Plant (Ch. & offset):

Sl. No.	Item / Requirement	Details as per Actual
1	Predominant wind direction	
2	Size and area of the proposed plant site (m xm & Sq.m)	
3	Present land use (barren or fallow land having no prominent vegetation should be preferred)	
4	No dwelling units within 1.5km from the plant boundary in downwind direction	
5	Distance of nearest boundary of State Highways and National Highways (should be at least 250 m from the plant boundary)	
6	Sensitive areas such as religious places, schools/educational institutions, reserved / protected forest, sanctuary etc. within 1.5 km (should be nil)	
7	River/Stream/Lake within 1.5 km and ponds within 500 m	
8	No other trees of girth>0.3m present and will be affected (no tree should be affected)	
9	Width of Haul road (m)	
10	Total Length of Haul Road (km)	
11	Length of non-metal Haul Road (km) (should be as minimum as possible)	

#### Documents to be attached:

Site plan showing wind direction, haul road and other environmental features.

Certified that the furnished information is correct and all relevant information as required is attached.

Contractor:

## **B. CAMPSITE MANAGEMENT**

### **Purpose**

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

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

### **Scope**

This guideline covers the Contractors' camp sites – whether used by in-house crew or by any sub-contractors' crew. It covers siting, operation, maintenance, repair and dismantling procedures for facilities for labor employed on project (and ancillary) activities as well as equipment and vehicles. It does not include siting, operation, maintenance, repair and dismantling of major plants – Hot-mix Plant, Concrete Batching Plant, Crusher or Wet Mix Macadam Plant.

### **Siting, Establishing, Operation and Closure of Construction Camp**

#### **1. Potential Environmental Impacts**

Construction camps require large areas for siting facilities like major plants, storage areas for material, residential accommodation for construction labor and supervisors, and offices. Removal of topsoil and vegetation from the land to be utilized for camps is the first direct impact of any such establishment. In addition, local drainage may be impaired if proper drainage is not effected by grading. Other impacts may include damage to ecologically important flora and fauna, if campsites are located close to such areas. Water pollution because of discharge of sediment, fuel and chemicals is also a possibility. Pollution of land due to indiscriminate disposal of construction wastes including scarified pavement, concrete and even substantial quantities of domestic wastes from residential areas can also be potentially disastrous, especially if the site is reverted to its original use after the project (mostly agriculture).

### **Mitigation Measures**

#### **2. Siting of Construction Camps**

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

- Maintain a distance of at least 1.5 km from boundaries of designated Reserved Forests, Sanctuary or National Park area for locating any temporary or permanent camps.
- Maintain 1.5 km from river, stream and lake and 500m from ponds
- Maintain 250 m from the boundary of state and national highways

- Locate facilities in areas not affected by flooding and clear of any natural or storm water courses.
- Locate campsites in the (most prevalent) downwind direction of nearest village(s). The boundary of the campsite should be at least 1.5 km from the nearest habitation so that the incoming labor does not stress the existing local civic facilities.
- The ground should have gentle slope to allow free drainage of the site.
- Recorded consultations should be held with residents of the nearest settlement and/or their representatives to understand and incorporate where possible, what they would like to see within their locality.

### **3. Establishment, Operation, and Closure of Camps**

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

## **Equipment and Vehicle-related issues**

### **Potential Environmental Impacts**

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

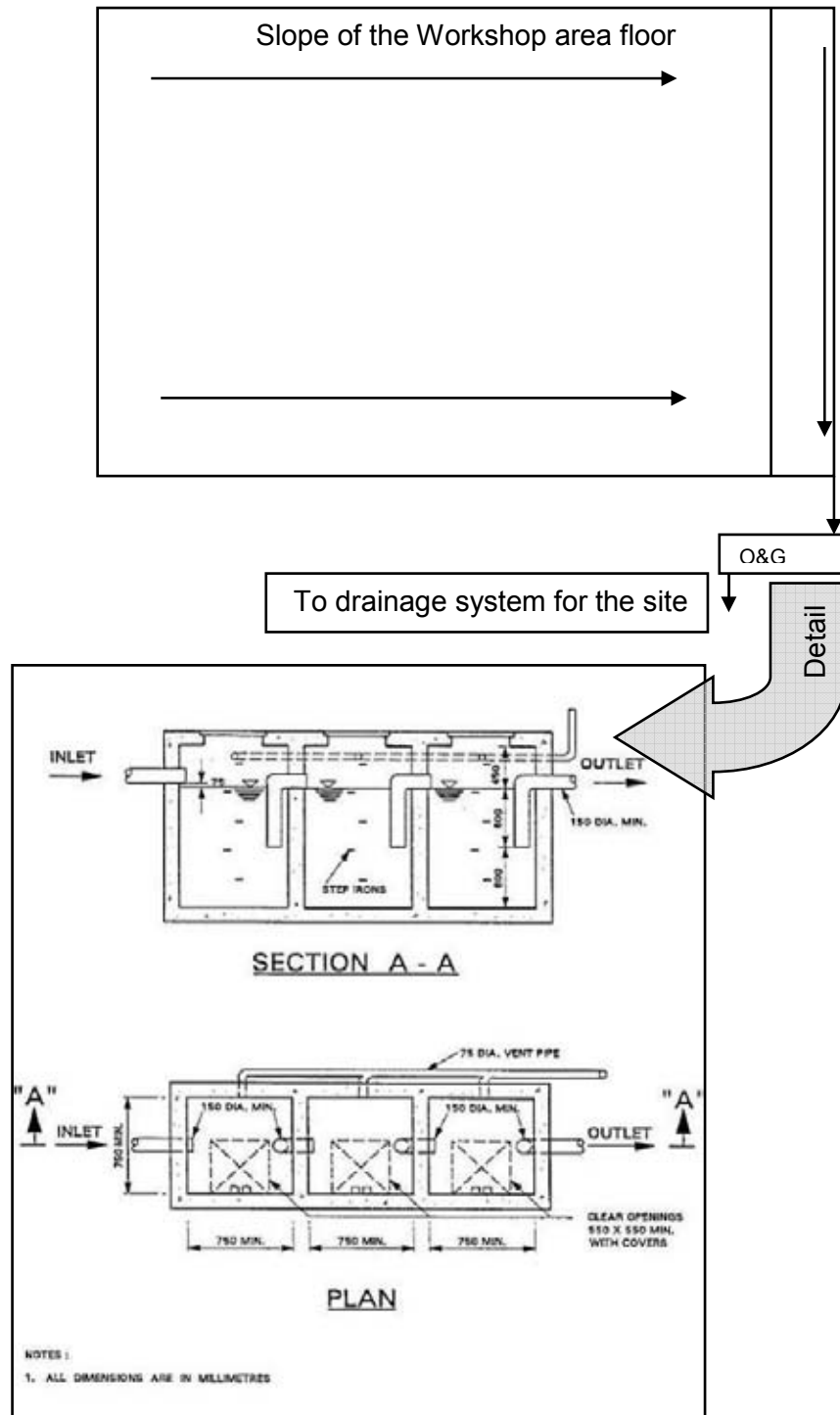
### **Mitigation Measures**

#### **1. Vehicles**

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

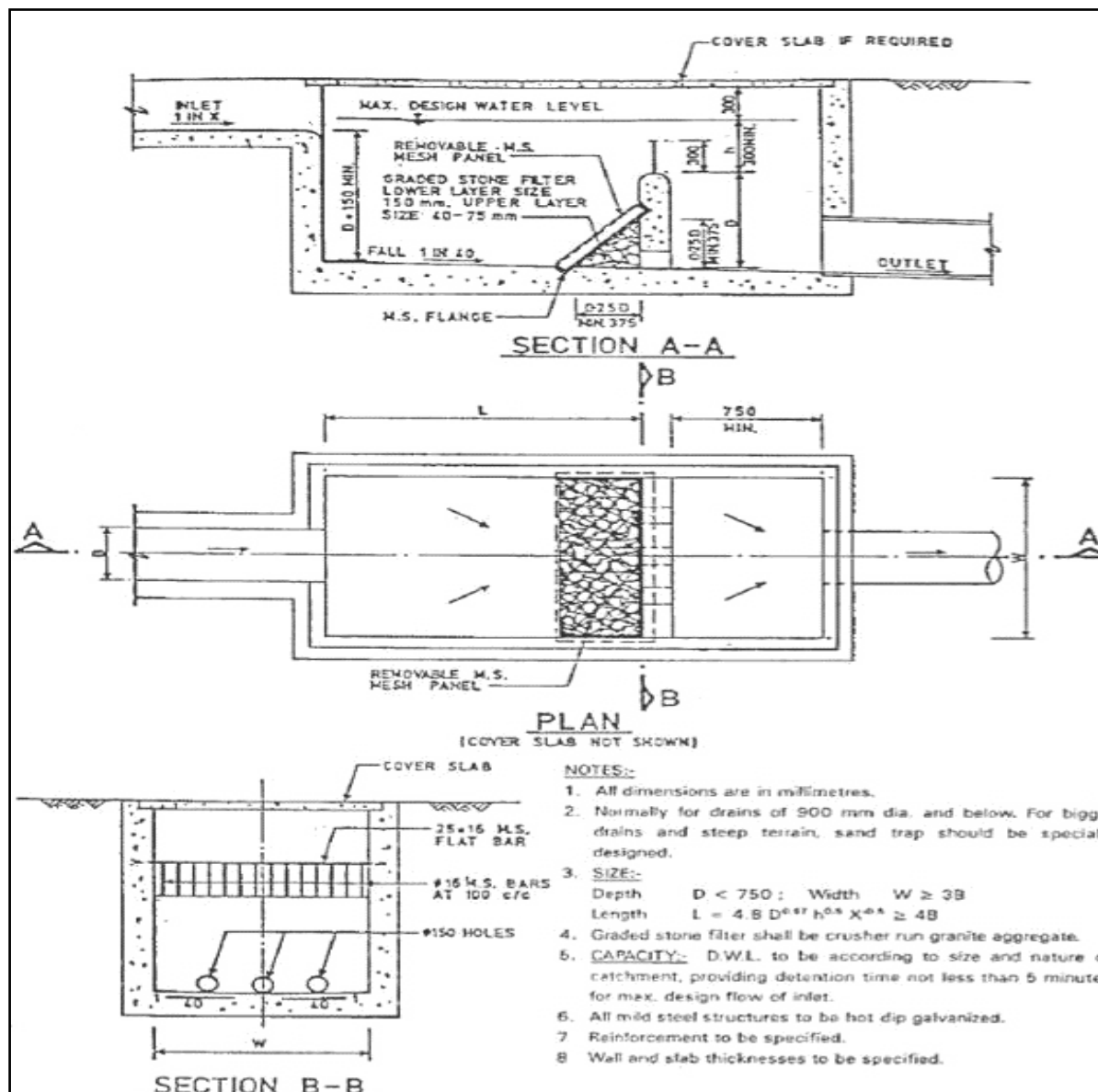
#### **2. Workshop and Maintenance areas**

- These areas must have impervious flooring to prevent seepage of any leaked oil & grease into the ground. The area should be covered with a roof to prevent the entry of rainwater.
- The flooring shall be sloped to from both directions to one corner where an oil-and-grease trap with sufficient capacity should be installed. All discharges from the workshop area must pass through the trap to remove the floating oil and grease before entering the drainage system of the site. The trap should be designed to provide a hydraulic residence time of about 20 minutes for the peak hourly discharge anticipated from the area (as per following figure).
- Alternatively, degreasing can also be carried out using mechanical spray type degreaser, with complete recycle using an enclosure with nozzles and two sieves, coarse above and fine below, may be used as shown in the adjacent photograph. This arrangement will require some initial investment and running cost for the pump, but the payback period, in terms of the use of diesel, under Indian conditions, has been reported to be less than 1 year.
- All the waste oil collected, from skimming of the oil trap as well as from the drip pans, or the mechanical degreaser shall be stored in accordance with the Environment Protection (Storage and Disposal of Hazardous Wastes) Rules, 1989. For this purpose, metallic drums should be used. These should be stored separately in sheds, preferably banded. The advantage of this arrangement is that it allows for accurate accounting in case the waste material is sold to oil waste recyclers or other users like brick-kiln owners who can burn such inferior fuel.



**Figure A: Workshop Area Pollution Control**

- A separate vehicle washing ramp shall be constructed adjacent to the workshop for washing vehicles, including truck mounted concrete mixers, if any, after each day's construction is over, or as required. This ramp should have an impervious bottom and it should be sloped so that it drains into a separate chamber to remove the sediment from the wash water before discharge. The chamber should allow for a hydraulic residence time of about 10 minutes for discharge associated with the washing of each truck. Following figure shows an outline sketch for a sedimentation chamber.

**Figure B: Sedimentation Chamber for vehicle washing ramp discharge**

### Facilities for Labour

#### **Potential Environmental Impacts**

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

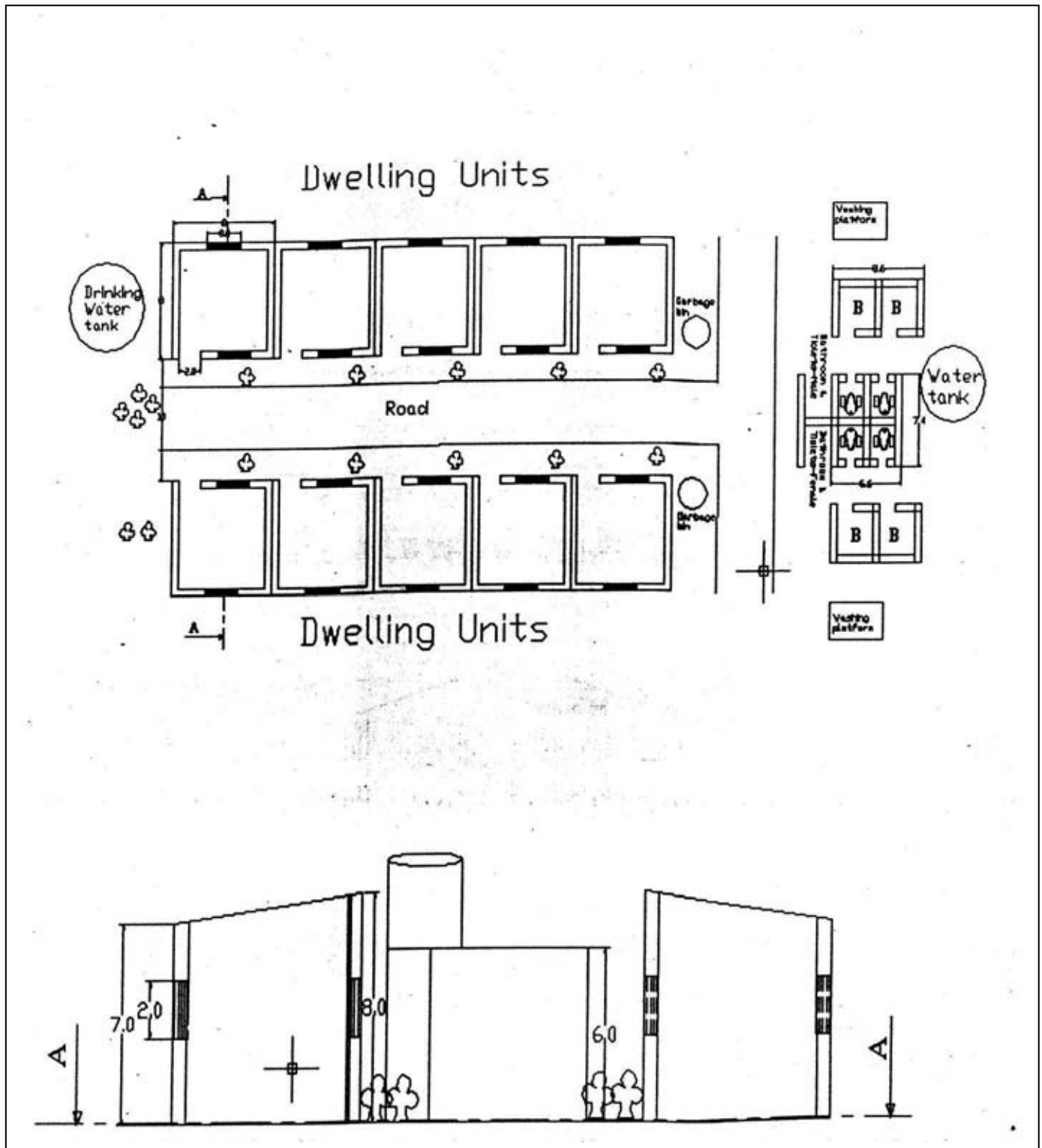
#### **Mitigation Measures**

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

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

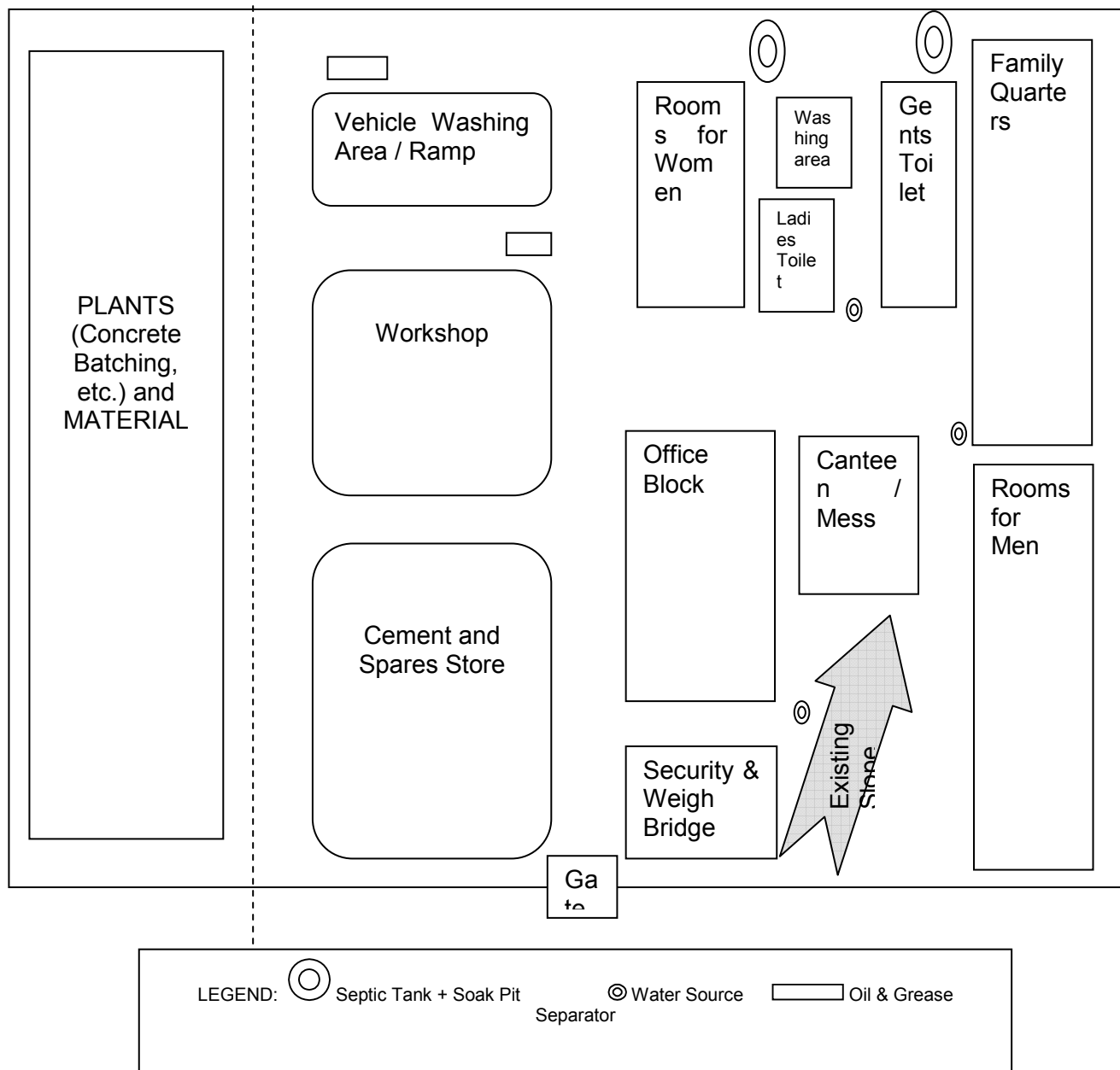
- The contractor shall provide free-of-charge temporary accommodation to all the labour employed for the project. The accommodation includes separate cooking place, bathing, washing and lavatory facilities. At least, one toilet will be provided for every 35 people and one urinal will be provided for every 20 persons. More toilets and/or urinals may have to be provided if the Engineer decides that these numbers are insufficient. In case female labourers are employed, separate toilet and urinals will be provided in locations clearly marked “Ladies Toilets” in a language understood by most labourers.
- The contractor shall ensure the supply of wholesome water for all the labour, including those employed by any other agency working for the contractor. These locations will be marked “Drinking Water” in the language most commonly understood among the labour. In hot season, the contractor shall make efforts to ensure supply of cool water. No water point shall be located within 15 m of any washing place, urinal, or latrine.
- The contractor shall ensure that adequate cooking fuel, preferably kerosene or LPG, is available on-site. The contractor will ensure that wood/ coal are not used as fuel on the site. Workers need to be made aware of this restriction. In cases where more than 250 labours are employed, canteen facility should be provided by the Contractor.
- A crèche must be provided in each campsite where more than 50 female labourers are employed, whether directly or indirectly, for the project or its ancillary activities.
- Contractor must provide adequate facilities for first-aid treatment at the campsite. A doctor / ambulance should be available on call for the duration of project implementation.
- The contractor shall obtain the approval of the Engineer for these facilities within 30 days of mobilization.

Figure 3: TYPICAL DRAWING OF WORKERS' CAMP SANITARY FACILITY





**Figure 4: Layout of a Construction camp**



## C. DEBRIS DISPOSAL

### Purpose

- To maximize re-use of material generated during construction and
- To avoid environmental hazards due to improper disposal of construction waste material.

### Procedure

**The following procedures should be followed for upkeep of storage and disposal sites;**

- Contractor shall maintain register for keeping records on kilometer-wise quantities of material generated during grubbing, stripping, excavation and scarifying;
- Contractor shall re-use construction material to the extent possible based on engineering properties. Possible re-use areas are fill sections, embankment slope, village approach roads etc. Debris without bitumen could be used for backfilling of quarry / borrow areas as recommended by the Engineer. At locations identified for dumping of residual bituminous wastes, the dumping shall be carried out over a 60mm thick layer of rammed clay so as to eliminate the possibility of the leaching of the wastes into the ground water. The contractor shall ensure that the filled area is covered with a layer of preserved topsoil layer of preserved topsoil.
- Contractor shall estimate the chainage-wise quantities of various waste material to be disposed of;
- Contractor shall restrict waste disposal strictly at approved site/s only;
- Contractor shall prepare a plan including detailed lay out plan and cross-section for disposal of debris and bitumen waste and get approval of the same by the Engineer;
- Bentonite slurry or similar debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area;
- Contractor and Engineer shall ensure that disposal areas are properly treated as per agreed plan;
- Contractor and Engineer's representatives shall undertake joint weekly inspection to ensure compliance of various environmental requirements.
- Engineer's representatives shall issue non-compliance if disposal site is not managed as per agreed plan;
- All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental to the work and should be planned and implemented by the contractor as approved and directed by the SC.

### Site Inspection

Weekly joint site inspection shall be undertaken for all the storage areas. The details of attributes, which are to be inspected, are given as follows. The Contractor shall ensure compliance of the requirements.

### Details to be inspected for Monitoring Construction Material Reuse & Disposal

Attributes	Requirements
Construction material generation and re-use	<ul style="list-style-type: none"> <li>✓ Segregating debris and bitumen during generation;</li> <li>✓ Segregating re-usable portion of debris and bitumen and storing preferably near areas of re-use; and</li> <li>✓ Temporary storage of waste material at sites as directed by the Engineer.</li> </ul>
Waste disposal	<ul style="list-style-type: none"> <li>✓ Disposal of waste material at approved disposal site within a week of generation;</li> <li>✓ Disposal site should be properly demarcated;</li> <li>✓ Proper leveling / grading at disposal site/s;</li> <li>✓ Recommended / agreed safeguard measures to avoid ground water contamination by leachate from disposal of scarified material are to be implemented;</li> <li>✓ Recommended / agreed safeguard measures to avoid soil erosion are to be implemented;</li> <li>✓ Recommended / agreed plan for surface treatment of waste disposal site/s are to be implement.</li> </ul>

## D. BORROW AREA MANAGEMENT

### Purpose

Borrow areas are generally required to provide material for road construction sites, can have significant adverse environmental effects, especially on ecologically sensitive areas. Borrow areas can become environmental hotspots and can significantly affect the visual appearance of an area. Special mitigation and management measures are often required to avoid or minimise the environmental and social impacts of borrow areas.

### Scope

These guidelines for borrow areas cover:

- statutory approvals
- environmental and social impacts of borrow areas
- selection of borrow areas
- operation of borrow areas
- rehabilitation of borrow areas

The guidelines seek to ensure that Contractors:

- comply with the regulatory requirements in force at the time
- reasonably manage any impacts
- reinstate and rehabilitate the land appropriately
- consult with affected communities

### Impacts

Some of the potential impacts of borrow areas are:

- trucks transporting materials to the site causing air pollution, and noise and vibrations
- ponds of stagnant water forming in excavated areas giving rise to the breeding of mosquitoes and the spreading of malaria and other mosquito-borne diseases
- natural beauty of the landscape being affected by excavations and the removal of vegetation
- natural drainage systems in the area being affected by excavations
- agriculture land and productive soils being lost, especially in paddy field areas

Borrow areas are not generally specified in Contract documents but rather it is generally the responsibility of Contractors to identify borrow areas and obtain the necessary consent from land owner and approval from SC.

In IRC: 10 and Clause 305.2.2.2 of MoRTH Specification, exclusive guideline has been given for borrow areas located alongside the road and only some of the requirements have been indicated for borrow areas located outside the road land. Following guideline is proposed to supplement the existing stipulation in IRC: 10 and Clause 305.2.2.2 of MoRTH Specification for Roads and Bridge Works:

### **Location**

- Identify areas having present land use as barren land, riverside land. Otherwise, un-irrigated agriculture land or land without vegetation and tree cover;
- Prefer borrow areas on bed of irrigation water storage tank;
- Prefer areas of highland with respect to surroundings;
- Avoid locating borrow area close to any road (maintain atleast 30 m distance from ROW and 10 m from toe of embankment, whichever is higher);
- Should be at least 1.5 km away from inhabited areas;
- Maintain a distance of about 1.5km from ecologically sensitive area i.e. Reserve Forest, Protected Forest, Sanctuary, wetland etc.;
- Maintain a distance of about 1.5 km from school, hospital and any archaeological sites;
- Having adequate approach road with minimum length of earthen road;
- Ensure that unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult;
- 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 unsuitable excavated soil (from roadway), then filling should be adequately compacted except topsoil which is to be spread on topmost layer (for at least 20cm thick).

### **Operation**

- Controlled operation as per agreed / approved plan;
- Preservation of topsoil at designated areas e.g. corners of the area etc.;
- Maintain necessary buffer zone in all directions and go for vertical cut within this area. Final cut slope should be maintained within the buffer zone;
- Step-wise excavation if borrow area is located on inclined area having more than 2% slope;
- Restricting excavation up to 2m for each stages of operation if allowed depth is more;

- Avoid cutting of any tree of girth size > 30cm<sup>5</sup>. if any tree cutting is inevitable, prior permission (written) from the competent authority should be taken and compensatory plantation has to be raised.

### Rehabilitation

- Prior approval of Rehabilitation Plan considering terrain, land use and local need;
- Restricting operation as agreed by landowner and approved by the Engineer;
- Rehabilitation within agreed timeframe and before taking over;
- Integrate debris disposal and borrow area redevelopment.

### Management Procedure

The important aspects of this procedure are:

- The first and foremost thing is to have tentative estimate of borrow material requirement chainage-wise. For this, BoQ quantity for earth work, which is given as total quantity for the entire package/milestone, has to be distributed chainage-wise. The requirement of borrow material chainage-wise then has to be estimated based on the suitability of roadway excavation material for reuse and BoQ.
- Contractor to site borrow areas fulfilling environmental requirements and obtaining one time approval of the Engineer both on quality as well as environmental consideration thereby integrating environmental safeguard measures into day-to-day activities;
- Contractor to submit environmental information in prescribed format for obtaining Engineer's approval, as given in the following format (**Borrow Area Identification**). The format has been so designed that it stipulates the requirements as well as what is actual for each borrow areas and could be easily understood by any person, whoever in-charge of identifying borrow areas;
- Contractor to submit Borrow Area Layout Plan as attachment to the format showing the land use of the proposed and surrounding area along with the presence of other environmental features such as water bodies, forests, settlement, temple and any sensitive receptor i.e. health and educational institution, roads etc. within a radius of 1.5km area from the boundary of the borrow area;
- Contractor to prepare and submit Block Contour Map of each borrow area (especially which are located close to road and on undulating terrain) for deciding on operation and redevelopment plan;
- Contractor to prepare Operation Plan and submit as attachment to the format including cross sections on both directions (x,y) mentioning natural ground level, depth of topsoil (if any), total depth of excavation, cut side slope and bed slope;
- Contractor to prepare Redevelopment Plan and submit as attachment to the format include cross sections on both directions (x,y) mentioning natural ground level, excavated profile, finished profile after redevelopment etc.;
- Contractor to maintain Borrow Material Register;
- Periodic joint inspections of each borrow area until rehabilitation is complete as agreed and approved.
- The checklist for periodic inspection is given in this appendix

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<sup>5</sup> Plant having girth size more than 30cm is considered as tree.

**BORROW AREAS IDENTIFICATION**

Construction Stage Report: One Time

Date:

Location of Borrow Area (Ch. &amp; Offset):

Revenue Survey No.:

Sl. No.	Item / Requirement	Details as per Actual (to be filled by Contractor & checked by Engineer)
1	Date of Borrow Area planned to be operational	
2	Current Land use (preference to barren land, riverside land, otherwise, un-irrigated agriculture land or land without tree cover)	
3	Size (Sq.m) and area (m x m) of Borrow Area	
4	Proposed maximum depth of pit in m (IRC 10 & Clause 305.2.2 of MoRTH Spec.)	
5	Details of riverside borrow area (inner edge should not be less than 10m from the toe of the bank and bottom of pit should not cut the imaginary line of 1:4 from embankment top)	
6	Borrow area in cultivable land (should be avoided or restricted to total depth of 45cm including preservation of 15cm topsoil)	
7	Quantity Available (Cum)	
8	Quantity of top soil to be removed (Sq.m & depth in cm)	
9	Details of preservation (storage) and management (re-use / re-laid) of top soil	
10	Width of Haul road (m)	
11	Total Length of Haul Road (km)	
12	Length of Non-metal Haul Road (should be as minimum as possible)	
13	No of settlements within 200 m of Non-metal Haul Road (should be as minimum as possible)	
14	Distance from settlement (should be minimum 1500 m)	
15	Should be away from water bodies. Give details of water bodies within 250 m.	
16	Details of water sources for dust suppression	
17	Quantity of water required for dust suppression i.e. sprinkling at borrow area and on haul road (Cum)	
18	Availability of water required for dust suppression (Cum)	
19	Details of ecologically sensitive area i.e. RF, PF, Sanctuary etc. within 1500m (should be nil)	
20	Details of school, hospital and any archaeological sites within 1500m (should be nil)	
21	Distance from nearby road embankment, fence line / boundary (should be minimum 30m from ROW and 10m from toe of embankment, whichever is higher)	
22	No of Trees with girth more than 0.3 m (No tree should be affected)	

**Documents to be attached:**

- 1) Site plan and layout plan of borrow area;
- 2) Proposed borrow area operation and redevelopment plan;

- 3) Written consent from competent authority for use of water for dust suppression
- 4) Written consent of landowner on agreed operation and redevelopment plan

Certified that the furnished information is correct and all relevant information as required is attached

Contractor's Representative:

### CHECKLIST FOR MONITORING BORROW AREA OPERATION & MANAGEMENT

Attributes	Requirements
Access road	✓ Only approved access road shall be used
Top soil preservation	<ul style="list-style-type: none"> <li>✓ Top soil, if any, shall be stripped and stored at corners of the area before start of excavation for material collection;</li> <li>✓ Top soil should be re-used / re-laid as per agreed plan</li> </ul>
Depth of excavation	<ul style="list-style-type: none"> <li>✓ For cultivable (agriculture) land, total depth of excavation should be limited to 45 cm including top 15 cm for top soil preservation;</li> <li>✓ For riverside borrow area, the depth of excavation shall be so regulated that the inner edge of any borrow pit should not be less than 10m from the toe of the bank and bottom of pit should not cut the imaginary line of 1:4 from embankment top;</li> <li>✓ If borrow area is located within 1500 m of towns or villages, they should not exceed 30 cm in depth and should be properly drained;</li> <li>✓ Borrow areas close to ROW should be rectangular in shape with one side parallel to center line of the road and depth should be so regulated that it should not cut an imaginary line having slope of 1 in 4 projected from the edge of the final section of the embankment.</li> </ul>
Damage to surrounding land	✓ Movement of man & machinery should be regulated to avoid damage to surrounding land.
Drainage control	<ul style="list-style-type: none"> <li>✓ The surface drainage in and around the area should be merged with surrounding drainage;</li> <li>✓ No water stagnation shall occur.</li> </ul>
Dust suppression	<ul style="list-style-type: none"> <li>✓ Water should be sprayed on <i>kutch</i>a (earthen) haul road twice in a day or as may be required to avoid dust generation during transportation of material;</li> <li>✓ 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.</li> </ul>
Covering material transport vehicle	✓ Material transport vehicle shall be provided with tarpaulin cover
Personal Protective Equipment	✓ Workers should be provided with helmet, gumboot 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.

### E. QUARRY AREA MANAGEMENT

#### Purpose

Quarries generally required to provide material for road construction sites, can have significant adverse environmental effects, especially on ecologically sensitive areas. Quarries can become environmental hotspots and can significantly affect the visual appearance of an area. Special

mitigation and management measures are often required to avoid or minimise the environmental and social impacts of quarries.

### Scope

**These guidelines for quarries cover:**

- statutory approvals
- environmental and social impacts of quarries
- selection of quarries
- operation of quarries
- rehabilitation of quarries

**The guidelines seek to ensure that Contractors<sup>6</sup>:**

- comply with the regulatory requirements in force at the time
- reasonably manage any impacts
- reinstate and rehabilitate the land appropriately
- consult with affected communities

### Impacts

**Some of the potential impacts of quarries are:**

- rock blasting causing air pollution, and noise and vibrations
- trucks transporting materials to the site causing air pollution, and noise and vibrations
- ponds of stagnant water forming in excavated areas giving rise to the breeding of mosquitoes and the spreading of malaria and other mosquito-borne diseases
- natural beauty of the landscape being affected by excavations and the removal of vegetation
- natural drainage systems in the area being affected by excavations

**The procedure for identification and finalization of quarry site/s shall be as given below:**

- Estimating the quantity of quarry material to be collected from each quarry area
- Only licensed quarry will be used
- New quarry will be at least 1.5 km away from the settlement, forest and other ecologically sensitive areas
- Away from water body
- Contractor shall identify alternative quarry sites along the whole corridor based on required quantity and environmental consideration as given in the following prescribed format of **Quarry source identification**.
- Contractor shall submit to the Engineer the detailed information / documents as prescribed in the format;
- Engineer shall undertake site inspection of alternate quarry sites and convey to Contractor on accepting a particular quarry site on environmental consideration;
- Contractor shall then take apply and obtain Quarry Lease Deed / License from the Department of Mines and Geology and provide copy of the same to the Engineer prior to operation;
- Contractor shall estimate water requirement for dust suppression at quarry sites during operation and for water spraying on *kutchha* (non-metal) haul road and ensure availability water by identifying sources and obtaining necessary permission;
- Contractor shall prepare quarry sites operation and redevelopment plan considering surrounding land uses, local needs and agreement with the landowner;

<sup>6</sup> The EMP stipulations will be applicable even if contract use existing licensed quarry. In case contractor use the existing licensed quarry a copy of the quarry license and lease / sub-lease agreement should be submitted to the Project Proponent. Contractor shall submit a plan delineating how he shall comply with requirements stipulated in this plan and elsewhere in the EMP on quarrying activity.

- Only licensed blaster i.e. short-firer certificate holder will be responsible for quarry blasting
- Permits for transportation, storage and use of explosive, as will be required, shall be obtained from the Controller of Explosive;
- Whenever so advised by the Engineer, controlled blasting e.g. using less charge, restricting depth and dia or drill holes, cut-off blasting etc., shall be undertaken.
- Quarry operation will be undertaken in stages with adequate benching

**The procedure for environmentally sound operation and management of quarry sites is given below:**

- Estimating the quantity of quarry material to be collected from each quarry area;
- Demarcating the entire quarry area by fencing and putting red-flag poles;
- Providing adequate metallic access road;
- Preserving topsoil from the quarry compound, if any, by stripping and stacking aside separately at corners;
- Carrying out blasting as per agreed operational plan complying with the requirements of MoRTH Specification (Clause 302 & 303) and Ministry of Environment & Forests (MoEF) as given below;
- Maintaining a **Quarry Material Collection Register** on daily material collection for each of the quarry area, which shall be produced to Engineer's representative as and when requested;
- Redeveloping the area within 2 months (or as will be agreed upon) of completion of quarry material collection;

## **Use of Explosive for Blasting**

### **General**

Blasting shall be carried out in a manner that completes the excavation to the lines indicated in drawings, with the least disturbance to adjacent material. It shall be done only with the written permission of the Engineer. All the statutory laws, regulations, rules, etc., pertaining to the acquisition, transport, storage, handling and use of explosives shall be strictly followed.

The Contractor may adopt any method or methods of blasting consistent with the safety and job requirements. Prior to starting any phase of the operation the Contractor shall provide information describing pertinent blasting procedures, dimension and notes.

The magazine for the storage of explosives shall be built as per national / international standards and located at the approved site. No unauthorized person shall be admitted into the magazine which when not in use shall be kept securely locked. No matches or inflammable material shall be allowed in the magazine. The magazine shall have an effective lightning conductor. The following shall be displayed in the lobby of the magazine:

- A copy of the relevant rules regarding safe storage in English, Portuguese and in the language with which the workers concerned are familiar.
- A statement of up-to-date stock in the magazine.
- A certificate showing the last date of testing of the lightning conductor.
- A notice that smoking is strictly prohibited.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided to the satisfaction of the Engineer and in general not closer than 300 m from the road or from any building or camping area or place of human occupancy. In addition to these, the Contractor shall also observe the following instructions and any further additional instructions which may be given by the Engineer and shall be responsible for damage to property and any accident which may

occur to workmen or the public on account of any operations connected with the storage, handling or use of explosives and blasting. The Engineer shall frequently check the Contractor's compliance with these precautions.

### **Materials, Tools and Equipment**

All the materials, tools and equipment used for blasting operations shall be of approved type. The Engineer may specify the type of explosives to be allowed in special cases. The fuse to be used in wet locations shall be sufficiently water-resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and definitely known to permit such a length being cut as will permit sufficient time to the firer to reach safety before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder, explosives, detonators, fuses, etc., shall be fresh and not damaged due to dampness, moisture or any other cause. They shall be inspected before use and damaged articles shall be discarded totally and removed from the site immediately.

### **Personnel**

The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations.

### **Blasting Operations**

The blasting shall be carried out during fixed hours of the day preferably during the mid-day luncheon hour or at the close of the work as ordered in writing by the Engineer. The hours shall be made known to the people in the vicinity. All the charges shall be prepared by the man in charge only.

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury. In advance of any blasting work within 50 m of any railway track or structures, the Contractor shall notify the concerned Railway Authority of the location, date, time and approximate duration of such blasting operations.

Red danger flags shall be displayed prominently in all directions during the blasting operations. The flags shall be planted 200m and 500m from the blasting site in all directions for blasting at work site and quarry, respectively. People, except those who actually light the fuse, shall be prohibited from entering this area, and all persons including workmen shall be excluded from the flagged area at least 10 minutes before the firing, a warning siren being sounded for the purpose.

The charge holes shall be drilled to required depths and at suitable places. Blasting should be as light as possible consistent with thorough breakage of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued.

When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped in. The powder shall be gently tamped with copper rods with rounded ends. The explosive powder shall then be covered with tamping material which shall be tamped lightly but firmly.

When blasting is done with dynamite and other high explosives, dynamite cartridges shall be prepared by inserting the square cut end of a fuse into the detonator and finishing it with nippers at the open end, the detonator gently pushed into the primer leaving 1/3rd of the copper tube exposed outside. The paper of the cartridge shall then be closed up and securely bound with wire or twine. The primer shall be housed into the explosive. Boreholes shall be such size that the cartridge can easily go down. The holes shall be cleared of all debris and explosive inserted. The space of about

200 mm above the charge shall then be gently filled with dry clay, pressed home and the rest of the tamping formed of any convenient material gently packed with a wooden rammer.

At a time, not more than 10 such charges will be prepared and fired. The man in charge shall blow a siren in a recognised manner for cautioning the people. All the people shall then be required to move to safe distances. The charges shall be lighted by the man-in-charge only. The man-in-charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to the blasting site.

### **Misfire**

In case of misfire, the following procedure shall be observed:

Sufficient time shall be allowed to account for the delayed blast. The man-in-charge shall inspect all the charges and determine the missed charge.

If it is the blasting powder charge, it shall be completely flooded with water. A new hole shall be drilled at about 450 mm from the old hole and fired. This should blast the old charge. Should it not blast the old charge, the procedure shall be repeated till the old charge is blasted.

In case of charges of gelignite, dynamite, etc., the man-in-charge shall gently remove the tamping and the primer with the detonator. A fresh detonator and primer shall then be used to blast the charge. Alternatively, the hole may be cleared of 300 mm of tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 150 mm away and parallel to it. This hole shall then be charged and fired when the misfired hole should explode at the same time. The man-in-charge shall at once report to the Contractor's office and the Engineer all cases of misfire, the cause of the same and what steps were taken in connection therewith.

If a misfire has been found to be due to defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority directed by the Engineer for inspection to ascertain whether all the remaining materials in the box are also defective.

### **Account**

A careful and day to day account of the explosive shall be maintained by the Contractor in an approved register and manner which shall be open to inspection by the Engineer at all times.

During quarry operation, periodic joint inspection should be carried out by the Contractor and Engineer's representatives.

A typical checklist for the same is given here.

**QUARRY SOURCE IDENTIFICATION**

Construction Stage Report: One Time

Supervision Consultant:

Contractor:

Date:

Contract Package:

Location of Quarry (Ch. &amp; Offset):

Sl. No.	Item / Requirement	Details as per Actual
1	Present land use (bare land with no prominent vegetation is preferred)	
2	Predominant wind direction	
3	Size and area of Quarry (m xm & Sq.m)	
4	Quantity Available (Cum)	
5	Quantity proposed to be collected (Cum)	
6	No of Trees with girth more than 0.3 m	
7	No Settlement within 1500 m of Quarry	
8	No water body within 1500 m of Quarry	
9	Width of Haul road (m)	
10	Total Length of Haul Road (km)	
11	Length of Non-metal Haul Road (km) (should be as minimum as possible)	
12	No of Settlements within 200m of Non-metal Haul Road (should be as minimum as possible)	
13	Quantity of water required for dust suppression i.e. sprinkling at borrow area and on non-metal haul road (Cum)	
14	Details of Water sources for dust suppression	
15	Availability of water required for dust suppression (Cum)	

**Documents to be attached:**

- 1) Site plan and layout plan of quarry site
- 2) Proposed quarry site operation and redevelopment plan
- 3) Written consent / lease agreement with the Department of Mines & Geology
- 4) Written consent from competent authority for use of water for dust suppression

Certified that the furnished information is correct and all relevant information as required is attached

Contractor's Representative:

### Details to be inspected for Monitoring Quarry Area Operation & Management

Attributes	Requirements
Access road	✓ Only approved access road shall be used
Top soil preservation	✓ Top soil, if any, should be stripped and stored at designated area before start of quarry material collection; ✓ Top soil should be re-used / re-laid as per agreed plan
Controlled blasting & safety	✓ Storage of explosive magazine as per threshold quantity with all the safety measures; ✓ Handling of explosive by licensed blaster only; ✓ Use low intensity explosive; ✓ Check unfired explosive, if any, before drilling; ✓ Carryout blasting at lean time only; ✓ Cordoned the area within 500m radius with flagmen having whistle for signaling preparedness; ✓ Using properly designed audio visual signal system i.e. siren and flagmen for blasting; ✓ Keep ready an emergency vehicle near blasting area with first aid facility and with active emergency response system.
Damage to surrounding land	✓ Movement of man & machinery should be regulated to avoid damage to surrounding land.
Drainage control	✓ The surface drainage in and around the area should be merged with surrounding drainage;
Dust control	✓ Haul road should be made metallic; ✓ Suitable dust arrester for drilling; ✓ Water spraying at quarry complex, if required.
Covering material transport vehicle	✓ Material transport vehicle should be provided with tail board, and cover
Personal Protective Equipment	✓ Workers shall be provided with helmet, safety shoes, ear muffler and air mask and their use should be strictly enforced.
Redevelopment	✓ The area should be redeveloped within two months (or as agreed) on completion of material collection as per agreed plan.

## Appendix 11: National Standards for Water, Air and Noise Levels

### A. Indian Standard Drinking Water Specification: IS 10500:1991

Sl. No.	Substance/ Characteristic	Desirable Limit	Permissible limit	Remarks
1	Colour, Hazen units, Max	5	25	Extended to 25 if toxic substance are not suspected in absence of alternate sources
2	Odour	Unobjectionable		a) Test cold and when heated
				b) Test at several dilution
3	Taste	Agreeable		Test to be conducted only after safety has been established
4	Turbidity NTU, Max	5	10	
5	pH value	6.5 to 8.5	No relaxation	
6	Total Hardness (as CaCO <sub>3</sub> mg/lit)	600	600	
7	Iron (as Fe mg/lit, Max	0.3	1.0	
8	Chlorides (as Cl mg/lit Max	250	1000	
9	Residual Free Chlorine, mg/lit Max	0.2		To be applicable only when water is chlorinated. Treated at consumer end. When protection against viral infection is required, it should be Min 0.5 mg/lit
10	Dissolved Solids mg/l, Max	500	2000	
11	Calcium (as Ca) mg/l, Max	75	200	
12	Copper (as Cu) mg/l, Max	0.05	1.5	
13	Manganese (Mn) mg/l Max	0.1	0.3	
14	Sulphate (As SO <sub>4</sub> ), Max	200	400	May be extended up to 400 provided (as Mg) does not exceed 30
15	Nitrate (as NO <sub>3</sub> ) mg/l, Max	45	100	
16	Fluoride (as F) mg/l, Max	1.0	1.5	
17	Phenolic Compounds (as C <sub>6</sub> H <sub>5</sub> OH) mg/l Max	0.001	0.002	
18	Arsenic (as As mg/l	0.05	No relaxation	To be tested when pollution is suspected
19	Lead (as Pb) mg/l	0.05	No relaxation	
20	Anionic Detergents (as MBAS) mg/l	0.2	1.0	
21	Chromium (as Cr) mg/l	0.05	1.0	To be tested when pollution is suspected
22	Mineral Oil mg/l	0.01	0.03	
23	Alkalinity mg/l	200	600	
24	Total Coliform	95% of the sample should not contain coliform in 100 ml. 10 coliform /100 ml		

**B. National Ambient Air Quality Standards (MoEF, 2009)**

Pollutant	Time Weighted Average	Concentration in Ambient air ( $\mu\text{g}/\text{m}^3$ )	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Areas
Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average*	50	20
	24 hr**	80	80
Oxides of Nitrogen (as $\text{NO}_2$ )	Annual Average *	40	30
	24 hr**	80	80
Particulate Matter: $\text{PM}_{10}$ ( $<10 \mu\text{m}$ )	Annual Average *	60	60
	24 hr**	100	100
Particulate Matter: $\text{PM}_{2.5}$ ( $<2.5 \mu\text{m}$ )	Annual Average *	40	40
	24 hr**	60	60
Lead	Annual Average *	0.5	0.5
	24 hr**	1.0	1.0
Carbon monoxide $\text{mg}/\text{m}^3$	8 hr	2.0	2.0
	1 hr	4.0	4.0

\* Annual Arithmetic mean of minimum 104 measurement in a year taken for a week 24 hourly at uniform interval.

\*\* 24 hourly or 8 hourly or 1 hourly monitored values should meet 98 percent of the time in a year

Source: MoEF notification Central Pollution Control Board (1997) National Ambient Air Quality Monitoring Series, NAQMS/a/1996-97.

**C. National Ambient Noise Level Standards**

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

Note: (1) Daytime: 6 AM to 9 P.M., Night-time 9 PM to 6 AM;

(2) Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts.

Source: Central Pollution Control Board, New Delhi